Indicative Management Plan

for the proposed

MONTEBELLO/BARROW ISLANDS MARINE CONSERVATION RESERVES

2004

GOVERNMENT OF WESTERN AUSTRALIA

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

MPRA
MARINE PARKS & RESERVES AUTHORITY

PUBLIC SUBMISSIONS ON THE INDICATIVE MANAGEMENT PLAN

Prior to gazettal of a marine conservation reserve, the *Conservation and Land Management Act 1984* requires the release of an indicative management plan to provide an opportunity for the community to comment on the proposal. It is an opportunity to say whether you support the creation of the marine conservation reserve, provide information, suggest alternatives and generally have a say on how the proposed Montebello/Barrow islands marine conservation reserves should be managed over the next ten years if gazetted.

If you prefer not to write your own submission you could make a joint submission with others. To ensure your submission is as effective as possible:

- make it clear and concise;
- list your points according to the subject sections (and page numbers) in the plan;
- describe briefly each subject or issue you wish to discuss;
- say whether you agree or disagree with any or all of the objectives or strategies within each subject or just those of specific interest to you - clearly state your reasons (particularly if you disagree) and give sources of information where possible; and
- suggest alternatives to deal with any issues with which you disagree.

It is important to indicate those strategies and recommendations you agree with as well as those with which you disagree.

Each submission is important, but those that give reasons for concerns, provide supporting evidence where appropriate and offer information and constructive suggestions are most useful.

All submissions will be summarized according to topics discussed. The indicative management plan will then be reviewed, in the light of submissions, according to established criteria (see below). A summary of the submissions will be published along with the final management plan, including an indication of how the plan was amended or not in response to the submissions.

Criteria for amending the indicative management plan are that:

1. The indicative management plan *may* be amended if a submission:
   a) provides additional resource information of direct relevance to management;
   b) provides additional information on affected user groups of direct relevance to management;
   c) indicates a change in (or clarifies) government legislation, management commitment or management policy;
   d) proposes strategies that would better achieve management objectives and aims; or
   e) indicates omissions, inaccuracies or a lack of clarity.

2. The indicative management plan *may not* be amended if a submission:
   a) clearly supports the draft proposals;
   b) offers a neutral statement or no change is sought;
   c) addresses issues beyond the scope of the plan;
   d) makes points that are already in the plan or were considered during its preparation;
   e) is one amongst several widely divergent viewpoints received on the topic and the strategy of the indicative plan is still considered the best option; or
   f) contributes options which are not possible (generally due to some aspect of existing legislation, or government policy).

Submissions are welcome for three months after the date of release of the indicative management plan. Written submissions should be sent to:

Plan Coordinator
Indicative Management Plan for the Proposed Montebello/Barrow Islands Marine Conservation Reserves
Marine Conservation Branch
Department of Conservation and Land Management
47 Henry St
Fremantle WA 6160

Submissions can also be forwarded by e-mail to judyd@calm.wa.gov.au

Alternatively, refer to the Department of Conservation and Land Management's NatureBase web site (www.naturebase.net), which has an electronic copy of the plan and allows you to lodge your submission electronically.

The closing date for submissions on the plan is 24 May 2004.

Cover photographs courtesy of Eva Boogaard/Lochman Transparencies (background), Col Roberts/Lochman Transparencies (insert 1), Peter & Margy Nicholas/Lochman Transparencies (insert 2), Department of Conservation and Land Management (insert 3).

INDICATIVE MANAGEMENT PLAN FOR THE PROPOSED MONTEBELLO/BARROW ISLANDS MARINE CONSERVATION RESERVES

VISION

To maintain and improve the marine flora and fauna, habitats and water quality of the Montebello/Barrow islands area. The area will support commercial and recreational activities which are compatible with the maintenance of environmental quality and be valued as an important ecological, economic and social asset by the community.

ACKNOWLEDGMENTS

The Advisory Committee for the Proposed Montebello/Barrow Islands Marine Conservation Reserve put considerable time and effort into discussions and meetings that provided the basis of the indicative management plan. The advisory committee greatly assisted the Department of Conservation and Land Management (CALM) in developing the proposal and their efforts are acknowledged.

The advisory committee members are listed below:

Norm Halse (Chair)
Iva Stejskal
Russell Lagdon
Guy Leyland
John Baas
Craig Thomas
Noel Parkin
John Jenkin
Kellie Pendoley
Vicki Long

Many groups and individuals provided valuable input to the advisory committee through Sector Reference Groups, individual submissions and out-of-session discussions. In particular, representatives from the hydrocarbon companies, pearling industry, charter boat industry, Australian Petroleum Production and Exploration Association Ltd., Pearl Producers Association and RecFishwest provided valuable information and constructive input.

A number of CALM's planning team staff were involved in preparation of the plan including Andrew Hill (Coordinator), Dr Chris Simpson, Liesl Jonker, Judy Davidson, Fran Stanley and Mark Sheridan. Staff from the Department of Industry and Resources and the Department of Fisheries provided information and guidance in respect to the petroleum industry and commercial and recreational fishing, and pearling. In particular, the input of Bill Carr, Graham Cobby, Eve Bunbury, Robin Clark and Neil Sumner in developing this plan is acknowledged.

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EXECUTIVE SUMMARY

What is the indicative management plan and why has it been produced?

Section 14 of the *Conservation and Land Management Act 1984* (CALM Act) requires the Minister for the Environment to provide a clear public statement of any proposal to create a marine conservation reserve. This is known as the notice of intent and must include the following:

- proposed boundaries;
- reserve purpose;
- whether the reserve is to be classified as an A class reserve;
- an indicative management plan;
- any proposed zoning;
- where interested persons can obtain the above information; and
- how the public can make a submission.

The indicative management plan for the proposed Montebello/Barrow islands marine conservation reserves has been prepared in accordance with the requirements of the CALM Act and has been produced to provide the public with a guide as to how the area would be managed (over a ten year period) if the reserves were gazetted. It will also provide the community with an opportunity to comment on the most appropriate category of marine conservation reserve for the area and to suggest ways in which the indicative management plan could be improved.

How has the plan been developed?

The Department of Conservation and Land Management (CALM) undertook an assessment of the existing biological and social information relevant to the area before commencing the planning and consultation process. CALM subsequently undertook field surveys of marine habitats in June 1999 and compiled human usage information on recreational and commercial use. The assessment process involved gathering information from government agencies, industry and community groups, as well as reports produced by CALM's Marine Conservation Branch. This information was summarised and published in 2000 in the *Montebello/Barrow Islands Regional Perspective* report (CALM, 2000) to provide an overview of the ecological and social values of the area. The assessment process also involved consultation with stakeholders to gain an understanding of community views. These views were summarised in a paper entitled *An Analysis of Issues Relating to the Proposed Montebello/Barrow Islands Marine Conservation Reserve.*

Following the information gathering process a community consultation program was initiated in 2000 with the appointment, by the Minister for the Environment, of a community based advisory committee to consider the proposed Montebello/Barrow Islands marine conservation reserves. The Marine Parks and Reserves Authority (MPRA) provided guidance to the advisory committee at the commencement of the process and had an observer at meetings to provide advice during its consideration of the proposal where required. The committee met five times in developing a position in respect to the proposed category, boundaries, zoning and management of the marine conservation reserves. To facilitate community input to the advisory committee, CALM identified Sector Reference Groups (SRGs), which were provided with regular updates of advisory committee meeting outcomes. Feedback from the SRGs was summarised and provided directly back to the committee for consideration. During this period, CALM also undertook a broader community consultation program, which included distribution of information (e.g. brochures) and presentations to government committees, community and industry groups, media articles, meetings and presentations to key interest groups. This program was aimed at raising community awareness through education, to encourage community discussion of the proposal and to facilitate input into the advisory committee deliberations. The committee provided its advice to the Minister for the Environment in May 2003.

During their meetings, the advisory committee identified the ecological and social values, outlined the strategic objectives and vision for the proposed reserves, as well as determining management objectives, strategies and targets. In doing so, the advisory committee developed the content and direction of the indicative management plan, in conjunction with feedback from the community. The outcomes of the advisory committee formed the basis of the indicative management plan, which was prepared by CALM and presented to the MPRA for consideration.

In developing the indicative management plan the advisory committee felt that they were not able to adequately address two issues relating to the operation of the petroleum industry in the area; approvals processes and

ecological targets. They, therefore, recommended that a separate industry/government working group be formed to address these issues. Industry representatives on the advisory committee supported this recommendation. Subsequently, a working group was formed comprising representatives of government agencies, petroleum companies operating in the area and the Australian Petroleum Production and Exploration Association Ltd. (APPEA). The first issue considered by the working group was the clarification of the environmental approvals processes and regulation of petroleum activities in the proposed reserves. The working group addressed this matter with the agreement outlined in a Memorandum of Understanding (MOU) (Appendix I). The second issue was the specific wording of ecological targets. The working group's advice on this matter was provided to the MPRA and duly considered.

The MPRA, after fully considering all inputs received, provided advice to the Minister for the Environment recommending that she seek agreement from the Minister for Agriculture, Forestry and Fisheries and the Minister for State Development to release a *notice of intent* to create the proposed reserves.

What are the options in terms of marine conservation reserve categories?

The CALM Act provides for the classification of a marine conservation reserve as a marine nature reserve, a marine park or a marine management area. To determine the appropriate category for a proposed marine conservation reserve it is necessary to assess the conservation significance and current and future uses of the area. The decision is guided by the purpose of the various reserve types as set out in the CALM Act. More specific guidance is outlined in the MPRA's *Policy Statement: The Application of the Marine Management Area Category in a Marine Conservation Reserve Planning Process*. The marine conservation reserve categories and the situations in which they may apply are described below.

Marine nature reserves are created for conservation and scientific research. Although low impact tourism may be permitted, no recreational or commercial fishing, aquaculture, pearling, petroleum drilling or production is allowed in these areas.

Marine parks are created to protect natural features and aesthetic values while at the same time enabling recreational and commercial uses where these activities do not compromise conservation values. In marine parks, conservation is clearly the priority purpose and commercial and recreational activities are legitimate secondary purposes. In marine parks, four statutory management zones can be created, these being:

- Sanctuary zones- "look but don't take" areas managed solely for nature conservation and low-impact recreation and tourism.
- Recreation zones- provide for conservation and recreation including recreational fishing (subject to bag limits and other conservation measures).
- Special purpose zones- managed for a particular priority use or issue. This could be protection of a habitat, a seasonal event such as wildlife breeding or whale watching or a particular type of commercial fishing. Uses compatible with the priority use or seasonal event are allowed in these zones.
- General use zones- areas of marine parks not included in sanctuary, recreation or special purpose zones. Conservation of natural resources in general use zones is a priority but activities such as sustainable commercial fishing, aquaculture, pearling and petroleum exploration and production are permissible provided they do not compromise the conservation values.

Marine management areas will provide a formal integrated management framework over areas that have high conservation value and intensive multiple use. These areas will be selected primarily on the basis of their biological and recreational values and their existing or future commercial activities such as petroleum production and commercial fishing. As with other marine conservation reserves, marine management areas will be subject to environmental impact assessments for activities in accordance with the *Environmental Protection Act 1986* (EP Act). In a marine management area, conservation is but one of the "uses" managed under the broader purpose of managing and protecting the marine environment. In accordance with the CALM Act marine management areas can be zoned to meet management objectives of the reserve.

What are the major outcomes of the plan and the type of approach taken?

The indicative management plan has been prepared in the context of an over-riding community vision that reflects the aspirations of the community of Western Australia for conservation and sustainable management of human activities of the area both now and in the future. In addition, the MPRA provided strategic objectives, based on the CALM Act, which offer a legislative guide to the overall management aims for conservation and human usage. The format of the indicative management plan is based on the identification of key ecological and social values, followed by an assessment of risks to these values, in order to formulate the operational management objectives, the long-term management targets and the proposed key management strategies for the

area. The plan was developed with an emphasis on an outcome-based approach to facilitate more effective auditing of the implementation of the plan by the management agency (CALM) and the statutory vesting authority (MPRA).

The indicative management plan has been prepared on the basis that the "marine park" and "marine management area" reserve categories are the most appropriate categories for the proposed Montebello/Barrow islands marine conservation reserves.

The CALM Act states that a marine park is established *"... for the purpose 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."*

The CALM Act states that a marine management area is established "... *for the purpose of managing and protecting the marine environment so that it may be used for conservation, recreational, scientific and commercial purposes. Commercial purposes include:*

a) aquaculture, commercial fishing and pearling activity;
b) mining, within the meaning of the Mining Act 1978;
c) seismic surveys and exploratory drilling for petroleum; and
d) *production of petroleum and associated activities."*

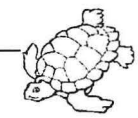
The marine environment of the proposed reserves is characterised by relatively low use, high water quality and marine habitats that are in a mostly undisturbed condition. The islands, reef and non-reef areas of the proposed reserves are further offshore than any other islands off the Pilbara coastline. The area experiences a unique set of environmental conditions that lie midway between the clear-water, high wave energy environments of the Ningaloo Marine Park, and the more turbid, relatively low energy marine environments typical of the Pilbara coastline. This wide range of environmental conditions gives rise to a broad range of habitats and a very diverse marine flora and fauna. The most westerly portions of the proposed reserves are under the influence of the Leeuwin Current and are likely to represent an important biological "stepping stone", connecting areas of Western Australia's marine environment to the north and south. These features make the Montebello/Barrow islands area a key component of the statewide network of marine conservation reserves in Western Australia. Whilst there have been localised modifications of some habitats by industrial developments and anecdotal reports of impacts on some targeted fish populations, the biological values of the proposed reserves are, in general, not significantly threatened by existing human activities.

The hydrocarbon industry is a major user of the area and has the highest economic return of all industries in the proposed reserves. The use of the area by the hydrocarbon industry may increase depending on economic factors, future hydrocarbon discoveries and improvements in technology. Another important user of the area is the pearling industry. This industry currently operates in the Montebello Islands and in the vicinity of the Lowendal Islands. There is currently a low level is use for recreation and nature-based tourism. However, the potential for increased use, particularly by charter boat tour operators, is high and use is likely to increase as the public becomes aware of the natural values of the area. There is a low level of use of the proposed reserves for commercial fishing with the most intensive fishing activities occurring outside of the proposed reserves. The gazettal of the proposed reserves will provide a management framework to ensure the protection of the ecological values while allowing human usage to continue in a sustainable and equitable manner. The establishment of the proposed reserves reflects a pro-active approach to conserving the values and managing the human usage of the area..

Given the above, management of the proposed reserves will focus on the establishment of an appropriate administrative/management framework including the gazettal of the reserves and management zones, and the implementation of the management plan. Research, monitoring, education and interpretation, surveillance, enforcement and public participation programs will be implemented to gain a better understanding of the marine ecosystems and to assess and manage the impacts of human use in the area. The plan, when implemented, will conserve representative areas of the Montebello/Barrow islands region, as well as contributing to the sustainable management of human activities in the area.

What happens next?

The public submissions to this plan will be reviewed and summarised for consideration by the MPRA. The indicative management plan may be revised by the MPRA as a result of public submissions received and they will provide formal advice to the Minister for the Environment. The Minister for the Environment will then



forward the draft management plan to the Minister for Agriculture, Forestry and Fisheries and the Minister for State Development seeking concurrence to create the proposed reserves. The reserves will then be created and the management plan formally approved by notice in the *Government Gazette*.

1 INTRODUCTION

The coastal environment of Western Australia extends from latitudes 14°-35° South and ranges from the warm, tropical waters off the Kimberley coast to the cool temperate waters of the Great Australian Bight. The coastline is over 13,000 kilometres in length and comprises about 40% of the continental coastline of Australia. A unique feature of the coastal waters of Western Australia is the presence of a poleward, shelf-edge flow of tropical water, the Leeuwin Current, which flows down the Western Australian coastline. The current flows year round but is stronger and closer to shore during autumn and winter due to the absence of the opposing southerly wind stress and associated nearshore northward Capes and Ningaloo currents that occur during the late spring and summer months (Pearce & Pattiaratchi, 1999; Taylor & Pearce, 1999).

The Leeuwin Current has a major influence on the biogeography of the State's marine flora and fauna and is responsible for the occurrence of tropical biota at latitudes where these species are not typically found (Pearce & Walker, 1991). Three major biogeographic zones occur: a *tropical* zone north of North West Cape; a *temperate* zone east of Cape Leeuwin; and a *biological overlap* zone in between. Other major influences on the marine environment of Western Australia are the regular occurrence of severe tropical storms (i.e. cyclones), particularly off the northwest coastline, the low level of freshwater and sediment input to most of the nearshore waters of the State and the high wave energy of the west and south coasts.

The above natural characteristics and influences combine to produce a diversity of marine ecosystems and habitats unrivalled in other states of Australia. Much of the marine biodiversity of the State is poorly described, particularly along the west and south coasts where many endemic species are likely to occur. The conservation of Western Australia's marine biodiversity is not only important from an intrinsic point of view, but also as the fundamental basis of major recreational, nature-based tourism, fishing and, potentially, pharmaceutical industries.

In recognition of the importance of conserving the State's marine biodiversity, the Minister for the Environment established the Marine Parks and Reserves Selection Working Group (MPRSWG) in 1986 to identify representative and unique areas of Western Australia's marine waters for consideration as part of a statewide system of marine conservation reserves under the CALM Act. The MPRSWG's report was released in June 1994 and identified over seventy candidate areas throughout the coastal waters of Western Australia.

The marine and coastal environs of the Montebello-Barrow-Lowendal islands region, with the unique combination of offshore islands, intertidal and subtidal coral reefs, mangroves, macroalgal communities and sheltered lagoons, were identified in the MPRSWG report as a distinct coastal type with very significant conservation values (MPRSWG, 1994). Specifically, the MPRSWG recommended that the waters encompassing the Montebello Islands, Biggada Reef on the western side of Barrow Island and Bandicoot Bay on the southern end of Barrow Island be considered for reservation (MPRSWG, 1994). In May 2000, the then Minister for the Environment appointed a community-based committee, the Advisory Committee for the Proposed Montebello/Barrow Islands Marine Conservation Reserve, to assist CALM in developing an indicative management plan to guide the conservation and management of the marine environment in this area. The advisory committee met five times before finalising its advice in May 2003 to the Minister.

The *Indicative Management Plan for the Proposed Montebello/Barrow Islands Marine Conservation Reserves* (hereafter referred to as "the proposed reserves") provides a detailed description of the ecological and social values of the area, management objectives, strategies and targets. The goal of the plan is to facilitate the conservation of the marine biodiversity of the area and to ensure that the existing and future pressures on the reserves' values are managed within an ecologically sustainable framework. The plan also provides mechanisms for the community and users to actively participate in the day to day planning and management.

The management plan for the proposed reserves should not be viewed in isolation but as an integral part of a suite of complementary management practices that occur within and adjacent to the reserves. These include fisheries regulations, industry regulations, wildlife protection, pollution control and environmental impact assessment, as well as maritime transport and safety measures. The plan has been prepared to be consistent with the management objectives of the adjacent island reserves. In addition it should be noted that many marine species are not permanently resident in the proposed reserves and move in and out of the reserves during different stages of their lifecycles. The water quality within the reserves may also be affected by activities outside the reserves and by land-based activities. It is therefore critical that the environmental management objectives of the environment external to and within the reserves are compatible. The plan provides a framework to achieve the necessary integration and close co-operation that are needed between marine management and

regulatory agencies to achieve the conservation and sustainable management objectives outlined in this plan.

2 DEFINITION OF THE AREA AND RESERVE TENURE

The proposed Montebello Islands Marine Park, Barrow Island Marine Park and Barrow Island Marine Management Area are located off the north-west coast of Western Australia, approximately 1600 km north of Perth, and cover areas of 59,240 ha, 4,530 ha and 148,540 ha respectively (Figure 1). The boundaries of the proposed reserves are congruent with the seaward limit of Western Australian waters (3 nm from the territorial baseline) in the north and west of the reserves. The remaining boundary has been defined to include habitats in their entirety, east-west and north-south boundary lines where possible for ease of enforcement, and to avoid areas of high industry use where this did not result in the exclusion of significant ecological features of the reserves.

The CALM Act provides for the classification of marine conservation reserves as marine park, marine nature reserve or marine management area. To determine the appropriate category for a proposed reserve, it is necessary to assess the conservation significance and current and future uses of the area and the decision is guided by the purpose of the various reserve types as set out in the CALM Act (outlined below). More specific guidance is outlined in the MPRA's *Policy Statement: The Application of the Marine Management Area Reserve Category in a Marine Conservation Reserve Planning Process*. The indicative management plan has been prepared on the basis that the "marine park" and "marine management area" reserve categories are the most appropriate categories for the proposed reserves.

The CALM Act (Section 13B (1)) states that a marine park is established *"... for the purpose 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."*

The CALM Act (Section 13A (1)) states that a marine nature reserve is established *"...for:*

a) the conservation and restoration of the natural environment;
b) the protection, care and study of indigenous flora and fauna; and
c) the preservation of any feature of archaeological, historic or scientific interest."

The CALM Act (Section 13C (1)(2)) states that a marine management area is established *"... for the purpose of managing and protecting the marine environment so that it may be used for conservation, recreational, scientific and commercial purposes. Commercial purposes include:*

a) aquaculture, commercial fishing and pearling activity;
b) mining, within the meaning of the Mining Act 1978;
c) seismic surveys and exploratory drilling for petroleum; and
d) production of petroleum, and associated activities."

The CALM Act (Section 6 (6)) also states that a marine park, marine nature reserve or marine management area *"... includes:*

a) the airspace above such waters or land;
b) in the case of waters, the sea-bed or other land beneath such waters and the subsoil below the sea-bed or other land to a depth of 200 m; and
c) *in the case of land other than waters, the subsoil below such land to a depth of 200 m."*

It is proposed that the Montebello Islands area and an area west of Barrow Island be vested as marine park given the high ecological values as well as the fact that the primary social values are reliant on the maintenance of these ecological values (e.g. pearling, nature-based tourism, recreational and commercial fishing). The remainder of the area is proposed as a marine management area. The use of this area is dominated by petroleum activities with a lower level of use for commercial fishing and recreational fishing. On the balance of ecological and social values, and in keeping with MPRA policy, it is recommended that marine management area is the most appropriate category and will provide an appropriate management framework for this area.

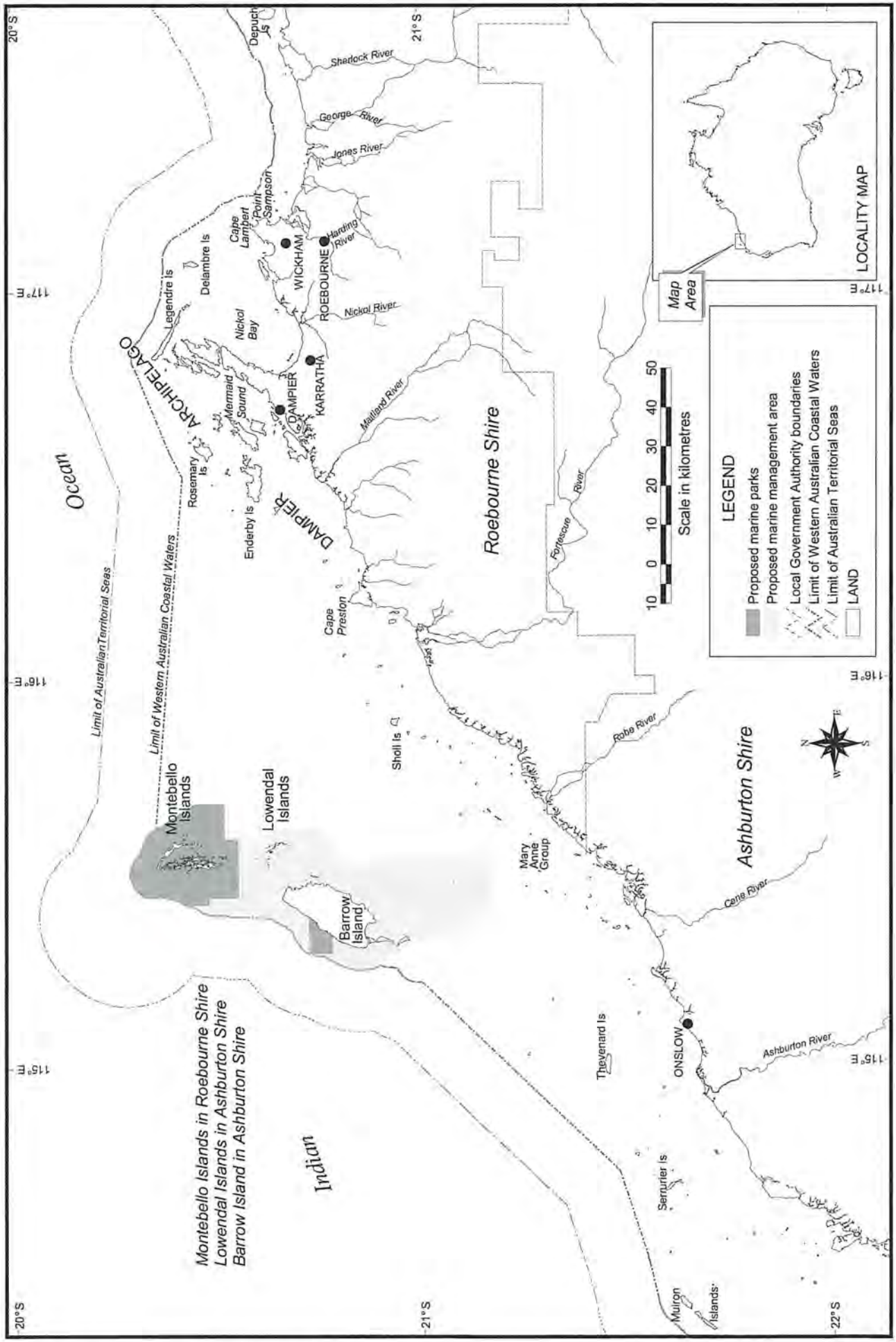


Figure 1: Locality of the proposed Montebello/Barrow islands marine conservation reserves

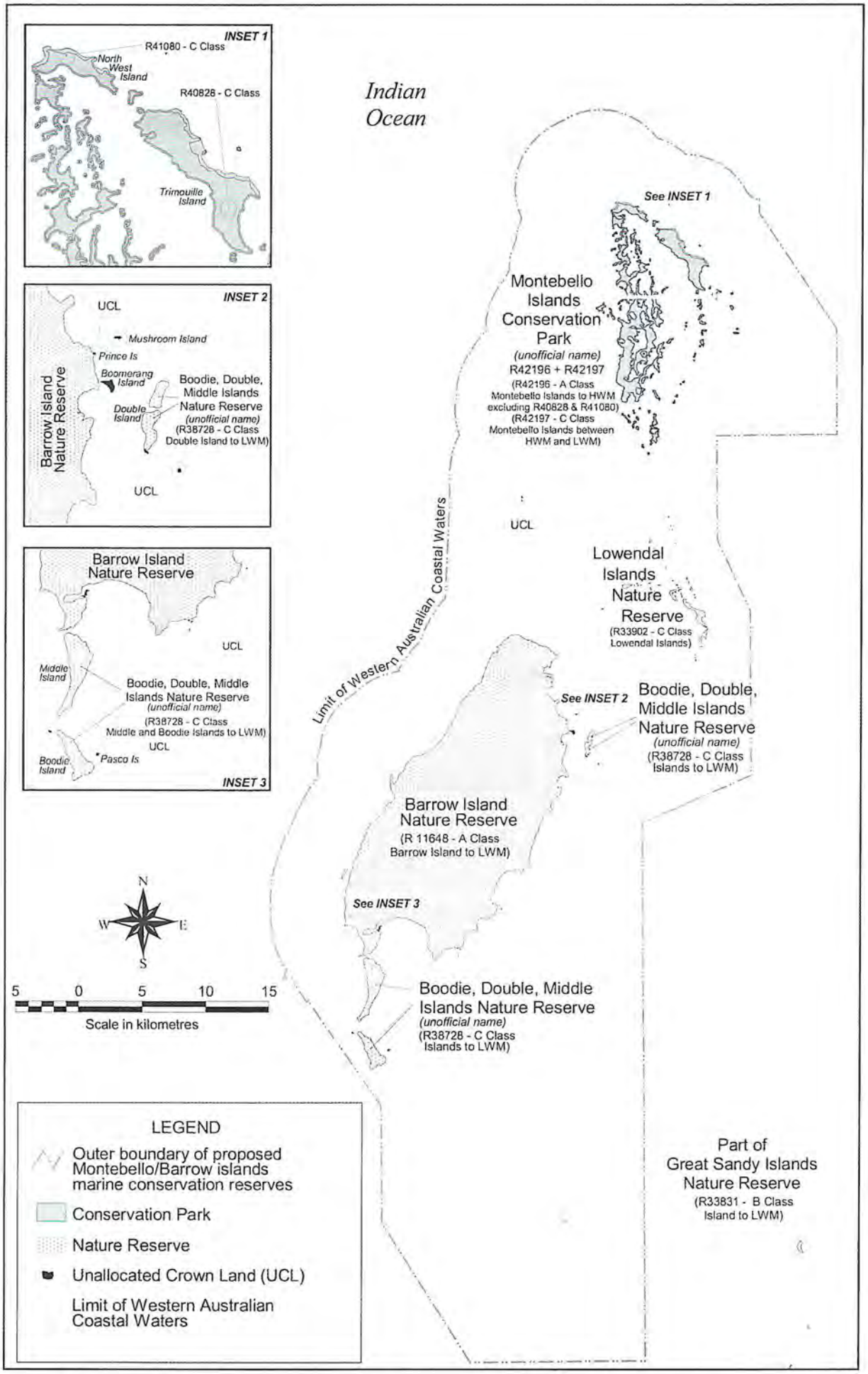


Figure 2: Tenure within the proposed Montebello/Barrow islands marine conservation reserves

As the reserves are proposed to be gazetted as Class A reserves, the amendment of the purpose and boundaries of the reserves, once gazetted, requires the tabling of an order in both Houses of Parliament. Either House can resolve to disallow an order and as such Class A vesting provides high security of tenure. By contrast, the zoning scheme and the management plan can be amended through a formal public consultation process and do not require Parliamentary consideration. This provides the flexibility to respond to changing management priorities and community aspirations, and new information on the values and uses of the area. Any substantial change to the management plan requires a statutory three-month public submission period and approval by the Minister for the Environment, the Minister for Agriculture, Forestry and Fisheries and the Minister for State Development.

The area contains many islands that are vested in the Conservation Commission of Western Australia (CCWA) and managed by CALM for the purpose of conservation. The boundaries of the island reserves extend to the low water mark and therefore the intertidal communities are part of these terrestrial reserves. Intertidal areas contain important ecological communities (e.g. mangroves, mudflats, coral reefs) and many marine-related activities (e.g. fishing, swimming, reef-walking etc) occur in the area covering both the intertidal and nearshore subtidal areas. Furthermore, the geographic position of the low water mark is often difficult to determine accurately, particularly in macrotidal areas like the Pilbara. With these considerations in mind, management of intertidal areas as part of the marine conservation estate is proposed by the MPRA. Strategies for the management of intertidal areas in the Montebello/Barrow islands marine conservation reserves are outlined in this indicative management plan, despite these areas being part of the island reserves. The most appropriate mechanism to give legal effect to these strategies will be addressed by the MPRA and the CCWA. The proposed boundaries of the reserves and tenure in the Montebello/Barrow islands region are shown in Figure 2.

3 VISION AND STRATEGIC OBJECTIVES

3.1 Vision

The vision statement for the proposed reserves represents the community's future aspirations for the proposed reserves as well as providing a broad direction for management of the reserves.

Vision for the Montebello/Barrow islands marine conservation reserves

To maintain and improve the marine flora and fauna, habitats and water quality of the Montebello/Barrow islands area. The area will support commercial and recreational activities which are compatible with the maintenance of environmental quality and be valued as an important ecological, economic and social asset by the community.

3.2 Strategic Objectives

The Government has a policy of establishing a comprehensive, adequate and representative system of marine conservation reserves in Western Australia, based on the principle of multiple use. The objectives of the marine conservation reserve system are:

- to preserve representative as well as special ecosystems in the marine environment; and
- to put a formal management framework in place to ensure the various uses of marine conservation reserves are managed in an equitable, integrated and sustainable manner.

Within the context of Government policy and the CALM Act, the strategic objectives for the proposed reserves are:

Conservation

- to maintain the marine biodiversity of the reserve;
- to maintain key ecological processes and life support systems (i.e. ecosystem structure and function);

Recreational Uses

- to facilitate and, where appropriate, assist in the management of a diverse range of recreational activities within an equitable and ecologically sustainable framework;

Commercial Uses

- to facilitate and, where appropriate, assist in the management of commercial activities in the reserves within an equitable and ecologically sustainable framework; and

Science and Education

- to promote education, nature appreciation and scientific research.

The strategic objectives of the proposed reserves cannot be achieved in isolation from other statutory and non-statutory management measures both within and external to the reserves. Thus the management of the reserves

must be seen as part of a complementary suite of management practices including fisheries management, wildlife management, pollution control, environmental impact assessment and maritime transport and safety measures that all contribute in varying degrees to achieving the above strategic objectives.

4 ECOLOGICAL AND SOCIAL VALUES

This section provides a brief overview of the ecological and socio-economic values of the proposed reserves. More comprehensive and detailed descriptions of the natural attributes and social values of the area can be found in Section 7, in some of the references and source documents outlined in Sections 11 and 12 and in the *Montebello/Barrow Islands Regional Perspective* (CALM, 2000).

4.1 Ecological Values

Ecological values are the intrinsic physical, chemical, geological and biological characteristics of an area. Their value is measured in relation to their local, regional, national and global biodiversity significance and their role in maintaining the structure and function of ecosystems. For convenience, the ecological values are treated individually in this plan. However, in reality the marine environments of the proposed reserves are a structurally and functionally complex array of relationships between the plants and animals interacting with their physical environment.

The proposed reserves lie approximately 1600 km north of Perth, in the Pilbara Offshore (PIO) marine bioregion (IMCRA, 1997). The PIO marine bioregion covers an area of 41,491 km^2 seaward of the 10 m depth contour, between North West Cape and Cape Keraudren. The PIO marine bioregion is characterised by a series of limestone islands on a section of coast where the continental shelf is wide and the Montebello/Barrow islands comprise a geomorphological and ecological unit that is unique on the coast. Because of the range of substrate types and oceanographic conditions, the structural variety of the system creates exceptional habitat diversity and these habitats are species-rich. Species are mainly tropical and are generally widespread throughout much of the Indo-West Pacific region with some species that are locally endemic. The PIO marine bioregion also contains mangroves that occur in isolated mangrove communities in sheltered lagoons and as scattered mangrove trees on the eastern sides of islands. The area is considered to be in a generally undisturbed condition, largely as a result of the relatively low human usage and the management of industry activities in the area. The Montebello/Barrow islands region was identified for consideration as a marine conservation reserve in the MPRSWG report for these reasons (MPRSWG, 1994).

