Nyinggulu (Ningaloo) coastal reserves

Red Bluff to Winderabandi

draft joint management plan

2019

GOVERNMENT OF WESTERN AUSTRALIA

Conservation and Parks Commission

Department of **Biodiversity, Conservation and Attractions**

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Warning: This plan shows photographs of, mention names, and/or refer to quotations from Aboriginal people who may have passed away.

NB: The spelling of some of the language words for country and species of plants and animals may vary. Baiyungu should be seen to encompass the Payungu, Baiong, By-yung, By-oong and similar spellings and Thalanyji to encompass the Thalanyii, Talangi, Thananj, Tallinjee, Talandji and similar spellings and Jinigudira to encompass the Yinikurtira, Yinigudura, Yinkutura and similar spellings.

Questions regarding this plan should be directed to:

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Front cover photos

Main Photo:	Aerial view over the Ningaloo Marine Park coastal strip to the southern end of Cape Range. Photo - DBCA
Top left:	Sand sculpture of a turtle by Nova Walgar. Photo - Hazel Walgar
Top right:	Traditional owner explaining the use of grinding stones. Photo - Aberline Attwood/DBCA

All photos where not credited throughout the document were taken by Aberline Attwood/DBCA.

This document is available in alternative formats on request.

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Acknowledgements

The Department of Biodiversity, Conservation and Attractions wishes to thank the traditional owners for their contributions to the planning for the *Nyinggulu* (Ningaloo) coastal reserves: for the sharing of cultural knowledge by elders, the field trips, the spirit of collaboration, the enthusiasm for joint management and the long yarns around maps discussing country along with the guidance and direction provided by Yamatji Marlpa Aboriginal Corporation.

Particular thanks and acknowledgement is given to Gwen Peck, Hazel Walgar, Glenda Morrison, Deborah Dodd, Laurie Tittums, Jamie Tittums and Paul Baron for their sharing of knowledge during the on-country trips as well as to the younger generation of traditional owners who are keen to get involved in joint management.

We also recognise and acknowledge all past and present traditional owners for their knowledge, leadership and guidance in the management of country.

This draft joint management planning area was prepared by a Department of Biodiversity, Conservation and Attractions planning team consisting of Aberline Attwood (Planning Officer), Arvid Hogstrom (Exmouth District Manager), Todd Quartermaine (Senior Operations Officer – Ningaloo Coast), Ray DeJong (Regional Leader Parks and Visitor Services), Roger Syme (Ranger), Derek Sandow (District Conservation Coordinator), Peter Barnes (Marine Program Coordinator) and Emma West (Landscape Architect). Thanks also go to specialist branches within the department who have commented on the draft joint management plan.

Traditional owners and departmental staff during an on-country planning trip August 2017. Photo - DBCA

Invitation to comment

This draft joint management plan has been released for a three-month period to provide the public with an opportunity to comment on how the planning area is proposed to be managed over the next ten years.

To ensure your submission is as effective as possible:

- be clear and concise
- refer your points to the page numbers or specific sections in the plan
- say whether you agree or disagree with any or all of the management arrangements – clearly state your reasons, particularly if you disagree
- give sources of information where possible
- suggest alternatives for those aspects of the plan with which you disagree.

The draft joint management plan will be reviewed in light of the submissions, according to the criteria outlined below. A summary of public submissions will be made available along with the final joint management plan.

The draft joint management plan may be modified if a submission:

a) provides additional information of direct relevance to management
b) indicates a change in (or clarifies) government legislation or management policy
c) proposes strategies that would better achieve management objectives
d) indicates omissions, inaccuracies or a lack of clarity.

The draft joint management plan may not be modified if a submission:

a) clearly supports proposals in the plan or makes general or neutral statements
b) refers to issues beyond the scope of the plan
c) refers to issues that are already noted within the plan or already considered during its preparation
d) is one among several widely divergent viewpoints received on the topic but the approach in the plan is still considered the best option
e) contributes options that are not feasible (generally due to conflict with legislation or government policy)
f) is based on unclear or factually incorrect information.

The draft joint management plan can be viewed and submissions made online at:
www.dpaw.wa.gov.au/parks/management-plans/draft-plans-open-for-comment

Alternatively, you can write to:
Planning Branch
Parks and Wildlife Service
Department of Biodiversity, Conservation and Attractions
Locked Bag 104
Bentley Delivery Centre WA 6983

Executive summary

This draft joint management plan provides direction for the joint management of existing and proposed coastal conservation and recreation reserves along the *Nyinggulu* (Ningaloo) Coast (the planning area). This includes the terrestrial portion of Ningaloo Marine Park which is a reserve 40m landward of high water mark north of Amherst Point, land not renewed in the 2015 pastoral lease renewal process from Red Bluff in the south to Winderabandi in the north and other portions of unallocated Crown land.

This joint management plan aims to conserve and protect the values of the planning area in the long-term. It provides a summary of operations proposed to be undertaken in the planning area and the vision includes a desire to maintain a low-key recreation experience, welcoming and encouraging visitors to enjoy, understand and respect the culture and other values of the area.

Values

Camping at Sandy Point.

The *Nyinggulu* (Ningaloo) Coast is highly valued by the many visitors to the area seeking to enjoy the marine park and low-key remote recreation experience. The planning area and adjacent marine park are major tourism attractions along the North-West Cape with visitation steadily increasing since the 1980s and economic benefits flowing into the local communities of Carnarvon, Coral Bay and Exmouth. Many of the visitors are long-term repeat visitors with strong attachments to the coast and a desire to be able to continue their experience into the future.

The planning area is highly valued by the traditional owners of the area with many significant cultural values, including cultural heritage sites and places of ceremonial and mythological significance. Undertaking customary activities on country is central to maintaining the cultural heritage of the land and an important part of traditional owner and wider Aboriginal culture, enabling maintenance of traditional relationships with the land and water; sharing of knowledge; engagement in traditional practices; and accessing and looking after significant places.

There are also plants and animals of cultural significance such as sacred totems or animals and plants related to creation stories, ceremonies or are used as medicine or food. There are also significant *thalu* sites along the coast, places for ceremonies and rituals for the increase in numbers of a particular species.

Other key values of the planning area include those associated with the Ningaloo Coast World Heritage Area, namely, karst environments and interglacial fossil reefs as well as various landscape values of the varying rocky shores and sandy beaches adjacent to the marine park.

There are populations of the threatened black-flanked rock wallaby, turtle nesting areas, seabird and shorebird roosting and breeding areas, priority flora, vegetation complexes underrepresented in the conservation reserve system, transitional habitats between the temperate and tropical zones with range end species, and a high level of endemism for reptiles and land snails.

Termite mound.

There is a rich European heritage associated with the early exploration of the North West cape, shipping, pastoralism and settlement as well as the Afghan and North Indian cameleers and traders and the whaling, rock lobster and turtle harvesting industries. Remains of this heritage can still be found throughout the planning area and pastoralists still manage adjacent land for stock such as goats and cattle and some tourism enclaves within the planning area and homestead accommodation.

Management

The Department of Biodiversity, Conservation and Attractions (the department) on behalf of the State government and Conservation and Parks Commission has been negotiating with the Gnulli Native Title claimants to enter into an Indigenous Land Use Agreement. This will allow the creation of the proposed reserves and allow joint management for the reserves to occur with the formation of a Joint Management Body (JMB). The representatives from the Gnulli Native Title claimants on the JMB will ensure the traditional owners will have an opportunity to make decisions about how their country is looked after and be able to discuss the implementation of this joint management plan in further operational detail.

The creation of the proposed conservation and recreation reserves will provide statutory protection under the *Conservation and Land Management Act 1984* and will enable conservation of the significant natural and cultural values within the planning area. The public conservation and recreation reserves will importantly provide ongoing access for all Western Australians, and national and international visitors and a basis for integrated management across the marine and terrestrial environments.

The public conservation and recreation reserves will provide ongoing access for all and protect the cultural, natural and recreational values.

This draft joint management plan proposes that affordable low-key camping and caravanning along the coast will be maintained at current levels, with a key focus on continuing the current experience and the sense of remoteness and high level of self-sufficiency prized by visitors. Short to medium term management effort will be directed towards rehabilitating tracks and degraded areas around camping and day use areas while keeping development to a minimum, with no built accommodation proposed.

This draft joint management plan proposes strategies ensuring cultural sites will be protected and monitored with further cultural planning undertaken. Aboriginal place names and language translations will be incorporated as appropriate and the cultural heritage values and protocols will be communicated to the visitors to ensure visitation is

culturally sensitive and appropriate. The traditional owners will be supported to maintain their connection to, and responsibilities for, country by facilitating customary activities, and native title rights and interests. Traditional owners will be involved in the trainee ranger program in addition to other business and employment opportunities. Cultural traditional knowledge will inform management activities, research and monitoring programs.

Trainee Ranger Cody Farrell participating in the *Ningaloo Turtle Program* as part of his Conservation and Land Management traineeship. Employing traditional owners as Trainee Rangers is an important part of joint management in the planning area. Photo – Tom Nagle/DBCA

To protect the natural values of the planning area, the draft joint management plan proposes to collect more biodiversity data including flora and fauna baseline surveys, establish and conduct research and monitoring programs, implement species recovery plans, rehabilitate dune areas, implement an integrated predator control program, control weeds, manage goats and other introduced herbivores, respond to pollution incidents, seek to reduce marine and coastal debris and manage fire in an appropriate way to protect the key values.

Key performance indicators

Key performance indicators (KPIs) have been selected for each value identified as the highest priority for management over the next 10 years (some of these link into other reporting requirements of other plans such as the adjacent marine park and species recovery plans). These KPIs, identified throughout the joint management plan, will be reported against during the life of the final plan, providing a measure of success of the joint management plan. They include the following measurement areas:

- joint management
- protection of significant cultural and heritage places including sites
- traditional law and knowledge
- customary activities
- protection of other Australian cultural heritage sites
- protection of geological features including cultural significant features, coastal beach processes, karst and interglacial fossil reefs
- watering points of cultural significance
- water quality and quantity of groundwater, soaks and receiving waters
- health and condition of plant and animal species of cultural significance

- knowledge of plant and animal diversity
- coastal vegetation cover and density
- range and population size of threatened and other conservation significant fauna
- conservation status of threatened fauna species
- nesting turtles and hatchlings
- diversity and abundance of seabirds, migratory shorebirds and waders
- weed control
- introduced animal control
- bushfire risk mitigation and size of large, intense fires
- knowledge of fire ecology within the planning area
- the condition of nominated fire-sensitive habitats and communities
- the persistence of fire-sensitive species within the planning area
- cultural knowledge shared appropriately
- visitor satisfaction levels of nature-based experiences
- the extent of visitor management settings and recreation site classes
- track density and proliferation
- track erosion and rehabilitation
- visitor impacts from camping and day use
- visitor compliance with regard to disposal of chemi-toilet waste, general waste disposal and other visitor activities
- numbers of goats, sheep and cattle within the planning area.

Public consultation and implementation

This draft joint management plan will be released for public comment with regard to the proposed management directions and strategies within this plan. The public submissions will be considered and the plan modified as required. The finalised joint management plan will be implemented by the JMB including the Gnulli Native Title claimants and the department.

In addition to joint managers, the wider community such as neighbouring land managers, relevant government agencies, research institutions, conservation groups, tour operators, recreational peak bodies and volunteers can contribute to the management of the planning area through liaison, co-operative work programs, research and monitoring.

Maggies campsite. Photo – DBCA

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Introduction

This joint management plan for the *Nyinggulu* (Ningaloo) coastal reserves has been prepared by the Conservation and Parks Commission of Western Australia (Conservation and Parks Commission) through the Parks and Wildlife Service of the Department of Biodiversity, Conservation and Attractions (the department; or DBCA) jointly with the Gnulli Native Title claimants through the Yamatji Marlpa Aboriginal Corporation (YMAC).

This is the draft of the joint management plan prepared for stakeholder and public consultation. Once finalised, this joint management plan will guide management of the planning area for 10 years from the date the plan is gazetted. During this time, the department, together with the traditional owners and the Conservation and Parks Commission may make amendments to the plan under section 61 of the *Conservation and Land Management Act 1984* (CALM Act), with any proposed changes first released for public comment. If the plan is not reviewed and replaced by the end of the 10-year period, this plan will remain in force until a new plan is approved.

> *Nyinggulu* (nose)
> Ningaloo *is the Aboriginal name for, because of Ningaloo on a map (Point Cloates) is like a nose and the Baiyungu name for nose is* nyinggulu.
> Hazel Walgar, traditional owner, January 2017.

1. Management plan area

The planning area (approximately 70,400ha including potential additions) is located within the Gascoyne area of Western Australia, along the coast adjacent to and including part of Ningaloo Marine Park and the Ningaloo Coast World Heritage Area, south of Cape Range National Park and the Commonwealth Defence land (see Map 1 and Appendix 1). The planning area lies within the Gnulli Native Title Claim area and includes the unallocated Crown land between Ningaloo Marine Park and the adjoining Quobba, Gnaraloo, Warroora, Cardabia and Bullara pastoral stations (69,826ha) as well as the existing[1] coastal strip of Ningaloo Marine Park (reserve 40079[2], 557ha) which extends 40m landward from high water mark between Amherst Point and just to the north of Winderabandi Point (the southern boundary of the Commonwealth Defence Land).

Cape Farquhar area.

The northern portion of the unallocated Crown land is proposed to be added to the nearby Cape Range National Park protecting the southern extent of the Cape Range formation and the remainder is proposed to be a CALM Act section 5(1)(h) reserve for 'conservation and recreation'[3] (proposed section 5(1)h reserve) (see Appendix 1). The planning area will be vested[4] in the Conservation and Parks Commission and jointly managed with the Gnulli Native Title claimants (see Section 3 *Management context - Joint management*).

[1] This existing coastal strip is included in the *Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area* (CALM 2005) but is now included in the planning area for this joint management plan. Once the plan is gazetted it will replace CALM (2005) as the guiding document for the reserve.

[2] This land was reserved for foreshore protection under the *Land Administration Act 1997* in 1987. All terrestrial access to the Ningaloo Marine Park must occur through this coastal strip from Ningaloo Station in the north to Warroora Station in the south; apart from *Murlanda* (Mauds Landing) and Coral Bay townsite.

[3] The creation of these reserves will not extinguish native title and traditional owners can continue to exercise their native title right unless inconsistent with the management and operation of the reserves.

[4] Vesting is a process where a reserve is placed under the care, control and management of an appropriate body/bodies.

Within the planning area, the proposed section 5(1)(h) reserve will extend landwards from the existing coastal strip of Ningaloo Marine Park (north of Amherst Point) or from high water mark (south of Amherst Point) with the intent that the area between high and low water mark to be included in the adjoining Ningaloo Marine Park where it is not already[5]. This will provide contiguous management between Ningaloo Marine Park and the planning area. Management of the intertidal area between reserves will be complementary.

To create the proposed section 5(1)(h) reserve and additions to Cape Range National Park and Ningaloo Marine Park in accordance with the Commonwealth *Native Title Act 1993*, the Western Australian Government is currently negotiating an Indigenous Land Use Agreement (ILUA) with the Gnulli Native Title claimants (see Section 3 *Joint management*). Once the ILUA is signed and registered, the reserves can be created.

The need to create public reserves along the Ningaloo coast has been identified by successive State governments since the 1970s. Apart from a coastal strip 40m landward of the high water mark along the majority of the coast from Red Bluff to Winderabandi (and a couple of other small Crown reserves), the proposed reserves were previously part of the adjacent pastoral stations (see Section 7 *Other Australian cultural heritage*). The coastal land was identified in the Environmental Protection Authority's *Conservation Through Reserves Committee* recommendations, other planning documents and CALM Act management plans (CTRC 1974, WHCC 2004, CALM 1987, CALM 2005a, CALM 2005b, DEWHA 2007 and DEC 2010) as areas not be renewed when the pastoral leases were renegotiated in 2015. After determining future State land requirements through consultation with state and local government agencies, the then Minister (for lands) notified all affected pastoral lessees (of Ningaloo, Cardabia, Warroora, Gnaraloo and Quobba stations) of areas to be excluded from a renewed or extended lease from 1 July 2015 in November 2002. Either prior or during lease negotiations, Quobba, Gnaraloo and Cardabia pastoral lease holders secured tourism leases under the *Land Administration Act 1997* for camping enclaves within the planning area (Red Bluff, 3 Mile Camp and Bruboodjoo) and Warroora pastoral lease holders were able to continue to manage camping along the coast until the proposed conservation reserves are created (noting that much of this coastal camping occurs in the Ningaloo Marine Park coastal strip 40m landward of high water mark and as such has never been under pastoral lease).

The proposed section 5(1)(h) reserve and Cape Range National Park additions will provide statutory protection under the CALM Act and enable a joint management framework with the traditional owners to conserve and protect the values of the area. Having public conservation and recreation reserves will provide ongoing access for all Western Australians, and national and international visitors, and will enable conservation of the significant natural and cultural values within the planning area. The public conservation and recreation reserves will also provide for investments in nature- based tourism such as tours and walking trails and opportunities for employment and commercial partnerships with traditional owners. Affordable low-key camping and caravanning along the coast will be retained.

2. Key values and management issues

This joint management plan focuses on the conservation and protection of the cultural heritage, natural environment, recreation and tourism values within the planning area. This will include developing, supporting and promoting traditional owner involvement, joint management, employment and career development.

This plan identifies management strategies to protect these values and opportunities which will continue to be informed by research and monitoring to enable adaptive management decisions. Management issues are pressures, threats, risks or challenges that have already or may in the future impact on the protection of key values. The key values and management issues are summarised in Table 1, which also highlights some of the opportunities within the planning area. Background text in each section supports and further explains these values, management issues and opportunities. The management strategies in this plan have been developed to address the potential impacts of these management issues on the protection of key values.

Table 1. Key values, management issues and opportunities

Values	Management issues	Opportunities
Culture and heritage		
• connection to country • traditional cultural knowledge • significant sites (registered and otherwise) • plants and animals of cultural significance	• impacts from inappropriate visitor access or activities • traditional owners may feel disconnected to country • impacts from introduced animals	• joint management • access for traditional owners to country for customary activities • employment of traditional owners on country

[5] To correct various anomalies arising from mapping the high water mark.

Values	Management issues	Opportunities
• customary activities, including ceremonial and hunting activities • rich European heritage associated with early explorers, shipping, pastoralism, whaling, rock lobster and turtle fisheries as well as heritage associated with the Afghan and North Indian cameleers and traders	• impacts from weeds • impacts from commercial activities such as pastoralism • mining and mineral exploration • visitor risk at European heritage sites	• development of new education and interpretation programs • tourism and commercial opportunities for traditional owners
Natural		
• landscape values • geological features of National Heritage significance • conservation significant plants, animals and communities e.g turtles, rock wallabies, shorebirds and invertebrate cave fauna • food and medicinal plants • culturally significant animals and *thalu* e.g. totems, bush tucker • habitat values (e.g. karst, turtle nesting areas, seabird and shorebird roosting and breeding areas) • area of transition between temperate and tropical zones • high level of endemism for reptiles and land snails	• need to incorporate traditional ecological knowledge • inappropriate fire regimes • impacts from weeds • impacts from introduced animals, in particular foxes, feral cats and goats • environmental impacts e.g dune erosion, vegetation removal, habitat destruction, turtle disturbance, marine and coastal pollution • biodiversity knowledge gaps • coastal erosion, changing climate and extreme weather events • mining and exploration	• joint management • sharing of traditional ecological knowledge • integrated landscape-scale approach for the management of issues e.g. weeds, introduced animals and fire, in collaboration with neighbouring land managers • greater ability to integrate marine and terrestrial management • research and monitoring of the values to inform adaptive management • dune rehabilitation works to restore natural vegetation
Recreation, tourism and community		
• low-key remote recreational experiences, the 'Ningaloo experience' • landscapes and cultural heritage providing opportunities for a diverse range of cultural and nature-based visitor experiences including four-wheel driving and camping • terrestrial base for accessing, exploring and appreciating the adjacent Ningaloo Reef • commercial nature-based tourism operations	• environmental impacts from inappropriate visitor access or activities e.g four-wheel driving, firewood collection, inappropriate waste disposal • duplication of access and vegetation clearing associated with recreational use • maintaining four-wheel drive road access routes • managing visitor risk issues associated with access and activities • extreme weather events	• joint management • continued sustainable public access to the Ningaloo Coast • social and economic benefits for traditional owners and local communities • communication with visitors, commercial operators and external organisations • continuing education and interpretation programs • maintain a spectrum of recreation opportunities along the coast • greater ability to integrate marine and terrestrial management • easier management of the marine environment through managing visitors and access on land • new commercial operations of appropriate type, style, size and scale • social research

Management direction and context

This joint management plan aims to conserve and protect the values of the planning area in the long-term. It provides a summary of operations proposed to be undertaken in the planning area as guided by the department, traditional owners and Conservation and Parks Commission policies and guidelines[6]. This management plan also provides guidance for operational documents that provide more specific on-ground management direction that allow for adaptive management.

The planning area will be managed through a landscape-scale approach that seeks to enable a coordinated management of visitors, fire, weeds and introduced animals in collaboration with neighbouring land managers. This joint management plan should be viewed as part of a wider management framework for the lands and waters that occur within and around the planning area, in particular the adjoining Ningaloo Marine Park and nearby Cape Range National Park. Existing management plans for these areas include the *Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area* (CALM 2005a) and *Cape Range National Park Management Plan* (DEC 2010).

3. Management context

Legislation and policy

The planning area will be managed in accordance with the provisions of the CALM Act, *Wildlife Conservation Act 1950* (which will be replaced by the *Biodiversity Conservation Act 2016* from 1 January 2019), the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and other relevant legislation and policies[7] mentioned throughout this plan.

In preparing a proposed management plan for any land, the department has the legislative objective of achieving or promoting the purpose for which the land is reserved and in particular for this planning area the proposed management plan shall be designed in the case of:

- the proposed southern extension to Cape Range National Park, to fulfil so much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest (section 56(1)(c) of the CALM Act)
- the existing coastal strip of Ningaloo Marine Park to achieve, or to promote as far as possible, the purposes of allowing only that level of recreational and commercial activity which is consistent with the proper conservation and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest (section 56(1)(db) of the CALM Act)
- the proposed conservation and recreation section 5(1)(h) reserve, to achieve the purpose for which the land was vested in, or for which the care, control and management of the land were placed with, the Conservation and Parks Commission, whether solely or jointly (section 56(e) of the CALM Act).

In preparing a proposed management plan for any land, the department also has a second objective under the CALM Act of:

- protecting and conserving the value of the land to the culture and heritage of Aboriginal persons, in particular from any material adverse effect caused by (i) entry on or the use of the land by other persons; or (ii) the taking or removal of the land's fauna, flora or forest produce; but in a manner that does not have an adverse effect on the protection or conservation of the land's fauna and flora.

If the first objective conflicts or is inconsistent with the second objective, the latter prevails.

[6] Departmental policies can be found at: www.dpaw.wa.gov.au/about-us/36-policies-and-legislation. The Conservation and Parks Commission Position Statements can be found at www.conservation.wa.gov.au/position-statements.aspx.

[7] Relevant legislation can be found on the department's website at: www.dpaw.wa.gov.au/about-us/36-policies-and-legislation or the State Law Publisher's website: www.slp.wa.gov.au

Under the Commonwealth Government's EPBC Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance (e.g. threatened species and ecological communities, migratory species, world heritage properties and national heritage places), need approval from the responsible Australian Government Minister, in addition to any approval that may be needed in Western Australia.

Joint management

The planning area will be jointly managed by the traditional owners and the department. Joint management will be given effect under the CALM Act through a section 56A Joint Management Agreement (JMA) between Gnulli Native Title claimants and the department. The Western Australian Government is negotiating an ILUA with the Gnulli Native Title claimants to ensure the creation of the reserves meets the requirements of the Native Title Act. Once agreed, the ILUA will enable the creation of the proposed reserve and the additions to Cape Range National Park and Ningaloo Marine Park.

> *Joint management*
> *Let's work together to protect our unique coastline because it is very important to us traditional owners and future generations.*
> Hazel Walgar, traditional owner, January 2017

For formal joint management to occur, the final management plan will require the Chief Executive Officer of the department to jointly manage the planning area with traditional owners. Formal joint management can commence once the proposed reserves have been created and a JMA has been signed and attached to the final management plan. The JMA will outline the establishment of a Joint Management Body (JMB) with representatives from the Gnulli Native Title claimants and the department to manage the planning area in accordance with the agreement and the CALM Act. The representatives from the Gnulli Native Title claimants on the JMB will ensure the traditional owners will have an opportunity to make decisions about how their country is looked after and be able to set priorities for implementing this management plan.

Traditional owners and departmental staff during an on-country planning trip January 2017. Photo - Emma West/DBCA

The JMB will oversee management of the planning area, make management decisions, provide strategic input into how management strategies are implemented, and monitor implementation of the plan. Operational responsibility will be coordinated by the department, under the guidance of the JMB and as agreed in the JMA (see Section 6 *Aboriginal cultural heritage*).

Applying a joint management framework will enhance the protection of culture and heritage, geology and landforms, plants, animals and habitats, while allowing culturally appropriate opportunities for recreation and tourism. The joint management framework will also apply to research and monitoring and the management of fire, weeds, introduced animals, resources and utilities.

Once Native Title has been determined, the ILUA provides for joint vesting of the planning area with the Native Title holders. This extends to Cape Range National Park and Ningaloo Marine Park.

World Heritage

The Ningaloo Coast including Cape Range National Park and Ningaloo Marine Park was inscribed on the World Heritage List in June 2011 for its outstanding natural values (UNESCO 2011). The World Heritage listing recognises the outstanding universal value of the area's diverse and abundant marine life, it's amazing cave fauna and the spectacular contrast between the colourful underwater scenery and the arid and rugged land of the Cape Range.

The Ningaloo Marine Park coastal strip (reserve 40079) is part of the World Heritage area. Management of the planning area needs to protect the World Heritage values of the Ningaloo Marine Park coastal strip and adjoining lands and waters within the boundary of the listing. Any action within the planning area that may have a significant impact on the listed property's World Heritage values will need to be assessed under the EPBC Act (see above *Legislation and policy*).

It is proposed to amend the World Heritage boundary to include the remainder of the planning area (now that the proposed reserve and additions to both Cape Range National Park and Ningaloo Marine Park are to be included in the conservation reserve system) as per the intent of the original nomination (DEWHA 2010) (see Section 12 *Native animals and habitats*). Once the reserves are created, this will ensure all the conservation estate along the Ningaloo Coast is within the World Heritage boundary.

The fundamental criterion for a place to be entered in the World Heritage List is that it should be "of outstanding universal value." This concept of outstanding universal value has been teased apart in the *Operational Guidelines*[8] for different categories of value to produce a total of 10 specific criteria.

The Ningaloo Coast area was deemed to meet the following two criteria (WHC 2008, UNESCO 2011):

- criteria (vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
  The landscapes and seascapes of the property are comprised of mostly intact and large-scale marine, coastal and terrestrial environments. The lush and colourful underwater scenery provides a stark and spectacular contrast with the arid and rugged land. The property supports rare and large aggregations of whale sharks (Rhincodon typus) along with important aggregations of other fish species and marine mammals. The aggregations in Ningaloo following the mass coral spawning and seasonal nutrient upwelling cause a peak in productivity that leads approximately 300-500 whale sharks to gather, making this the largest documented aggregation in the world.

- criteria (x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation
  In addition to the remarkable aggregations of whale sharks the Ningaloo Reef harbours a high marine diversity of more than 300 documented coral species, over 700 reef fish species, roughly 650 mollusc species, as well as around 600 crustacean species and more than 1,000 species of marine algae. The high numbers of 155 sponge species and 25 new species of echinoderms add to the significance of the area. On the ecotone, between tropical and temperate waters, the Ningaloo Coast hosts an unusual diversity of marine turtle species with an estimated 10,000 nests deposited along the coast annually.

  The majority of subterranean species on land, including aquatic species in the flooded caves are rare, taxonomically diverse and not found elsewhere in the southern hemisphere. The combination of relict rainforest fauna and small fully aquatic invertebrates within the same cave system is exceptional. The subterranean fauna of the peninsula is highly diverse and has the highest cave fauna (troglomorphic) diversity in Australia and one of the highest in the world. Above ground, the diversity of reptiles and vascular plants in the drylands is likewise noteworthy.

The World Heritage Committee also recommended (UNESCO 2011) that the area be re-nominated to include criterion:

- (ix) be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.

There may be basis for also including cultural criterion to the listing, this is a matter for the Ningaloo Coast World Heritage Advisory Committee. This committee was established as a representative stakeholder group in 2013 by

[8] The *Operational Guidelines* are periodically revised to reflect the decisions of the World Heritage Committee. At the time of inscription, the latest English version was dated January 2008. At the time of writing this management plan the latest version is July 2017, and the criteria remain the same. However, the criteria may change during the life of the plan. The latest version can be accessed here: whc.unesco.org/en/guidelines *(English*.

agreement between the Commonwealth and Western Australia governments. Membership covers a wide range of expertise and community interest including indigenous heritage, pastoral interests, local government, planning, science, tourism, conservation and industry. The role of the Ningaloo Coast World Heritage Advisory Committee is to:

- provide advice to the Commonwealth and State Environment Ministers on the protection, conservation, presentation and management of the values of the World Heritage area
- develop and provide input into initiatives and opportunities for the promotion and presentation of the World Heritage area values to the local, national and international communities
- contribute to enhancing the stewardship and connection of the community to the World Heritage area
- nominate members from the Ningaloo Coast World Heritage Advisory Committee to represent the Committee on the Australian World Heritage Advisory Committee and the Australian World Heritage Indigenous Network.

National Heritage

Although not all the planning area is yet covered by the World Heritage listing, all of the planning area is covered within the Ningaloo Coast National Heritage Place which was listed on the *National Heritage List* in 2010 (AHDB 2010). Any action within the planning area that may have a significant impact on the listed property's National Heritage values will also need to be assessed under the EPBC Act (see above *Legislation and policy*).

The Ningaloo Coast National Heritage Place includes the Exmouth Peninsula and the Ningaloo Reef and it is considered to have outstanding natural heritage value, meeting several criteria:

- (a) the place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history
  The uplifted terraces and fossil reefs in immediate juxtaposition with the modern Ningaloo Reef and Tantabiddi Terrace have outstanding natural heritage value to the nation for their contribution to understanding mechanisms which led to the modern character of the west coast of Australia (see Section 9 *Geology, landforms and soils*). *The rock shelters of Exmouth Peninsula provide the best evidence in Australia for the use of marine resources during the Pleistocene including their uses as food and for personal adornment* (see Section 6 *Aboriginal cultural heritage*).

- (b) the place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history
  As the only example in Australia of a Tertiary orogenic karst and a rare example of active marine karst solution, the Ningaloo Coast contains rare aspects of Australia's natural history (see Section 8 Geology, landforms and soils).

- (c) the place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history
  The Exmouth Peninsula subterranean estuary has outstanding heritage value to the nation for supporting the most diverse and the richest anchialine and groundwater fauna in Australia, among the richest in the world. These ecosystems and the troglobites and stygofauna they support have the potential to yield information about biogeography, evolution and changing climates in Australia over hundreds of millions of years, from the late Palaeozoic to the present. Given that only a handful of the caves and rock shelters of the Exmouth Peninsula region has been investigated the place has outstanding heritage value to the nation because of its potential to provide further insights into marine resource use by Aboriginal people in the Pleistocene and the less well understood last glacial maximum (see Section 12 *Native animals and habitats*).

- (d) the place has outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of:
  1. a class of Australia's natural or cultural places; or
  2. a class of Australia's natural or cultural environments.

  The Ningaloo Coast demonstrates the principal characteristics of a Tertiary karst environment in Australia, including a high concentration of karst features and subterranean ecosystems of global importance, unparalleled in Australia and a geological, hydrological and ecological unity which harmonises the region's present ecosystem functions with its evolutionary history as a time-series of coral reefs and an evolving karst system (see Section 8 *Geology, landforms and soils*).

- (f) the place has outstanding heritage value to the nation because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period.
  The evidence for standardisation in size and manufacture of the shell beads found at Mandu Mandu Creek rockshelter, coupled with the fact they provide the earliest unequivocal evidence for the creation of personal ornaments in Australia, demonstrates a high degree of creative and technical achievement (see Section 6 *Aboriginal cultural heritage*).

4. Strategic direction

Vision

To jointly manage the *Nyinggulu* (Ningaloo) coastal reserves with traditional owners to protect the rich cultural heritage and conserve the coastal reserves' outstanding natural values. Together we will maintain a low-key recreation experience, welcoming and encouraging visitors to enjoy, understand and respect the culture and other values of the area. Throughout the life of the plan, our focus will be on having a healthy country and healthy people.

Objectives

In addition to the legislative objectives of the management plan (see Section 3 *Management context*), the following objectives have been developed for the management plan.

Strategic objectives

The following strategic objectives state the overarching direction for management of the planning area and provide a link between the vision statement and management objectives:

- To protect and conserve the cultural and heritage values of the land while supporting traditional owner customary activities, employment and career progression, and business opportunities.
- To protect and conserve biodiversity and geological, hydrological and ecological integrity of the planning area and the adjoining Ningaloo Marine Park.
- To support and enhance compatible recreation and tourism experiences for the appreciation of the planning area's remote landscape, natural and cultural heritage values.
- To increase understanding of the values and management issues of the planning area, and gain knowledge to guide, adapt and improve management.

The following parts of the management plan (e.g. *Connection to country*) follow these strategic objectives.

Management objectives

Within each part, the values and management issues are organised into sections (e.g. Section 11 *Native plants and plant communities*) and each one has a management objective. The strategies within each section are presented to deliver on these management objectives. A selection of the values and management issues have Key Performance Indicators (KPIs) assigned to them to measure performance and adequacy of the management plan (see Section 5 *Performance assessment*). See Figure 1 for more details.

Figure 1. Strategic direction within management plans

5. Performance assessment

Assessment is an important component of an adaptive management framework and can signal where management may need to be altered if it is not successfully meeting management objectives. Monitoring and evaluating the outcomes of management strategies, and reporting against the KPIs[9] allows the implementation of the plan and management effectiveness to be assessed.

Research and monitoring and other strategies (see Section 28 *Research and monitoring*) will include gaining a better understanding of those values identified over the life of the plan as being most at risk and the threats most likely to impact on cultural, natural, recreation and tourism values. This will inform and improve management of those values.

The Conservation and Parks Commission is the statutory body responsible for periodic assessment of this management plan and will measure the success of this plan in accordance with section 19(1)(g)(iii) of the CALM Act. The JMB, Gnulli Native Title claimants and the department will provide information to the Conservation and Parks Commission on request to enable an assessment of the plan's implementation as well as an assessment of how the plan is performing against the strategic and management objectives. The assessment may be carried out in conjunction with the Gnulli Native Title claimants. This dual output and outcome-based approach provides a robust framework to support adaptive national park management. Other than the Conservation and Parks Commission's periodic assessment of the plan, the JMB will seek reports on the implementation of the plan and the KPIs at the required reporting intervals. The department will continually assess the adequacy of the plan and any need to amend the plan during the life of the plan.

Key performance indicators

A set of KPIs[10] has been chosen to target key components of the plan. The application of a KPI is identified throughout the plan and presented with performance measures, targets and reporting requirements at the end of each section's strategies where applicable. The KPIs are linked to management 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 for this planning area.

Some of the KPIs in this management plan measure changes in populations. Monitoring trends in populations should include monitoring of pressure trends and natural variance as well so that any sustained change (i.e. a continuous decrease or increase) will trigger the requirement for, and type of, management intervention.

Portfolio of evidence

The department will establish and maintain a portfolio of evidence relating to the KPIs throughout the life of the plan to enable measurement of implementation and management effectiveness of actions. The first step is establishing protocols for collecting data and adequate baseline data for each indicator. The next step is to regularly monitor the performance measure so that when the reporting requirement is reached (e.g. in this plan annually or every two to five years), the data has already been collected and some preliminary analysis has already occurred. The results should be reported to the JMB at least at the nominated reporting intervals and then to the Conservation and Parks Commission on request. The Conservation and Parks Commission may audit the management plan at the end of a ten-year period or mid-term depending on their audit schedule.

The implementation of this plan and any assessment for amendment or review is under direction of the local District office, so the portfolio of evidence for this management plan will be collected by the Exmouth District office of the department in consultation with other areas of the department such as Science and Conservation Division.

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
- 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.

[9] KPIs encompass a performance measure, target and reporting requirements.
[10] Refer to Conservation Commission (2014a) for guidelines on selecting KPIs.

Connection to country (managing cultural values)

Strategic objective
To protect and conserve the cultural and heritage values of the land while supporting traditional owner customary activities, employment and career progression, and business opportunities.

6. Aboriginal cultural heritage

Aboriginal people of the planning area

The planning area covers the traditional lands of the Baiyungu and the (west) Thalanyji, also referred to as the Jinigudira, who lived on the North West Cape and its peninsula (Bates 1913, Brandenstein 1967, Tindale 1974, Austin 1992).

Evidence suggests that Aboriginal people have inhabited the area of the North West Cape and Ningaloo Coast for at least 32,000 years (Morse 1993a, b, c). Both the Baiyungu and Jinigudira were predominantly coastal dwelling peoples with an economy that focused on marine resources including turtles, turtle eggs, fish and shell fish such as *Terebralia*, *Melo* and rock oyster (McGann 1999, Chisholm 2013).

The Aboriginal people camped primarily in open-air sites in the dunes adjacent to the tidal mud-flats and mangroves (there is evidence for mangroves once existing in the planning area) which provided the majority of their food resources (Lantze, Murphy and Hammond 1995). The local environment also provided rock overhangs and rockshelters in the gorges and along the coast that would also have been used for habitation and as a refuge during inclement weather (Lantze, Murphy and Hammond 1995).

Both groups also exploited a variety of vegetation for both food and medicinal purposes. For example, when Francis Gregory explored the Gascoyne region in 1858 he observed local Aboriginal people collecting and processing seeds, roots and other plant matter (Petkovic 2007).

Shell fragments including fragments of the large baler shell (*Melo* species) which was used for carrying water at one of the many unsurveyed Aboriginal heritage sites.

The Jinigudira and Baiyungu also manufactured a wide range of tools including lithic artefacts made from the local silicified limestone as well as imported 'exotic' materials. Shells (in particular baler shell) were used to carry water and also worked into tools. The presence of adzes and adze slugs in some of the artefact scatters is also possible evidence of wood working activities undertaken by the groups (Lantze, Murphy and Hammond 1995). Ethnographically, boomerangs and spears were very important to the Jinigudira and Baiyungu who used them for hunting and warfare (Clark 1992). Composite barbed spears in particular were very important for fishing. Gregory, also observed the Aboriginal people using wooden 'scoops' to carry grain and root vegetables. This grain (most likely spinifex or native grass seeds) could then be processed using a grindstone and muller to produce flour that could be made into flat bread and baked in the fire (Petkovic 2007).

The close proximity of the North West Cape to colonial shipping routes meant the Aboriginal people may have been familiar with the sight of European ships on their way north prior to white contact. While the coastline was first sighted in 1616, no Europeans settled in the planning area until 1889 (see Section 7 *Other Australian cultural heritage*).

First recorded contact within the planning area occurred in October 1875 when the barque *Stefano* wrecked on the coast towards the south of the Cape. Two crew members of the *Stefano* survived after relying on the local Aboriginal people for their survival for several months (Petkovic 2007).

> "*When we arrived, natives who were already camped there greeted us with joy and, more importantly, with food and water. We were somewhat restored. Our benefactors, taking care to allow space for our abdomens which were distended from starvation, dug holes in the sand where we were to sleep*."
>
> "*The next day we were further improved, even though we were too feeble to walk much. We rested and ate and drank as much as we wanted. The men fished most of the day while the women and children gathered berries, fruit, and firewood. Periodically, they took some water to the men. Toward evening when the men returned, they made it clear to us that they wanted us to stay with the tribe and go with them when they resumed their wanderings. We knew our basic needs were food and water and they made us realise these would best be provided by them..., even though we knew it wouldn't be easy because they had to move far and fast each day in order to gather enough from the scant supply to keep from starving. We rested at the well-site meeting ground for about a week. We were learning a lot about the daily routine of these people. Their needs were few; they were in perfect balance with nature. There was no surplus nor waste and, although they occasionally went hungry, there didn't seem to be periods of famine*."
>
> Account January 1876 by the survivors of the wreck of the barque *Stefano* (Rathe 1990).

The 1870s onward brought pastoralism to the larger Gascoyne area (see Section 7 *Other Australian cultural heritage*), with physically able Aboriginal people being solicited to perform stock and house-work for the white station owners, in return for often meagre rations (Clark 1992, Goode *et al*. 2014). The introduction of pastoral settlements brought foreign animals and fenced lands, forcing the Aboriginal people away from their traditional runs, hunting places and ceremonial sites. Cattle stations and later sheep stations spread over tribal lands, depleting and fouling water supplies and declining the numbers of native animals in the area (Machin 1998).

The introduction of new diseases that the European settlers brought with them was often fatal for the Aboriginal people and in particular the population of the Jinigudira people was severely impacted through the introduction of disease and other aspects associated with colonisation (Turner 1985, Berndt and Berndt 1999, Chisholm 2013).

The remains of the jetty at Murlanda (Maud's Landing) historically used for the wool trade but also, where some Aboriginal people were taken by ship to Moore River. Inset: The jetty in 1919. Source: National Library of Australia, Michael Terry collection of negatives of his expeditions and travel, 1918-1971.

The removal of Aboriginal children from their families into missions, such as around Carnarvon and the Moore River Native Settlement, affected many traditional family and kin group social patterns. The resulting changes due to this displacement of the Aboriginal people from their traditional land led to fragmented family groups and loss of traditional language and identity. Those who continued to live on pastoral properties followed an adapted life style allowing the Aboriginal people to live on or close to country, and maintain knowledge and connection despite living away from their land (Dagmar 1984, Clarke 1992).

The introduction of the *Federal Pastoral Industry Award* (1968) that required pastoralists to pay their Aboriginal workers the same wages as their other staff led to the majority of the Aboriginal pastoral workers being laid off (Edmunds 1989). As a result, even more Aboriginal people were drawn into missions and developing towns, such as Onslow, Exmouth and Carnarvon (Wangka Maya Pilbara Aboriginal Language Centre 2007).

The pearling industry, which developed in Exmouth Gulf at the same time as the pastoral industry, also tended to relocate Aboriginal people, although in this case displacement meant that individuals were often taken a long way from their traditional lands and recruitment was often forced.

The traditional lands of the Jinigudira and Baiyungu are currently covered by the Gnulli Native Title Claim (WC1997/028) which also extends further east of the planning area. The term *Gnulli* does not refer to a specific tribe of the planning area but comes from the Thudgari language and means 'all of us' (Jones *et al*. 2009). The *Gnulli* label accounts for a complex dispersion and intermingling that has taken place throughout this region since the onset of colonisation. The Gnulli Native Title Claim is comprised of the Yinggarda, Baiyungu and Thalanyji peoples and is represented in heritage and native title matters by YMAC.

Traditional owners Ethan Cooyou, Hazel Walgar, Glenda Morrison, Ronnie Johnston, Cape Farquhar.

Our identity

We belong to one language group, the Ganyara which comprises the Baiyungu, Thalanyji, Binnigura and Budurna languages. The Baiyungu and the Binnigura belong to the emu and the Thalanyji and the Budurna belong to the rain. We identify ourselves wherever we go as ***our language, our clan and our skin.***

Hazel Walgar, traditional owner, January 2017

Dreamtime and traditional law

Many Aboriginal people refer to the creative period as 'The Dreaming'. As the mythological ancestors travelled they carved out 'runs,' leaving clearly marked landscape features across the country. Radcliffe-Brown (1926) was one of the earliest researchers who wrote about one of these mythological ancestors, the Rainbow Serpent myth of Australia. He wrote that throughout Aboriginal Australia there is a common belief in the powers of a huge serpent, which controls the rain cycles and governs the vitality of water sources through totemic increase rituals. The name given to the rainbow serpent by the Baiyungu is *Wanamangura* (Radcliffe-Brown 1926).

Gajalbu or emu

The gajalbu *is the sacred bird. He's the sacred bird for the Baiyungu people…to us he is the Creator.*

Hazel Walgar, traditional owner speaking about her totem the *gajalbu* (emu), January 2017

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 Baiyungu 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.

The Baiyungu people traditionally obeyed a system of rights and obligations, transmitted through birth and marriage, which gave individuals rights to the use and economic benefits of the land over which they also acted as custodians. Daisy Bates, an anthropologist in documenting the Aboriginal tribes of Western Australia, states that the groups of the North-West Nation, including the Baiyungu, followed a four-class system of organisation (also known as the 'skin system'), the Boorong, Banaka, Kaimera and Paljeri (Bates 1985). These four-class systems dictated appropriate marriage laws and laws of descent (often matrilineal), as well as influencing individual *jalnga* (totem) associations (often patrilineal) (Bates 1985).

Initiation ceremonies were also very important, through these ceremonies boys became men and important cultural knowledge was transmitted to the next generation (Clark 1992). Corroborees provided valuable opportunities for people to meet, share stories, perform ceremonies and transmit important cultural knowledge (Clark 1992).

