



Australian Government
Great Barrier Reef
Marine Park Authority

Identifying *Special or Unique Sites*
in the Great Barrier Reef
World Heritage Area for inclusion in
the *Great Barrier Reef*
Marine Park Zoning Plan 2003

Compiled by Kirstin Dobbs



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EXECUTIVE SUMMARY

A comprehensive and adequate network of protected areas requires the inclusion of both representative examples of different habitats, and special or unique sites. Thus, review of the zoning of the Great Barrier Reef Marine Park as part of the Representative Areas Program explicitly took *special and unique* sites into consideration as one aspect of maximising the comprehensiveness and adequacy of the final zoning network. Guiding principles were developed to assist with incorporating these sites into the network of highly protected, no-take areas as well as through other zoning arrangements in the *Great Barrier Reef Marine Park Zoning Plan 2003*.

Potential sites (n=408) were identified by surveys of expert scientists, with expertise in both reef and non-reef habitats, from workshops to develop bioregions (refer Kerrigan et al. 2010), and from preliminary user workshops, held between October 2000 and February 2001 (Fernandes et al. 2010). A set of criteria were necessary to formalise the selection of *special or unique* sites and their inclusion into the zoning process. These criteria included: geographic explicitness; the amount and detail of information about the site including the number of independent sources; and whether the site was relevant to the Great Barrier Reef Marine Park Authority's national or international obligations. Fifty-three sites (13% of the identified potential sites) were assessed as being *special or unique* by these criteria. The types of justifications provided ranged from threatened species to geomorphologic formations that are rare within the Great Barrier Reef World Heritage Area.

The *special or unique* sites were then incorporated into the selection process for the network of highly protected, no-take areas as well as being considered in other arrangements under the *Great Barrier Reef Marine Park Zoning Plan 2003*. Not all identified *special or unique* sites were incorporated into the final no-take network. In total, the area of no-take protection of the *special or unique* sites in the Great Barrier Reef Marine Park increased from 1,614 km² to 4,013 km². Twenty-two of the *special or unique* sites were already zoned as no-take or highly protected because of seabird or marine turtle nesting significance or importance as dugong foraging habitat. Of the remaining sites, 25 increased in overall protection with regard to no-take zoning.

The Great Barrier Reef Marine Park Authority recognised that the protection of the particular biophysical attributes that warrant *special or unique* status may involve other types of management action than just inclusion into no-take zones. Protection for some *special or unique* features is better achieved through the use of a combination of management tools, and by holistic and adaptive management of the increasing pressures some of these features face. Examples of potential tools include reef-wide initiatives such as best environmental practices, raising the awareness of reef users, regulations for approach distances to minimise interference (e.g. cetaceans), the development of fisheries management plans and Traditional Use of Marine Resources Agreements,.

For the Great Barrier Reef Marine Park Authority, future efforts to identify *special or unique* sites should ensure that cultural relationships between people and their natural resources are included as part of the assessment. Future initiatives should also explicitly incorporate species of marine plants, invertebrates or fish that are less well-known, and habitats and species that inhabit the deepwater near the continental shelf.

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INTRODUCTION

The Great Barrier Reef is widely acclaimed as one of the world's great natural treasures. Established under the *Great Barrier Reef Marine Park Act 1975*, the 344,400 km² Great Barrier Reef Marine Park (Marine Park) supports one of the most complex and biologically diverse ecosystems on earth. The Marine Park comprises over 99% of the Great Barrier Reef World Heritage Area, which was inscribed on the World Heritage List in 1981 on the basis of its outstanding natural values and its ecological integrity. The Great Barrier Reef World Heritage Area is one of only a few World Heritage Areas that satisfy all four natural World Heritage criteria.

In general the biophysical attributes for which the Great Barrier Reef World Heritage Area is recognised include (Lucas et al. 1997, Wachenfeld 1998):

- Six of the world's seven species of marine turtles, all of which are listed as threatened
- One of the world's most important dugong populations
- More than 30 species of marine mammals
- Over 200 species of birds and one of Australia's most significant seabird rookeries
- About 360 species of hard coral
- 800 species of sea star which is 13% of the world's total
- Over 1,500 species of fish
- Over 1,500 species of molluscs
- 2,200 species of native plants (25% of Queensland's total native plant species)
- Over one third of the world's soft coral and sea pen species
- Approximately 2,900 coral reefs
- Over 3,000km² of mangrove including 54% of the world's mangrove diversity
- Breeding humpback and other whale species.