The Montebello Islands complex consists of 265 distinct, low lying islands and islets composed of limestone and cross-bedded sandstones. The islands are generally irregular with convoluted coastlines, and are dominated by lagoons, channels, intertidal embayments, barrier and fringing reefs, intertidal rocky and occasionally sandy shores and shallow limestone platforms exposed to open ocean conditions. The islands are capped in places with sand dunes with elevations up to 40 m high, although most are characterised by bare rocky terrain. The Lowendal Island group contains more than 40 limestone islands, islets and rocky stacks, typically with steep shorelines. The larger islands have dunes of white sand, while the smaller islands consist mostly of low lying, bare rocky islets and stacks. The Barrow Island region contains Barrow Island, the largest island within the proposed reserves, and nine smaller islands. Barrow Island is composed almost entirely of limestone outcrops and deposits overlain by sands. It is 62 m above sea level at its highest point, and has steep, undercut limestone rocky shores connected with intertidal limestone pavements.

The tropical, relatively low salinity, narrow Leeuwin Current flows south along the Western Australian coastline from the North West Shelf to the Great Australian Bight. The Leeuwin Current transports substances such as eggs and larvae from reef habitats to more southerly destinations. The Montebello/Barrow islands are located in an area considered to be the headwaters of the Leeuwin Current, which suggests that the proposed reserves may be an important source of recruitment for tropical species along the west coast. Nearshore water movements and mixing patterns in the Montebello/Barrow islands region are driven primarily by strong current flows, large tidal ranges and winds, but are also influenced by wave pumping, seabed topography and the steering effect of islands and reefs. These processes cause strong currents and flushing in most parts of the region, although some areas, including the lagoons and intertidal embayments of the Montebello Islands, may be subject to weaker currents and limited flushing. Water clarity in the region varies according to water movement and sediment type but is generally clearer on the western sides of the Montebello Islands and Barrow Island.

The marine flora and fauna of the Montebello/Barrow islands region are predominantly tropical species and are biologically connected to more northern areas by the Leeuwin Current and the Indonesian Throughflow.

Preliminary surveys indicate that while most of the marine biota is very diverse and typical of the Indo-West Pacific flora and fauna, there are a number of endemic species, as well as species that are not yet described and are "new" to science. The Montebello/Barrow islands region is dominated by two major marine habitat types, these being macroalgae dominated limestone reef and subtidal reef platform/sand mosaic. Other major habitat types include coral reef, mangroves and sand. Macroalgal communities are dominated by species of brown algae, particularly of the genera *Sargassum*, *Turbinaria* and *Pandina*, while green algae from the genera *Caulerpa* and *Cladophora* are also quite common. A wide range of invertebrate life is associated with this habitat and it is the major primary producer for the area. The subtidal coral reef communities in the proposed reserves have a high diversity of invertebrates, with at least 150 species of hard corals recorded from fringing and patch coral reef areas. Sand habitats are generally unvegetated but may have seasonal vegetation or permanent patches of seagrass or macroalgae and a significant invertebrate fauna. Rocky shores are typically undercut, unvegetated, low limestone cliffs, which support a variety of mollusc species and other invertebrates. In addition, six species of mangroves are found in the proposed reserves. These mangroves represent the unique offshore mangrove communities in the Pilbara, and are considered to be globally significant (Semeniuk, 1997). Mangrove communities support a range of invertebrate fauna and provide valuable nursery areas for juvenile fishes and crustaceans. The benthic and shoreline habitats in the proposed reserves are shown in Figure 3 and 4.

Of the six species of marine turtle found in Western Australia, five have been recorded in the proposed reserves. Of these, green, hawksbill and flatback turtles regularly using the sandy beaches in the reserves for breeding, while occasional nesting by loggerheads has been recorded on Barrow Island. The Western Australian hawksbill turtle population is the only large population of this species remaining in the Indian Ocean, while flatback turtles breed only in Australia. The nesting population of green turtles in the proposed reserves is large and the proposed reserves are the northernmost breeding limit for loggerheads in Western Australia.

A total of seven species of toothed whale and three species of baleen whale have been recorded from the Montebello/Barrow islands region. Humpback whales use the proposed reserves as a resting area, and some whale migration paths pass through the reserves. Dugongs are found in the vicinity of the Montebello Islands, Lowendal Islands and Barrow Shoals where they feed on seagrasses and algae. The Montebello/Barrow islands region is a significant rookery for at least 15 seabird species, with the largest breeding colony of roseate terns in Western Australia found in the Montebello Islands.

The ecological values of the proposed reserves are listed below.

Summary of Ecological Values

- ***Geomorphology:*** *A complex seabed and island topography consisting of subtidal and intertidal reefs, sheltered lagoons, channels, beaches and cliffs.*
- ***Sediment quality:*** *The sediments of the reserves are generally undisturbed and are essential to the maintenance of a healthy ecosystem.*
- ***Water quality:*** *The waters of the proposed reserves are generally pristine and are essential to the maintenance of a healthy marine ecosystem.*
- ***Coral reef communities:*** *Undisturbed intertidal and subtidal coral reefs and bommies with a high diversity of hard corals.*
- ***Mangrove communities:*** *Six species of mangroves are found in the proposed reserves, and the Montebello Islands mangrove communities are considered to be globally unique given their occurrence in lagoons of offshore islands.*
- ***Macroalgal and seagrass communities:*** *Extensive macroalgal and seagrass communities which are important primary producers and refuge areas for fishes and invertebrates.*
- ***Intertidal sand/mudflat communities:*** *The intertidal sand/mudflat communities of the proposed reserves are primary producers with abundant invertebrate fauna. This in turn provides a valuable food source for shorebirds.*
- ***Rocky shore/intertidal reef platform communities:*** *Rocky shores predominate on most of the islands and provide habitats for a variety of intertidal organisms, which in turn provide food for shorebirds.*
- ***Marine mammals:*** *Ten species of cetaceans are recorded in the proposed reserves, with the humpback whale passing through the area during its annual migration. Dugongs also occur in the shallow warm waters.*
- ***Turtles:*** *Loggerhead, green, flatback, hawksbill and leatherback turtles are found in the proposed reserves, with the hawksbill population in Australia being the largest remaining in the Indian Ocean. All species except the leatherback use sandy beaches in the reserves for nesting.*
- ***Seabirds:*** *Islands within the proposed reserves are nesting areas for 15 species of seabirds. The proposed*

reserves also provide important feeding and resting areas for migrating shorebirds.

- ***Finfishes:*** *A rich finfish fauna with at least 456 species.*
- ***Invertebrates (excluding corals):*** *A diverse marine invertebrate fauna comprising mostly tropical species.*

4.2 Social Values

Social values are those cultural, aesthetic, recreational and economic characteristics for which the area is significant or well known.

In 2000/01, Western Australia's petroleum industry was worth $10,600 million per annum, making it the State's most valuable commodity. The Pilbara region is the State's most productive petroleum area producing 99.3% of the State's oil and 92.2% of the State's gas. The value of petroleum production from the Montebello/Barrow area alone was worth $498 million in 2000/01 (DoIR, pers. comm.).

The proposed reserves produce some of the highest quality pearls in the world, from the pearl oyster, *Pinctada maxima*. There are currently two pearling leaseholders in the proposed reserves, which collectively hold leases over approximately 2,763 ha. There are several attributes of the proposed reserves which make it suitable for pearl production including warm water temperatures, high nutrient levels, protection from wave damage, clear sandy bottoms above which the pearl oysters can be suspended, relatively shallow water and a relatively high latitude in comparison to other locations suitable for pearl production. Most of the pearls produced in the proposed reserves are sold to Japan and some are exported to the United States, Hong Kong and Europe.

The major commercial fishing activities in the proposed reserves are fish trapping and line fishing. The Pilbara Trap Managed Fishery has a total of six licences issued and is worth $1.1 million with a total catch of 266 tonnes (DoF, 2002). Any fisher with a Western Australian Fishing Boat Licence can potentially fish in the Montebello/Barrow islands area (in 2003 there were 1,200 licences in operation). However a very small proportion of these actually fish in the area. The estimated total line fishing catch in the Pilbara region in 2001 was 99 tonnes worth $0.5 million (DoF, 2002). The species making up the greatest proportion of the catch is jobfish. In addition, fishing for shark, mud-crabs, beche de mer, rock lobsters (for aquarium purposes only) and collecting of specimen shells and aquarium fishes are carried out within the proposed reserves.

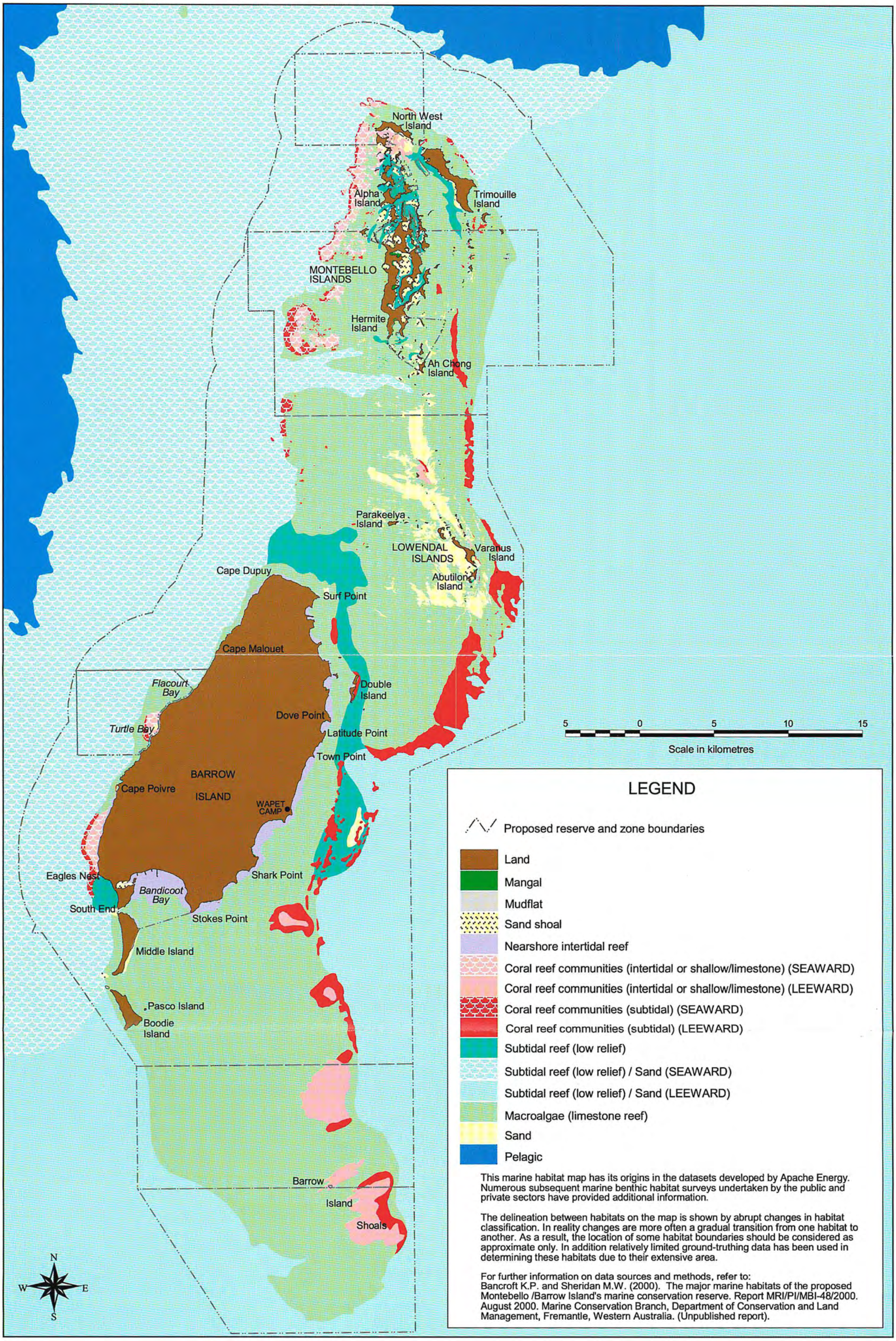
The proposed reserves, particularly the Montebello Islands area, is an important area for nature-based tourism, even though, current usage for tourism is low. The appeal for tourists includes the wide variety of wildlife and the wild, natural appearance of the land and seascapes, as well as the rich maritime heritage, including exploration, whaling, turtle harvesting, cultured pearl farming and military use (including nuclear testing). However, due to the area's isolation from major mainland centres, the lack of visitor facilities, landing restrictions on some islands and fast tidal currents, the use of the proposed reserves for nature-based tourism and recreation is low at this time. Nature-based tourism is limited to the charter vessel industry, where passengers participate in diving, snorkelling, recreational fishing, mud-crabbing, wildlife appreciation, island exploring and a limited amount of surfing.

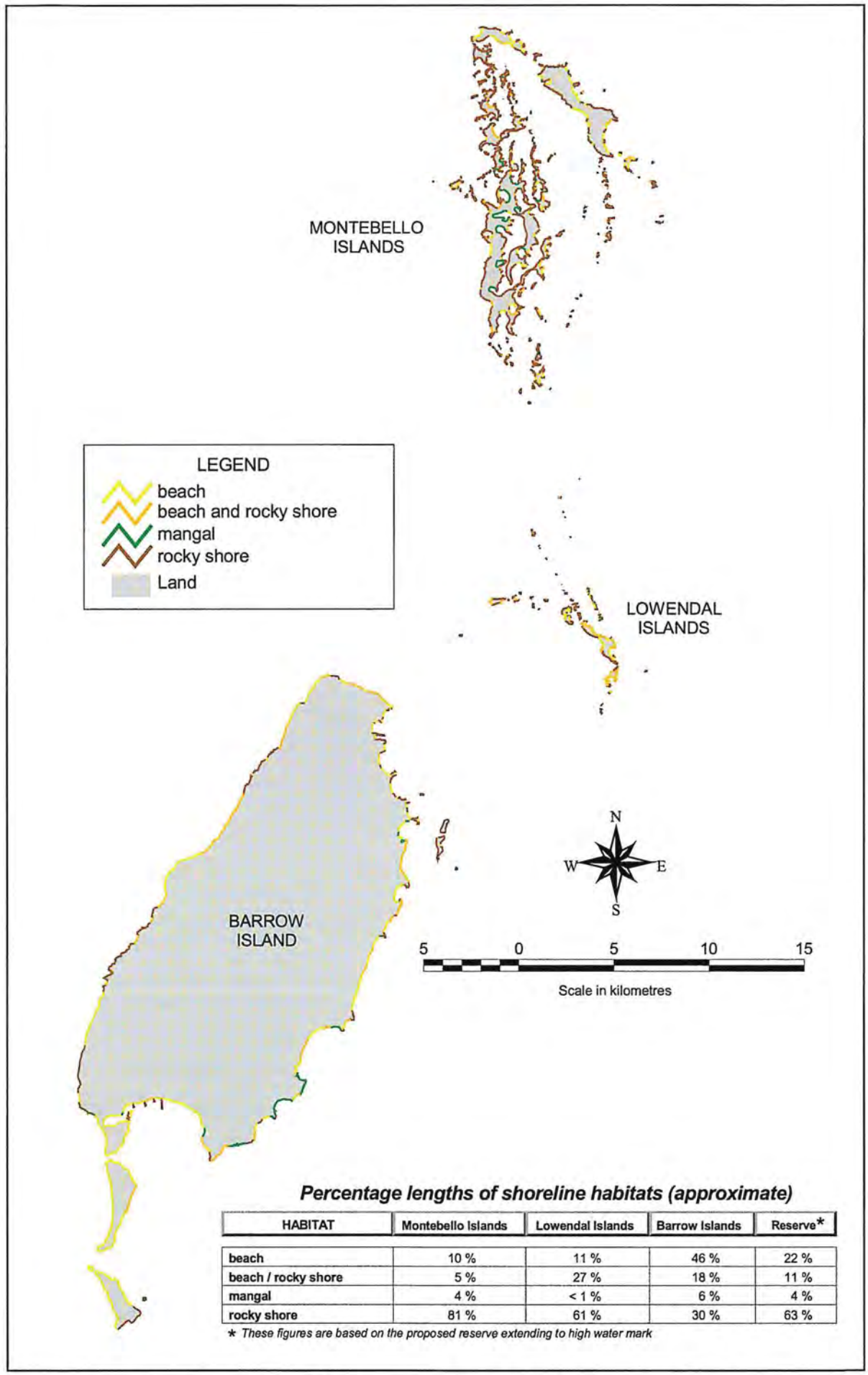
The productive coral reefs in the proposed reserves support an abundance of prized table fishes. However, due to the remoteness of the area, only larger vessels can safely travel to the area and so very few recreational fishers visit the proposed reserves. Most recreational fishing activity occurs from charter vessels, though there is some recreational fishing from yachts, either passing through the area or using the Montebello Islands as a safe anchorage. Those recreational fishers who do visit the proposed reserves target spangled emperor, red emperor, spanish mackerel, coral trout, mangrove jacks, oysters and squid.

There are no recorded seabed aboriginal sites in the waters of the proposed reserves. However, it is possible that there are aboriginal archaeological sites on the seabed that were created before the most recent sea level rise. All aboriginal sites, registered or otherwise, are protected under the *Aboriginal Heritage Act 1972*.

Given the high conservation value of the relatively undisturbed marine environment of the Montebello/Barrow islands region and the potentially incompatible uses of the area, the commercial, recreational and nature-based tourism uses need to be managed to ensure compatibility with and, to minimize impact on, the reserves' conservation values.

Figure 3: Major marine benthic habitats within the proposed Montebello/Barrow islands marine conservation reserves





Percentage lengths of shoreline habitats (approximate)

HABITAT	Montebello Islands	Lowendal Islands	Barrow Islands	Reserve*
beach	10 %	11 %	46 %	22 %
beach / rocky shore	5 %	27 %	18 %	11 %
mangal	4 %	< 1 %	6 %	4 %
rocky shore	81 %	61 %	30 %	63 %

* *These figures are based on the proposed reserve extending to high water mark*

Figure 4: Major shoreline habitats of the proposed Montebello/Barrow islands marine conservation reserves

The social values of the proposed reserves are listed below.

Summary of Social Values

- ***Hydrocarbon exploration and production industry:*** *The Montebello/Barrow islands region is the State's most productive petroleum area (for both oil and gas), with Barrow Island producing 34% of the State's oil production.*
- ***Pearling:*** *The warm pristine waters of the proposed reserves provide optimal conditions for production of high quality pearls by the existing pearling operations.*
- ***Nature-based tourism:*** *The reserves are developing rapidly as an important area for the nature-based tourism industry, with charter boats taking tourists to the Montebello Islands to participate in activities such as fishing, diving, wildlife viewing, island exploring and surfing.*
- ***Commercial fishing:*** *The reserves are used by commercial fishers targeting a variety of finfish, sharks, mud-crabs and beche de mer.*
- ***Recreational Fishing****: Excellent shore and boat based recreational fishing opportunities targeting a variety of pelagic and reef finfish species, mud-crabs and other edible invertebrates*
- ***Water sports:*** *The natural values, climate, and scenic values provide the basis for a wide range of recreational activities.*
- ***European history/maritime heritage:*** *The Montebello Islands have a history of European contact dating from 1622, which includes pearling, whaling, fishing for turtles and more recently, British atomic testing.*
- ***Scientific research:*** *The undisturbed nature and wide variety habitats and communities within the proposed reserves provide unique opportunities for scientific research.*

5 MANAGEMENT FRAMEWORKS

5.1 International and National Context

At a national level, the conservation of marine biodiversity, maintenance of ecological processes and the sustainable use of marine resources are addressed by the Intergovernmental Agreement on the Environment. This is implemented through actions developed under national strategies such as the *National Strategy for Ecologically Sustainable Development* (Commonwealth of Australia, 1992), the *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia, 1996a), *Australia's Oceans Policy* (Commonwealth of Australia, 1998) and the *Strategic Plan of Action for the National Representative System of Marine Protected Areas: A Guide for Action by Australian Governments* (ANZECC TFMPA, 1999).

The proposed reserves will become part of the National Representative System of Marine Protected Areas (NRSMPA). The NRSMPA is being developed cooperatively by the Commonwealth, State and Northern Territory governments responsible for the conservation, protection and management of the marine environment (ANZECC TFPMA, 1998a). The primary goal of the NRSMPA is to establish and manage a comprehensive, adequate and representative system of marine protected areas to contribute to the long-term ecological viability of marine and estuarine systems, to maintain ecological processes and systems, and to protect Australia's biological diversity at all levels. The development of an NRSMPA helps fulfil Australia's international responsibilities and obligations as a signatory to the Convention on Biological Diversity, to provide a means of meeting obligations under the Convention on Migratory Species (Bonn Convention) and to satisfy responsibilities under bilateral agreements for migratory birds with Japan and China. In addition, it supports the World Conservation Union (IUCN) World Commission on Protected Areas Program of promoting the establishment and management of a global representative system of marine protected areas (ANZECC TFPMA, 1998b).

5.2 State Policy Context

In 1984, the new CALM Act provided the first State legislation to create marine conservation reserves, and between 1987 and 1990 seven marine conservation reserves were created. In 2003, the eighth marine conservation reserve (Jurien Bay Marine Park) was created. In 1994, the State Minister for the Environment released a report entitled *A Representative Marine Reserve System for Western Australia* that identified about 70 areas in the coastal waters of Western Australia that were worthy of consideration for marine reservation under the CALM Act. In 1997, legislative changes were made to the CALM Act to change the mechanisms by which marine conservation reserves were established, vested and managed. These changes revised statutory consultative protocols for the establishment of marine reserves, provided clear guidance for commercial activities in marine reserves, and established the MPRA. The New Horizons policy released in June 1998

(Government of Western Australia 1998) provided policy guidance in respect to the establishment and management of marine conservation reserves.

5.3 Legislative Framework

Under the CALM Act, marine conservation reserves are vested in the MPRA and CALM is responsible for their management. The *Wildlife Conservation Act 1950* (WC Act), which is also administered by CALM, provides legislative protection for flora and fauna across the State's lands and waters. The Department of Fisheries (DoF) is responsible for the management and regulation of recreational and commercial fishing, aquaculture and pearling in CALM Act marine conservation reserves in accordance with the *Fish Resources Management Act 1994* (FRM Act). The *Fishing and Related Industries Compensation (Marine Reserves) Act 1997* provides the mechanism by which the holder of an existing DoF authorisation for commercial fishing, aquaculture, pearling or fish processing may seek compensation if the commercial value of the authorisation is apparently diminished by the establishment of a marine nature reserve, or an exclusion zone in a marine park. The *Western Australian Marine Act 1982* and *Navigable Waters Regulations* regulate boating in State waters and apply within marine conservation reserves. These Acts are administered by the Department for Planning and Infrastructure (DPI). In addition, any development that may have a significant impact on the environment in or adjacent to a marine conservation reserve is assessed in accordance with the EP Act by the Environmental Protection Authority (EPA). The Department of Environment (DoE) is responsible for controlling pollution to marine waters.

The proposed reserves lie within State territorial waters. Waters seaward of this limit and extending to the 200 nautical mile limit fall under the jurisdiction of the Commonwealth Government. The proposed reserves encompass many islands within its boundaries which are terrestrial reserves vested in the Conservation Commission of Western Australia and managed by CALM. These terrestrial reserves do not form part of the proposed marine reserves and are not covered by this management plan.

5.4 Responsibilities of Authorities and Government Agencies

CALM is responsible for the overall management of marine conservation reserves under the marine conservation reserve provisions of the CALM Act. CALM also collaborates with other agencies and authorities (i.e. MPRA, Conservation Commission of Western Australia, EPA, and local government authorities) that have responsibilities within marine conservation reserves and in the surrounding waters and coastal areas, to ensure the various regulatory and management practices are complementary. In some cases MOUs are developed to facilitate co-operation and promote operational efficiency. An MOU between EPA and Department of Industry and Resources (DoIR) is being developed to guide assessment of petroleum activities, including within marine reserves. This is an important document in relation to the management of the proposed reserves.

The MPRA plays an important role in the development of marine policy, management plans and in auditing management of marine conservation reserves vested in the Authority. The audit function is an important role aimed to ensure that CALM's management of these reserves is meeting stated objectives and targets. The management plan provides the principal framework by which the MPRA will carry out this function.

The State agencies with statutory responsibilities in marine conservation reserves in Western Australia are listed in Table 1.

Table 1: State authorities and agencies with responsibilities in the proposed reserves

Marine Parks and Reserves Authority	• vesting body for the marine conservation reserves; • provides policy advice to the Minister for the Environment; and • audits management plan implementation by CALM.
Department of Conservation and Land Management	• manages marine conservation reserves vested in the MPRA. This includes the: a) preparation of management plans; b) implementation of the management plan; c) co-ordination with other agencies; d) implementation of education and monitoring programs; e) wildlife research and management; f) management of nature-based tourism; and g) lead role in enforcement (non-fisheries issues). • ensures integrated management of marine conservation reserves with adjoining mainland and island conservation reserves.

Department of Fisheries	• manages and regulates commercial and recreational fishing, aquaculture and pearling in all State waters including marine conservation reserves; and • lead role in enforcement of fisheries legislation within the marine conservation reserves.
Department for Planning and Infrastructure	• responsible for all boating regulations including licensing, safety standards, vessel navigation, marker buoys, moorings, jetties and support facilities such as navigation marks, navigation charts and harbour facilities (NB mooring controls can be delegated to other agencies); • chairs and supports the State Co-ordinating Committee which provides the mechanism to coordinate the management of marine pollution incidents; and • responsible for management of vessel navigation and in the development and management of support facilities.
Department of Environment	• assists the Environmental Protection Authority in the process of assessing proposals that may significantly affect the marine environment, including marine conservation reserves; and • administers pollution control legislation.
Environmental Protection Authority	• assesses reports and makes recommendations on proposals that may significantly affect the marine environment, including marine conservation reserves.
Western Australian Maritime Museum	• protects pre-1900 shipwrecks and artifacts under the *Marine Archaeology Act 1973*. Shipwrecks over 75 years old are declared and protected under the Commonwealth *Historic Shipwrecks Act 1976.*
Department of Industry and Resources	• administers Acts that control mineral and petroleum exploration and development; and • regulates petroleum industry operations.

6 DESCRIPTION OF MANAGEMENT ISSUES

Management of the proposed reserves aims to maintain the ecological and social values of the reserves in the long-term, while providing for recreational and commercial activities where these activities are compatible with maintaining the reserves' values. An important step is to undertake a risk assessment by considering the range of existing and potential pressures on the reserves' key values and their associated ecological and social implications. The level of risk posed by existing and/or potential pressures on the values of the reserves can be assessed by considering the following factors:

- the *temporal* scale of the pressure - pressures that continue over a longer time frame are often of greater concern than short-lived pressures;
- the *spatial* scale of the pressure - pressures that affect a large area are often of greater concern than localised pressures;
- the *trophic* level and conservation status of the species affected by the pressure - pressures that impact on lower trophic levels (i.e. primary producers) are of greater concern than those at higher trophic levels (i.e. secondary consumers) as a result of potential cascading effects on the whole ecosystem;
- the likelihood (*probability* and *frequency*) of a pressure occurring; and
- the *consequences* of the pressure (the ecological or socio-economic implications and the manageability of the pressure).

It is therefore necessary to determine how each value is, or is likely to be, affected by existing or future pressures. The natural attributes and the major uses of the Montebello/Barrow islands region are well known. However, the short-term and long-term cumulative ecological effects of pressures on the environment are not fully understood. For the purposes of the management plan, pressures on the values are confined to current pressures and pressures likely to occur during the life of the management plan and considered to be manageable within a marine conservation reserve context. By definition this excludes such threats as the worldwide global warming phenomenon. The vision and strategic objectives of the plan (Section 3) provide the longer term (>10 years) direction for management of the proposed reserves.

The pressures on the reserves' values are either a primary or secondary impact of user activities. Therefore, the management plan's strategies for the proposed reserves focus primarily on alleviating the effects of human activities. These can be direct effects such as physical disturbance to intertidal sand and mudflat habitats by laying and bottom towing of pipelines or impacts on fish stocks. Indirect effects on the reserves' values can arise from activities such as littering, inappropriate sewage disposal and downstream effects of activities such as introduction of pests from ballast water discharge or sedimentation from dredging and trenching. The pressures on the conservation values of the proposed reserves could increase in the future as use of the area increases, and conflicts between users could emerge. Pro-active strategies involving education programs, spatial controls and active participation of the reserves' users in the on-going management of the reserves will be important strategies in ensuring management objectives are met and conflicts minimised.

7 MANAGEMENT OF ECOLOGICAL AND SOCIAL VALUES

The conservation of marine biodiversity and sustainable management of human activities in the marine environment of Western Australia are achieved through a number of complementary mechanisms that include marine conservation reserves, fisheries regulations, pollution control, environmental impact assessments of development proposals and maritime safety regulations. The management of the proposed reserves employs both specific management strategies (outlined in Section 7) to address the existing pressures on the proposed reserves values and generic strategies to ensure the undesirable effects of future pressures on the marine environment are minimised (outlined in Sections 8 – 9).

The format of this section is based on the best practice principles outlined in the report entitled *Best Practice in Performance Reporting in Natural Resource Management* (ANZECC, 1997). The model is also broadly consistent with the performance assessment framework being developed in the *Strategic Plan of Action for the National Representative System of Marine Protected Areas: A guide for action by Australian Governments* (ANZECC TFMPA, 1999). The objectives, strategies, performance measures and management targets outlined in Section 7 reflect an outcome-based "best practice" approach from which the effectiveness of management can be better assessed. This model has been adopted by the MPRA to facilitate better conservation and management outcomes and a more objective and effective approach to auditing CALM management.

Management Objectives

Management objectives identify **what** the primary aims of management are and reflect the statutory responsibilities of the CALM Act. Objectives have been developed for all of the ecological and social values of the reserves. Where a significant pressure/s on an ecological value has been identified, the management objective addresses the specific pressure/s. When there is not an obvious existing pressure or threat, the management objective provides broader direction to management in relation to protecting the value from the most likely future threats. Management objectives for social values address, where appropriate, the effect of the activity on other reserves' values and the complementary interests of other statutory management arrangements or activities that exist in the reserves.

Management Strategies

Management strategies provide specific direction on **how** the management objective/s for each value might be achieved. All strategies outlined in this plan have been defined as high (**H**), medium (**M**) or low (**L**) priority to provide an indication of their relative importance. The (**H**) strategies considered to be critical to achieving the long-term objectives of the proposed reserves are also designated as *key management strategies* (**H – KMS**). These strategies will also form part of the performance assessment of reserve management by the MPRA, particularly during the initial years of establishing the reserves (see Section 10 – Performance Assessment). A proposed timeline for implementation of the management strategies is outlined in Appendix II. It should be noted that management priorities are likely to alter in response to changes in usage patterns or to new knowledge acquired during the life of the management plan.

Performance Measures

Performance measures are **indicators of management effectiveness** in achieving the reserves' objectives and targets. They are developed for both ecological values and *passive* social values (i.e. those social values that are unlikely to impact negatively on the ecological values of the proposed reserve). Performance measures should be quantitative, representative and, where possible, simple and cost-effective. Performance measures for indirect (e.g. nutrient enrichment impacts on seagrass meadows) and direct (e.g. mooring impacts on seagrass meadows) impacts should focus on surrogate (e.g. changes in phytoplankton biomass and species composition) and direct (e.g. changes in seagrass biomass) measures of the value respectively. Performance measures for some social

values have not been developed due to inadequate existing information. These will be developed during the early phase of the implementation of this plan.

In regard to the *active* social values (i.e. those social values that have the potential to negatively impact on the ecological values of the proposed reserves) a different approach to performance assessment is required. This has been termed *Reporting*, and incorporates information on the status and level of the human activity. This information is important in monitoring human activities to assist in determining trends in use, and to assist in assessing impacts of the social values on the ecological values of the proposed reserves.

Management Targets

Management targets represent the **end points of management**. Targets should be measurable, time bound and expressed spatially. Ecological targets will be set as either the "natural state" or some acceptable departure from the "natural state" and quantitative targets for marine habitats in unzoned areas of the Marine Management Area will be developed in consultation with stakeholders prior to the finalisation of the management plan following additional habitat mapping to more accurately define the extent of habitats. The long-term target provides a specific benchmark to assess the success or otherwise of management action within the life of the management plan. The short-term target provides a benchmark for management to achieve within a specified time period and, in most cases, is a step to achieving the long-term target. Targets have been developed for all ecological and social values. The targets for *active* social values (e.g. recreational fishing, commercial fishing, nature-based tourism, pearling, water sports, and the hydrocarbon exploration and production industry) are process-based and are generally stated as "*Implementation of management strategies within agreed timeframes*". This ensures that strategies for the social values are implemented in accordance with the management objectives.

Key Performance Indicators

Key performance indicators (KPIs) are a **measure of the overall effectiveness** of management in relation to the strategic objectives of the reserves. KPIs relate specifically to the management targets for key ecological and social values and reflect the highest conservation (from biodiversity and ecosystem integrity perspectives) and management (social) priorities of the MPRA, CALM and the community. KPIs are a key element of the MPRA audit process (Section 10).

Given the key values and pressures on the area, the KPIs for the proposed reserves will be based on the management targets for water quality, coral reef communities, mangrove communities, macroalgal and seagrass communities, turtles and finfish.

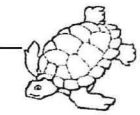
7.1 Ecological Values

Ecological values are the physical, geological, chemical and biological characteristics of an area. Ecological values are significant in terms of their biodiversity (i.e. representative, rare or unique) and ecosystem integrity role. Ecological values also have a social significance in that many social values are functionally dependent on the maintenance of ecological values.