Radcliffe-Brown states that within the "*territory of each horde are found a number of totemic centres, called Thalu, each of which is specially associated with one or more species of natural object*" (Radcliffe-Brown 1931). These totemic-centres are believed to have been the creation of mythological ancestors and the "*spirit-homes of the many different varieties of plant and animals, left there by the Dreaming beings*" (Tonkinson 1991). *Thalu* sites are utilised as

places for ceremonies and rituals surrounding that totemic species, including ceremonies for the increase in numbers of a particular totem. *Thalu* sites within and adjacent to the planning area include *thalu* for *majun* (turtles), *nhuga* (shark), *yambarna* (rays), *bilyguru* (fish), *wuruwurugaja* (squid), *manimanira* (octopus), *bigurda* (hill kangaroo *Macropus robustus*), and *gajalbu* (emu *Dromaius novaehollandiae*) (see Section 12 *Native animals and habitats*). Those who inherited ownership of the land and custodianship of the Dreaming sites were in return entrusted with a responsibility to care for the country (Radcliffe-Brown 1931, Clark 1992). Berndt and Berndt (1999) note that the *thalu* rituals are part of an intricate belief system that is "*concerned with defining and establishing or sustaining man's relationship with his environment*". *Thalu* sites further epitomised the link between totemic descent systems and country. Daniel (1990) clarifies this, stating:

> *Thalu sites are places set aside as a focus for ceremonies that will ensure the continuation or proliferation of particular species of animals, plants and natural phenomena. The ceremonies to achieve this are aimed at "taming" and then driving or directing the spiritual forces inherent in the landscape* (Daniel 1990).

Thalu ceremonies typically can only be performed by a member of a particular totemic association, often seen as the descendent or reincarnation of that totem (Berndt and Berndt 1999). Each member of a kin group was seen as having a totemic association and subsequent *thalu* site, all of which belonged to the head of each family, descending from father to son (Withnell 1901). If, for example, a Banaka man had the totem and *thalu* of an eagle hawk, and wished for them to multiply, that Banaka man and any number of other Banaka men would journey to the appropriate *thalu* site for the eagle hawk to conduct an increase ceremony. When the elder Banaka man died, the eagle totem and *thalu* site would then descend to his sons or daughters, the eldest in particular, who would be of the Paljari class group (Withnell 1901). Withnell (1901) also reported that each of the Boorong, Paljari, Banaka and Kaimera classes have other totems dedicated to their care and these totems, along with *thalu* sites, are also intrinsically woven into descent systems and class organisations.

There will be many opportunities to include stories and language names along the coast, for example *Gabarlawangganji* (Dog Rock), Ningaloo Marine Park. Todd Quartermaine (DBCA) and traditional owners Paul Baron and Hazel Walgar.

Gabarlawangganji (Dog Rock)

By the sea, all ladies, one boy who was mute. He had a pet dog. He went out on the reef when the tide was out. The ladies called to him to come out, but the boy didn't hear. The dog spoke out to the boy and when he heard the dog the boy turned to stone. Today, the rock formation is seen at low tide.

Glenda Morrison, traditional owner, January 2017

Traditional knowledge

Traditional owners, collectively hold an extensive body of cultural and ecological knowledge that in accordance with traditional law, they are responsible and obliged to transfer 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 tools, fishing, hunting, learning about bush tucker and natural medicine and generally through everyday life. Traditional ecological knowledge is underpinned by seasonal calendars and the life cycles of individual species, as well as a deep spiritual attachment to country.

> *That's one thing I'll say to you fellas, we had a good teacher, that was our old dad. His name was* ***Bujigurru, that*** *was his Aboriginal name and he was our good teacher…that's why we got that knowledge, from him. And we so proud of it.*
>
> Gwen Peck, traditional owner, January 2017

To support the traditional owners in passing their traditional knowledge on in the future, management of this value will focus on:

- facilitating the traditional owners to go on country to share their traditional knowledge with the younger generations
- entering into a JMA between the Gnulli Native Title claimants and the department (see Section 3 *Joint management*)
- providing employment opportunities for rangers and fee for service arrangements to assist in all areas of land management.

Traditional owner, Hazel Walgar doing *gulbayamarnu* (bush medicine) for internal illness, Cardabia Station. Photos - provided by Hazel Walgar

This will aid the department to gain a better understanding of traditional knowledge applicable to the planning area, and foster opportunities for integration of traditional knowledge with contemporary conservation science and management. Successful integration of traditional knowledge requires an understanding and appreciation that traditional knowledge is part of a complementary worldview with its associated values, institutions and management systems.

Traditional owners Ethan Cooyou, Sarah Johnstone, Deborah Dodd, Hazel Walgar, Jermaine Baron, Cody Farrell and Joint Management Operations Officer Tom Nagle at Cape Farquhar during a planning trip with the new Trainee Rangers and elders, November 2017. Photo - Todd Quartermaine/DBCA

Significant Law and cultural sites

The most common sites in the planning area are open air and rock shelter sites with an accompanying midden of predominantly shell as well as lithic artefacts and sometimes terrestrial mammal bones. There are 25 Aboriginal heritage sites registered within the planning area including one site within the inland potential addition of Ningaloo Station north of Point Cloates (Department of Aboriginal Affairs *Register of Aboriginal Sites*[11] 2017 data). These include shell middens, artefact scatters, skeletal material/burial sites, camps, meeting places, hunting places and water sources.

The Holocene (the last 10,000 years) has been characterised by a warmer climate resulting in a gradual increase in sea levels. Most of the current midden sites are located on or very near to the coast and have been dated to be 5,000 to 8,000 years old. Many of the older midden sites within the planning area from the earlier Pleistocene (10,000BP to 1.26 million years BP) would also have been located on or very near the coast and as such these sites would have been inundated during the Holocene sea level rise and would now be lost. However, some of the Pleistocene sites are preserved in the rock shelters to the north of the planning area (such as Mandu Mandu Creek Rockshelter, Cape Range National Park) which have been dated between 35,000 and 17,000 years ago (Morse 1992, Morse 1993a, b, c and Przywolnik 2005). At the height of last glacial maximum, the Aboriginal people were episodically occupying these rock shelters and as the shoreline would have only been about 10km away they still utilised a diverse range of marine resources together with the arid plains fauna (Morse 1999). The discovery of shell beads within a rock shelter at Cape Range dated to more than 32,000 years BP provides the earliest evidence of human use of decorative ornaments in Australia, to a time comparable with the earliest such evidence from Europe (Morse 1993b).

The archaeological record from current midden sites near Coral Bay and elsewhere along the coast within the planning area, has provided important evidence for the presence and subsequent decline during the middle Holocene of a more diversified intertidal environment along the coast of the planning area than exists today and provides valuable information on climate change (see Section 8 *Climate and projected climate change*) (Wells 1980, Morse 1993a, b, c, Morse 1996, DPI 2002, McGann 1999). The presence of terebralia shells at several locations within the planning area (e.g. within the potential addition north of Point Cloates) and the earliest known shell middens (in the Coral Bay area) are seen to be evidence for the existence of mangroves within the planning area during the early to middle Holocene (Morse 1996). Terebralia (*Terebralia sulcata* and *Terebralia palustris*) are mud whelks that are strictly associated with soft substrates of the intertidal mangrove environment of tropical Australia. Today the nearest known population of both *T. palustris* and *T. sulcata* is in the Bay of Rest in Exmouth Gulf, and there is an outlier of *T. sulcata* at the mouth of the Gascoyne River, over 200km south of Coral Bay.

Archaeological evidence suggests that an intensification of occupation began around 6,000 BP when sea levels stabilised at their current levels. Rock shelters and shell middens show a similar marine faunal assemblage to that of the Pleistocene with the addition of more turtle bone and shell, and an expanded terrestrial faunal assemblage (Morse 1993a). There is also a change in the type of stone used during this period with exotic fine-grained stone being introduced to sites and a new tool assemblage, including tula adzes, burren adzes and backed artefacts and points. Tula adzes and burren adzes were used for woodworking, while backed artefacts and points were used in hunting. New rock art motifs painted in red rather than white ochre also appear, showing stylistic similarities with rock art found in the Pilbara and Murchison regions (Przywolnik 2005). These late Holocene developments are indicative of growing social and economic networks with groups from outside the peninsula. During the Holocene changes in technology and food preferences conform to the established sequence in the Pilbara and other parts of northern Australia.

The registered sites within the planning area only represent a small proportion of the actual sites that occur there as the majority of Aboriginal heritage places that appear on the register have been identified and reported as a result of cultural resource management surveys undertaken as part of the legislative responsibilities of development projects. When going on country, it is apparent that there are many more sites to be surveyed and recorded so that they can be protected and managed appropriately. It is recommended that during the life of the plan all sites encountered during on country visits by departmental staff and/or traditional owners are documented by the department and the JMB and protected, which may or may not include registering with the Department of Planning, Lands and Heritage as there is some concern that registration of sites may lead to unwanted access and less confidentiality of location.

The JMB may direct the areas that are of priority for heritage survey and/or pursuing registering of sites. For example, some of the recreation sites that are in the north of the planning area between Winderabandi Point and Jane Bay have been identified during preliminary discussions with traditional owners as high priority for heritage surveys as well as areas between Amherst Point and Alison Point. Results from these surveys would guide location and management of recreation sites to avoid further deterioration.

[11] Now recorded through the Department of Planning, Lands and Heritage's *Aboriginal Heritage Enquiry System*.

Track currently going through Aboriginal heritage site.

Inset: Stone artefacts including a grindstone within the potential Aboriginal heritage site. Artefact scatters are a very common type of heritage place and are thought to be the archaeological remains of habitation camps or task specific camps. They may or may not have shell middens associated with them. Grindstones indicate food preparation beyond the exploitation of marine resources.

Some sites both registered and unregistered are being and have been impacted by feral animals, livestock, four-wheel driving, camping and other activities associated with recreational use such as building campfires or cairns, shell collecting/souveniring (see Section 21 *Visitor activities*).

Other threats to Aboriginal sites include the effects of cyclones in the area. Cyclone Vance (see Section 8 *Climate and project climate change*) had a devastating effect on the coastal middens on the Cape Range peninsula. More than 70% of the total amount of archaeological material was removed from all shell middens analysed in a study of Vlamingh Head north of Cape Rage National Park with a mean loss of 86% (Przywolnik 2002). Three of the seven middens surveyed had less than 10% of their archaeological material remaining. Sites within reach of storm surge, particularly those afforded only minimal protection by low foredunes, tended to have loose surface sediment, artefacts and faunal material either removed out to sea or redeposited lower down on the beach. In all middens the material that tended to survive the cyclone was typically the largest and heaviest objects, or the most numerous. Baler shell, giant clam, artefactual stone and chiton were the most prevalent archaeological materials contained in the post-cyclone middens. In some cases, small and fragmentary faunal remains such as turban opercula and bone fragments were still present, when most other small and fragmentary artefacts had been removed entirely.

The impact of extreme seasonal weather on archaeological sites located on high-energy, exposed coastlines in northern Australia is the most likely explanation for the lack of mounded midden sites in such areas. Whilst the impacts of cyclones on coastal middens have not been specifically studied in the planning area, it is likely that archaeological material would still be removed or redistributed with sites closer to the coast most affected by the storm surge and wave action. The implication of the Przywolnik study for cultural heritage management is that dune rehabilitation and stabilisation is vital for the preservation of vulnerable midden sites. This would be achieved by limiting human and stock access to degraded dunes to prevent further deterioration, and revegetating dunes to assist with stability (see sections 9 *Geology, landforms and soils*, 20 *Visitor access* and 25 *Grazing*). This would provide a buffer for exposed sites and reduce the impact of wind and water erosion during extreme weather occurrences (Przywolnik 2002).

Other Aboriginal cultural sites include sites of ceremonial and mythical significance. For example, former meeting places such as *Murlanda* (Mauds Landing) where the young people would go to meet their future husband or wife. As there were rules about which skin groups could marry, this would be a meeting place of the appropriate groups.

Murlanda (Maud's Landing)
Its where people used to come from the North, South and East, that was a main meeting place. It is a very significant place, not just for the Baiyungu. You had people from Thalanji come there for ceremonies and dances and things. That was the place to be.

That was the place and you met the people, and dances and songs and marriage in terms of people coming in and you were given away. That's where the kids met their future wives.
Hazel Walgar, Glenda Morrison, Gwen Peck, Paul Baron traditional owners, January 2017.

Hunting places and increase sites known as *thalu* are also significant cultural sites along the coast. With hunting places in the northern end of the planning area and *thalu* for *majun* (turtles), *nhuga* (shark), *yambarna* (rays), *bilyguru* (fish), *wuruwurugaja* (squid), *manimanira* (octopus), *bigurda* (hill kangaroo *Macropus robustus*), and *gajalbu* (emu *Dromaius novaehollandiae*) occurring in or adjacent to the planning area (see *Dreamtime and traditional law* above). The coastline adjacent to Warroora Station is a *thalu* for green turtles and the traditional owners recall collecting many turtle eggs from there in the past, whereas now it is not a known breeding site for green turtles (see Section 12 *Native animals and habitats*).

Juburda (The Sandbar)
The sand, that white represents the beard of an old man, you can see it when the tide goes out.
Gwen Peck, Glenda Morrison, traditional owners, January 2017

There is a strong connection to the adjacent coastal pastoral stations, associated with long-term employment dating back to the 1870s, as well as birth place, ceremonial areas and burial sites, the latter of which are highly vulnerable to disturbance. Most burial sites are unfenced and traditional owners would like to protect them from damage caused from inappropriate recreation and access. Some of the known sites where skeletal remains[12] have been relocated need to be formally registered and protected as an Aboriginal heritage site.

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 persons who have special cultural authority in culturally sensitive areas will be imperative to ensure site integrity is retained. Some access restrictions have been recommended in this plan accordingly.

Traditional owner, Hazel Walgar with a grinding stone, Ningaloo Coast.

[12] In 2015/16 Aboriginal skeletal remains were transferred and reburied from Coral Bay to *Gurdbardu* (Skeleton Bay).

Grinding stones

Old people might have dropped it or it got too heavy so they left it to next time to come back to know where it is. That's why they leave a lot of heavy ones behind. They will come back later on, on their way through they use it again. But they will always carry little teeny one.

Gwen Peck, traditional owner January 2017

Plants and animals of significance

Plants and animals have sustained Aboriginal people living on country for many years, providing them with food, water and medicine. Many animals are totems for the Baiyungu people and have special significance. 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. 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. Appropriate fire regimes ('right-time fire') are also considered to be a key factor in their successful conservation. See *Caring for country* sections 11 *Native plants and plant communities*, 12 *Native animals and habitats* and 18 *Fire* for further information.

Enjoyment of country and customary activities

Undertaking customary activities on country is central to maintaining the cultural heritage of the land. Although the majority of the traditional owners of the planning area live in towns and communities such as Onslow, Carnarvon, Geraldton and Perth, families and individuals retain close personal connections (socially, spiritually and culturally) with their country. The Baiyungu Aboriginal Corporation was formed in 1999 and holds the title of Cardabia Station on behalf of the traditional owners. Since then, this station has been a focus for the traditional owners for enjoyment of country and customary activities.

Customary activities are an important part of traditional owner and wider Aboriginal culture, enabling maintenance of traditional relationships with the land and water; sharing of knowledge; engagement in traditional practices; and accessing and looking after significant places. Therefore, the ability to access all parts of the planning area for customary practices is crucial. Provisions under the CALM Act enable traditional owners to access country 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 the *Guide to Aboriginal customary activities on Parks and Wildlife-managed lands and waters* (DPaW 2016c).

Above: Chloe Cooyou, the younger generation of traditional owners, *Murlanda* (Maud's Landing). *Kawirri* (shells) are often used for necklaces and other decorations.

Left: The next generation of Baiyungu men left to right: Robert Walgar, Curtley Walgar, Lyal Hughes, Ethan Cooyou, Ryan Merritt, and Deharn Merritt. Photo - Hazel Walgar

Left: Traditional owner, Glenda Morrison, preparing a *bigurda* (euro/hill kangaroo *Macropus robustus*) tail for cooking, Cardabia Station. Right: Damper and kangaroo tail cooking. Photos - Hazel Walgar

Left: Traditional owner, Lyal Hughes, with a *yunggurrji* (sand goanna [*Varanus gouldii*]). Right: Ted Harvey holding a Chinaman cod (*Epinephelus rivulatus*). Photos - Hazel Walgar

Hunting grounds

*That's where the hunting ground was. Going from Farquhar going back up to Yardie, that's all open and that was their hunting ground…that was their feeding ground, their tucker place you know. Even that vine that grows up there, they used to sit down and dig that. It was like yam you know? With the purple flowers, that's the one (*gurraniny*, bush potato or rock morning glory [*Ipomea costata*]).*

Gwen Peck, traditional owner, January 2017

Customary take of threatened species such as *majun* (marine turtles) (see Section 12 *Native animals and habitats*) can sometimes require further arrangements to ensure the harvest is sustainable in the long term. Turtles are of enormous cultural, spiritual and economic (subsistence) importance to the Baiyungu people. Resources such as turtles and other traditional foods reinforce their culture and demonstrate affiliation with tradition and the land. Indigenous hunting of marine turtles has traditionally been managed along the Ningaloo Coast through customary law. The national recovery plan for turtles (Environment Australia 2003) has identified that a combination of State/Commonwealth and customary law is needed to ensure that customary harvest (of eggs and turtle meat) does not contribute to any further decline of marine turtles. Customary law can be used to manage the harvest, utilising protocols such as:

- who can catch and cut up turtles
- not allowing the take of nesting turtles from the beach
- restrictions on the take of eggs
- seasonal closures of beaches and hunting areas
- traditional owners regulating hunting in their traditional areas.

To ensure the recovery of turtle populations, customary harvest needs to be managed in a culturally sensitive manner so that it is ecologically sustainable. The JMB will develop local area arrangements for the customary take of marine turtles (and other threatened species as required) to ensure sustainability and provide for community aspirations. These agreements should be based on sound science and local indigenous knowledge.

Traditional owner, Jamie Tittums, Turtle Cliffs, Ningaloo Marine Park.

Barrumba (wattle, ceremonial smoking tree)

We get a branch off it, we break it, we burn it and then we smoke them. We sit them in the smoke and that smoke gets rid of whatever is there. There is a distinct smell in that smoke, it is very strong.

Hazel Walgar and Paul Baron, traditional owners speaking about taking the young fellas on country to ward off bad spirits, January 2017

Chloe Cooyou, Glenda Morrison, Hazel Walgar, traditional owners standing in front of the *barrumba* (*Acacia sclerosperma* Limestone wattle) near *Murlanda* (Point Maud).

Spear making

The straight roots were used for spears. They were heated in a fire, straightened and then weighed down to help with throwing using spinifex wax.

Wambabarndi (termite mounds)

Termites use the spinifex wax to form the structure of the mound. Then the traditional owners would use the black wax for jewellery, weighing down spears or burnt for incense to ward off evil spirits.

Above: Roots exposed by erosion show an example of straight roots used traditionally for spear making. Right: Close up of a termite mound and the black spinifex wax inside the tubes. Below left: Gwen Peck, traditional owner, January 2017 sharing knowledge about the spinifex wax. Below right: Extracted spinifex wax. Photo – Todd Quartmaine/DBCA

Customary activities must be carried out safely and be consistent with this management plan, relevant legislation (e.g. regarding the use of fire and firearms) and Policy Statement No. 86 *Aboriginal customary activities* (DPaW 2015a) and Corporate Guideline No. 22 *Guidelines regarding Aboriginal customary activities* (DPaW 2016a).

Management objective: To protect and conserve cultural sites and support the continuation and strengthening of connection to country and sharing of cultural knowledge

Management strategies

Joint management

1. Jointly manage the planning area with the traditional owners in accordance with the JMA attached to the final management plan.
2. Work with the JMB to determine the best method to measure the KPIs for Aboriginal cultural heritage e.g. how to measure traditional owner satisfaction levels.

Cultural sites

3. Identify and record Aboriginal cultural sites.
4. Protect cultural sites and artefacts and through the JMB determine which sites of high cultural sensitivity may require special management and/or access restrictions and implement as appropriate.
5. Learn more about the cultural sites and artefacts with regard to date, patterns of use and culture where appropriate.
6. Monitor the condition of culturally significant sites to determine whether they are being adequately protected and maintained.
7. Develop a protocol to protect and sensitively deal with Aboriginal human skeletal material if it is discovered.

Traditional law and knowledge

8. Undertake further cultural planning and develop a cultural plan to record the cultural heritage values of the planning area (e.g. the collation and recording of traditional law and knowledge from senior traditional owners and other sources).
9. Develop an understanding and appreciation of the cultural significance of the planning area to the traditional owners (e.g. through joint on-country visits).
10. Through the JMB, develop guidelines to ensure cultural heritage values, cultural knowledge and traditional laws and protocols (where appropriate) inform management activities, research and monitoring programs (e.g. 'right-time fire' to protect important sites and species and promote habitat diversity).
11. Measure traditional owner satisfaction that traditional knowledge is being considered and adopted as appropriate into management.
12. Include Aboriginal place names and Aboriginal language translations to support recognition of Aboriginal associations with the planning area.
13. Communicate the cultural heritage values of the planning area and appropriate cultural protocols to the public and commercial tour operators when visiting cultural sites through information, interpretation and education.
14. Identify and support opportunities to provide employment, business and training for traditional owners on country to assist in maintaining connection to country.
15. Ensure employment conditions for Aboriginal employees provide an avenue for them to discuss culturally sensitive matters relating to their employment with their elders.
16. Ensure mentoring support is provided for Aboriginal (and non-Aboriginal) employees from elders (e.g. language and spiritual support).
17. Provide cultural awareness training to departmental employees.
18. Support the raising of new leaders within the traditional owner group.

Customary activities

19. Support the traditional owners to maintain their connection to, and responsibilities for, country by facilitating the conduct of customary activities, and native title rights and interests (e.g. support on-country trips by younger and older generations of traditional owners to ensure knowledge, stories and songs about country are passed on, and to undertake other customary activities).
20. 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.
21. Measure traditional owner satisfaction that they are able to access locations in the planning area for the purposes of carrying out customary practices, transferring knowledge to the younger generations and enjoying country.
22. Gather information on cultural take and hunting within the planning area and adjacent marine areas for the purpose of joint management and sustainable use of resources.

23. Develop local area arrangements for cultural hunting in particular of threatened species within the planning area and in the adjacent marine park as required.

Other strategies in this plan also refer to the management of cultural values in recognition of their intrinsic link with other values in particular natural values. By implementing the other strategies in this plan this will also maintain or improve the health of country which is important to the traditional owners of the land.

See also sections 11 *Native plants and plant communities*, 12 *Native animals and habitats*, 14 *Weeds*, *19 Visitor planning*, 20 *Visitor access*, 21 *Visitor activities*, 22 *Commercial operations*.

KPIs: Aboriginal cultural heritage

Performance measure	Target	Reporting
Joint management		
The ability of the traditional owners to make decisions about the management of their country	Conduct JMB meetings in accordance with the JMA	Annually
Cultural sites		
Identification and protection of sites	Stable or increasing number of sites being protected	Annually
Condition of significant cultural and heritage places	• All known sites and areas with cultural and/or gender access restrictions are monitored and managed accordingly • Physical disturbance to significant sites is being mitigated and no new signs of physical disturbance to specified sites and areas within three years of the release of the plan	Annually
Traditional law and knowledge		
Employment and training opportunities (direct and indirect) are generated as a result of the reserves	Stable or increasing number of full-time equivalent positions as indicated in the ILUA and provide opportunities for the development of supervisory/management positions	Annually
Level of traditional owner satisfaction that traditional knowledge is being considered and adopted into management	Traditional owners (through the JMB) are satisfied that traditional knowledge is being considered and adopted as appropriate into management of the planning area	Annually
Customary activities		
Opportunities for traditional owners to visit their country within the planning area, including for on-country planning meetings and visiting of special sites	Maintain or increase opportunities for traditional owners to access their traditional lands	Annually
Level of traditional owner satisfaction that they have been able to continue customary practices and remain custodians of country and culture	Traditional owners (through the JMB) are satisfied that they are able to access the planning area for the purposes of carrying out customary practices, transferring knowledge to younger generations and enjoying country	Annually

Sharing knowledge

I think sharing the knowledge and cultural knowledge with you is just the beginning, you still got more to learn and more areas to cover. Because like I said this coastline is really unique and you know a lot of sacred sites that we need to protect…and I suppose we want to educate the people…its time that we move forward.

Hazel Walgar, traditional owner, January 2017

7. Other Australian cultural heritage

The planning area has a rich European heritage associated with the early explorers of the North West Cape, shipping, pastoralism and settlement as well as the Afghan and North Indian cameleers and traders and the whaling, turtle and rock lobster industries.

European maritime exploration and shipping

The first known Europeans in the area were the Dutch under Dirk Hartog in 1616. They were the first of many sailors who sailed past the North West Cape and sighted land but did not stop there. The English first sighted the Cape in 1620 and from then they began using what they called Cloates Island (Point Cloates) as a navigation aid in their voyages north. A Dutchman, Willem de Vlamingh, visited the North West Cape in 1696 and Vlamingh Head Lighthouse was later named after him (Marchant 1988).

The Ningaloo Coast was first described by William Dampier in 1699 (Dampier 1703) but there were no accurate charts of the coastline. Later expeditions include those led Nicholas Baudin on the *Géographe* in 1801 and 1803 (Péron and Freycinet 1807-16; Baudin 1974; Marchant 1988). Baudin's mission was to locate the North West Cape and later with Freycinet produce a chart of the region.

A number of international wrecks are found in close proximity to each other in and around the waters of the adjacent Ningaloo Marine Park, including the early nineteenth-century wooden ships the American *Rapid* which sank in 1811 and the Portuguese *Correio da Azia* (1816), the Singaporean *Fairy Queen* (1875, wrecked in Exmouth Gulf), the Austro-Hungarian *Stefano* (1875) and *Zvir* (1902), the Scottish *Benan* (1888), and the Norwegian barque *Iona* (1923) (WAM Shipwrecks databases, WAM 2011). Some of these wrecks are visible from the shore during low tide and provide numerous interpretation opportunities within the planning area (see Section 19 *Visitor planning*).

Point Cloates lightstation built in 1910. Photo-Arvid Hogstrom/DBCA.

Point Cloates was considered especially dangerous because of the set of the currents, the low-lying land in the vicinity and the reefs extending offshore. In 1910, a lightstation and keeper's quarters was made from locally available sandstone and erected on Cloates Hill, which was located within the Ningaloo Station pastoral lease. An oil store, stabling and wash-houses were also provided. A 2-foot wide tramway, about 2.5 miles in length, connected the quarters and oil store with the beach landing place. Goods were moved from the beach landing on a trolley pulled along the tram track by horse-power. An area of about fifteen acres was fenced in for the use of the light keepers. An 80-foot tall flagstaff was erected for signalling ships. However, the structures were built on top of a parabolic sand dune which subsequently became unstable. This led to a steel framed lighthouse being constructed in 1936 on Frazer Island, a sand cay in Norwegian Bay.

With the abandonment of the Point Cloates lightstation and quarters letters were sent to pastoral stations in the area requesting offers for purchase and removal of the quarters, but the only offer received was from D. and L. Black of Ningaloo Station, who offered to rent and maintain the place for two years at £5 a year. The offer was accepted. The lighthouse tower and quarters remained in the ownership of the Commonwealth.

In December 1937, Lefroy and MacBolt (see *Pastoralism* below) took over Ningaloo Station and after paying the next six months rent, declined to continue with the rental agreement, as they had no need for quarters. They reported that the lighthouse was deteriorating and 'tumbling down'. The roof was rusting and wind erosion was undermining the foundations. In September 1939, Ningaloo Station purchased the quarters from the Commonwealth Department of the Interior for £30, and paid £5 for the remaining one mile of tram track and a small shed at each end. Timber and iron were removed from the roof of the quarters and stone was removed from the walls over time. In 1958, Commonwealth interest in the lighthouse tower and site were reassigned to the State and the land was re-incorporated into the pastoral

lease, which was in the hands of F. E. and E. J. Lefroy at that time. The Lefroys purchased the lighthouse tower for £5.27.

The unattended light on Frazer Island was subject to sand drift and erosion caused by storms and the action of the sea. By 1965, the island had been eroded to within six feet of the tower's concrete base. On 6 May 1966, the Frazer Island tower collapsed into the sea and a temporary light was erected on the Island. A new lightstation was promptly established on Perth Hill, one kilometre from Point Cloates Lighthouse. This second Point Cloates Lightstation tower came into operation on or about 16 July 1966 and the temporary light on Frazer Island was discontinued. In 1983, the lightstation was converted to solar power. In December 2000 an 'A' Class reserve was created (A44892) at Perth Hill for the purpose of "*Navigation, Communication, Meteorology, Survey and Conservation*" and a Land Administration Act section 47 lease issued to the Australian Maritime and Safety A for 20 years.

In 2018, Point Cloates Lightstation remains as a ruin but is listed on the State heritage register as:

- the place, in its elevated position, is a landmark on the remote Ningaloo coastline, from both the ocean and the sea
- the place was an important link in the development of coastal lights in Western Australia in the early twentieth century, and operated from 1910-1936
- the place was one of four coastal lights established on the north west coast in 1909-1910 in response to the imminent takeover of such installations by the Commonwealth Government
- the place is the earliest site of European occupation on the Ningaloo coast.

Ruins at Point Cloates lightstation. Photo - Arvid Hogstrom/DBCA.

The nearby Perth Hill Lightstation continues to function as a coastal light but has been assessed as having no cultural significance (Considine and Griffiths 2000).

Pastoralism

The beginning of the pastoral industry in the region is marked by the establishment of Minilya Station in 1876. The lease covered the whole of Exmouth Peninsula, and was gradually subdivided into the present leases.

Thomas Carter was the first pastoralist to settle in the Cape Range Peninsula region, establishing a 54,633ha station at Point Cloates in 1889 building his house from material washed up from two shipwrecks nearby (Vines 1968, Przywolnik 2003). Carter ran sheep on his pastoral lease known as Yardie Creek Station for 13 years. He was also a dedicated ornithologist and was one of the first to describe the unique native fauna and flora of North West Cape. Carter's charts of entrances through the dangerous reefs of adjacent Ningaloo Reef are still in use. An assistant of Carter's was speared but Carter himself remained on good terms with the Aboriginal people, recording their bird names in *Birds occurring in the region of the North-West Cape*, published in the *Emu* on 1 July 1903. He identified 180 birds and secured specimens of 170, two entirely new—rufous-crowned emu-wren *(Stipiturus ruficeps*) and the spinifex-bird which bears his name, *Eremiornis carteri*. Carter sold out and returned to England in 1903 (Carmody 1979).

> *Tachypetes minor (lesser frigate-bird,* wannoo*). The appearance of these fine birds was a certain indication of an approaching hurricane or of very stormy weather further north, and they were classed by the natives, with other occasional visitor at such times, as "rain-brothers". There were some numbers of them at Point Cloates at the commencement of the servere hurricane of the 25th and 26th January, 1898…As soon as the weather cleared they returned north, and on one occasion were distinctly seen, late at night, flying north by the bright moonlight".*
>
> Carter (1903 Part IV)

In 1885 Maud's Landing became the central port for loading wool from the pastoral stations into lighters (small boats) and then transferred to larger vessels anchored in deeper water. A jetty, tramway and combined shop and wool store were also built. This landing was used until the late 1920s, before being abandoned by the Harbour and Lights Department after 1927 when extensive repairs were needed.

After subsequent subdivision of Yardie Creek Station from 1907 followed by amalgamation in 1933, the State Government acquired the remaining Yardie Creek Station in 1959, and it eventually formed part of the Cape Range

National Park, gazetted in 1964. In 1972 the newly formed Environmental Protection Authority instigated a thorough review of Western Australia's conservation system, eventually recommending the exclusion for conservation purposes of a number of areas of pastoral leases in the Exmouth region (CTRC 1974, EPA 1975). Point Cloates is specifically mentioned for inclusion into Cape Range National Park and it is recommended that the entire Ningaloo Station is acquired and declared an 'A' class National Park.

From 1995 to 2004, pastoral lessees were offered renewed leases with an exclusion of a strip of coastal land to be added to the conservation estate and managed for conservation and recreation. Noting the pastoral leases were only landward from the 40m above high water mark, many of the existing recreation sites are located within Ningaloo Marine Park with access only through the pastoral stations. Whilst the pastoral exclusions are now to be added to the conservation reserve system, the adjoining pastoralists feel a strong sense of connection to the coast and the land that they have managed and lived on.

As the planning area has a rich pastoral history with remnants of pastoral infrastructure and an ongoing interaction with the existing adjacent pastoralists (access is still through the stations and some pastoralists still manage enclaves within the planning area at Red Bluff, 3 Mile Camp), interpretation and visitor signage and infrastructure will continue to reflect that heritage where appropriate (see Section 19 *Visitor planning*).

Pastoral infrastructure, both used and abandoned, can be found throughout the planning area. A *bilygurumarda* (osprey [*Pandion haliaetus*]) has made a nest in this windmill.

Afghan and North Indian cameleers and traders

For a short period of time from the late 1870s to the early 1900s, the 'Afghan' cameleers (actually from a variety of Muslim countries) and their camels transported wool from the pastoral stations to Maud's Landing or the port in Carnarvon. They carted supplies, tools and equipment, mail and even water to remote settlements.

By the 1930s, Australia's inland transport was controlled by rail and, increasingly, road networks. Facing the prospect of no employment and a sometimes hostile government and people, many of the cameleers returned to their homelands, some after decades of living in Australia. Others remained and turned to other trades and means of making a living. Rather than see their camels shot, they released them into the wild, where they have since flourished. In 2007, the estimated feral camel population of Australia was around 1,000,000, approximately half of which were in Western Australia.

Reminders of the cameleers within the planning area include this stand of date palms planted by them that still exist today. Departmental staff Arvid Hogstrom and traditional owner Paul Barron discuss an area that was a camping area for Aboriginal people as well as a site for Afghan cameleers and pastoral activities.

Whaling

American whalers operated along the Ningaloo Coast as early as the 1790s, initially targeting sperm whales. With improved understanding of whale migrations, they began to hunt humpback whales. While these men most likely went ashore in search of meat and fresh water, they did not establish any infrastructure.

Whaling was carried out from Norwegian Bay intermittently from 1913 to 1957 until it was forced to close due to reduced whale quotas. In 1915 a processing station and a guano (bone meal and fertiliser for use by farmers) factory was constructed on the coast at Norwegian Bay comprising of a 200-foot (50.6m) jetty, 115ft by 83ft two-level flensing deck, digesters, a tramway, guano factory, oil storage tanks, accommodation for the men and the manager, bakery, kitchen and dining rooms, general store and apothecary, and wells with windmills, pumps and pipelines.

The station remains have deteriorated greatly since it was closed. Apart from the remnants of jetties and slipways, the main settlement and processing works are located on a belt of low lying flat ground, running between the high water berm and the dune foot hills. Few permanent structures remain standing, most having collapsed due to the effects of weathering, strong winds and human salvage. In some instances, the only indications of former buildings are a few metal and/or wooden uprights with or without concrete foundations. In others, all that exists is a pile of miscellaneous rubble. Remains of machinery, boilers, storage tanks, fittings supplies, vehicles and so on, are found scattered throughout the place. Pottery shards, broken glassware and other various items are likewise found randomly distributed. An archaeological report was prepared in 1985 (Stanbury 1985) and a heritage assessment in 2004 (Register of Heritage Places 2006). Asbestos within the station remains may be considered a visitor risk and so in the short term, the public should be restricted from accessing this area until a visitor risk assessment and recommendations are made.

Norwegian Bay Whaling Station ruins. Photo- DBCA.

The ruins of the Norwegian Bay Whaling Station are included in two parcels of land: the former Ningaloo Station pastoral lease and the Ningaloo Marine Park 40m coastal strip. The ruins are listed on the State heritage register and are a reminder of the only bay whaling station in Western Australia in the first half of the twentieth century to operate successfully over a long period of time.

World War II

On 19 November 1941, a battle occurred between the Australia light cruiser HMAS *Sydney* and the German raider, the auxiliary cruiser HSK *Kormoran* off the coast. Both ships were destroyed from the half hour confrontation. After HMAS *Sydney* failed to return to port on 24 November, search by air and sea was undertaken. From the 645 strong HMAS Sydney crew, there were no survivors. The battle marks the largest loss of life in the history of the Royal Australia Navy. Three hundred and eighteen of the 399 personnel on the *Kormoran* survived. Some boats and rafts carrying survivors from the *Kormoran* were recovered at sea. Other survivors from the *Kormoran* made it to land at Red Bluff where they camped out at the caves on the southern end of the planning area. These survivors were held in

prisoner of war camps until the end of World War II. Both the HMAS *Sydney* and *Kormoran* wrecks were discovered in 2008 and artefacts are still being found in the area.

It is possible that further evidence of the *Kormoran* survivors exists in the Red Bluff area, although the deep sand in the caves is scoured out by large swells and cyclones. There is a possibility that fragmented artefactual material may have been re-deposited with wave action. There also remains a possibility that fragmented artefacts such as other pistols and bullets, or other buried, jettisoned or smashed/destroyed material such as stores, binoculars or other equipment exist in the Red Bluff rock holes.

Turtle harvesting

The turtle fishery operated intermittently in Western Australia between 1870 and 1961 prior to the industry becoming successfully established in the 1960s. Historical evidence suggests that up to 55,125 (archival records) and 69,000 (oral histories) green turtles (*Chelonia mydas*) were potentially harvested from Western Australian waters in the 13 years prior to the industry being closed down in 1973 (Halkyard 2014). The bulk of this fishing effort was concentrated in the waters off Coral Bay, Exmouth, Onslow and adjacent offshore islands. It is argued that the exploitation of green turtles led to an observable decline in the numbers of these animals, however in a global context, the exploitation of the green turtles in Western Australia occurred at a time when there was an extensive international harvest of marine turtles. The relatively small-scale harvest that took place in Western Australia is likely to have been a factor contributing to the green turtle populations being some of the largest populations remaining in the world. The green turtle is still considered threatened in Western Australia and is listed as Vulnerable (see Section 12 *Native animals and habitats – Fauna of conservation significance*).

Rock lobster fishery

In the 1960s to 1980s, a rock lobster fishery operated along Ningaloo Coast with a base at Nicks Camp in the planning area. Under a commercial licence Nick Farinaccio and his team of divers extracted approximately 25,000-35,000 individuals each year (Halkyard 2005, Depczynski *et al.* 2009). Rapidly declining population levels led to the end of the fishery. The current rock lobster populations along the reef and lagoon areas are at markedly low levels (132 individuals recorded in 2009 [Depczynski *et al.* 2009]).

Interpretation opportunities at the site of Nicks Camp where remnants of the factory and camp are still visible include the unique history of the industry, impact of overfishing and the potential impacts of the loss of the Ningaloo rock lobster species from the reef ecosystem.

Management objective: To conserve and protect other Australian cultural sites within the planning area in consultation with relevant stakeholders

Management strategies

1. Identify, research, document and map other Australian cultural heritage.
2. Control access to, protect, maintain and monitor known or identifiable other Australian cultural heritage.
3. Liaise with the Heritage Council of WA, WA Museum, local government, pastoralists and other relevant organisations, and the local community regarding the appropriate protection, conservation and management of heritage sites.
4. Ensure that other Australian cultural heritage values of the planning area inform and guide management actions.
5. Manage public access to the Norwegian Bay Whaling Station until visitor risk can be assessed with regards to the asbestos and/or appropriate protection and interpretation provided.
6. Provide appropriate information and interpretation on other Australian cultural heritage to promote awareness, appreciation and understanding.
7. Liaise with pastoralists to undertake the removal of derelict pastoral infrastructure of minimal heritage significance from the planning area.

See also Section *19 Visitor planning – Visitor safety* and *Information, education and interpretation*.

KPI: Other Australian cultural heritage

Performance measure	Target	Reporting
Protection of known or identifiable other Australian cultural heritage sites	No further disturbance without formal approval and consultation	Every 3 years

Caring for country (managing natural values)

Strategic objective
To protect and conserve biodiversity and geological, hydrological and ecological integrity of the planning area and the adjoining Ningaloo Marine Park.

Hummock grassland at Cape Farquhar

8. Climate and projected climate change

The Ningaloo Coast experiences an arid, semi-desert to subtropical climate, with variable summer and winter rainfall as it falls in the climatic transitional zone between the temperate, winter-dominated rainfall zone to the south and the tropical, summer-dominated rainfall to the north. A warm winter climate contributes to the planning area's high visitation during winter (see Section 19 *Visitor planning*). The Tropic of Capricorn crosses the southern end of the planning area.

Annual evaporation rates in the region of about 2,700mm far exceed its annual rainfall, of between 200 to 300mm along the coast. In an average year, maximum rain will fall in May/June and minimum rain, of less than two millimetres, will fall in the spring months.

Cyclones

South-east trade winds dominate most of the year. Tropical cyclones may occur in the region during summer bringing high rainfall in association with extreme wave energy and very strong winds to the coast. The direction and speed of the winds experienced during a tropical cyclone are highly variable and depend on the path taken by the cyclone—but may exceed speeds of 150km/hr.

On 22 March 1999, the centre of Tropical Cyclone Vance passed approximately 80km to the east of the Coral Bay settlement. A Category 5 cyclone[13], Vance caused damage to infrastructure, severe coastal erosion, disruption to ecosystems, power and water supplies and cuts to the main road links (BoM 2000, DAL Science and Engineering 2002).

Potentially the most destructive phenomenon associated with cyclones that make landfall is the storm surge—a raised mound of seawater typically some 50km across and up to several metres higher than the normal tide. The storm tide is the combined height of the astronomical (or normal) tide and the storm surge. The worst possible scenario arises when a severe cyclone crosses a coastline with a gently sloping seabed at or close to high tide. Wave action on top of the storm tide can raise the water level even further producing a battering effect on vulnerable structures (BoM 2000).

> "*The rain had stopped and directly overhead the sky was clear. Trees, brush, logs, even sizable boulders and clumps of coral were strewn everywhere. Seaweed uprooted from the ocean bottom was piled high long the shore—and there was not a sign of another living creature anywhere. The wind had stripped the leaves from every bush and tree in sight. The naked limbs were coated with salt spray, which began to glisten as the sun started to dry them out.*"
>
> Account of a tropical cyclone 21 December 1875 by the survivors of the wreck of the barque *Stefano* sheltering at Cape Farquhar (Rathe 1990).

Department of Fire and Emergency Services Western Australia (DFES) is the lead agency in combating incidents from cyclone impact. The department has prepared a Cyclone Contingency Plan (CCP) for use during a cyclonic event. The CCP is automatically activated once a cyclone watch or warning has been issued.

Climate Change

The Inter-governmental Panel on Climate Change (IPCC 2014) states that relative to 1986-2005 it is most likely there will be a global mean surface temperature change in the range of 0.3°C to 0.7°C and a mean global sea level rise of 0.26 to 0.82m by the end of the 21st century (by 2086-2100). Relative to 1850-1900, global surface temperature change is projected to likely exceed 1.5°C.

It is virtually certain that there will be more frequent hot and fewer cold temperature extremes over most land areas on daily and seasonal timescales, as global mean surface temperature increases. It is very likely that heat waves will occur with a higher frequency and longer duration. Occasional cold winter extremes will continue to occur (IPCC 2014).

Changes in precipitation will not be uniform. In many mid-latitude and subtropical dry regions, mean precipitation will likely decrease—modelled in the North West region of Australia as a decrease of 10-20%. Extreme precipitation events over most mid-latitude land masses and over wet tropical regions will very likely become more intense and more frequent as global mean surface temperature increases.

The representative key risks of climate change for the planning area and adjacent marine areas include: significant change in composition and structure of the coral reef system; increased coastal exposure to waves and storms; increased damage to coastal infrastructure and ecosystems and degradation of environmental features important to fisheries and tourism (IPPC 2014).

The planning area supports a number of species and communities that are endemic to the region or at or near the limits of their range (see sections 11 *Native plants and plant communities* and 12 *Native animals and habitats*) which are likely to be particularly vulnerable to climate change. The linear design of the conservation reserve provides good protection with a north-south corridor but limited protection west-east from the coast.

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 of the planning area and managing other issues (e.g. weeds, introduced animals, inappropriate 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, as well as providing large benefits under a range of future climate scenarios (Gross in press). 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.

[13] Categories of cyclone severity range from "1" for a relatively weak cyclone to "5" for the most severe.

Management objective: To minimise the impact of extreme weather events and climate change on the planning area values and enhance the resilience of species and ecosystems.

Management strategies

1. Identify, and where practicable protect, corridors, microhabitats and landform features suitable for species migration and refugia in response to extreme weather events and climate change.
2. Limit other stressors such as weeds, feral animals, inappropriate fire, pollution and inappropriate recreational activities.
3. Incorporate the results of climate change studies, as they become available, into current conservation strategies at the regional, community and species level.
4. Facilitate adaptation options such as assisted dispersal, seed collection and ex-situ conservation for threatened species.