In 1999, the Great Barrier Reef Marine Park Authority reviewed the comprehensiveness, adequacy and representativeness of the existing network of protected areas within the Great Barrier Reef Marine Park. This process highlighted inadequacies in protection of this biodiversity. To address this shortcoming, the Great Barrier Reef Marine Park Authority implemented the Representative Areas Program (refer Day et al. 2002, Fernandes et al. 2005) through rezoning the entire Great Barrier Reef Marine Park.

The objective of the Representative Areas Program was to help:

- maintain biological diversity;
- allow species to evolve and function undisturbed;
- provide an ecological safety margin against human-induced disasters;
- provide a solid ecological base from which threatened species or habitats can recover or repair themselves; and
- maintain ecological processes and systems.

This Program also contributed to Australia's National Representative System of Marine Protected Areas, the primary goal of which 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.

As part of the process of developing the Representative Areas Program a scientific steering committee recommended a series of biophysical operational principles (Fernandes et al. 2005) to guide the establishment of a new network of no-take areas in the Great Barrier Reef Marine Park that also could achieve the objectives of the

Representative Areas Program. A copy of the biophysical operational principles is at Appendix 1.

As part of those biophysical operating principles, the scientific steering committee identified that a critical aspect of maximising the comprehensiveness and adequacy of the network was to explicitly consider *special or unique* biological and/or physical habitats or sites when developing the final zoning network. This is in addition to incorporation of representative samples of different bioregions. The Committee's rationale was that these places might not otherwise be included in the network but would help ensure the network is comprehensive and adequate to protect biodiversity and the known special or unique areas in the Great Barrier Reef Marine Park.

Some of the attributes in the above list of Great Barrier Reef World Heritage values warranted specific attention as part of the initiative to incorporate comprehensive, adequate and representative protection to the Great Barrier Reef Marine Park. Lucas et al. (1997, p.46-47) highlighted the following specific attributes:

- A number of world significant dune areas (geological and geomorphological aspects)
- The most extensive actively accumulating *Halimeda* beds in the world
- Coral communities which are among the oldest living marine animals in the world
- Some of the best examples of 'blue holes' in the world
- The largest reef system the world has ever known
- The single largest coral reef in the world
- Massive aggregations of the butterfly *Tirumala hamata*
- Habitat for the world's largest fish, the whale shark
- One of the most diverse areas in the world for mangrove habitat
- The largest breeding green turtle population in the world
- One of the most diverse cuttle bone faunas in the world
- *Pisonia grandis* flora (trees) of world importance.

The aim of this report is to describe the process used to identify *special or unique* sites for the Representative Areas Program, to provide a brief description of each site and to report on the resulting level of protection offered to special or unique sites under the *Great Barrier Reef Marine Park Zoning Plan 2003*.

METHODS

Site identification

To identify candidate sites with biological or physical features or values that warrant classification as *special or unique*, suggestions were solicited from surveys of experts in the biophysical science of both reef and non-reef areas (Kerrigan et al. 2010), and from preliminary user workshops (Fernandes et al. 2010). A total of 408 potential sites were identified.

Each of the 408 potential sites then was assessed against criteria to determine whether it was suitable for consideration as *special or unique* for the purposes of the Representative Areas Program. Fernandes et al. (2010) describes in detail the criteria and its application. Briefly, these criteria were:

1. The degree to which the site was geographically defined and its boundaries could be mapped.

This is a practical requirement, to allow incorporation into the spatial (GIS) analyses and processes of the Representative Areas Program. Each *special or unique* site was digitally mapped, which allowed the area (km²) of the site to be calculated (Table 1). Each site was also described by the bioregion(s) it contained (refer Kerrigan et al. 2010 for a description of Great Barrier Reef Marine Park bioregions used during the Representative Areas Program) and what management area of Great Barrier Reef Marine Park it was located in.

2. The amount and detail of information available to support the classification of the site as *special or unique*. Relevant information included the number of independent sources verifying the information about the site, which allowed for cross-referencing and triangulation of information. Put simply, the same information coming from multiple independent sources increases the likelihood that the information was accurate.