7.1.1 Geomorphology

Ecological value	**Geomorphology**: *A complex seabed and island topography consisting of subtidal and intertidal reefs, sheltered lagoons, channels, beaches and cliffs.*

Background	The geomorphology of the proposed reserves has been influenced by geological events over the last 600 million years, including the collision of the Australian and Indonesian continental plates as Australia drifted northwards. The collision of these two tectonic plates resulted in a series of folds occurring along the north-west coast of Australia, one of which forms the backbone on which the Montebello, Barrow, and Lowendal islands are located. The influence of this tectonic plate movement, along with changes in sea levels and more recent oceanic and climatic conditions, has resulted in the complex geomorphology of the area as seen today. The Montebello Islands consists of 265 distinct, low lying islands and islets composed of limestone and cross-bedded sandstones. The islands have convoluted coastlines, and are dominated by lagoons, channels, intertidal embayments, barrier reefs, intertidal rocky and occasionally sandy shores and shallow limestone platforms exposed to open ocean conditions. The Lowendal Islands contain more than 40 limestone islands, islets and rocky stacks, typically with steep shorelines and with either dunes of white sand, or low lying and rocky with wave cut platforms. The Barrow Island region comprises Barrow Island and nine smaller islands. Barrow Island is composed almost entirely of limestone outcrops and deposits overlain by sands. The island has steep, undercut limestone rocky shores connected with intertidal limestone pavements, typically covered with sand or mud on eastern shores. The Montebello/Barrow islands region comprises a complex geomorphological unit that is unique on the Western Australian coast (MPRSWG, 1994). The complex intertidal and subtidal geomorphology of the area is important as it results in a complexity of marine habitat types and correspondingly high species diversity. Apart from a few locations where hydrocarbon industry pipelines come ashore (east and west sides of Varanus Island and the eastern side of Barrow Island), the geomorphology of the area is relatively undisturbed. Development proposals in the area, including new pipelines are subjected to assessment in accordance with the EP Act. The major pressures on the geomorphology of the proposed reserves relate to physical disturbance from the installation of pipelines and dredging and blasting for shipping channels. Proposed management of the reserves with regard to geomorphology relates to liaison with industry and other agencies to ensure the importance of the geomorphology is taken into account when proposed developments in the area are assessed.
Current status	The geomorphology is generally in an undisturbed condition, apart from some localised disturbance for pipelines and shipping channels.
Existing and potential uses and/or pressures	• Physical disturbance from: ▪ installation of pipelines; ▪ dredging and blasting of shipping channels; ▪ anchoring/mooring; ▪ installation of markers; and ▪ decommissioning of pipelines and platforms.
Current major pressure/s	Physical disturbance from development activities, particularly the installation of pipelines and the dredging and blasting for shipping channels.
Management objective/s	1. To ensure the structural complexity of the proposed reserves' geomorphology is not significantly reduced by installation of pipelines, or construction and infrastructure development. 2. To ensure coastal landforms within the proposed reserves are not significantly degraded by installation of pipelines, or construction and infrastructure development.
Strategies	1. Ensure that approvals and the setting of conditions for new petroleum, nature-based tourism and pearling operations are consistent with the management targets for the value of geomorphology and that appropriate monitoring conditions are applied to ensure these



	outcomes are achieved (DoE/EPA, DoIR, DoF, WATC, CALM). **(H)** 2. Ensure the hydrocarbon industry is informed of relevant management objectives and targets for geomorphology (CALM, DoE). **(H)** 3. Determine the level of existing disturbance/degradation to the geomorphology, to set benchmarks for this value (CALM). **(H)** 4. Educate users about the ecological importance of the reserves' geomorphology (CALM). **(L)**

Performance measure/s	1. Area of hard seabed disturbance (ha). 2. Area of coastal disturbance (ha).	**Desired trend/s**	1. Constant or negative. 2. Constant or negative.
Short-term target/s	Not Applicable.		
Long-term target/s	The targets for geomorphology will be as noted below. i. *Sanctuary* and *recreation* zones – no change, as a result of human activity. ii. *General use* and *special purpose (pearling)* zones of the *marine parks* and *conservation areas* of the *Marine Management Area* – no change except in areas approved by the appropriate government regulatory authority. The cumulative area of change is not to exceed 1% of the total area of these zones. iii. Unzoned areas of the *Marine Management Area*[§] - maintained in a natural state, except for areas where some level of acceptable change is approved by the appropriate government regulatory authority.		

[§]Quantitative targets for geomorphology, water quality, sediment quality and marine habitats in the unzoned areas of the Marine Management Area will be developed in consultation with stakeholders prior to the finalisation of the management plan, or early in the life of this management plan. This process will include additional habitat mapping to more accurately define the extent of marine habitats.

7.1.2 Sediment quality

Ecological value	**Sediment quality**: *The sediments of the proposed reserves are generally undisturbed and are essential to the maintenance of a healthy ecosystem.*

Background	The sediments of the Montebello/Barrow islands region are generally, with the exception of a few small areas of localised impact, in an undisturbed condition. High sediment quality is important for the maintenance of healthy ecosystems. Development and infrastructure proposals that have the potential to impact on sediment quality in the State are subject to assessment under the EP Act. The EPA can set conditions for sediment quality, which are subsequently regulated by the DoE and the DoIR. In this area, localised impacts on the sediment quality are the result of contamination by drilling fluids and cuttings, which may contain heavy metals and other pollutants. However, these impacts are very small. In areas of high shipping activity such as loading facilities and channels, the accumulation of Tributyl tin in the sediments may have negative effects on ecosystem health. Given the relatively low level of shipping in the reserves, this is not believed to be a major issue.
Current status	The sediment quality is generally in an undisturbed condition, apart from some areas of localised disturbance.
Existing and potential uses and/or pressures	• Contaminants from drilling fluids and cuttings. • Sediments from drill cuttings. • Tributyl tin accumulation in areas of high shipping activity.
Current major pressure/s	Contaminants from drilling fluids and cuttings.
Management objective/s	To facilitate long-term management by accumulating spatial and temporal information about impacts on sediment quality of various activities in the proposed reserves.
Strategies	1. Maintain a database of pollutant inputs to sediments (industry, CALM, DoE, DoIR). **(H-KMS)** 2. Minimise impacts on sediments by encouraging, where possible, the use of products that have less impact on the marine biota (DoE/EPA, DoIR, CALM). **(H)**

Performance measure/s	1. Metals and Metalloids. 2. Organic compounds. 3. Ammonia, sulfide and nutrients.	**Desired trend/s**	1. Constant. 2. Constant. 3. Constant.
Short-term target/s	Not Applicable.		
Long-term target/s	The targets for sediment quality will be as noted below. i. <u>*Sanctuary* and *recreation* zones</u> – no change from background[Ω] levels, as a result of human activity. ii. <u>*General use* and *special purpose (pearling)* zones of the *marine parks* and *conservation areas* of the *Marine Management Area*</u> – no change from background[Ω] levels, except in areas approved by the appropriate government regulatory authority. The area not meeting ANZECC guidelines is not to exceed 1% of these zones. iii. <u>Unzoned areas of the *Marine Management Area*[§]</u> - maintained in a natural state, except for areas where some level of acceptable change is approved by the appropriate government regulatory authority.		

[§] Quantitative targets for geomorphology, water quality, sediment quality and marine habitats in the unzoned areas of the Marine Management Area will be developed in consultation with stakeholders prior to the finalisation of the management plan, or early in the life of this management plan. This process will include additional habitat mapping to more accurately define the extent of marine habitats.

[Ω]*background* conditions are determined from an appropriate unimpacted reference site, as per the environmental quality management framework referred to in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000).

7.1.3 Water quality

Ecological value	**Water quality:** *The waters of the proposed reserves are generally pristine and are essential to the maintenance of a healthy marine ecosystem.*

Background	The majority of the waters of the Montebello/Barrow islands region are in a pristine condition. The broad oceanographic processes and the nature of water circulation in the region influence the transport, dispersal and mixing of sediment, biota and pollutants and consequently the water quality of the area. Nearshore water movements and mixing patterns in the Montebello/Barrow islands region are driven primarily by strong currents, large tidal ranges and winds. Wave pumping, seabed topography and the steering effect of islands and reefs also play an important role in water movements and mixing patterns. These water movements and mixing patterns cause rapid flushing in most parts of the Montebello/Barrow islands region. However, some areas, including the lagoons and shallow embayments of the Montebello Islands are subject to limited flushing and a subsequent low rate of exchange between these waters and the surrounding ocean. Sea surface temperatures around the islands range from 20°C in winter to about 30°C in summer, with temperatures sometimes increasing to 33°C in shallow areas. Due to tidal stirring, temperature and salinity are both constant throughout the water column. Water clarity varies throughout the proposed reserves. The reefs and channels on the western side of the Montebello Islands have the highest water clarity in the reserves, due to their exposure to high currents and strong wave action. Channels within the Montebello Islands have relatively low turbidity, while the lagoons with their fine sediments are more turbid. Water turbidity generally increases towards the south-eastern side of Barrow Island, mainly due to the influence of coastal water discharges that have a high load of fine sediments. The National Water Quality Management Strategy provides a framework for water quality management that is based on policies and principles that apply nationwide. It is implemented in Western Australia through the State Water Quality Management Strategy and the State implementation framework (EPA, 2002). Development and infrastructure proposals which have the potential to impact on water quality in the State are subjected to assessment under the EP Act. Conditions are set for water quality, which are regulated by the DoE and the DoIR. Petroleum industry activities have the potential, if not managed appropriately, to have negative impacts on the high water quality of the reserves. Exploration and production by the petroleum industry result in produced formation water (i.e. water with hydrocarbon contamination) and production of drilling fluids. In the proposed reserves, all produced formation water is re-injected and is not discharged into the marine environment. If this were not the case, Burns *et al.* (1999) report that the area of potential biological impact of produced formation water extends up to 900 m from the discharge with skewing in the direction of tidal flow. A separate review on the effects of drilling fluids (which may be water or oil based) on the marine environment has concluded that acute effects of drilling fluids are found only at very high concentrations and are typically observed less than 150 m from the discharge point for short periods after the discharge (Swan *et al.*, 1994). Whilst the effects of drilling operations are relatively localised, there is strong support for techniques such as re-injection of produced formation water to be used in the proposed reserves, to maintain high water quality in the area and avoid localized impacts around the discharge point. The frequency of oil spill in the area is low and in the event of a spill, the effects are likely to be short-term and acute, subsequent to which high water quality is restored via prevailing flushing and currents. In the last twelve years there have been six oil spills within the proposed reserves, ranging in volume from 20 to 25,000 litres (DoIR, pers. comm.). There are currently sewage outfalls from the accommodation facilities on both Barrow and Varanus Islands, as well as some less significant discharge from the pearling industry, houseboats and recreational and commercial vessels. The quantity of sewage is relatively low from these sources and dispersion is rapid. The risk of impacts due to high nutrients is believed to be low from these sources, and probably localised. At the current level of recreational and commercial activities in the proposed reserves, no major pressures on the high water quality in the majority of the area have been identified. Proposed management to maintain the water quality of the proposed reserves includes gaining a better

	understanding of the processes which contribute to the high water quality and development of predictive models in the event of oil spills or shipping accidents.
Current status	The water quality is generally in a pristine condition, apart from some small areas of localised disturbance.
Existing and potential uses and/or pressures	• Toxicants (e.g. accidental spillage of petroleum products, bilge water discharge). • Pollution (e.g. discharge of cooling water, drilling fluids and cuttings, sediments from drill cuttings, nutrients from sewage discharge). • Introduction of pests from ballast water, aquaculture/pearling activities, hull fouling organisms. • Litter.
Current major pressure/s	None.
Management objective/s	To facilitate long-term management by accumulating spatial and temporal information on impacts on water quality of various activities in the proposed reserves.
Strategies	1. Ensure there are appropriate predictive models and specific management plans (given location and weather conditions) for oil spills to assist the State Committee for Combating Oil Pollution in managing any pollution event that occurs (industry, DPI, CALM, DoIR). **(H-KMS)** 2. Ensure there are adequate management resources available to deal with pollution incidents consistent with the risk of such an event occurring (industry, DPI, CALM, DoIR). **(H)** 3. Ensure a pollutant inputs database for the reserves is maintained (industry, CALM, DoE). **(H)** 4. Develop an appropriate understanding of the circulation and mixing of the reserves' waters (CALM). **(M)** 5. Develop an appropriate understanding of the natural variability of the local water quality conditions (CALM, DoIR, industry). **(M)** 6. Encourage a policy of zero discharge where alternatives exist (DoE/EPA, DoIR, CALM). **(M)** 7. Inform users of the proposed reserves about government policy and regulations on boat sewage disposal (CALM, DPI). **(M)**

Performance measure/s	1. Nutrients: *Chlorophyll a* and inorganic N conc. in seawater. 2. Toxicants: conc. in seawater. 3. Pathogens: Faecal coliform conc. in seawater. 4. Litter: Mass (kg) of litter at selected monitoring sites.	**Desired trend/s**	1. Constant or negative. 2. Negative. 3. Negative. 4. Negative.
Short-term target/s (KPI)	Not Applicable.		
Long-term target/s (KPI)	The targets for water quality will be as noted below. i. *Sanctuary* and *recreation* zones – no change from background[Ω] levels, as a result of human activity. ii. *General use* and *special purpose (pearling)* zones of the *marine parks* and *conservation areas* of the *Marine Management Area* – no change from background[Ω] levels, except in areas approved by the appropriate government regulatory authority. The area not meeting ANZECC guidelines is not to exceed 1% (by area) of these zones. iii. Unzoned areas of the *Marine Management Area*[§] - maintained in a natural state, except for areas where some level of acceptable change is approved by the appropriate government regulatory authority.		

[§] Quantitative targets for geomorphology, water quality, sediment quality and marine habitats in the unzoned areas of the Marine Management Area will be developed in consultation with stakeholders prior to the finalisation of the management plan, or early in the life of this management plan. This process will include additional habitat mapping to more accurately define the extent of marine habitats.

$^{\Omega}$*background* conditions are determined from an appropriate unimpacted reference site, as per the environmental quality management framework referred to in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000).

7.1.4 Coral reef communities

Ecological value	**Coral reef communities:** *Undisturbed intertidal and subtidal coral reefs and bommies with a high diversity of hard corals.*

Background	Coral reef communities occur throughout the proposed reserves and together the shallow intertidal and subtidal reef communities comprise approximately 6% (12,588 ha) of the area. The best developed coral reef communities in the proposed reserves are in the relatively clear water and high energy conditions of the fringing reefs to the west and south-west of the Montebello Islands, Bigadda Reef on the west side of Barrow Island and "bommies" and patch reefs in the more turbid and lower energy waters along the eastern edge of the Montebello Islands and south-eastern edge of Barrow Island. The proposed reserves have a high diversity of hard corals with at least 150 species (54 genera) of hard corals recorded to date, from limited surveys (Berry, 1993). Species diversity and community structure vary with different environmental conditions such as exposure to wave action, currents and water clarity. Corals are important primary producers that provide food, substrate and shelter for a wide variety of marine life, including sponges, sea stars, sea urchins, crustaceans, molluscs, worms and fishes, some of which are targeted by recreational and commercial fishers. They also protect coastlines from wave erosion. The coral reef communities in the proposed reserves are currently in a good condition with no significant human impacts reported. Corals can be taken recreationally and commercially under the FRM Act. In 2001 however, the DoF imposed a prohibition on recreational collection of coral that will remain in place until such time as the Minister for Agriculture, Forestry and Fisheries has endorsed a long-term management strategy for this activity. Corals can be collected legally throughout the State under the FRM Act for commercial purposes, by five fishers who hold a Marine Aquarium Managed Fishery Licence with an endorsement to take corals. In addition to the removal of corals, development activities such as installation of petroleum pipelines may impact on corals through direct physical disturbance. In many cases these impacts can be avoided by appropriate placement of such facilities. Due to the area's remoteness and low levels of recreational use, the major pressures on coral reef communities in the proposed reserves are physical disturbance from installation of pipelines and from accidental spillage of petroleum products. Mooring and anchoring is carried out mainly by commercial charter boat operators, and to lesser extent recreational vessels, that use the area. Anecdotal reports from users indicate that mooring and anchoring occurs predominantly on sand areas and as a result has had minimal impact on coral reef communities in the past. However, as nature-based tourism use increases, the use of sensitive coral reefs is likely to increase and controls may be required. Given the major pressures on coral reef communities in the proposed reserves, proposed management of these communities is precautionary. This includes spatial controls to ensure adequate "insurance" against potential impacts and to allow for monitoring, as well as providing areas free of human impact that will provide coral viewing sites. Other proposed management controls include prohibitions on recreational coral collecting and regulation of mooring and anchoring.
Current status	Coral reef communities are generally in an undisturbed condition
Existing and potential uses and/or pressures	• Physical disturbance from: ▪ Installation of pipelines; ▪ Drilling; ▪ Dredging and trenching; ▪ Mooring and anchoring; and ▪ Commercial coral collecting. • Pollution from: ▪ Accidental spillage of petroleum products; ▪ Sedimentation (e.g. drilling, dredging and trenching); ▪ Discharge of cooling water; and ▪ Nutrients from sewage discharge. • Introduction of pests from ballast water, aquaculture/pearling activities, hull fouling organisms.

Current major pressure/s	• Accidental spillage of petroleum products. • Physical disturbance from installing pipelines.
Management objective/s	To ensure coral reef communities are not significantly impacted by accidental spillage of petroleum products or physical disturbance from development activities.
Strategies	1. Implement a zoning scheme that: • provides representative, undisturbed coral reef communities in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated); • provides protection to replenishment source sites; and • provides representative coral reef communities in areas free of significant human influence as an appropriate level of ecological "insurance" (CALM). **(H-KMS)** 2. Assess the nature, level and potential impacts of human activities on coral reef communities within the proposed reserves and implement an appropriate monitoring program (CALM). **(H-KMS)** 3. Ensure all existing and new moorings meet specified environmentally acceptable standards where these moorings are located in sensitive coral habitats (CALM, DPI). **(H)** 4. Ensure that approvals and the setting of conditions for new petroleum, nature-based tourism and pearling operations are consistent with the management targets for coral reef communities and that appropriate monitoring conditions are applied to ensure these outcomes are achieved (DoE/EPA, DoIR, DoF, WATC, CALM). **(H)** 5. Prohibit the commercial and recreational collection of coral within the proposed reserves (DoF, CALM). **(H)** 6. Ensure activities that are potentially detrimental to successful coral reproduction are not carried out during and immediately after the major period of coral spawning (industry, CALM, DoIR, DoE). **(H)** 7. Educate users of the reserves about the ecological importance of coral reef communities and the potential detrimental effects of indiscriminate reef walking, collecting, anchoring and boating on coral reef communities (CALM). **(M)** 8. Ensure the hydrocarbon industry is informed of relevant management objectives and targets for coral reef communities (CALM, DoIR, DoE). **(M)** 9. Ensure the State Committee for Combating Oil Pollution has access to data relevant to the management of oil spills (CALM, DPI). **(M)**

Performance measure/s	1. Diversity. 2. Biomass.	**Desired trend/s**	1. Constant or positive. 2. Constant or positive.
Short-term target/s (KPI)	Not Applicable.		
Long-term target/s (KPI)	1. No loss of coral diversity as a result of human activity in the proposed reserves. 2. The abundance[O] targets for coral reef communities will be as noted below. i. *Sanctuary* and *recreation* zones – no change due to human activity. ii. *General use* and *special purpose (pearling)* zones of the *marine parks* and *conservation areas* of the *Marine Management Area* – no change except in areas approved by the appropriate government regulatory authority. The cumulative area of change is not to exceed 1% (by area) of this habitat in these zones. iii. Unzoned areas of the *Marine Management Area*[§] - maintained in a natural state, except for areas where some level of acceptable change is approved by the appropriate government regulatory authority.		

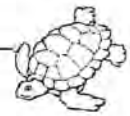
[§] Quantitative targets for geomorphology, water quality, sediment quality and marine habitats in the unzoned areas of the Marine Management Area will be developed in consultation with stakeholders prior to the finalisation of the management plan, or early in the life of this management plan. This process will include additional habitat mapping to more accurately define the extent of marine habitats.

[O]In this context a loss or change in *"abundance" or "biomass"* excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, marine reptiles and marine mammals where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).

7.1.5 Mangrove communities

Ecological value	**Mangrove communities:** *Six species of mangroves are found in the proposed reserves, and the Montebello Islands mangrove communities are considered to be globally unique given their occurrence in lagoons of offshore islands.*

Background	There are six species of mangroves found in the proposed reserves, these being the white mangrove (*Avicennia marina*), ribbed-fruit orange mangrove (*Bruguiera exaristata*), yellow-leaf spurred mangrove (*Ceriops tagal*), red mangrove (*Rhizophora stylosa*), club mangrove (*Aegialitis annulata*) and river mangrove (*Aegiceras corniculatum*). The area of mangals is less than 0.1% (approximately 70 ha) of the total area of the proposed reserves with the majority occurring in the Montebello Islands. The largest mangrove community (approximately 15 ha) is found in Stephenson Channel on Hermite Island, where individual trees can reach 5 m in height. Stunted mangrove trees in narrow fringing strips in embayments are found along approximately 5% of the Barrow Island coastline, and in the Lowendal Islands there are mangroves on less than 0.1% of the coastline. Due to the unusual and scientifically important combination of lagoonal mangrove assemblages occurring in oceanic islands, the mangrove communities at the Montebello Islands are considered to be globally unique (Semeniuk, 1997). The mangrove communities in the proposed reserves are important primary producers, with decomposing leaves providing food for microscopic organisms, which in turn provide food for a variety of other animals that feed either directly on the microbes or the leaves. Many organisms live within the muddy substrate typical of mangrove communities, most notably mud crabs (*Scylla serrata*), and these communities also provide valuable nursery areas for juvenile fishes and crustaceans, some of which are targeted by recreational and commercial fishers. Mangroves are protected throughout the State under the WC Act. In addition, development proposals that may impact on mangrove communities are subject to an environmental impact assessment by the DoE/EPA in accordance with *"Guidance statement for protection of tropical arid zone mangroves along the Pilbara coastline"* (EPA, 2001). This guidance statement, which has its basis in the EP Act, indicates that the EPA's environmental objective in regard to tropical arid zone mangroves of the Pilbara coastline, habitats and dependent habitats is *"to maintain ecological function and sustainability"* (EPA, 2001). Due to their remote and largely inaccessible location, there are few pressures on mangrove communities in the proposed reserves and, as a result, the mangrove communities are currently in a relatively undisturbed condition. The current major pressure that impacts on mangrove communities in the Montebello Islands is that of physical disturbance to the mangroves by fishing for mud-crabs in these habitats. The long term indirect effects of this activity are unknown but direct impacts, such as trampling of aerial roots and damage to individual trees are apparent. Pressures on mangrove communities in the Barrow Island area include some minor physical disturbance for future industry development facilities and infrastructure. Given that physical disturbance, plus extraction of a major component of the community are the most significant threats to mangrove communities, proposed management arrangements include protecting these communities in sanctuary zones. This will alleviate pressure on the mangrove communities from mud-crabbing activity and, given that mud-crabs are also found outside mangrove areas, it will still allow opportunities to take mud-crabs from the proposed reserves.
Current status	The mangrove communities are generally in an undisturbed condition with some localised areas of disturbance at Barrow Island.
Existing and potential uses and/or pressures	• Mud-crabbing- take of crabs. • Physical disturbance (e.g. mud-crabbing, recreational fishing, clearing for facilities, infrastructure and pipelines). • Toxicants (e.g. accidental spillage of petroleum products, use of dispersants, Tributyl tin from ship hulls). • Ropes/litter. • Nutrients from sewage. • Introduction of pests from ballast water, aquaculture/pearling activities, hull fouling organisms. • Dust from land-based activities. • Sedimentation from construction, installation of pipelines, dredging and drill cuttings.



Current major pressure/s	• Over exploitation of mud-crabs and physical disturbance of mangroves from mud-crabbing.
Management objective/s	To ensure that mangrove communities are not significantly impacted by physical disturbance or mud-crabbing in the proposed reserves.
Strategies	1. Implement a zoning scheme that: • protects the majority of mangrove communities in the Montebello Islands from extractive activities; and • provides representative, undisturbed mangrove communities in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated) (CALM, DoF). **(H-KMS)** 2. Educate users of the reserves about the ecological importance of mangroves in the proposed reserves and, in particular, the impacts of physical disturbance and mud-crabbing on mangrove communities (CALM). **(H-KMS)** 3. Annually assess the nature and level of human activities on mangrove communities within the reserves (CALM, industry). **(H)** 4. Monitor "at-risk" mangrove communities (at appropriate temporal and spatial scales), as appropriate, if significant risks are identified in strategy three (CALM, industry). **(H)** 5. Ensure the hydrocarbon and nature-based tourism industries are informed of relevant management objectives and targets for mangrove communities within the proposed reserves (CALM, DoIR). **(H)**

Performance measure/s	1. Diversity. 2. Biomass (extent in ha).	**Desired trend/s**	1. Constant. 2. Constant or positive.
Short-term target/s (KPI)	Not Applicable.		
Long-term target/s (KPI)	1. No loss of mangrove diversity as a result of human activity in the proposed reserves. 2. The abundance[Ø] targets for mangrove communities will be as noted below. i. *Sanctuary* and *recreation* zones – no change due to human activity. ii. *General use* and *special purpose (pearling)* zones of the *marine parks* and *conservation areas* of the *Marine Management Area* – no change except in areas approved by the appropriate government regulatory authority. The cumulative area of change is not to exceed 1% (by area) of this habitat in these zones. iii. Unzoned areas of the *Marine Management Area*[§] - maintained in a natural state, except for areas where some level of acceptable change is approved by the appropriate government regulatory authority.		

[§] Quantitative targets for geomorphology, water quality, sediment quality and marine habitats in the unzoned areas of the Marine Management Area will be developed in consultation with stakeholders prior to the finalisation of the management plan, or early in the life of this management plan. This process will include additional habitat mapping to more accurately define the extent of marine habitats.

[Ø]In this context a loss or change in "*abundance*" or "*biomass*" excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, marine reptiles and marine mammals where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).

7.1.6 Macroalgal and seagrass communities

Ecological value	**Macroalgal and seagrass communities**: *Extensive subtidal macroalgal and seagrass communities which are important primary producers and refuge areas for fishes and invertebrates.*

Background	Macroalgal meadows are the most extensive benthic habitat occupying 40% (approximately 86,920 ha) of the area. This community is the major primary producer in the proposed reserves. These communities are most commonly found on shallow limestone pavement in depths of 5-10 m. The macroalgal assemblage is typically dominated by species of brown algae, particularly of the genera *Sargassum*, *Turbinaria* and *Pandina* while green algae from the genera *Caulerpa* and *Cladophora* are also quite common. Macroalgae are important primary producers, trapping light energy from the sun and making it available to the ecosystem. They also provide important habitat for molluscs, sea urchins, sea stars, crabs and fishes. Seagrasses appear not to form extensive meadows in the proposed reserves but rather, are sparsely interspersed between the macroalgae. A total of six seagrass species have been recorded to date, these being *Cymodocea angustata*, *Halophila ovalis*, *Halophila spinulosa*, *Halodule uninervis*, *Thalassia hemprichii* and *Syringodium isoetifolium*. However, the level of knowledge on seagrass distribution in the proposed reserves is low. Seagrasses are also primary producers and the ephemeral seagrass typically found in the area is likely to be the preferred food source for resident dugong, while turtles feed on both seagrass and macroalgae. Given the ability of macroalgal and seagrass ephemeral communities in the proposed reserves to recover from human impact where water quality and substrate are not diminished, no major pressures on these communities have been identified. Proposed management controls for macroalgal and seagrass communities emphasise maintenance of areas free of human impact for monitoring as well as areas that provide insurance against impacts in the future. Development proposals that may impact on macroalgal and seagrass communities are subject to an environmental impact assessment by the DoE/EPA.
Current status	The macroalgal and seagrass communities are generally in an undisturbed condition.
Existing and potential uses and/or pressures	• Pollution (e.g. accidental spillage of petroleum products, nutrients from sewage discharge). • Tributyl tin from ship hulls. • Physical disturbance (e.g. trenching, dredging, drilling and bottom towing of pipelines). • Future artificial islands (shading). • Introduction of pests from ballast water, aquaculture/pearling activities, hull fouling organisms. • Sedimentation from drilling.
Current major pressure/s	None.
Management objective/s	To gain an increased understanding of the macroalgal and seagrass communities in the proposed reserves to facilitate long-term management.
Strategies	1. Implement a zoning scheme that: • provides representative, undisturbed macroalgal and seagrass communities in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated); and • provides representative macroalgal and seagrass communities in areas free of significant human influence as an appropriate level of ecological "insurance" (CALM). **(H-KMS)** 2. Initiate research and survey programs to provide a more comprehensive assessment of the seagrass communities in the reserves (CALM). **(H-KMS)** 3. Ensure that approvals and the setting of conditions for new petroleum, nature-based tourism and pearling operations are consistent with the management targets for macroalgal and seagrass communities and that appropriate monitoring conditions are applied to ensure these outcomes are achieved (CALM, industry, DoE/EPA, DoF, WATC, DoIR). **(H)** 4. Ensure the hydrocarbon industry is informed of relevant management objectives and targets for macroalgal and seagrass communities (CALM, DoE, DoIR). **(H)** 5. Annually assess the nature and level of human activities on macroalgal and seagrass communities within the reserves (CALM, industry). **(H)** 6. Monitor "at-risk" macroalgal and seagrass communities (at appropriate temporal and spatial scales), as appropriate, if significant risks are identified in strategy five (CALM,

	industry). **(H)** 7. Educate users of the reserves about the ecological importance of macroalgal and seagrass communities (CALM). **(L)**

Performance measure/s	1. Diversity. 2. Biomass.	**Desired trend/s**	1. Constant or positive. 2. Constant or positive.
Short-term target/s (KPI)	Not Applicable.		
Long-term target/s (KPI)	1. No loss of macroalgal and seagrass diversity as a result of human activity in the proposed reserves. 2. The abundance[O] targets for macroalgal and seagrass communities will be as noted below. i. *Sanctuary* and *recreation* zones – no change due to human activity. ii. *General use* and *special purpose (pearling)* zones of the *marine parks* and *conservation areas* of the *Marine Management Area* – no change except in areas approved by the appropriate government regulatory authority. The cumulative area of change is not to exceed 1% (by area) of this habitat in these zones. iii. Unzoned areas of the *Marine Management Area*[§] - maintained in a natural state, except for areas where some level of acceptable change is approved by the appropriate government regulatory authority.		

[§] Quantitative targets for geomorphology, water quality, sediment quality and marine habitats in the unzoned areas of the Marine Management Area will be developed in consultation with stakeholders prior to the finalisation of the management plan, or early in the life of this management plan. This process will include additional habitat mapping to more accurately define the extent of marine habitats.

[O]In this context a loss or change in *"abundance" or "biomass"* excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, marine reptiles and marine mammals where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).

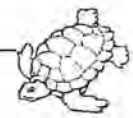
7.1.7 Intertidal sand/mudflat communities

Ecological value	**Intertidal sand/mudflat communities:** *The intertidal sand/mudflat communities of the proposed reserves are primary producers with abundant invertebrate fauna. This in turn provides a valuable food source for shorebirds.*

Background	Intertidal sand/mudflat communities (approximately 2% or 4190 ha of the proposed reserves) consist of sand, mud or silt and occur in sheltered, relatively low energy marine environments that result in depositional conditions. The intertidal sand/mudflat communities in the proposed reserves occur predominantly in the Montebello Islands area and to a lesser extent, along the eastern shore of Barrow Island. While not as extensive as other benthic communities in the proposed reserves, the intertidal sand/mudflat communities are extremely important from a biodiversity conservation perspective, because of the high diversity of infauna (particularly molluscs) found in these habitats. Although typically bare of vegetation, these areas are covered with a surface film of micro-organisms which are a rich source of food for the high diversity of invertebrates they support. This includes bivalve shells, lamp shells or brachiopods, worms, crabs and sea urchins. These invertebrates are found both living on the surface of the sand or mud and burrowing into the substrate, where their burrowing activities regularly turn over the sediment. The abundance of invertebrate life found on intertidal sand/mudflat communities provides a valuable food source for resident and migratory shorebirds. Pressures on intertidal sand/mudflat communities in the proposed reserves are physical disturbance from bottom towing of pipelines and the laying of pipelines on the seabed surface by the hydrocarbon industry. Other sources of physical disturbance on these communities include digging for bait and fossicking on the intertidal flats. Given the low usage of the area these activities do not pose a significant risk at this time. Proposed management of the intertidal sand/mudflat communities in the proposed reserves include the implementation of zones to provide areas of intertidal sand/mudflat communities, free of physical disturbance, to allow for monitoring and to provide an appropriate level of insurance for this community against future impacts. Development proposals that may impact on intertidal sand/mudflat communities are subject to an environmental impact assessment by the DoE/EPA.
Current status	The intertidal sand/mudflat communities in the proposed reserves are generally in an undisturbed condition, apart from some localised disturbance at Barrow Island

Existing and potential uses and/or pressures	• Physical disturbance from:
	  ▪ bottom towing and laying of pipelines;
	  ▪ fossicking and digging for bait; and
	  ▪ construction, e.g. groynes.
	• Accidental spillage of petroleum products.
	• Overfishing from bait and live shell collecting.
	• Introduction of pests from ballast water, aquaculture/pearling activities, hull fouling organisms.
	• Tributyl tin from ship hulls.
	• Nutrients from sewage discharge.

Current major pressure/s	Physical disturbance from development activities.
Management objective/s	To ensure that intertidal sand/mudflat communities are not significantly impacted by development activities in the proposed reserves.
Strategies	1. Implement a zoning scheme that: • provides representative, undisturbed intertidal sand/mudflat communities in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated); • protection of significant intertidal sand, silt and mudflat communities from unacceptable disturbance from development activities or extractive activities (e.g. laying of pipelines on the seabed); and • provides representative intertidal sand/mudflat communities in areas free of significant human influence as an appropriate level of ecological "insurance" (CALM). **(H-KMS)** 2. Liaise with DoE and the hydrocarbon industry to ensure that development proposals have minimal impact on intertidal sand/mudflat communities (CALM, industry, DoIR, DoE).



	(H-KMS) 3. Ensure that approvals and the setting of conditions for new petroleum, nature-based tourism and pearling operations are consistent with the management targets for intertidal sand/mudflat communities and that appropriate monitoring conditions are applied to ensure these outcomes are achieved (CALM, industry, DoE/EPA, DoF, DoIR, WATC). **(H)** 4. Ensure the hydrocarbon industry is informed of the management objectives and targets for intertidal sand/mudflat communities within the proposed reserves (CALM, DoE). **(M)**

Performance measure/s	1. Diversity. 2. Abundance of indicator species.	**Desired trend/s**	1. Constant. 2. Constant or positive.
Short-term target/s	Not Applicable.		
Long-term target/s	1. No loss of intertidal sand/mudflat community diversity as a result of human activity in the proposed reserves. 2. The abundance[Ø] targets for intertidal sand/mudflat communities will be as noted below. i. *Sanctuary* and *recreation* zones – no change due to human activity. ii. *General use* and *special purpose (pearling)* zones of the *marine parks* and *conservation areas* of the *Marine Management Area* – no change except in areas approved by the appropriate government regulatory authority. The cumulative area of change is not to exceed 1% (by area) of this habitat in these zones. iii. Unzoned areas of the *Marine Management Area*[§] - maintained in a natural state, except for areas where some level of acceptable change is approved by the appropriate government regulatory authority.		