9. Geology, landforms and soils

The planning area is within the Carnarvon Basin that lies mainly offshore and is one of a series of sedimentary basins that extend along the west coast of Australia. It originated over 400 million years ago and has been the main dumping ground for the sediments eroded from the ancient mountain ranges of Western Australia. The Carnarvon Basin is the country's most active oil exploration area and contains the large North West Shelf gas condensate fields and lesser, but nevertheless important reserves of oil (Lane 2004).

Geological structures in this basin are typical of those formed when continental plates have been pulled apart. Faults are common, but some areas experienced wrenching and it is here where anticlines have formed. Anticlines are folds in rocks and which are convex upwards—the centre of the fold has been bent up. Onshore, Cape Range is the most prominent of these anticlines. The rocks exposed here are from 20 to 23 million years old and consist mainly of limestones deposited in shallow marine environments. There are also younger rocks comprising shoreline and minor windblown deposits. This indicates that over geological time the water was becoming progressively shallower, due primarily to the anticline being uplifted at the same time as the sediments were being deposited. In a number of places marine fossils such as corals, echinoids and crustaceans are abundant (Lane 2004). Weathering and dissolution of the limestone has led to the development of karst terrains, including extensive networks of cave systems within Cape Range (Hamilton-Smith *et al.* 1998). South of the Commonwealth Defence land, Cape Range grades into undulating limestone and sand plain.

This southern extent of Cape Range is partly within the planning area within the former Ningaloo Station proposed addition (Russell 2004). The boundary of Cape Range follows the outcrop limits of the Trealla Limestone and Exmouth Sandstone, extending west to immediately north of Ningaloo Homestead/Point Cloates where the southernmost extent of the uplifted reef complex is located, which characteristically defines the western edge of the Cape Range (Hesp 1986, Russell 2004, Wyroll 2000). The uplifted reef complexes record periods of higher sea levels brought about during interglacial periods. The ages of formation of these terraces are not well known however it is assumed that the three upper terraces are older than the lower Tantabiddi Terrace, although there are some evidence indicating that it might be more complicated than that (Russell 2004). Fossil coral reefs, similar to those that can be snorkelled over along the adjacent coast, have been preserved on these terraces (see Section 3 *Management context - World Heritage* and *National Heritage*) (Hesp 1986, Lane 2004).

Part of the southern extent of Cape Range extends further south and east of the planning area into former Ningaloo Station. If the opportunity arises, this area should be added into Cape Range National Park to protect the more of the Cape Range system and associated world and national heritage values (see Section 3 *Management context - World Heritage* and *National Heritage*).

Bigurda or euro (*Macropus robustus*)

"*Cape Range is believed to be part of a continuous line of ranges that begin with the Kennedy Ranges. Padjari came out of the ground at the Kennedy Ranges where he began his travels. After creating many features in the landscape, Padjari ended his adventures at the furtherest tip of the Cape Range. Both ranges show the physical evidence of his travels in the Dreaming, when the world was soft and new and the landscape able to be moulded.*"

(Turner 1985)

A network of hidden caves and tunnels underlies the plateaux, canyons and coastal plain of Exmouth Peninsula. The high relief of Cape Range and lower sea levels in the past have encouraged significant karst development. The hard Miocene Tulki limestone is the main cavernous limestone but younger Pleistocene to Holocene age limestones also display karst erosion. Karst features include numerous caves, dolines (large, characteristically funnel-shaped

depressions or basins in karst limestone), karren (furrows or fissures eroded into karst limestone), gorges, dolines and springs. This Exmouth Peninsula karst system, while relatively common internationally, is almost unknown in Australia (Gillieson *et al*. 2006) (see Section 3 *Management context – National Heritage*). Surveys within former Ningaloo Station are required to determine the extent and significance of the karst system within the northern planning area (see Section 12 *Native animals and habitats*).

Bulbarli, Ningaloo Marine Park.

Along the coast to Warroora Station, the sandplains and dunes comprise of a series of carbonate-rich dune features including; parabolic dunes that are stable when heavily vegetated and undisturbed but highly susceptible to wind erosion which results in extensive northward developing blow-outs whenever foredunes or crests become degraded and active and relic beach ridge deposits. Several of the major blow-outs have their origins near obvious sites of disturbance (stock watering points, fence lines and access tracks) while the origin of others is unclear (Payne *et al*. 1987). Once initiated, the degradation is long term and self-perpetuating under the strong prevailing southerly winds. Blow-outs progress northwards, re-working previously stable crests and arms of the dunes and leaving deflation basins behind. The stability of coastal landform underpins the levels of use and development that can occur without causing environmental damage or degradation (WAPC 2004). Because of the strong prevailing southerly winds and very high susceptibility already of the dune system to wind erosion most of the coast is at high risk from use and development (Payne *et al*. 1987). In addition to the impacts on the vegetation and landscape, dune erosion can impact on cultural sites (see Section 6 *Aboriginal cultural heritage*).

South of Warroora Station, the limestone forms a low, partially dissected plain overlain by calcrete deposits and dunes along the coast (DPI 2002, Hesp 1986).

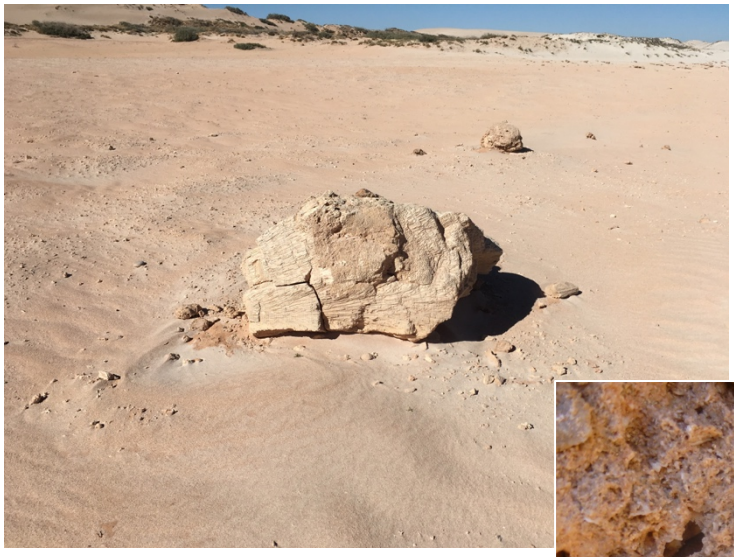
Nearly all beach types are reflective, with most incoming wave energy reflected back out to sea off the beach face. Most are low energy beaches except during cyclones when breaker wave heights and water levels may be significantly increased (see Section 8 *Climate and projected climate change*). Beaches are accordingly relatively steep and narrow. A series of cuspate forelands e.g. Winderbandi Point, Alison Point and Cape Farquhar have developed in the lee of the Ningaloo Reef due to the effects of wave refraction through gaps in the reef and circulation patterns within the lagoon (Sanderson 1997). The cuspate forelands are typically formed through the development of a sequence of beach ridge dune highly susceptible to coastal dune erosion.

Trainee Rangers Cody Farrell, Sarah Johnstone and Jermaine Baron preparing bollards as part of a coastal recovery project at Bruboodjoo camp site December 2017. Photo - Tom Nagle/DBCA

Some of the beaches of the planning area are rotating beaches, where sand is being eroded from an area and being deposited elsewhere, for example at Skeleton Bay which is steadily eroding with sand being deposited at Point Maud which has grown by 20m since the 1970s. In addition to the natural process, development can have impacts, for example Monck Head boat launching facility has cut off the normal supply of sand to Bills Bay. Coral cover has increased in the bay but sandy beach has been lost. In 50 years, it is estimated the coastline at Bills Bay will have progressed significantly eastwards (M. O'Leary pers. comm. 2017). These beach processes have implications on the tenure boundaries of the reserves as the high water mark is regularly being redefined and the actual high water mark in the future may not align with the gazetted boundaries.

Further south, the cuspate forelands of Alison Point and Cape Farquhar are characterised by high, bare, mobile dunes with vegetated parabolic dunes towards their northern ends. Shore-parallel beach ridges are often present adjacent to the shoreline and these are typically backed by recent parabolic dunes. Parabolic dunes are also often found at the northern (downwind) end of a sequence of beach ridges. Bare mobile parabolic dunes are present throughout this area. Along this coastal sector, the sandy shoreline is regularly interrupted by short sections of low coastal cliffs and rocky shoreline. Between Alison Point and Cape Farquhar, the coastal plateau is deeply incised by a series of creeks which drain westward to the sea from off the South Giralia Plateau (WAPC 2004).

The coast southwards from 3 Mile Camp to Point Quobba is largely composed of low limestone cliffs with rocky shores and occasional pocket beaches. Active parabolic dunes are observed adjacent to several of the pocket beaches and these dunes often extend landward onto the plateau area. Relict vegetated parabolic dunes occur along the seaward margin of this plateau for much of this coastal sector. Within a short distance from the coast, the parabolic dunes on the plateau give way to older linear dunes (desert dunes) (Payne *et al.* 1987, WAPC 2004).



West of Gnaraloo Homestead, there is a deposit of large coral heads behind the foredune. They may have been dumped there by a tsunami or super cyclone around 4,500 to 5,000 years ago (M. O'Leary pers. comm. 2017).

Left: Coral head deposit, west of Gnaraloo Homestead. Photo - M. O'Leary/Curtin University
Below: Late Pleistocene interglacial fossil reef at Red Bluff (120,000 to 130,000 years old). Photo - Mike O'Leary/Curtin University

Similar to the fossil reefs along the terraces of Cape Range which are of National Heritage value, there are late Pleistocene fossil reefs along the coast from Cape Cuvier south of the planning area to Gnarraloo Bay. They were formed in the last interglacial period 120,000 to 130,000 years ago. These fossil reefs are considered even more significant than the ones at Cape Range as they are more intact over a longer area. These reefs provide evidence of climate change during the last interglacial period when temperatures were 2°C higher than now and show a wider diversity of corals in the fossil reef than in the existing Ningaloo Reef. Some of these fossil reefs are more sensitive to disturbance than others and these will need to be identified and access managed.

A large area of saline flats occurs to the east of Point Maud which appears to be a palaeolagoon feature which was open to the sea in the vicinity of *Murlanda* (Mauds Landing) during a period of higher sea level (perhaps during the mid-Holocene sea level high stand of approximately 6,400 years ago).

Offshore, the Ningaloo Reef is a living coralgal fringing reef, the largest in Australia and extends from Bundegi Reef, north of Exmouth, around the North West Cape and continues south for some 260km to Red Bluff (CALM 2005a). However, from Gnaraloo Point to Red Bluff the reef borders the shoreline (WAPC 2004). The reef is discontinuous and encloses a shallow sandy lagoon which varies in width from 0.2km to 7km. The reef is broken every few kilometers by gaps which provides channels for navigation and water exchange between the lagoons and the ocean (Lowe *et al.* 2008). There are numerous shipwrecks along the coast (see Section 7 *Other Australian cultural heritage*) and there is the potential for oil spills from modern shipping activities (see Section 17 *Marine and other pollution*).

In addition to the natural geology of the area the presence of grinding stones and other stone artefacts throughout the planning area are part of the cultural landscape and need to be protected from disturbance from recreation or management operations (see Section 6 *Aboriginal cultural heritage*).

Management objective: To identify, protect and conserve geological features, coastal landforms and visual landscape quality.

Management strategies

1. Ensure key geological features and coastal landforms (such as the karst system, coastal cliffs and dunes, uplifted terraces and fossil deposits) are considered in site planning and management operations.
2. Manage access to significant geological features and coastal landforms which are vulnerable to damage e.g cliffs, coastal dunes, karst.
3. Rehabilitate coastal areas to stabilize dune areas as required.
4. Investigate the southern extent of Cape Range and other areas within the planning area for karst features and their significance.
5. Liaise with adjoining pastoralists where applicable to exclude/manage stock, feral goats (*Capra aegagrus hircus*) and rabbits (*Oryctolagus cuniculus*) from key geological features and vulnerable coastal landforms (e.g. within former Gnaraloo Station).
6. Add land to Cape Range National Park that contains the remainder of the geological and geomorphic features of the Cape Range system as the opportunities arise (e.g Commonwealth Defence land and portions of former Ningaloo Station).
7. Provide opportunities for visitors to increase their awareness and appreciation of geological values of the planning area and adjacent reserves in particular world and national heritage values.
8. Protect geological features of cultural significance such as caves and overhangs used at camping places and cultural heritage sites and artefacts where possible.

See also sections 3 *Management context*, 6 *Aboriginal cultural heritage*, 12 *Native animals and habitats* and 15 *Introduced animals*.

KPI: Geology, landforms and soils

Performance measure	Target	Reporting
Cultural significance of geological features and artefacts	Traditional owners are satisfied with the protection of cultural significant geological features and artefacts	Every 2 years
Coastal erosion and beach sedimentation	Natural coastal beach processes are not disrupted by management or recreational activities	Every 5 years
Karst	More information on karst systems within the planning area is known and values protected	Every 5 years
Interglacial fossil reefs	No damage to the interglacial fossil reefs	Every 5 years

10. Hydrology

> *This water along the coast, we call it* gayulu *that's what kept people going, along the coast up and down.*
>
> Gwen Peck, traditional owner, September 2018

Surface water

There are no major surface freshwater features along the coastal reserves. The terrestrial run-off that there is flows to the ocean along minor drainage lines. There are some seasonal brackish water creeks that flow to the coast which are sometimes closed to the ocean by sand bars.

From monitoring carried out as part of the marine park management, there is no evidence that surface run-off is impacting the marine park. However, there are only a few survey points measuring surface water run-off. Unlike the Great Barrier Reef on the east coast, the Ningaloo Reef is very close to shore. Corals and other reef building organisms need sunlight and clear water to survive—and to get these conditions on the east coast reefs must build far out to sea, well away from the sediments carried to the ocean from the mountainous, and in places, very wet coast. But as there is little run-off from the land along the coast at Ningaloo the reef is close to the shore and swimmers can step off the beach into the clear waters of the lagoon, between the reef and the beach. Therefore, any development or use along the coastal reserves needs to take care not to increase any run-off or sedimentation into the adjacent marine waters to protect Ningaloo Reef and its associated recreation values (WAPC 2004).

Coastal creek on former Gnaraloo Pastoral Station.

Groundwater

There are essentially two aquifers in the region; a shallow unconfined aquifer, and a deep confined aquifer (the Birdrong Sandstone) (Rockwater 1994). Most of the shallow groundwater is saline with salinities generally increasing towards the coast where seawater intrusion occurs.

The salinity of the shallow groundwater beneath the saline flats is likely to be even higher than the coastal saline intrusion (Rockwater 1994). In some dune locations there is a thin layer of fresh groundwater overlying the more saline waters; wells at *Murlanda* (Mauds Landing) and Cardabia Station homestead contain salinities of 1–5ppt. Much of the groundwater requires treatment to obtain potable drinking water.

The Birdrong Sandstone is the deeper groundwater aquifer and extends over a wide area of the Carnarvon Basin. This aquifer is the main source of water for the Coral Bay settlement where it occurs at a depth of approximately 800m. The water from this aquifer is hot (58°C) and saline (5.1–5.8 ppt) (DPI 2002).

There is a general lack of freshwater within the Ningaloo coast area. The Indigenous people of the area had the traditional knowledge of the location of the freshwater soaks (perched aquifers) so they could live and travel the coast.

> "*The native's facial expression and gestures suggested that he understood we were dying of thirst and hunger…They rapidly led us from shore until we reached a narrow, well-worn path leading east toward a gently sloping hill. Beyond the hill was a grassy plain, delightful and inviting. There were many flowering plants and shrubs—a vision of paradise for our eyes which were tired of the monotonous glare and heat from the burning sands. The natives searched the plain as if looking for something left behind. Suddenly, they seemed to find what they were looking for. It was a shallow indentation in the ground—about a foot deep and partially covered over with tree bark and dried brush. They peered intently at this hole in the ground. We gathered around but we couldn't see anything at all…*(They) *suddenly began digging in the sandy soil with their bare hands, and soon the sand they were removing appeared damp. As fast as they withdrew the damp earth, they deposited it along the walls of the enlarging hole to form a stronger surface and to prevent drier soil from tumbling back into the excavation. We were wild with delight at the sight of the damp sand. Half frantic with thirst, we greedily grabbed handfuls of wet dirt and stuffed it in our mouths. The natives, evidently unconcerned about our strange behaviour, continued digging and walling to a depth of about five feet, where clear fresh water streamed into the hole. The natives seemed puzzled by our exuberance and joy. We hurriedly gulped cooling drafts—once, twice, three times. We filled the empty bottles that we had carried for the past ten days in anticipation of finding water*"
>
> Account 9 November 1875 by the survivors of the wreck of the barque *Stefano* (Rathe 1990).

The pastoralists have used some of this knowledge and sunk bores into some of these soaks including those within the planning area and extract water for pastoral purposes using long surface pipes that stretch kilometres through the planning area (see Section 26 *Water resource use*).

Above: Disused well, former Cardabia Station.
Right: Surface pipe, former Gnaraloo Station.

Bores and soaks that are not in use should be restored to their natural state and protected taking into account non-Indigenous heritage values and/or value as a water source for native animals.

The limestone formations throughout the North West Cape are characterised by cave features with associated stygofauna (specialised subterranean aquatic species), troglofauna (specialised subterranean terrestrial species) and contain underground streams and caverns (Hamilton-Smith *et al.*, 1998) (see sections 3 *Management context – World Heritage* and *National Heritage*, 12 *Native animals and habitats*). Recharge to the karst province is by direct infiltration, albeit irregularly from the infrequent but intense or long-duration rainfall events. This has important implications for managing groundwater pollution and maintenance of karst ecosystem (Russell 2004). Care must be taken to maintain the aquifer habitat, and control groundwater abstraction in a sustainable way. It is important that pollutants and/or wastes (including sewage, oils and toxic sludge from rubbish tips, fertilisers and pesticides) do not enter the system.

Lake Macleod to the east of the planning area is recharged in part by lateral migration of water from the sea through the planning area to the western margin of the lake. This is due to the hydrostatic pressure generated by a three to four metre difference in water level between the ocean and the basin. Discharge rates can be high enough to produce jetting where water is discharged in a continuous stream at high velocity through narrow vents, or so low as to be expressed only as subsurface seepage. This seawater feed stock is subsequently modified by evaporation, infiltration and run-off (Shepherd 1990). Management of groundwater in the planning area needs to not impact on this flow of groundwater due to the high conservation values of Lake Macleod.

Management objective: To protect and conserve the natural hydrological regimes, particularly freshwater wells and minimise the impacts of altered hydrological regimes on the planning area and adjoining marine receiving waters.

Management strategies

1. Undertake research to improve knowledge of the coastal groundwater system and relationship to the adjoining reef system.
2. Protect watercourses from damage or disturbance during management activities, inappropriate recreation or from trampling from introduced herbivores that may affect water quality or quantity.
3. Liaise with relevant stakeholders on the protection, conservation and management of hydrological features on issues of water quality and quantity.
4. Incorporate provisions to minimise and monitor run-off and sedimentation from onshore activities (including recreation) to the receiving waters of the Marine Park.
5. Monitor surface water extraction and groundwater abstraction and impact on the natural hydrological regimes.
6. Liaise with pastoralists on the use of water resources within the planning area and rehabilitate bores and soaks as appropriate.

KPI: Hydrology		
Performance measure	**Target**	**Reporting**
Watering points of cultural significance	Traditional owners are satisfied with the rehabilitation and condition of culturally significant watering points	Every 3 years
Water quality and quantity of groundwater, soaks and receiving waters (e.g. nutrient levels, salinity, sedimentation, groundwater levels)	No significant detrimental changes in water quality and quantity parameters (i.e. beyond natural seasonal or other cyclic variation) due to onshore activities	Every 2 years

11. Native plants and plant communities

The Ningaloo Coast falls within the Carnarvon District of the Eremaean Botanical Province (Beard 1980) and the Carnarvon bioregion of the Interim Biogeographic Regionalisation for Australia (Thackway and Cresswell 1995). The Carnarvon bioregion is a transition zone between tropical and temperate marine and terrestrial flora (and fauna) species (Kendrick 1993, AHDB 2002, CALM 2003).

Acacia shrubland over spinifex and other grasses including the introduced buffel grass (*Cenchrus ciliaris*).

The vegetation is mainly hummock grasslands and low Acacia shrublands (Payne *et al*. 1987) which has been degraded to varying degrees by stock grazing, recreational use and erosion (CALM 2005a). In some areas, the spinifex has been replaced largely by the buffel grass (*Cenchrus ciliaris*) which has been introduced by the pastoral activities along the coast (see Section 7 *Other Australian cultural heritage*).

Coastal vegetation , 6 Mile.

Coastal vegetation is easily disturbed by vehicle traffic and pedestrian trampling and is difficult to rehabilitate (DCE 1984). The coastal vegetation is important as it protects dunes from erosion and is an integral part of the landscape value of the area.

The local flora has typical arid (Eremean) affinities evidenced by the significant presence of the families Poaceae, Malvaceae, Ateraceae and Mimosaceae. However, there are also species more typical of the flora of the south-west of the state.

According to *NatureMap* (July 2016 data) there are records of 88 native flora species from 31 families, mainly from Myrtaceae (eucalypts and paperbarks – 11 species), Fabaceae (legumes, peas and wattles –12 species), Poaceae (grasses – 8 species) and Asteraceae (daisies – 10 species). However, this is based on limited survey data so further surveying within the planning area would be required to fully describe the area.

Clockwise from left: true spinifex (*Spinifex longifolus*), camel bush (*Trichodesma zeylanicum*), Dampier pea (*Swainsona pterostylis*), the traditional owners use the red flower for moisturiser and sunscreen, *Thryptomene baeckeacea* and *Petalostylis* sp.

Vegetation associations

There are nine vegetation associations based on Beard's vegetation mapping and of these, only two are adequately reserved in the conservation reserve system. Three vegetation associations are currently not reserved in any conservation estate, three have less than 2% of the pre-European extent reserved in conservation reserves and one less than 7%. Almost all of these have been identified as high or medium priority for reservation within the Carnarvon bioregion (CALM 2003, Desmond and Chant 2001). With the reservation of the proposed reserves along Ningaloo Coast, it would improve the reservation level of two of the seven poorly reserved vegetation associations so that over 15% of the pre-European extent was reserved and increase the reservation level of two vegetation associations by between 4-7% (see Appendix 2).

Flora of cultural significance

Flora can be of cultural significance if it is used for food, medicine or ceremonies. It may also have mythological and spiritual significance. Appendix 3 has some species known to be of cultural significance but it is anticipated that this list will be added to during the life of the plan as knowledge is collected and shared between the traditional owners and the department during the joint management of the planning area.

Gurra (*Acacia* spp.), the Baiyungu grind up the seeds to make flour.

Left: *Acacia tetragonophylla*. Above: *Acacia coriacea* (wire wood). Below: Jamie Tittums, traditional owner holding the fruit of the *warlawarla* (sandalwood tree [*Santalum spicatum*]) which is good to eat.

"Although fishing was the main source of food, the women's seed-gathering provided variety as well as quantity. At this location the women gathered a bean somewhat like the European lentil. It was oblong and in pods that held 20 or more seeds. The pods grew on bushes that were three to four feet high and covered with long, slender, bright-green leaves. The women dried the beans and ground them with stones. The resulting flour was immediately mixed with water and shaped into small loaves that were baked on hot embers.

...Something everyone relished was a species of seedless date, which was very sweet. It was never eaten raw but was roasted or baked. Only the women knew where to gather them, and they kept the location secret from the men of the tribe..."

Account January 1876 by the survivors of the wreck of the barque *Stefano* (Rathe 1990).

Traditional owner, Chloe Cooyou, picking and peeling *gagurla* (bush banana), Cardabia Station. Photo - Hazel Walgar

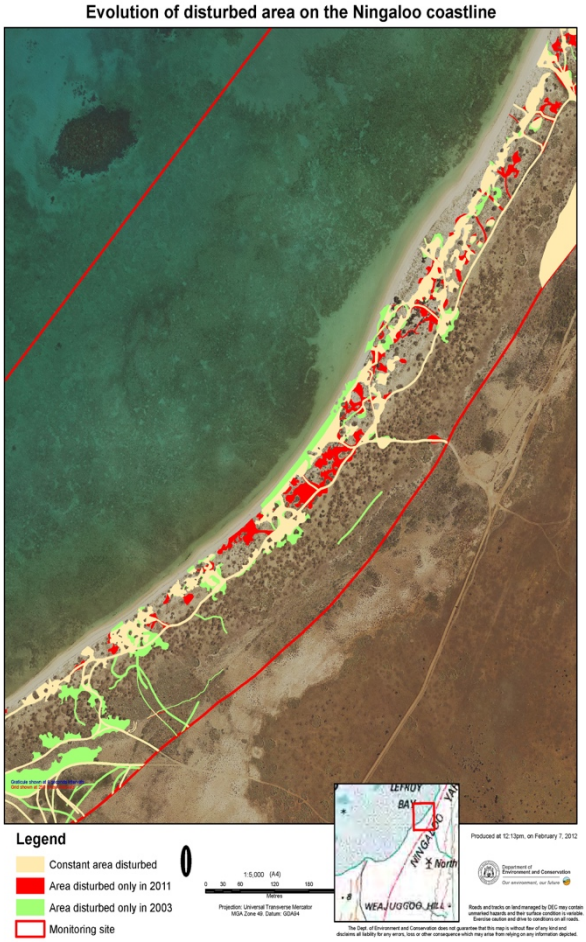
Flora of conservation significance

After more comprehensive surveying of the planning area there will be more accurate knowledge on the flora of conservation significance within the reserves. A population of priority flora *Whiteochloa capillipes* has been recorded from former Ningaloo Station in the Point Cloates area. There are also populations of *Corchorus congener* in the potential addition north-east of Point Cloates and *Stackhousia umbellata* on the eastern boundary of former Ningaloo Station both which might also occur in the planning area. There are also other priority species recorded from adjacent Cardabia, Warroora and Gnaraloo stations such as *Diplopeltis intermedia*, *Acacia ryaniana* and *A. startii* which after further surveying might be found to also occur in the planning area.

It is likely that some of the local endemic species known from Cape Range National Park such as Yardie morning glory (*Ipomea yardiensis*) may also be found in the north of the planning area (D. Sandow pers. comm. 2017) and that some species are at the northern or southern end of their range as the area is within the transition zone between temperate and tropical zones.

Vegetation condition

The department has undertaken a remote sensing project on coastal biological communities as part of measuring a KPI in the management of the Ningaloo Marine Park (CALM 2005a). This involved analysing aerial photography to interpret the change in anthropogenic (trails, tracks, roads, campsites, degraded areas) and natural impacts (erosion such as sand blowouts). Loss or gain of vegetation is considered as an indicator of condition and pressure. Monitoring sites utilised for assessing the historical trends of anthropogenic and natural disturbances on coastal biological communities within the reserve were located in the vicinity of *Majuns* (Turtles), *Walbal Wardu* (14 Mile Camp), *Murlanda* (Maud's Landing) and Lefroy Bay (Murray *et al.* 2014). While the vegetation condition was assessed as satisfactory, the pressure and pressure trend were assessed as high and increasing.



Example of analysis of tracks from the Kobryn *et al.* 2017 study.

In addition to this, collaborative research projects at Murdoch University have analysed and mapped the extent of vegetation and off-road vehicle tracks along the coast at Ningaloo (up to 2km inland) using hyperspectral remote sensing (Kobryn *et al* 2011 and Kobryn *et al* 2017). High densities of tracks were found at a range of locations along the coast. The existence of extensive network of unmanaged tracks is a concern in that continual degradation impacts on the quality of the tourism landscape and poses significant cost and effort in relation to closure and repair. The outputs of the Kobryn *et al*. 2017 study provide a quantitative and spatially explicit dataset of where management and restoration efforts are needed. These quantified areas will assist the department in prioritising track closure and rehabilitation works (see Section 20 *Visitor access*).

Rehabilitation has significant benefits from visual landscape, visitor management and environmental perspectives. At recreation sites, site protection plans will be prepared to provide interim protection to sites, prior to further works being implemented (see Section 21 *Visitor activities*).

Management objective: To protect and conserve native plants and plant communities particularly those of cultural and/or conservation significance

Management strategies

1. Undertake or support baseline surveys of native plants and plant communities.
2. Collate information on culturally significant native plants and plant communities.
3. Establish and maintain monitoring sites, monitor populations and maintain records of plant species and plant communities prioritizing those of cultural and/or conservation significance.
4. Develop and implement recovery plans for threatened plants as required.
5. Identify and protect native plants and plant communities that may require special protection from inappropriate fire regimes, weeds, grazing pressure from introduced herbivores and/or inappropriate recreational activities.
6. Rehabilitating coastal dune areas e.g where tracks have been closed or blowouts have occurred.
7. Expand the analysis areas for the current remote sensing vegetation monitoring and develop targets for dune vegetation restoration activities based on dune vegetation condition and prioritisation.
8. Prevent or minimise impacts on native flora and communities from visitor use. This may involve:
   a) guiding or restricting visitor access as necessary
   b) assessing ecological effects of proposed recreation and other infrastructure developments to inform siting and design decisions
   c) continuing to not permit firewood collection
   d) providing and promoting opportunities for visitors to increase their knowledge and appreciation of the area's flora values.

See also sections 14 *Weeds*, 15 *Introduced and other problem animals*, 18 *Fire*, 20 *Visitor access*, 21 *Visitor activities*, 25 *Grazing*.

KPIs: Native plants and plant communities

Performance measure	Target	Reporting
Health and condition of species of cultural significance	Traditional owners are satisfied with the health and condition of culturally significant species	Every 2 years

Management objective: To protect and conserve native plants and plant communities particularly those of cultural and/or conservation significance		
Knowledge of plant diversity	Flora surveys are carried out identifying species of cultural and conservation significance	Every 2 years
Vegetation cover and density+	No further loss of coastal biological community biomass as a result of human activity in the planning area	Annually

+ Links with KPI in CALM (2005).

12. Native animals and habitats

The planning area is situated within the Carnarvon Basin National Biodiversity Hotspot[14], one of only 15 in Australia. Some of the values contributing to its hotspot status are the aquatic and terrestrial cave-dwelling animals that live in the caves and sinkholes of Cape Range. The southern extent of Cape Range is in the north of the planning area (see sections 9 *Geology, landforms and soils* and 12 *Native animals and habitats - Karst*).

There are 231 native animal taxa recorded[15] in the planning area, including six mammal taxa, 160 bird taxa, 37 reptile taxa, one fish and 27 invertebrate taxa (derived from *NatureMap* 2017 data, departmental records and various other surveys). However, these figures are based on limited and patchy survey data so further surveying within the planning area would be required to fully describe the area and determine fauna values. Potential species to investigate within the planning area include: the striped faced dunnart (*Sminthopsis macroura*), a burrowing frog and the northern spiny tailed gecko (*Strophurus ciliaris*) (district records).

Little corellas (*Cacatua sanguinea*).

The planning area occurs in an area of overlap between the southern temperate and northern tropical zones so many species are at their northern or southern extent of their range. Therefore, maintaining healthy habitats for these species will ensure no range contractions occur.

Fauna of cultural significance

Fauna can be of cultural significance if it is a sacred totem, related to 'The Dreaming', has ceremonial significance or is used for food (bush tucker). Fauna within the planning area that is considered to be of cultural significance includes but is not limited to the *gajalbu* (emu), *bundgurdi* (kangaroo), *bardurra* (bush turkey), *majun* (marine turtles) and *bilygurumarda* (osprey, the language name literally means fisherman).

Totems

The Baiyungu can belong to either the gajalbu *(emu),* bundgurdi *(red kangaroo) or the* bardurra *(bush turkey) totems. There are subclasses within these totems depending on whether you are male or female.*

If you belong to the bardurra *(bush turkey) totem and you are female then your name would have* willari *as part of it. If you have* gajalbu *(emu) as your totem then you would have* guru *(*gurru *= feather) as part of your Aboriginal name, for example* Yarrbaguru *(emu walking sideways).*

[14] "*Biodiversity hotspots are areas that support natural ecosystems that are largely intact and where native species and communities associated with these ecosystems are well represented. They are also areas with a high diversity of locally endemic species, which are species that are not found or are rarely found outside the hotspot. The current, planned or potential management activities in hotspots place the natural values at risk, and it is likely this risk will increase in the future in the absence of active conservation management.*" (DoE 2017)

[15] Data compiled from district departmental records and observations, traditional owner knowledge, *NatureMap* 2017 records and published documents of the area.

If you have gajalbu *(emu) as your totem then you cannot cook or cut it, someone else has to do it for you. Once someone else has cooked it for you, then you have to eat it in silence.*

For the bundgurdi *(kangaroo) totem, you would have markings on you. At the first sign of pregnancy you might have a marking on you and that baby would be kangaroo totem. White markings on the baby signify the kangaroo totem and may be where the kangaroo got shot.*

Hazel Walgar, traditional owner January 2017

Left: Male *bardurra* (bush turkey [*Ardeotis australis*]) which is smaller than the female, looking for a mate. The *bardurra* is an important totem for the Baiyungu people. Right: When caterpillars are crossing the road that means the *gajalbu* (emus [*Dromaius novaehollandiae*]) are laying their eggs.

Fauna of conservation significance

There are 38 threatened and other specially protected vertebrate fauna taxa listed under the Wildlife Conservation Act[16] recorded within the planning area (*NatureMap* 2017 data).

Under schedules 1-3 of the Wildlife Conservation Act there are 10 threatened vertebrate fauna taxa recorded within the planning area (2017 data). These are listed as 'Endangered' or 'Vulnerable' and include:

- one mammal
  - Endangered – black-flanked rock wallaby (*Petrogale lateralis lateralis*)
- five birds
  - Endangered – lesser sand plover (*Charadrius mongolus*)
  - Vulnerable – curlew sandpiper (*Calidris ferruginea*), great knot (*Calidris tenuirostris*), eastern curlew (*Numenius madagascariensis*) and fairy tern (*Sterna nereis nereis*)
- three reptiles
  - Endangered – loggerhead turtle (*Caretta caretta*)
  - Vulnerable – green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*)
- one fish
  - Vulnerable – blind gudgeon (*Milyeringa veritas*).

A recovery plan[17] has been prepared for the black-flanked rock wallaby (Pearson 2013) and for the loggerhead, green and hawksbill turtles (Environment Australia 2003) both of which include actions applicable to the planning area (see further below).

The blind gudgeon is a small eyeless fish that lives in caves and underground waters of the narrow coastal plain of the peninsula and foothills of Cape Range (and Barrow Island). It is one of only two vertebrate animals known from Australia that are restricted to subterranean waters. The main identified threats include sedimentation and diffuse pollution from development, water abstraction and point source pollution from sewage, landfill, dumping and mining (DEWHA 2008a).

Under schedule 5 of the Wildlife Conservation Act there are 31 bird taxa subject to international agreements relating to the protection of migratory birds that are declared to be in need of special protection. This includes five taxa also listed as threatened.

[16] Threatened fauna is that declared 'rare or likely to become extinct' under the Wildlife Conservation Act.
[17] DBCA recovery plans www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/197-approved-recovery-plans
National recovery plans www.environment.gov.au/biodiversity/threatened/recovery.html.

Cape Range National Park has a high level of endemism in reptiles and this also seems to extend to include the wider Ningaloo Coast. There are at least four reptile taxa within the planning area that are endemic to the area with restricted ranges and five taxa that are at either the northern or southern extent of their ranges.

A number of invertebrate species are known to be of conservation significance within the planning area including the Camaenid land snails. The North West Cape is a centre of richness and endemism and has been identified as an important area for land snail conservation in Australia. Land snails are a good indicator species for environmental condition and the status of arid zone refugia due to their endemism, low number of species and dependence on moisture (Slatyer *et al*. 2007).

Other conservation significant species recorded near the boundaries of the planning area that may also occur in the planning area include:

- Gnaraloo Station mulch-slider skink (*Lerista haroldi*) Priority 1
- Ningaloo worm-lizard (*Aprasia rostrata*) Priority 3
- Cape Range slider (*Lerista allochira*) Priority 3
- *Quistrachia warroorana* (an endemic and resticted land snail).

As surveying of the planning area has not been extensive there may be other species of conservation significance discovered during the life of the plan, as well as changes to the conservation status of the species known to occur.

Ethan Cooyou, Hazel Walgar and Curtley Walgar, traditional owners, Coral Bay January 2017.

Black-flanked rock wallabies

The black-flanked rock wallaby is discontinuously distributed within Western Australia including several extant populations across Cape Range including Cape Range National Park, the Commonwealth Defence land and former Ningaloo Station. The black-flanked rock wallaby is found on rockpiles which are sufficiently weathered or fractured to provide access to shelter in the form of caves, crevices or fissures. Their diet includes fig plants along with a variety of other perennial species, especially dicotyledons (Creese 2007). Within the planning area there are populations of the black-flanked rock wallaby in low gorges within former Ningaloo Station; in both the portion proposed to be added to Cape Range National Park as well as in the potential addition adjacent that contains the southern extent of Cape Range.

These populations were first surveyed in 1979 and since then the limited monitoring that has occurred has shown that the population numbers have steadily increased despite no predator control in the areas and the high densities of feral goats that share the gorges with them at night (Kinnear 1995). More detailed monitoring of these populations should occur to determine population size, trends and natural variance. This may be by way of mark-recapture trapping with microchipping/transponders or less intensively by fresh faecal pellet searches, remote cameras and spotlight counts (Pearson 2013).

The general threats to rock wallabies include:

- predation by foxes (*Vulpes vulpes*), feral cats (*Felis catus*) and dogs (*Canis familiaris*)
- competition for food and shelter from introduced herbivores
- changes to fire regimes since colonisation
- habitat destruction from clearing, mining and quarrying
- habitat degradation due to weed incursions
- small population sizes and population fragmentation
- disease
- disturbance by tourists
- drought and the effects of climate change (Pearson 2013).

The recovery plan for rock wallabies (Pearson 2013) lists feral goats as the main threat to the Cape Range and Ningaloo populations. Feral goats are possible competitors of rock wallabies but there is little available evidence that competition is actually a significant factor. In other areas where goats have been controlled there has not been a consistent across the board population increase by rock wallabies (Kinnear 1995). The areas where the rock wallabies are found within the planning area have good shelter with multi-entranced crevices and lots of figs. It is a possibility that the goats provide a sentinel service to warn rock wallabies of the approach of predators such as foxes and/or cats. However, it is not known what might occur in future drought conditions if there are still high goat numbers (D. Pearson pers. comm. 2013). Another introduced herbivore, the rabbit also may be impacting on the amount of potential forage available for rock wallabies and their activities may encourage weed infestations although their principal threat is likely to be by supporting higher predator populations.

Feral goats (*Capra aegagrus hircus*) and a rock wallaby (*Petrogale lateralis lateralis*) at former Ningaloo Station. These populations of rock wallabies seem to be able to tolerate some goat presence, but usually only where the habitat is punctuated by numerous caves and crevices that goats cannot fully access but rock-wallabies can. Note the much larger size of feral goats.
Photo - D. Pearson/DBCA

Predation from foxes, feral cats and wild dogs/dingoes may also be impacting on the rock wallaby populations. The presence of such predators tends to result in a reduction in time spent foraging and in foraging distance from their rocky refugia (Pearson 2013). To date there has been limited introduced predator control for the populations within the planning area and they have been used as an unbaited control population in studies on the impact of fox predation on rock wallabies (Kinnear 1995). As the removal of dingoes and foxes may lead to an increase in feral cat numbers through a 'mesopredator release' mechanism, any future control program needs to take into account the interactions between the different predators (see Section 15 *Introduced animals and other problem animals*).

Removal of predators also may lead to increases in the densities of other macropods and so indirectly affect rock wallabies. The *bigurda* (hill kangaroo or euro) is one species that may potentially increase under a fox baiting regime (Read and Ward 2011). An overlap with rock wallaby diets and shelter sites is likely in some areas, although the nature and extent of competition is not known.

It is also unknown to what extent a large fire in the area in March 2017 impacted on the Ningaloo populations. Rocky habitats often cause fire fronts to slow and reticulate, they also provide protection from fire and remain after fire reducing predation risk. Thus, rock wallaby populations are often buffered from the worst effects of bushfires (Burbidge and McKenzie 1989, McKenzie *et al*. 2007). While fire may cause short-term loss of feeding resources, it may also

remove senescent unpalatable vegetation (such as old spinifex) and stimulate regeneration of more palatable ephemeral and perennial plant species. There has been no research on the impact of fire specifically on rock wallabies. Although observations on the impact of large fires on rock wallabies on a south coast island found that there was some mortality of individual rock wallabies, but many survived and soon began to forage through burnt areas (Pearson unpublished). Apart from some anecdotal accounts of rock wallabies vacating burnt areas for short periods, understanding of the short and long-term effects of fire is limited. Therefore, research into the most appropriate ways to manage fire around rock wallaby colonies is required (see Section 18 *Fire*).

The increased likelihood of inbreeding when rock wallaby populations are small may result in reduced genetic variability, the expression of recessive genes or suppressed reproductive rates (Eldridge *et al.* 1999). As populations within WA are studied in more detail, it is likely that population sub-structuring will increasingly become an important aspect for consideration in rock wallaby conservation and management.

Majun (turtles)

Three species of *majun* (marine turtle) have been recorded in the planning area, the loggerhead, green and hawksbill turtles (CALM 2005a). Most turtle activity is within Ningaloo Marine Park and adjacent Cape Range National Park, Muiron Islands and the Jurabi Coastal Park, however there are also important rookeries within this planning area. These include Red Bluff, Gnaraloo Bay, Cape Farquhar, Pelican Point, Five Fingers, Bateman's Bay, Dugong, Point Cloates and Jane's Bay.

The majority of nests are green and loggerhead turtle nests. The green turtle is abundant throughout the year with a large resident population along Ningaloo Reef with the other turtles being migratory, visiting the planning area November to March to nest and/or haul out and rest on the sandy beaches. Green turtles tend to nest in higher proportions in the northern areas of the reserves while loggerheads tend to favour the sandy beaches of the southern areas of the reserves (Waayers 2003). Whilst there are less hawksbill turtles nesting along the Ningaloo Coast, the population is significant as they represent the largest remaining population in the Indian Ocean (CALM 2005a).

There are also records of occasional foraging along the Ningaloo Coast by the other marine turtles found in Australian waters, the flatback turtle (*Natator depressus*), leatherback turtle (*Dermochelys coriacea*) and olive ridley turtle (*Lepidochelys olivacea*) (CALM 2005a).

Marine turtles are under immense pressure internationally from a range of activities including illegal trade and harvest; unsustainable harvest; some forms of commercial fishing such as trawling and long-lining; and loss or degradation of habitat such as seagrass beds, coral reef ecosystems and intact coastlines. A recovery plan for marine turtles in Australia (Environment Australia 2003) has been prepared.

Potential threats to turtle populations in the planning area are mainly from disturbance to nesting habitat (i.e. vehicle access to nesting beaches), as well as disturbance of the females during nesting activity. This can be by commercial interactions or by inappropriate recreational activities. When turtles are disturbed during nesting they may abandon the nest and return to the ocean. Light pollution emitted by car headlights and/or camping areas can also disturb nesting turtles and disorientate emerging hatchlings.

Foxes and feral cats can predate on egg clutches from nests on the beaches (CALM 2005a) however predation levels are now considered to be low after long-term management and feral baiting programs along the coast (DPaW 2015b, see Section 15 *Introduced and other problem animals*). Predation studies using remote cameras and nest cameras show reduction in fox numbers and turtle nest predation but also that seagulls eat hatchlings during the night as well, not just during the day. Ongoing monitoring and baiting will be required to ensure predation is remaining low as well as investigation of the impact of seagull predation (Onton *et al* 2013).

There have been two turtle programs running in the planning area; the *Ningaloo Turtle Program* and the *Gnaraloo Turtle Conservation Program*. These programs involve monitoring turtle activity during the nesting seasons and monitoring feral animals.

Trainee Ranger Sarah Johnstone counting turtle tracks as part of the *Ningaloo Turtle Program* December 2017. Photo - Tom Nagle/DBCA

Anecdotal advice suggests that indigenous hunting of marine turtles (mainly green) in the region is minimal. This is because the traditional owners will generally only catch turtles for large family occasions and this may occur only once or twice a year (CALM 2005a). Turtles have cultural significance to the traditional owners and indigenous hunting is an important cultural use of the area (see Section 6 *Aboriginal cultural heritage – enjoyment of country ad customary activities*). The extent and level of indigenous hunting of marine turtles and collection of eggs will need to be quantified and discussed with the traditional owners to determine an appropriate level of sustainable hunting (Environment Australia 2003). The traditional owners have queried why green turtles no longer breed as much, if at all, along the coastline adjacent to Warroora Station as this is a traditional *thalu* site for green turtles (see Section 6 *Aboriginal cultural heritage – Significant law and cultural sites*). This may be due to impacts from historical commercial turtle harvesting (see Section 7 *Other Australian cultural heritage*), impacts from inappropriate recreation or because of natural processes. Effective ongoing management of the *thalu* will require the identification and sound understanding of potential impacts and natural population changes.