Other sources of information, including scientific publications and unpublished reports, were reviewed for each of the sites, where applicable. The Australian Littoral Society's Great Barrier Reef Resource Inventories contained within the Reef and Island Database (held by the Great Barrier Reef Marine Park Authority) included historical information about many of the locations. A bibliographic reference library database of over 1200 references developed for the Representative Areas Program of relevant literature including reports, publications and scientific journal papers was reviewed. Relevant information was also obtained from documents used as a basis for past zoning decisions in the Marine Park.

The extensive references used in developing the bioregionalisation for the Representative Areas Program (see Kerrigan et al. 2010 for the full citations for each reference) were invaluable in providing additional justification and background for many of the *special or unique* sites. Topics covered by these references included:

- Soft Corals
- Hard Corals
- Sponges
- Other Reefal and Inter-reefal Invertebrates
- Fishes
- Macro-Algae
- Mangroves
- Halimeda
- Seagrasses: Shallow and deepwater
- Cetaceans
- Marine turtles
- Seabirds
- Bathymetry – Great Barrier Reef Depth and Elevation Model

- 15 and 30 Arc Second Gridded Bathymetry
- Geomorphology of the Queensland Shelf
- Sedimentology - AUSEABED
- Sediments Associated with Halimeda Beds
- Mud, Carbonate, Mineral and Biological Sediment Facies
- Sediment Data Sets for Great Barrier Reef Region - additional
- Coverage of Queensland Coastline
- Coverage of Intertidal Areas
- Coverage of Coastal Rivers
- Australian Estuaries
- Coastal Wetlands
- Australian Drainage Basin
- Islands - Great Barrier Reef GIS Coverage of Islands
- Cays - Great Barrier Reef GIS Coverage of Cays
- Island and Reef Inventory
- Classification of Islands of the Great Barrier Reef
- Coverage of Reefs
- Coverage of Exposed Reefs
- Coverage of Named Rocks
- Classification of Reef Morphology
- Regionalisation of Reef Morphology
- Numerical Grid Regionalisation of Reef Morphology
- Oceanography - Biological Oceanography of the Great Barrier Reef
- Cyclones, Flood Plumes and Water Quality - Great Barrier Reef Lagoon
- Australian Region Oceanography
- Sea Temperature
- Sea Temperature and Effects on Coral Bleaching
- Tides and Currents
- Coral Reefs and Mangroves: - Modelling and Management Project
- Tidal Ranges for the Great Barrier Reef and Adjacent Waters
- Waves
- Cyclones - Atlas of Tropical Cyclones in the Great Barrier Reef Region
- Australian Region Cyclone Data Set

Other databases and information reviewed as part of collating information about each *special or unique* site included:

- Australian Natural Resources Atlas
- Australian Wetlands Database
- Department of Environment and Resource Management's Protected Area Management Plan Register
- Department of Environment and Resource Management's Regional Coastal Management Plans
- Fisheries Queensland Seagrass assessment and monitoring reports
- Fisheries Queensland Declared Fish Habitat Plans

3. Whether the justification for the site included species or habitats relevant to the Great Barrier Reef Marine Park Authority's international, national or local obligations.

In addition to the justifications for each *special or unique* site, consideration was given to whether the justification for the sites included species that relate to international, national or local obligations (refer Stokes et al. 2004). The Australian Government is a signatory to many international conventions and agreements. This often confers particular obligations upon Australia to promote and implement those international arrangements within its domestic work program.

Obligations that were considered included those species, habitats and locations that were specifically listed under the following conventions and agreements:

- *Convention for the Protection of the World Cultural and Natural Heritage* (World Heritage Convention). Sites selected for World Heritage listing are inscribed on the basis of their merits as the best possible examples of the cultural and natural

heritage. Countries that are signatory to the convention recognize that the sites located on their national territory, and which have been inscribed on the World Heritage List, constitute a world heritage 'for whose protection it is the duty of the international community as a whole to cooperate'.