[§] Quantitative targets for geomorphology, water quality, sediment quality and marine habitats in the unzoned areas of the Marine Management Area will be developed in consultation with stakeholders prior to the finalisation of the management plan, or early in the life of this management plan. This process will include additional habitat mapping to more accurately define the extent of marine habitats.

[Ø]In this context a loss or change in "*abundance*" or "*biomass*" excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, marine reptiles and marine mammals where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).

7.1.8 Rocky shore/intertidal reef platform communities

Ecological value	**Rocky shore/intertidal reef platform communities**: *Rocky shores predominate on most of the islands of the proposed reserves and provide habitats for a variety of intertidal organisms, which in turn provide food for shorebirds.*

Background	The majority of the island shores within the proposed reserves are primarily composed of rocky limestone cliffs and horizontal rock platforms. Most of the limestone cliffs are approximately one to two metres above high water level. However, the cliffs on the west coast of southern Barrow Island are 30 m high. The larger tidal ranges within the proposed reserves result in pronounced horizontal zonation of plants and animals such as oysters, barnacles, crabs and molluscs. Beneath the undercut cliffs, intertidal limestone rock platforms extend seaward for up to 100 m. In areas of low wave action, such as the east coasts of the islands of the reserves, a layer of mud or sand often covers the platforms. In more exposed areas, platforms are covered with an algal turf and corals may grow on the outer edges. This habitat supports a myriad of marine animals, whose distribution is controlled by the action of the tides. Bivalve shells, snails, crabs, worms and small fish can seek refuge from desiccation in shallow rock pools at low tide, while larger fish and other marine animals come in to feed on these organisms when the tide is high. Offshore intertidal reefs in the reserves are surrounded by coral reef communities and support coralline algae and a range of invertebrates. The abundance of invertebrate life on rocky shores provides a valuable food source for shorebirds and these areas contribute significantly to the variety of habitats and therefore the biological diversity of the proposed reserves. Under the FRM Act, DoF is responsible for the management of the recreational and commercial take of invertebrate species from rocky shore/intertidal reef platform communities. Any development proposals that may impact on rocky shore/intertidal reef platforms are subject to assessment under EPA guidelines. Given the low level of human usage of the proposed reserves, there are no current major pressures on the rocky shore/intertidal reef platform communities. Management of these communities in the proposed reserves will relate to the use of spatial controls to provide for areas of no impact in which monitoring can be undertaken, as well as education of users of the reserves about the importance of this value.
Current status	The rocky shore/intertidal reef platform communities are generally in an undisturbed condition.
Existing and potential uses and/or pressures	• Physical disturbance from human activity, infrastructure development. • Litter. • Sewage. • Transition zone seismic. • Overfishing by recreational and commercial fishers including collecting. • Accidental spillage of petroleum products.
Current major pressure/s	None.
Management objective/s	To gain an increased understanding of the rocky shore/intertidal reef platform communities in the proposed reserves to facilitate long-term management.
Strategies	1. Implement a zoning scheme that: • provides for representative, undisturbed rocky shore/intertidal reef platform communities in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated) (CALM). **(H-KMS)** 2. Initiate research programs to characterise the flora and fauna of selected rocky shore/intertidal reef platform communities within the proposed reserves (CALM). **(M)** 3. Educate users of the reserves about the detrimental effects of human activities on rocky shore/intertidal reef platform communities (CALM). **(M)** 4. Ensure the hydrocarbon industry considers appropriate methods when performing transition zone seismic activities in these areas (DoE/EPA, DoIR, CALM). **(M)**

Performance measure/s	1. Diversity. 2. Abundance of indicator species.	**Desired trend/s**	1. Constant or positive. 2. Constant or positive.
Short-term target/s	Not Applicable.		
Long-term	1. No loss of rocky shore/intertidal reef platform community diversity as a result of human		

target/s	activity in the proposed reserves. 2. The abundance[Ø] targets for rocky shore/intertidal reef platform communities will be as noted below. i. *Sanctuary* and *recreation* zones – no change due to human activity. ii. *General use* and *special purpose (pearling)* zones of the *marine parks* and *conservation areas* of the *Marine Management Area* – no change except in areas approved by the appropriate government regulatory authority. The cumulative area of change is not to exceed 1% (by area) of this habitat in these zones. iii. Unzoned areas of the *Marine Management Area*[§] - maintained in a natural state, except for areas where some level of acceptable change is approved by the appropriate government regulatory authority.

[§] Quantitative targets for geomorphology, water quality, sediment quality and marine habitats in the unzoned areas of the Marine Management Area will be developed in consultation with stakeholders prior to the finalisation of the management plan, or early in the life of this management plan. This process will include additional habitat mapping to more accurately define the extent of marine habitats.

[Ø]In this context a loss or change in "*abundance*" or "*biomass*" excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, marine reptiles and marine mammals where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).

7.1.9 Marine mammals

Ecological value	**Marine mammals**: *Ten species of cetaceans are recorded from the proposed reserves, with the humpback whale passing through the area during its annual migration. Dugongs also occur in the shallow warm waters.*

Background	A total of seven species of toothed whale and three species of baleen whale have been recorded from the Montebello/Barrow islands region, including the minke whale, Bryde's whale, humpback whale, sperm whale, short-finned pilot whale, killer whale, false killer whale, common dolphin, striped dolphin and bottlenose dolphin. The migration path of the humpback whale passes through the proposed reserves (Figure 5) during the annual migration north to the warm tropical waters off the Pilbara and Kimberley coasts in June and July to give birth and suckle their young. An area of sheltered water to the west of Trimouille Island in the Montebello group is used as a resting area for female humpback whales and their young calves during their southerly migration to feeding grounds in Antarctica for the summer months. The dugong (*Dugong dugon*) occurs throughout the tropical and subtropical Indo-West Pacific but has been reduced to relict populations separated by large areas in which it is extinct or close to extinction. In the proposed reserves, dugongs are frequently found in the shallow, warm waters in the vicinity of the Montebello Islands, Lowendal Islands and Barrow Shoals, though not in the comparatively large or dense concentrations seen further south in Exmouth Gulf or Shark Bay. Current knowledge of the size, distribution and migratory habits of dugong populations in the region is limited. A survey by Prince (2001) of dugong numbers in the Pilbara estimated a Pilbara population of approximately 2000 individuals. The seagrass beds around the Lowendal Islands are thought to provide a valuable food source for these animals. All marine mammals are fully protected under the WC Act. The humpback whale (*Megaptera novaeangeliae*) is a threatened species of baleen whale that is declared to be specially protected under the WC Act due to over-exploitation during the whaling era. The dugong is specially protected under the WC Act. Due to the low level of usage, there are no current major pressures on the marine mammal populations in the proposed reserves. Management of the proposed reserves will focus on undertaking further research to determine the importance of the area for marine mammals in the reserves and educating users of the reserves about marine mammals.
Current status	Whales and dolphins - population generally undisturbed in the proposed reserves. Dugongs - population status unknown in the proposed reserves.
Existing and potential uses and/or pressures	• Physical disturbance by visitors and fishers in the proposed reserves. • Physical disturbance from seismic survey. • Entanglement in fishing gear and litter. • Pollution from accidental spillage of petroleum products.
Current major pressure/s	None.
Management objective/s	To gain an increased understanding of marine mammals in the proposed reserves to facilitate long-term management.
Strategies	1. Undertake research to ascertain the regional importance of the Montebello/Barrow islands area for dugongs and the relative importance of areas within the reserves (CALM). **(H-KMS)** 2. Ensure relevant industry activities are undertaken at times and places that do not conflict with humpback whale migration through the reserves (CALM, DoE/EPA, DoIR, DoF). **(H-KMS)** 3. Ensure that offshore developments do not have significant impacts on marine mammals through the provision of advice to the DoE/EPA (CALM). **(M)** 4. Educate users of the reserves on the possible detrimental impacts of human activities on marine mammals (CALM). **(M)** 5. Maintain records of the incidence of entanglement, boat collisions and strandings of marine mammals in the reserves (CALM). **(L)**

Performance measure/s	1. Diversity. 2. Abundance.	**Desired trend/s**	1. Negative. 2. Negative.

Short-term target/s	To be developed.
Long-term target/s	1. No loss of marine mammal diversity as a result of human activity in the proposed reserves. 2. No loss in marine mammal abundance[Ø] as a result of human activity in the proposed reserves.

[Ø]In this context a loss or change in "*abundance*" *or* "*biomass*" excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, marine reptiles and marine mammals where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).

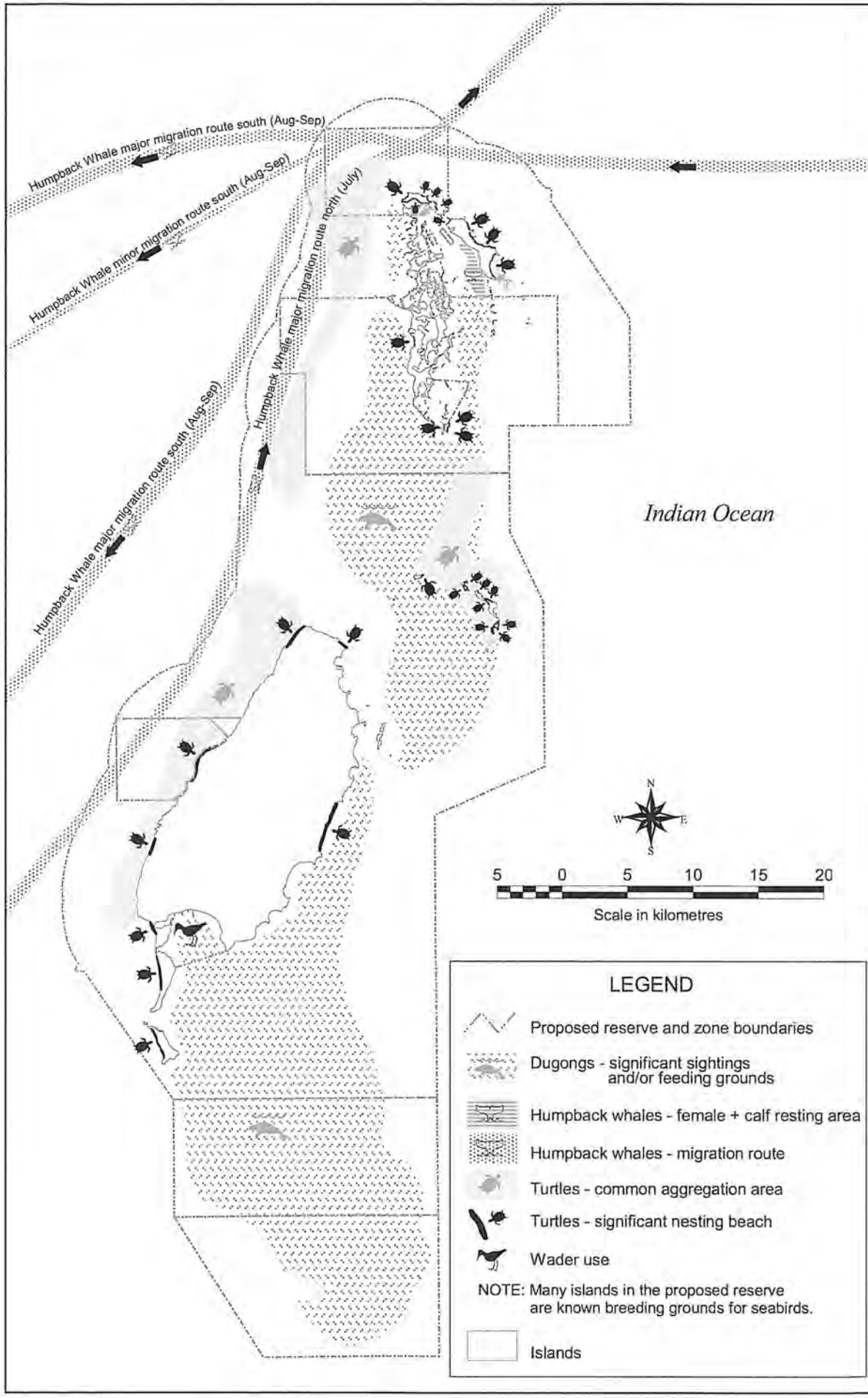


Figure 5: Significant wildlife distribution in the proposed Montebello/Barrow islands marine conservation reserves

7.1.10 Turtles

Ecological value	**Turtles**: *Loggerhead, green, flatback, hawksbill and leatherback turtles are found in the proposed reserves, with the hawksbill population in Western Australia being the largest remaining in the Indian Ocean. All species except the leatherback use sandy beaches in the proposed reserves for nesting.*

Background	Australia is one of the few countries in the world still to have relatively large turtle populations and the Montebello/Barrow islands region provides an important habitat and undisturbed nesting areas for these populations. Five species of marine turtle have been recorded from the proposed reserves, these being the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), flatback (*Natator depressus*), hawksbill (*Eretmochelys imbricata*), and leatherback (*Dermochelys coriacea*) turtles. The hawksbill population in Western Australia is the largest remaining population in the Indian Ocean. Of the species that do occur in the proposed reserves, the green, hawksbill and flatback regularly use the sandy beaches in the proposed reserves for breeding, while occasional nesting by loggerheads has been recorded on Barrow Island. Aggregations of turtles occur along the western edge of the Montebello Islands during various times of the year, as well as mating aggregations south of North-West Island. As the population numbers of marine turtles are declining worldwide due to direct and indirect impacts, the Montebello/Barrow islands, which provide areas relatively free of human impact, will increase in significance in terms of their value to turtle populations. Green, hawksbill, leatherback and flatback turtles are threatened species declared to be vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the loggerhead is a threatened species declared to be endangered under this Act. Loggerhead, leatherback, green, hawksbill and flatback turtles are threatened species declared to be specially protected under the WC Act. The current major pressure on turtles in the proposed reserves relates to the impacts of lights and flares from pearling and hydrocarbon industry operations on new hatchlings. The hatchlings use the lighter horizon over the ocean to orientate themselves to head out to sea. Lights and flares from industry attract the hatchlings so not only do they become disorientated, but also become vulnerable to attack from predators such as gulls, which are also attracted to the lights. Management of the proposed reserves will include the use of spatial controls for protection of turtle nesting and aggregation sites, as well as regulation of the use of appropriate lighting by existing and future industry in the region.
Current status	Population probably stable in the proposed reserves.

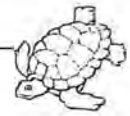
Existing and potential uses and/or pressures	• Lighting and flares causing disorientation and increased predation of hatchlings.
	• Accidental spillage of petroleum products.
	• Entanglement in fishing nets.
	• Physical disturbance from:
	  ▪ people on foot, vehicles on or near beaches and people in the water;
	  ▪ seismic surveys; and
	  ▪ sand extraction and other physical disturbances to nesting beaches.
	• Litter – entanglement and ingested.

Current major pressure/s	Lighting and flares causing disorientation and increased predation of turtle hatchlings.
Management objective/s	To ensure no loss of species diversity of turtles and that abundance of turtles is not significantly impacted by lighting and flares attracting hatchlings in the proposed reserves.
Strategies	1. Implement a zoning scheme that: • provides for protection of significant sites for turtle nesting beaches; and • provides for protection of large turtle aggregations in the vicinity of North-West Island and between Wonnich and South-West Reefs (CALM). **(H-KMS)** 2. Ensure that licences for pearling/aquaculture, nature-based tourism and hydrocarbon operations contain conditions to minimise the impacts of lights and flares on turtle hatchlings (DoE/EPA, DoIR, DoF, WATC, CALM). **(H-KMS)** 3. Determine the impacts of lights on hatchling survival (due to disorientation and predation by silver gulls) (CALM, industry). **(H-KMS)** 4. Ensure that mating aggregations and nesting activities of turtles are not significantly

	disturbed by recreational boating, nature-based tourism, pearling/aquaculture and hydrocarbon operations (CALM, DoE/EPA, DoF, WATC). **(H)** 5. Monitor turtle nesting activities to determine the relative importance of nesting beaches and to assess long term changes in abundance and usage of sites (CALM, industry). **(M)** 6. Facilitate research applicable to the management of turtles in the proposed reserves (CALM). **(M)** 7. Educate users of the reserves on the possible detrimental impacts of human activities on nesting turtles in the reserves (CALM). **(M)** 8. Maintain a database of turtle mortality and incidents of entanglement in the proposed reserves (CALM). **(L)**

Performance measure/s	Number of nesting females (by species) on individual beaches.	**Desired trend/s**	Constant or positive.
Short-term target/s (KPI)	Not Applicable.		
Long-term target/s (KPI)	1. No loss of turtle diversity as a result of human activity in the proposed reserves. 2. No loss of turtle abundance[Ø] as a result of human activity in the proposed reserves.		

[Ø]In this context a loss or change in "*abundance*" *or* "*biomass*" excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, marine reptiles and marine mammals where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).



7.1.11 Seabirds

Ecological value	**Seabirds**: *Islands within the proposed reserves are nesting areas for 15 species of seabirds. The proposed reserves also provide important feeding and resting areas for migrating shorebirds.*

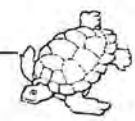
Background	The Montebello/Barrow islands region is a significant rookery for at least 15 species of seabirds. Wedge-tailed shearwaters (*Puffinus pacificus*), crested terns (*Sterna bergii*), bridled terns (*Sterna anaethetus*) and roseate terns (*Sterna dougallii*) have large nesting populations on North West Shelf islands. The largest breeding colony of roseate terns in Western Australia is located in the Montebello Islands. At least 61 islands in the Montebello group are used for nesting. At the change of season, particularly in March, many migrating seabirds use the waters to the west of the Montebello Islands. The proposed reserves are also an important resource for a variety of resident and migratory shorebird species that feed on the worms, bivalves and other invertebrates in the sand and mudflats. Seabird and shorebird colonies which breed on the island nature reserves and rocky outcrops that are scattered throughout the area are protected from introduced ground predators, such as foxes and feral cats, which occur on the mainland. As well as being of ecological significance, these seabird colonies are one of the attractions for people who visit these islands. Many of the sea and shorebirds within the proposed reserves are covered by international treaties with Japan and China, so Australia has an international obligation to protect these species. All birds are fully protected under the WC Act. Due to the low level of usage, there are no current major pressures on seabirds in the proposed reserves. Disturbance of seabird rookeries on the islands in the region will be addressed under a separate management plan for these terrestrial reserves. Management of seabirds in the proposed reserves will include implementation of spatial controls to provide protection to seabird nesting and roosting areas.
Current status	Population probably stable in the proposed reserves.

Existing and potential uses and/or pressures	• Physical disturbance from:
	  ▪ Visitation including boats and helicopters near nesting colonies;
	  ▪ Future nature-based tourism operations;
	  ▪ Visitors reef/rock fishing; and
	  ▪ Removal or disturbance to habitat by construction.
	• Accidental spillage of petroleum products.
	• Entanglement in litter.
	• Displacement by silver gulls.

Current major pressure/s	None.
Management objective/s	To gain an increased understanding of the seabirds of the proposed reserves to facilitate long-term management.
Strategies	1. Implement a zoning scheme to provide for the: • protection of significant seabird and shorebird nesting sites; and • protection of large seabird and shorebird aggregations (CALM). **(H-KMS)** 2. Encourage the completion and implementation of CALM management plans for the island reserves (CALM). **(H)** 3. Minimise the increase in silver gull numbers by: • discouraging feeding of silver gulls by employees and visitors though education programs; • liaising with industry regarding lighting to reduce night-time feeding opportunities for silver gulls; and • liaising with industry and local government regarding rubbish disposal and freshwater sources (CALM, industry). **(M)** 4. Ensure that important seabird and shorebird breeding and feeding areas are not significantly affected by human activities (CALM, industry). **(M)** 5. Educate users of the reserves on the ecological significance of the reserves' seabird and shorebird populations and the potential detrimental impacts of human disturbance (CALM). **(L)**

Performance measure/s	To be developed.	**Desired trend/s**	To be developed.
Short-term target/s	Not Applicable.		
Long-term target/s	1. No loss of seabird and shorebird diversity as a result of human activity in the proposed reserves. 2. No loss of seabird and shorebird abundance[Ø] as a result of human activity in the proposed reserves.		

[Ø]In this context a loss or change in *"abundance" or "biomass"* excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, marine reptiles and marine mammals where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).



7.1.12 Finfishes

Ecological value	**Finfishes**: *A rich finfish fauna with at least 456 species.*

Background	A total of 456 fish species from 75 families were recorded from the Montebello Islands during a 1993 Western Australian Museum survey (Allen, 2000). While a small number of these species are found only in the north-west of the State, most of the species have relatively wide distributions throughout the Indo-West Pacific region. Two of the pipefish species recorded, these being *Doryrhamphus multiannulatis* and *Phoxocampus belcheri*, represent new records for Australia. The majority of the fish species found in the area have eggs or larvae that are dispersed in the water column. It is therefore likely that recruitment is supplemented from elsewhere, such as the Dampier Archipelago, Rowley Shoals and outer reefs upstream in the Leeuwin Current. It is also likely that the proposed reserves are an important source of recruits for more southerly destinations along the Western Australia coast. Some of the fish species found within the proposed reserves are important to commercial and recreational fishers. These include sharks, north-west snapper (*Lethrinus* spp.), Spanish mackerel (*Scoberomorus* spp.), red emperor (*Lutjanus sebae*), coral trout (*Plectropomus* spp.), sea perch (*Lutjanus* spp.), golden trevally (*Gnathanodon speciocus*) and cod (*Epinephelus* spp. and *Cephalopholis* spp.). Under the FRM Act, the DoF is responsible for the management of the recreational and commercial take of finfish species. Under this Act, the potato cod (*Epinephelus tukula*) and the hump head maori wrasse (*Cheilinus undulatus*), which occur in the proposed reserves, are totally protected. The whale shark (*Rhincodon typus*) is also protected under the FRM Act and the WC Act and although no sightings have been recorded to date, it is likely that this species frequents the proposed reserves. Given the low level of commercial and recreational fishing in the proposed reserves, it is considered that there are no current major pressures on finfishes. The management of finfish species that are extracted needs to consider the viability of the populations of these species in the context of maintaining the values of the proposed reserves. Fisheries management scales are rarely reconciled with the spatial scales of proposed reserves and impacts on some populations of fish stocks in the reserves could occur even though the fishery is being managed on a sustainable basis at the broader scale. To overcome this potential problem, consideration is required as to the appropriateness of recreational and/or commercial extraction of these species and whether specific finfish species should be protected in part or all of the proposed reserves. This decision would be based on a number of factors including species distribution, abundance, life history and an assessment of the ecological and social importance of the species in the context of the reserves (e.g. "icon" species). Species for which take is considered appropriate will be managed by DoF, in accordance with Ecologically Sustainable Development principles. The remaining species will be protected throughout the proposed reserves using appropriate legislation.
Current status	Fish populations are generally in an undisturbed condition, apart from some localized impacts of selected site-attached species.
Existing and potential uses and/or pressures	• Recreational fishing. • Commercial fishing. • Accidental spillage of petroleum products. • Introduction of pests from ballast water, aquaculture/pearling activities, hull fouling organisms.
Current major pressure/s	None.
Management objective/s	To gain an increased understanding of the finfish diversity and abundance throughout the proposed reserves to facilitate long-term management.
Strategies	1. Implement a zoning scheme that: • provides protection to important fish spawning aggregation sites and nursery areas in the proposed reserves; and • provides representative, undisturbed finfish populations in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated) (CALM). **(H-KMS)**

	2. Identify finfish species that can be taken by recreational and commercial fishers in the reserves and, in liaison with DoF, provide the necessary legislation to provide protection for species which will not be extracted (CALM, DoF). **(H)** 3. Review the need for special conditions (e.g. bag limits and possession limits) for target finfish species in the proposed reserves (DoF). **(H)** 4. Undertake research programs to characterise finfish diversity and abundance in the reserves (CALM, DoF). **(M)**

Performance measure/s	1. Abundance. 2. Diversity.	**Desired trend/s**	1. Constant or positive. 2. Constant or positive.
Short-term target/s (KPI)	To be developed.		
Long-term target/s (KPI)	1. No loss of finfish diversity as a result of human activity in the proposed reserves. 2. No loss in protected finfish species abundance[Ø] as a result of human activity in the proposed reserves. 3. No loss in targeted finfish species abundance[Ø] in *sanctuary zones* of the *marine parks* and the *conservation area (flora/fauna protection)* of the *Marine Management Area* as a result of human activity in the proposed reserves. 4. Management targets for abundance of targeted finfish species in all other areas to be determined in consultation with Department of Fisheries and peak bodies.		

[Ø]In this context a loss or change in *"abundance" or "biomass"* excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, marine reptiles and marine mammals where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).

7.1.13 *Invertebrates*

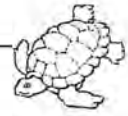
Ecological value	**Invertebrates**: *A diverse marine invertebrate fauna comprising mostly tropical species.*

Background	Marine invertebrates are those marine animals without a backbone and include such animals as corals, sponges, rock lobster, squid, cuttlefish, shells, jellyfishes, seastars and anemones. The proposed reserves have a high diversity and abundance of invertebrate species, which is attributed to the wide range of habitats. The invertebrate fauna comprises tropical species, which are common throughout the Indo-West Pacific region. Knowledge of the invertebrate fauna of the proposed reserves is incomplete, although some survey work has been undertaken in the Montebello Islands. Data from these limited surveys indicate that the Montebello Islands region is home to the highest number (633 species) of molluscs recorded from any tropical reef system in Western Australia, and is the type locality of a number of species (Wells *et al.*, 1993). The echinoderm fauna of the Montebello Islands is rich in species compared with most other areas in Western Australia, with a total of 170 species of echinoderms recorded in the region. Some of the recorded echinoderm species are thought to be undescribed species and several are thought to be new records for Australia (Marsh, 1993b). Sea stars, sand dollars, heart urchins and sea cucumbers are found in soft bottom and/or reef habitats. The invertebrate fauna is a food source for fishes and migratory birds. Several invertebrate species, including oysters, squid, sea cucumbers and shells are targeted by commercial and recreational fishers and collectors. Under the FRM Act, the DoF is responsible for the management of the recreational and commercial take of invertebrate species. Because of the low level of commercial and recreational fishing in the proposed reserves, it is considered that there are no current major pressures on invertebrates. The management of invertebrate species that are extracted needs to consider the viability of the populations of these species in the context of maintaining the values of the proposed reserves. Fisheries management scales are rarely reconciled with the spatial scales of marine conservation reserves and impacts on some populations of fish stocks in the reserves could occur even though the fishery is being managed on a sustainable basis at the broader scale. To overcome this potential problem, consideration is required as to the appropriateness of recreational and/or commercial extraction of these species and whether specific invertebrate species should be protected in part or all of the proposed reserves. This decision would be based on a number of factors including species distribution, abundance, life history and an assessment of the ecological and social importance of the species in the context of the reserves (e.g. "icon" species). DoF will manage species for which extraction is considered appropriate, in accordance with Ecologically Sustainable Development principles. The remaining species will be protected throughout the proposed reserves using appropriate legislation.
Current status	Invertebrate populations are generally in an undisturbed condition.
Existing and potential uses and/or pressures	• Recreational and commercial fishing for invertebrates, e.g. shell, bait and beche de mer collecting. • Accidental spillage of petroleum products. • Introduction of pests from ballast water, aquaculture/pearling activities, hull fouling organisms.
Current major pressure/s	None.
Management objective/s	To gain an increased understanding of the invertebrate diversity and abundance throughout the proposed reserves to facilitate long-term management.
Strategies	1. Implement a zoning scheme that: • provides representative, undisturbed invertebrate populations in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated); and • provides protection to replenishment source sites (CALM). **(H-KMS)** 2. Identify invertebrate species that can be taken by recreational and commercial fishing in the reserves and, in liaison with DoF, provide the necessary legislation to provide protection for species which will not be extracted (CALM, DoF). **(H)** 3. Prohibit recreational shell collecting in the proposed reserves (DoF, CALM). **(H)**

	4. Undertake research programs to characterise invertebrate diversity and abundance in the reserves (CALM, DoF). **(M)**

Performance measure/s	1. Diversity. 2. Abundance.	**Desired trend/s**	1. Constant or positive. 2. Constant or positive.
Short-term target/s	Not Applicable.		
Long-term target/s	1. No loss of invertebrate diversity as a result of human activity in the proposed reserves. 2. No loss in protected invertebrate species abundance[Ø] as a result of human activity in the proposed reserves. 3. No loss in targeted invertebrate species abundance[Ø] in *sanctuary zones* of the *marine parks* and the *conservation area (flora/fauna protection)* of the *Marine Management Area* as a result of human activity in the proposed reserves. 4. Management targets for abundance of targeted invertebrate species in all other areas to be determined in consultation with Department of Fisheries and peak bodies.		

[Ø]In this context a loss or change in *"abundance" or "biomass"* excludes losses of a minor, transient or accidental nature. This qualification does not apply to seabirds, marine reptiles and marine mammals where minor or transient losses would be unacceptable (but does not apply to losses due to accidents).



7.2 Social Values

Social values are those cultural, aesthetic, recreational and economic characteristics for which the area is significant or well known. These can include aboriginal and maritime heritage, commercial and recreational usage, aesthetic and cultural values, science and education.

7.2.1 Hydrocarbon Exploration and Production Industry

Social value	**Hydrocarbon Exploration and Production Industry**: *The Montebello/Barrow islands region is the State's most productive petroleum area (for both oil and gas), with Barrow Island producing 34% of the State's oil production.*

Background	Western Australia's petroleum industry began more than 40 years ago and was worth $10,600 million per annum in 2000/2001, making it the State's most valuable commodity. The Pilbara region is the State's most productive petroleum area with 99.3% of the State's oil and 92.2% of the State's gas production (DoIR, pers. comm.). The value of petroleum production from the Montebello/Barrow area alone was worth $498 million in 2000/01 (DoIR, pers. comm.). There are two major petroleum projects within the proposed reserves, these being the Barrow Island Project and the Harriet and East Spar projects on Varanus Island (Figure 6). The Barrow Island Project operated by ChevronTexaco Australia Pty. Ltd. is the State's largest oil producing project, with 34% of total State production (DoIR, pers. comm.). Over 275 million barrels of oil have been produced to date, from 30 reservoirs and 8 producing horizons and a total of 800 wells have been drilled on the Island (DoIR, pers. comm.). The oil field has an estimated production life of a further 25 years. Apache Energy operates the Harriet and East Spar projects on Varanus Island that produce gas condensate and oil. The projects comprise the Harriet, Agincourt, Campbell, Tanami, Sinbad, Rosette, East Spar and Wonnich fields, all of which are linked to the Varanus facilities. The two projects produce approximately 6% of the State's oil production and 25% of domestic gas production. Gas, condensate and oil are produced from 11 wells, seven of which are located on platforms or monopods to the north-east of the island, two onshore and two at sub-sea buoys. There are other petroleum finds within the proposed reserves that are yet to be developed, and due to the presence of east-west faults with the potential to trap oil and gas, the area is considered to be highly prospective. The DoIR is responsible for management of petroleum activities carried out in State waters and is responsible for the assessment, evaluation and approval of petroleum operation proposals in Western Australia (Department of Minerals and Energy, 2000). This is effected via the legislative framework of the *Petroleum (Submerged Lands) Act 1982* which controls marine based petroleum operations, and the *Petroleum Pipelines Act 1969* which governs the construction, operation and maintenance of petroleum pipelines. Petroleum proposals may also be subject to assessment by the EPA under the EP Act and where proposals may impact on matters of national environmental significance, under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, by the Department of Environment and Heritage. The standard approvals process for the petroleum industry, which currently includes referral of petroleum development proposals to a variety of bodies, continues to apply in the proposed reserves. There will not be a duplicated environmental approvals process for petroleum development proposals within the reserves. Conditions and regulations for proposals will continue to be set, monitored and managed by the DoE and the DoIR. The MPRA will be informed of all petroleum development proposals in the proposed reserves and would be expected to provide advice where proposals are formally assessed by the EPA. The MPRA's advice will relate to whether the proposal is consistent with the management plan (i.e. targets for the ecological values and management objectives for the social values). To facilitate such an approach CALM will work towards development of appropriate ecological management targets for all values. The petroleum industry has the potential to impact on the ecological and social values of the proposed reserves, with the most likely scenario of greatest public concern being that of a major oil spill or shipping accident. While the effects of such an incident could be widespread, the historical frequency of such events has been low. Between 1989 and 2001, there were six oil spills within the petroleum permit areas over the proposed reserves during production and exploration activities. Four of these spills were of crude oil and two were of diesel and ranged in volume from 20 to 25,000 litres (DoIR, pers. comm.). The most recent spill was approximately 25,000 litres. However, after investigation by the DoE and DoIR, it was

	concluded that there had been no significant shoreline contact with spilled oil or impact of spilled oil on any islands of the Montebello/Lowendal Islands group (DoE, 1999). This was probably due to the volatility of the products and the prevailing weather/current conditions, which resulted in the spills evaporating quickly. Other potential impacts on the ecological values of the proposed reserves include negative effects of seismic survey on marine animals, impacts from produced formation water and drilling fluids, smothering of marine life by drilling cuttings and possible disorientation and increased predation of turtle hatchlings as a result of the artificial lights which are used at hydrocarbon production facilities. These impacts can generally be mitigated through appropriate management of the activity. The primary role of reserve management in relation to hydrocarbon exploration and production is, in liaison with DoIR and the DoE/EPA, to ensure that hydrocarbon exploration and production activities in the proposed reserves are ecologically and socially sustainable and to ensure equitable access to the proposed reserves for the industry. Drilling for petroleum exploration or production is not permitted in sanctuary, recreation, and special purpose (pearling) zones in the marine parks. Subject to environmental assessment, it can be permitted in all other areas of the marine parks and the Marine Management Area.
Requirements	Equitable access to the proposed reserves.
Management objective/s	1. To ensure that, in collaboration with the hydrocarbon industry and DoIR, hydrocarbon industry activities in the proposed reserves are managed in a manner that is consistent with maintaining the proposed reserves values. 2. Cooperate with the industry and DoIR in the maintenance of a viable hydrocarbon exploration and production industry in the proposed reserves.
Strategies	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and the level of impact of petroleum activities (sufficient and representative appropriate areas); and • provides "insurance" against possible impacts of hydrocarbon activities on the ecological values (CALM). **(H-KMS)** 2. Ensure a coordinated approach to industry assessment and reporting requirements in the proposed reserves (DoE/EPA, DoIR, industry, CALM). **(H)** 3. Ensure the licence conditions of approved petroleum industry projects include: • appropriate environmental performance measures; • desired trends; • short-term and long-term management targets; and • monitoring and reporting requirements (DoE/EPA, DoIR, CALM). **(H)** 4. Ensure that environmental research and monitoring undertaken by industry is coordinated and maximise opportunities for collaboration to increase understanding and knowledge of the area (CALM, DoIR, industry). **(H)** 5. Ensure other users of the reserves do not unnecessarily restrict future petroleum industry opportunities in appropriate areas in the reserves (CALM). **(M)**

Reporting	To be developed.
Target/s	Implementation of management strategies within agreed timeframes (Appendix II).