Seabirds, shorebirds and waders

Shallow sandy intertidal beaches interspersed with rocky shorelines provide diverse habitats for foraging waders, while the abundance of baitfish offshore is an important food source for seabirds including the two most common families, Laridae (gulls and terns) and Procellariidae (wedge-tailed shearwaters) (DPI 2002).

Crested terns (*Sterna bergii*) and silver gulls (*Larus novaehollandiae*), Pelican Point.

Red-capped plover (*Charadrius ruficapillus*) along one of the creek margins in the planning area.

Pied cormorant (*Phalacrocorax varius*) perched on the intertidal fossil reef in the south of the planning area.

There are 31 taxa of shorebirds and waders recorded in the planning area. This includes 21 migratory shorebirds protected by international agreements and specially protected under the Wildlife Conservation Act apart from the grey-tailed tattler (*Tringa brevipes*) which is Priority 4.

There are approximately 25 taxa of seabirds that roost along the coast including 13 protected by international agreements and specially protected by the Wildlife Conservation Act. The lesser sand plover is also considered Endangered under the Wildlife Conservation Act and the curlew sandpiper, great knot, eastern curlew and fairy tern are Vulnerable. Within the planning area the main seabird rookeries are Cape Farquhar, Pelican Point, Point Maud and Winderabandi Point. Up to 5,000 terns, mostly common terns (*Sterna hirundo*) have been recorded roosting between Bateman Bay and north of *Murlanda* (Mauds Landing) (DPaW and AMOSC 2014a). Other terns include roseate (*Sterna dougallii*), lesser crested (*Sterna bengalensis*), Caspian (*Sterna caspia*) and crested terns (*Sterna bergii*). In 1992 Point Maud was gazetted as a prohibited area under the *Control of Vehicles (Off-road Areas) Act 1978* prohibiting vehicle access and managed as a *Bird Roosting Sanctuary* (BBG 1995). New significant roosting and rookery sites are still being found along the coast (P. Barnes pers. comm. 2017).

Vehicles, foxes, cats and goats are the main threats to the shorebirds, waders and seabirds. Additional management of seabirds, shorebirds and migratory waders in the planning area will include implementation of spatial controls to provide protection to seabird nesting and roosting areas and increased education and awareness with shoreline users. Management of seabirds, shorebirds and migratory waders also includes undertaking research to better characterise these communities and to assess the level of human impact on them.

Silver gulls (*Larus novaehollandiae*), a native predator upon the eggs and hatchlings of seabirds and marine turtles should be monitored as artificially high numbers can impact nesting seabird colonies and marine turtle hatchlings.

Karst

The northern part of the planning area is the southern extent of the Cape Range which includes the extensive Cape Range karst province (see Section 9 *Geology, landforms and soils*). Cape Range is the only Tertiary orogenic karst in Australia and supports one of the world's richer subterranean faunas which has contributed to the World Heritage listing of Ningaloo Coast. The fauna occurs in three parts, separate terrestrial faunas in Cape Range proper, on its coastal plain, and a relict fauna, largely of Tethyan origin, occurring in the anchialine groundwater of the coastal plain.

The diverse subterranean fauna of Cape Range karst encompasses both terrestrial and aquatic ecosystems and is entirely endemic to the range and include fish; crustaceans, such as amphipods and isopods; snails; insects, such as diplurans and millipedes; arachnids including spiders and pseudoscorpians; archaeognaths, and thysanurans. Cape Range is considered to possibly be the most diverse karst area in the world for cave fauna. Much of the fauna in the caves is uncommon and vulnerable to extinction due to the very limited geographic range, and low numbers. The cave deposits contain fossil mammalian faunas that differ from the modern fauna, and are of considerable importance in helping to understand mammal extinction in Australia, and in reconstructing the distribution of the mammal fauna immediately prior to European settlement.

The only blind cave fish in Australia, the blind gudgeon has been recorded from within the planning area, however, more research is required to fully characterise and understand the karst environments specifically within the planning area.

Potential threats to the karst environment include fire, weeds and feral animals such as goats which can impact by grazing around and utilising water from sinkholes, and from camping within cave entrances, where large volumes of goat faeces accumulate, causing significant increase in local nutrient loads into the karst. It is proposed to incorporate remainder of the planning area into the Ningaloo World Heritage listing as per the intent of the original nomination (DEWHA 2010) (see Section 3 *Management context*). This would bring more of the Cape Range karst into the World Heritage listing.

Management objective: To identify, protect and conserve native animals and habitats, particularly those of cultural and/or conservation significance.

Management strategies

1. Undertake or support baseline surveys of native animals identifying species of cultural or conservation significance including endemics and range end taxa.
2. Document animals of cultural significance to the traditional owners including totems, bush tucker, bush medicine and animals featuring in stories as well as *thalu* (areas known as important habitats/breeding areas) and prepare guidelines for management, in particular where species or *thalu* have been or have the potential to be impacted.
3. Monitor the condition of culturally significant fauna in the planning area to determine whether these are being adequately protected and maintained.
4. Determine the extent and level of indigenous hunting and then develop and apply sustainable harvest strategies and management targets e.g marine turtles.
5. Survey the northern part of the planning area within Cape Range for black-flanked rock wallabies and monitor these populations over time.
6. Examine the variation in the rock wallabies from Cape Range National Park/planning area with the race populations in MacDonnell Ranges in NT and SA and Central Ranges Region of WA.
7. Implement an integrated predator control program focusing on foxes, feral cats and wild dogs to reduce animal predation on rock wallabies, turtle nests and shorebirds and migratory waders.
8. Monitor the impacts of introduced predators (foxes, feral cats and wild dogs) on seabirds, shorebirds, migratory waders, rock wallabies and turtles.
9. Investigate the interaction between introduced herbivores such as rabbits and goats on the rock wallaby habitats and populations.
10. Incorporate habitat requirements of threatened animals within the planning area into any fire management prescriptions.

Management objective: To identify, protect and conserve native animals and habitats, particularly those of cultural and/or conservation significance.

11. Support captive breeding programs and/or translocations of black-flanked rock wallabies.
12. Educate the visitors about the ecological significance of nesting, feeding and roosting sites for resident and migratory bird species.
13. Develop, review and/or implement recovery plans for threatened animals as required e.g the *National turtle recovery plan* (Environment Australia 2013) and the *Recovery plan for five species of rock wallabies* (Pearson 2013).
14. Determine the location and relative significance of turtle aggregation sites and rookeries within the planning area and adjacent marine areas.
15. Ensure wildlife interaction activities, vehicles, camping and domestic dogs do not impact on turtles, through education and compliance programs, liaison with commercial operators and appropriate licensing.
16. Continue to support and implement turtle monitoring programs within the planning area and adjacent marine areas and monitor the status and trends of the turtle populations in relation to historical populations and natural variance.
17. Monitor the impact of vehicles and domestic dogs on seabirds, shorebirds and migratory waders and introduce restrictions where appropriate to protect important coastal habitats.
18. Support research to characterize the karst fauna within the planning area.
19. Monitor populations of the blind gudgeon and minimise adverse impacts of landuse within the range of the groundwater ecosystem, prevent point source pollution to the groundwater and ensure sediments do not enter the system.
20. Investigate the impact of feral herbivores on Cape Range karst systems including water quantity and quality.
21. Seek to amend the Ningaloo World Heritage boundary to include the remainder of the planning area.
22. Encourage and support, wherever possible, external agencies and individuals whose research contributes directly to the joint managers' objectives or the implementation and auditing of this plan, and advocate the involvement of the traditional owners in this research.

See also sections 14 *Weeds*, 15 *Introduced and other problem animals*, 16 *Diseases*, 18 *Fire*.

KPIs: Native animals and habitats

Performance measure	Target	Reporting
Health and condition of species of cultural significance	Traditional owners are satisfied with the health and condition of culturally significant species	Every 2 years
Knowledge of animal diversity	Fauna surveys are carried out identifying species of cultural and conservation significance	Every 2 years
Range and population size of threatened and other conservation significant fauna	Subject to natural variation, recovery and maintenance of viable populations of threatened and other conservation significant fauna within the planning area	Every 5 years, or as per recovery plans
Conservation status of threatened fauna species	No decline in the conservation status of threatened fauna species	Every 3 years, or as per recovery plans
Nesting turtles+	More than 70% of nests produce hatchlings	Annually
Diversity and abundance of seabirds, migratory shorebirds and waders+	No loss of seabird, migratory shorebird and wader diversity or abundance as a result of human activity in the planning area	Every 5 years

+ Links with KPI in the *National recovery plan* (Environment Australia 2013).

13. Ecological communities

There are currently no listed Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) within the planning area. However, as the Bundera Sinkhole TEC is 5km to the north of the planning area, there may be ecological communities connected through the underground aquifer within the karst of the northern planning area (see Section 12 *Native animals and habitats*) that may be determined also to be conservation significant during the life of the plan.

Management objective: Threatened and other ecological communities of conservation significance within the planning area are identified and protected.

Management strategies

1. Investigate and assess the karst systems of the north of the planning area.
2. Identify and protect threatened and priority ecological communities by seeking to list them under State and/or Commonwealth legislation as appropriate.

14. Weeds

Environmental weeds are plants that invade natural ecosystems and negatively affect the survival of native flora and fauna. Weeds can have adverse impacts on the environment including a reduction in biodiversity, competition with native species for space, light, nutrients and water, disruption of ecosystem processes, impacts to important medicine plants and other culturally important plants, changes and loss of fauna habitat and resources, alteration of fire regimes, and loss of landscape and scenic values.

Relatively few weed species have been recorded in the planning area (see Table 2), as the area has not yet been surveyed specifically for weeds. However, weeds are most likely to be found along roads, access tracks, waterways, drainage lines, day use and camping areas in the planning area and include grasses such as buffel grass introduced through pastoralist activities in the region. Weeds within the adjacent pastoral stations and Coral Bay townsite may be at risk of entering the planning area through vehicles, introduced animals and other recreational or pastoral activities.

New flower buds on a coral cactus (*Cylindropuntia fulgida*) at Quobba Station. Photo - DBCA

Table 2. Environmental weeds within or adjacent to the planning area

Common Name	Species Name	Ecological impact	District prioritisation	Location	Local proposed management
Buffel grass	*Cenchrus ciliaris*	High	Low	Widespread but ubiquitous adjacent to Warroora Station	Contain and limited density reduction
Coral cactus	*Cylindropuntia fulgida*	High	High, WONS	Adjacent to Warroora, Gnaraloo and Quobba stations	Localised eradication
Caltrop	*Tribulus terrestris*	High	High	Adjacent to Warroora Station	Localised eradication
Ice plant	*Mesembryanthemum crystallinum*	Low	Low	Adjacent to Quobba and Gnaraloo stations	Contain and localised eradication
Kapok	*Aerva javanica*	High	Medium	Ex-Ningaloo Station, adjacent to Warroora Station	Contain and limited density reduction
Lantana	*Lantana camara*	High	Medium	Unknown, potential for incursions	Monitor
Mexican poppy	*Argemone ochroleuca*	High	High, WONS	Adjacent to Warroora Station	Localised eradication

Common Name	Species Name	Ecological impact	District prioritisation	Location	Local proposed management
Mimosa bush	*Varchellia farnesiana*	High	Low	Adjacent to Warroora Station and ex-Ningaloo Station	Monitor and contain
Pie melon	*Citrullus lanatus*	High	Medium	Widespread	Monitor and contain
Ruby dock	*Rumex vesicarius*	High	Medium	Unknown, potential for incursions	Monitor
Tamarisk	*Tamarix aphylla*	High	Medium	Adjacent to Warroora Station at Nicks Camp, Pelican Point, and entry to Sandy Point	Monitor and localised containment
Thornapple	*Datura* spp.	High	Medium	Unknown, potential for incursions	Monitor

* Weed of National Significance

Comprehensive surveying and mapping of weed species in the planning area would facilitate assessment of weed distribution, vegetation condition, prioritisation of weed control measures and the effectiveness of weed control.

Turtle Cliffs/Point Anderson area where buffel grass (*Cenchrus ciliaris*) has displaced the native vegetation on a large scale. Photo - Todd Quartermaine/DBCA

Buffel grass

Buffel grass is a hardy, drought-resistant perennial bunchgrass native to Africa, the Middle East and Asia (Dixon *et al.* 2001). It is believed that buffel grass was introduced into Australia between 1870 and 1880 with the packsaddles of Afghan camel drivers (Humphreys 1967). Since then it has been deliberately introduced by the pastoral industry to revegetate eroded areas and as a pasture supplement throughout the Pilbara and Kimberley regions of WA (Humphreys 1974, Dixon *et al.* 2001).

Buffel grass can impact directly on biodiversity values, for example through competition, and indirectly through increasing the frequency and intensity of fires. These hotter fires can affect groundcover vegetation (including bush foods important to traditional owners) and carry into the canopy of keystone arid zone trees with flow-on effects to other plants and animals. They can also increase the risk of damage to infrastructure and cultural sites.

When buffel grass is dense it can dominate light and space, reducing opportunities for native vegetation establishment. Even at lower densities buffel grass may reduce soil nitrogen, exhaust the mineral pool and inhibit plant regeneration and growth through competition and allelopathic suppression. Buffel grass can aggressively colonise riparian habitats, displacing native vegetation. Infestation of water points such as soakwells and rock holes can impede access to sites of Aboriginal cultural significance. Buffel grass is considered a 'transformer weed' of the Australian rangelands due to its ability to transform the basic attributes of habitats. Many consider it to be the most debilitating weed of natural ecosystems in arid and semi-arid Australia where it can directly or indirectly displace and threaten a large number of native and endemic plants and animals.

Little research has been undertaken relating to the impacts of buffel grass on fauna, however likely impacts considered are: loss of native vegetation and therefore change to habitat and food source, reduced foraging efficiency due to dense grass, increased mortality and decreased reproductive success due to changes in the fire regime and dietary constraints. Research undertaken on specialist seed eating birds such as finches and some parrots noted that these species do not include buffel seed in their diet and become rare in buffel dominated landscapes (Franks *et al*. 2000). Best (1998) found that the total number of invertebrate orders and species are significantly reduced by buffel grass presence. Leachates from the leaves and roots of buffel grass have also been shown to have a phytotoxic effect on other species (Fulbright and Fulbright 1990). Little is known about the impact of buffel grass (or weeds in general) on rock wallaby habitats and long-term effects on rock wallabies (Pearson 2013). It is eaten by rock wallabies, although its palatability and nutritional status is low as it dries off.

Where the native plant species displaced by the spread of buffel grass produced a lesser fuel load, the new conditions created by this exotic species will lead to more intense fires and in some cases the potential for more frequent fires. The introduction of buffel grass has therefore greatly increased the risk of fire to assets and infrastructure in some areas by increasing the fuel loads by several times the site's natural fuel loads.

Buffel grass is now widespread within the planning area and because of the extent of its distribution and difficulties with its control, it is the most serious weed in the planning area. It has largely replaced native *Triodia* grasslands on the coastal plain as a result of disturbance such as heavy grazing pressure (by stock in the past and by goats and euros presently), and by its positive response to fire (Keighery and Gibson 1993).

Weed management

The department engages in weed management focusing on reducing the impacts of existing priority weed populations on key natural, cultural and recreational values and assets, whilst also preventing and eradicating new infestations in a cost-effective manner. Priority weeds within the planning area are based on the regional rankings within the *Pilbara Region weed prioritisation database* (revised biennially) and the *Exmouth District weed strategy* (DPaW 2016b). Priorities may change during the life of this management plan.

Options for environmental weed management include prevention, eradication, control, containment, density reduction or monitoring. The preferred option is to prevent the introduction of environmental weeds through appropriate management, as eradication is rarely feasible. Methods of control include managing introductions and disturbance, the use of herbicides, biological control, manual control and, potentially, control through the application of fire. In May 2018, the cochineal beetle was trialled to control coral cactus (*Cylindropuntia fulgida*) in the planning area. Table 2 (above) shows the proposed local management of weeds in the planning area.

Effective control programs encourage the growth of native species through rehabilitation and the suppression of weeds with the overall aim of boosting the area's resilience to further weed invasion. The role of rehabilitation where weeds have been removed is critical in order to prevent reinvasion of new weeds. Management of weeds needs to occur on a landscape scale in cooperation with neighbouring land managers and in conjunction with other management programs (e.g. fire).

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 is well established across parts of the planning area and may be difficult to contain and eradicate (see below). Creation of the conservation reserve should eventually 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.

Buffel grass

Control of buffel grass is complex. There does not appear to be any single control method that may be employed for the successful management of buffel grass at a landscape scale such as within the planning area. The long, dense root mass makes manual removal of the grass difficult, it withstands cutting and grazing (in some instances cutting only encourages growth), and it recovers quickly from fire. Improved understanding of buffel grass and its interaction with

factors such as grazing (i.e. from feral herbivores and euros) and fire is required to facilitate control of this weed. Further research into the implications of its toxic effects on rehabilitation species is also necessary.

To facilitate effective management of this weed in association with fire management activities, information on the location and extent of infestations is required. Opportunistic recording of infestations should be encouraged. Information on infestations should be recorded in the department's weed management database (via the *Weed App* or similar) to allow access by fire practitioners for use in planning prescribed fire activities. Aerial surveying can be a useful tool for mapping buffel grass along the Ningaloo Coast, especially when it is green and actively growing, and can help prioritise control activity.

Recommended management of buffel grass within the planning area will be as per the impact on significant cultural sites or conservation significant species and habitats, otherwise as per the level of infestation and guidelines in Fire Management Information Note S12 Buffel grass and fire management (DEC 2008).

The dead below ground biomass of buffel grass does provide soil binding to prevent wind erosion for at least three years (Dixon *et al*, 2002), in which time revegetation needs to proceed. With all methods of control it should be recognised that disturbances can stimulate buffel grass seed germination and enhance seedling establishment, so soil disturbance should be minimised in restoration work.

Bigurda (euro) standing in buffel grass.

Follow up surveys, monitoring and control (for at least five years due to seed longevity) is essential to achieve effective control.

Buffel grass has C4 photosynthesis like many other warm climate grasses. It is generally considered that C4 plants have an advantage in a warmer climate due to their higher CO_2 assimilation rates at higher temperatures and higher photosynthetic optima than their C3 counterparts (Dwyer *et al*. 2007). In addition, buffel grass, along with other exotic grasses, had higher biomass when resprouting after fire than native grasses when grown under elevated CO_2 (Tooth and Leishman 2014). This indicates a mechanism – better response to fire under elevated CO_2 – which implies that buffel grass will remain, if not increase, in its ability to transform ecosystems under climate change (Scott 2014).

Management objective: To minimize the impact of weeds on the planning area

Management strategies

1. Surveying and mapping of weed species in the planning area.
2. Update corporate weed databases including *Weed App*, the *Pilbara Region weed prioritisation database* including details of distribution, history of weed control and relevant biological information.
3. Assess key values and areas including flora and fauna, landscapes, recreation sites, cultural sites and bush tucker that are most vulnerable to the impacts of weeds.
4. Develop and implement a weed control plan that prioritizes species based on distribution, invasiveness, cultural and environmental impact and feasibility of control consistent with regional and local priorities (e.g. the *Pilbara Region weed prioritisation database* and the *Exmouth District Weed Strategy*).
5. Investigate whether weeds are affecting the foraging habitat of the rock wallaby populations in the planning area and rehabilitate if necessary.
6. Investigate techniques to control buffel grass and research its impact on rock wallabies in general e.g. its importance in the diet and its relative nutritional value compared to alternative plants.
7. Remove introduced herbivores to manage grazing and implement appropriate managed fire regimes to allow native plants to recruit seedlings and set seed.
8. Monitor the effectiveness of weed control within the planning area.
9. Investigate disturbed areas to revegetate with native vegetation.
10. Prevent new infestations and limit the opportunity for new weeds to be introduced and established by:

Management objective: To minimize the impact of weeds on the planning area

- monitoring and containing existing weed infestations
- understanding methods of weed dispersal in the planning area
- liaising with adjacent landholders to implement measures to prevent weeds from adjacent areas further establishing within the planning area
- applying appropriate hygiene practices as required to machinery entering the planning area
- minimising disturbance of soil while carrying out management activities, particularly in areas within or adjacent to sources of weeds
- restricting the importation of soil into the planning area to only those sources with strict soil quarantine
- raising public awareness to the significance and identification of environmental weeds and promoting appropriate hygiene practices.

See also sections 11 *Native plants and plant communities*, 12. *Native animals and habitats*, 18 *Fire,* 25 *Grazing*.

KPIs: Weeds

Performance measure	Target	Reporting
Weed control plan	A weed control plan is developed and implemented	Every 5 years
Cultural value of native species	Traditional owners are satisfied that traditional knowledge is being consulted and adopted as appropriate into management of weeds to protect culturally significant species	Annually
	No bush tucker or cultural site is affected by weeds	Annually
Presence of weeds of local priority	Decrease in the area of weeds of local priority	Every 2 years

Left: Melons (*Citrullus* sp.). Below: Feral goats eating melons and assisting in weed spread.

15. Introduced and other problem animals

The introduced animals in the planning area include foxes, wild dogs, feral cats, rabbits, goats, rats and mice. The main management strategies will be targeted to control foxes, feral cats, rabbits and goats.

Foxes and feral cats

The red fox and feral cat are mid ranking predators (mesopredators[18]) that prey on medium-sized ground dwelling mammals, birds and reptiles in the planning area, including turtle eggs and hatchlings. Predation by foxes and cats are listed as key threatening processes under the EPBC Act. Five-year threat abatement plans and five-yearly reviews (DEWHA 2008c, DEWHA 2008d, DoE 2013b, DoE 2014) have been prepared for both threatening processes to provide national coordination, with the emphasis on local control programs to ensure recovery of endangered species. Faunal predation of marine turtle eggs is listed as a threat for loggerhead turtles (and green turtles) in Western Australia in the *National recovery plan for turtles* (Environment Australia 2003) and in the abatement plans. Some estimate of nest predation will be valuable in determining ongoing management actions for controlling feral and native predators of eggs.

Nature Conservation Coordinator, Derek Sandow and traditional owners sharing knowledge of feral animal control, January 2017.

Through the department's *Western Shield* program which has been implemented adjacent to Ningaloo Marine Park since 1996, foxes have been controlled using 1080 poison baits which has afforded some protection to the turtle-nesting beaches. Aerial baiting for foxes is undertaken at least twice a year in addition to strategic ground baiting, but continual research is required to help maximise the locations and effectiveness of these baiting regimes. Current ground baiting locations in the planning area include Bateman's Bay, Jane's Bay and adjacent to Gnaraloo pastoral lease. Feral cat baiting with *Eradicat* baits has been trialled to control feral cats and may be introduced into the planning area.

The mesopredator release hypothesis (Crooks and Soulé 1999) predicts that when a higher order predator is removed, lower order predators increase their abundance, which often results in amplified pressure on smaller prey species. These interactions can cause trophic cascades (Ritchie and Johnson 2009), where the effects of increased mesopredator and herbivore abundance can flow through the food chain ultimately causing undesirable outcomes for faunal and floral biodiversity. Conversely, an increase of apex predators can reduce herbivore and mesopredator abundance and indirectly promote vegetation growth (Hayward and Somers 2009). In Australia, these processes are thought to occur between dingoes, red foxes and feral cats, with effects being felt by several prey species across entire ecosystems (Glen *et al*. 2007).

Therefore, mesopredator control within the planning area needs to be integrated with objectives of other introduced animal control programs and threatened species recovery plans because of the complex interactions. For example, reducing cats may increase the rabbit population which may in turn increase fox populations and predation on other animals. Similarly, broad-scale 1080 baiting for foxes may remove the top predators; dingoes and wild dogs. This may relieve pressure on feral cats and lead to increases in their abundance or changes in behaviour. Concurrent research and adaptive management will have to occur along with introduced animal control programs.

Goats

Large populations of feral goats occur in some locations in the planning area and are managed as *de facto* stock in some of the neighbouring pastoral stations (see Section 25 *Grazing*). Competition and land degradation by feral goats is listed as a Key Threatening Process under the EPBC Act and a threat abatement plan and a five-year review have been prepared (DEWHA 2008b, DoE 2013a). The threat abatement plan identifies feral goats as a threat to the threatened black-flanked rock wallaby (see Section 12 *Native animals and habitats*).

[18] Mesopredators are potential prey of top predators, as well as being predators.

Goats are currently the most significant feral herbivore within the planning area. Goats are responsible for a variety of impacts on native flora and fauna, including competing with native fauna for food, water and shelter, and threatening the survival of native flora through their feeding habits (DEWHA 2008b). The impact of hooves and overgrazing destabilises soils and greatly increases erosion. Goats may also be having an impact by increasing nutrient and sediment loads into the receiving waters of Ningaloo Marine Park as well as the karst aquifer system (see Section 12 *Native animals and habitats - Karst*).

Feral goats at Cape Farquhar. Photo – J. Morgan/DBCA

Goat control efforts on conservation lands are significantly impeded where land management objectives on adjacent lands are to maintain or promote their numbers, and where there is a concomitant lack of effective control measures to prevent them wandering in from adjacent pastoral properties. In 2002, recognition was given to the growing goat industry in that goats were reclassified from 'prohibited' stock to 'authorised' stock under the Land Administration Regulations 1998. There is currently little statutory requirement for pastoralists to prevent movement of their stock onto adjacent lands, although the department will seek to work in collaboration with individual pastoralists and the Pastoral Lands Board of Western Australia to encourage strategies to this end.

Feral goats near Turtles recreation site.

Goat control within the planning area may include aerial and ground shooting, removal of watering points and/or allowing mustering and trapping for commercial sale (e.g. through cooperative arrangements with adjoining pastoral landholders). Population numbers will be monitored to determine effectiveness of control measures and compare impacts.

Barriers (e.g. fencing) can provide localised protection for conservation significant areas although this is costly to both install and maintain.

Rabbits

Competition and land degradation by feral rabbits is listed as a Key Threatening Process under the EPBC Act and a draft threat abatement plan (DoE 2015) has been prepared. It is uncertain to what extent rabbits are present in the planning area but within adjacent areas it appears they are largely limited to small isolated pockets with fluctuating numbers in response to climate conditions.

Various strategies are employed to control rabbit populations in Australia, including the widespread introduction of biological control agents such as *myxoma* and rabbit *calicivirus*. These disease agents have an important role in controlling rabbit numbers, but will not, in isolation, necessarily provide adequate levels of control and new strains need to be developed regularly to cope with increasing resistance of rabbits.

Jidarra (perentie [*Varanus gigantus*] eating a dead rabbit near Monument Cliffs.

The control of rabbits around rock wallaby colonies has been limited but may be important to prevent over-grazing or an elevation in fox numbers due to prey abundance. Rabbit control is complicated by concerns about non-target species being affected by baits, and most techniques are expensive to continue repeatedly at sufficient intensity to provide a prolonged decrease in numbers.

It is unclear to what extent rabbits contribute to the overall impact of introduced animals on the planning area's conservation values, however this has been assumed to be relatively low, so priority will be given to the control of foxes and goats. Nevertheless, a targeted rabbit monitoring and control program with a focus on protection of threatened or other species of special conservation may be warranted in the future.

Management objective: To minimise the impact of introduced and other problem animals on the key values of the planning area and adjacent Marine Park

Management strategies

1. Survey the key locations of the planning area and monitor tracks
2. Maintain information on introduced animals (and other problem animals where required) including a register of animals, details of distribution, relevant biological information and history of control.
3. Develop and implement an introduced animal control plan that prioritises the control of introduced animals based on their ecological impact, current and potential distribution, and feasibility of control.
4. Implement an integrated predator control program including fox, wild dog and feral cat baiting and targeted trapping to protect native fauna such as rock wallabies, turtle hatchings and migratory shorebirds.
5. Monitor the effectiveness of the integrated predator control program (e.g. by calculating activity indices of introduced predators and/or habitat use by the native species such as the rock wallaby and introduced predator as well as using remote cameras and turtle nest cameras).
6. Research interactions between predators and prey with regard to the mesopredator release theory and adapt management as required.
7. Develop a goat control plan for feral goats within the planning area.
8. Manage goat and other introduced herbivore (sheep, cattle, rabbit) populations within the planning area as required in liaison with the adjoining pastoralists.
9. Determine feasibility and construct stock exclusion fences prioritising sensitive areas e.g former Ningaloo Station and Cape Farquhar.
10. In partnerships with adjoining pastoralists manage introduced animals adjacent to the planning area to provide a buffer for the conservation values.

See also sections 12 *Native animals and habitats* and 25 *Grazing*.

Management objective: To minimise the impact of introduced and other problem animals on the key values of the planning area and adjacent Marine Park

KPI: Introduced and other problem animals

Performance measure	Target	Reporting
Introduced animal control plan	A control plan is developed and implemented	Every 5 years
Integrated predator control program	Decreasing activity of introduced predator and/or increasing habitat use of the native species such as the black-flanked rock wallaby	Every 5 years
	Reduce predation of turtle hatchlings by 5%*	Annually
Introduced herbivores	Decreasing trend in numbers of introduced herbivores (observable impacts at monitored sites to be kept at 'low' or 'no' observable impact)	Every 5 years

*Links with KPI in *Ningaloo Marine Park management plan* (CALM 2005).

16. Plant and animal diseases

There are not many documented diseases known within the planning area, however it is possible that there may be various plant or animal diseases discovered during the life of the plan. There may be incidences of toxoplasmosis or other diseases in the macropods of the planning area.

Fibropapillomatosis is a benign tumour disease of marine turtles, predominantly in the green turtle but it has also been reported in the loggerhead and other turtle species outside of the planning area. It is possible that the green turtles in the adjacent marine waters may carry this disease. A large tumour can mechanically hamper sight, swallowing, and swimming, which may ultimately be fatal. The prevalence of this disease is associated with highly populated coastal areas polluted by large amounts of agricultural, domestic and industrial wastes or marine biotoxins. Some studies also show a correlation with tumour-associated viruses. The most effective treatment for this disease is surgical removal.

Management objective: To minimise impacts of plant and animal diseases on the key values as well as departmental staff.

Management strategies

1. Investigate and document the prevalence of toxoplasmosis and other diseases and parasites in macropods such as the black-flanked rock wallabies of Cape Range and the Ningaloo Coast as required.
2. Conduct or support research on the prevalence and frequency of tumour disease in turtles as required.
3. Monitor plant and animal diseases within the planning area during the life of the plan.
4. Encourage community reporting of potential plant or animal diseases to the District office or to the Department of Primary Industries and Regional Development[19].
5. Prepare and implement plant and animal disease control plans as required.

17. Marine and other pollution

Boating and shipping activities within the Ningaloo Reef have the capacity to impact on the values of the planning area, in particular the coastal environment. This may be by way of marine debris, pollutants from vessel and ship spills, anti-fouling paints used on ship hulls, introduced pests causing biosecurity concerns, bilge pumping and/or land-based run-off. There is a major shipping lane that runs parallel to the coast. There is also a minor shipping channel that provides access to the Point Maud area. In addition, there are a number of sites where recreational and small commercial vessels are launched and retrieved.

Oil and gas spills from offshore petroleum operations off the North West Cape have the potential to spread along the Ningaloo Coast and impact on turtles, seabirds and shorebirds (as well as other important species within the beach ecosystem such as crabs, insects, worms and grasses) covering them in pollutants.

[19] The Pest and Disease Information Service provides advisory and identification services on animal and plant pests, weeds and diseases that impact Western Australia's agriculture and food industries.

Land-based activities also have the capacity to pollute the planning area and adjacent marine areas with inappropriate rubbish and toilet waste disposal (see Section 21 *Visitor activities – Waste management*). There may also be asbestos waste associated with historical use (see Section 7 *Other Australian cultural heritage*).

Marine oil pollution

The Ningaloo Coast has been assessed as a high risk for oil spills over one tonne (contributions from ships at sea and in port, small commercial vessels, offshore production and drilling and shore-based spills) and a very high environmental sensitivity producing a high environmental risk index (Det Norske Veritas 2011). The *Western Australian oiled wildlife response plan* (DPaW and AMOSC 2014b) sets out guidance and best practice procedures for oiled wildlife response agencies, including both the department and the petroleum industry, as to the approach to an oiled wildlife marine pollution incident in Western Australia. Sitting beneath and providing a regional context and detail for the State plan is the *Pilbara Region oiled wildlife response plan* (DPaW and AMOSC 2014a), corresponding to the departmental regional boundary that applies to the planning area. The regional plan outlines detailed 'on ground' regional information required to carry out an oiled wildlife response, including wildlife values, high-risk wildlife areas, identified oiled wildlife facilities, equipment, resource and contact lists.

Marine debris

Injury and fatality to vertebrate wildlife caused by ingestion of, or entanglement in, harmful marine debris has been listed as a key threatening process under the EPBC Act (DEH 2003). Turtles, marine mammals and seabirds can be severely injured or die from entanglement in marine debris, causing restricted mobility, starvation, infection, amputation, drowning and smothering. Seabirds entangled in fishing lines, fragments of fishing nets, plastic packing straps or other marine debris may lose their ability to move quickly through the water, reducing their ability to catch prey and avoid predators, or they may suffer constricted circulation, leading to asphyxiation and death. Fishing line debris, nets and ropes cut into the skin of marine mammals or turtles, leading to infection or the amputation of flippers, tails or flukes. Marine species can confuse plastics including bags, rubber, balloons and confectionery wrappers with prey and swallow them. This debris can cause a blockage in the digestive system. Turtles are known to eat plastic bags, confusing them with jellyfish, their common prey. Seabirds eat polystyrene balls and plastic buoys, confusing them with fish eggs and crustaceans, and whales are also known to eat plastic debris.

The issue of harmful marine debris has been recognised as a global problem with up to 150 million tonnes of plastic in the Earth's oceans (Ocean Conservancy 2015). It has been estimated that the sea is expected to contain 1 tonne of plastic for every 3 tonnes of fish by 2025, and by 2050, more plastics than fish (by weight) (World Economic Forum 2016).

Harmful marine debris includes land-sourced rubbish, fishing gear from recreational and commercial fishing abandoned or lost to the sea, and vessel-sourced, solid, non-biodegradable floating materials disposed of or lost at sea. Most of these items are made of synthetic plastics materials (Rochman *et al*. 2016). Common items of marine debris include: plastic bottles, crates, buckets, packing materials, plastic microbeads, fishing nets, cigarette butts, rope, food packaging, gloves, fishing gear and plastic bags.

Many industry, government and non-government stakeholders are working to address marine debris and related issues (e.g. through beach clean-up and management of litter and illegal dumping). The *Threat abatement plan for the impact of marine debris on vertebrate wildlife of Australia's coasts and oceans* (DEE 2018) is a revised threat abatement plan focussed on reducing injury and fatality to wildlife caused by harmful marine debris as well as now recognising the global nature of the marine debris problem and the potential sublethal and other impacts of microplastic and associated chemical contamination. The national recovery plan for turtles (Environment Australia 2003) also calls for the sources of marine debris to be identified, which together with responding to stranding events and quantifying mortality caused by marine debris, are the primary actions to monitor and manage marine debris as a threat to turtles.

The most effective way to reduce the impacts of marine debris remains to prevent it entering the marine environment. In terms of this management plan, that means preventing land-based waste ending up on the beach or in the ocean by educating visitors on the issue of marine debris and engendering community action to reduce plastic use in the planning area as well as providing appropriate facilities to collect waste (see sections 19 *Visitor planning – Information, education and interpretation* and 21 *Visitor Activities – Waste management*).

Management objective: Activities are appropriately managed to reduce pollution impacts on the key values of the planning area and adjacent marine areas

Management strategies

1. Implement the regional response plan (DPaW and AMOSC 2014a) for wildlife affected by shipping and boating pollution, such as oil spills in line with Australia's *National plan for maritime environmental emergencies* (AMSA 2017) and the State plan (DPaW and AMOSC 2014b).

Management objective: Activities are appropriately managed to reduce pollution impacts on the key values of the planning area and adjacent marine areas

2. Identify sources of marine and land-based pollution and monitor mortality of marine species due to entanglement and ingestion.
3. Support community clean up days and opportunistically remove marine and coastal debris.
4. Educate visitors to the marine area and adjacent areas on preventing marine pollution and the damaging impacts of marine pollution including the potential marine food chain and human health impacts from microplastic and contaminants.
5. Support community-based action within Coral Bay to change the way people buy, use and dispose of consumer products, in particular single-use disposal plastic and reduce the amount of plastics brought into the planning area and adjacent tourism areas.
6. Work with recreational and commercial fishing groups to ensure fishing gear is disposed of appropriately.
7. Develop and maintain a register of toxic waste such as asbestos within the planning area.
8. Ensure waste generated by visitors to the planning area is collected and disposed of safely and appropriately so it does not contaminate the marine environment.

See also sections 19 *Visitor planning – Information, education and interpretation* and 21 *Visitor activities – Waste management*.

18. Fire

Fire is an important natural component of ecosystem function and is one of a number of factors that influences biodiversity and ecosystem health, function and condition. However, large and intense bushfires are a threat to biodiversity, life, property and other values. Effective fire management relies on co-operation between all landholders and managers along the Ningaloo coast.

Recent fire history

The fire history of the planning area has not been systematically collected, but it is thought the majority of the planning area has a fuel load that is over 6 years old apart from a portion of former Ningaloo Station which burnt in 2017.

Major fires known to have occurred in the last 20 years include fires on:

- Warroora and Cardabia stations in 1997
- Ningaloo Station in 1997, 2012 and 2017
- Gnaraloo and Warroora stations in 2009.

The extent of impact (if any) of the 2017 fire within ex-Ningaloo Station on the populations of black-flanked rock wallabies is yet unknown (see Section 12 *Native animals and habitats - Black-flanked rock wallabies*).

Fire ecology

The ecological effects of fire depend on a complex interaction between factors including:

- the fire regimes that ecosystems are exposed to, particularly the frequency, seasonality and intensity of fire occurrence
- the attributes and life cycle of ecosystem components, such as regeneration strategies, time between germination and flowering and recolonisation/dispersal capabilities
- the climatic and weather conditions under which fires occur and post-fire
- any concurrent ecological stressors that interact with regimes such as grazing, weed invasion and predation pressure.

There has been little research undertaken on the occurrence and effects of fire in the planning area therefore a key focus for future research in the area is improving knowledge about the interrelationship of fire and the ecology of the area.

Traditional burning practices of the area are also inadequately understood by the department. Traditional owners have an interest in fire management and may be interested in manipulating fire intervals to promote the growth or numbers of culturally significant species. Further discussion of traditional burning in the planning area is required within the JMB to assess whether this would be appropriate.

Climate change may affect fire regimes and the fire ecology of the planning area and the broader region. Hennessy *et al.* (2006) predicted that by 2030 the climate of north-western Australia will be slightly warmer, with a small decrease in annual rainfall. More frequent and severe droughts are expected, as well as increases in extreme weather events (see

Section 8 *Climate and projected climate change*). These environmental changes may interact with existing stressors, leading to complex and unpredictable outcomes (Steffen *et al*. 2009).

Fire and flora

The predominant vegetation of the planning area is hummock grasslands, consisting of *Triodia* species with a sparse overstorey of *Acacia* trees or shrubs (see Section 11 *Native plants and plant communities*). These will usually require about five to seven years after a fire to accumulate enough fuel to carry a subsequent fire. This period may be shorter following periods of high rainfall or under severe weather conditions, (Burrows *et al*. 1991). Rainfall is the primary influence on growth rates in hummock grasslands and so extensive bushfires are usually preceded by several seasons of above average rainfall. Studies in other spinifex-dominated communities (Burrows *et al.* 1991, Burbidge 1985 and Griffin *et al*. 1983) have shown frequent, small fires result in a mosaic of vegetation successional stages, which increases habitat diversity and reduces the likelihood of the occurrence of large, intense bushfires.

The interaction between fire and flammable weed species, such as buffel grass, complicates fire management in parts of the planning area. Fire may enhance weed invasion, leading to more frequent or intense fires and suppress the regeneration of native species. Mild, patchy prescribed burning of areas adjoining buffel grass infestations, may maintain native grass swards and limit the expansion of buffel grass (DEC 2008). 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 of buffel grass (DEC 2008).

Fire management is an important consideration in the management of coastal dune systems. Although the vegetation of these areas is not considered to be fire-sensitive, its temporary removal by intense fires may result in the destabilisation of dunes and erosion.

Fire and fauna

The rate of post-fire recovery of animal populations is strongly influenced by the size of the fire and the recovery of the flora communities within their habitat (Muller 2001, Abbott and Burrows 2003). Post-fire ecological pressures may also be influential, for example, the loss of vegetation cover through fire may result in increased exposure to predation and increased competition for food and shelter.

Predicting the impacts of fire on fauna is aided by understanding species attributes such as:

- the distribution and location of key habitat areas
- specialised habitat requirements, particularly for mature or relatively long unburnt vegetation
- life history attributes, including fecundity
- dispersal capability (i.e. ability to relocate to unburnt areas)
- the interaction of fire with concurrent pressures (e.g. from predators, introduced fauna, climate change).

The black-flanked rock wallaby is a significant species of the planning area which is vulnerable to predation by foxes and cats, and competition for resources with goats and rabbits (see Section 12 *Native animals and habitats*). The maintenance of suitably-sized and distributed patches of unburnt vegetation in the landscape is important to the conservation of the black-flanked rock wallaby. It is also important to consider the minimum fire interval required to maintain species required to provide the black-flanked rock wallaby with its food and habitat requirements.

The culturally significant *bardurra* (bush turkey) also has specific fire management requirements. *Bardurra* benefit from fire by aggregating at burning or recently burnt areas to exploit food resources exposed or killed by the fire. They also benefit from the more open vegetation structure in recently burnt areas, using them for mating display areas and foraging. However, large and intense fires, which generally occur in the late dry season, may be detrimental to *bardurra* if the fire destroys nests. Other impacts of fire regimes may be indirect or operate at longer temporal scales by influencing the availability of food resources, floristics, nutrient availability and habitat structure (Ziembicki 2009).

Further research is required to improve knowledge of the key fire response fauna species and communities within the planning area. However, as a fundamental principle, fire regimes that result in a reduced risk of large damaging bushfires and that promote floristic and structural diversity (thereby providing a range of habitats), will help to maintain faunal diversity. Landscapes exposed to repeatedly uniform fire regimes can result in habitat homogenisation that may be detrimental to faunal diversity (Burrows *et al.* 1991) while variation in the frequency, interval, season, intensity and scale of fire promotes biodiversity.

Fire and karst

The effects of fire on arid karst landscapes and associated ecosystems are not well documented or understood. Holland (1994) found that fire in karst landscapes could weather the limestone surface and destroy minor solution features (known as karren). These effects were associated with hot fires in areas of high fuel load. He also observed that the

degree to which vegetation fires will aid erosion of the limestone depends upon the purity of the limestone, its inclination and its degree of karstification. Other probable effects of fire in karst include:

- alteration in the 'usual' surface-subsurface interactions, particularly of water and nutrient flows between the surface and subsurface
- increased sediment loads (limestone fragments, ash and debris) into the karst cavities and pore spaces, and the groundwater
- the loss of vegetation around cave entrances affecting flows of air, soil and nutrients into the cave thereby altering environmental conditions and disrupting cave ecosystems.

It is expected that the ecological significance of any effects of fire on karst would increase in proportion to the intensity and scale of fire. Holland (1994) considered that longer intervals between fires would increase the potential for degradation of the limestone surface in the event of a fire, as the accumulation of larger fuel loads increases the likelihood of more intense fire behaviour. Therefore, it is likely that fire management which promotes diverse fire regimes, and reduces the likelihood of large and intense bushfires, will reduce the impacts of fire on the karst and associated ecosystems. Which specific fire regimes will best provide for conservation of karst and karst-related ecosystems of the planning area, is also an area for future fire research.

The characteristics of a fire regime that will best provide for the conservation of the karst and karst-related ecosystems of the planning area should be the subject of future research. Research should include investigations into the attributes and fire response of species commonly occurring near the entrances of caves, or with roots penetrating into caves (e.g. *Ficus* spp.).

Fire management

Fire management in the planning area will be guided by the latest Pilbara regional fuel management plan (in prep.)[20] and be complementary to the fire management requirements in the *Cape Range National Park management plan* (DEC 2010) and *Buffel Grass and Fire Management* (DEC 2008).

Fire management within the planning area will be undertaken with due consideration of:

- managing the risk of bushfire to fire vulnerable assets of the planning area and adjacent lands (cultural heritage, life and property, amenity and recreation sites)
- fire regime requirements of native flora and fauna
- enhancement and maintenance of biodiversity at a localised scale
- developing knowledge concerning the interactions of fire and the biota of the planning area
- the potential for any fire to interact with existing threatening processes such as weed invasion, soil erosion, predation by feral predators and/or climate change.

Some of the most important ecological considerations for fire management in the area are:

- karst environments
- threatened fauna such as rock-wallaby populations
- fire-sensitive species and communities
- coastal plain buffel grass communities (fire exclusion).

For large parts of the planning area where spinifex grasslands are the dominant vegetation, fire management will be guided by the management principles provided at Appendix 5.