- *Convention on Biological Diversity*. This Convention provides an important framework for Australia's integration of natural resources and environment and biodiversity management policies. The Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* provides a legal framework to protect and manage nationally and internationally important biodiversity- that is flora, fauna, ecological communities and heritage places, defined in the Act as matters of national environmental significance.
- *Convention on the Conservation of Migratory Species of Wild Animals*. This international convention aims to conserve terrestrial, marine and avian migratory species throughout their range, specializing in the conservation of migratory species, their habitats and migration routes. Species listed under the convention are considered 'listed migratory species' and protected under the *Environment Protection and Biodiversity Conservation Act 1999*.
- *Convention on the International Trade of Endangered Species of Wild Flora and Fauna (CITES)*. CITES is an international agreement between governments with the aim of ensuring that international trade in specimens of wild animals and plants does not threaten their survival. Permits for the removal of these species from Australia are required under the *Environment Protection and Biodiversity Conservation Act 1999*.
- *The Convention on Wetlands of International Importance especially as Waterfowl Habitat* (the RAMSAR Convention). Locations of these sites in Australia are protected as matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999*.
- Agreements between the Government of Australia and the Governments of Japan (since 1974) and China (since 1986) for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment. All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999*.
- The *1979 Emerald Agreement*, signed by the Prime Minister of Australia and the Queensland Premier at the time, provided for the Australian and Queensland governments to continue to manage the islands, reefs and waters of the Great Barrier Reef in a co-operative and complementary way. More specifically, it provided for day-to-day management of the Great Barrier Reef Marine Park (the Marine Park) to be carried out by Queensland agencies. Therefore, recognition of species of marine mammals, birds or reptiles prescribed as 'endangered wildlife', 'vulnerable wildlife' or 'rare wildlife' under the *Nature Conservation Act 1992* of Queensland was also considered appropriate for the purposes of the identification of *special or unique* sites.

Incorporation into the *Great Barrier Reef Marine Park Zoning Plan 2003*

The zoning of the GBRMP includes six different levels of zoning, with different types of protection relevant to different uses of the Marine Park. Full details of all use and entry provisions for each zone are found in the *Great Barrier Reef Marine Park Zoning Plan 2003* (Great Barrier Reef Marine Park Authority 2003).

The scientific steering committee recommended that the Great Barrier Reef Marine Park Authority should judge which type of zoning protection best matched each *special or unique* site. Therefore, classifying a site as *special or unique* did not automatically mean it required zoning in a no-take (or highly protected) area. For the purposes of the

Marine Park, no-take areas are those areas zoned as Marine National Park or Preservation (Figure 1).

The *special or unique* sites were then used in the process of identifying candidate areas, in further refining the selection of candidate areas and in reporting back on the content of alternative networks of candidate areas and the final network (refer to Day et al. 2002, Day et al. 2003, Great Barrier Reef Marine Park Authority 2005, Lewis et al. 2003 for a description of these processes).

ACTIVITIES GUIDE (see relevant Zoning Plans and Regulations for details)	General Use Zone	Habitat Protection Zone	Conservation Park Zone	Buffer Zone	Scientific Research Zone 2	Marine National Park Zone	Preservation Zone
	Aquaculture	Permit	Permit	Permit 1	✗	✗	✗
Bait netting	✓	✓	✓	✗	✗	✗	✗
Boating, diving, photography	✓	✓	✓	✓	✓ 2	✓	✗
Crabbing (trapping)	✓	✓	✓ 3	✗	✗	✗	✗
Harvest fishing for aquarium fish, coral and beachworm	Permit	Permit	Permit 1	✗	✗	✗	✗
Harvest fishing for sea cucumber, trochus, tropical rock lobster	Permit	Permit	✗	✗	✗	✗	✗
Limited collecting	✓ 4	✓ 4	✓ 4	✗	✗	✗	✗
Limited spearfishing (snorkel only)	✓	✓	✓ 1	✗	✗	✗	✗
Line fishing	✓ 5	✓ 5	✓ 6	✗	✗	✗	✗
Netting (other than bait netting)	✓	✓	✗	✗	✗	✗	✗
Research (other than limited impact research)	Permit	Permit	Permit	Permit	Permit	Permit	Permit
Shipping (other than in a designated shipping area)	✓	Permit	Permit	Permit	Permit	Permit	✗
Tourism program	Permit	Permit	Permit	Permit	Permit	Permit	✗
Traditional use of marine resources	✓ 7	✓ 7	✓ 7	✓ 7	✓ 7	✓ 7	✗
Trawling	✓	✗	✗	✗	✗	✗	✗
Trolling	✓ 5	✓ 5	✓ 5	✓ 5,8	✗	✗	✗

Figure 1. Summary of activities allowed in zones according to the Great Barrier Reef Marine Park Zoning Plan 2003.