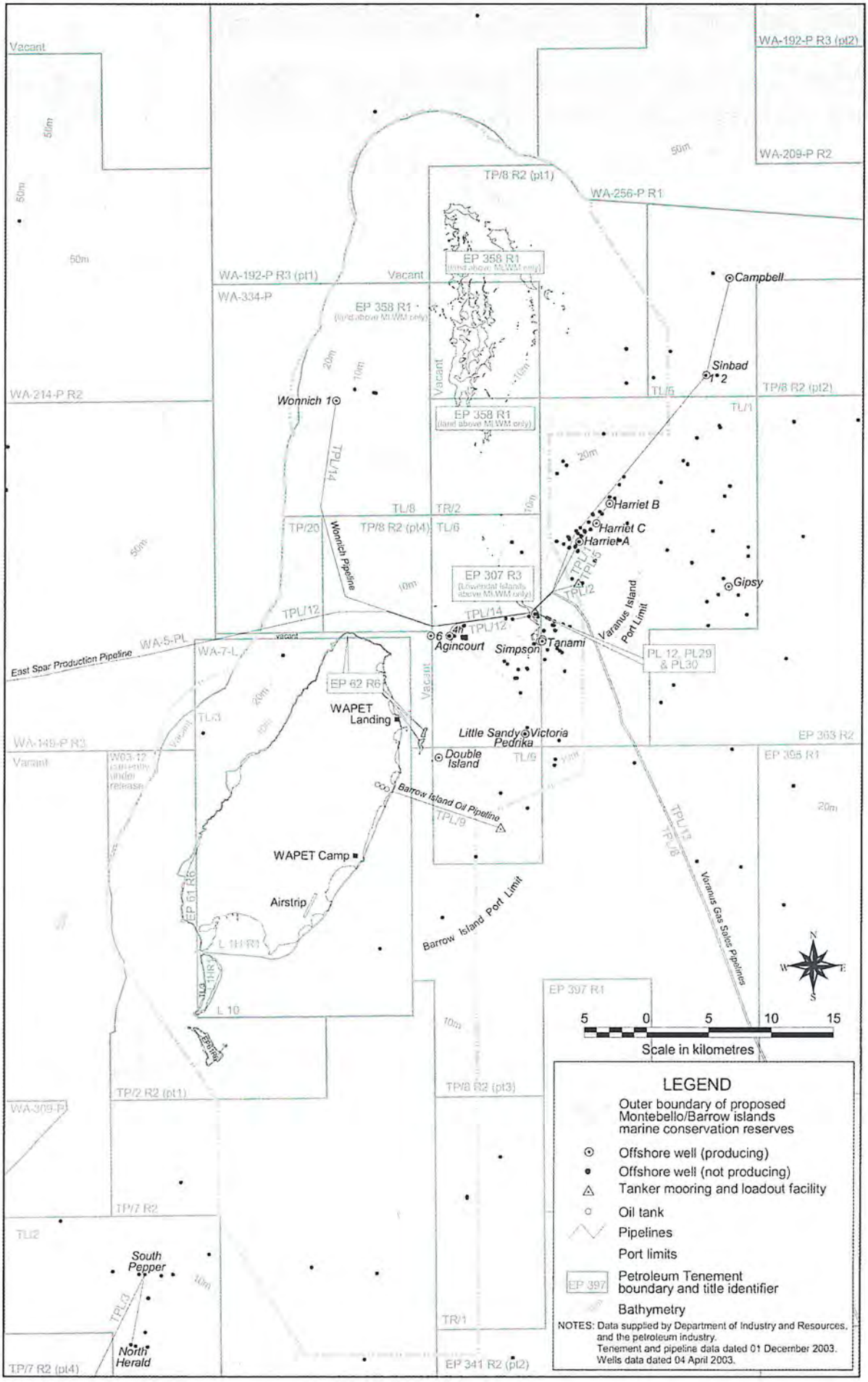


Figure 6: Petroleum tenements, petroleum infrastructure, and port limits within the proposed Montebello/Barrow islands marine conservation reserves

7.2.2 *Pearling*

Social value	**Pearling**: *The warm pristine waters of the proposed reserves provide optimal conditions for production of high quality pearls by the existing pearling operations.*

Background	Pearling is the production of pearls from the oyster species *Pinctada maxima*, which are either collected from the wild or grown in hatcheries. The warm water temperatures, high nutrient levels, protection from wave damage, clear sandy bottoms and relatively shallow water of the proposed reserves makes it one of the best areas in the world for pearl production. There are currently two pearling leaseholders in the proposed reserves, these being Morgan & Co. Pty. Ltd. and Fantome Pearls Pty. Ltd. (formerly Cossack Pearls Pty. Ltd.) (Figure 7). The Morgan & Co. lease includes 14 areas in the Montebello Islands, covering approximately 3.79 square nautical miles. The Morgan & Co. site in Claret Bay is used as quarantine area for any shell which is imported from outside the DoF pearling zone one. The Morgan & Co. operation is an important contribution to the industry with the 2001 harvest approximately 50 kan (one kan is equivalent to 3.75 kg), worth approximately $20 million. Fantome Pearls has one pearl lease of 3.59 square nautical miles to the north of Parakeelya Island and two pearl leases of 0.463 square nautical miles and 0.207 square nautical miles in the vicinity of Bridled Island in the Lowendal Islands group. Pearling in Western Australia is managed by DoF under the *Pearling Act 1990* through the granting of licences, quotas and size limits on the collection of wild oysters, restrictions on hatchery production and restrictions on allowable distances between leases to minimise disease transfer. Ministerial Policy Guideline Number 8 (DoF, 1998) sets out guidelines for the assessment of pearling proposals. Pearling is permitted in marine management areas and in general use and appropriate special purpose zones of marine parks. Proposals for new pearling activities involve the referral of the application to the DoE/EPA, CALM, the MPRA and a range of other government, community and industry groups. The approval of the Minister for the Environment is also required. Where the establishment of a marine nature reserve or exclusion zone in a marine park is claimed to have reduced the commercial value of a pearling licence or lease, the licensee or lessee may be eligible for compensation under the *Fishing and Related Industries Compensation (Marine Reserves) Act 1997.* In 2003, the Northern Pearl Oyster Fishery was accredited under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* as an ecologically sustainable fishery. In addition, a review of environmental impacts of pearling (Enzer Marine Environmental Consulting, 1998) concluded, "*... in general the industry is environmentally benign, producing a high value product with a minimum of environmental disruption.*" However, if not carefully managed, activities associated with pearling could have minor localised negative impacts on the ecological and social values of the proposed reserves. This could include impacts from anchoring, shading of benthic fauna by grow out panels, sewage, waste disposal, introduction of marine pests, loss of visual amenity, and perceptions of loss of access by other users. The management of human activities that affect the ecological values (i.e. high water quality and healthy habitats) that are critical requirements of the industry is a key issue for pearling. The primary role of management in relation to pearling in the proposed reserves is to ensure pearling activities are socially and ecologically sustainable and to help maintain the natural values of the proposed reserves on which the industry depends. Activities associated with the pearling industry, such as vessel movement, cleaning of shell and landing of seaplanes will not be unnecessarily restricted within the proposed reserves. Special purpose (pearling) zones are proposed for existing pearling leases that are known to be essential for the production of high quality pearls in the Montebello Islands Marine Park and where no conflict with other users have been identified. It is proposed that lease areas A, B, C, D, G, H, I, J, O and P, as well as the quarantine site in Claret Bay be zoned as special purpose (pearling) to give priority use of these areas. The other existing pearling leases currently held by Morgan & Co. (i.e. lease areas E, F, K and L), as well as Fantome Pearls's lease areas in the Lowendal Islands, are currently being assessed by the two companies in liaison with DoF and CALM, as some of the lease areas may not be suitable and/or be acceptable from an ecological or social perspective. The zoning of these areas as special purpose (pearling) zones will be

	reconsidered in due course by the MPRA following a review and rationalization of the areas concerned which will take into account the ecological and social values in these areas. It should be noted that this does not preclude a lease being held or created within a general use zone of the reserves. Pearling is not permitted in sanctuary and recreation zones of marine parks. It is also not permitted in the Bandicoot Bay Conservation (Benthic Fauna/Seabird Protection) Area or the Barrow Shoals Conservation (Flora/Fauna Protection) Area in the Marine Management Area. It is permitted in the general use and the special purpose (pearling) zones of the marine parks and in the multiple use area of the Marine Management Area.
Requirements	• High water quality. • Equitable access to locations suitable for pearl production in appropriate zones of the proposed reserves. • Detailed knowledge of ecological processes to assist pearling planning and monitoring programs.
Management objective/s	1. To ensure that, in collaboration with the industry and DoF, the pearling industry in the proposed reserves is managed in a manner that is consistent with maintaining the proposed reserves' values. 2. To maintain the ecological values of the proposed reserves that are important to the pearling industry. 3. Cooperate with the industry and DoF in the maintenance of a viable pearling industry in the proposed reserves.
Strategies	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and the level of impact from pearling activities (sufficient and representative appropriate areas); • provides equitable access for the pearling industry in appropriate areas; and • provides "insurance" against possible impacts of pearling activities on the ecological values (CALM). **(H-KMS)** 2. Ensure pearling licences are consistent with the management plan and they include: • conditions requiring environmental monitoring to the satisfaction of DoE and CALM; and • conditions relating to lighting, navigational marking and site utilisation to the satisfaction of DPI and DoF (DoF, CALM, EPA, DPI). **(H-KMS)** 3. In collaboration with the Pearl Producers Association and DoF, assess the need for Codes of Practice for pearling in the reserves to ensure social and ecological sustainability (CALM, DoF, PPA). **(H)** 4. Ensure that proposals for petroleum and nature-based tourism operations do not affect the key ecological requirements for pearling operations (e.g. high water quality) (CALM, DoE/EPA, WATC). **(H)** 5. Ensure that due consideration is given to activities which would unnecessarily exclude future pearling activities in appropriate zones in the reserves (CALM). **(M)** 6. Provide formal advice to DoF and EPA (as appropriate) in relation to the environmental assessment of proposed pearling activity in the reserves (CALM). **(M)**

Reporting	To be developed.
Target/s	Implementation of management strategies within agreed timeframes (Appendix II).

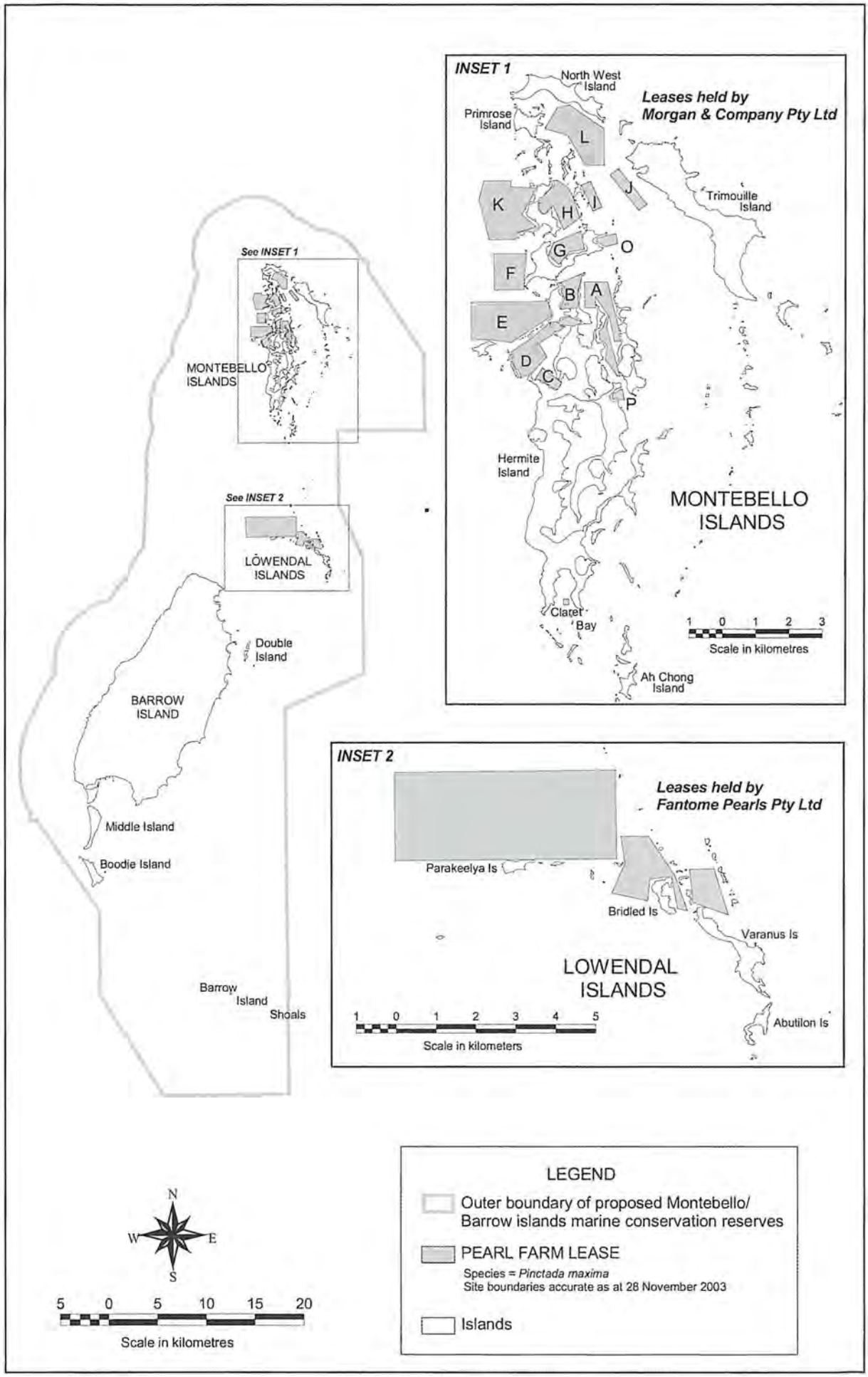


Figure 7: Pearling leases within the proposed Montebello/Barrow islands marine conservation reserves

7.2.3 Nature-based tourism

Social value	**Nature-based tourism**: *The proposed reserves are developing rapidly as an important area for the nature-based tourism industry, with charter boats taking tourists to the Montebello Islands to participate in activities such as fishing, diving, wildlife viewing, island exploring and surfing.*

Background	The wide variety of wildlife and the wild, natural appearance of the land and seascapes within the proposed reserves have the potential to support nature-based tourism. This high nature-based tourism potential was identified in the Pilbara Development Commission's ecotourism management strategy for the Pilbara offshore islands. In 2001/2002, a total of 251,000 domestic tourists visited the Pilbara region, spending approximately $193 million (Western Australian Tourism Commission, pers. comm.). The percentage of these tourists who visited the proposed reserves is unknown, but would be small. At present nature-based tourism in the proposed reserves is limited to a small seasonal charter vessel industry. Approximately 10 charter vessels visit the proposed reserves, with each vessel making between 3 and 27 trips per year between April and November, and passenger numbers per boat trip varying between 4 and 20. The majority of these visits centre on the Montebello Islands, with activities around Barrow Island being rare. Charter vessel passengers participate in SCUBA diving, snorkelling, fishing, mud-crabbing, wildlife appreciation, island exploring and a limited amount of surfing. The area of the Montebello Islands visited depends on the activity being undertaken and charter operators have their preferred areas to which they take passengers. Despite the presence of infrastructure from the hydrocarbon and pearling industries, an attraction for visitors to the Montebello Islands is the sense of isolation and remoteness that can be found in some areas due to the absence of man-made structures and the small number of visitors to the area. These characteristics should be considered when developments are proposed to maintain, where possible, this feature of the area. Until the latter half of 2001 there was no requirement for aquatic tour operators to be licensed by DoF. As a result of recommendations to government it was decided that licensing and management arrangements be implemented to regulate the activities of fishing and aquatic-eco tour operations in Western Australia. DoF considered a "precautionary approach" was required with regard to the fishing tour sector and imposed a restriction on the number of licences granted in order to cap effort as historic levels until the relative impact of fishing tour activities was established. The restriction to industry entry was implemented by the use of a benchmark selection criterion that required the applicant to demonstrate operational history prior to a certain date. Aquatic eco-tourism by its nature is likely to have less of an impact on fish resources than fishing tours and in recognition of this there is no capping of effort and these licenses will continue to be granted. Meanwhile a mandatory research logbook regime will track any potential for adverse impacts on the aquatic environment and fish stocks. Human interactions with wildlife are controlled through the WC Act. When the proposed reserves are created, all non-fishing commercial tour operations will require a license under the CALM Act. Issues for the industry raised by operators include disposal of rubbish, equity of access for charter operators and the current low level of promotion of the area for nature-based tourism. Impacts on some populations due to fishing, especially of mud-crabs, were the greatest concerns among the majority of operators. Nature-based tourism has the potential to make an important contribution to protecting the region's ecosystems by fostering a greater understanding of the environment. However, unless carefully managed, visitation has the potential to cause environmental damage, particularly as the numbers of visitors continues to increase. This includes increases in litter, impacts on fish stocks due to fishing, damage to coastal and island landforms and disturbance to seabirds, marine mammals and nesting turtles. The goal of the proposed reserves' management in relation to nature-based tourism is to manage tourism activities in the reserves in a manner that is consistent with maintaining the reserves' values, to maintain the values of the reserves on which the nature-based tourism industry depends, and assist in maintaining a viable nature-based industry in the reserves. Non-extractive tourism activities will be permitted in all zones of the marine parks. However, in sanctuary and special purpose zones there may be restrictions on activities that are shown to be incompatible with the zone. Extractive tourism activities (i.e. charter fishing) are permitted in accordance with the permitted uses in various management zones (see Table 2).

Requirements	• High water quality. • Equitable access to the natural values of the proposed reserves. • Healthy benthic communities. • High aesthetic quality of the marine environment. • Provision of "undisturbed" areas for nature appreciation.
Management objective/s	1. To manage nature-based tourism in the proposed reserves in a manner that is consistent with maintaining the proposed reserves' values. 2. To maintain the ecological values of the proposed reserves that are important to the nature-based tourism industry. 3. Cooperate in maintaining a viable nature-based tourism industry in the proposed reserves.
Strategies	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and the level of impact of human activities (sufficient and representative appropriate areas); • provides protection to key dive sites and nature-based tourism opportunities; and • provides "insurance" against possible impacts of nature-based tourism activities on the ecological values (CALM). **(H-KMS)** 2. License all nature-based tourism operators within the reserves with appropriate conditions (CALM). **(H)** 3. Develop Codes of Practice for nature-based tourism operations in the reserves including: • performance measures; • desired trends; • short-term and long-term management targets; and • monitoring and reporting requirements (CALM, WATC). **(M)** 4. Ensure equitable access for nature-based tourism within appropriate zones in the reserves (CALM). **(M)**

Reporting	To be developed.
Target/s	Implementation of management strategies within agreed timeframes (Appendix II).

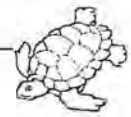
7.2.4 Commercial fishing

Social value	**Commercial fishing**: *The proposed reserves are used by commercial fishers targeting a variety of finfish, sharks, mud-crabs and beche de mer.*

Background	The commercial fisheries which occur in the proposed reserves are the Pilbara Trap Managed Fishery, the North Coast Shark Fishery, Onslow Prawn Managed Fishery and wetline fishery, and to a lesser extent the mud-crab, beche de mer and tropical rock lobster fisheries and shell and aquarium fish collecting. However, many of these fisheries do not operate in the proposed reserves, rarely fish or fish only on the extremities of the reserves. There are two methods used by commercial fishers in the proposed reserves to catch finfish, these being fish trapping and line fishing. The Pilbara Trap Managed Fishery has a total of 6 licences issued and was worth $1.1 million with a total catch of 266 tonnes in 2002 (DoF, 2002). Any fisher with a Western Australian Fishing Boat Licence can potentially fish in the Montebello/Barrow island area (in 2003 there were 1,200 licences in operation). However, a very small proportion of these actually fish in the area. The total line fishing catch in the Pilbara region in 2001 was 99 tonnes worth $0.5 million, with the species making up the greatest proportion of the catch being jobfish (DoF, 2002). Commercial line fishers also troll for spanish mackerel in waters of 20 m depth or more. Commercial boats operating in Commonwealth managed fisheries such as tuna longliners can access the waters of the proposed reserves but are currently not active in the region. The seven licensed operators in the North Coast Shark Fishery have access to the proposed reserves and in 2001 landed approximately 272 tonnes worth about $0.9 million (DoF, 2002). Hook and line techniques are used by this fishery, including drop lines and long lines, and a wide range of species including black tip, spot tailed, hammerhead and milk sharks and a variety of whalers are targeted. Zones 2 and 3 of the Onslow Prawn Managed Fishery fall within the Montebello/Barrow islands region. Even though there are 31 licensed operators, prawn trawling is generally restricted to inshore areas near the mainland coast, so operators do not currently use the proposed reserves. Four commercial operators have licences to take mud crabs from the proposed reserves (excluding the south-west corner). However, they rarely visit the area due to its distance from mainland facilities. Though there are seven licences in Western Australia that permit collection of beche de mer by hand, the level of collection in the proposed reserves is currently unknown. There is a closed area for tropical rock lobsters between Onslow and Cape Preston that includes the Montebello Islands, however the fishery has access to waters west of Barrow Island. Two commercial operators have licences to take tropical rock lobsters for aquarium display purposes only. There are 34 commercial shell collecting and 13 aquarium fish collecting licences issued by DoF throughout the State but the levels of collection are unknown. Commercial fishing in Western Australian is managed by DoF under the FRM Act. A range of management strategies is used including limitations on fishing gear, closed areas, limits to the number of licences issued and the monitoring of catch and stock levels. The Pilbara Trap Managed Fishery has been regulated since 2000 by the allocation of time/gear units, which is currently one fish trap used for one day and for the year 2000, 5,867 trap days were allocated for the entire fishery. Commercial line fishing is currently unrestricted throughout the proposed reserves. No trawling for finfish is carried out in the proposed reserves as it lies in a DoF trawling exclusion area. Where the establishment of a marine nature reserve or exclusion zone in a marine park is claimed to have reduced the commercial value of a fishing licence, the licensee may be eligible for compensation under the *Fishing and Related Industries Compensation (Marine Reserves) Act 1997*. Potential habitat damage and impacts on fish stocks are the major considerations in regard to commercial fishing in the proposed reserves. However, given the low level of usage of the proposed reserves for commercial fishing and the types of gear used, the potential for impacts from these activities is low. The primary role of management within the proposed reserves in relation to commercial fishing is to help maintain the natural values of the proposed reserves on which the industry depends and, in liaison with DoF, to ensure that commercial fishing activities are ecologically and socially sustainable. In addition, the creation of no-take areas within the proposed reserves will provide research and monitoring opportunities through which the impacts of commercial fishing

	on the proposed reserves' values can be assessed. Commercial fishing will not be permitted in sanctuary, recreation or special purpose (pearling) zones of the marine parks. It will also not be permitted in the Bandicoot Bay Conservation (Benthic Fauna/Seabird Protection) Area or the Barrow Shoals Conservation (Flora/Fauna Protection) Area of the Marine Management Area. Commercial fishing is permitted in the multiple use area of Marine Management Area and the general use zones of the marine parks.
Requirements	• High water quality. • Maintenance of key habitat (e.g. nursery grounds, areas of high primary productivity). • Equitable access to fishing grounds (in appropriate areas). • Maintenance of target fish stocks.
Management objective/s	1. To ensure that, in collaboration with the industry and DoF, commercial fishing activities in the proposed reserves are managed in a manner consistent with maintaining the proposed reserves' values. 2. To maintain the ecological values of the proposed reserves that are important to commercial fisheries. 3. Cooperate with the industry and DoF in the maintenance of a viable commercial fishing industry in the proposed reserves.
Strategies	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and the level of impact from commercial fishing activities (sufficient and representative appropriate areas); • provides protection of nursery habitats (e.g. mangroves) and spawning sites for key commercially targeted species; and • provides "insurance" against possible impacts of commercial fishing activities on the ecological values (CALM). **(H-KMS)** 2. Determine the levels and effects of commercial fishing activity in the reserves and review management controls where required (DoF, CALM). **(H)** 3. Monitor and report on commercial fishing catch/effort within the reserves (DoF). **(H)** 4. Ensure commercial fishers are aware of the zoning scheme and any restrictions that may apply to their operations (DoF, CALM). **(M)** 5. Liaise with the MPRA in regard to proposed new fisheries and major changes to existing fisheries within the reserves (DoF). **(M)**

Reporting	To be developed.
Target/s	Implementation of management strategies within agreed timeframes (Appendix II).



7.2.5 Recreational fishing

Social value	**Recreational fishing**: *Excellent shore and boat-based recreational fishing opportunities targeting a variety of pelagic and reef finfish species, mud-crabs and other edible invertebrates.*

Background	The productive coral reefs in the proposed reserves support an abundance of prized table fishes, but due to the remoteness of the area, very few of Western Australia's 600,000 recreational fishers visit the proposed reserves. Those recreational fishers who do visit target spangled emperor, red emperor, spanish mackerel, coral trout, mangrove jacks, oysters and squid. The areas of highest recreational fishing activity are reported to be off the north-eastern end of Trimouille Island and in the waters south of the Montebello group. Medium intensity recreational fishing is reported to be carried out in the vicinity of the small islands to the south of Trimouille Island. Recreational fishing activity near the other islands in the proposed reserves is low. Recreational fishing is managed by DoF through a variety of management tools, to limit catches to sustainable levels. These tools include bag and size limits, gear restrictions, seasonal restrictions and licensing. The potato cod and hump-headed maori wrasse are fully protected in all State waters. DoF has also commenced work on a Regional Recreational Fishing Strategy for the Pilbara region, which aims to provide broad scale management across stocks and populations, as well as identify human activities that threaten them. Management strategies will be reviewed to ensure that fishing pressure remains within sustainable limits and possession limits are currently being considered. The main issues in regard to recreational fishing in the proposed reserves are impacts on target species due to fishing and associated impacts on the ecological values, for example, from litter and trampling of sensitive habitat. However, given the current low level of usage of the proposed reserves for recreational fishing, the potential for impacts from this activity is probably low. The primary role of the proposed reserves management in relation to recreational fishing is to help maintain the natural values of the proposed reserves on which this activity depends and, in liaison with DoF, to ensure that recreational fishing activities in the proposed reserves are ecologically and socially sustainable. In addition, the creation of no-take areas within the proposed reserves will provide research and monitoring opportunities through which the impacts of recreational fishing on the reserves' values can be assessed. Recreational fishing will not be permitted in sanctuary zones of the marine parks or in the Barrow Shoals Conservation (Flora/Fauna Protection) Area in the Marine Management Area. Certain types of recreational fishing will be permitted in special purpose (pearling) zones in the Montebello Islands Marine Park, and in the Bandicoot Bay Conservation (Benthic Fauna/Seabird Protection) Area in the Marine Management Area. All recreational fishing activities are permitted in general use and recreation zones of the marine parks and multiple use areas of the Marine Management Area.
Requirements	• High water quality. • Maintenance of target species' habitat. • Equitable access to fishing grounds (in appropriate areas). • Maintenance of recreational fish stocks in the proposed reserves.
Management objective/s	1. To ensure that, in collaboration with the community and DoF, recreational fishing in the proposed reserves is managed in a manner consistent with maintaining the proposed reserves' values. 2. To maintain the ecological values of the proposed reserves that are important to recreational fishing. 3. To cooperate with the community and DoF in maintaining quality recreational fishing opportunities in the proposed reserves.
Strategies	1. Implement a zoning scheme that: • provides for protection of potential spawning and nursery sites for key recreational fishing species; • provides for opportunities to contribute to the achievement of DoF's objectives for the broader management of recreational fishing;

	• provides for opportunities to review the effectiveness of zoning as a management tool; • provides assistance in the maintenance of fish stocks in the area; and • provides "insurance" against possible impacts of recreational fishing activities on the ecological values (CALM, DoF). **(H-KMS)** 2. Ensure recreational fishers are aware of the zoning scheme and of restrictions which apply to their activities in the reserves (DoF, CALM, industry). **(H)** 3. Evaluate the sustainability of existing recreational fisheries in the proposed reserves (DoF). **(H)** 4. Formulate performance measures and targets for key recreational species for the maintenance of the quality of recreational fishing in the reserves (DoF). **(M)** 5. Determine the effects of recreational fishing activities in the reserves and review management controls as required (DoF, CALM). **(M)** 6. Monitor recreational fishing catch/effort within the proposed reserves (DoF). **(M)**

Reporting	To be developed.
Target/s	Implementation of management strategies within agreed timeframes (Appendix II).

7.2.6 Water sports

Social value	**Water sports:** *The natural values, climate, and scenic values provide the basis for a wide range of recreational activities.*

Background	The warm climate, stunning island and ocean vistas, abundant wildlife and relatively undisturbed environment of the proposed reserves provides the opportunity for a variety of marine recreation activities. Recreational boating, diving, snorkelling and wildlife observation (e.g. whales, dolphins, dugongs, turtles and birds) all occur within the proposed reserves. However, due to the area's isolation from major mainland centres, as well as the lack of visitor facilities and landing restrictions on some islands, visitation remains at a low level. Boating is a popular recreational activity in Western Australia with 57,000 private vessels registered with the DPI. Approximately 2100 of these are registered to owners residing in the towns of Karratha, Dampier, Point Samson, Roebourne, Onslow and Exmouth. Despite Pilbara coastal towns having the highest rate of boat ownership per capita in Western Australia, anecdotal reports from charter boat operators indicate that a total of only about 20 private yachts and 10 other private vessels visit the reserves each year for recreation activities. There is very little use of the proposed reserves for surface water sports such as sea-kayaking and windsurfing. Recreational usage of the proposed reserves is shown in Figure 8. The DPI is responsible for all boating regulations including licensing, safety standards, marker buoys, moorings and jetties. Mooring controls can be delegated to other management agencies. Whales, dolphins, dugongs, turtles, birds and whale sharks are fully protected under the WC Act and it is an offence to disturb these animals. Wildlife viewing is controlled by a code of conduct, which includes minimum approach distances, maximum boat speeds and use of lights in the vicinity of wildlife. Increases in boating in the future have the potential to negatively impact on the ecological values of the proposed reserves through an increase in the disposal of effluent and rubbish, as well as through inappropriate anchoring and installation of inappropriate moorings in sensitive habitats. The goal of the proposed reserves' management in relation to water sports is to manage recreational use in the reserves in a manner that is consistent with maintaining the reserves' values, to maintain the values of the reserves important to water sports, and to ensure water sports are carried out in an equitable manner. Boating will be permitted in all areas of the proposed reserves. Speed and area restrictions may be necessary where boating use is shown to be incompatible with the ecological or social values. Any restrictions would be developed in consultation with key stakeholders.
Requirements	• High water quality. • Equity of access to appropriate areas in the proposed reserves. • Separation of incompatible recreational activities.
Management objective/s	1. To ensure water sports are managed in a manner that is consistent with maintaining the proposed reserves' ecological values. 2. To maintain the ecological values of the proposed reserves that are important to recreational users. 3. To manage recreational activities in a manner that minimises conflict between users of the proposed reserves.
Strategies	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and level of impact of human activities (sufficient and representative appropriate areas); • provides protection to key recreation sites; • provides equitable access to the proposed reserves for recreational users; and • provides "insurance" against possible impacts of water sports on the ecological values (CALM). **(H-KMS)** 2. In collaboration with user groups, develop Codes of Conduct to minimise environmental impacts of recreational activities, as appropriate (CALM). **(M)** 3. Determine the nature, spatial patterns, compatibility and potential environmental impacts of all existing water sports in the reserves (CALM). **(M)** 4. Implement restrictions on boating (e.g. speed/area closures), in consultation with key stakeholders, if these activities are shown to be impacting on the ecological and social

	values of the proposed reserves (DPR, CALM). **(L)**

Reporting	To be developed.
Target/s	Implementation of management strategies within agreed timeframes (Appendix II).