The short to medium term focus of fire management for the planning area will be the protection of life and property within, and adjacent to, the planning area and the prevention of large, intense bushfires. This will be achieved by responding to bushfires in a manner that is proportionate to the prevailing and forecast conditions, assets at risk and resources available and using prescribed fire to create a strategic buffer system of fuel-reduced areas. The longer-term fire management will be adapted to include gains in knowledge of the fire ecology of the planning area.

Management objective: To protect human life and maintain key values by actively managing fire

Management strategies

1. Develop a rolling three-year fire program of prescribed burning guided by the latest Pilbara regional fuel management plan (or equivalent).

[20] The 2008 Pilbara regional fire management plan (DEC 2008) is being reviewed. See Appendix 4 for an extract of the 2008 regional fire management plan.

2. Host regular collaborative fire planning meetings with traditional owners.
3. Manage fire consistent with relevant fire management legislation, policies and guidelines and relevant recovery plans for threatened species by using an adaptive management framework that incorporates cultural responsibilities, available scientific and traditional knowledge and input from traditional owners and key stakeholders.
4. Identify fire sensitive flora and fauna, catalogue vital attributes, fire ecology interactions, fire regime requirements and monitor condition post fire where applicable.
5. Apply prescribed fire and/or other fuel management techniques at the appropriate scale, intensity, frequency and season to:
   - protect and conserve species and ecosystems with specific fire regime requirements[21]
   - reduce the area burnt by late dry-season fires
   - limit the potential for bushfires to run without intersecting low-fuel areas
   - establish and maintain a fire-induced mosaic of different vegetation structures and ages (time since fire) across the landscape with inter-fire periods sufficient to maintain biodiversity.
6. Integrate fire management with weed and introduced animal management programs such as buffel grass, foxes and/or goats.
7. Establish post-fire monitoring sites to measure the impact of fire, and to develop an understanding of ecological fire requirements of plants and animals within the planning area.
8. Establish and maintain a strategic system of protective fire buffers and access tracks for fire management, with a focus on areas of high conservation value, sites of cultural significance and other community assets (such as Coral Bay townsite, recreation sites and boundary fences).
9. Work closely with DFES, shires of Carnarvon and Exmouth, neighbouring land managers, communities and other relevant groups to encourage cooperative and compatible fire management arrangements and ensure appropriate community protection from fire.

KPI: Fire

Performance measure	Target	Reporting
Bushfire risk mitigation	A strategic buffer system of low-fuel loads is identified and maintained	Every 3 years
Size of large, intense fires	Reduction in area of large, intense bushfires, using the 2013 to 2018 five-year levels as the comparison	Every 5 years
Knowledge of fire ecology within the planning area	• Identification of fire-sensitive habitats and communities • Increased knowledge of vital attributes of species and ecological communities • Increased knowledge of the interaction between fire and buffel grass • Increased knowledge of the impact of fire on karst systems • Increased knowledge of optimal fire regimes for the black-flanked rock wallaby and interrelation with competition for food resources with goats	Every 5 years
The condition of nominated fire-sensitive habitats and communities	Fire sensitive or threatened taxa or communities are maintained or enhanced	Every 5 years
The persistence of fire-sensitive species within the planning area (e.g rock-wallabies)	Nominated populations of species maintained	Every 5 years

[21] Species and communities that require a specific fire regime, or sequence of fire, for its persistence, which could be a unique combination of fire interval, season and intensity.

People on country (managing recreation, tourism and community values)

Strategic objective
To support and enhance compatible recreation and tourism experiences for the appreciation of the planning area's remote landscape, natural and cultural heritage values.

19. Visitor planning

Ningaloo experience

The planning area, Cape Range National Park and adjoining Ningaloo Marine Park are major natural attractions for recreation and tourism along the North-West Cape. Visitors to the planning area value the remote and self-sufficient recreational opportunities in an undeveloped natural area that the Ningaloo Coast offers, and this is often broadly referred to as the 'Ningaloo experience'. This includes low-key camping with little or no facilities along the coast but may range from camping in tents to campervans with many modern amenities. Some visitors may be in small camping areas with only a few sites but also some are in large sites with hundreds of sites spread over a few kilometres. So even within this notion of the remote 'Ningaloo experience' there are still varying scales of remoteness and development (see sections 19 *Visitor planning – Visitor management settings and recreation site classification* and 21 *Visitor activities – Overnight stays*).

Visitors also come to the planning area during day trips from Carnarvon, Coral Bay or Exmouth (or adjoining pastoral station accommodation such as Quobba, Gnaraloo and Warroora homesteads or tourism lease areas such as Red Bluff, 3 Mile Camp or Bruboodjoo). Recreation activities include four-wheel driving, sightseeing, spending time on the beach/swimming, boat launching, shore fishing, surfing, snorkelling, windsurfing and/or sea kayaking and viewing wildlife (Smith and Shields 2017). For many visitors, the 'Ningaloo experience' is seen as being very different to that offered in Cape Range National Park or other national parks in Western Australia and is highly valued. However, this experience may be affected by increasing visitation if it is not managed appropriately.

The peak tourism season for the area is March to October with the off-peak season still attracting high numbers of visitors in the December and January school holidays (see Appendix 6). Visit numbers have increased markedly over the last 20 years leading to multiple track duplication, additional camp sites and coastal dune degradation (see sections 20 *Visitor Access* and 21 *Visitor activities*). Historical aerial photography shows that recreation sites have continued to incrementally expand as camp sites are pushed out into the surrounding vegetation or additional camping areas are developed (see Section 21 *Visitor activities – Overnight stays*).

Planning for future visitor use in the planning area will seek to preserve and enhance the 'Ningaloo experience' along the coast whilst protecting the environment and cultural values with minor site protection works around key camping and day use areas. Where necessary this will include track rationalisation and rehabilitation works (see sections 20 *Visitor Access* and 21 *Visitor activities*). Maintaining the visitor experience will also rely on all visitors following the 'leave no trace' ideology and education and interpretation will focus on the importance of visitors observing these principles during their stay including camping within existing cleared areas, bringing their own chemi-toilets and firewood, using fire rings or defined campfire sites, only driving on designated access tracks, and disposing of their waste properly. This will ensure the beauty and undeveloped landscape of the coast and its natural values that attract visitors to the area and the sense of remoteness are continued into the future.

Visitor management settings and recreation site classifications

Visitor management settings within the planning area are based on the Recreation Opportunity Spectrum (Clark and Stankey 1979) and provide a specified range of recreation opportunities in a given area, while limiting unintended incremental development and minimising visitor impacts (Appendix 7). Some recreation sites within or adjacent to the planning area have a highly modified visitor management setting and some are the more natural and remote (see maps 2a and 2b).

The Cape Farquhar area and the inland portion of ex-Ningaloo Station are classified as 'natural' due to being closed to public vehicles, however the majority of the planning area is considered 'natural/recreation' due to the site impacts and modifications that have occurred from historic recreation and pastoral use with 'recreation' settings occurring around key visitor sites. This directs a low level of development, basic facilities, a high self-reliance for visitors and pre-visit planning required. Sites classified as 'highly modified'[22] include major camping areas such as 3 Mile Camp and Red Bluff, due to their high level of visitor use, built accommodation and facilities.

A recreation site classification (major, medium, minor) is used in conjunction with the visitor management settings to provide a controlled (site-by-site) mechanism to cap the level of development within the planning area and maintain a diversity of experiences within a setting (see Appendix 8 and maps 3a-3d).

The visitor management settings and the site classifications for the planning area reflect existing and proposed works and as such will guide recreation site works over the life of this plan and will be used to ensure the Ningaloo experience is maintained and enhanced.

It is the intent of this management plan to maintain visitor management settings and the site classification as similar to existing settings and classifications, in order to protect the more natural settings and minor recreational sites from further incremental development. This includes maintaining the challenging vehicle access, limited facilities and high degree of self-reliance for campers. Site protection works will be undertaken in some areas that have become highly degraded, to preserve and rehabilitate the remaining coastal vegetation and return the areas closer to a 'natural' setting. An example of this is the coastal sand dune areas around Coral Bay that have become highly degraded from vehicle access. The intention is to maintain access to these recreation sites, but provide defined four-wheel drive access routes, restrict off-road vehicle use, limit the level of future site disturbance, and rehabilitate the surplus network of tracks and clearings, to ensure the longevity of these sites into the future (see Section 20 *Visitor access*).

Caravans on beach at *Walbal Wardu*/14 Mile Camp, 2011. Photo - DBCA

Along the coast, there are a range of recreational opportunities within the conservation estate and adjacent pastoral areas so that even within the 'Ningaloo experience' there may be some visitors staying in safari tents (Red Bluff), chalets (Gnaraloo Homestead) or caravans (14 Mile) (see Section 21 *Visitor activities - Overnight stays*). The existing major sites (such as 14 Mile Camp and South Lefroy Bay) will remain as high use sites. Although at all sites there will be further assessments undertaken to determine the sustainable number of camp sites that can be accommodated in the area, without adversely affecting the key values of the planning area and the adjacent marine park. Similarly, the intention is that the existing minor camp sites and day use areas where suitable will remain as such, to maintain the diversity of opportunities of the reserve, and ensure that visitors continue to have the opportunities for solitude and isolation.

Recreational masterplanning

Detailed recreational site planning is being undertaken at the same time as the preparation of this management plan to develop a recreation master plan to address more specific visitor use issues, to design facilities and to consider the visual impact of development on the landscape and amenity.

The recreation master plan includes the operational level of detail such as proposed materials for recreation site works and access track maintenance which is a level of detail not normally included in CALM Act management plans. Both processes inform each other and consultation with traditional owners and other key stakeholders is and will occur at the same time for this planning.

[22] 'Highly modified' should be seen in the context of a recreational experience in a natural area or conservation reserve and is not necessarily as modified as would be found in an urban setting.

The design and placement of any facilities including structures, access tracks and fencing will aim to minimise visual impact within the landscape. Both landscapes and seascapes will be managed to protect their visual quality. The Ningaloo landscape has a high visual sensitivity due to the undulating terrain and low vegetation. Vertical structures will have a high visual impact so all structures will remain low to reduce visual impacts on the natural environment. Individual visual landscape management assessments will be required for any new development that occurs, including proposals for phone towers, road realignments, and building upgrades within lease areas. Where possible materials will be chosen to be in keeping with the rustic pastoral character of the area.

The aim is to take a sensitive and complimentary approach to site development, and install only infrastructure required to mitigate environmental and cultural impacts. All efforts will be made to prevent the loss of the remote/outback appeal through inappropriate, unnecessary or over development. Infrastructure upgrades in the planning area will currently be limited to waste disposal infrastructure (see Section 21 *Visitor activities – Waste management*), furniture associated with day use areas, parking area upgrades (see Section 20 *Visitor access*), site protection for day use areas and camping areas (see Section 21 *Visitor activities*), refurbishment or installation of information shelters and installation of essential signage across the planning area where appropriate. Other activity will include revegetation/rehabilitation of degraded areas to ensure long term sustainability of the fragile coastal environment and therefore support long term recreation use in the area. A summary of proposed site works is included in Appendix 9.

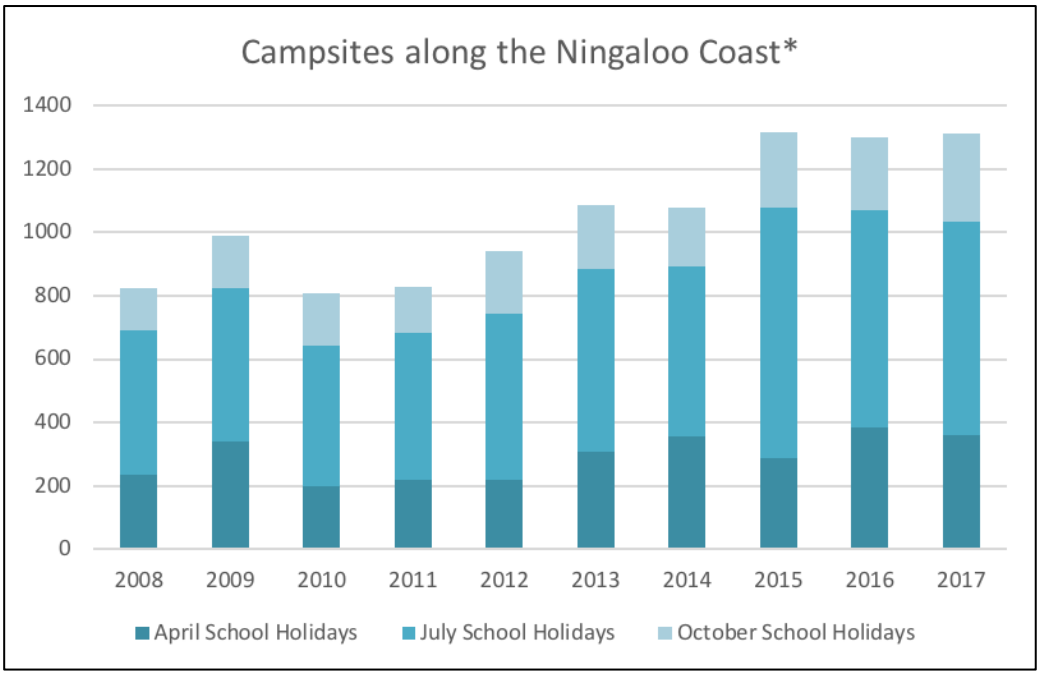
A new joint management operations base may be constructed in the south of the planning area. Construction of ranger housing, workshop/sheds and an office/information facility at Coral Bay is already underway.

Preliminary maps for the recreation masterplan will be available for stakeholder discussions during the public comment period of this draft joint management plan, with the more detailed site plans being prepared as required.

Visit numbers

The planning area is widely visited by people from the local communities of Exmouth and Carnarvon as well as mostly by tourists from Perth, the south-west and elsewhere in Western Australia (Smith and Shields 2017).

The department has been counting the campsites along Ningaloo Marine Park annually during school holidays, the peak period for visitors since 1995 (see Figure 2 and Appendix 6 for the aerial flight count data). This aerial flight data shows a steady increase in visitation.



*not including Coral Bay or Cape Range National Park

Figure 2. Aerial flight data for the Ningaloo Coast 2008-2017

Visitation also occurs outside of school holidays, in particular between March and October. Therefore, to get an overall picture of visitation during the year, annual visit days[23] have been modelled using the 2016 campsite figures as well as

[23] A visit day is defined as a day, or part thereof, that a visitor is located in a specified area. If a person visits the area on a day trip they would account for a single visit day statistic. If a person were to enter the area and stay overnight, they would be accounted for as two visit days.

other data including traffic counters which together reveal the extent of visitation (camping and day use) of the planning area and adjacent areas in Table 3.

Table 3. Estimated visit days to the Ningaloo Coast (planning area and adjacent tourism lease areas)

Areas camped	Estimated visit days
Total visit days (camping – planning area and adjacent tourism lease areas)	538,697
Visit days (day use - non-camping)	308,159
Total camping and day use	846,856

Note: These modelled figures do not include Coral Bay due to the lack of available visit data. However, the Gascoyne Development Commission quote overnight visitors in 2015 as being 79,434 people (GDC 2016).
In addition, the model does not include the station homestead accommodation, only camping along the coast.

A total of 846,856 visit days for Ningaloo Coast was modelled for 2016 (not including Coral Bay) including 538,697 visit days associated with camping. This makes the planning area, the most heavily camped area of Western Australia and in terms of recreational use, one of the highest in any departmental-managed area outside of the Perth metropolitan area. This volume of visits requires appropriate management to ensure the key values of the area are not diminished and that people can continue to enjoy visiting the region for many years to come. In comparison, Cape Range National Park has a modelled annual visit days of 112,049 for camping and 241,700 for day use (total of 353,749 visit days) for the same period.

Figure 3 shows the locations camped according to the aerial flight count data and is a reflection of the number of camping opportunities. Studies into track density and vegetation degradation (see Section 11 *Native plants and plant communities*) show the coastal area of the planning area has a higher track density and is more degraded than Cape Range National Park. As many of the visitors want to maintain the sense of remoteness the challenge of management will be to manage the high visitation to prevent further degradation whilst maintaining a sense of remoteness and self-sufficiency.

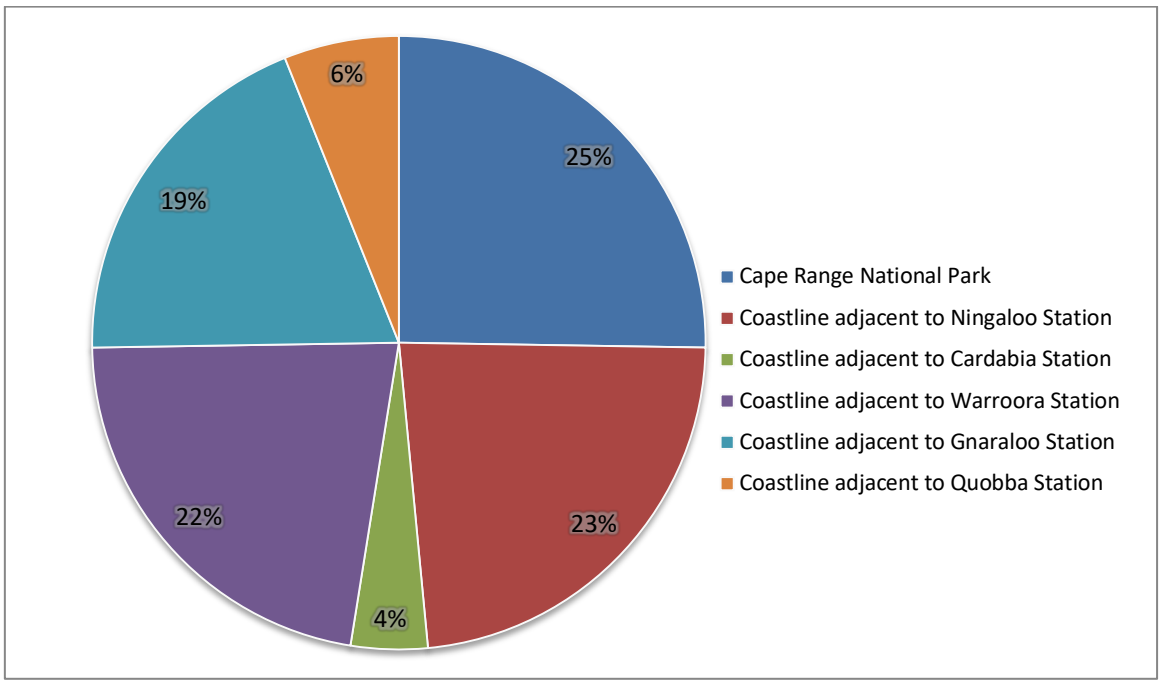


Figure 3. Distribution of Ningaloo Coast camp sites by location based on 2016 aerial flight data (not including Coral Bay)

Using the distribution information from Figure 3 above, it can be roughly estimated that the coastline adjacent to former Ningaloo Station may get over 170,000 visit days (camping) and the coastline adjacent to Warroora Station over 185,000. Using the same data, the lease areas Bruboodjoo, 3 Mile and Red Bluff may get 30,000, 90,000 and almost 35,000 visit days (camping) respectively. These figures can be confirmed and refined during the life of the plan.

The existing visitor monitoring research program for the planning area should be expanded to include information about the existing levels of use and conditions (social, environmental and economic) at sites. This data should be

supplemented by traffic count data and ongoing recording of vehicle numbers by staff and will additionally incorporate visitor numbers within Coral Bay.

Some increase in visitor numbers and change in visitor types can be expected and should be planned for. Increased bed numbers are anticipated at the tourism lease areas, and more than 800 additional beds are planned for at Coral Bay. This will have immediate impacts on the day use sites near these areas, and as a result may need to be upgraded or protected accordingly.

Visitor research

A significant amount of independent visitor research has been undertaken since 1990 along the Ningaloo coast. The key findings of this visitor research have been reviewed and summarised in a literature review by the department (Shields and Smith 2016). Additional visitor consultation was undertaken during 2016/2017, through on-site interviews (79 interviewees) and an online survey (1,045 respondents), in order to validate the independent research and determine if visitor perceptions have changed in that time. The findings of the on-site interviews and 2017 visitor survey confirm the key findings of the previous research, and demonstrate that little has changed in terms of the desired experience or desired level of facility for visitors.

The visitor research shows that visitors desire open, largely unmanaged coastal camping, there is a perceived sense of isolation along the coast and many people state that they do not want a "national park experience". However, many visitors to the planning area are camping within degraded natural areas (see sections 11 *Native plants and plant communities- Vegetation condition*, 20 *Visitor access – Vehicle impacts* and 21 *Visitor activities – Waste management*) and are camping in closer proximity to others than they would be in camping areas in a national park.

2017 visitor survey

Visitors were asked a range of questions to better understand user demographics, the desired camping experience, what they value about the Ningaloo coast and the types of visitor facilities people would like to see provided or upgraded along the coast. The major findings are discussed below and are being used to inform recreation planning for the reserves.

The visitor survey (Smith and Shields 2017) shows that most Ningaloo coast visitors are predominantly Australian residents with a high proportion of Western Australians, travelling with family and friends, with more than half of the groups travelling with children. They are generally long-term, repeat visitors with more than half (54%) that have been visiting the Ningaloo coast for over 10 years (29% for more than 20 years). Almost a third have been visiting for six to 10 years (23%) and only 7% have been visiting for less than two years.

The visitor survey confirmed that the most important reasons people are visiting the coastal areas are to experience nature while being close to the beach and accessing the marine park. They come to have a break from everyday urban/town life, to rest and relax and enjoy the peace and quiet. It is important to those surveyed that campsites are spread out and that there is a lack of development. Other extremely important reasons for more than half of the respondents to visit the coast are being in a remote location, wide open spaces, seeing the stars, experiencing back-to-basics camping, having a low-cost holiday and being self-sufficient.

The majority of respondents support existing attributes that facilitate the experience such as access to rubbish disposal facilities, chemi-toilet dump points, access to potable water and toilet facilities (where they are already present which is only in limited locations). Information about where they can fish, the plants and animals, visitor safety and directional signs are also important for most people.

When asked about facilities/services that are currently not provided or that could be improved that would make their stay more comfortable/convenient while not detracting from the reason they visit the Ningaloo Coast, most respondents support "rehabilitation of tracks and heavily impacted areas that are severely degraded" (77.0%).

Other areas with high support are:

- being able to book a camp site in advance (72.4%)
- additional rubbish disposal facility (e.g. pit or removal service) (71.6%)
- more information on plants and animals (70.0%)
- more information on the cultural values of the site (69.6%)
- more regular grading of access tracks to campgrounds and sites (67.6%)
- signage that helps you find a site (67.2%)
- additional chemi-toilet dump points (66.6%).

In the general comments section, suggested improvements (351 mentions from 1,045 total respondents) cover a variety of aspects such as facilities (194 mentions), management (131) and environment (26). Facility improvements included campsite design improvements (62 mentions) such as not too close to other sites/sites a good size/open, a range of camping options along the coast and provision of gear-specific areas (e.g. tent only areas), tracks/trails/access road improvements (32), and rubbish/waste disposal improvements (30) such as more bins/rubbish/dump/recycling points. Suggested management improvements include better management/planning, habitat protection improvements and limitations on length of stay.

In the general comments of the survey, about a third of total respondents expressed concern over future development and a resultant change in experience. A third also desired there to be no change (see Section *Ningaloo experience* above). The description of experience (334 mentions) mostly included words such as rustic/remote/wilderness/isolated/untouched/unique/pristine (157 mentions) and self-sufficiency/back-to-basics (87 mentions).

Based on the aim of protecting the current values including maintaining the 'Ningaloo experience' and the consideration of results from the visitor survey, the short to medium term management effort will be directed towards rehabilitating tracks and degraded areas around camping and day use areas (see sections 20 *Visitor access* and 21 *Visitor activities*). Reviewing camping facilities, keeping development to a minimum and addressing waste disposal facilities and practices whilst preventing further impacts of the expansion of existing development footprints will also remain a focus for the duration of this plan (see Section 21 *Visitor activities*). Ongoing visitor satisfaction surveys will monitor the success of this plan to meet the expectations of visitors.

Visitor safety

Visitors are drawn to the planning area's remoteness, solitude and challenging four-wheel driving terrain, but there is inherent risk in going to such remote places. The planning area experiences extreme temperatures, tropical cyclones, has limited communications and emergency assistance, encompasses steep dunes, cliffs, unstable overhangs and caves and has boggy when wet terrain. Overall, the environment requires visitors to take care and responsibility while in the planning area. There are also the hazards within the adjacent marine environment—the primary purpose for many visiting the planning area—with risks such as currents, swells and stinging marine life normally associated with swimming and boating activities.

This vehicle track close to the cliff edge at Harpoons, south of Tombstones has been closed due to visitor risk. Photo - Emma West/DBCA

Visitors to the planning area need to be prepared and take measures to reduce their risk. This may include carrying a supply of water, carrying appropriate spare tyres and vehicle recovery gear, staying on tracks, drive safely, using personal protection (such as protective clothing and sunscreen), having a first aid kit and ready access to a means of emergency communication equipment (e.g. satellite phone, EPIRB or Personal Locator Beacon).

Annual Visitor Risk Management (VRM) assessments will be continually undertaken for the planning area detailing risks and proposed mitigation actions. A geotechnical survey will be commissioned to survey potential cliff risks sites, particularly in the south of the planning area, and establish a geoindicator monitoring program, involving periodic assessment of the sites and baseline studies of aerial photography.

Vehicle access track to Maggies campground over a blind ridge. Photo - Emma West/DBCA

A coastal geomorphology survey of the Gascoyne coast was undertaken in 2012, which included recommendations for the coastline of the reserve.

> *"Further consideration of coastal risk is required, with clear definition of the level of acceptable risk, for all permanent and temporary infrastructure…An emergency management plan is required for areas with a high risk of experiencing inundation, such as camping shelters, including monitoring, warning systems and the definition and dissemination of an evacuation plan. For any new development, a setback assessment should account for potential changes to the coastal environment. It is recommended at minimum to consider the risks associated with inundation and wave loading, in the context of potential foredune retreat associated with the passage of an extreme tropical cyclone."* (Elliot *et al*. 2012)

Also VRM assessments will include assessments of potential risks arising from the past use of the reserves including the Norwegian Bay Whaling Station ruins, Point Cloates lightstation, pastoral disused infrastructure remnants and wells (see sections 7 *Other Australian cultural heritage* and 10 *Hydrology*).

VRM in the planning area will involve appropriate signage as part of the broader interpretation plan (see below).

Information, education and interpretation

Visitor information, education and interpretation raises awareness about the planning area and its values, promotes support for its management, and encourages community involvement and appropriate behaviours. Communication is also vital to managing visitor risk so visitors have safe, enjoyable experiences of the planning area and adjoining marine areas.

There is already extensive information, education and interpretation material available for Ningaloo Marine Park and Cape Range National Park. So any new education and interpretation material for the planning area should take this into account and be developed as part of an overall Ningaloo Coast communication strategy whilst referencing the unique character of the planning area.

Existing signage throughout the planning area is limited, ad hoc and generally dated. The pastoral stations each have websites where they provide pre-visit information and mud-maps to download before arrival. Sign styles and materials vary for each station, and are mainly directional signs to campgrounds. Day use areas are generally unidentified, with the exception of some of the day use sites around Coral Bay. The pastoral station signage, though worn, forms part of the character of the area, and will be incorporated where possible into future signage plans. There is currently limited management or risk signage on site. There is also no information provided regarding the Aboriginal heritage of the area. There is an opportunity for dual naming of recreation sites and the introduction of language names for animals, plants and places within the planning area.

Language

I think that it is interesting that pop George Cooyou and my grandmother they put this book together. It's a Baiyungu dictionary (Austin 1992) and in as so far as interpretation and interpretive signs and

that sort of thing I think we can use now, I think it would be a great honour to use that material for our purposes. I think it would be quite fitting that we bring that old book back out in respect to our old people.

Paul Baron, traditional owner, January 2017

Only essential signage will be installed on site, to limit visual impact in the landscape and retain the remote experience. Promotion of a location will likely increase use of that area, so only those locations or settings where increased visitor numbers are considered appropriate should be promoted and sign posted. The intention is to keep the existing rustic tone of the area and steer away from the modern standard of signage that the department typically implements. An assessment will have to be made about what VRM signage is essential in order to avoid cluttering the visual landscape.

Examples of signs used in planning area. Above left: directional sign for Stevens campsite. Above right: 3 Mile Lagoon. Photo: Vicki Winfield/DBCA

Above left: Coral Bay. Photo: Emma West/DBCA
Right: Tombstones.

The visitor information centre in Coral Bay will be upgraded to improve visitor communications. This is an important location for conveying key management messages to visitors to the planning area as well as to the adjoining marine park. The majority of information will also be restricted to 'entry points' to the planning area and key sites such as Red Bluff, 3 Mile, Gnaraloo Homestead and Coral Bay to reduce the amount of additional on-site signage.

Future expanded information, education and interpretation material for the planning area may include the primary themes such as:

- the traditional owners – the cultural significance of the planning area and Baiyungu traditional law and knowledge, bush tucker, Baiyungu place names, totems, stories and language, respectful and appropriate behaviour and recreational use
- natural values and the significance of the area –the Ningaloo Coast World Heritage Area and in particular the landscape, geology (including karst, fossil reefs), conservation significant flora and fauna (including *majun* [saltwater turtles]) and the 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
- the Tropic of Capricorn and change in environment between the temperate and tropical zones and plants and animals at their geographical range ends

There are many opportunities to promote an understanding of cultural values within the planning area. Baiyungu Aboriginal Corporation sign previously situated at Coral Bay Maritime Facility at Monck Head.

- the approach for managing key issues – particularly introduced animals such as fox, *guruwanyji* (feral cats) and introduced grazing animals, weeds and inappropriate *garla* (fire) regimes
- other cultural heritage such as shipwrecks, pastoralism, whaling, Afghan and North Indian cameleers and traders
- appropriate visitor use and visitor safety, a 'code of the coast' education program that outlines acceptable behaviour on issues of tracks, camping, waste disposal and fishing
- reducing land-based sources of marine debris including reducing single-use plastic use in the wider Ningaloo area and how to report and/or dispose of marine and coastal debris.

In addition to signage, information displays, publications, the department's website and other electronic media (e.g. the Explore Parks WA website and various phone apps produced by the department), the department encourages its own staff, traditional owners, commercial tour operators, neighbouring land managers, conservation groups and the wider community to also disseminate this information. The traditional owners and commercial tour operators have particularly important roles and opportunities to deliver cultural and appropriate messages to visitors (see Section 22 *Commercial operations*).

Management objective: The 'Ningaloo experience' is maintained and the visitors' awareness, safety, understanding, enjoyment and appreciation of the values of the planning area are improved through the provision of a range of interpretative and educational material, and visitor programs.

Management strategies

1. Ensure that existing and future visitor activities and recreational and/or tourism operations are consistent with the allocated visitor management settings (maps 2a and 2b).
2. Continue to collect visitor use data to improve management along the coast (e.g. aerial surveys of camping areas, visitor counters and visitor satisfaction surveys).
3. Manage visitor numbers and carrying capacities of sites through strategies such as site design, education, marketing/de-marketing and investigate the feasibility of online booking systems where appropriate.
4. Prepare and implement a VRM plan that identifies and assesses the risks associated with all recreation sites and use; and that monitors and regularly reviews visitor risk.
5. Undertake VRM assessments and implement recommendations of degraded and derelict pastoral infrastructure throughout the planning area, Point Cloates lightstation and Norwegian Bay whaling station remains.
6. Apply industry and departmental standards and utilise appropriate expertise in the safe design, construction and maintenance of visitor facilities whilst keeping in line with the low-key remote 'Ningaloo experience'.
7. Prepare and/or adopt codes of safe and environmentally sustainable conduct for popular activities (such as four-wheel driving, hiking, swimming, fishing, sea kayaking and surfing) and promoting and publicising them as appropriate.
8. Minimise risk to visitor safety and coastal infrastructure from severe weather events by preparing emergency response plans in the event of wildfire, cyclones, tsunami and storm surges.
9. Manage access along cliffs and coastal dunes with regards to visitor safety whilst providing visitor opportunities and experience for scenic land and sea values.
10. Ensure that traditional owners have a primary and active role in communication about their culture and heritage.

11. Enhance visitor experience by developing and implementing an information, interpretation and education program that promotes visitor awareness, appreciation and understanding of cultural and natural values, threatening processes, World Heritage, visitor safety, wildlife interactions, appropriate visitor behaviour and marine debris.
12. Introduce Baiyungu language on signs and interpretative material for the planning area.
13. Where possible utilise materials to maintain the character of the planning area and develop guidelines for future signage that factors in the heritage of the reserves and the particular Ningaloo experience.
14. Ensure that external providers such as volunteers, commercial operators and the tourism industry have relevant and factual information and interpretive material about the planning area.

See also sections 7 *Other Australian cultural heritage* and 20 *Visitor access*.

KPI: Visitor planning

Performance measure	Target	Reporting
Cultural knowledge shared appropriately	Traditional owner satisfaction with provision of information to visitors	Every 2 years
Visitor satisfaction levels of nature-based experiences	Maintained or increased from when the conservation reserves are created with a target to be achieved of over 85% satisfaction after 10 years	Every 5 years
The extent of visitor management settings and recreation site classes	Maintain the extent of visitor management settings and recreation site classes	Every 5 years

20. Visitor access

Access

There used to be one road and they used to walk that where now you got four-wheel drives. You only went over the hills when you wanted something from the thanardi *(sea).*

Gwen Peck, traditional owner, April 2017

The planning area is mostly accessible only by four-wheel drive vehicles and the terrain is difficult and challenging though this adds to the sense experience that visitors are looking for. It is therefore proposed to maintain this level of accessibility and access to the majority of existing recreation sites, however improve roads that provide vehicle access to recreation sites and close and rehabilitate duplicate access and tracks where visitors are pushing into surrounding vegetation or eroding dune systems.

Traditional owners Curtley Walgar, Gwen Peck, Ethan Cooyou, Jamie Tittums, Sarah Johnston, Hazel Walgar, Chloe Cooyou, Glenda Morrison and Paul Baron discussing recreation and access during the January 2017 on-country meeting.

Vehicle access

The planning area is bounded by the Commonwealth Defence land to the north and five leased pastoral stations to the east (Bullara, Cardabia, Warroora, Gnaraloo and Quobba), and also surrounds the township of Coral Bay. Access into the planning area is through these stations, via roads that will need to be managed collaboratively by several different land managers. Some roads are managed by the shires of Exmouth or Carnarvon, others by the pastoralists and some are now managed by the department. Access planning will be required to ensure that roads are maintained to appropriate standards to reduce visitor risk, provide all-weather access where practicable, maintain the desired 'rugged' experience and facilitate access into recreation sites.

Whilst the majority of vehicle access to the planning area is by four-wheel drive, there are some tracks that are also used by two-wheel drives at Red Bluff, Gnaraloo Bay, 14 Mile and Bruboodjoo. However, the condition of the tracks is more suited to four-wheel drive vehicle access.

There is a north-south access track (Gnaraloo Road, Mauds Landing-Warroora Road, Ningaloo Yardie Creek Road) that either goes through the planning area or is the eastern boundary of the planning area for most of its length, connecting with the North West Coastal Highway and Exmouth-Minilya Road via spur roads. The Cape Farquhar section between Gnarraloo Bay and Amherst Point has been closed to vehicles for more than 15 years and it is proposed to continue to keep this section closed due to current visitor risk issues and high conservation and cultural values. The north-south track is a local Government road although the actual alignment does not always match the road reserve as it goes up the coast. The majority of the spur roads (other than Coral Bay Road) go through pastoral leases and easements are to be created to ensure access is maintained for visitors to the recreation sites within the planning area. Other tracks leading to recreation sites within the planning area are departmental managed. Refer to maps 3a-3d for more details on proposed access within the planning area. Vehicle access to existing recreation sites will remain open but will be rationalised, however vehicle access will be closed to some recreation sites because of impacts to cultural sites (middens, burial sites, ceremonial significance). Walk in access will still be available. Access to all recreation sites will be monitored for sustainability and access managed accordingly.

> *There shouldn't be any cars up in there. When we went up and buried that bones. I see some of those little plants coming back…by them going in there they going to shift all that growth, so they should be stopped…they can walk there that alright.*
>
> Gwen Peck, traditional owner speaking about closing vehicle access in areas where cultural sites are being impacted, January 2017

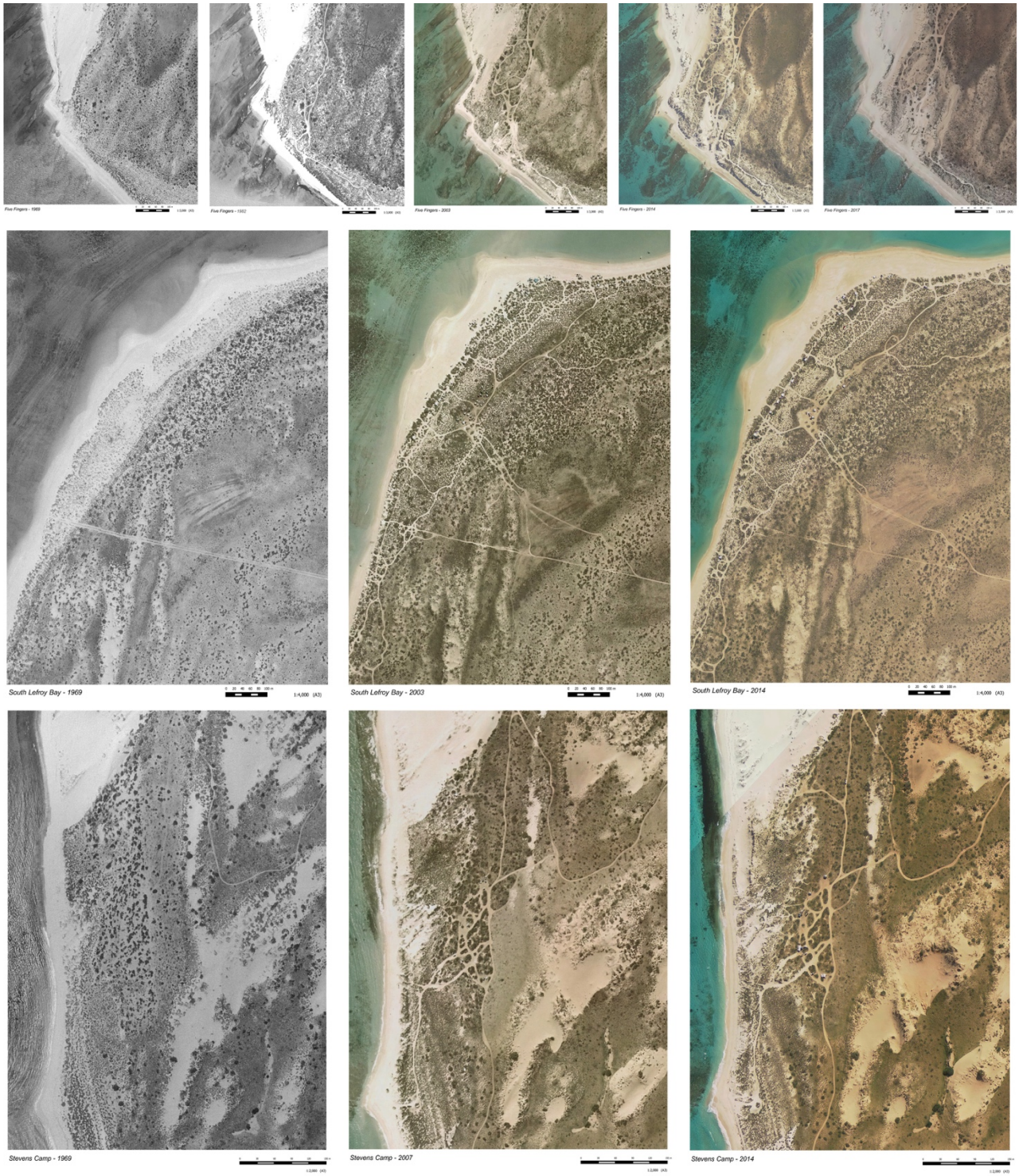
Four-wheel driving along beaches is a means of accessing certain areas and is an activity that is attractive to many visitors. All of the beaches north of Amherst Point are within Ningaloo Marine Park and the department has historically not permitted vehicle access for the majority of these beaches for visitor safety, and to protect the dune system, turtles, seabirds and shorebirds. This has been reinforced by the pastoralists' management of adjacent areas, however some use of the beaches around Coral Bay has occurred.

Many of the vehicle access tracks have significant maintenance and management issues such safety issues associated with one way tracks and blind hill crests, poor drainage, exposed sheet rock and corrugation of surfaces. The network of tracks can also be difficult for visitors to navigate, based on the lack of directional signage and extensive track duplication. Management of the track network is made more difficult in places by the steep terrain and loose sands that are highly susceptible to erosion and take a long time to rehabilitate.

Vehicle access into and around the planning area will be maintained similar to existing standards of four-wheel drive access. Track improvements may be made to improve visitor safety and minimise maintenance while not increasing accessibility generally. The department will only have management control of the spur roads into recreation sites, but will collaborate with adjacent land managers to achieve appropriate access standards for the rest of the access network.

Vehicle impacts

Over the last 20 to 30 years, visitation to the planning area has increased (see Section 19 *Visitor planning* and Appendix 6) and over this time more vehicle tracks have proliferated along the coast to recreation sites particularly to day use sites around Coral Bay. In many instances, off-road drivers create new tracks rather than go over old tracks that have blown out and could be potentially boggy. The proliferation of tracks is compounded by low, sparse vegetation types, varying track conditions between the seasons and the increasing visitor numbers and increased four-wheel drive ownership. Unless this access is managed, it will continue to erode dune systems and have a negative visual impact on the planning area as well as impact on natural and cultural values.



Some comparisons between aerial photographs taken from 1969 to present day 2017, Five Fingers, South Lefroy Bay and Stevens Camp.

A study characterising the coastal landscapes along Ningaloo Marine Park found that:

> *"... despite the management strategies employed by pastoral stations, considerable degradation of the delicate environment, particularly coastal vegetation, has led to erosion and remobilization of sediment (WAPC 2004). Environmental degradation is linked to the uncontrolled development of access roads, leading to the proliferation of tracks (Schlacher and Thompson 2008). Further insufficient management of four-wheel drive vehicle access along Ningaloo could cause the erosion of the fore-dune system (CALM 2005a). Consolidation and supervision of access tracks and camping grounds is necessary to reduce the damage to coastal vegetation and allow degraded areas to recover (CALM 2005a). If not managed, tracks will increase in density and continue to spread out from inland access points towards the coast (Priskin 2003).*

> *Along many areas of the Ningaloo coastline, visitors can view, or be in very close proximity to, the ocean while travelling along the coastal roads and this also accelerates uncontrolled access to the beach (WAPC 1996). It is also a challenge to direct visitors to appropriate spots as long stretches of coastline are easily accessible by many tourists (WAPC 1996).”*
>
> Kobryn *et al*. 2011

Vehicles can impact on large areas in just a single trip. The first few passes of a vehicle are sufficient to cause significant damage to vegetation, soil compaction, dune destruction, erosion, killing of terrestrial animals and intertidal sandy beach invertebrates which are significant food sources for shorebirds, habitat loss, introduction of new diseases and weeds and disruption of nesting birds and turtles (Havlick 2002, Priskin 2003, Moss and McPhee 2006, Groom *et al.* 2007, Schlacher *et al.* 2008, Schlacher and Thompson 2007, Lucrezi and Schlacher 2010, Kobryn *et al.* 2011, Schlacher *et al* 2013a,b, Weston *et al.* 2014, Schlacher *et al.* 2016a,b). Vehicles can damage marine turtle nests and nesting habitat by compacting sand, crushing nests and creating wheel ruts that impede or trap hatchlings (Environment Australia 2003). In general, the overall negative impact on the environment of the planning area is expected to increase with increased off-road vehicular use, particularly when visitation is increasing.

Track densities can be used as indicators of recreation and tourism impacts. A study of track density and impacts on vegetation along the coast found that the planning area had a higher density of tracks (9.7km/km^2) compared to Cape Range National Park (1km/km^2) (Kobryn *et al.* 2017). High densities of roads/tracks were found at a range of locations along the coast including (as to be expected) around recreation sites: Red Bluff Camp, 3 Mile Camp, Gnaraloo Bay, Gnaraloo Homestead, the camping areas adjacent to Warroora Station and around Warroora Homestead, around Coral Bay, Cardabia Homestead, Bruboodjoo Point, Ningaloo Homestead, around the sheds and shearers quarters and camp sites around Lefroy Bay and Winderabandi Point (see Section 11 *Native plants and plant communities – Vegetation condition*).

Above: Proliferation of vehicle and walking tracks, Stevens Camp, August 2016.

Below: Aerial view of *Mini Minimara* (Five Fingers) 2015. Photo - DBCA

Vehicle tracks and dune destabilisation can lead to soil erosion which can impact not only the land but also the adjacent marine environment. If terrestrial soil erosion causes sediment deposition within a reef system to increase beyond natural levels, fatal coral smothering can occur, as well as impacts such as the interruption of natural biological cycles and a reduction in the rate of photosynthetic activity through increased turbidity (Rogers 1990). While no severe sedimentation has thus far been recorded at Ningaloo Reef, its close proximity to a large landmass makes it particularly vulnerable to the effects of any land use changes that may occur.