RESULTS AND DISCUSSION

Fifty-three *special or unique* sites (13% of total) were identified from the 408 potential sites compiled (Table 1, Figure 2). Some of the sites identified were found *special or unique* due to high species richness, diversity of hard or soft corals, fish communities and/or algal composition. Many were also listed because of terrestrial characteristics such as seabird or turtle nesting (e.g. Rocky Isles, Raine Island). Most sites were identified on the strength of a combination of types of justifications.

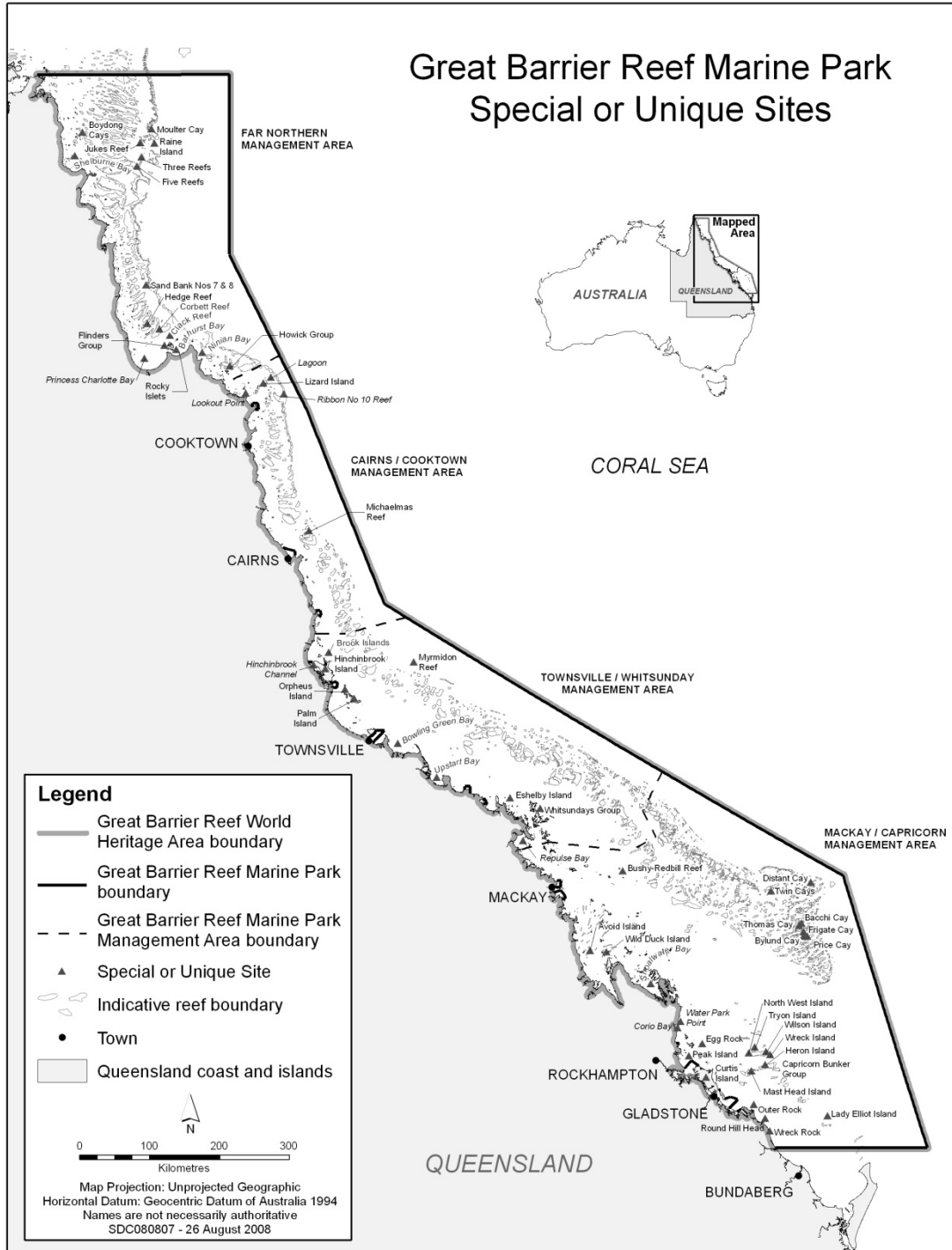


Figure 2. Special or unique sites identified during the Representative Areas Program.