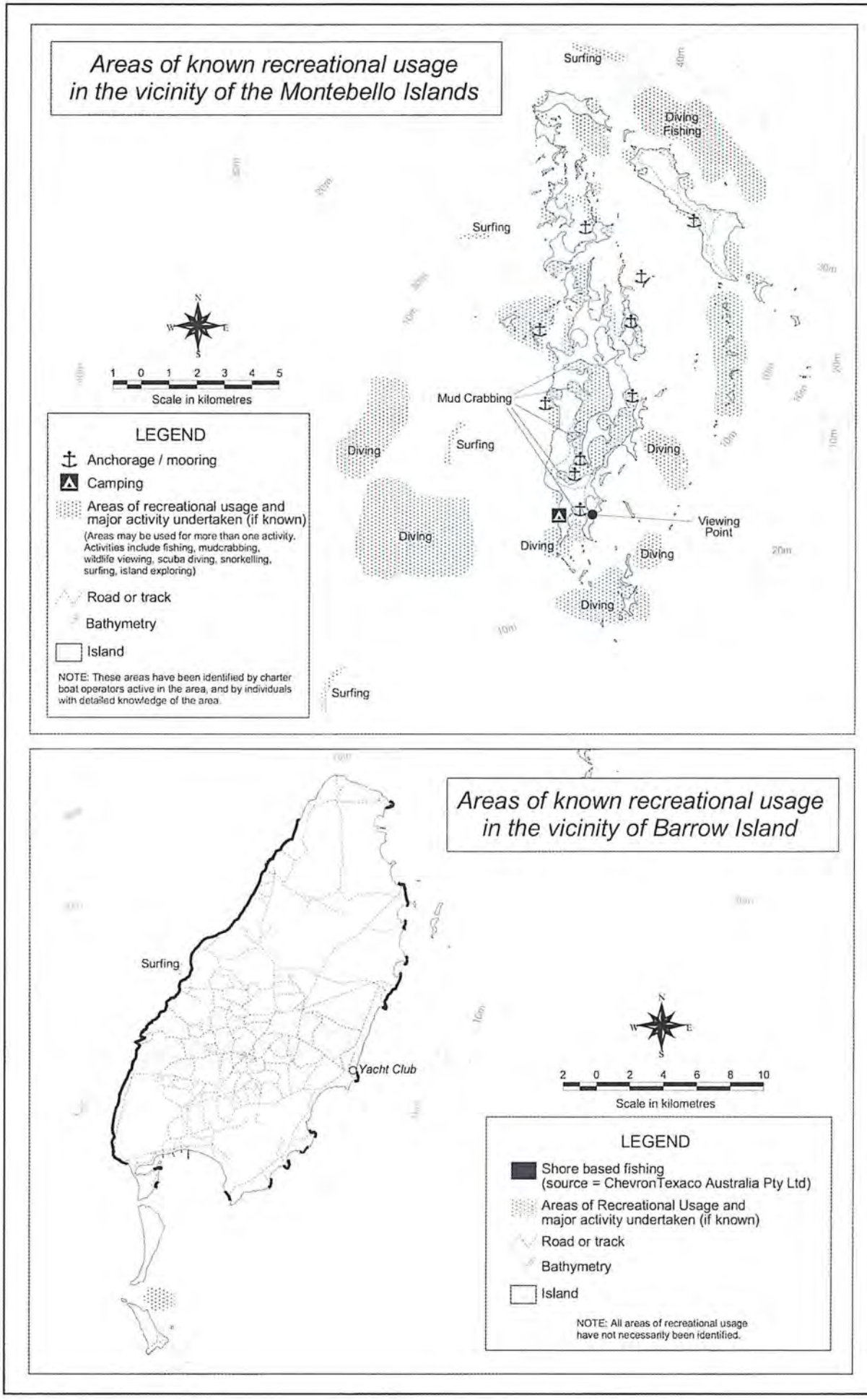


Figure 8: Recreational use within the proposed Montebello/Barrow islands marine conservation reserves

7.2.7 European history/maritime heritage

Social value	**European history/maritime heritage**: *The Montebello Islands have a history of European contact dating from 1622, which includes pearling, whaling, fishing for turtles and more recently, British atomic testing.*

Background	The Montebello/Barrow islands have a long history of European contact, which began with the wreck of the English East India Company vessel, the *Tryal* on Tryal rocks (outside the proposed reserves). The 46 survivors from the wreck who landed on the Montebello Islands are the first recorded European landings on the islands. Since then, the *Wild Wave* was wrecked at the Montebello Islands in 1872, an unidentified boat was lost in 1893 and the *Marietta* was wrecked in 1905. In addition, it is believed that there are a number of uncharted wrecks within the proposed reserves, including pearling luggers lost over the years during cyclones. The natural resources of the proposed reserves have been harvested for many years. American and British whalers are believed to have worked in the region as early as the late 1800's, while turtle harvesting was carried out from the late 1870s until 1973. Cultured pearl farming in the Montebello Islands began in 1902 and continues today. The Montebello Islands also have a history of military use, with a total of three British nuclear weapons tests being conducted there during 1952 and 1956. The 1952 test, called Operation Hurricane, saw a 25 kiloton device exploded inside the hull of the *HMS Plym*, a frigate anchored in 40 feet of water, 400 yards off Trimouille Island. The explosion left a saucer shaped crater on the sea-floor that was 20 feet deep and 1,000 feet across. The testing carried out for Operation Mosaic in 1956 saw a 15 kiloton device exploded on Trimouille Island and a 98 kiloton device exploded on Alpha Island. The area has been described as being destroyed after the tests, with the device exploded at Alpha Island being the largest nuclear weapon tested on Australian soil. Remains of the military activities including scrap steel, disused roadways and the foundations of former British operational headquarters can still be found on some islands Pre-1900 shipwrecks are protected under the *Maritime Archaeology Act 1973* (State legislation) and the *Historic Shipwrecks Act 1976* (Commonwealth legislation). The WA Maritime Museum has statutory responsibility for management of these wrecks. In regard to European history/maritime heritage, the goal of management within the proposed reserves is to prevent significant human impacts on important historic sites by education of reserves users.
Requirements	Not applicable.
Management objective/s	To ensure that, in collaboration with the Western Australian Museum, human activities do not significantly impact on historic sites in the proposed reserves.
Strategies	1. Distribute educational material regarding conserving the history of the islands to visitors of the proposed reserves (WAMM, CALM). **(L)** 2. Advise park users of the relevant regulations under the *Heritage of Western Australia Act 1990*, the *Maritime Archaeology Act 1973* and the Commonwealth *Historic Shipwrecks Act 1976*, where appropriate (WAMM, CALM). **(L)**

Performance measure/s	To be developed as required.	**Desired trend/s**	To be developed as required.
Short-term target/s	To be developed as required.		
Long-term target/s	To be developed as required.		

7.2.8 Scientific research

Social value	**Scientific research:** *The undisturbed nature and wide variety of habitats and communities within the proposed reserves provide opportunities for scientific research.*

Background	The marine biodiversity of the proposed reserves is broadly representative of the Pilbara Offshore marine bioregion. The region is a significant and important source of larval recruitment to reefs further south and this, coupled with the high habitat and species diversity, unusual habitats and species assemblages, mangrove communities of international significance and undisturbed nature of the region, make the area of particular interest and value for scientific research. Despite the wide range of natural features and history of commercial use of the proposed reserves, the level of knowledge about environmental processes and existing pressures on the reserves' values is relatively limited. There is expected to be an increase in the amount of scientific research being conducted in the region, particularly with the proposal to create the reserves. The opportunities that the proposed reserves provide for scientific research are an important value of the area. Research and monitoring are also important generic management tools used as a management strategy for many other values. This is discussed further in section 8.4. All research within the proposed reserves requires the appropriate research permit issued under the CALM Act, WC Act or the FRM Act. Most scientific research programs have relatively benign sampling methods, but the combined effects of many destructive research projects has the potential to impact adversely on the ecological values of the marine environment. Conflicts with other human activities can also be an issue for management as scientific research has specific access requirements, e.g. access to representative areas free of major human influence for "scientific sites" and areas covering the range of major human activities for "impact sites". Management strategies for scientific research within the proposed reserves include the implementation of spatial controls to provide for the monitoring and assessment of key ecological processes and the level of human impact as well as equitable access to appropriate zones. Another management strategy is to ensure that proponents of scientific research obtain and comply with appropriate CALM and DoF permits. Scientific research is permitted in all areas of the marine parks and the Marine Management Area, subject to the appropriate permit.
Requirements	• Access to sites free of major human influences for "scientific reference" sites. • Access to representative sites covering the range of major human activities in the park for "impact" sites. • Equitable access to the reserves for ecological and social research opportunities in appropriate zones.
Management objective/s	To ensure the proposed reserves' value for scientific research is not diminished as a result of human activities in the proposed reserves.
Strategies	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and level of impact of human activities (sufficient and representative appropriate areas); and • provides equitable access to the proposed reserves for scientific research (CALM). **(H-KMS)** 2. Identify and communicate high priority scientific and social research projects relevant to the management of the reserves to appropriate research organisations (CALM). **(H)** 3. Facilitate scientific and social research in the reserves by research, academic and educational institutions by providing financial and logistical assistance (where possible) (CALM, industry). **(M)** 4. Liaise with the petroleum industry to coordinate industry and CALM research programs with the aim of maximising priority research outcomes for the area (CALM). **(M)**

Reporting	To be developed.
Target/s	Implementation of management strategies within agreed timeframes (Appendix II).

8 GENERIC MANAGEMENT STRATEGIES

The vision, strategic objectives, management targets and management objectives outlined in Section 7 provide the framework for the development of specific management actions designed to conserve ecological and social values. These actions are achieved by applying one or more of seven generic management strategies:

- the development of an appropriate administrative framework;
- education and interpretation;
- surveillance and enforcement;
- research;
- monitoring;
- public participation; and
- direct management intervention.

8.1 Development of an Administrative Framework

The development of an appropriate administrative framework is essential to ensure the proposed reserves can be managed effectively over the long term. This framework should include statutory considerations such as the reserves' purpose, class and boundaries, a suitable zoning scheme and appropriate regulations as well as human, financial and infrastructure/plant resources.

For administrative purposes, CALM is divided into regions, which may be divided into districts. The proposed reserves are within the Pilbara Region and the day to day operational management of the reserves would be the responsibility of the Regional Manager. CALM has management infrastructure and staff at Karratha. The District Office is supported by the Marine Conservation Branch, which has a central role in assisting Regional and District offices in the management of marine conservation reserves throughout the State. A number of other specialist branches provide support, direction and assistance in relation to such areas as wildlife management and licensing of nature-based tourism operations.

The reserves will comprise part of the National Representative System of Marine Protected Areas. The objective is to build a system of marine protected areas that will be:

- *Comprehensive* – include marine protected areas in all the major bioregions in Australia.
- *Adequate* – include marine protected areas that are of appropriate size and configuration to ensure the conservation of biodiversity and integrity of ecological processes.
- *Representative* – that includes the marine flora, fauna and habitats that are representative of the bioregion.

The area contains many islands that are vested in the CCWA and managed by CALM for the purpose of conservation. The boundaries of the island reserves extend to the low water mark and therefore the intertidal communities are part of these terrestrial reserves. Intertidal areas contain important ecological communities (e.g. mangroves, mudflats, coral reefs) and many marine-related activities (e.g. fishing, swimming, reef-walking etc) occur in the area covering both the intertidal and nearshore subtidal areas. Furthermore, the geographic position of the low water mark is often difficult to determine accurately, particularly in macrotidal areas like the Pilbara. With these considerations in mind, management of intertidal areas as part of the marine conservation estate is proposed by the MPRA. Strategies for the management of intertidal areas in the Montebello/Barrow islands marine conservation reserves are outlined in this indicative management plan, despite these areas being part of the island reserves. The most appropriate mechanism to give legal effect to these strategies will be addressed by the MPRA and the CCWA. The proposed boundaries of the reserves and tenure in the Montebello/Barrow islands region are shown in Figure 2.

In respect to the criterion of representativeness, the proposed marine conservation reserves are representative of the Pilbara Offshore marine bioregion and include a broad range of habitats, flora and fauna that is typical of this bioregion. In terms of adequacy the reserves are large, therefore ensuring an appropriate scale of management of the area and the activities that have potential to impact on the ecological values. The management of the reserves is guided by this indicative management plan. The indicative management plan outlines a range of strategies that are recommended to ensure that the ecological values are adequately conserved. One important facet of the management framework is the implementation of a zoning scheme that contributes to the protection and management of the ecological and social values.

The implementation of the zoning scheme is an important strategy for the conservation of marine biodiversity and the management of human use in the proposed reserves. The zoning scheme assists in separating conflicting uses and provides for specific activities such as for pearling, recreation, scientific study and nature appreciation. The partial or total restriction of extractive activities in representative habitats is a key strategy in the long-term maintenance of marine biodiversity values of the reserves. Specifically, the establishment of zones in which extractive activity is not permitted will play a key role in the protection of representative areas of important habitat such as mangrove communities, coral reef communities, macroalgal and seagrass communities and intertidal sand/mudflat communities. As well as providing a measure of management "insurance", these zones also provide areas where natural processes can be studied free of significant human influence. These zones provide the opportunity to improve the understanding of the reserves' key ecological processes and to obtain critical baseline data to compare against areas of the reserves where extractive activities are permitted and/or where environmental impacts may be occurring.

Zoning is a flexible management tool that can accommodate evolving uses of the proposed reserves during the period of the management plan. The nature and extent of zoning should be considered within the context of the other generic management strategies of education and interpretation, surveillance and enforcement, research, monitoring, public participation and direct management intervention (Sections 8.2 – 8.7). Section 62 of the CALM Act provides for classification of zones in any marine conservation reserve as the Minister thinks necessary to give effect to the objects of the CALM Act. In marine management areas zones *may* be created to give effect to the management of the reserve. However, this is not a requirement. In contrast Section 13B(2) of the CALM Act *requires* that marine parks be zoned as one or a combination of specific management zones. These are sanctuary, recreation, general use and special purpose zones.

Sanctuary zones in marine parks provide for the maintenance of environmental values and are managed for nature conservation by excluding human activities that are likely to adversely affect the environment. They are used to provide the highest level of protection for vulnerable or specially protected species and to protect representative habitats from human disturbance so that marine life can be seen and studied in an undisturbed state. Specified passive recreational activities consistent with maintaining environmental values may be permitted, but extractive activities, including fishing and traditional fishing and hunting are not. Commercial tourism operations (such as for nature-based tours) will be considered where they do not conflict with other uses and will be regulated under the CALM Act.

Recreation zones in marine parks provide for conservation and recreation, including recreational fishing where this is compatible with conservation values. Commercial fishing, pearling and aquaculture are not permitted in these zones.

Special purpose zones in marine parks are managed for a particular priority purpose or use, such as a seasonal event (e. g. wildlife breeding, whale watching) or a particular type of commercial activity (e.g. pearling). Uses that are incompatible with the specified priority purpose are not allowed in these zones.

General use zones in marine parks are those areas of the marine park not included in sanctuary, special use or recreation zones. Conservation of natural values is still the priority of general use zones, but activities such as sustainable commercial and recreational fishing, aquaculture, pearling and petroleum exploration and production are permitted provided they do not compromise the ecological values of the marine park.

Changes to the zoning of the reserves during the life of the management plan can only occur after meeting the statutory public consultation requirements and acquiring the approval of the Minister for the Environment, the Minister for Agriculture, Forestry and Fisheries and the Minister for State Development.

8.1.1 Development of a zoning scheme

The zoning scheme for the proposed reserves was derived primarily through an iterative consultative process with the Advisory Committee for the Proposed Montebello/Barrow Islands Marine Conservation Reserve and with key community stakeholder groups. The *type* of zones was generally based on the primary purpose of the zone and the level of protection needed. The *location* of zones was generally based on achieving the various management strategies for the ecological values (e.g. having sanctuary zones in representative areas and for monitoring and research), with as least impact as possible on the social values. The *size* of zones has, where possible, been based largely on scientific principles developed by the Great Barrier Reef Marine Park Authority to ensure they are of an adequate size to provide the appropriate level of protection. The *number* of zones and their general spread through the area relates to the requirement to ensure all habitats are represented in these zones and, where possible, to ensure each habitat type is represented in more than one zone.

The development of the zoning plan for the proposed reserves was based on a number of key principles. These principles included:

- that the zoning scheme should include "no take" areas as "insurance" against significant long term impacts of projected usage;
- that the zoning scheme should provide areas free of significant human impact for research and monitoring;
- the requirement that a network of no-take areas should be of representative of the habitats found in the reserve, and that these areas should be of sufficient size to fulfil the functions of the zones;
- operational principles from the Great Barrier Reef Marine Park Authority Representative Areas Program on the design of no-take areas, including -
    - having, where possible, no-take areas with a minimum distance of 10 km (for coastal bioregions) along the smallest dimension;
    - having larger versus smaller no-take areas;
    - having only whole reefs in no take areas; and
    - including biophysically special/unique places (e.g. spawning areas);
- the application of the precautionary principle which, in this case, means that a lack of scientific certainty about the location, size or number of no-take areas should not prevent the establishment of no-take areas;
- that zoning is one in a suite of management mechanisms for the area;
- that the zoning scheme should be simple for users to understand and therefore to comply with any restrictions; and
- that, where possible, the placement of zones to achieve the management objectives should be done so as to minimise impacts on the existing social values.

The proposed zoning scheme has successfully met most of these criteria. Specifically:

- The proposed sanctuary zones and conservation zones provide high protection areas that will provide comprehensive opportunities for research and monitoring, and insurance against unacceptable impacts of human activities. These areas have been chosen to ensure all major habitats are represented in such zones, and in many cases they also include areas of high biodiversity and ecological importance;
- There are few but relatively large zones. These zones largely meet the operational principles developed by the Great Barrier Reef Marine Park Authority;
- The proposed zoning scheme is simple to facilitate implementation and ease of enforcement;
- The zoning as developed has been structured to minimise impacts on the existing users of the area, thereby providing for the important socio-economic activities to continue, and will in some cases provide new opportunities (e.g. for nature-based tourism);
- The zoning has been developed in liaison with other agencies (e.g. DoF) to ensure that the zones are consistent with, and where possible enhance, the management of activities in the area; and
- Other aspects such as the views of the community, public safety and logistics of surveillance and enforcement have also been taken into account when developing the proposed boundaries of the zones.

The proposed Montebello Islands Marine Park and Barrow Island Marine Park will be zoned as a combination of sanctuary, recreation, special purpose (pearling), and general use zones. In the Barrow Island Marine Management Area the majority of the reserve will not be specifically zoned but it is proposed to establish two specific management zones. These are the Barrow Shoals Conservation (Flora/Fauna Protection) Area and the Bandicoot Bay Conservation (Benthic Fauna/Seabird Protection) Area. The zoning scheme for the proposed reserves is shown in Figures 9, 10, 11 and 12 and the permitted activities are outlined in Table 2. The names, size, purpose and description of the zones are detailed in Section 8.1.2 and 8.1.3.

The zoning scheme is an important strategy in achieving the strategic objectives of this plan. Specifically the implementation of the zoning scheme is a key strategy in achieving the management objectives for the ecological (*coral reef communities, macroalgal and seagrass communities, intertidal sand/mudflat communities, finfishes, invertebrates, rocky shore/intertidal reef communities, mangrove communities, turtles, seabirds*) and social (*scientific research, pearling, commercial fishing, hydrocarbon industry, nature-based tourism, water sports, recreational fishing*) values.

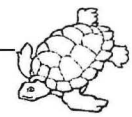
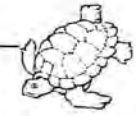


Table 2: Uses permitted in each zone of the proposed reserves

Activity	Marine Parks				Marine Management Area		
	Sanctuary zone	Recreation zone	Special purpose (pearling) zone	General use zone	Conservation (flora/fauna protection) area	Conservation (benthic fauna/seabird protection) area	Unzoned areas
COMMERCIAL							
Pearling [bd]	No	No	Assess	Assess	No	No	Assess
Aquaculture [bd]	No	No	Assess [e]	Assess	No	No	Assess
Commercial beche de mer fishing [bd]	No	No	Yes [c]	Yes	No	No	Yes
Commercial trap fishing [bd]	No	No	No	Yes	No	No	Yes
Commercial long line [bd]	No	No	No	Yes	No	No	Yes
Commercial beach seine [bd]	No	No	No	Yes	No	No	Yes
Commercial wetlining [bd]	No	No	No	Yes	No	No	Yes
Commercial prawn trawling [bd]	No	No	No	No	No	No	Yes
Commercial mud crabbing [bd]	No	No	No	Yes	No	No	Yes
Commercial aquarium collecting [bd]	No	No	No	Yes	No	No	Yes
Commercial specimen collecting [bd]	No	No	No	Yes	No	No	Yes
Mineral & petroleum exploration (seismic) [f]	Assess	Assess	Assess [e]	Assess	Assess	Assess	Assess
Petroleum drilling & mineral development [f]	No	No	No	Assess	Assess	Assess	Assess
Petroleum pipelines [f]	No	No	No	Assess	Assess	Assess	Assess
Charter vessels - fishing [bd]	No	No	Yes [e]	Yes	No	No	Yes
Charter vessels - other [cd]	Yes	Yes	Yes [e]	Yes	Yes	Yes	Yes
RECREATIONAL							
Boating (motor & non-motorised) [a]	Yes	Yes	Yes [e]	Yes	Yes	Yes	Yes
Surface water sports [a]	Yes	Yes	Yes [e]	Yes	Yes	Yes	Yes
Recreational rock lobster fishing [b]	No	Yes	Yes [e]	Yes	No	No	Yes
Recreational line fishing [b]	No	Yes	Yes [e]	Yes	No	Yes	Yes
Recreational netting [b]	No	No	No	Yes	No	Yes	Yes
Spearfishing [b]	No	Yes	Yes [e]	Yes	No	No	Yes
Recreational crabbing [b]	No	Yes	Yes [e]	Yes	No	No	Yes
Recreational specimen collecting [b]	No	No	No	No	No	No	Yes
Snorkelling and diving	Yes	Yes	Yes [e]	Yes	Yes	Yes	Yes
Wildlife interaction [c]	Yes	Yes	Yes [e]	Yes	Yes	Yes	Yes
OTHER ACTIVITIES							
Proposals for marine infrastructure (e.g. moorings) [ad]	Assess	Assess	Assess [e]	Assess	Assess	Assess	Assess
Dredging and dredge spoil dumping for shipping activities [d]	No	No	No	No	No	No	Assess
Research [d]	Yes	Yes	Yes [e]	Yes	Yes	Yes	Yes

KEY:

a.	Subject to the *Western Australian Marine Act 1982*
b.	Subject to the FRM Act and *Pearling Act 1990.*
c.	Subject to the CALM Act and WC Act.
d.	Licence required from CALM and/or DoF and/or DoIR and/or DoE/EPA.
e.	Activities permitted unless the activity is shown to be incompatible with the specified primary purpose of the zone.
f.	Subject to the EP Act.
Assess	Proposal will be assessed by relevant agencies in accordance with standard procedures.



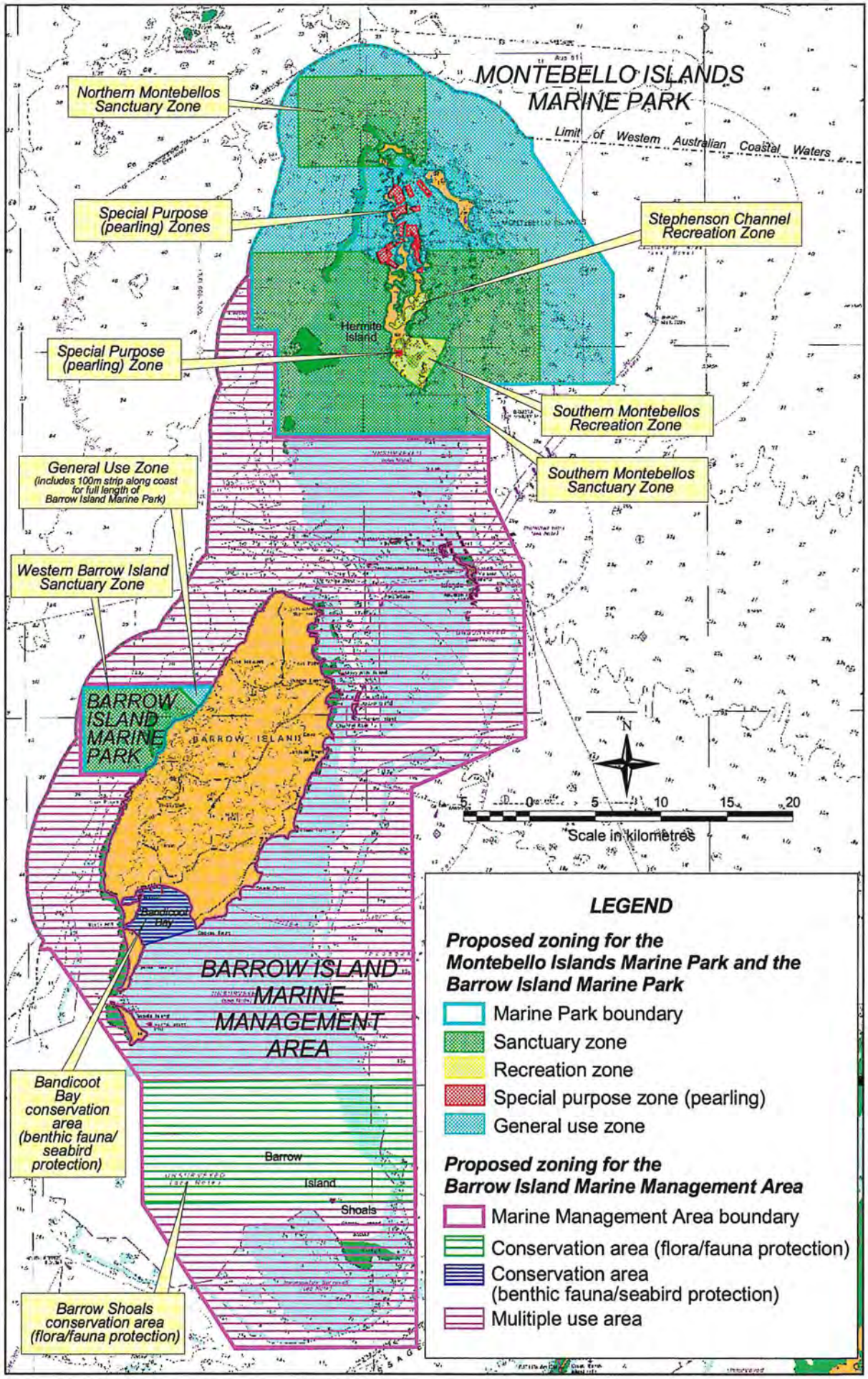


Figure 9: Proposed zoning scheme for the proposed Montebello/Barrow islands marine conservation reserves

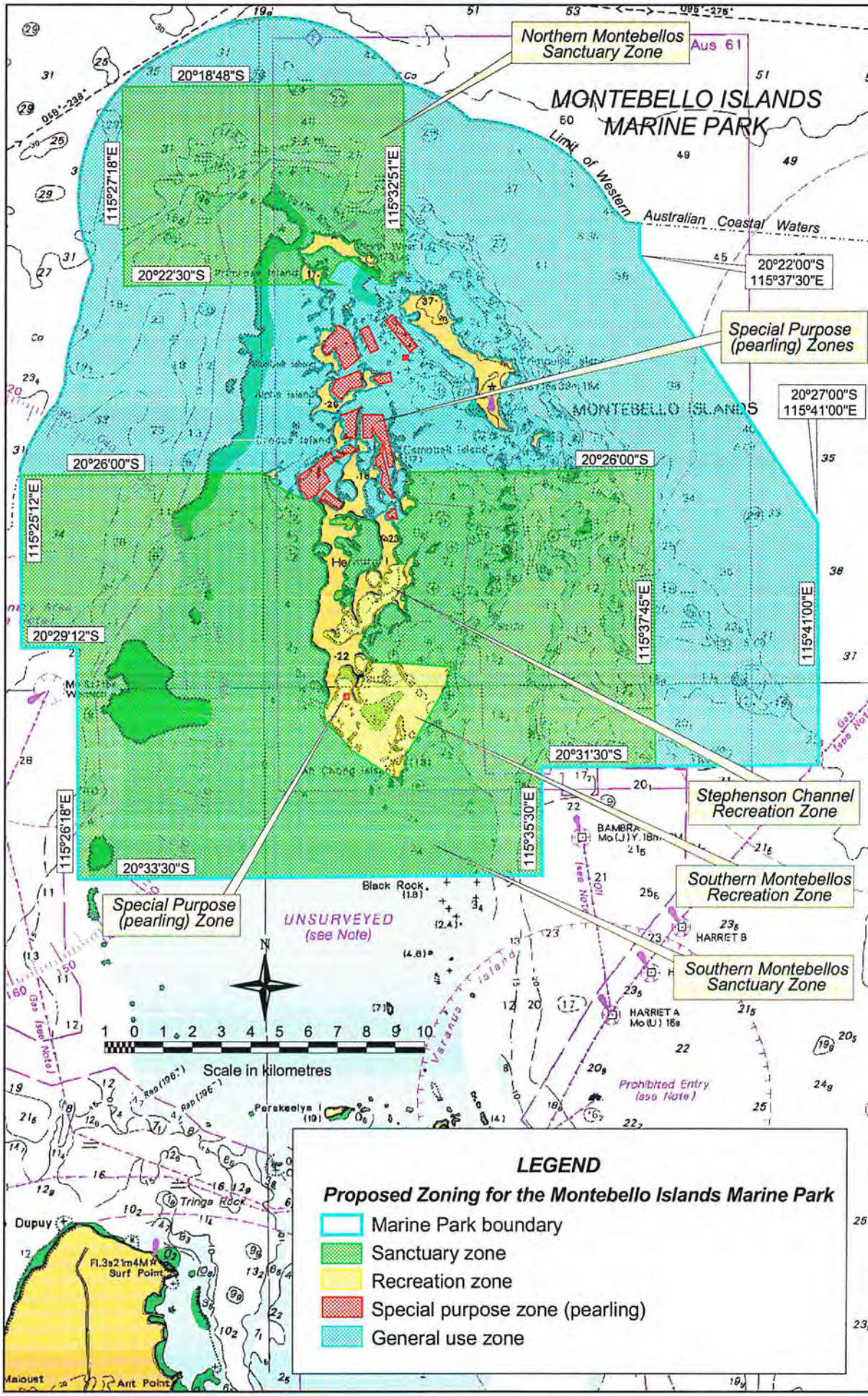


Figure 10: Proposed zoning scheme for the proposed Montebello Islands Marine Park

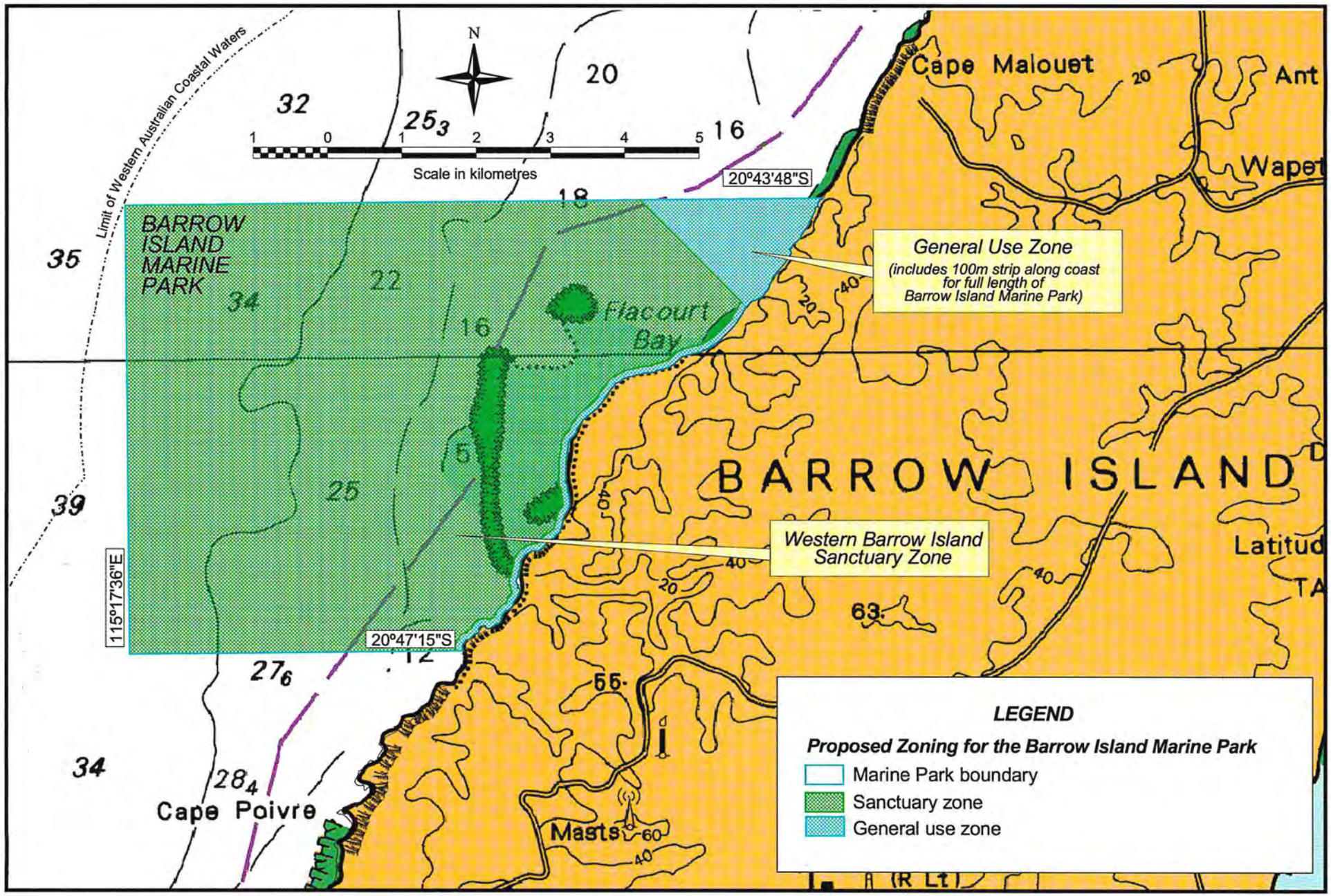


Figure 11: Proposed zoning scheme for the proposed Barrow Island Marine Park

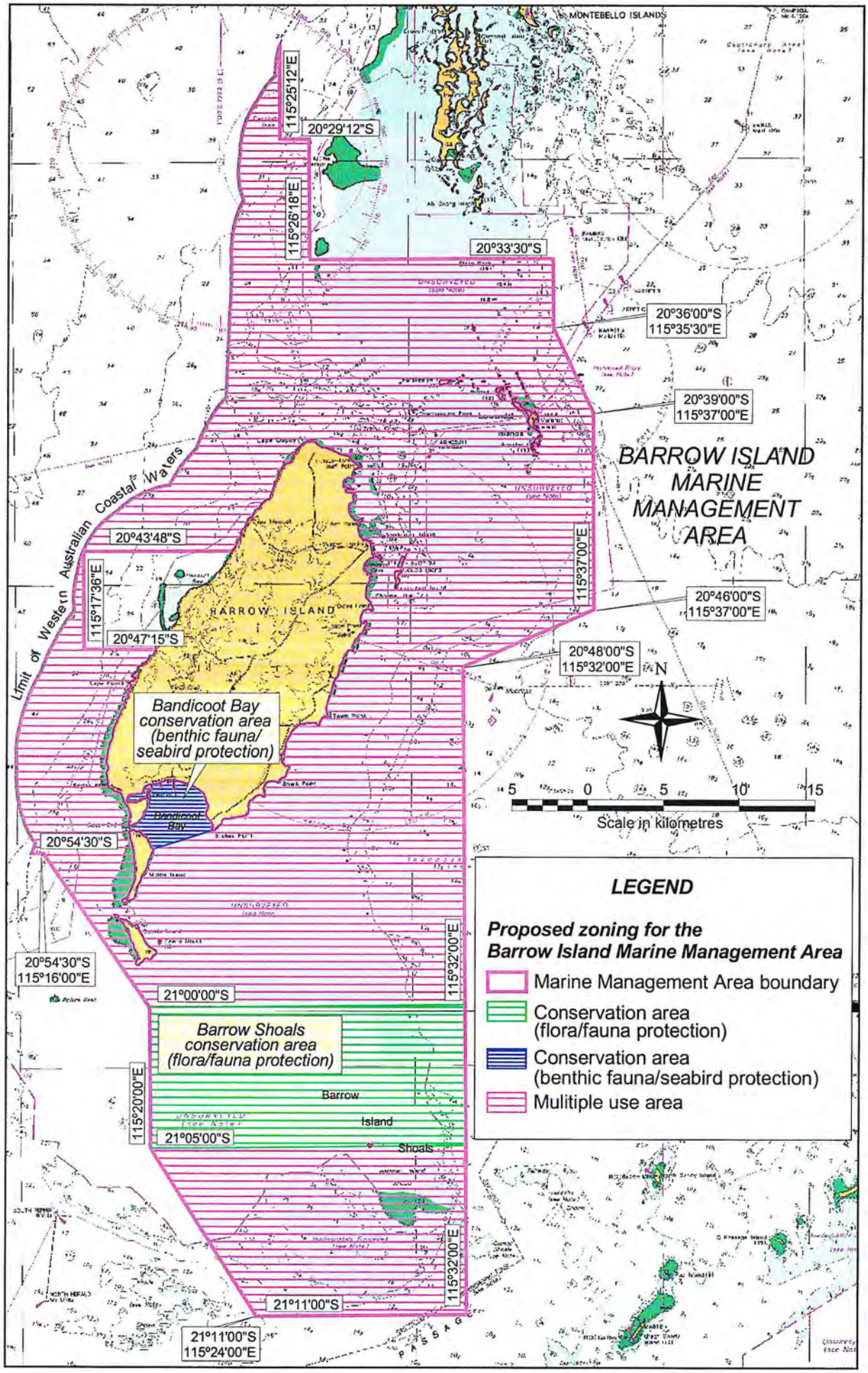


Figure 12: Proposed zoning scheme for the proposed Barrow Island Marine Management Area

A summary of the generic administration objectives, strategies and targets are outlined below.