Other vehicles to impact the planning include off-road vehicles such as all-terrain vehicles (ATVs or ‘quad bikes’). Along the Ningaloo coastline the effect of ATVs on dune systems and the associated wildlife need to be investigated (see sections 21 *Visitor activities – ATVs* and 22 *Commercial operations - Licences*).

To minimise track damage and visitor risk, appropriate signage advising track condition will be installed at entry points to the planning area, most likely at tyre deflation points (see Section 19 *Visitor planning – Information, education and interpretation*). The initial focus areas for coastal track stabilisation and rehabilitation works will be the sites around Coral Bay, and other high use recreation areas. Also, beach vehicle access (other than to launch boats) will continue to not be permitted in the planning area.

Closed tracks at Cardiac Hill, after eight years showing little regeneration naturally occurs without active rehabilitation or stabilisation works, January 2017.

Air access

Some of the neighbouring pastoral stations have airstrips nearby for emergency incidents and/or tourism purposes. There is also one airstrip near Gnaraloo Homestead which is in the planning area. This airstrip does not meet the standards required for Royal Flying Doctor Service aircraft and is generally not suitable for use. Therefore, all fixed wing and helicopter access requests will be directed to the adjoining pastoral leases and there will be no lawful landing of aircraft permitted within the planning area except in emergency situations.

Airstrip near Gnaraloo Homestead.

Boat access

Right: Bruboodjoo, August 2016.
Below: 3 Mile Lagoon.

Many visitors bring dinghies or small boats with them, which they launch at informal, beach launch points within the planning area.

Marine access for large boats is limited to the Coral Bay Maritime Facility at Monck Head managed by the Department of Transport which is utilised by both the public am multiple commercial tour operators.

Monck Head. Photo - Emma West/DBCA

In some areas debris left on beaches by visitors to assist in boat launching is causing an issue to the natural and scenic values of the planning area. Gnarraloo Bay August 2016.

All the beach launching sites are near camping and/or day use sites and are across sandy beaches. No formal boat launching sites other than the Monck Head facility are proposed at this point and existing beach launch locations may be reviewed to determine sustainability. In some areas, there is an issue with visitors leaving debris on the beach that is used for launching boats when the sand is boggy. This is unsightly and impacts on the habitat for breeding shorebirds and turtles as well as being a visitor risk for other users so this will continue to be removed and managed accordingly.

Management objective: To provide visitor access to enjoy nature-based recreation opportunities that minimises the impact on natural, cultural and recreation values.

Management strategies

1. Provide public access as shown in maps 3a-3d, consistent with the appropriate visitor management setting (maps 2a and 2b), the department's road classification system and in consultation with visitors and relevant stakeholders.
2. Provide visitor information and education such as on-site directional, risk and management signage, as well as public maps and brochures to advise people of road conditions and layout.
3. Install designated tyre deflation points which may be co-located with reserve entry pullover areas.
4. Monitor vegetation cover along the coast to assess the nature and level of vehicle use and human impact on coastal vegetation communities.
5. Close and where appropriate, rehabilitate unnecessary, duplicated or inappropriate access that is poorly located, in poor condition, difficult to maintain, unsuitable for recreation and conservation purposes, no longer required or where there is adverse and unacceptable impact on the environment.
6. Temporarily or partially close public access as required for conservation or visitor safety reasons such as during breeding bird season, fire damage or dangerous beach driving conditions.
7. Prohibit vehicles driving off roads and tracks as shown on maps 3a-3d.
8. Carry out an ethnographic survey at Cape Farquhar and conduct further planning to consider appropriate visitor access.
9. Monitor impacts of vehicle access, including erosion and dune blowouts on Aboriginal cultural sites such as middens and close access and rehabilitate where required.
10. Investigate different methods for rehabilitation works along the coast.
11. Liaise with the Shire of Carnarvon and Gnaraloo Station to maintain the closure of public vehicle access into the Farquhar area in order to achieve conservation outcomes and assist in the maintaining the feeling of wildness and isolation to the adjacent sites.

12. Prohibit the use of private quad bikes or any other 'off-road vehicle' as defined under the *Control of Vehicles (Off-road Areas) Act 1978*.
13. Annually review registered ATV use by commercial tour operators.
14. Investigate options for managing access to sensitive cultural areas (such as classified 'prohibited' or 'limited access' areas under section 62 of the CALM Act, installing gates and/or signage, and consolidating or realigning tracks).
15. Where appropriate, classify land under section 62(1) of the CALM Act or apply other access restrictions to manage access for the conservation of natural values such as Cape Farquhar or the inland portion of ex-Ningaloo Station (but still allow access for the traditional owners or walk in access).
16. Liaise with the local shires to develop appropriate signage and road closure mechanisms for managing access following rain events to limit ongoing road damage following such events.
17. Ensure management access tracks are effectively closed to the public and any public access only provided in exceptional circumstances with prior approval of the District Manager.
18. Monitor track erosion and rehabilitation efforts.
19. Work together with recreation and conservation groups to raise awareness on beach vehicle access impacts and mitigation.
20. Liaise with Main Roads WA, local government authorities and adjoining pastoralists to ensure the appropriate management and alignment of regional roads, road reserves and road development to, and through, the planning area.
21. Develop site specific guidelines for the operation of aircraft within the park.
22. Review and monitor existing beach boat launch locations for visitor safety and consistency with marine park management.

See also sections 6 *Aboriginal cultural heritage*, 11 *Native plants and plant communities – Vegetation condition* and 22 *Commercial operations*.

KPI: Visitor access

Performance measure	Target	Reporting
Track density and proliferation	A reduction in track density	Every 5 years
Track erosion and rehabilitation	An increase in areas undergoing rehabilitation	Every 3 years

21. Visitor activities

Overnight stays

Many of the visitors to the Ningaloo Coast stay overnight. Smith and Shields (2017) found that 90% of visitors stay overnight in the planning area, with the average length of stay about 16 nights. Only camping is provided for in the planning area with built accommodation available in the Red Bluff tourism lease and Gnaraloo Homestead adjacent to the planning area. Camping varies from tent-based camping to vehicle-based and caravan camping. No built accommodation will be provided in the planning area.

Outside of the tourism lease areas (Red Bluff, 3 Mile Camp and Bruboodjoo) and the homestead accommodation precincts managed by Quobba, Gnaraloo and Warroora station lessees, there are approximately 17 camping areas in the planning area (see Appendix 9 and maps 3a-3d). This roughly translates to approximately 471 camp sites[24] based on visible clearings in aerial photos. All 17 camping areas are north of Cape Farquhar.

The camping areas range in size from small camping nodes which each have space for only two or three small camp sites, to large dispersed camping areas, such as South Lefroy Bay and Point Billie (6.6km in length, see below), Winderabandi Point (2.3km in length), North Lefroy Bay (2.2km in length) and 14 Mile Camp (2.1km in length). The majority of camp sites are located within the marine park or in the proposed conservation reserves adjacent to Warroora Station (approx. 220 sites) and the former Ningaloo Station (approx. 251 sites) based on visible clearings in aerial photos. All the camping areas in the planning area have been classified as major, medium or minor as per Appendix 8 (see Section 19 *Visitor planning*). Campers in these areas are expected to be self-sufficient, bringing their own chemi-toilets, firewood and water supplies.

Online booking of some camping areas may be beneficial in allowing visitors to plan their trips ahead and be assured of a site when they arrive. This is especially useful during peak season when demand is high. The introduction of easy-to-

[24] In comparison, Cape Range National Park has 156 defined camp sites.

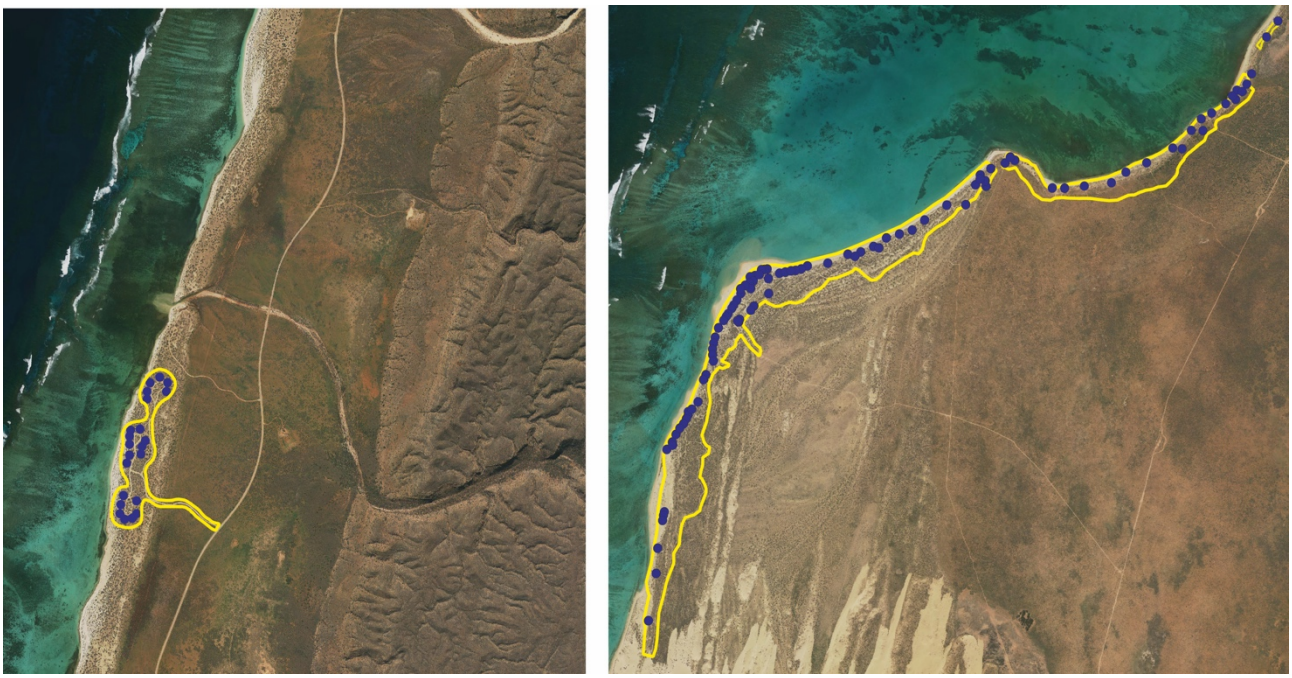
use booking options provides flexibility and equal opportunity to book camping areas and also provides a consistent and efficient method to make payments before arrival.

Amherst Point camping area, August 2017.

Vehicles and caravans parked on beach at *Walbal Wardu* (14 Mile Camp). Photo - Amanda Smith/DBCA

There is a long history of coastal camping in the planning area over several decades, with a strong desire for the coast to remain undeveloped with minimal facilities. Due to increasing demand for access to the coast, however, there is increasing visitation pressure and concern that further development will detract or destroy one of the few remaining coastal localities providing this type of experience (see Section 19 *Visitor planning*).

The intent in managing the camping along the Ningaloo Coast is to retain the remote, natural experience of 'open' camping, but minimise the impacts on the natural and cultural values of the area. Along with rehabilitation and essential site works, the focus will be educational management strategies to reinforce appropriate visitor behaviour and continue to engender respect for the values of the planning area and adjoining marine areas. The success or failure of this process will determine the future requirements for further site infrastructure, site definition and hardening.



Campground scale comparison – two campgrounds at the same scale, (left) Kurrajong Campground, Cape Range National Park: 35 camp sites; (right) Point Billie and South Lefroy Bay: approx. 98 informal camp sites over 6.6km.

Based on existing information, the planning area may be at carrying capacity in terms of camp sites. Taking a precautionary approach to protect key values, there will be no increase in the approximate number of overall camp sites within the planning area (there may be redistribution without increasing capacity) until investigations regarding carrying capacity and further heritage surveys are carried out. Walk-in camp sites within the Cape Farquhar area may be investigated in the future, in conjunction with development of the Baiyungu Track (see *Other recreational activities - Walking* below). No new 'developed' camping experiences or built accommodation will be created in the planning area. Sufficient highly developed accommodation options exist in Coral Bay, the existing tourism lease areas at Red Bluff and 3 Mile Camp, and the adjacent homestead accommodation areas. See Appendix 9 for the camping areas within the planning area and a summary of proposed site works.

Future heritage surveys along the coast will inform ongoing management of the recreation sites within the planning area to ensure the cultural values of the planning area are not being impacted by visitor use. Camping (and day use) areas will be moved if recreational use is impacting on cultural sites. It also may be necessary to investigate site capacity and definition at the large linear camp sites and how best to protect the natural and cultural values as well as the ongoing visitor experience.

There has been a significant loss of vegetation around some camping areas as well as issues with litter, fire ash/charcoal and toilet waste.

Visitor survey responses indicate that the most important campsite attributes include a campsite close to the beach, minimal litter, price, reasonable distance to neighbouring campsite, and provision of sewage dump points (Shields and Smith 2016, Smith and Shields 2017).

Various models will be considered for managing camping into the future, with various options considered for different campsites. Models may include fee-for-service, licence or lease arrangements or direct management by the department as considered and assessed by the JMB.

Campfires

Campfires and firewood collection can have detrimental effects on the natural environment, including loss of vegetation cover, soil compaction and the accumulation of ash. Hot ash and coals from beach campfires can be a visitor risk, and campfire escapes can be a source of bushfires. Feedback from campers along the Ningaloo Coast reinforce that coals and other campfire remains impact on the visitor experience as large areas of sand can end up being mixed with charcoal making camping in those areas less enjoyable.

Using rocks to build walls for campfires can also disturb cultural sites as has unfortunately been the case at some sites.

We left this area with a very heavy heart. It was a place known for our artefacts, a significant site for us and we asked for people not to go there. When we last visited there were no artefacts, no nothing there for the young ones and our future generations to show their grandchildren. Respect and look after our traditional country. Our country will respect and look after you.
Hazel Walgar, traditional owner, August 2016

Providing fire rings or defined campfire sites may help alleviate the problem of coal and ash on the beach and dune area and the disturbance of cultural sites. Where feasible, fire rings will be provided at camping areas although firewood will have to continue to be brought into the planning area by the visitor. Total fire bans may apply at times of high bushfire risk.

Cultural sites have been significantly disturbed by inappropriate recreational activities in the area such as campfire building.

Day use sites

The location of the existing day use sites throughout the planning area is related to the site's suitability for an activity such as surfing, swimming, snorkelling, boat launching and/or fishing. These areas provide alternative recreational opportunities for campers and add value to their stay. There are at least 41 day use sites in the planning area. Most of these sites are simply cleared areas used for parking, with no existing facilities (see Appendix 9). Major day use sites include Tombstones, 3 Mile Lagoon and Gnarraloo Bay where visitor demand in peak seasons can exceed the capacity of the existing parking areas.

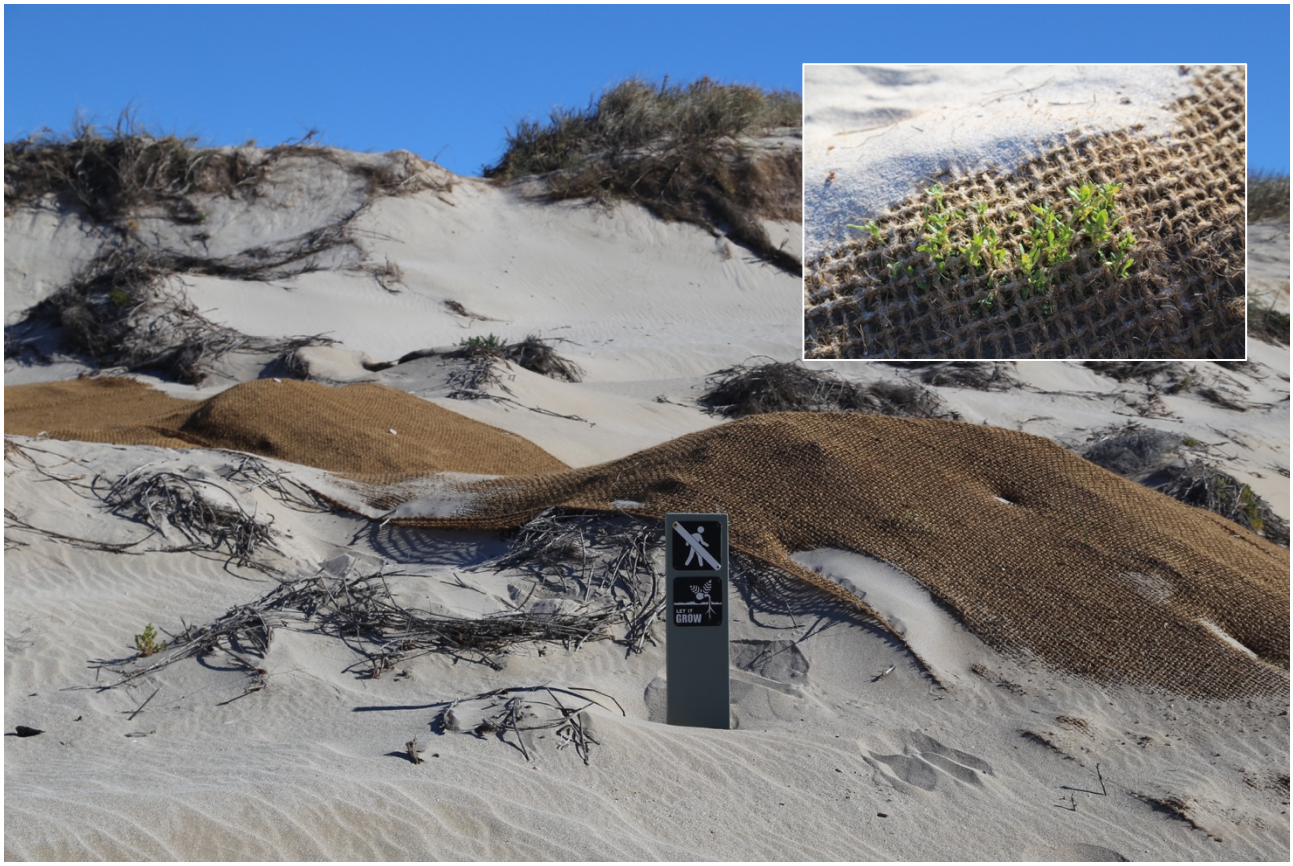
Traditional owners, Ronnie Johnston, Gwen Morrison, Hazel Walgar, Damien Cooyou, Turtles day use site, August 2016.

The Coral Bay settlement is the gateway for many visitors to access day use sites within the planning area and adjacent marine waters. The impact of unmanaged recreation by four-wheel drives and all-terrain vehicles (ATVs) around the Coral Bay area has led to significant coastal degradation in a relatively short period of time. The impacts include damage to native vegetation, disturbance of wildlife, track degradation and impacts on cultural sites (Syme 2009) (see Section 20 *Visitor access*).

Using dripline and bollards to reduce proliferation of tracks, *Mini Minimara* (Five Fingers) August 2017.

The most significant damage has occurred to the day use sites at *Mini Minimara* (Five Fingers), *Windura* (Turtle Cliffs), *Gurdbardu* (Skeleton Bay), *Murlanda* (Mauds Landing) and Lagoon. The department has recently begun remedial site protection works at these key sites, installing basic signage and fencing to try and limit damage to dunal areas. These works have focused primarily on track rationalisation and closures, to prevent further compaction and loss of vegetation caused by vehicles.

Some day use sites will need to have car parks relocated or modified where they are at capacity or poorly located, for example at Gnaraloo Bay. A summary of proposed site works for the day use areas are shown in Appendix 9.



Biodegradable coconut fibre matting laid over fore dunes, *Mini Minimara* (Five Fingers) August 2017. Inset: Regeneration using the coconut fibre matting after being in place four to six weeks.

Gnarraloo Bay, where the day use carpark needs to be redesigned to improve visitor experience, increase capacity and provide designated boat trailer parking.

Above: Currently important sign information can be obscured by vehicles.
Right: Current car park design allows boat trailers to damage fencing. August 2017.

Nyarrara Bula (Snapper Headland) before and after proposed rationalisation of tracks, creation of a walk trail and formalisation of a car park. Photos - DBCA

Other recreation activities

Walking

There are no designated walk trails within the planning area. Informal walk trails have generally formed between key recreation nodes and campgrounds, or visitors walk along the coast or on station vehicle tracks. Designated walk trails are required to improve the visitor experience of the reserve and limit visitor risk conflict with vehicles (e.g from Coral Bay to Five Fingers, 3 Mile to Tombstones). There is also opportunity to have a long-distance walk trail though Cape Farquhar which is currently closed to vehicle traffic. One such proposal includes the Baiyungu Walk Trail. This is a 350km long-distance coastal trail from Exmouth to Carnarvon with Coral Bay as a primary trailhead (ENFAC Consulting 2009)

Monument Cliffs, including some fossilised reefs 116,000 to 117,000 years old.

which would include education about the cultural values of the area. It is proposed that the track would be implemented in stages, with Stage 1 being trails in the Coral Bay area.

There may also be an opportunity to provide walktrails at Red Bluff and between Tombstones and Monuments where there are geological points of interest along the beach (see Section 9 *Geology, landforms and soils*) Most new walk trails within the planning area will be of Class 5 classification as they will be predominately natural surface trails.

Cycling

There are no existing cycle trails or facilities within the planning area, and the climate and terrain makes cycling unattractive to many visitors. The soil type within the planning area is also problematic for cycle trails, however if warranted, constructed surfaced trails could provide cross country cycling experiences. Further research will be conducted to determine demand for cycling opportunities in the planning area.

Snorkelling and swimming

Snorkelling and swimming, as well as other water-based recreational activities, are popular in Ningaloo Marine Park and are key attractions for most visitors to the planning area. Snorkelling is known to be a popular activity at Coral Bay, and other protected lagoons and bays in the marine park including Gnarraloo Bay, Nature Bay, 3 Mile Lagoon, Elle's Camp, The Lagoon, *Gabarlawangganji* (Dog Rock) and *Nyilleri* (Oyster Bridge).

Recreation planning needs to occur to address existing visitor conflicts at sites such as Gnarraloo Bay and 3 Mile Lagoon where boat launch points are adjacent to popular snorkelling areas. General facilities at recreation sites will cater for snorkelling and swimming however, no formal snorkelling trails are proposed as part of this plan. On-site interpretation of snorkelling opportunities may be provided.

Fishing

Recreational fishing is managed under the *Fish Resources Management Act 1994* by the Department of Primary Industries and Regional Development by restricting bag and size limits, gear, seasons and by issuing licences. The department works with the Department of Primary Industries and Regional Development to ensure visitors to the planning area and adjacent marine waters comply with the fishing regulations. Since 1992, there have been daily bag limits and a possession limit specific for Ningaloo Marine Park. The marine park management plan (CALM 2005a) covers recreational fishing in the marine park, education of visitors to the coast and compliance aspects of management so this management plan will focus more on the indirect management of fishing by the provision of access and recreational facilities for this user group.

There are nine Sanctuary Zones along the coast of the planning area (CALM 2005a, maps 3a-3d). These zones preclude recreational fishing as well as traditional hunting and fishing. In some areas, a Special Purpose (shore-based activities) Zone has been created to allow recreational shore-based angling to continue. Fishing in closed waters of sanctuary zones remain the highest fisheries offence type for Department of Primary Industries and Regional Development as well as excess bag limits and high levels of fish/fillets being transported away from the area (2015-2016 data). The highest number of offences being at Point Cloates.

Under the CALM Act, customary activities such as hunting and fishing are permitted for traditional owners. In any review of the marine park management plan (CALM 2005a) traditional hunting and fishing in sanctuary zones in the Marine Park needs to be considered.

Surfing, windsurfing and kitesurfing

Surfing is a popular activity in the marine park, and the southern breaks along the cliff coast adjacent to Gnaraloo and Quobba stations are internationally renowned. From April through to September the winter swells from the southern ocean push their way as far as Indonesia and produce world class waves along this area.

Further surveying needs to be conducted to determine the requirements of the surfing community in these areas. Known issues are that access into the water from the rocky shores can be hazardous, and this combined with big swells can result in surfers sustaining serious injuries.

Surf break locations will be assessed to determine suitable sizes and locations for day use parking areas, risk signage and information which can be understood by international visitors, and spectator viewing areas. A range of surfing opportunities will be maintained, from popular, formal sites to wilder sites with no facilities that might only be accessed by locals or regular visitors.

Surfers waiting beyond the break along the Ningaloo Coast. Photo - Mark Graves/DBCA

There are a number of community surfing groups with stakeholder interest in the area. These groups may be able to provide support and assistance with maintenance and rehabilitation of surfing locations.

Windsurfing and kite surfing are also popular water sports which utilise the same recreation sites in the planning area. There is potential for conflict with surfers, though the peak season for each group does not overlap. An additional requirement for these users are a large cleared area or beach which can be used for rigging up.

Surfers entering the water at *Majuns* (Turtles) surf break. Photo - Tamara Beers/DBCA

All-Terrain Vehicles

Private unlicensed all-terrain vehicles/quad bikes (ATVs) and other off-road vehicles are not permitted in the planning area. However, commercial ATV treks have historically been allowed to operate in these areas under licences issued through the CALM Act for Ningaloo Marine Park and the Land Administration Act for the proposed 5(1)(h) reserve. These licences and the route maps attached to their licences will need to be continually reviewed due to potential impacts on the natural and cultural values of the planning area (see Section 22 *Commercial operations*).

Boating

Visitors mostly launch small boats and dinghies across the beach to access the marine park (see Section 19 *Visitor access - Boats*). Boat launching facilities may require a number of associated terrestrial facilities such as parking for boat trailers and signage conveying regulatory fishing information. The provision of these facilities will be considered, particularly at major sites such as Bruboodjoo, 14 Mile and Gnarraloo Bay.

Ongoing use of beach boat launch points will be subject to maintaining visitor safety and consistency with marine park management strategies. Existing sites will be reviewed and subject to ongoing monitoring, as part of the recreation planning for each area. None of the existing beach boat launch points are proposed to be upgraded or stabilised, though their positions may be reviewed to limit conflicts with swimmers, and improve the experience of beach users which may be compromised by vehicles launching, retrieving boats and parking on the beach.

The sheltered lagoons of Ningaloo Marine Park are also attractive to other forms of passive boating recreational activities such as paddlers, sea kayakers and stand up paddleboarders. Opportunities for short paddle trails or overnight stay trips could be explored and promoted to visitors.

Wildlife viewing

Sustainable wildlife viewing activities provide valuable opportunities to raise public awareness of wildlife conservation issues both in the planning area and beyond. However, inappropriate interaction with wildlife can put both visitors and wildlife at risk. Potential include disruption of activities (e.g. feeding, breeding and/or nesting), direct injury (e.g. nest

trampling) or changes to habitat. Adverse effects can be minimised through education, restricting vehicle access on beaches, and the appropriate siting/design of facilities.

Feeding of wildlife either deliberately or as a consequence of poor rubbish management is also a particular problem

Sandboarding

Sandboarding can cause serious environmental damage as both sliding down the dune and climbing to the top again can destroy stabilizing vegetation. There are many large unstable sand dunes in the planning area and sandboarding will continue to not be allowed.

Rock climbing and abseiling

Opportunities for rock climbing and abseiling may be accommodated within specific areas but may be subject to restrictions (e.g. to specified numbers of people or certain seasons or times to protect rock wallabies or nesting birds). Visitors undertaking abseiling must have obtained 'lawful authority' from the Exmouth District office.

The Department's Policy Statement No. 18 *Recreation, Tourism and Visitor Services* provides further guidance regarding the management of recreational abseiling and rock climbing.

Visitors conducting commercial rock climbing and abseiling on lands managed by the department must obtain a commercial activity licence. All commercial operators and not-for-profit groups conducting abseiling with dependent participants must also be registered under the National Outdoor Leader Registration Scheme (NOLRS) or hold current equivalent qualification recognised by the department[25]. Not-for-profit groups where participants are non-dependent (e.g. military and emergency services training groups or specialist abseiling clubs/groups) may operate under their own training guidelines and competencies and do not require NOLRS accredited qualification, although this is subject to review by the department as warranted.

Orienteering, rogaining, geocaching, cross country running

The hot climate of the planning area is generally not suitable for orienteering, rogaining or cross country running and the native vegetation, particularly spinifex does not withstand trampling and it can cause injuries. However, orienteering, rogaining, cross country running and geocaching may be considered if these activities are proposed for environments that can withstand trampling. Applications will be considered on a case-by-case basis. Orienteering, rogaining, cross country running and geocaching will not be considered for the Cape Farquhar area.

Geocaching involves leaving containers for others to find which could present a risk to fauna. Therefore, geocaching is considered not an appropriate recreational activity in the planning area.

Caving and cave diving

The caves within the planning area have not been assessed for possible tourism use or public access. During the life of the plan, they may be assessed using the department's cave classification system. All caves within the planning area will be managed as 'restricted access' until an assessment has been made of the values, potential impacts to these and visitor safety issues. It is important that the assessment also includes criteria for evaluation against cultural and scientific or educational values.

Horseriding and camel riding

Adjacent pastoral stations may have horses associated with pastoral activities and there may be future proposals for horse and/or camel treks within the planning area. As horses and camels can cause erosion in fragile coastal environments, introduce weeds and horses and camels using vehicle access tracks can create a visitor safety issue, especially where the tracks are narrow, they will not be permitted within the planning area.

Waste management

Visitation to the recreation sites within the planning area generates waste, including human waste. Inappropriate waste disposal from camping areas or from boats can pollute the environment within and adjacent to the planning area. Visitors are encouraged at many of the recreation sites within the planning area to take their rubbish with them when they leave as opposed to providing bins at recreation sites and pick up any rubbish they find floating at sea or on the coast (see Section 17 *Marine and other pollution*).

[25] For example, the Abseiling Instructors Certificate and Professional Association of Climbing Instructors Schemes are currently regarded as acceptable accreditation.

Chemi-toilet dump points on Warroora Station. Photo (below) - Nathan Greenhill/DBCA

Currently there is only one toilet (Tombstones) provided within the planning area with most overnight visitors being required to bring chemi-toilets with them with some chemi-toilet disposal sites provided within the pastoral lease and/or tourism lease areas. Otherwise the closest licensed chemi-toilet disposal facilities are paid facilities at Coral Bay or Carnarvon or free disposal areas in Exmouth. Visitor compliance with the chemi-toilet policy will require ongoing monitoring to determine if the current practice is effective in protecting the environment or if toilet facilities should be installed at major or medium sites. There will also be a need to consider the impacts of grey water (water from sinks or showers in caravans) being discharged directly onto the beach.

In some areas adjacent to the planning area, limited facilities for rubbish disposal are provided (Bruboodjoo, Warroora Homestead, 14 Mile Camp rubbish dump, The Lagoon rubbish dump, Gnaraloo Homestead and Red Bluff) and some sites are within the planning area such as the rubbish dump near 3 Mile Camp where recyclables and other waste is dumped. These sites vary in the level of ongoing management, compliance and containment with some dump areas being significant sources of pollution to the environment by rubbish being blown and scattered into the wider area as well as being significant potential sources of marine pollution from nutrients leaching into the marine environment (see Section 17 *Marine and other pollution*).

Left: Rubbish dump Warroora Station. Below: Recyclable bottles and cans that need to be removed from existing rubbish dump near 3 Mile Camp.

Bigurda (euro) amongst scattered rubbish at the rubbish dump near 3 Mile Camp.
Photo – Emma West/DBCA

Future waste management within the planning area will include installing sealed vault drop toilets at a few select major or medium recreation sites if required, providing some chemi-toilet disposal sites with approved sealed systems if required, converting existing rubbish dumps within the planning area to waste transfer stations and/or using rubbish dumps on adjacent pastoral stations. The department will also liaise with the tourism leaseholders to ensure their waste management practices do not impact on the values of the planning area or adjacent marine waters.

Domestic animals

As domestic animals may impact on wildlife, they are generally not allowed in national parks or conservation estate, unless it is a designated area. The exception is approved assistance dogs (guide dogs) and specially trained dogs for search and rescue operations, security or educational purposes or feral animal control. Areas may be declared designated dog areas on some department-managed lands where impacts are considered manageable and/or there has been a history of dog access in the area. Under the CALM Regulations, designated areas will be signposted where practical and the conditions specified on the sign, with dogs to remain under control at all times.

Dogs will be allowed in the planning area in designated areas, mostly within the proposed 5(1)(h) reserve where there is a history of dog access. Noting there may be seasonal modifications based on feral animal control programs and other areas where dogs are restricted such as turtle nesting or bird roosting and nesting sites.

Management objective: To maintain appropriate recreational opportunities for visitors to experience, appreciate and understand the cultural and natural values.

Management strategies

1. Provide a range of camping and day use opportunities as well as visitor activities that are consistent with department policy, the proposed visitor management setting (maps 2a and 2b) and recreation site classifications (maps 3a-3d) and that they are designed and constructed to minimise environmental, cultural and social impacts.
2. Promote and support cultural ecotourism opportunities in the park.
3. Consider different management options for managing camping and day use areas such as fee-for-service, or management under a licence or a lease arrangement.
4. Refer inconsistent non-conforming visitor activities and recreational and/or tourism operations to the Conservation and Parks Commission and/or the JMB as appropriate for determination.
5. Review the limits for length of stay in some locations in consultation with key stakeholders.
6. Prohibit any vehicles not registered under the *Road Traffic Act 1974* (e.g. quad motorbikes).
7. Avoid unnecessary duplication of recreation opportunities with those occurring outside the planning area.
8. Not increase the overall current level of campsites within the planning area even though some may need to be relocated.
9. Assess the need for alternate camping areas.
10. Not create any new ‘developed’ camping experiences or built accommodation.
11. Monitor visitor impacts and review access where impacts are unacceptable.
12. Monitor levels of change and impacts of visitor use on recreational areas and facilities, and modify management where appropriate.
13. Monitor visitor impact within the planning area and adjacent marine park (e.g. relating to compliance, track proliferation, site compaction, track erosion, vegetation cover, littering/waste disposal, disease/weed spread, disturbance zones, informal camping sites and/or site condition).
14. Consider an online and phone booking system for camping sites as required (e.g. within former Ningaloo Station where camping is currently controlled with an online booking system).
15. Undertake low key site protection and maintenance works at existing sites, by installing the minimum amount of infrastructure and site definition required to protect natural and cultural values and limit site expansion.
16. Work with leaseholders of the tourism lease areas at Red Bluff, 3 Mile Camp and Bruboodjoo regarding issues such as building standards and compliance, provision of facilities, site capacity, coastal setbacks and waste disposal so management can be integrated and complimentary where possible and to reduce impacts on the planning area and adjacent marine environment.

17. Undertake an education program to ensure recreational and commercial fishers are aware of zoning restrictions and regulations, which apply to their activities within the planning area and adjacent marine park, in particular in camping areas adjacent to Sanctuary Zones.
18. Develop walk trails to improve visitor experience and limit conflict with vehicles (e.g from Coral Bay to Monck Head, 3 Mile Camp to Tombstones).
19. Support the development of a long-distance walk trail through the planning area (e.g. the Baiyungu Walk Trail).
20. Investigate the demand for mountain biking or cycling trails in the planning area and if warranted provide sustainable cross-country trails.
21. Review existing boat launching locations and separate boat launching activities from areas where visitors swim or snorkel where possible (e.g. Gnarraloo Bay and 3 Mile Lagoon).
22. Undertake joint surveillance and enforcement programs with the Department of Primary Industries and Regional Development to ensure compliance with restrictions and fishing regulations.
23. Work with the Department of Primary Industries and Regional Development to consider opportunities for customary take of fish in the marine park.
24. Provide further specific wildlife viewing opportunities that can increase visitor's enjoyment of the planning area and awareness of wildlife conservation issues whilst minimising the potential for disruption of activities, direct injury, and habitat alteration.
25. Provide or authorise guided turtle-watching within the planning area if appropriate and provide visitors with information on turtles, their conservation and ways to prevent disturbance.
26. Undertake a review of abseiling and rock climbing with relevant stakeholder groups involving assessment against criteria based on protection of key values and visitor safety, to identify which/whether areas within the planning area are suitable for accommodating the activities.
27. Restrict abseiling and rock climbing (e.g. to specific areas, seasons, times, visitor numbers) and implementing other visitor management measures as necessary in the light of the review, to protect black-flanked rock wallabies, nesting birds, other key values and visitor safety and prohibit use if unacceptable impacts to key values cannot be effectively mitigated.
28. Implement an access monitoring and management system (e.g. registration or booking system) as required to assist with monitoring and managing abseiling and rock climbing use.
29. Ensure VRM assessments of abseiling and rock climbing sites including geotechnical investigations are undertaken and responded to as required.
30. Manage all caves in the park as restricted access until assessment (environmental, cultural and safety) and classification has been undertaken.
31. Require that visitors remove the rubbish and waste generated during their visit to the planning area to waste transfer stations where provided or to other waste disposal areas outside of the planning area.
32. Monitor chemical dumping areas and provide toilet facilities if required to reduce risk of contamination of the groundwater and receiving waters of the marine park.
33. Educate visitors to the planning area and adjacent areas on the appropriate management of waste, the harmful effects of marine debris and encourage waste minimisation.
34. Rehabilitate or contain historical waste disposal sites (including chemical loo dump pits) and provide waste transfer sites.
35. Monitor visitor behaviour in relation to waste disposal, to determine if the existing practice of using chemi-toilets and designated dump points is effective, or if toilet facilities should be installed at major or medium sites.
36. Allow campfires in fire rings or designated campfire sites provided by the department.
37. Provide information to visitors about the environmental impacts of firewood collection and campfires.
38. Not allow competitive car rallies, motor sports, hang-gliding, paragliding, sandboarding and abseiling and/or variations thereof, within the planning area.
39. Manage domestic animals in accordance with department policies and relevant legislation.
40. Allow dogs in designated areas under the CALM Regulations.
41. Educate visitors to the planning area about the harmful impacts of domestic pets and the necessary measures to protect wildlife, and the dangers to their pets in areas where feral animal baiting programs are conducted.

See also sections 19 *Visitor planning*, 21 *Visitor access* and 22 *Commercial operations*.

KPI: Visitor activities

Performance measure	Target	Reporting
Visitor impacts from camping and day use	No increase in the overall footprint/disturbance zone, compaction or vegetation cover of camping areas	Every 5 years
Compliance	Compliance with regards to appropriate visitor behaviour such as the disposal of chemi-toilet waste, general waste disposal, informal camping and campfires	Every 2 years

22. 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. 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 with approval from the Minister in consultation with the Conservation and Parks Commission and traditional owners through the JMB. They 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 promote Aboriginal culture on land that the CALM Act applies to.

Licences

By issuing of licenses, not only does the department allow lawful access for appropriate commercial use of the land, but it can monitor access, use and environmental impact of commercial businesses to ensure natural and cultural values are protected. There are two types of commercial operations licences depending on the nature of the operation; 'T' Class and 'E' Class licences. Most commercial operations are 'T' Class and examples include safari tours, guided walks and general snorkel/dive charters. In these circumstances, environmental and visitor management objectives can be achieved simply through appropriate licence conditions which are in the *Commercial operator handbook* and can be for periods of two months and one, three, five, seven and 10 years. In some cases, the department may choose to conduct a higher level of assessment. 'E' Class licences are required when there are environmental, management, safety, or access reasons why licence numbers must be limited, for example when demand for licences exceeds the number that can be sustainably managed. They are usually allocated via a publicly advertised call for an Expression of Interest (EOI) which is a competitive process. These licences can be granted for periods of up to ten years and may be renewed for up to a further five. After this time, the restricted opportunities are then offered through another competitive application process, usually an EOI.

ATV tours often stop at dune crests and ridges for visitors to appreciate the views out to the marine park. Dune crests are vulnerable to erosion.

Currently there are only two commercial operators licensed to operate in the planning area; two ATV companies that provide guided tours to visitors to Coral Bay. As part of their 'T' Class licence conditions they currently have approved routes to be used north and south of Coral Bay including Five Mile Bay, Lagoon, Oyster Bridge, Mauds Beach, Monck Head, Five Fingers Reef and Turtle Cliffs. These routes transverse the marine park as well as the planning area. Other licence conditions include a maximum of 10 registered ATVs being used in the tour, a maximum speed of 40km/hr and only being able to drive below the mean high water mark during turtle breeding season and accessing Bateman Beach only once between sunrise and sunset.

Whilst the ATVs give visitors a novel way to experience the area, often an ATV will venture where a four-wheel drive will not, creating new tracks which are eventually also utilised by four-wheel drives.

For the commercial ATV use to continue long-term in the planning area, the ATV use of the beaches and coastal dunes will be investigated further to ensure the impacts are

Evidence of likely ATV impacts as vehicles encroach on the dune system for no other reason than to increase the recreational enjoyment.

Tracks used by four-wheel drives and ATVs crisscross the landscape.

acceptable and sustainable in a conservation reserve. In the meantime, annual reviews of operations will be continued to review routes and to ensure adherence to licence conditions. This review would require local staff tracking route variation and incident reporting throughout the licence period and done in liaison with the ATV companies.

Some areas due to cultural significance will be closed to ATV use as requested by the traditional owners. Reviewing ATV use will be an ongoing responsibility of the JMB.

Future applications for licences for commercial activities such as tours and nature appreciation activities (e.g. turtle watching) will assessed in accordance with the CALM Act and Regulations, this management plan and departmental policy.

Leases

There are currently no CALM Act leases in the planning area.

The tourism leases in the adjacent enclaves and pastoral stations are managed under the Land Administration Act by the Department of Planning, Lands and Heritage. DBCA will have a role in providing advice to other government departments and the local council with regards to any developments in these areas so the values of the planning area and adjacent marine park are protected.

Management objective: To ensure that commercial activities are compatible with the values of the planning area and the range of services, facilities and experiences available to the visitor are extended through the involvement of private enterprise and/or traditional owners

Management strategies

1. Support traditional owner enterprises that meet the objectives of protecting and conserving the natural and cultural values of the planning area and adjacent marine park e.g. cultural tours, language courses, passing on traditional knowledge and law to the younger generations.
2. Evaluate and grant proposals for commercial purposes according to departmental policy and ensure that operators demonstrate a commitment to protect and promote the planning area's values, behave appropriately and respectfully at cultural sites and conduct operations according to departmental policy and licence conditions.
3. Encourage operators to maximise opportunities for business, partnerships, employment and training with traditional owners within the planning area.
4. Ensure all commercial operations operate under a lease or licence with appropriate conditions.
5. Review licence and lease conditions to include requirements where deemed necessary, to provide information to enable impact assessment of the tourism activity and monitor compliance with general conditions.
6. Apply commercial operator licence conditions to ensure accurate cultural heritage information is provided to visitors and that visitation to cultural heritage sites is culturally sensitive and appropriate.
7. Collect and compile data from tour operators as required to be submitted under the various conditions of the leases and licences.
8. Monitor impacts of commercial operations on turtles that breed or haul-out in the planning area.
9. Review ATV commercial operator licences annually to modify routes as necessary to minimise environmental and/or cultural impacts.
10. Consider different management options for managing camping and day use areas such as fee-for service or management under a licence or lease arrangement.

See also sections 6 *Aboriginal cultural heritage* and 21 *Visitor activities*.

23. Community involvement

In addition to joint managers, neighbouring land managers and relevant government agencies, involving the wider community is an integral part of the department's operations, including 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, conservation groups, tour operators, recreational peak bodies and volunteers are key groups within the community that can contribute to management of the planning area through programs such as revegetation, weed control, flora and fauna surveys, interpretation and development of visitor facilities.

Management objective: To promote and facilitate community involvement in the management of the planning area

Management strategies

1. Engage the community in planning to foster appreciation and respect for the planning area's landscape and environmental values.
2. Continue to foster links and partnerships with stakeholders including local government, adjacent land managers, the Coral Bay community, research institutions, conservation groups, volunteers and recreational groups.
3. 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).

Left: The southern coastline of the planning area is mostly low limestone cliffs with rocky shores and occasional pocket beaches.

Right: *Nitraria billardierei* (nitre bush), *gajalbu* (emus) eat the berries in summer which assists in the spread and germination of the seeds.

Using resources from country (managing economic and resource use)

From time to time the department is asked to provide comment on development proposals relating to using resources from the planning area. The responsible and sustainable use of natural resources in and adjacent to the planning area by the department and by other parties will need to be managed sustainably to not impact on the cultural, natural and recreational values of this area or interfere with the objectives of this plan.

The main existing and potential extractive activities associated with the planning area are mining, pastoralism and groundwater abstraction. Public and private utilities also sometime request to locate their services within or adjacent to conservation reserves.

24. Mineral and petroleum exploration and development

Exploration, extraction and rehabilitation activities are approved and largely governed by other government agencies under legislation such as the *Environmental Protection Act 1986*, *Mining Act 1978* and state agreements. Petroleum (which includes oil, gas and geothermal energy) exploration and production within state land and onshore waters is authorised under the *Petroleum and Geothermal Energy Resources Act 1967* (Petroleum Act). The Department of Mines, Industry Regulation and Safety (DMIRS) is the State's lead agency for related assessment and approvals under the Mining Act and the Petroleum Act and is a decision-making authority for non-state agreement projects under these Acts. Projects of state significance may be administered by the Department of State Development under project specific agreement acts.