The final list of *special or unique* sites spanned the entire length of the Great Barrier Reef Marine Park (Table 1). Nearly 50% were in the Mackay / Capricorn Management Area, perhaps reflecting the long history of scientific research in this part of the Marine Park.

Special or unique sites ranged in size from 0.01km² (Egg Rock) to 3182.02 km² (the Whitsundays). Portions of 45 of the 70 bioregions within the Great Barrier Reef Marine Park were part of the *special or unique* sites (Table 1). The sites comprised portions of 29 of the 40 non-reef bioregions, 22 of the 30 reef bioregions and 2 of the 8 unclassified bioregions. These unclassified bioregions were generally in deep water, offshore areas near the continental shelf on the eastern border of the Great Barrier Reef World Heritage Area.

The amount and detail of information that supports the labelling of each site as *special or unique* varied considerably between sites. The information in Table 1 is a short summary of the key points for the justification for each site and is not exhaustive. Rather it provides supplementary justification supporting the original information provided by the scientist(s) and/or stakeholder(s) that originally suggested the site.

All *special or unique* sites have linkages with one or more of the Great Barrier Reef Marine Park Authority's international, national or local obligations. Many of the *special or unique* sites exemplify at least one of the four criteria for which the Great Barrier Reef was inscribed on the World Heritage list in 1981 and/or were specifically listed as part of the nomination document (Great Barrier Reef Marine Park Authority 1981).

Migratory birds and listed threatened or migratory species were the most common reasons for incorporation as *special or unique sites*. Two such sites, Bowling Green Bay and Shoalwater and Corio Bays, are wetlands of international significance and listed under the RAMSAR Convention.

Some *special or unique* sites overlapped with sites important for implementation of other Biophysical Operational Principles (principles 5 and 7 in Appendix 1), such as the need to consider habitats significant for marine turtles or dugongs (Fernandes et al. 2005, Dobbs et al. 2007, 2008). For example, Bowling Green Bay was identified as incorporating habitat significant for foraging dugongs and for the southern Great Barrier Reef genetic stock of green turtles, in part, due to the seagrass beds there. Implementing the Biophysical Operational Principles that aimed to protect examples of every type of habitat (e.g. bioregion) as well as those that aimed to protect *special or unique* features, ensured that the particular seagrass habitats important for both dugongs and green turtles were incorporated into the new zoning network. Overlap between guiding principles is not considered to be problematic. In practice, such redundancy ensures that all the available information and all the relevant features of importance for protection of an ecosystem have a greater opportunity to be offered the desired level of protection (Fernandes et al. 2010).

This work identified more reef than non-reef *special and unique* sites. This reflects the past priority placed on studying reefs rather than non-reef areas. With regard to the Great Barrier Reef ecosystem, Kerrigan et al. (2010) stated, "*Despite over 30 years of underwater research on reefs, limited empirical data is available on biota ... within the pelagic habitat, continental slope and abyssal plain ... (and) on inter-reefal fauna (infauna and epifauna) and flora*". Any future identification exercises should particularly ensure that less well known species of marine plants, invertebrates and fish are specifically addressed in the selection of *special or unique sites*, and non-reefal areas in particular. They should also ensure the cultural relationships between people and their natural resources are included as part of the assessment.

Table 1. Special or unique sites for the Representative Areas Program.