Summary of Generic Administration Objectives, Strategies and Targets

Management objective/s	1. To implement the zoning scheme for the reserves within two years of gazettal. 2. To establish practical and appropriate boundaries for the proposed reserves.
Strategies	1. Gazette appropriate notices under the CALM Act and FRM Act to implement the zoning scheme of the proposed reserves (CALM, DoF). **(H - KMS)** 2. Inform users about the types of zones, reasons for and restrictions on activities in the proposed reserves using signage, information manuals and education programs (CALM, DoF). **(H - KMS)** 3. MPRA and CCWA to develop an appropriate vesting basis for the management arrangements of the intertidal areas of the reserves (MPRA, CCWA, CALM). **(H-KMS)** 4. Facilitate research on the effectiveness of zoning as an aid to achieving the objectives of the proposed reserves (CALM). **(H)**
Target	Implementation of management strategies within agreed timeframes (Appendix II).

8.1.2 Zones in the proposed Montebello Islands Marine Park

The zoning of the proposed Montebello Islands Marine Park comprises two sanctuary zones (approximately 30,770 ha or 52% of the Marine Park), two recreation zones (approximately 1,280 ha or 2% of the Marine Park), eleven special purpose (pearling) zones (approximately 370 ha or <1% of the Marine Park) with all other areas in the Marine Park not included in sanctuary, recreation or special purpose zones to be zoned as general use (approximately 26,820 ha or 45% of the Marine Park). The zoning of the proposed Montebello Islands Marine Park is shown in more detail in Figure 10.

Sanctuary Zones

Two sanctuary zones (approximately 30,770 ha or 52% of the Marine Park) have been proposed in the Montebello Islands Marine Park and are located at the northern Montebellos and southern Montebellos.

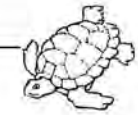
Northern Montebellos Sanctuary Zone

The Northern Montebellos Sanctuary Zone includes representative areas of deep water habitats, seaward coral reef communities, macroalgal and seagrass communities, intertidal sand/mudflat communities and rocky shore/intertidal reef platform communities. It encompasses important turtle aggregation and nesting areas and has a high diversity of finfish and invertebrate species. The bathymetry in this zone is the most complex in the proposed reserves and because of this has high habitat diversity and may contain important fish spawning areas. The boundaries of this proposed zone have been placed so as to exclude existing pearling leases to the south. The eastern boundary of the zone has been placed so as to avoid impacts to existing commercial mackerel fishing areas and the zone does not overlay known high value petroleum areas.

Southern Montebellos Sanctuary Zone

The Southern Montebellos Sanctuary Zone includes representative areas of seaward and leeward coral reef communities, the majority of the internationally significant mangrove communities in the proposed reserves, macroalgal and seagrass communities, intertidal sand/mudflat communities and rocky shore/intertidal reef platform communities. It encompasses turtle aggregation areas, turtle and seabird breeding/nesting areas, as well as diverse finfish and invertebrate populations. It includes areas of complex geomorphology and seabed topography, as well as spectacular diving opportunities (free of extractive activity) for commercial and recreational users. The boundaries of this proposed zone have been placed, in consultation with industry and stakeholders, so as to exclude the existing Wonnich platform and the majority of the Wonnich reservoir to the west and existing pearling leases to the north. The southern Montebellos and Stephenson's Channel recreation zones are not included in this sanctuary zone to provide an opportunity for recreational and commercial tourism activities in the southern part of the Montebello Islands. There are no known existing high use commercial fishing areas in this proposed sanctuary zone.

The primary purpose of sanctuary zones is to provide areas where natural processes can be studied or appreciated free of significant human influence. These zones provide the opportunity to improve the understanding of the Marine Park's key ecological processes and to obtain critical comparative data with areas of the Marine Park where extractive activities are permitted and/or where environmental impacts may be occurring. These zones will also potentially provide other ecological benefits such as refugia for exploited species, replenishment areas, nature appreciation sites and "insurance" against the failure of the adaptive management approach adopted for the rest of the proposed reserves. A detailed description of the role of "No Take" (sanctuary) zones in Western



Australia's marine conservation reserve system can be found in Colman & Simpson (1999).

All extractive activities are excluded from sanctuary zones. Passive nature-based tourism, some recreational activities, boating and approved scientific research is permitted. The locations of sanctuary zones in the Montebello Islands Marine Park are shown in Figure 10. The permitted activities are shown in Table 2. The names and areas of these zones are shown in Table 3.

Table 3: Names and areas of sanctuary zones in the Montebello Island Marine Park

Name	Approximate area (hectares)
Northern Montebellos Sanctuary Zone	6410
Southern Montebellos Sanctuary Zone	24360

Recreation Zone
Two recreation zones (approximately 1,280 ha or 2% of the Marine Park) are proposed in the Montebello Islands Marine Park and will be located at the Southern Montebellos and Stephenson's Channel.

Southern Montebellos Recreation Zone and Stephenson's Channel Recreation Zone
The intent of the Southern Montebellos and Stephenson's Channel recreation zones is to provide opportunity for existing recreational activities and commercial non-extractive tourism activities in this area, including recreational fishing (subject to bag limits and other restrictions from the DoF). Due to the relatively sheltered nature of the areas, as well as the existence of mooring sites, the areas are currently utilised for shore and dinghy-based recreational fishing and other recreational activities such as snorkeling, diving and nature appreciation. The boundaries of these proposed recreation zones have been devised, in consultation with stakeholders, to encompass the majority of the areas used for recreational activities while not compromising the ecological values of the surrounding sanctuary zone. The proposed recreation zones do not overlap any known high use commercial fishing areas or known petroleum reservoirs.

The recreation zones will provide priority areas for recreational activities, including recreational fishing by both private visitors and patrons of commercial tourism operations where these are compatible with the maintenance of the values of the proposed reserves. Petroleum drilling and production, commercial fishing, pearling and aquaculture are not permitted in recreation zones.

The locations of the recreation zones are shown in Figure 10 and the permitted activities are shown in Table 2.

Special Purpose (Pearling) Zones
Special purpose (pearling) zones (approximately 370 ha or <1% of the Marine Park) are proposed for some of the existing pearling leases in the proposed Montebello Islands Marine Park, including lease areas A, B, C, D, G, H, I, J, O, and P, as well as the quarantine site in Claret Bay. The other existing pearling leases held by Morgan & Co. Pty. Ltd. (i.e. lease areas E, F, K and L), are currently being assessed and the zoning of these areas as special purpose (pearling) zones will be considered by the MPRA in due course.

The priority purpose of these zones is pearling. The designation of these zones does not exclude other existing activities, but if other uses conflict in a significant and unavoidable way with pearling, these activities will not be permitted to occur in these zones. It should be noted that the designation of these zones for the primary purpose of pearling does not provide automatic approval for pearling proposals. Any proposal will be assessed in accordance with Ministerial Policy Guideline No 8 (DoF, 1998) and only permitted where this use is compatible with the maintenance of the values of the proposed reserves. It should also be noted that this does not preclude a lease being held or created within a general use zone of the marine parks or unclassified areas of the Marine Management Area.

The locations of all special purpose (pearling) zones are shown in Figure 10 and the permitted activities are shown in Table 2.

General Use Zone
All waters of the Montebello Islands Marine Park not zoned as sanctuary, special purpose or recreation zone will be zoned as general use. This area (approximately 26,820 ha or 45% of the Marine Park) will provide for recreational and commercial activities to occur, providing that they are compatible with the overall maintenance of the park's values.

The locations of the general use zone are shown in Figure 10 and the permitted activities are shown in Table 2.

8.1.3 Zones in the proposed Barrow Island Marine Park

The zoning of the proposed Barrow Island Marine Park comprises one sanctuary zone (approximately 4,260 ha or 94% of the Marine Park) with the remainder to be zoned as general use (approximately 270 ha or 6% of the Marine Park).

Western Barrow Island Sanctuary Zone

The Western Barrow Island Sanctuary Zone includes Biggada Reef, which is one of two examples of significant fringing reef that occur in the proposed reserves, as well as Turtle Bay, a significant nesting area for green turtles and which, on occasion, is used for hawksbill and flatback turtle nesting. It also includes representative areas of macroalgal and seagrass communities and deep water habitat. The proposed zone has been placed to avoid impacts on future planned pipelines in the north, and the boundary is set 100m from the shoreline to allow for shore-based recreational fishing.

The primary purpose of sanctuary zones is to provide areas where natural processes can be studied or appreciated free of significant human influence. These zones provide the opportunity to improve the understanding of the Marine Park's key ecological processes and to obtain critical comparative data with areas of the Marine Park where extractive activities are permitted and/or where environmental impacts may be occurring. These zones will also potentially provide other ecological benefits such as refugia for exploited species, replenishment areas, nature appreciation sites and "insurance" against the failure of the adaptive management approach adopted for the rest of the proposed reserves. A detailed description of the role of "No Take" (sanctuary) zones in Western Australia's marine conservation reserve system can be found in Colman & Simpson (1999).

All extractive activities are excluded from sanctuary zones. Passive nature-based tourism, some recreational activities, boating and approved scientific research are permitted. The location of the Western Barrow Island Sanctuary Zone is shown in Figure 11 and the permitted activities are shown in Table 2.

8.1.4 Zones in the proposed Barrow Island Marine Management Area

The zoning of the proposed Barrow Island Marine Management Area comprises one conservation (flora/fauna protection) area (approximately 18,860 ha or 13% of the Marine Management Area) and one conservation (benthic fauna/seabird protection) area (approximately 1,640 ha or 1% of the Marine Management Area). The remaining area is not zoned (approximately 128,040 ha or 86% of the Marine Management Area).

Barrow Shoals Conservation (Flora/Fauna Protection) Area

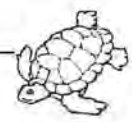
One conservation (flora/fauna protection) area (approximately 18,860 ha or 13% of the Marine Management Area) is proposed in the Barrow Island Marine Management Area and will be located at Barrow Shoals.

The Barrow Shoals Conservation (Flora/Fauna Protection) Area includes representative areas of macroalgal and seagrass communities and the largest area of leeward coral reef communities in any zone or classified area of the proposed reserves. Given the proximity to the mainland and degree of exposure, this area is believed to be significantly different from an ecological perspective, compared to similar habitats to the north of the proposed reserves. While this area does not overlay any known high use commercial or recreational fishing areas, it does overlay part of a known petroleum reservoir.

The Barrow Shoals Conservation (Flora/Fauna Protection) Area will provide an area where natural processes can be studied or appreciated free of significant human influence. This zone will provide the opportunity to improve the understanding of the proposed reserves' key ecological processes and to obtain critical comparative data with areas of the proposed reserves where extractive activities are permitted and/or where environmental impacts may be occurring. This area will also potentially provide other ecological benefits such as refugia for exploited species, replenishment areas, nature appreciation sites and "insurance" against the failure of the adaptive management approach adopted for the rest of the proposed reserves.

Similar to sanctuary zones in the marine parks most extractive activities are excluded from the Barrow Shoals Conservation (Flora/Fauna Protection) Area (including recreational and commercial fishing and specimen collecting). Passive nature-based tourism, some recreational activities, boating and approved scientific research are permitted. Proposals for petroleum drilling, mineral development and the installation of pipelines in the Barrow Shoals Conservation (Flora/Fauna Protection) Area will be assessed by the relevant agencies in accordance with standard procedures.

The location of the Barrow Shoals Conservation (Flora/Fauna Protection) Area is shown in Figure 12 and the



permitted activities are shown in Table 2.

Bandicoot Bay Conservation (Benthic Fauna/Seabird Protection) Area
One conservation (benthic fauna/seabird protection) area (approximately 1,640 ha or 1% of the Marine Management Area) is proposed in the Barrow Island Marine Management Area and will be located Bandicoot Bay.

The Bandicoot Bay Conservation (Benthic Fauna/Seabird Protection) Area includes the largest intertidal sand/mudflat community in the proposed reserves, which is known to be high in invertebrate diversity and which provides important feeding grounds for migratory birds. This area also encompasses representative areas of macroalgal and seagrass communities, rocky shore/intertidal reef platform communities and turtle aggregation areas. The boundaries of this proposed classified area have been placed so as to encompass the majority of the intertidal sand/mudflat community. This classified area does not overlay any known high use commercial fishing areas.

The Bandicoot Bay Conservation (Benthic Fauna/Seabird Protection) Area will provide an area where natural processes can be studied or appreciated free of significant human influence. This area will provide the opportunity to improve the understanding of the proposed reserves' key ecological processes and to obtain critical comparative data with areas of the proposed reserves where extractive activities are permitted and/or where environmental impacts may be occurring. This area may also potentially provide other ecological benefits such as refugia for exploited species, replenishment areas, nature appreciation sites and "insurance" against the failure of the adaptive management approach adopted for the rest of the proposed reserves.

Most extractive activities are excluded from the Bandicoot Bay Conservation (Benthic Fauna/Seabird Protection) Area (including commercial fishing, specimen collecting, and recreational spearfishing, rock lobster fishing and crabbing). Recreational line fishing, recreational netting, passive nature-based tourism, some recreational activities, boating and approved scientific research are permitted. Proposals for petroleum drilling, mineral development and the installation of pipelines in the Bandicoot Bay Conservation (Benthic Fauna/Seabird Protection) Area will be assessed by the relevant agencies in accordance with standard procedures.

The location of the Bandicoot Bay Conservation (Benthic Fauna/Seabird Protection) Area is shown in Figure 12 and the permitted activities are shown in Table 2.

Unzoned Areas
The majority of the Marine Management Area (excluding Bandicoot Bay and Barrow Shoals) will not be zoned. This area (approximately 128,040 ha or 86% of the Marine Management Area) will provide for recreational and commercial activities to occur, providing that they are compatible with the overall maintenance of the reserves' values.

The zoning for the Maine Management Area is shown in Figure 12 and the permitted activities are shown in Table 2.

8.2 Education and Interpretation

Developing community support for the proposed reserves is critical to the effective implementation of this management plan. The level of public compliance in relation to management controls in the reserves will be related directly to the level of understanding of the values of the proposed reserves and the reasons for regulation of activities in the reserves. Education programs will initially need to raise awareness of the creation of the proposed reserves and new restrictions on commercial and recreational activities as a result of the implementation of zoning and other management strategies. Given the remoteness of the Montebello/Barrow islands and the fact that most users are employed by, or access the reserves through, the hydrocarbon, pearling or charter industries, these industries will play a crucial role in providing information, courses and education materials to their staff and/or patrons about the reserves. Specific education strategies are detailed for each ecological and social value in Section 7 and a summary of the generic education and interpretation objectives, strategies and targets are outlined below.

Summary of Generic Education and Interpretation Objectives, Strategies and Targets

Management objective/s	To enhance community understanding of, and support for, the proposed reserves through education and interpretation programs.
Strategies	1. Develop and implement, in collaboration with industry, DoF and other relevant agencies, education and interpretation programs to ensure users of the reserves are aware of and understand the values of the reserves, management zones and regulations and the reasons for these controls (CALM, DoF). **(H – KMS)** 2. Develop and distribute to the community and visitors a range of education materials about the reserves' values and management (CALM, DoF). **(H)** 3. Assist the hydrocarbon, pearling and charter industries to access and deliver information courses/materials to their staff or patrons (CALM). **(H)** 4. Provide talks and briefings about the reserves' values, uses and management to user groups (CALM). **(M)**
Target	1. Implementation of management strategies within agreed timeframes (Appendix II). 2. 50% of visitors aware of the existence of the reserves, their values and of the restrictions applying to the area within three years of gazettal. 3. 90% of visitors aware of the existence of the reserves, their values and of the restrictions applying to the area within ten years of gazettal.

8.3 Surveillance and Enforcement

This management plan details a range of strategies relating to the management of particular human activities within the proposed reserves. The effectiveness of these strategies will be dependent on the extent to which the users of the reserves abide by these restrictions. The education program is critical to achieving a high level of compliance as in most cases users will support controls where they are clearly aware of what they are and why they have been implemented. There will, however, always be a need to monitor the level of compliance and, where users continue to undertake illegal activities, take action to stop inappropriate behaviour. Given the remoteness of the proposed reserves and the resources and infrastructure that would be required to have a CALM enforcement presence in the area year round, it is appropriate that the existing users of the area (hydrocarbon, pearling and charter industries) play both a self-regulatory and visitor/user regulation role in the surveillance and enforcement program. A summary of the generic surveillance and enforcement objectives, strategies and targets is outlined below.

Summary of Generic Surveillance and Enforcement Objectives, Strategies and Targets

Management objective/s	Maximise public compliance of regulations related to the ongoing management of the proposed reserves.
Strategies	1. Develop and implement a surveillance and enforcement program, in collaboration with DoF, to ensure an adequate level of compliance with zoning restrictions (CALM, DoF). **(H-KMS)** 2. Develop and implement procedures to ensure coordination between government agencies to maximise efficiency and effectiveness of surveillance and enforcement activities (CALM, DoF, DPI). **(H - KMS)** 3. Facilitate cross authorisation of government enforcement officers as appropriate (CALM, DoF, DPI). **(H - KMS)** 4. Facilitate the hydrocarbon, pearling and charter industries, as well as visitors to the reserves, to take an active role in a voluntary surveillance and enforcement program (CALM). **(H)**
Target	Implementation of management strategies within agreed timeframes (Appendix II).

8.4 Research

Developing an understanding of the natural and social environment of the proposed reserves is critical to their effective management. A research program is a key strategy, in order to provide background information on the ecological and social environment and provide an understanding of what is "natural" as a benchmark for monitoring programs. Much of this information does not exist at this stage for the proposed reserves and so research programs need to focus on establishing the natural state of key ecological values and processes. Research programs should, ideally, be designed to fill key gaps in current knowledge, but any increase in knowledge is beneficial. Specific research strategies are detailed for each ecological and social value and are outlined in section 7 and scientific research as a value of the proposed reserves is outlined in section 7.2.8. A summary of the generic research objectives, strategies and targets is outlined below.

Summary of Generic Research and Monitoring Objectives, Strategies and Targets

Management objective/s	1. To obtain an appropriate understanding of the biodiversity and key ecological and social processes within the proposed reserves. 2. To promote ecological and social research in the proposed reserves that improves knowledge of the reserves and the technical basis for management decisions.
Strategies	1. Develop and progressively implement a coordinated and prioritised research and monitoring program of key values and processes of the reserves (CALM, DoF). **(H - KMS)** 2. Develop detailed habitat and wildlife distribution maps for the proposed reserves (CALM, industry). **(H-KMS)** 3. Develop and maintain a database of human usage in the reserves (CALM, DoF). **(H - KMS)** 4. Identify, prioritise and communicate high priority ecological and social research projects relevant to the management of the proposed reserves to appropriate research organisations via a strategic research plan with the aim of maximising priority research outcomes for the proposed reserves (CALM). **(H - KMS)** 5. Develop and maintain a database of historical and current research in the reserves (CALM). **(H)** 6. Facilitate scientific and social research in the reserves conducted by research, academic and educational institutions, by providing financial and logistical assistance (where possible) (CALM, DoF). **(H)**
Target	Implementation of management strategies within agreed timeframes (Appendix II).

8.5 Monitoring

Monitoring the state of the marine environment is critical to the effective management of any marine conservation reserve. A monitoring program is a key strategy, to allow the early detection of detrimental changes and provide the trigger for management action to ameliorate potential impacts before they lead to undesirable changes in the reserves' values to occur. The detection of human-induced changes requires an understanding of what is "natural" as a benchmark and this information should be provided through strategic research programs. Specific monitoring strategies are detailed for each ecological and social value and are outlined in section 7 and scientific research as a value of the proposed reserves is outlined in section 7.2.8. A summary of the generic monitoring objectives, strategies and targets is outlined below.

Summary of Generic Monitoring Objectives, Strategies and Targets

Management objective/s	1. To obtain an appropriate understanding of the biodiversity and key ecological and social processes within the proposed reserves. 2. To monitor key ecological values at risk and human usage in the proposed reserves. 3. To promote ecological and social research in the proposed reserves that improves knowledge of the reserves and the technical basis for management decisions.
Strategies	1. Develop and progressively implement a coordinated and prioritised monitoring program of key values and processes of the proposed reserves (CALM, DoF). **(H - KMS)** 2. Ensure that proponents of development proposals or activities with the potential to impact on the reserves' values conduct appropriate compliance monitoring programs (CALM). **(H)**
Target	Implementation of management strategies within agreed timeframes (Appendix II).

8.6 Public Participation

Developing community support for the proposed reserves is critical to the effective implementation of this management plan. The level of public compliance in relation to management controls in the reserves will be related directly to the level of understanding of the values of the proposed reserves and the reasons for regulation of activities in the reserves. An important early step in the administration of the proposed Montebello/Barrow islands marine conservation reserves is the establishment of a community-based Management Advisory Committee (MAC). Its main function would be the provision of advice and assistance to CALM and the MPRA. For example, local stakeholders would be able to raise issues with CALM and the MPRA in matters relating to the reserves' management, administration, zoning, conflicts of usage and any other management-related issues that arise during the life of the management plan. A summary of the generic public participation objectives, strategies and targets is outlined below.

Summary of Generic Public Participation Objectives, Strategies and Targets

Management objective/s	To facilitate on-going community participation in the management of the proposed reserves.
Strategies	1. Establish and maintain a MAC (CALM). **(H - KMS)** 2. Encourage community and local industry involvement in education and interpretation programs (CALM). **(M)** 3. Encourage community and local industry involvement in monitoring programs (CALM). **(M)**
Target	Implementation of management strategies within agreed timeframes (Appendix II).

8.7 Direct Management Intervention

Direct Management Intervention covers those management strategies that are not related to administration, surveillance and enforcement, education and public participation. Intervention management strategies generally relate to three aspects of management – rehabilitation of degraded areas, visitor facilities and risk management.

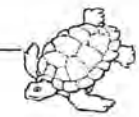
Although the majority of the waters in the Montebello/Barrow islands area are in a relatively pristine condition, there may be areas that have suffered some localised disturbance from past human use. Anecdotal evidence from current users of the proposed reserves suggests that there may be accumulations of litter in some areas and impacts on mud-crab or finfish stocks. Other impacts may include, for example, sediment contamination or damage to coastal vegetation due to visitor access. Such localised disturbances may negatively affect the ecological and social values of the area. Management response in this case would be to identify areas that have been disturbed prior to gazettal of the proposed reserves and evaluate what, if any, rehabilitation measures should be undertaken. Decisions as to whether it would be appropriate to rehabilitate an area would be based on the ability of an area to recover naturally (i.e. if no further pressure is applied and with no management intervention), the current level of disturbance of the area, ecosystem effects of not carrying out rehabilitation, aesthetic impacts of the disturbance and the cost of rehabilitation.

It is envisaged that the human use of the Montebello/Barrow islands area will increase in the future. An increase in visitor numbers may require additional facilities to be provided, so as to protect the ecological values from human disturbance and to enhance the visitor experience (e.g. moorings, dive trails, pontoons, walk trails on islands). The level of use of the proposed reserves and the areas which come under the highest visitor pressure should be monitored and consideration given to provision of visitor facilities where appropriate.

The remote nature of the proposed reserves, combined with shallow submerged reefs, strong ocean currents, high winds and seasonal cyclones, pose a high risk to visitors who may be inexperienced in, or unprepared for, such conditions. Additionally, the rugged island coastlines with undercut cliffs may pose a risk to visitors to the islands. As the use of the proposed reserves will probably increase during the life of the management plan, an ongoing visitor risk assessment should be undertaken to identify potential hazards and measures implemented to minimise these. A summary of the generic intervention objectives, strategies and targets is outlined below.

Summary of Generic Direct Management Intervention Objectives, Strategies and Targets

Management objective/s	1. To remediate, where necessary, existing human impacts on the ecological and social values of the proposed reserves. 2. To provide visitor facilities that minimise environmental impact to, and enhance visitor enjoyment of, the proposed reserves. 3. To take reasonable steps to minimise visitor risk where possible in the proposed reserves.
Strategies	1. Identify areas of existing human impact in the proposed reserves (CALM). **(M)** 2. Assess rehabilitation options and, where appropriate, implement these (CALM). **(M)** 3. Monitor human use (visitor numbers and high use areas) of the proposed reserves and, consistent with available resources, provide visitor facilities where appropriate (CALM). **(M)** 4. Perform assessments of visitor risk in the proposed reserves and, where necessary, implement appropriate measures to minimise visitor risk (CALM). **(M)**
Target	Implementation of management strategies within agreed timeframes (Appendix II).



9 DEVELOPMENT PROPOSALS WITHIN THE PROPOSED RESERVES

All development proposals within the marine reserves are subject to the environmental impact assessment requirements of the EP Act and consideration by CALM in the context of the approved management plan. During the life of the plan there may be proposals for the installation and construction of marine infrastructure associated with petroleum industry facilities (e.g. pipelines), pearling or tourism operations and potential infrastructure for public recreational facilities. These could be major development such as jetties, or minor works such as the installation of moorings, Fish Aggregating Device or navigation markers. The nature of the development will determine the appropriate level of assessment. Any assessment should review the proposal in terms of its potential impacts on the reserves' ecological and social values and whether it is consistent with the ecological targets of the proposed reserves.

In relation to petroleum development in marine conservation reserves there are agreed assessment procedures and protocols that are set out in a Memorandum of Understanding (MOU) between the EPA and DoIR (see Appendix I). The MPRA have endorsed the approach outlined in the MOU. They will be informed of all proposals submitted within the reserves, although the EPA/DoIR will be the primary mechanism for environmental assessment and approvals. There will not be a duplicated approvals process undertaken by the MPRA for petroleum operations. It should be noted that under this arrangement, the MPRA and CALM would still provide input and advice to the EPA on proposals when requested.

The Mooring Policy (Policy Statement No. 59) for marine conservation reserves aims to (i) minimise the detrimental impacts of uncontrolled mooring and anchoring; (ii) enhance user safety, access and equity in relation to moorings; and (iii) provide a framework to accommodate present and future mooring usage patterns. At this stage there are no areas in the proposed reserves that have been identified where moorings would not be permitted. Areas in which moorings would be acceptable or necessary from environmental, safety or equity points of view should be identified and the capacity (or number) of environmentally acceptable moorings established. Applications for moorings should be assessed on a case-by-case basis and in relation to criteria established in the CALM/MPRA Mooring Policy. A summary of the objectives, strategies and targets for development proposals is outline below.

Summary of Development Proposals Objectives, Strategies and Targets

Management objective/s	To ensure that the ecological and social impacts of infrastructure development proposals on the ecological and social values are evaluated through an appropriate level of environmental assessment.
Strategies	1. Ensure appropriate advice is provided to relevant authorities with regard to proposed marine infrastructure and the relevant ecological targets for the reserves (CALM, DoE). **(H)** 2. Identify areas in which moorings are acceptable and/or necessary from environmental, safety and equity perspectives (CALM, DoE, DPI). **(M)** 3. Assess mooring applications on a case-by-case basis and in relation to mooring criteria established in the CALM/MPRA Mooring Policy (CALM, DoE, MPRA). **(M)**
Target	Implementation of management strategies within agreed timeframes (Appendix II).

10 PERFORMANCE ASSESSMENT

The effectiveness of the management plan for the proposed reserves will be periodically reviewed through a formal auditing and review process. This will be undertaken through an annual assessment carried out by CALM and a formal audit by the MPRA every three years. The audits will include reports on the status of the key ecological values of the proposed reserves and an assessment of the effectiveness of current management strategies, providing feedback to reserve managers.

Overall management performance will be audited by the MPRA via a status report assessing compliance against the stated key ecological and social management targets (i.e. outcome-based approach) and against progress regarding implementation of the key management strategies (i.e. activity-based approach) as outlined in Sections 7 - 9. Management targets of selected key ecological and social values of the reserves are used as *key performance indicators* (KPIs) of the effectiveness of the reserves' management. These are identified in Section 7 by the symbol *(KPI)*. The KPIs reflect both the conservation priorities and the management imperatives of the

MPRA, CALM and the community. *Key management strategies* (KMS) are identified in Sections 7 - 9 by the symbol (H-KMS).

10.1 Audit by the Department of Conservation and Land Management

The prioritised strategies outlined in Sections 7 - 9 of the management plan will be built into annual works program of CALM's Pilbara Region that is responsible for the day to day management of the proposed reserves. Progress against the KPIs, KMSs and the remaining management targets and strategies will form the basis of an annual status report on the proposed reserves by CALM's Pilbara Region to CALM's Corporate Executive.

10.2 Audit by the MPRA

Progress against the KPIs and KMSs will form the basis of a formal MPRA audit of the proposed reserves every three years. CALM will provide annual status reports to the MPRA, from the time of gazettal of the proposed reserves, from which the MPRA can monitor annual progress of CALM's implementation of the management plan. The adequacy of the range of selected KPIs and KMSs will be reviewed following each MPRA audit and amended if appropriate.

10.3 Review of the Management Plan

The proposed reserves' management plan will cover management of the reserves for a period of 10 years from the date the plan is approved. This is the maximum allowable period that may be set for a management plan, as specified by the CALM Act.

At the completion of the 10 year period, the plan will be reviewed with full public consultation, re-submitted to the MPRA and then submitted to the Minister for the Environment, the Minister for Agriculture, Forestry and Fisheries and the Minister for State Development for approval. The CALM Act specifies that in the event of such a revision not occurring by the end of the plan's specified lifespan, the plan will remain in force in its original form, unless it is either revoked by the Minister or until a new plan is approved.

10.4 Links with State Environment Reporting

The first Western Australian State of the Environment Report was prepared in 1992 and a second report was published in 1998 (Government of Western Australia, 1998b). These reports provided an overview of the key marine and terrestrial environmental issues in the state. The EPA will be responsible for ongoing State of the Environment reporting building on the framework contained within the 1998 report. Relevant marine issues covered by this framework are the implementation of a statewide system of marine conservation reserves, biodiversity, degradation of marine habitats, contamination of the marine environment, the introduction of exotic marine species and tourism, fisheries, mining and petroleum industries. The performance assessment of the marine parks and Marine Management Area as described above, is broadly consistent with the State of the Environment reporting framework.

10.5 Links with National Environment Reporting

At a national level, there are two major reporting mechanisms relevant to marine conservation reserves. These are the national State of the Environment Report and the performance assessment framework for the National Representative System of Marine Protected Areas (NRSMPA). A State of the Marine Environment Report (SOMER) was published in 1996 (Commonwealth of Australia, 1996b) and will form part of the national State of the Environment Report. A range of performance assessment criteria are being developed to assess whether the goals of the NRSMPA are being achieved. The performance assessment framework of this plan is broadly consistent with the performance assessment criteria being developed for the NRSMPA.

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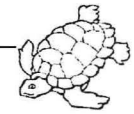

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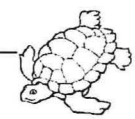

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13 APPENDICES

Memorandum of Understanding Between the Department of Industry and Resources and the Environmental Protection Authority for Offshore Petroleum Exploration and Production

Endorsement

The purpose of this Memorandum of Understanding is to establish an efficient and transparent administrative process for the Department of Industry and Resources to refer environmentally significant offshore petroleum exploration and production proposals to the Environmental Protection Authority pursuant to Part IV of the *Environmental Protection Act 1986.*

The Environmental Protection Authority (EPA) does not abrogate its responsibilities in regard to environmental assessment and any proposal may be referred to the EPA at any time. The EPA retains the right, under the *Environmental Protection Act 1986*, to call in any proposal which is likely to have a significant effect on the environment for assessment.

The signatories below endorse this Memorandum of Understanding.

Jim Limerick
Director General
Department of Industry and Resources

Walter Cox
Chairman
Environmental Protection Authority

1. Definitions and terminology

From here on in this document the following acronyms and short titles will be used:

AMSA	- Australian Maritime Safety Authority
DEP	- Department of Environmental Protection
DIA	- Department of Indigenous Affairs
CALM	- Department of Conservation and Land Management
DoF	- Department of Fisheries
DoIR	- Department of Industry and Resources
DPI	- Department of Planning and Infrastructure
DEH	- Department of Environment and Heritage
EPA	- Environmental Protection Authority
EP Act	- The *Environmental Protection Act 1986*
EPBC Act	- The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
Petroleum Acts	- The Western Australian *Petroleum Act 1967* and *Petroleum (Submerged Lands) Act 1982*
MPRA	- Marine Parks and Reserves Authority
MoU	- Memorandum of Understanding

The terminology used in this document is defined below:

Proposal	- a submission to the DoIR for exploration or production activities.
Decision-Making Authority	- public authority empowered by or under a written law or any agreement to which the State is a party and which is ratified or approved by an Act, to make a decision in respect of any proposal.
Inform	- this term is reserved for use when the term "refer" or "notify" cannot be used and means advertise (e.g. on the DoIR website) or make aware through other means.
Notify	- this term is reserved for use when the term "refer" cannot be used and means to make a particular person or persons aware by direct communication.
Refer	- this term is reserved for referrals as defined under Part IV of the EP Act.

2. Introduction

This MoU clarifies arrangements between the DoIR and the EPA for the protection of the environment and efficient consultation between the two agencies regarding offshore petroleum exploration and production proposals situated in environmentally sensitive areas in Western Australian coastal waters.