The planning area includes important mineral resources such as limestone, oil and gas. It may be also prospective for a range of mineral resources (including bauxite and diamonds) and base metals (copper, lead and zinc).

Potential threats from mining include habitat destruction from clearing, mining and quarrying. Applications to explore or mine within reserves vested in the Conservation and Parks Commission may be referred to the Minister for Environment as required under environmental, mining and petroleum legislation. Exploration and development proposals that may cause significant impact on and risks to key values may be referred to the Environmental Protection Authority (EPA) for environment impact assessment. Developments that can potentially have a significant impact on matters of national environmental significance[26] may also be referred to the Australian Government Minister for the Environment (or equivalent) for assessment under the EPBC Act.

There is a live Temporary Reserve (TR7002614) covering part (7,567ha) of the northern part of the planning area (the proposed extension to Cape Range National Park part of former Ningaloo Station). This is part of a large Temporary Reserve for limestone that covers land to the east of Cape Range National Park. The mining of this part of the planning area may impact on the karst and rock-wallaby habitat values. There is also one petroleum Exploration Permit (EP359R3) over a corner (774ha) of the potential addition to Cape Range National Park in the south of the former Ningaloo Station.

Basic raw materials

Basic raw materials including gravel, sand and limestone should be preferentially sourced from outside conservation reserves. However, the remote nature of the planning area makes it difficult to source these materials from elsewhere. Therefore, access to basic raw materials for departmental operations such as road building for use within the boundary of the planning area may be considered if it is not feasible to bring in the material from somewhere else.

[26] There are nine matters of national environmental significance protected under the Act. Four of them are relevant to the planning area: world heritage properties, national heritage places, listed threatened species and ecological communities and migratory species protected under international agreements.

Management objective: Impacts of mineral and petroleum exploration and development, including basic raw material extraction and development activities, on the key values are minimised.

Management strategies

1. Review and advise Government (including the Conservation and Parks Commission) on the effect of resource development proposals on the values and integrity of the conservation reserve system relative to the planning area.
2. Liaise with DMIRS in their monitoring of existing exploration and/or development activities within and adjacent to the planning area and request they take any necessary action where conditions are breached.
3. Refer or recommend referral of exploration or development proposals with the potential to impact significantly on the values of the planning area to the EPA for consideration of assessment under the Environmental Protection Act.
4. Make exploration or development proponents aware of their legal obligation to refer proposals that could have a significant impact on matters of national significance to the Australian Government Minister for the Environment, Heritage and the Arts (or equivalent) for assessment under the EPBC Act.
5. Ensure that all areas in which mining activity occurs within the planning area are rehabilitated according to the approval conditions of the proposal as well as departmental rehabilitation standards and guidelines (e.g. *Policy Statement No. 10 Rehabilitation of Disturbed Land* [CALM 1986]).
6. Rehabilitate disused gravel pits in accordance with departmental guidelines.

25. Grazing

Prior to mid-2015, part of the proposed 5(1)(h) coastal reserve and Ningaloo Station were held under pastoral lease. Some of these areas are still subject to livestock grazing (goats, cattle and sheep) although it is a priority that the stock be removed as soon as possible. Under the renegotiation agreements of the Warroora pastoral lease it was agreed by Government that grazing could continue on the proposed 5(1)(h) coastal reserve adjacent to this station for five years after gazettal of the reserve or until Native Title is determined, whichever is sooner.

Pastoral operations continue on a small section of the former Ningaloo Station and the other stations to the east of the planning area, therefore ongoing incursion of livestock is both an existing and a potential management issue. Managed goats will be allowed access to part of the planning area adjacent to Warroora Station for up to five years from creation of the section 5(1)(h) reserve (this does not include the Ningaloo Marine Park coastal strip 40m landward of HWM) as part of the Government agreement entered into with Warroora Station holder.

Historical grazing has impacted on the planning area with stock trampling vegetation and fragile dune systems, preventing native vegetation re-sprouting, overgrazing/browsing, increasing erosion, exposing midden sites, introducing nutrients and was a vector for the introduction of exotic pasture grasses and other weeds. Grazing by livestock is known to alter habitat structure, negatively affecting species that depend on vegetation for foraging and nesting (Martin and Possingham 2005). The pastoralists have also widely introduced buffel grass into the planning area to provide feed for stock, changing the environment drastically (see Section 13 *Weeds*). The interaction between the goats and the rock wallabies could be more complex with the goats perhaps acting as sentinel species alerting the rock wallabies to predators and this should be considered in developing and implementing goat control programs adjacent to rock wallaby habitats (see sections 12 *Native animals and habitats* and 15 *Introduced and other problem animals*).

Other indirect impacts include alteration of the movement and behaviour of native and introduced fauna species and altered fire, nutrient and surface water flow regimes. Weeds and introduced animals are often favoured by ecological changes arising from grazing (e.g. nutrient availability). Research from sites with a history of pastoralism elsewhere suggest that ecological recovery is achievable 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).

Management objective: to reduce the impact of grazing on the planning area.

Management strategies

1. Work with the pastoralists to facilitate the removal of livestock from the planning area.
2. Investigate the need for and feasibility of installing and maintaining stock-proof fencing to exclude livestock from sensitive sites and locations.
3. Undertake regular estimates of feral stock abundance.
4. Investigate the interaction between goats and rock wallabies in the north of the planning area.

5. Remove and where appropriate relocate pastoral infrastructure from within the planning area to the pastoral lease area.

See also sections 6 *Aboriginal cultural heritage*, 12 *Native animals and habitats* and 15 *Introduced and other problem animals*.

KPI: Grazing

Performance measure	Target	Reporting
Numbers of goats, sheep and cattle within the planning area	Reduce numbers of stock within the planning area to almost nil within 10 years	Every 2 years

26. Water resource use

Groundwater in the planning area is brackish to very saline, varies in temperature and is corrosive (see Section 10 *Hydrology*). Intercepted by a bore, substantial treatment is required (i.e. desalinisation, iron removal) to achieve potable drinking water (WAPC 2004). Limited supplies of treated groundwater from the Birdrong Sandstone Formation are provided at Coral Bay, Gnaraloo, Warroora and Cardabia. Fresh groundwater is generally restricted within the vicinity of major rivers (WAPC 2004).

Historically the groundwater was first used by the traditional owners as they moved up and down the coast with campsites often located at well sites (see Section 10 *Hydrology*). As a consequence, most of these well locations have cultural significance. These well locations are also used as a resource by the pastoralists for their stock and associated operations and dwellings.

> *Freshwater soaks are important to us, it was a matter of survival. Most of these water places have been used for pastoralism. If there are places we can still access we should and look after them.*
> Paul Baron, traditional owner, September 2018.

Pastoral infrastructure can be found throughout the planning area.

Groundwater abstraction from the planning area or adjacent pastoral areas has the potential to impact on the cultural and natural values of the planning area by impacting on the quantity and/or quality of the groundwater. Karst environments in the north of the planning area have a dependent relationship on groundwater but not much is known on the requirements of these communities in those areas.

Under the pastoral lease renegotiations, ongoing use has been granted pastoral infrastructure with easements to be created within the planning area across the water source, pipes and pipelines.

The continued use of bores or soaks within the planning area should be investigated and discussed by the JMB to whether this use should continue on a case-by-case basis. Any new request for water resource use within the planning area should be thoroughly investigated and only permitted if there is no impact on cultural and natural values. Any bores or soaks not in use or seen to be a priority by the JMB should be restored to their natural state if feasible and protected taking into account their non-Indigenous heritage values and/or value as a water source for native animals.

Management objective: the impacts of water resource use are minimised.

Management strategies

1. Liaise with the Department of Water and Environmental Regulation (or equivalent) and adjacent land managers to ensure impacts of water abstraction are minimised.
2. In partnership with the traditional owners, identify and rehabilitate some of wells to their natural state if feasible.
3. Protect the Aboriginal cultural values of the soaks and preserve the non-Indigenous heritage value of the wells as required.
4. Investigate the relationship between karst environments and groundwater in the north of the planning area..
5. Identify potential water sources for management purposes.

See also Section 10 *Hydrology*.

27. Utilities and services

Utility corridors are sometimes requested through conservation estate so that electricity, gas, telephone, fibre optic cable, water and rail services can be provided to enclaves of private property, or as the most direct route for these services to townsites or other nearby lands. The construction and subsequent maintenance of these corridors in proximity to the planning area, as with all access routes, can result in impacts on scenic quality, soil erosion, the introduction of weeds and disease as well as create problems for managing visitor access.

There are currently limited utilities or services located within or adjacent to the planning area with most utility structures and services located in Coral Bay and the homesteads on neighbouring stations. Utility infrastructure that is not servicing the planning area itself should be located outside the conservation reserves. When this is not possible, the use of already degraded areas, pre-existing corridors or co-location with existing infrastructure is preferred.

Management objective: To minimise the impact of utilities on cultural, natural, recreation and tourism values.

Management strategies

1. Recommend any new utilities or services be located within existing corridors and/or off conservation estate.
2. Liaise with providers to ensure that the operation and maintenance of utility and services are in accordance with departmental lease conditions including:
   - the responsible management of environmental issues, particularly bushfire prevention and the introduction and/or spread of weeds, problem animals and disease
   - a visual impact assessment is conducted and visual impacts are minimised
   - the removal of infrastructure (except if the department considers it to have cultural heritage value) and rehabilitation of land, if utilities and services are no longer required.

Tombstones at low tide. Photo - Mark Graves/DBCA

Keeping country healthy (monitoring and assessment)

Strategic objective
To increase understanding of the values and management issues of the planning area, and gain knowledge to guide, adapt and improve management.

28. Research and monitoring

Research and monitoring are essential components of management, and are required to successfully implement this management plan. Research leads to improved knowledge and a better understanding of the values of the planning area, while long-term monitoring[27] should inform adaptive management and performance assessment against the objectives of the management plan (see Section 5 *Performance assessment*). Monitoring should also include measurement of pressures so that the asset condition can be linked to variance related to natural/anthropogenic influences. Linking cause-effect relationships is a key requirement of effective monitoring and is needed for evidence-based adaptive management. If there are declines in key values then knowing why (e.g. natural variance, climate change or local anthropogenic pressures) will assist in determining whether a management response will be effective in mitigating the impact.

Flora transect surveying during the Back to Country trip in August 2018. Ranger Judith Peck and Carmel Cooyou. Photo - Eleanor Killen/DBCA

Research also includes social research, which contributes to an understanding of people's attitudes and behaviour towards the environment and how they interact with it. It can also help in better understanding issues related to the department's programs, improve decision making and the effective and timely delivery of services. It is important that surveys are periodically conducted throughout the planning area, targeting high use areas and areas of interest.

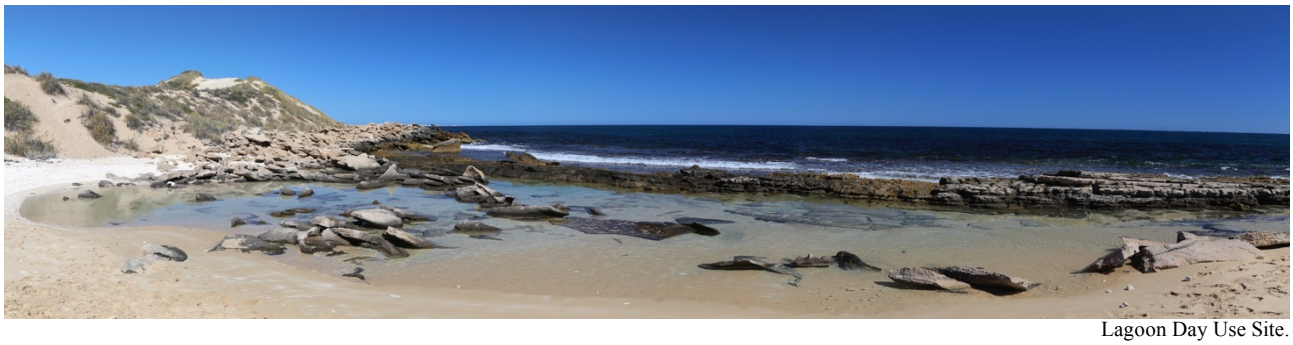
[27] Monitoring refers to ongoing and systematic collection and analysis of routine quantitative data and qualitative information used by management and joint management partners to determine progress on the implementation of activities, achievement of objectives and use of resources, and allows for adjustments and improvements to be made.

Management objective: Increase knowledge and understanding of the key values and management issues of the planning area to inform management and allow assessment of the KPIs in this plan.

Management strategies

1. Conduct integrated research and monitoring programs that facilitate management of the planning area, with a focus on key issues and values identified in this management plan, the establishment of baseline information, determining cause-effect relationships, natural variance, collecting evidence to allow reporting on KPIs, and other departmental research priorities.
2. Ensure that traditional knowledge about country informs research and monitoring programs so they are culturally appropriate.
3. Advocate the involvement of the traditional owners in the research and monitoring carried out in the planning area and adjacent marine areas.
4. Ensure relevant information gained through research, monitoring and experience is available to the JMB and the department in regional and district office libraries/databases, and updated when required.
5. Develop and maintain a database of historical, current and required research to address knowledge gaps and in the planning area and requirements of this plan.
6. Prioritize research and monitoring requirements within the planning area and contribute to other departmental programs and strategies as applicable.
7. Establish and maintain a portfolio of evidence relating to the KPIs throughout the life of the plan to enable measurement of implementation and management effectiveness of actions.
8. Monitor, review and continuously improve the effectiveness and applicability of management techniques and strategies, and implement adaptive management as required.
9. Incorporate research and monitoring findings into interpretive and educational material where appropriate.
10. Pursue external funding sources to assist in achieving research and monitoring objectives.
11. Encourage and support, wherever possible, external agencies and individuals where their research contributes directly to the strategies or the implementation and auditing of this management plan.

See also Section 5 *Performance Assessment* and various research and monitoring strategies throughout the plan.



Lagoon Day Use Site.

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Appendices

Appendix 1. Tenure of the Planning Area

Name	No.	Tenure	Size (ha)	Current purpose	Notes
Existing conservation reserves					
Ningaloo Marine Park Coastal Strip (Amherst Point to Winderabandi Point from HWM to 40m above HWM)	A40079	Marine Park under the Land Act 1933	557.10	Marine Park	No change
Point Cloates (Perth Hill) Lighthouse	A44892	Navigation Aid	0.14	Navigation, Communication, Meteorology, Survey and Conservation	Proposed addition to Cape Range National Park or maintain as a separate section 5(1)(h) for the purpose of navigation and conservation. Currently leased to AMSA until 30 November 2020.
Foreshore reserve adjacent to 3 Mile Camp	C41869	Foreshore reserve	2.11	Foreshore protection	Proposed CALM Act section 5(1)(h) reserve for 'conservation and recreation'.
		Total existing	559.35		
Proposed reserves					
UCL adjacent to Quobba landwards from HWM (previously UCL and pastoral lease)		Unallocated Crown land	440.31		Proposed CALM Act section 5(1)(h) reserve for 'conservation and recreation'. This would protect populations of Priority 3 flora *Whiteochloa capillipes* and provide integrated management across the marine and terrestrial environments to preserve cultural, natural and recreation values as per previous Environmental Protection Authority's *Conservation Through Reserves Committee* recommendations, other planning documents and CALM Act management plans (CTRC 1974, EPA 1975, WHCC 2004, CALM 1987, CALM 2005a, CALM 2005b, DEWHA 2007, DEC 2010).
UCL adjacent to Gnaraloo landwards from HWM (previously UCL and pastoral lease)			10,364.04		
UCL landwards from 40m above HWM (former Warroora pastoral lease)			2,557.98		
UCL landwards from 40m above HWM (former Cardabia pastoral lease and UCL south of Coral Bay Townsite)			5,605.56		

Name	No.	Tenure	Size (ha)	Current purpose	Notes
Mauds Landing ex-townsite UCL			337.57		
UCL landwards from 40m above HWM coastal strip south of Point Cloates (former Ningaloo pastoral lease*)			2185.8		
UCL landwards from 40m above HWM coastal strip north of Point Cloates (former Ningaloo pastoral lease*)			4321.95		Proposed CALM Act section 5(1)(h) reserve for 'conservation and recreation', however could be added to Cape Range National Park as per original CTRC (1974) recommendations. This would enable the entire Cape Range formation and peninsula to be within the National Park especially if the inland portion is included. This would also provide integrated management across the marine and terrestrial environments to preserve cultural, natural and recreation values.
UCL landwards from 40m above HWM coastal strip and inland eastern portion (former northern Ningaloo pastoral lease*)			11,810.10		Proposed southern extension to Cape Range National Park as per CTRC (1974) recommendations. This would protect further portions of the Cape Range formation, karst habitat, populations of the threatened black-flanked rock wallaby and national heritage values.
Red Bluff Land Administration Act Section 79 lease area		General Crown lease	49.13		Potential section 5(1)(h) reserve with a CALM Act lease.
		Total proposed	37,672.44		
Potential reserves					
UCL inland eastern portion North of Point Cloates (former Ningaloo pastoral lease*)			10,961.34		Potential addition to Cape Range National Park as: • there are significant populations of the threatened black-flanked rock wallaby and reservation would allow goat and fire management along with ongoing monitoring of the populations. These populations are the southernmost populations of the Cape Range black-faced rock wallabies and may be used in future translocations in Kalbari National Park

Name	No.	Tenure	Size (ha)	Current purpose	Notes
					• it contains the southern extent of the Cape Range formation and associated karst habitats with unique cave fauna and fossils • the southern extent of Cape Range has World Heritage and National Heritage values with uplifted terraces along the coast and anticlinal range inland partly overlain by sand dunes. Reserving this area would facilitate the amendment of the World Heritage boundary to capture these values • vegetation associations 662 and 681 are under represented in the conservation reserve system • there are significant cultural sites including Jarvis Well shell midden (DAA ID16595 not registered) which has *Terebralia* shells, a species that normally inhabits mangroves which have not existed in the great numbers in this area since the mod-Holocene. The presence of *Terebralia* at the site indicates this may be one of the older surviving shell middens in the area (McGann 1999) • as per CTRC (1974) recommendations
Former Ningaloo inland portion South of Point Cloates*			21,192.49		Potential addition to Cape Range National Park as per CTRC (1974) recommendations. This would protect populations of Priority 3 flora *Corchorus congener* and include further under represented vegetation associations (662 and 681) into the conservation reserve system. There may also be range end populations of endemic reptiles such as the Ningaloo worm-lizard.
		Total potential	32,153.83		
		Total planning area	**70,385.62**		

*References to UCL derived from the former Ningaloo pastoral lease premises assume that Supreme Court proceedings directed to the question of whether or not a current pastoral lease is in place will be resolved by a finding that the lease expired on 30 June 2015. It is acknowledged that the Court may come to a different view, which may have implications for this component of the management plan area and the extent to which the management plan may be implemented over such land.

Appendix 2. Vegetation associations of the planning area

Beards vegetation associations		Pre-1750 extent	Current extent	(proportion of pre-1750 extent)	Pre-1750 extent in conservation reserves	(proportion of pre-1750 extent)	Current extent in existing conservation reserves	(proportion of Pre-1750 extent)	(proportion of current extent)	Current extent In existing reserves in PA	(proportion of pre-1750 extent)	Current extent in proposed reserves in PA	(proportion of pre-1750 extent)	Current extent in potential additions to PA	(proportion of pre-1750 extent)	Current extent in PA
No.	Description	(Ha)	(Ha)	(%)	(Ha)	(%)	(Ha)	(%)	(%)	(Ha)	(%)	(Ha)	(%)	(Ha)	(%)	(%)
95	Hummock grasslands, shrub steppe; acacia & grevillea over *Triodia basedowii*	390,084.97	389,947.89	99.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4,795.71	1.23			
329	Shrublands; dwarf waterwood (*Acacia coriacea*) shrubs on recent dunes	25,113.19	25,100.87	99.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4,490.20	17.88			
345	Mosaic: Shrublands; *Acacia sclerosperma* & *A. victoriae* patchy scrub, barren / Succulent steppe; saltbush & bluebush	57,166.11	57,166.11	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.50	0.03			
662	Hummock grassland; shrub steppe; mixed acacia scrub & dwarf scrub with soft spinifex & *Triodia basedowii*	282,709.68	281,679.32	99.64	5,210.94	1.84	5,137.55	1.82	1.82	238.15	0.08	18,070.24	6.39			
663	Hummock grasslands, shrub steppe; waterwood over soft spinifex	29,068.26	25,866.32	88.98	7,598.07	26.14	6,768.57	23.29	26.17	22.10	0.08	1,378.61	4.74			
664	Hummock grasslands, sparse tree-steppe; scattered bloodwood over soft spinifex & *Triodia* sp. indet. aff. *Angusta*	83,739.62	82,154.14	98.11	34,993.58	41.79	34,989.00	41.78	42.59	0.00	0.00	500.38	0.60			
676	Succulent steppe; samphire	51,983.51	51,232.57	98.56	3,356.03	6.46	3,348.72	6.44	6.54	0.00	0.00	243.20	0.47			
681	Shrublands; open dwarf scrub, waterwood (*Acacia coriacea*) on recent dunes	5,687.50	5,406.56	95.06	54.17	0.95	40.88	0.72	0.76	62.83	1.10	5,460.37	96.01			
2685	Shrublands; *Acacia quadrimarginea* & jam scrub on greenstone	39,718.93	39,693.81	99.94	23.63	0.06	20.54	0.05	0.05	32.65	0.08	1,726.09	4.35			

Appendix 3. Plants, animals and habitats of cultural significance

The following plants, animals and habitats are especially important to traditional owners. This list is not comprehensive at this stage, it is considered draft and will be added to during the life of the plan.

Language name	Common name	Scientific name	Significance	Locations
Plants				
Warlawarla	Sandalwood	*Santalum spicatum*	Bush tucker, incense	
Gagulara	Bush tomato		Bush tucker	
	Dampier pea	*Swainsona pterostylis*	Medicinal, sunscreen and moisturiser	Adjacent to Cardabia Station
Barrumba	Wattle	various	Bush tucker, ceremonial (smoking tree for warding off bad spirits)	
Gurra	Wattle	*Acacia tetragonophylla*	Bush tucker (seeds dried, ground up and used for flour and then made into bread), ceremonial (tapping sticks)	
Gurrawiny/gunthuwa/gulya	Wild potato		Bush tucker	
Wardula	Wild onion		Bush tucker	
Gulijiguliji	Bloodwood tree fruit		Bush tucker	
Gagurla	Bush banana		Bush tucker	
	Bush with red berries		Soap	Adjacent to Cardabia Station
(Medicine tree)	Currant bush/maroon bush (bush with cream flowers and black purple berries)	*Scaevola spinescens*	Bush tucker, medicine plant (boil the young ends and use to gargle, wash eyes, put on sores or in a bath - has antibacterial properties)	
(Wax spinifex)			Ceremonial and hunting – can be melted down for jewellery, weighing down spears and used as incense to ward off evil spirits	
	Yam	*Ipomea*	Bush tucker	
Animals				
Nyirlbu	Bardie grub		Bush tucker	
Yunggurrji	Sand goanna	*Varanus gouldii*	Bush tucker ("*don't eat the black one* jirdarra" [perentie])	
Majun	Saltwater turtle	various	Bush tucker; spiritual; ceremonial	
Gajalbu/ Jankurna	Emu	*Dromaius novaehollandiae*	Bush tucker, eggs; totem	

Bilygurumarda	Osprey	*Pandion haliaetus*	Dreaming	
Bardurra	Australian bustard/bush turkey	*Ardeotis australis*	Bush tucker, totem	
Mabanu	Dingo	*Canis familiaris dingo*	Companion animal	
Bigurda/pigurda	Hill kangaroo/euro/common wallaroo	*Macropus robustus*	Bush tucker (cook in the ground)	
Bunggurdi/punggurdi	Red kangaroo	*Macropus rufus*	Bush tucker, totem	
Language name	**Other name**	**Species**	**Significance**	**Locations**
Thalu and other habitats				
Gurdbardu	Skeleton Bay	Shark	Thalu/breeding area	Ningaloo Marine Park adjacent to former Cardabia Station
Wambabarndi	Termite mounds	Termites	Use the black wax spinifex that the termites have used to build their tunnels and tubes as above	Former Cardabia Station
Yambarna		Manta rays	Thalu/breeding area	Ningaloo Marine Park adjacent to former Cardabia Station
Majun		Green turtles	Thalu/breeding area	Coastline adjacent to former Warroora Station

Appendix 4. Summary of fire management for Carnarvon Fire Management Area by vegetation type

Vegetation type and indicator species	Fire management outcome	Prescribed fire regime	Bushfire response	Monitoring for fire management effectiveness
Acacia shrublands over limestone	Retention of shrublands	Unknown	Does not burn readily	Compartmentalisation of conservation estate and adjoining UCL using roads and physical features Monitor on a landscape scale e.g using Landsat
Dune fields	Management of fuels at a landscape scale	Differential burning based on fuel type/age and arrangement, vegetation, physical features Patch size <2,000ha Identify combined fire percentage annually	Where feasible contain to smallest area	
Northwest cape coastal plains – grasses and *Acacia* shrub on sandplains	Minimise impact of fire on buffel grass infestation and erosion	Fire suppression	Fire suppression	No fire greater than 5ha

Based on *Regional Fire Management Plan Pilbara* (DEC 2008)

Appendix 5. 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 the subsequent rainfall and by the scale and patchiness of fire, 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) optimize connectivity (ability of key species to migrate between seral stages).
11. A sequence of 2-3 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 in order 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.

Source: Burrows (2004)

Appendix 6. Visitor numbers

Annual aerial camp survey

Since 1995, during school holiday periods the coast has been flown with the purpose of counting campsites along Ningaloo Marine Park. These results are presented below.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
April																							
Cape Range National Park				30	7	32	35	49	57	54	77	54	51	69	71	62	84	84	101	104	54	97	132
Commonwealth Defence Land				9	1	2	10	2	25	15	13	39	20	11	19	17	1	0	0	0	0	0	0
Coastline adj to Ningaloo Station				19	14	60	36	84	87	73	79	93	56	123	158	81	69	92	119	127	137	168	156
Coastline adj to Cardabia Station				4	6	4	6	8	14	1	5	3	2	9	10	5	7	3	8	13	16	16	6
Coastline adj to Warroora Station				18	15	27	22	43	72	39	37	57	21	51	92	49	70	61	103	130	73	124	125
Coastline adj to Gnaraloo Station												41	26	34	36	36	53	48	50	54	49	65	57
Coastline adj to Quobba Station													5	7	25	12	20	15	27	30	12	10	15
Sub total				**80**	**43**	**125**	**109**	**186**	**255**	**182**	**211**	**287**	**181**	**304**	**411**	**262**	**304**	**303**	**408**	**458**	**341**	**480**	**491**
July																							
Cape Range National Park	70	63	82	79	71	94	116	89	105	107	107	109	76	87	83	88	85	104	132	111	126	125	120
Commonwealth Defence Land	37	43	34	43	25	35	35	46	63	38	28	35	43	25	23	9	0	0	0	0	0	0	0
Coastline adj to Ningaloo Station	74	101	128	107	141	141	154	208	202	181	97	165	180	167	173	170	179	182	229	203	270	211	252
Coastline adj to Cardabia Station	20	18	52	33	28	29	46	24	27	27	11	26	24	22	28	35	36	38	44	46	69	61	60
Coastline adj to Warroora Station	56	76	110	96	92	105	121	110	140	111	122	109	117	145	172	138	146	192	211	183	273	274	232
Coastline adj to Gnaraloo Station												107	73	74	53	55	65	74	68	70	105	97	79
Coastline adj to Quobba Station													48	23	34	37	35	40	25	35	76	46	52
Sub total	**257**	**301**	**406**	**358**	**357**	**404**	**472**	**477**	**537**	**464**	**365**	**551**	**561**	**543**	**566**	**532**	**546**	**630**	**709**	**648**	**919**	**814**	**795**
October																							
Cape Range National Park														62	93	76	90	103	120	73	106	107	111
Commonwealth Defence Land														5	6	0	0	0	0	0	0	0	0
Coastline adj to Ningaloo Station														47	32	33	46	58	44	43	59	53	69
Coastline adj to Cardabia Station														2	10	7	1	6	10	5	18	5	20

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Coastline adj to Warroora Station														23	50	22	30	48	60	61	60	68	83
Coastline adj to Gnaraloo Station														55	48	80	60	73	71	70	92	72	83
Coastline adj to Quobba Station															22	21	9	12	19	8	8	30	23
Sub total														**194**	**261**	**239**	**236**	**300**	**324**	**260**	**343**	**335**	**389**
December																							
Cape Range National Park													43										
Commonwealth Defence Land													3										
Coastline adj to Ningaloo Station													20										
Coastline adj to Cardabia Station													1										
Coastline adj to Warroora Station													12										
Coastline adj to Gnaraloo Station													45										
Coastline adj to Quobba Station													7										
Sub total													**131**										
TOTAL	**257**	**301**	**406**	**438**	**400**	**529**	**581**	**663**	**792**	**646**	**576**	**838**	**873**	**1041**	**1238**	**1033**	**1086**	**1233**	**1441**	**1366**	**1603**	**1621**	**1675**

Note: April School Holiday data collection commenced in 1998, October School Holiday data in 2008 and Gnaraloo data only incorporated into the aerial surveys following the extensions of the Ningaloo Marine Park in 2005. December flights completed in 2007 only.

Appendix 7. Visitor management settings criteria

Visitor management settings in the planning area

	Visitor management setting class				
	Wilderness*	**Natural**	**Natural - recreation**	**Recreation**	**Highly modified**
Principal purposes	Conservation, low level recreation	Conservation, low level recreation	Conservation, low to medium level recreation	Conservation, medium level recreation, education and interpretation	High level recreation, education and interpretation, conservation, multiple-use
Description	Natural areas with minimal evidence of modern human activity. Large, remote areas (8,000ha in temperate areas)	Natural areas with minimal evidence of modern human activity. No size criteria	Predominantly natural areas, with some disturbance and modern human activity apparent at specific sites	Mostly natural areas, but with disturbance and modern human activity apparent at some sites	Concentrated areas of modified environment but with natural or rural background. Human activity conspicuous
Access Access standards and type of transport used for visitors, resource users and protected area managers	Vehicles: mechanised access in emergency situations or essential management operations only Walking: via natural routes formed principally by human use (AS Walking Track class 6 only) Aircraft: no airstrips allowed and landing of non-fixed wing aircraft is allowed for emergency and essential research purposes only. Fixed wing aircraft must fly above 2,000 feet and non-fixed wing above 1,500 feet	Vehicles: mechanised access in emergency situations or essential management operations only Walking: via natural routes formed to a minimum standard (AS Walking Track class 4 to 5)	Vehicles: mechanical access on 4WD tracks. Cycle type 4 trails Walking: formed walk trails (AS Walking Track class 2 to 5)	Vehicles: mechanical access on 2WD unsealed tracks. Cycle type 2 and 3 trails Walking: well-built walking trails with direction signs (AS Walking Track class 2 to 4)	Vehicles: mechanical access on 2WD sealed tracks. Cycle type 1 trail Walking: Well-built, signposted walking trails (AS Walking Track class 1 and 2)
Site modification Extent, type and design of infrastructure, facilities, amenities and the style of accommodation provided	No site modification and no facilities or structures except for reasons of visitor safety, resource protection and/or management operations. Camping sites are not defined (wild camping)	No site modification and no facilities or structures except for reasons of visitor safety, resource protection and/or management operations. Trail markers may be used. Camping sites are not defined (wild camping). Day use sites not defined	Minor modification of specific sites. Basic facilities may be provided in specific locations. 'Minor' or 'Medium' recreation sites and beach camping may be provided	Modification of specific sites. Low-key facilities such as simple car parks, toilets, shelters and picnic areas may be present. 'Major' or 'Medium' recreation sites or beach camping may be provided	Modified site, with often a range of facilities. accommodation facilities, picnic areas, visitor centres and lookouts may be present. 'Major' recreation sites may be provided
Commercial uses	Commercial recreation and tourism operations not allowed	Commercial tourism licences allowed, but may consider regulating	Commercial tourism licences allowed with a focus on nature-based/cultural activities	Commercial tourism licences allowed with a focus on nature-based/cultural and adventure activities	Commercial tourism licences allowed with a focus on nature-based/cultural and adventure activities

	Visitor management setting class				
	Wilderness*	**Natural**	**Natural - recreation**	**Recreation**	**Highly modified**
		numbers (e.g. E Class Licence) Leases not allowed	Leases allowed	Leases allowed	Leases allowed
Probable social interaction Density of users and degree of social interaction and opportunities for solitude	Interaction between users is minimal, with usually less than two other groups encountered during a day, and no other groups within sight or sound at camp sites. Maximum group size of about six to eight people	Little interaction between users, with usually less than about four to six other groups encountered during a day, and usually no more than about two other groups within sight or sound at camp sites. Group size approximately 8-12 people	Moderate interaction between users, with encounters with several other groups likely along access routes and at camp sites. Group size approximately 12-15 people	High level of contact and interaction with other users on roads and in camping and picnic areas, moderate interaction on walking tracks. Groups of more than 15 people may be expected, depending on location	High level of contact and frequent interaction with many other groups. Groups may exceed 20 people
Probable recreation experiences	Opportunities for isolation, independence, closeness to nature, tranquillity and self-reliance through the application of outdoor skills in an environment that offers a high degree of challenge	Opportunities for isolation, independence, closeness to nature, tranquillity and self-reliance through the application of outdoor skills in an environment that offers a high degree of challenge	Opportunities for closeness to nature, tranquillity and self-reliance through the application of outdoor skills in an environment that offers a moderate degree of challenge	Opportunities include closeness to nature and nature appreciation. Moderate levels of social contact and some opportunity to experience tranquillity	Opportunities for nature appreciation, and for social interaction. Facilities often support presentation of nature or access to nature-based opportunities in nearby areas
Degree of self-reliance Level of support services provided	Visitors must be totally self-reliant as support services are inappropriate and are not provided. Commercial tourism and recreation operators not allowed	Visitors must be totally self-reliant, as support services are inappropriate and are minimal or non-existent	Visitors must be largely self-reliant as basic support services are provided in specific locations only	Self-reliance requirements are generally low where facilities are provided, but outdoor skills will be important in areas away from roads and tracks	+Low level of self-reliance due to high level of support services and facilities present
Style of visitor management Level of on-site management, site constraints and regulations	On-site visitor management is very low with controls primarily off site. All interpretation is off-site. No trail information in brochures. Boundary signage only. Very infrequent ranger presence	On-site regimentation is low with controls primarily off site. Generally, boundary signs only. Infrequent ranger presence	Low on-site regimentation. Walking trails and camp sites may be defined. Most interpretation is off-site. Along trails and at trail camping sites there may be basic markers and signage with minimal management messages. Infrequent ranger presence	Moderate on-site regimentation, including some signs and barriers. Facilities may be common and clustered. Track signs may include interpretation. Brochures and track guides often available. May be frequent ranger presence	+A high degree of on-site visitor management, including the use of physical barriers to constrain movement of pedestrians and vehicles/boats. Well-developed structures. There may be considerable interpretive signage, materials or activities. Frequent ranger presence likely

* Refer to *Policy No. 62 Identification and Management of Wilderness and Surrounding Areas* (CALM 2004b).
+this is generally not applicable in this planning area, visitors may still have to be largely self-reliant due to the vision of the planning area.

Appendix 8. Recreation site classification

	Recreation site categories			Other areas	
	Major	**Medium**	**Minor**	**No facilities, vehicles [3]**	**No facilities, no vehicles [4]**
General facilities					
Vehicle access to area	Yes	Yes	Optional	Optional	No
Long vehicle turning & parking[1]	Preferred	Optional	No	No	No
Water provided	Optional	Optional	Optional	No	No
Toilets or chemi-toilet disposal sites	Preferred	Optional	Optional	No	No
Cooking – Gas/Electric BBQs	Acceptable	Optional	Optional	No	No
Cooking – Wood BBQs/Fire rings[5]	Yes	Yes	Yes	Yes	No
Tables	Optional	Optional	Optional	No	No
Shelters	Optional	Optional	No	No	No
Rubbish collection	Acceptable	Optional	No	No	No
Visitor information	Yes	Optional	Optional	No	No
Overnight stays specific					
Camping sites defined	Yes	Optional	Optional	No	No
Resident manager	Optional	Optional	No	No	No
Campground host (peak)	Optional	Optional	No	No	No
Cooking – fuel stoves only	Optional	Optional	Optional	Preferred	Yes
Fires allowed in container (where/when ground fires permitted) [5]	Yes	Yes	Yes	Yes	No
Camping area numbers[2]	20+ sites 100+ people	6 – 20 sites 21 – 100 people	1 – 5 sites 1 – 20 people	Preferred <4 vehicles, 20 people	One group of <10 people
Accommodation • Basic shelter (e.g. 3-sided) • Semi-permanent structure (e.g. safari tent) • Other (e.g. permanent structures)	 Optional Optional Yes	 Optional Optional No	 No No No	 No No No	 No No No
Day use specific					
Car parking	Yes	Yes	Optional	NA	NA
Site numbers	Up to 200 vehicles or 800 people	Up to 30 vehicles or 120 people	Up to 12 vehicles or 50 people	NA	NA

1 – Long vehicles include coaches, buses, caravans, campervans and motor homes.
2 – To preserve the visitor management setting, the maximum number of people ideally should not be exceeded; as a site reaches the threshold limits, a review should be conducted to confirm future intent of site.
3 – Could include beach or bush camping.
4 – Often referred to as 'wild' or remote camping.
5 – Permitted in this planning area.

Legend
Yes = facility or service should be provided.
Preferred = facility should be provided; this option is preferred but not only valid option; local conditions will determine the best option.
Optional = facility or service may be provided, but is not essential.
Acceptable = facility may be provided but there may be a better option; local conditions will determine best option.
No = facility or service will not be provided.

Recreation site definitions and classification guidelines

Major recreation site

Major recreation sites are primary recreation nodes catering for a broad range of visitors with facilities and interpretation hubs. Most visitors entering the park/reserve will be directed to these sites, considered to be the main attractions within the park/reserve. High recreation sites are provided in the 'highly modified' visitor management setting only.

Recreation experience	Generally, the recreation experience has opportunities for nature appreciation, a chance to discover a specific feature or experience, and chances for solitude and social interaction in a natural environment with a higher level of access to facilities.
Modifications and development	The site is developed and has parking areas and facilities.
	The local landscape and features are evident although changes have occurred to the vegetation or landform, such as clearings, formed tracks, buildings and other structures. Some levelling of the site may have been undertaken to create developed areas.
Visitation and interaction	The site has a high level of visitation from the local population and visitors to the area.
	Choice in the level of social interaction between staying to oneself or one's group, however contact with other people will likely be unavoidable.
Services	Degree of self-reliance within a day use setting is low. Needs such as, shelter and toilets are catered for, providing for a high level of comfort and safety to visitors.
Management presence	A high degree of management presence at the site by authority or representative such as ranger patrols.
Interpretation	Moderate to high levels of the natural, cultural and historical interpretation including interpretation displays, brochures, interpretation tracks, guided activity program or access to information through ranger or expert contact.
Recreation experience	Generally, the recreation experience has opportunities for active activity, solitude, independence, closeness to nature, tranquillity in a natural environment, but has access to basic facilities where possible.
Modifications and development	Site is modified with car parking areas and site access, additional facilities may be provided based on visitation.
	The local landscape and features are dominant although there have been some changes to the vegetation or land form, such as clearings and formed tracks.
Visitation and interaction	The site has a moderate level of seasonal visitation from the local population and visitors to the area.
	Choice in the level of social interaction between staying to oneself or groups however contact with other visitors is to be expected.
Services	Moderate degree of self-reliance for essential needs. Some facilities including shelter provided possibility of providing toilet facilities.
Management presence	Some degree of management presence such as ranger patrols at the site depending on site conditions.
Interpretation	Moderate levels of natural, cultural and historical interpretation, which may include interpretation displays and interpretation tracks.

Medium recreation site

Medium recreation sites provide for moderate to low intensity recreation set in mostly natural landscapes. These sites are considered to be secondary sites and offer unique experiences within the park/reserve. They may be provided in either the 'highly modified' or 'recreation' visitor management settings, with the possible level of development varying according to the setting.

Recreation experience	Generally, the recreation experience has opportunities for active activity, solitude, independence, closeness to nature, tranquillity in a natural environment, but has access to basic facilities where possible.
Modifications and development	Site is modified with car parking areas and site access, additional facilities may be provided based on visitation.
	The local landscape and features are dominant although there have been some changes to the vegetation or land form, such as clearings and formed tracks.
Visitation and interaction	The site has a moderate level of seasonal visitation from the local population and visitors to the area.

	Choice in the level of social interaction between staying to oneself or groups however contact with other visitors is to be expected.
Services	Moderate degree of self-reliance for essential needs. Some facilities including shelter provided possibility of providing toilet facilities.
Management presence	Some degree of management presence such as ranger patrols at the site depending on site conditions.
Interpretation	Moderate levels of natural, cultural and historical interpretation, which may include interpretation displays, interpretation tracks.

Minor recreation site

Minor recreation sites have minimal development and facilities catering specifically for a purpose. They may generally be provided in the 'recreation' and 'natural-recreation' visitor management settings.

Recreation experience	Generally the recreation experience has opportunities for solitude, independence, closeness to nature and tranquillity in a natural environment.
Modifications and development	Some site modification to provide car parking areas and access. Site is dominated by the local landscape and features without major changes to the landform or features.
	Little facilities apart from essential site infrastructure such as car parking, signage and trails.
Visitation and interaction	Experiences a low to moderate level of visitation, visitors are predominantly local. Some likelihood of interaction between users, although the emphasis would be on socialising with own group.
Services	High degree of self-reliance for essential needs such as the provision of shelter and toilet facilities.
Management presence	Some degree of management presence such as ranger patrols at the site depending on site conditions.
Interpretation	No to low levels of natural, cultural and historical interpretation apart from essential information for identification of sites and visitor risk issues. Specific interest site signage for niche user groups may be present.

No facilities, vehicles camping (beach camping)

These areas are by four-wheel drive vehicles and/or by foot and no facilities are provided. These areas include either beach camping (or bush camping in remote bush areas). Camping may occur at any time in this area provided it is safe to do so. Generally camping will only be allowed as an overnight stay. Campfires will generally be allowed. Camping groups will be limited to four vehicles. For beach camping, camping will not be allowed in the primary dune area or within 2km of a formal camping area. Camping may be provided in the visitor management settings where vehicles are allowed.

No facilities, no vehicles camping ('wild' camping)

These areas are accessed by foot. They are referred to as 'wild' or 'remote' camping. No sites will be defined and minimum impact camping techniques will be practiced at all times. Camping group sizes generally will be limited to 10 people. Campfires will not be allowed. Camping will generally occur in the more natural visitor management settings.

Appendix 9. Ningaloo Coast camping areas and day use sites

The criteria for prioritising site works will be based on:

- protection of cultural values
- management of risk to users (e.g. from the environment or conflict between users)
- protection of natural values (addressing environmental degradation)
- level of visitor use of the site (high use sites will be generally addressed before minor sites unless above criteria apply)
- improvement of visitor experience.

The below table is a summary of proposed works in the camping areas and day use sites of the planning area (more site names may change to include *Baiyungu* language over the life of the plan). All sites will be managed at current capacity unless indicated otherwise below with the current footprint assessed and sites lightly delineated where required. The potential provision of water points and/or waste disposal (central transfer stations/trailer/rubbish skips and/or chemi-toilet dump points/toilets) particularly in the major camping areas will continue to be assessed through the life of the plan.

Rehabilitation and stabilisation works may already be underway.