The application of this MoU is restricted to offshore petroleum exploration and production proposals. Similar agreements addressing the following have been, or are being, developed separately:

- terrestrial (onshore) petroleum exploration and production;
- marine (offshore) mineral exploration and development; and
- terrestrial (onshore) mineral exploration and development.

Through this MoU, the DoIR and the EPA have established procedures for efficient performance of their duties, whilst retaining the responsibilities of both parties. The MoU is not a formal delegation of powers under the EP Act but provides an administrative understanding concerning which proposals will be referred to the EPA. The EPA believes that the judgement and advice of other agencies is appropriate for managing several stages in the early development of petroleum proposals, particularly when there is restricted potential for significant environmental impacts.

This MoU is without prejudice to the statutory responsibilities of other Government agencies (e.g. AMSA, CALM, DEP, DIA, DPI, DoF and DEH) or their respective Ministers. Every effort has been made to make it consistent with State Government policy, in particular the *New Horizons* policy .

The MoU is predicated upon the following principles:

- the DoIR has lead responsibility for management of petroleum exploration and production for State and Commonwealth waters and is a Decision-Making Authority under the *Environmental Protection Act 1986*;
- the EPA has lead responsibility for environmental protection for the State;
- the conservation significance of sensitive environments must be recognised when assessing the acceptability of offshore petroleum exploration and production in these sensitive environments; and
- within marine conservation reserves the management plan will provide the framework (via management targets for ecological values) to guide consideration of proposals.

The parties in this MoU recognise that it facilitates the administration of the following legislation:

- the EP Act and Regulations; and
- the Petroleum Acts and Regulations.

3. Objectives

The objectives of this MoU are:

1. to ensure that sensitive environments are protected where offshore petroleum exploration and production occurs;
2. to facilitate efficient and effective consultation processes between the relevant government agencies whilst meeting and maintaining responsibilities of all parties;
3. to ensure that consultation between the DoIR, the EPA and any other relevant agencies is initiated as early as possible and to maintain public transparency of this consultation process;
4. to maximise consistency and minimise uncertainty for proponents and the public in regard to approval procedures for offshore petroleum proposals; and,
5. to clarify the approvals process for proposals within or adjacent to marine conservation reserves.

4. The DoIR responsibility in the procedural arrangements

Upon receiving an application, the DoIR is responsible for:

- informing the public by publishing basic details of each application on their website;
- forwarding the application to other Government agencies as necessary;
- notifying the MPRA/CALM of proposals that are within existing marine conservation reserves or in proposed reserves identified in the Marine Parks and Reserves Selection Working Group Report (CALM 1994);
- using the referral arrangements contained in Table 1 to determine whether the application needs to be referred to the EPA[1]; and,
- referring the application to the EPA, if the proposal is likely to have a significant effect on the environment.

5. The EPA responsibility in the procedural arrangements

The responsibility of the EPA is to:

- keep the DoIR informed of any proposals received to which this MoU applies;
- advise the DoIR when the level of assessment has been set on the proposal;
- carry out the environmental impact assessment process as required under Part IV of the EP Act; and,
- monitor the current list of proposals on the DoIR website on a regular basis.

6. Public involvement in the procedural arrangements

Any person can access information on the DoIR website and refer any proposals which are likely to have a significant effect on the environment to the EPA.

7. Criteria for referral to the EPA

The EPA and the DoIR have jointly agreed on a number of criteria used to determine if a proposal for petroleum exploration or production requires referral to the EPA. These criteria are given in Table 1.

8. Transparency of procedural arrangements by maintaining a public record

Information posted on the DoIR web site will identify current petroleum proposals and referrals to the EPA. It will include at least the following:

- proponent;

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[1] Table 1 outlines the minimum referral arrangements. The DoIR may choose to refer any proposal that it considers has a potential for significant environmental effects. The criteria used by the DoIR to determine whether a proposal has the potential for significant effects are those published by the EPA (1993) and are based on the following factors:

- character of the receiving environment and the use and value which society has assigned to it;
- magnitude, spatial extent and duration of anticipated change;
- resilience of the environment to cope with change;
- confidence of prediction of change;
- existence of policies, programmes, plans and procedures against which the need for applying the environmental impact assessment process to a proposal can be determined;
- existence of environmental standards against which a proposal can be assessed; and
- degree of public interest in environmental issues likely to be associated with a proposal.

For more information see the DoIR website:

http://www.doir.wa.gov.au

- petroleum proposal;
- supporting environmental documentation;
- permit area and location;
- date submitted;
- environmental assessment status (eg. referral to EPA or assessed by DoIR); and
- closing date for public comment.

More detailed information regarding the proposal and potential risks to the environment can be obtained from the proponent as listed on the DoIR website.

These processes, procedures and criteria will ensure that transparency (to the public) of the arrangements under the MoU is maintained.

9. Duration and Review

The procedures contained within the MoU shall be subject to periodic review. This review shall occur at least every five years unless there is either a change of State Government policy, or one of the parties associated with this MoU determines that a review is required.

10. Audit

Referral arrangements under the MoU shall be audited every 12 months and the results of the audit will be publicly available.

Table 1 Referral Arrangements for Offshore Petroleum Activities [1,2]

Activity	CALM Marine Conservation Reserves [3]							Other Marine Areas		
	Marine Nature Reserves	Marine Parks [4]				Marine Management Area		Other Marine Protected Areas [9]	Other WA Coastal Waters	Commonwealth Waters
		Sanctuary Zone	Recreational Zone	Special Purpose Zone [5]	General Use Zone [5]	Special Protected Zones	Unzoned			
Seismic survey (airgun towed array)	closed *(for minor extensions of adjacent surveys refer to EPA)*	closed *(for minor extensions of adjacent surveys refer to EPA)*	closed *(for minor extensions of adjacent surveys refer to EPA)*	DoIR refers to EPA	DoIR refers to EPA	DoIR refers to EPA	DoIR seeks advice from CALM [6,8]	DoIR refers to EPA	Assessed and managed by DoIR [6]	Outside EPA jurisdiction. Assessed and managed by DoIR
Exploration or appraisal drilling	closed	closed	closed	DoIR refers to EPA	DoIR refers to EPA	DoIR refers to EPA	DoIR seeks advice from CALM [8]	DoIR refers to EPA	DoIR refers to EPA if within 3 nm of coast, islands or intertidal reefs	Outside EPA jurisdiction. Assessed and managed by DoIR
Production development and/or pipelines [7]	closed	closed	closed	DoIR refers to EPA	DoIR refers to EPA	DoIR refers to EPA	DoIR refers to EPA	DoIR refers to EPA	DoIR refers to EPA	Outside EPA jurisdiction. Assessed and managed by DoIR

[1] Notwithstanding the MoU administrative arrangements with DoIR, the EPA reserves the right to call in any proposal for assessment. Any member(s) of the public also have the right to refer a proposal should they consider there is potential for significant effects on the environment.

[2] Activities in State or Commonwealth waters may also require referral to DEH under the *Environment Protection and Biodiversity Conservation Act 1999*.

[3] DoIR will inform CALM Marine Branch of any proposals in existing Marine Conservation Reserves or areas indicated in the Marine Parks & Reserves Schedule Working Group Report (1994). CALM will consult with MPRA.

[4] Drilling and development are not permitted in Ningaloo Marine Park.

[5] Drilling and development are permitted in parts of special purpose or general use zones, pending EPA assessment.

[6] All intertidal zone seismic proposals and also seismic proposals in shallow water (<15m) in turtle breeding areas during turtle breeding season require referral to the EPA. Seismic proposals which may affect migrating whales or are located in whale mating/calving areas (e.g. Buccaneer Archipelago area) in the breeding season also require referral to the EPA.

[7] Additional production wells drilled from an existing production facility (deviated wells) would not normally require referral and would be managed by DoIR consistent with the existing EPA environmental conditions.

[8] DoIR seeks advice from CALM as to whether the proposal is consistent with the Management Plan, or is otherwise environmentally significant (for example because of potential for impacts on breeding turtles from artificial lighting), in order to determine if referral to the EPA is required.

[9] Protected areas other than those managed under the CALM Act. For example areas protected under the *Fish Resources Management Act 1994* such as the Abrolhos Islands, areas protected under the *Rottnest Island Authority Act 1987*, historic wreck sites, Ramsar sites and World Heritage Areas.

Appendix II: Timetable for Implementation of Management Strategies

VALUE	MANAGEMENT STRATEGY	YEAR									
Ecological		1	2	3[#]	4	5	6[#]	7	8	9	10[#]
Geomorphology (EV 7.1.1)	1. Ensure that approvals and the setting of conditions for new petroleum, nature-based tourism and pearling operations are consistent with the management targets for the value of geomorphology and that appropriate monitoring conditions are applied to ensure these outcomes are achieved (DoE/EPA, DoIR, DoF, WATC, CALM). **(H)**	→	→	→	→	→	→	→	→	→	→
	2. Ensure the hydrocarbon industry is informed of relevant management objectives and targets for geomorphology (CALM, DoE). **(H)**	→	→	→							→
	3. Determine the level of existing disturbance/degradation to the geomorphology, to set benchmarks for this value (CALM). **(H)**	→	→	→							
	4. Educate users about the ecological importance of the reserves' geomorphology (CALM). **(L)**	→	→	→	→	→	→	→	→	→	→
Sediment quality (EV 7.1.2)	1. Maintain a database of pollutant inputs to sediments (industry, CALM, DoE, DoIR). **(H-KMS)**	→	→	→	→	→	→	→	→	→	→
	2. Minimise impacts on sediments by encouraging, where possible, the use of products that have less impact on the marine biota (DoE/EPA, DoIR, CALM). **(H)**	→	→	→	→	→	→	→	→	→	→
Water quality * (EV 7.1.3)	1. Ensure there are appropriate predictive models and specific management plans (given location and weather conditions) for oil spills to assist the State Committee for Combating Oil Pollution in managing any pollution event that occurs (industry, DPI, CALM, DoIR). **(H-KMS)**	→	→	→	→	→	→	→	→	→	→
	2. Ensure there are adequate management resources available to deal with pollution incidents consistent with the risk of such an event occurring (industry, DPI, CALM, DoIR). **(H)**	→	→	→	→	→	→	→	→	→	→
	3. Ensure a pollutant inputs database for the reserves is maintained (industry, CALM, DoE). **(H)**	→	→	→	→	→	→	→	→	→	→
	4. Develop an appropriate understanding of the circulation and mixing of the reserves' waters (CALM). **(M)**	→	→	→							
	5. Develop an appropriate understanding of the natural variability of the local water quality conditions (CALM, DoIR, industry). **(M)**	→	→	→							
	6. Encourage a policy of zero discharge where alternatives exist (DoE/EPA, DoIR, CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
	7. Inform users of the proposed reserves about government policy and regulations on boat sewage disposal (CALM, DPI). **(M)**	→	→	→	→	→	→	→	→	→	→

VALUE	MANAGEMENT STRATEGY	YEAR									
Ecological		1	2	3†	4	5	6†	7	8	9	10‡
Coral reef communities * (EV 7.1.4)	1. Implement a zoning scheme that: • provides representative, undisturbed coral reef communities in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated); • provides protection to replenishment source sites; and • provides representative coral reef communities in areas free of significant human influence as an appropriate level of ecological "insurance" (CALM). **(H-KMS)**	→	→								
	2. Assess the nature, level and potential impacts of human activities on coral reef communities within the proposed reserves and implement an appropriate monitoring program (CALM). **(H-KMS)**	→	→	→	→						
	3. Ensure all existing and new moorings meet specified environmentally acceptable standards where these moorings are located in sensitive coral habitats (CALM, DPI). **(H)**	→	→	→	→	→	→	→	→	→	→
	4. Ensure that approvals and the setting of conditions for new petroleum, nature-based tourism and pearling operations are consistent with the management targets for coral reef communities and that appropriate monitoring conditions are applied to ensure these outcomes are achieved (DoE/EPA, DoIR, DoF, WATC, CALM). **(H)**	→	→	→	→	→	→	→	→	→	→
	5. Prohibit the commercial and recreational collection of coral within the proposed reserves (DoF, CALM). **(H)**	→									
	6. Ensure activities that are potentially detrimental to successful coral reproduction are not carried out during and immediately after the major period of coral spawning (industry, CALM, DoIR, DoE). **(H)**	→	→	→	→	→	→	→	→	→	→
	7. Educate users of the reserves about the ecological importance of coral reef communities and the potential detrimental effects of indiscriminate reef walking, collecting, anchoring and boating on coral reef communities (CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
	8. Ensure the hydrocarbon industry is informed of relevant management objectives and targets for coral reef communities (CALM, DoIR, DoE). **(M)**	→	→	→	→	→	→	→	→	→	→
	9. Ensure the State Committee for Combating Oil Pollution has access to data relevant to the management of oil spills (CALM, DPI). **(M)**	→	→	→	→	→	→	→	→	→	→
Mangrove communities * (EV 7.1.5)	1. Implement a zoning scheme that: • protects the majority of mangrove communities in the Montebello Islands from extractive activities; and • provides representative, undisturbed mangrove communities in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated) (CALM, DoF). **(H-KMS)**	→	→								
	2. Educate users of the reserves about the ecological importance of mangroves in the proposed reserves and, in particular, the impacts of physical disturbance and mud-crabbing on mangrove communities (CALM). **(H-KMS)**	→	→	→	→	→	→	→	→	→	→
	3. Annually assess the nature and level of human activities on mangrove communities within the reserves (CALM, industry). **(H)**	→	→	→	→	→	→	→	→	→	→

VALUE	MANAGEMENT STRATEGY	YEAR									
Ecological		1	2	3[†]	4	5	6[†]	7	8	9	10[‡]
	4. Monitor "at-risk" mangrove communities (at appropriate temporal and spatial scales), as appropriate, if significant risks are identified in strategy three (CALM, industry). **(H)** 5. Ensure the hydrocarbon and nature-based tourism industries are informed of relevant management objectives and targets for mangrove communities within the proposed reserves (CALM, DoIR). **(H)**	→	→	→	→	→	→	→	→	→	→
Macroalgal and seagrass communities [*] (EV 7.1.6)	1. Implement a zoning scheme that: • provides representative, undisturbed macroalgal and seagrass communities in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated); and • provides representative macroalgal and seagrass communities in areas free of significant human influence as an appropriate level of ecological "insurance" (CALM). **(H-KMS)** 2. Initiate research and survey programs to provide a more comprehensive assessment of the seagrass communities in the reserves (CALM). **(H-KMS)** 3. Ensure that approvals and the setting of conditions for new petroleum, nature-based tourism and pearling operations are consistent with the management targets for macroalgal and seagrass communities and that appropriate monitoring conditions are applied to ensure these outcomes are achieved (CALM, industry, DoE/EPA, DoF, WATC, DoIR). **(H)** 4. Ensure the hydrocarbon industry is informed of relevant management objectives and targets for macroalgal and seagrass communities (CALM, DoE, DoIR). **(H)** 5. Annually assess the nature and level of human activities on macroalgal and seagrass communities within the reserves (CALM, industry). **(H)** 6. Monitor "at-risk" macroalgal and seagrass communities (at appropriate temporal and spatial scales), as appropriate, if significant risks are identified in strategy five (CALM, industry). **(H)** 7. Educate users of the reserves about the ecological importance of macroalgal and seagrass communities (CALM). **(L)**	→	→	→	→	→	→	→	→	→	→
Intertidal sand/mudflat communities (EV 7.1.7)	1. Implement a zoning scheme that: • provides representative, undisturbed intertidal sand/mudflat communities in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated); • protection of significant intertidal sand, silt and mudflat communities from unacceptable disturbance from development activities or extractive activities (e.g. laying of pipelines on the seabed); and • provides representative intertidal sand/mudflat communities in areas free of significant human influence as an appropriate level of ecological "insurance" (CALM). **(H-KMS)** 2. Liaise with DoE and the hydrocarbon industry to ensure that development proposals have minimal impact on intertidal sand/mudflat communities (CALM, industry, DoIR, DoE). **(H-KMS)** 3. Ensure that approvals and the setting of conditions for new petroleum, nature-	→	→	→	→	→	→	→	→	→	→

VALUE	MANAGEMENT STRATEGY	YEAR									
Ecological		1	2	3†	4	5	6†	7	8	9	10‡
	based tourism and pearling operations are consistent with the management targets for intertidal sand/mudflat communities and that appropriate monitoring conditions are applied to ensure these outcomes are achieved (CALM, industry, DoE/EPA, DoF, DoIR, WATC). **(H)**										
	4. Ensure the hydrocarbon industry is informed of the management objectives and targets for intertidal sand/mudflat communities within the proposed reserves (CALM, DoE). **(M)**	→	→	→	→	→	→	→	→	→	→
Rocky shore/intertidal reef platform communities (EV 7.1.8)	1. Implement a zoning scheme that: • provides for representative, undisturbed rocky shore/intertidal reef platform communities in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated) (CALM). **(H-KMS)**	→	→								
	2. Initiate research programs to characterise the flora and fauna of selected rocky shore/intertidal reef platform communities within the proposed reserves (CALM). **(M)**	→	→	→	→						
	3. Educate users of the reserves about the detrimental effects of human activities on rocky shore/intertidal reef platform communities (CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
	4. Ensure the hydrocarbon industry considers appropriate methods when performing transition zone seismic activities in these areas (DoE/EPA, DoIR, CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
Marine mammals (EV 7.1.9)	1. Undertake research to ascertain the regional importance of the Montebello/Barrow islands area for dugongs and the relative importance of areas within the reserves (CALM). **(H-KMS)**	→	→	→							
	2. Ensure relevant industry activities are undertaken at times and places that do not conflict with humpback whale migration through the reserves (CALM, DoE/EPA, DoIR, DoF). **(H-KMS)**	→	→	→	→	→	→	→	→	→	→
	3. Ensure that offshore developments do not have significant impacts on marine mammals through the provision of advice to the DoE/EPA (CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
	4. Educate users of the reserves on the possible detrimental impacts of human activities on marine mammals (CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
	5. Maintain records of the incidence of entanglement, boat collisions and strandings of marine mammals in the reserves (CALM). **(L)**	→	→	→	→	→	→	→	→	→	→
Turtles * (EV 7.1.10)	1. Implement a zoning scheme that: • provides for protection of significant sites for turtle nesting beaches; and • provides for protection of large turtle aggregations in the vicinity of North-West Island and between Wonnich and South-West Reefs (CALM). **(H-KMS)**	→	→								
	2. Ensure that licences for pearling/aquaculture, nature-based tourism and hydrocarbon operations contain conditions to minimise the impacts of lights and flares on turtle hatchlings (DoE/EPA, DoIR, DoF, WATC, CALM). **(H-KMS)**	→	→	→	→	→	→	→	→	→	→
	3. Determine the impacts of lights on hatchling survival (due to disorientation and predation by silver gulls) (CALM, industry). **(H-KMS)**			→	→	→					
	4. Ensure that mating aggregations and nesting activities of turtles are not significantly disturbed by recreational boating, nature-based tourism, pearling/aquaculture and hydrocarbon operations (CALM, DoE/EPA, DoF,	→	→								

VALUE	MANAGEMENT STRATEGY	YEAR									
Ecological		1	2	3†	4	5	6†	7	8	9	10‡
	WATC). **(H)** 5. Monitor turtle nesting activities to determine the relative importance of nesting beaches and to assess long term changes in abundance and usage of sites (CALM, industry). **(M)** 6. Facilitate research applicable to the management of turtles in the proposed reserves (CALM). **(M)** 7. Educate users of the reserves on the possible detrimental impacts of human activities on nesting turtles in the reserves (CALM). **(M)** 8. Maintain a database of turtle mortality and incidents of entanglement in the proposed reserves (CALM). **(L)**	→	→	→	→	→	→	→	→	→	→
Seabirds (EV 7.1.11)	1. Implement a zoning scheme to provide for the: • protection of significant seabird and shorebird nesting sites; and • protection of large seabird and shorebird aggregations (CALM). **(H-KMS)** 2. Encourage the completion and implementation of CALM management plans for the island reserves (CALM). **(H)** 3. Minimise the increase in silver gull numbers by: • discouraging feeding of silver gulls by employees and visitors though education programs; • liaising with industry regarding lighting to reduce night-time feeding opportunities for silver gulls; and • liaising with industry and local government regarding rubbish disposal and freshwater sources (CALM, industry). **(M)** 4. Ensure that important seabird and shorebird breeding and feeding areas are not significantly affected by human activities (CALM, industry). **(M)** 5. Educate users of the reserves on the ecological significance of the reserves' seabird and shorebird populations and the potential detrimental impacts of human disturbance (CALM). **(L)**	→	→	→							
Finfishes * (EV 7.1.12)	1. Implement a zoning scheme that: • provides protection to important fish spawning aggregation sites and nursery areas in the proposed reserves; and • provides representative, undisturbed finfish populations in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient size and replicated) (CALM). **(H-KMS)** 2. Identify finfish species that can be taken by recreational and commercial fishers in the reserves and, in liaison with DoF, provide the necessary legislation to provide protection for species which will not be extracted (CALM, DoF). **(H)** 3. Review the need for special conditions (e.g. bag limits and possession limits) for target finfish species in the proposed reserves (DoF). **(H)** 4. Undertake research programs to characterise finfish diversity and abundance in the reserves (CALM, DoF). **(M)**	→	→	→	→	→	→	→			
Invertebrates (EV 7.1.13)	1. Implement a zoning scheme that: • provides representative, undisturbed invertebrate populations in the proposed reserves as "reference" sites for research and monitoring purposes (of sufficient	→	→								

VALUE	MANAGEMENT STRATEGY	YEAR									
Ecological		1	2	3†	4	5	6†	7	8	9	10‡
	size and replicated); and • provides protection to replenishment source sites (CALM). **(H-KMS)** 2. Identify invertebrate species that can be taken by recreational and commercial fishing in the reserves and, in liaison with DoF, provide the necessary legislation to provide protection for species which will not be extracted (CALM, DoF). **(H)** 3. Prohibit recreational shell collecting in the proposed reserves (DoF, CALM). **(H)** 4. Undertake research programs to characterise invertebrate diversity and abundance in the reserves (CALM, DoF). **(M)**	→		→	→		→		→		

VALUE	MANAGEMENT STRATEGY	YEAR									
Social		1	2	3†	4	5	6†	7	8	9	10‡
Hydrocarbon exploration and production industry (SV 7.2.1)	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and the level of impact of petroleum activities (sufficient and representative appropriate areas); and • provides "insurance" against possible impacts of hydrocarbon activities on the ecological values (CALM). **(H-KMS)** 2. Ensure a coordinated approach to industry assessment and reporting requirements in the proposed reserves (DoE/EPA, DoIR, industry, CALM). **(H)** 3. Ensure the licence conditions of approved petroleum industry projects include: • appropriate environmental performance measures; • desired trends; • short-term and long-term management targets; and • monitoring and reporting requirements (DoE/EPA, DoIR, CALM). **(H)** 4. Ensure that environmental research and monitoring undertaken by industry is coordinated and maximise opportunities for collaboration to increase understanding and knowledge of the area (CALM, DoIR, industry). **(H)** 5. Ensure other users of the reserves do not unnecessarily restrict future petroleum industry opportunities in appropriate areas in the reserves (CALM). **(M)**	→	→								→
Pearling (SV 7.2.2)	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and the level of impact from pearling activities (sufficient and representative appropriate areas); • provides equitable access for the pearling industry in appropriate areas; and • provides "insurance" against possible impacts of pearling activities on the ecological values (CALM). **(H-KMS)** 2. Ensure pearling licences are consistent with the management plan and they	→	→								→

VALUE	MANAGEMENT STRATEGY	YEAR									
Social		1	2	3†	4	5	6†	7	8	9	10†
	include: • conditions requiring environmental monitoring to the satisfaction of DoE and CALM; and • conditions relating to lighting, navigational marking and site utilisation to the satisfaction of DPI and DoF (DoF, CALM, EPA, DPI). **(H-KMS)** 3. In collaboration with the Pearl Producers Association and DoF, assess the need for Codes of Practice for pearling in the reserves to ensure social and ecological sustainability (CALM, DoF, PPA). **(H)** 4. Ensure that proposals for petroleum and nature-based tourism operations do not affect the key ecological requirements for pearling operations (e.g. high water quality) (CALM, DoE/EPA, WATC). **(H)** 5. Ensure that due consideration is given to activities which would unnecessarily exclude future pearling activities in appropriate zones in the reserves (CALM). **(M)** 6. Provide formal advice to DoF and EPA (as appropriate) in relation to the environmental assessment of proposed pearling activity in the reserves (CALM). **(M)**			→	→						→
Nature-based tourism (SV 7.2.3)	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and the level of impact of human activities (sufficient and representative appropriate areas); • provides protection to key dive sites and nature-based tourism opportunities; and • provides "insurance" against possible impacts of nature-based tourism activities on the ecological values (CALM). **(H-KMS)** 2. License all nature-based tourism operators within the reserves with appropriate conditions (CALM). **(H)** 3. Develop Codes of Practice for nature-based tourism operations in the reserves including: • performance measures; • desired trends; • short-term and long-term management targets; and • monitoring and reporting requirements (CALM, WATC). **(M)** 4. Ensure equitable access for nature-based tourism within appropriate zones in the reserves (CALM). **(M)**		→								→
				→	→						
											→
Commercial fishing (SV 7.2.4)	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and the level of impact from commercial fishing activities (sufficient and representative appropriate areas); • provides protection of nursery habitats (e.g. mangroves) and spawning sites for key commercially targeted species; and • provides "insurance" against possible impacts of commercial fishing activities on the ecological values (CALM). **(H-KMS)**		→								

VALUE	MANAGEMENT STRATEGY	YEAR									
Social		1	2	3†	4	5	6†	7	8	9	10‡
	2. Determine the levels and effects of commercial fishing activity in the reserves and review management controls where required (DoF, CALM). **(H)**			→	→	→					
	3. Monitor and report on commercial fishing catch/effort within the reserves (DoF). **(H)**	→	→	→	→	→	→	→	→	→	→
	4. Ensure commercial fishers are aware of the zoning scheme and any restrictions that may apply to their operations (DoF, CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
	5. Liaise with the MPRA in regard to proposed new fisheries and major changes to existing fisheries within the reserves (DoF). **(M)**	→	→	→	→	→	→	→	→	→	→
Recreational fishing (SV 7.2.5)	1. Implement a zoning scheme that: • provides for protection of potential spawning and nursery sites for key recreational fishing species; • provides for opportunities to contribute to the achievement of DoF's objectives for the broader management of recreational fishing; • provides for opportunities to review the effectiveness of zoning as a management tool; • provides assistance in the maintenance of fish stocks in the area; and • provides "insurance" against possible impacts of recreational fishing activities on the ecological values (CALM, DoF). **(H-KMS)**	→	→								
	2. Ensure recreational fishers are aware of the zoning scheme and of restrictions which apply to their activities in the reserves (DoF, CALM, industry). **(H)**	→	→	→	→	→	→	→	→	→	→
	3. Evaluate the sustainability of existing recreational fisheries in the proposed reserves (DoF). **(H)**	→	→	→	→	→	→	→	→	→	→
	4. Formulate performance measures and targets for key recreational species for the maintenance of the quality of recreational fishing in the reserves (DoF). **(M)**	→	→	→	→	→	→	→	→	→	→
	5. Determine the effects of recreational fishing activities in the reserves and review management controls as required (DoF, CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
	6. Monitor recreational fishing catch/effort within the proposed reserves (DoF). **(M)**	→	→	→	→	→	→	→	→	→	→
Water sports (SV 7.2.6)	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and level of impact of human activities (sufficient and representative appropriate areas); • provides protection to key recreation sites; • provides equitable access to the proposed reserves for recreational users; and • provides "insurance" against possible impacts of water sports on the ecological values (CALM). **(H-KMS)**	→	→								
	2. In collaboration with user groups, develop Codes of Conduct to minimise environmental impacts of recreational activities, as appropriate (CALM). **(M)**				→	→	→				
	3. Determine the nature, spatial patterns, compatibility and potential environmental impacts of all existing water sports in the reserves (CALM). **(M)**			→	→	→					
	4. Implement restrictions on boating (e.g. speed/area closures), in consultation with key stakeholders, if these activities are shown to be impacting on the ecological and social values of the proposed reserves (DPR, CALM). **(L)**	→	→	→	→	→	→	→	→	→	→

VALUE	MANAGEMENT STRATEGY	YEAR									
Social		1	2	3†	4	5	6†	7	8	9	10†
European history/maritime heritage (SV 7.2.7)	1. Distribute educational material regarding conserving the history of the islands to visitors of the proposed reserves (WAMM, CALM). **(L)** 2. Advise park users of the relevant regulations under the *Heritage of Western Australia Act 1990*, the *Maritime Archaeology Act 1973* and the Commonwealth *Historic Shipwrecks Act 1976*, where appropriate (WAMM, CALM). **(L)**	→	→	→	→	→	→	→	→	→	→
Scientific research (SV 7.2.8)	1. Implement a zoning scheme that: • provides for monitoring and assessment of key ecological processes and level of impact of human activities (sufficient and representative appropriate areas); and • provides equitable access to the proposed reserves for scientific research (CALM). **(H-KMS)** 2. Identify and communicate high priority scientific and social research projects relevant to the management of the reserves to appropriate research organisations (CALM). **(H)** 3. Facilitate scientific and social research in the reserves by research, academic and educational institutions by providing financial and logistical assistance (where possible) (CALM, industry). **(M)** 4. Liaise with the petroleum industry to coordinate industry and CALM research programs with the aim of maximising priority research outcomes for the area (CALM). **(M)**	→	→		→						

VALUE	MANAGEMENT STRATEGY	YEAR									
Generic		1	2	3†	4	5	6†	7	8	9	10†
Administration	1. Gazette appropriate notices under the CALM Act and FRM Act to implement the zoning scheme of the proposed reserves (CALM, DoF). **(H - KMS)** 2. Inform users about the types of zones, reasons for and restrictions on activities in the proposed reserves using signage, information manuals and education programs (CALM, DoF). **(H - KMS)** 3. MPRA and CCWA to develop an appropriate vesting basis for the management arrangements of the intertidal areas of the reserves (MPRA, CCWA, CALM). **(H-KMS)** 4. Facilitate research on the effectiveness of zoning as an aid to achieving the objectives of the proposed reserves (CALM). **(H)**	→	→	→	→	→	→	→	→	→	→
Education and interpretation	1. Develop and implement, in collaboration with industry, DoF and other relevant agencies, education and interpretation programs to ensure users of the reserves are aware of and understand the values of the reserves, management zones and regulations and the reasons for these controls (CALM, DoF). **(H - KMS)** 2. Develop and distribute to the community and visitors a range of education materials about the reserves' values and management (CALM, DoF). **(H)** 3. Assist the hydrocarbon, pearling and charter industries to access and deliver	→	→								

VALUE	MANAGEMENT STRATEGY	YEAR									
Generic		1	2	3*	4	5	6*	7	8	9	10*
	information courses/materials to their staff or patrons (CALM). **(H)**										
	4. Provide talks and briefings about the reserves' values, uses and management to user groups (CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
Surveillance and enforcement	1. Develop and implement a surveillance and enforcement program, in collaboration with DoF, to ensure an adequate level of compliance with zoning restrictions (CALM, DoF). **(H-KMS)**	→	→	→							
	2. Develop and implement procedures to ensure coordination between government agencies to maximise efficiency and effectiveness of surveillance and enforcement activities (CALM, DoF, DPI). **(H - KMS)**	→	→	→							
	3. Facilitate cross authorisation of government enforcement officers as appropriate (CALM, DoF, DPI). **(H - KMS)**	→	→	→							
	4. Facilitate the hydrocarbon, pearling and charter industries, as well as visitors to the reserves, to take an active role in a voluntary surveillance and enforcement program (CALM). **(H)**	→	→	→							
Research	1. Develop and progressively implement a coordinated and prioritised research and monitoring program of key values and processes of the reserves (CALM, DoF). **(H - KMS)**	→	→	→							
	2. Develop detailed habitat and wildlife distribution maps for the proposed reserves (CALM, industry). **(H-KMS)**	→	→	→							
	3. Develop and maintain a database of human usage in the reserves (CALM, DoF). **(H - KMS)**	→	→	→							
	4. Identify, prioritise and communicate high priority ecological and social research projects relevant to the management of the proposed reserves to appropriate research organisations via a strategic research plan with the aim of maximising priority research outcomes for the proposed reserves (CALM). **(H - KMS)**	→	→								→
	5. Develop and maintain a database of historical and current research in the reserves (CALM). **(H)**	→	→								
	6. Facilitate scientific and social research in the reserves conducted by research, academic and educational institutions, by providing financial and logistical assistance (where possible) (CALM, DoF). **(H)**	→	→	→	→	→	→	→	→	→	→
Monitoring	1. Develop and progressively implement a coordinated and prioritised monitoring program of key values and processes of the proposed reserves (CALM, DoF). **(H - KMS)**	→	→	→							
	2. Ensure that proponents of development proposals or activities with the potential to impact on the reserves' values conduct appropriate compliance monitoring programs (CALM). **(H)**	→	→	→	→	→	→	→	→	→	→
Public participation	1. Establish and maintain a MAC (CALM). **(H - KMS)**	→									
	2. Encourage community and local industry involvement in education and interpretation programs (CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
	3. Encourage community and local industry involvement in monitoring programs (CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
Direct management intervention	1. Identify areas of existing human impact in the proposed reserves (CALM). **(M)**	→	→	→							
	2. Assess rehabilitation options and, where appropriate, implement these (CALM).	→	→	→							

VALUE	MANAGEMENT STRATEGY	YEAR									
Generic		1	2	3†	4	5	6†	7	8	9	10‡
	(M) 3. Monitor human use (visitor numbers and high use areas) of the proposed reserves and, consistent with available resources, provide visitor facilities where appropriate (CALM). **(M)** 4. Perform assessments of visitor risk in the proposed reserves and, where necessary, implement appropriate measures to minimise visitor risk (CALM). **(M)**	→	→	→	→	→	→	→	→	→	→
Development proposals	1. Ensure appropriate advice is provided to relevant authorities with regard to proposed marine infrastructure and the relevant ecological targets for the reserves (CALM, DoE). **(H)** 2. Identify areas in which moorings are acceptable and/or necessary from environmental, safety and equity perspectives (CALM, DoE, DPI). **(M)** 3. Assess mooring applications on a case-by-case basis and in relation to mooring criteria established in the CALM/MPRA Mooring Policy (CALM, DoE, MPRA). **(M)**	→	→	→	→	→	→	→	→	→	→

Key:
Ecological (EV) and social (SV) value reference in management plan
* = Key Performance Indicator
† MPRA Audit
‡ MPRA Audit and Management Plan Review