Camping areas north to south (17)	Management Setting	Approx. no. sites currently	Access	Proposed works
Major (>25 sites) camping areas (6 open totalling approx. 344 sites)				
Winderabandi Point	Recreation	64	4WD	Review campground capacity and footprint Define individual sites Consider day use component Undertake site rehabilitation works Close and rehabilitate duplicate tracks Provide fire rings or defined camp fire sites Consider access to chemi-toilet dump point or toilet facilities in the long term Investigate central waste transfer area options Provide campground host/caretaker in peak season
North Lefroy Bay	Recreation	54	4WD	Review campground capacity and footprint Define individual camp sites Undertake site rehabilitation works Close and rehabilitate duplicate tracks Provide fire rings or defined camp fire sites Consider access to chemi-toilet dump point or toilet facilities in the long term Investigate central waste transfer area options Provide campground host/caretaker in peak season
South Lefroy Bay	Recreation	73	4WD	Review campground capacity and footprint Define individual camp sites Undertake site rehabilitation works Close and rehabilitate duplicate tracks Provide fire rings or defined camp fire sites Consider access chemi-toilet dump point or toilet facilities in the long term Investigate central waste transfer area options Provide campground host/caretaker in peak season
Janes Bay	Recreation	30	2WD unsealed	Undertake site rehabilitation works Close and rehabilitate duplicate tracks Define overall camping footprint Provide fire rings or defined camp fire sites Consider access to chemi-toilet dump point or toilet facilities in the long term Investigate central waste transfer area options
Walbal Wardu (14 Mile Camp)	Recreation	97	4WD	Provide fire rings or defined camp fire sites Consider access to chemi-toilet dump point or toilet facilities in the long term Investigate central waste transfer area options

Camping areas north to south (17)	Management Setting	Approx. no. sites currently	Access	Proposed works
				Provide campground host/caretakers as appropriate Review campground capacity and footprint Undertake site rehabilitation works Define individual camp sites Define boat launching area
Stevens Camp	Recreation	26	4WD	Provide fire rings or defined camp fire sites Undertake site rehabilitation works including stabilising vehicle access tracks Close and rehabilitate duplicate tracks Define pedestrian access points to beach Review campground footprint Consider installing new, sealed chemi-toilet dump point nearby Investigate central waste transfer area options Define suitable and defined access routes for vehicles
Medium (6 to 25 sites) camping areas (6 open totalling approx. 108 sites)				
Point Billie	Recreation	25	4WD	Add day use area Review campground capacity and footprint Define individual camp sites Undertake site rehabilitation works Close and rehabilitate duplicate tracks Provide fire rings or defined camp fire sites Consider access to chemi-toilet dump point or toilet facilities in the long term Investigate central waste transfer area options
Sandy Point	Recreation	20 (and 5 day use bays)	4WD	Define individual camp sites Provide fire rings or defined camp fire sites Undertake site rehabilitation works Consider toilet facilities in the long term Designate boat launching area
Maggies	Recreation	10	4WD	Review campground capacity and footprint Provide day use component Review alignment of vehicle access track into site Provide fire rings or defined camp fire sites Define individual camp sites or camping area perimeter Close access track to the north
Elles Camp	Recreation	20	4WD	Provide fire rings or defined camp fire sites Define suitable and defined access routes for vehicles Rehabilitate duplicate and spur tracks Provide day use parking area Close boat launching
Jirndal Gumagu (Black Moon Cliff)	Recreation	n/a	4WD	Convert to day use Close northern section to protect cultural and/or natural values Undertake site rehabilitation works
Bulbarli	Recreation	n/a	4WD	Now closed. Day use site only The former camping area will be rehabilitated and vehicle access will be restricted to prevent further damage to cultural and/or natural values Informal camping nearby will not be permitted
The Lagoon	Recreation	25	4WD	Review campground capacity and footprint Undertake site rehabilitation works Provide fire rings or defined camp fire sites Provide chemi-toilet dump point Provide campground host/caretaker in peak season

Camping areas north to south (17)	Management Setting	Approx. no. sites currently	Access	Proposed works
Amherst Point	Recreation	7 or 8	4WD	Define individual campsites or camping area perimeter Provide fire rings or defined camp fire sites
Scorpion Ridge	Highly Modified	n/a	2WD unsealed	Proposed inclusion into the 3 Mile Camp tourism lease. However, if site remains in planning area it should be closed and rehabilitated
Minor (1 to 5 sites) camping areas (5 open totalling approx. 19 sites)				
Point Edgar	Natural-recreation	5	4WD	Maintain current footprint
Caretakers Camp	Natural-recreation	5	2WD unsealed	Maintain current footprint
Camping 1	Natural-recreation	1 or 2	4WD	Maintain current footprint
Camping 2	Natural-recreation	5	4WD	Maintain current footprint
Camping 3	Natural - recreation	n/a	4WD	Close
Camping 4	Natural-recreation	2	4WD	Maintain current footprint Realign vehicle access to site
Nicks Camp	Natural-recreation	n/a	4WD	Closed – may be suitable interpretive area on history of rock lobster fishery
Tourism lease area enclaves (3)				
Bruboodjoo	Recreation	70	2WD unsealed	Continue to liaise with lessees to ensure public access is retained to planning area for day use visits and that appropriate day use facilities (including waste management) are provided Improve marine park signage adjacent to lease area
3 Mile Camp	Highly modified	73	2WD unsealed	Continue to liaise with lessees Lease area to be expanded to incorporate Scorpion Ridge Define pedestrian beach access paths from lease area Improve marine park signage adjacent to lease area Alternative waste disposal should be negotiated as current site within the planning area is significantly polluting the environment
Red Bluff	Highly modified	45 including safari tents	2WD unsealed	Continue to liaise with lessees. Lease area will be modified to more accurately reflect the existing locations of the built accommodation Improve marine park signage adjacent to lease area

Before and after images showing an example of the way in which camp sites may be defined where required. This will vary depending on local conditions, issues and locally available materials. Photos - Emma West/DBCA

Day use areas north to south (43)	Management Setting	Approx. No. cars currently	Access	Proposed works
Major (>30 vehicles) day use areas (3)				
Monck Head	Highly Modified	80	2WD	Close and rehabilitate duplicate tracks and clearings around the boat launch facility in liaison with the Department of Transport and Shire of Carnarvon Consider trailhead for Baiyungu Trail
Gnarraloo Bay	Recreation	20	2WD unsealed	Provide dedicated and improved boat launch (with dedicated boat trailer parking) area Provide day use car parking area with an overall increased capacity Install low key infrastructure such as pedestrian access paths, seating and signage where required
Tombstones	Recreation	20	2WD unsealed	Expand existing parking area to meet visitor demand Install low key infrastructure such as pedestrian access paths, seating and signage where required Improve vehicle access track to site
Medium (13 to 30 vehicles) day use areas (7)				
Point Billie	Recreation	25	4WD	Proposed new day use area with defined parking area Undertake site rehabilitation works Close and rehabilitate duplicate tracks
Nyilleri (Oyster Bridge)	Recreation	20	4WD	Undertake site rehabilitation works Identify sustainable access route for vehicles to the site and parking area set back from beach Restrict vehicle access onto beach
Murlanda (Mauds Landing)	Recreation	30	2WD unsealed	Restrict vehicle access to beach Redevelop existing parking area Install low key infrastructure such as new pedestrian access paths, seating and signage where required Undertake site rehabilitation works Close and rehabilitate duplicate tracks
Mini Minimara (Five Fingers)	Recreation	30	4WD	Define suitable access for vehicles Undertake site rehabilitation works where required Close and rehabilitate duplicate tracks Restrict vehicle access to beach
Bulbarli	Recreation	15	4WD	Undertake site rehabilitation works to prevent further damage to cultural sites Restrict vehicle access to a defined area Install low key infrastructure such as pedestrian access paths
3 Mile Lagoon	Recreation	15	4WD	Provide defined parking area
Majuns (Turtles)	Recreation	18	4WD	Re-establish car park adjacent to coastal access track Define suitable access for vehicles if possible Undertake site rehabilitation works and controls to protect dunes Close and rehabilitate duplicate tracks
Minor (up to 12 vehicles) day use areas (31)				
Norwegian Bay	Natural-recreation	6	4WD	Define suitable access for vehicles Provide interpretative signage on historical whaling station at an appropriate location within the site Provide defined day use parking area and bays

Day use areas north to south (43)	Management Setting	Approx. No. cars currently	Access	Proposed works
				Assess visitor risk of remains of whaling station (e.g. asbestos)
Ningaloo Beach	Natural-recreation	10	4WD	Define suitable access for vehicles Restrict vehicle access to beach
6 Mile Well (ex-Ningaloo)	Natural-recreation	5	4WD	None
10 Mile Well	Natural-recreation	5	4WD	None
Juburda (The Sandbar)	Natural-recreation	6	4WD	Some parking area definition required Restrict vehicle access to beach
Bolman/Cardiac Hill	Natural-recreation	5	4WD	Some parking area definition required Define pedestrian access to a minor lookout point
Gabarlawangganji (Dog Rock)	Natural-recreation	7	4WD	Provide vehicle parking bays Undertake site rehabilitation and controls to keep 4WDs off beach where required Improve visitor use signage
Lagoon (north of Oyster Bridge)	Natural-recreation	12	4WD	Define suitable access for vehicles Provide suitable vehicle parking bays as required Close and rehabilitate duplicate tracks Restrict vehicle access onto beach
Bateman Beach	Natural-recreation	10	4WD	Improve visitor risk and turtle habitat signage
Gurdbardu (Skeleton Bay)	Natural-recreation	7	4WD	Close vehicle access into dunes and rehabilitate area Facilitate pedestrian access to shark nursery along foreshore
Nyarrara Bula (Snapper headland)	Natural-recreation	10	4WD	Define suitable access for vehicles Provide suitable vehicle parking bays as required Close and rehabilitate duplicate tracks
Point Anderson	Natural-recreation	5	4WD	Investigate suitability of site for day use and ongoing impacts
Pearson Hill	Natural-recreation	2 to 5	4WD	None
Windura (Turtle Cliffs)	Natural-recreation	5 to 10	4WD	Define suitable access for vehicles Provide suitable vehicle parking bays as required Close and rehabilitate duplicate tracks
Day Use 1	Natural-recreation	5	4WD	None
Pelican Point	Natural-recreation	4	4WD	Rehabilitate duplicate tracks Provide suitable vehicle parking bays as required
Wedding Hill	Natural-recreation	5	4WD	Define pedestrian access to a minor lookout point Stabilise and rehabilitate degraded areas
Jirndal Gumagu (Black Moon Cliff)	Natural-recreation	5	4WD	Convert to day use site only Undertake site rehabilitation works Provide suitable vehicle parking bays as required
6 Mile	Natural-recreation	5	4WD	Provide suitable vehicle parking bays as required
Nature Bay	Natural-recreation	5	4WD	Provide suitable vehicle parking bays as required Install low key infrastructure such as pedestrian access paths and signage where required Undertake site rehabilitation works

Day use areas north to south (43)	Management Setting	Approx. No. cars currently	Access	Proposed works
Heart Attacks	Natural-recreation	5	4WD	None
Unnamed DU for kite surfing north of Tombstones	Natural-recreation	5	4WD	Provide suitable vehicle parking bays as required
Midgies	Natural-recreation	15	4WD	Provide suitable vehicle parking bays as required Undertake site rehabilitation works
Magnolia Lookout	Natural-recreation	2 to 5	4WD	Provide suitable vehicle parking bays as required Undertake site rehabilitation works
Dolphins	Natural-recreation	5	4WD	Provide suitable parking bays as required
The Gallery	Natural-recreation	10	4WD	None
Monument Cliffs	Natural-recreation	5	4WD	Define suitable access for vehicles Close and rehabilitate duplicate tracks
Wonderlands	Natural-recreation	2 to 5	4WD	Provide suitable vehicle parking bays as required Close and rehabilitate duplicate tracks
Harpoons	Natural-recreation	2 to 5	4WD	Define suitable access for vehicles Provide suitable vehicle parking bays as required Close and rehabilitate duplicate tracks
Fenceline	Natural-recreation	5	4WD	Provide parking area Install low key infrastructure such as new pedestrian paths and signage Undertake site rehabilitation works
Happy Valley	Natural-recreation	10	4WD	Provide parking area Undertake site rehabilitation works

Note: The proposed works in this Appendix are based on a preliminary site investigations. The implementation of these proposals will be subject to further detailed assessment and planning, and effective mitigation of potential adverse impacts on ecological or other values.

Gurdbardu (Skeleton Bay) and *Murlanda* (Point Maud) before and after proposed closure to vehicles to protect cultural and natural values. It is proposed in the recreation masterplan to maintain one vehicle access track, formalise a car park setback from the beach and rehabilitate former tracks.
Photos - DBCA

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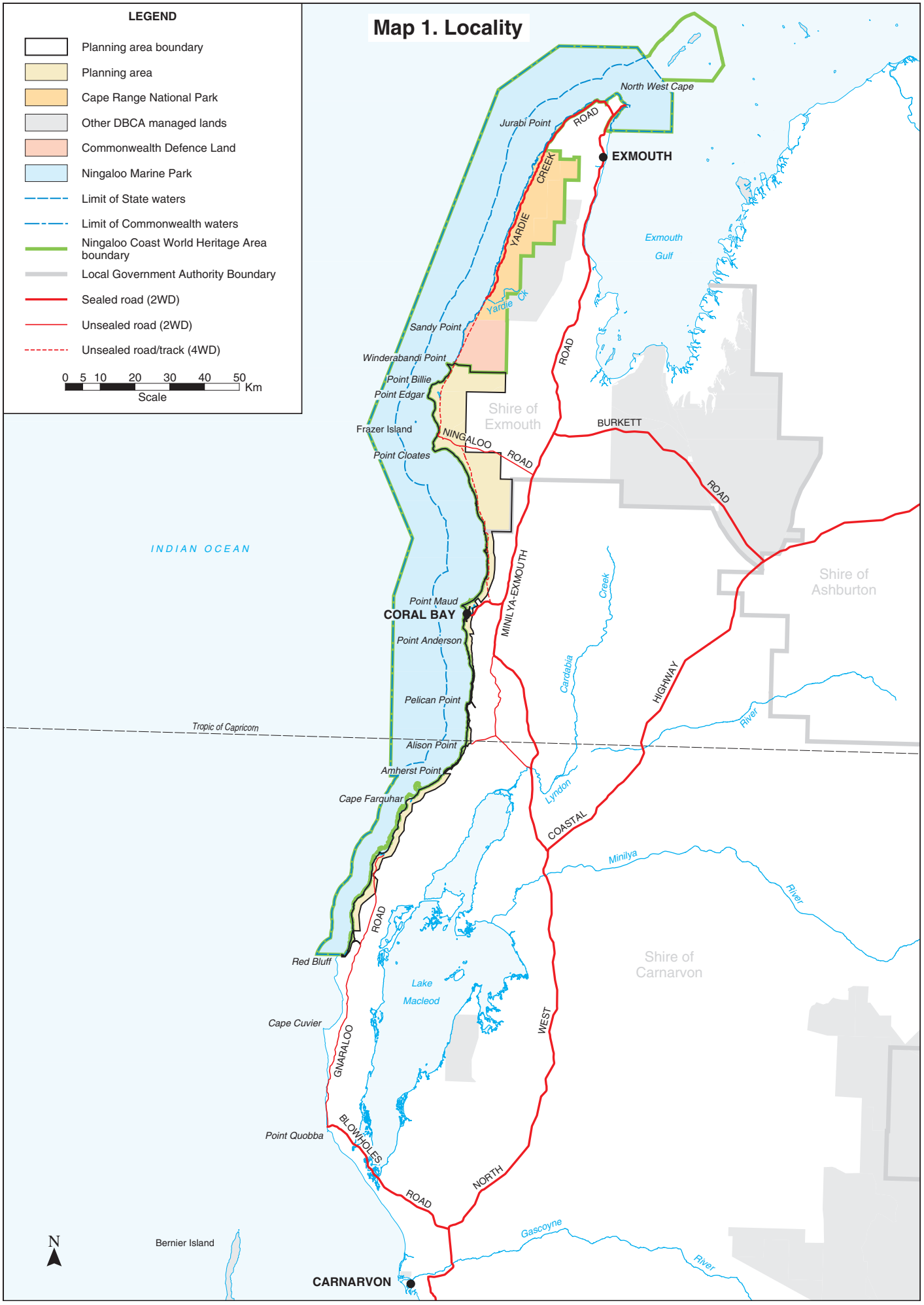
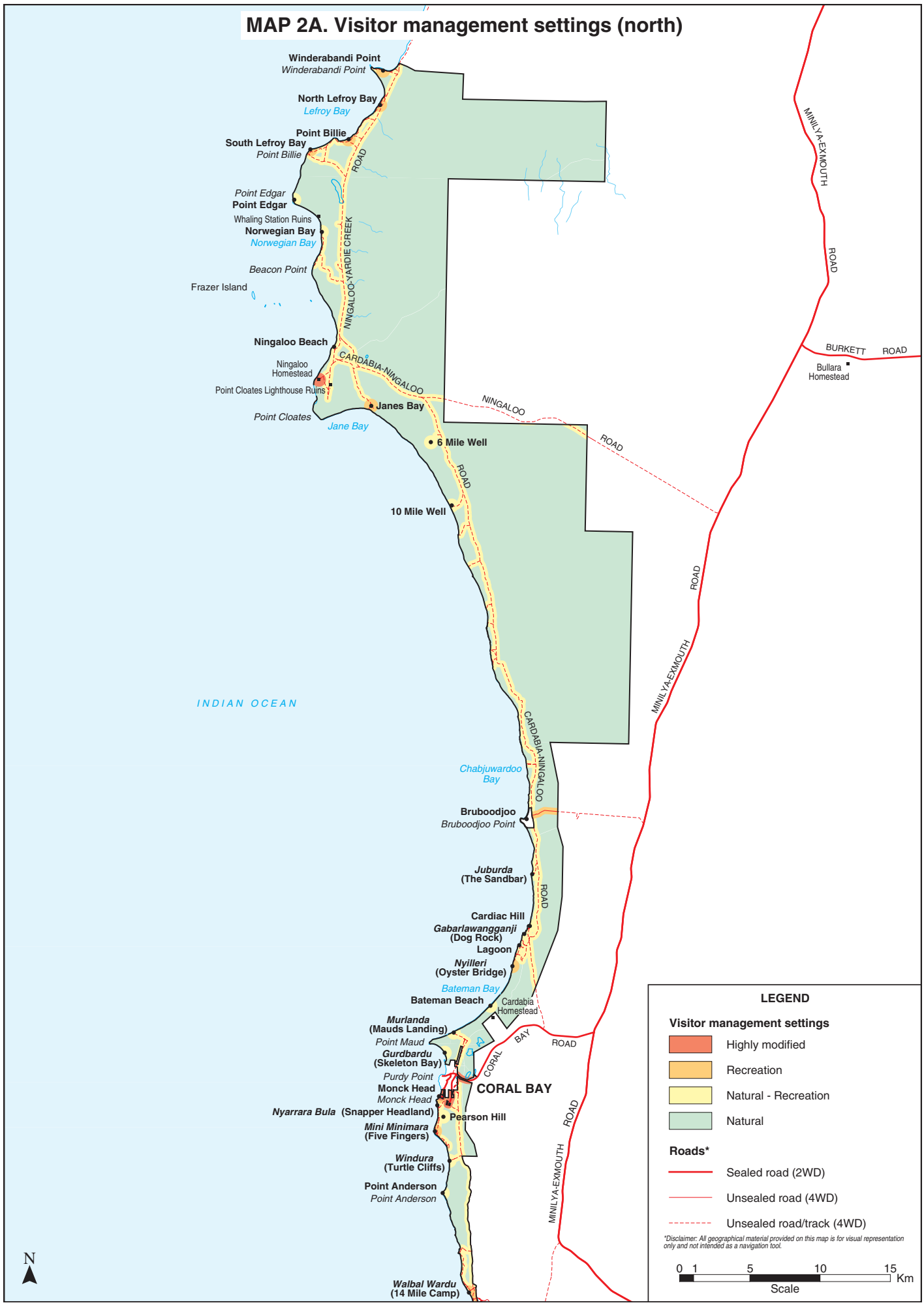
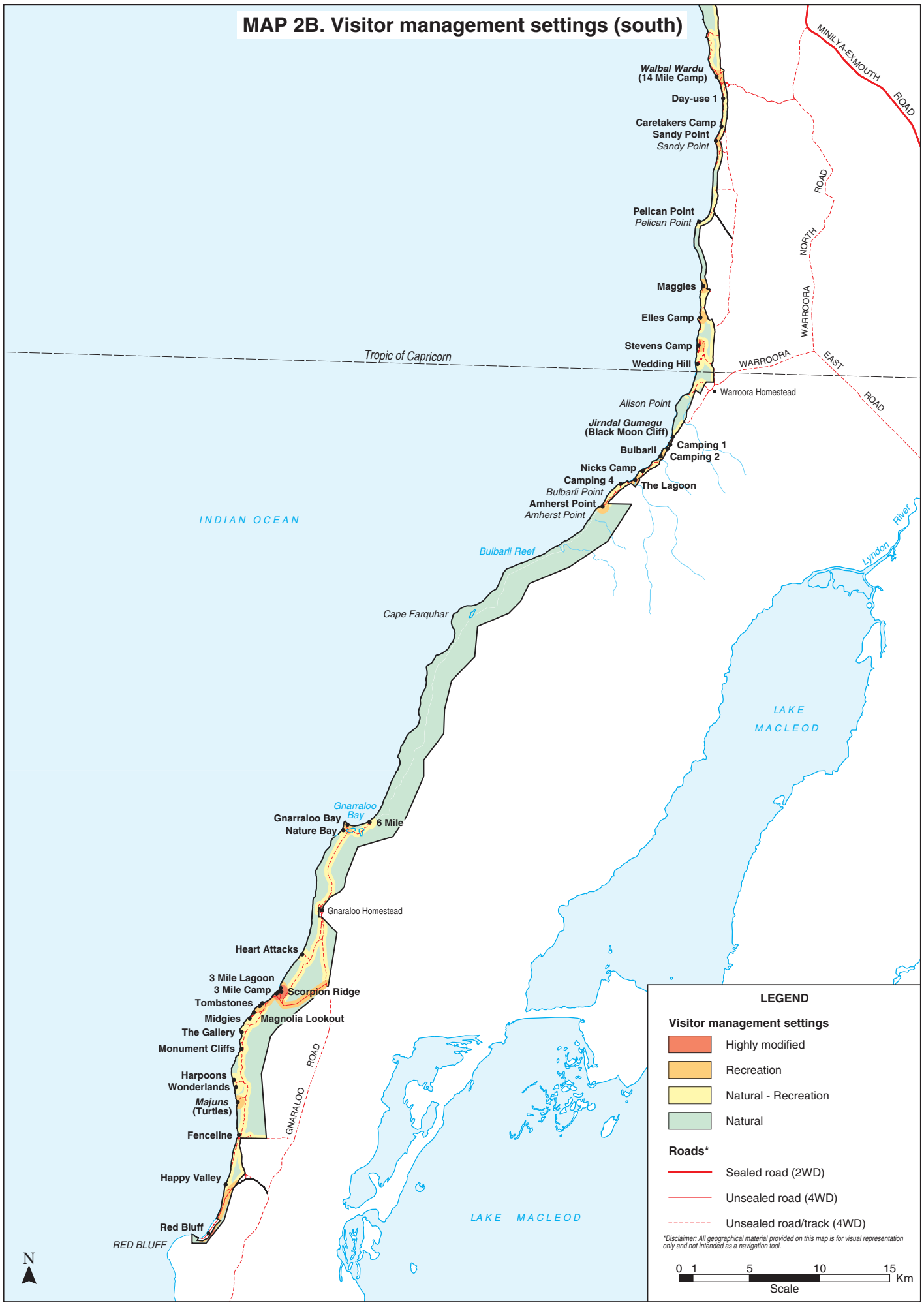
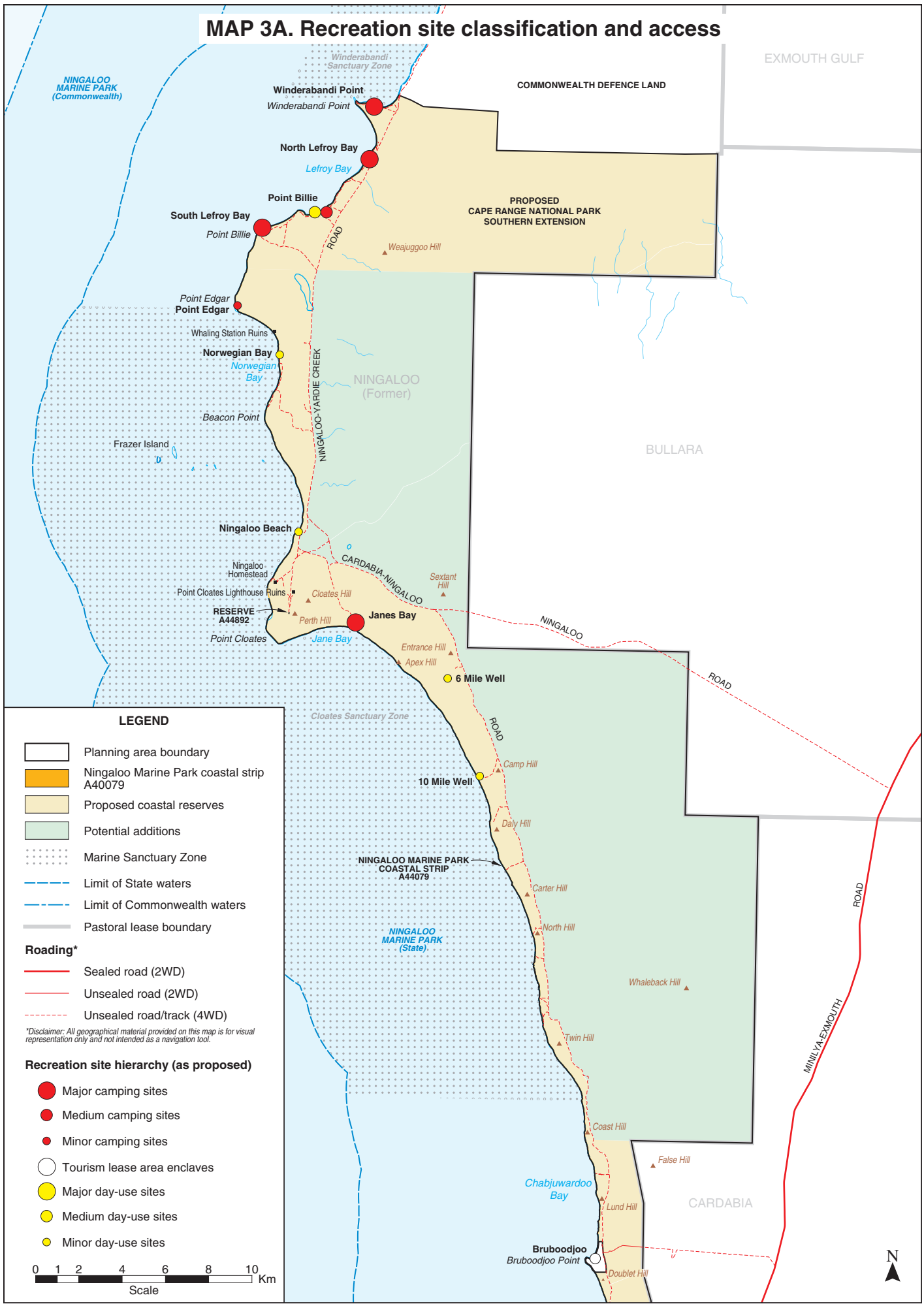

Map 1. Locality
LEGEND
Planning area boundary
Planning area
Cape Range National Park
Other DBCA managed lands
Commonwealth Defence Land
Ningaloo Marine Park
Limit of State waters
Limit of Commonwealth waters
Ningaloo Coast World Heritage Area boundary
Local Government Authority Boundary
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road/track (4WD)
0 5 10 20 30 40 50 Km
Scale
North West Cape
Jurabi Point
ROAD
EXMOUTH
CREEK
YARDIE
Exmouth Gulf
Yardie Ck
Sandy Point
Winderabandi Point
Point Billie
Point Edgar
Shire of Exmouth
ROAD
Frazer Island
NINGALOO
ROAD
Point Cloates
BURKETT
ROAD
INDIAN OCEAN
Point Maud
CORAL BAY
MINILYA-EXMOUTH
Point Anderson
Creek
Shire of Ashburton
Pelican Point
Carolabia
HIGHWAY
Tropic of Capricorn
River
Alison Point
Amherst Point
Cape Farquhar
Lyndon
COASTAL
Minilya
River
ROAD
Red Bluff
Lake Macleod
Shire of Carnarvon
Cape Cuvier
GNARALOO
WEST
BLOWHOLES
Point Quobba
NORTH
ROAD
Gascoyne
River
N
Bernier Island
CARNARVON

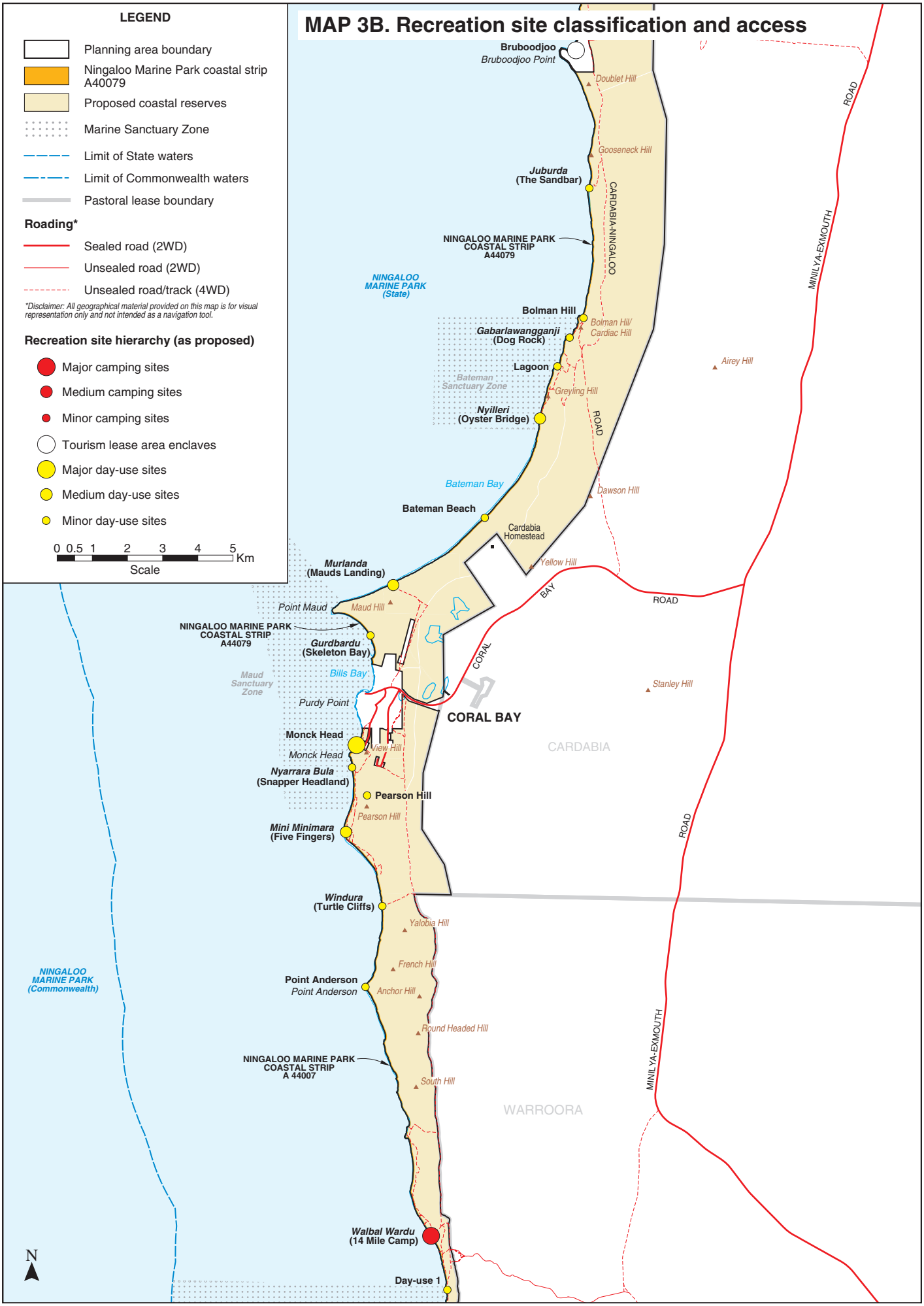

MAP 2A. Visitor management settings (north)
Winderabandi Point
Winderabandi Point
North Lefroy Bay
Lefroy Bay
Point Billie
South Lefroy Bay
Point Billie
Point Edgar
Point Edgar
Whaling Station Ruins
Norwegian Bay
Norwegian Bay
Beacon Point
Frazer Island
Ningaloo Beach
Ningaloo Homestead
Point Cloates Lighthouse Ruins
Point Cloates
Jane Bay
Janes Bay
6 Mile Well
10 Mile Well
INDIAN OCEAN
Chabjuwardoo Bay
Bruboodjoo
Bruboodjoo Point
Juburda
(The Sandbar)
Cardiac Hill
Gabarlawangganji
(Dog Rock)
Lagoon
Nyilleri
(Oyster Bridge)
Bateman Bay
Bateman Beach
Cardabia Homestead
Murlanda
(Mauds Landing)
Point Maud
Gurdbardu
(Skeleton Bay)
Purdy Point
Monck Head
Monck Head
Nyarrara Bula (Snapper Headland)
Pearson Hill
Mini Minimara
(Five Fingers)
Windura
(Turtle Cliffs)
Point Anderson
Point Anderson
Walbal Wardu
(14 Mile Camp)
CORAL BAY
ROAD
NINGALOO-YARDIE CREEK ROAD
CARDABIA-NINGALOO ROAD
NINGALOO ROAD
MINILYA-EXMOUTH ROAD
BURKETT ROAD
Bullara Homestead
LEGEND
Visitor management settings
Highly modified
Recreation
Natural - Recreation
Natural
Roads*
Sealed road (2WD)
Unsealed road (4WD)
Unsealed road/track (4WD)
*Disclaimer: All geographical material provided on this map is for visual representation only and not intended as a navigation tool.
0 1 5 10 15 Km
Scale
N

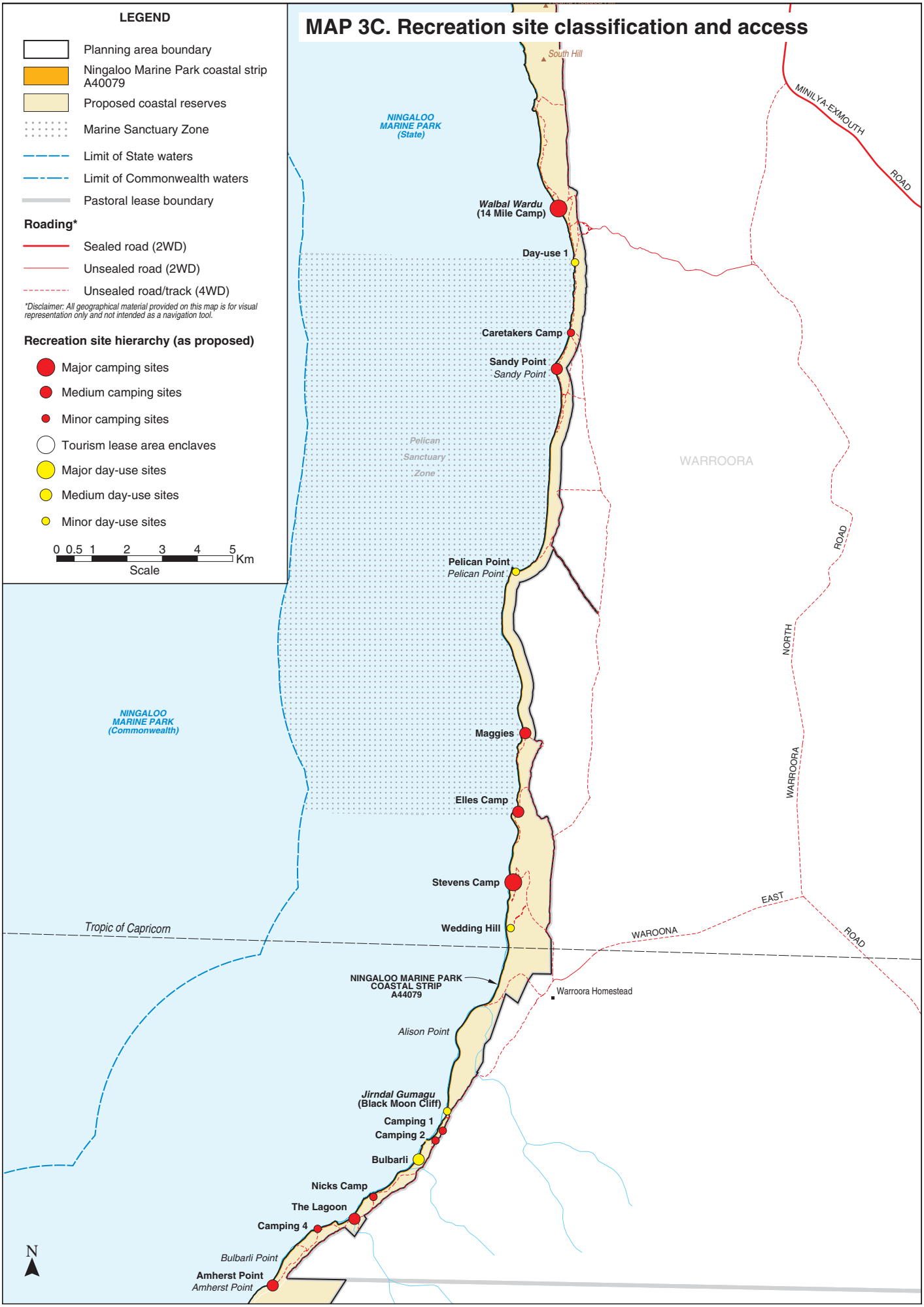

MAP 2B. Visitor management settings (south)
Walbal Wardu
(14 Mile Camp)
Day-use 1
Caretakers Camp
Sandy Point
Sandy Point
Pelican Point
Pelican Point
Maggies
Elles Camp
Stevens Camp
Wedding Hill
Tropic of Capricorn
Warroora Homestead
Alison Point
Jirndal Gumagu
(Black Moon Cliff)
Bulbarli
Camping 1
Camping 2
Nicks Camp
Camping 4
Bulbarli Point
The Lagoon
Amherst Point
Amherst Point
INDIAN OCEAN
Bulbarli Reef
Cape Farquhar
Gnarraloo Bay
Gnarraloo Bay
6 Mile
Nature Bay
Gnaraloo Homestead
Heart Attacks
3 Mile Lagoon
3 Mile Camp
Scorpion Ridge
Tombstones
Midgies
Magnolia Lookout
The Gallery
Monument Cliffs
Harpoons
Wonderlands
Majuns
(Turtles)
Fenceline
Happy Valley
Red Bluff
RED BLUFF
GNARALOO ROAD
MINILYA-EXMOUTH ROAD
NORTH WARROORA ROAD
WARROORA EAST ROAD
Lyndon River
LAKE MACLEOD
LAKE MACLEOD
N
LEGEND
Visitor management settings
Highly modified
Recreation
Natural - Recreation
Natural
Roads*
Sealed road (2WD)
Unsealed road (4WD)
Unsealed road/track (4WD)
*Disclaimer: All geographical material provided on this map is for visual representation only and not intended as a navigation tool.
0 1 5 10 15 Km
Scale

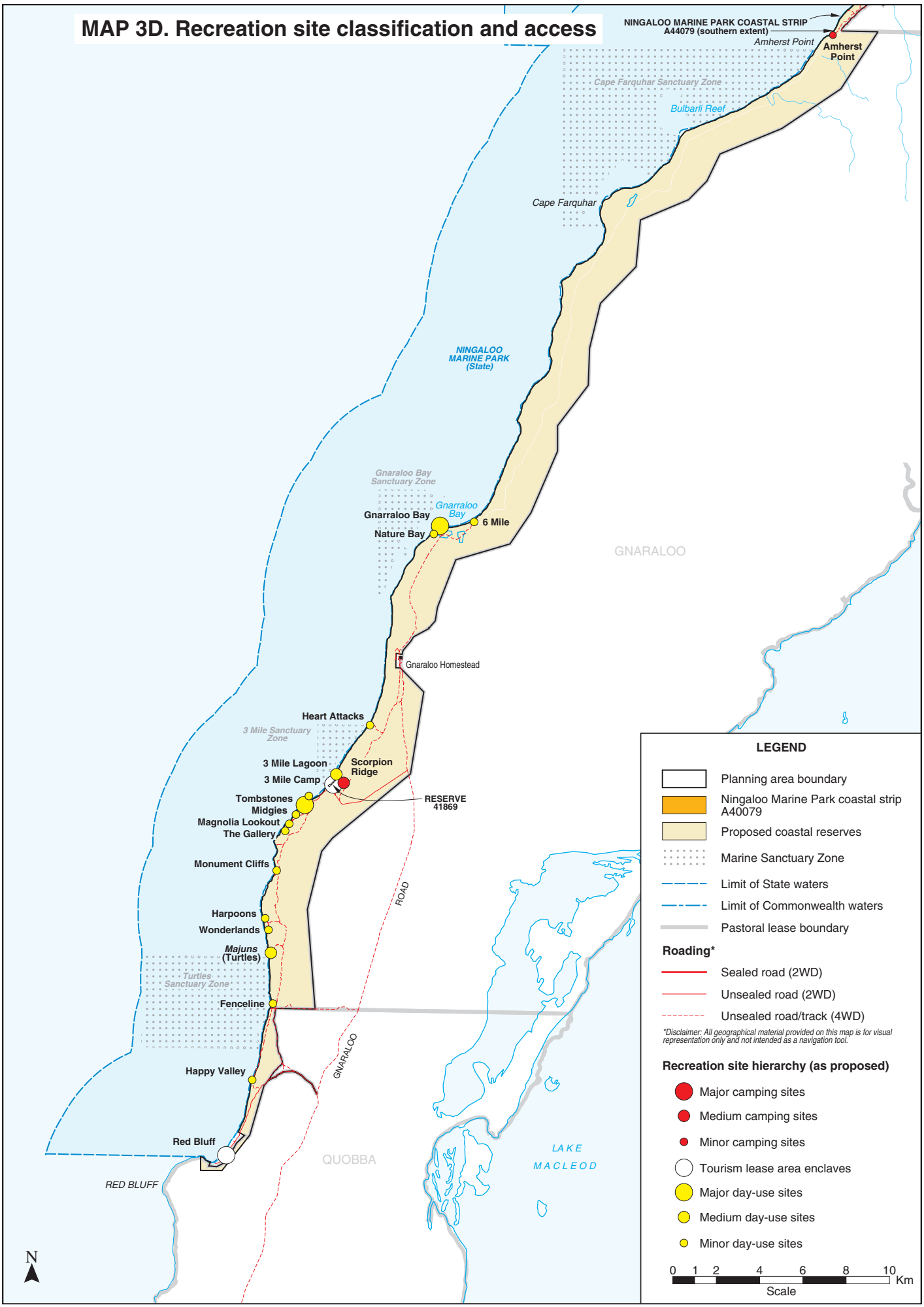
MAP 3A. Recreation site classification and access



MAP 3B. Recreation site classification and access




MAP 3C. Recreation site classification and access
LEGEND
Planning area boundary
Ningaloo Marine Park coastal strip A40079
Proposed coastal reserves
Marine Sanctuary Zone
Limit of State waters
Limit of Commonwealth waters
Pastoral lease boundary
Roading*
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road/track (4WD)
*Disclaimer: All geographical material provided on this map is for visual representation only and not intended as a navigation tool.
Recreation site hierarchy (as proposed)
Major camping sites
Medium camping sites
Minor camping sites
Tourism lease area enclaves
Major day-use sites
Medium day-use sites
Minor day-use sites
0 0.5 1 2 3 4 5 Km
Scale
South Hill
NINGALOO MARINE PARK (State)
MINILYA-EXMOUTH ROAD
Walbal Wardu (14 Mile Camp)
Day-use 1
Caretakers Camp
Sandy Point
Sandy Point
Pelican Sanctuary Zone
WARROORA
Pelican Point
Pelican Point
NORTH WARROORA ROAD
NINGALOO MARINE PARK (Commonwealth)
Maggies
Elles Camp
Stevens Camp
Wedding Hill
Tropic of Capricorn
WAROONA EAST ROAD
NINGALOO MARINE PARK COASTAL STRIP A44079
Warroora Homestead
Alison Point
Jirndal Gumagu (Black Moon Cliff)
Camping 1
Camping 2
Bulbarli
Nicks Camp
The Lagoon
Camping 4
Bulbarli Point
Amherst Point
Amherst Point
N


MAP 3D. Recreation site classification and access
NINGALOO MARINE PARK COASTAL STRIP
A44079 (southern extent)
Amherst Point
Amherst Point
Cape Farquhar Sanctuary Zone
Bulbarli Reef
Cape Farquhar
NINGALOO MARINE PARK (State)
Gnaraloo Bay Sanctuary Zone
Gnarraloo Bay
Gnarraloo Bay
6 Mile
Nature Bay
GNARALOO
Gnaraloo Homestead
Heart Attacks
3 Mile Sanctuary Zone
3 Mile Lagoon
Scorpion Ridge
3 Mile Camp
RESERVE 41869
Tombstones
Midgies
Magnolia Lookout
The Gallery
Monument Cliffs
ROAD
Harpoons
Wonderlands
Majuns (Turtles)
Turtles Sanctuary Zone
Fenceline
GNARALOO
Happy Valley
Red Bluff
QUOBBA
LAKE MACLEOD
RED BLUFF
N
LEGEND
Planning area boundary
Ningaloo Marine Park coastal strip A40079
Proposed coastal reserves
Marine Sanctuary Zone
Limit of State waters
Limit of Commonwealth waters
Pastoral lease boundary
Roading*
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road/track (4WD)
*Disclaimer: All geographical material provided on this map is for visual representation only and not intended as a navigation tool.
Recreation site hierarchy (as proposed)
Major camping sites
Medium camping sites
Minor camping sites
Tourism lease area enclaves
Major day-use sites
Medium day-use sites
Minor day-use sites
0 1 2 4 6 8 10 Km
Scale