Site name (and identification number) ¹	Total Area in GIS layer (km ²)	Great Barrier Reef Marine Park Bioregion(s) ²	Management Area of Great Barrier Reef Marine Park	Justifications	Linked BOPs Number ³	Survey / workshop source identifier
Avoid Island (380)	0.94	RE6	Mackay / Capricorn	Of the three high priority nesting beaches for the eastern Australian flatback turtle breeding population, this island is the only one that is not a Queensland National Park. This breeding stock is the only marine turtle population on the Great Barrier Reef that is not exhibiting declines. The flatback turtle is endemic to the Australian continental shelf and is not known to nest elsewhere in the world.	7	010226M14_S01; 010226R11_S02
Bacchi Cay (408)	0.04	NL5	Mackay / Capricorn	<p>Located in the Swains Reefs area. The Swains Reefs form the only breeding sites on the Great Barrier Reef for the Least Frigatebird ; Masked booby breeding sites in the Swains Reefs are the only ones that occur apart from Raine Island and Moulter Cay and may account for 10% of the total Great Barrier Reef population ; and the area contains significant shearwater foraging sites. Recoveries of banded masked & brown boobies indicate links from Swains Reefs to the Queensland central & southern coasts for both species and Papua New Guinea and the Solomon Islands for the brown booby.</p> <p>Loggerhead turtles nest in 'large numbers' on Price and Frigate Cays; also in smaller numbers on Thomas, Bacchi, Gannet and Bylund Cays. Loggerhead turtle nesting in the Swains Reef cays are of extreme importance and represent 20-25% of the total annual nesting effort for eastern Australia. Tag recoveries from some loggerhead turtles indicate foraging areas for breeding turtles occur at Heron Island/Wistari Reefs and Moreton Bay.</p>	7	010227S4_S04; 010226S5_S01
Bathurst Bay	92.40	NB1, RD	Far northern	This site contains fringing reefs, significant high continental	7	001114P5_S01

¹ Refer to Figure 1 for the location of each site within the Great Barrier Reef.

² Great Barrier Reef Marine Park Bioregions are described in Kerrigan et al. (2010).

³ If a number is listed here, then the location was also listed as part of another Biophysical Operational Principle (BOP) associated with the Representative Areas Program. A list of all BOPs is at Appendix 1.

Site name (and identification number) ¹	Total Area in GIS layer (km ²)	Great Barrier Reef Marine Park Bioregion(s) ²	Management Area of Great Barrier Reef Marine Park	Justifications	Linked BOPs Number ³	Survey / workshop source identifier
- Flinders Group (6)				<p>islands and non-reefal habitats. There appears to be a constant influx of relatively sediment free water.</p> <p>Bathurst Bay, along with Princess Charlotte Bay and the coastal area from Cape Melville south to Ninian Point is the most important area for dugongs in northern Great Barrier Reef. The area is known for its extensive seagrass areas and dugong habitat that may be disturbed by large vessel anchoring. The area also has high seagrass diversity.</p> <p>The waters surrounding the islands support some seagrass, limited benthic organisms and are inhabited by large populations of Irrawaddy dolphins, dugong, turtles and estuarine crocodiles. The islands are well established with extensive vegetation and provide habitat for a number of threatened bird species, including the Beach Stone-Curlew.</p>		Scientists (Reef or Non-reef Panel): 36-38; 35-37
Bowling Green Bay (14)	696.14	NA3A, NA3B, RF2	Townsville / Whitsundays	<p>Bowling Green Bay is a significant site for dugongs, seagrass, shorebirds (water birds) and has "pristine" mangrove mud crab and fish habitat and also contains breeding grounds for grunter.</p> <p>DUGONGS: Dugong Protection Area 'B' Zone; 6.8% of dugongs in southern Great Barrier Reef (Cooktown south) stock found in Bowling Green Bay. 8.5% of dugongs in Great Barrier Reef section (e.g. Central Section) found in Bowling Green Bay. Most sightings in SE portion of Bay. Aerial Survey Information indicates that when the habitat is 'good', the bay can support quite large numbers of dugongs.</p> <p>INSHORE (Irrawaddy & Indo Pacific Humpback) DOLPHINS: Australia may hold the most secure population of Irrawaddy & Indo-Pacific Humpback dolphins in the SE Asian region. Subject to mortality from drowning in nets set by commercial fishers. Generally found close to shore, within 7km from the nearest shallow area (either point of land or reef), waters generally less than 10m deep. Aerial surveys showed Indo-Pacific Humpback dolphin sightings on the eastern side of Cape Bowling Green.</p> <p>RAMSAR WETLAND: The wetlands adjacent to Bowling Green Bay are listed under the RAMSAR convention and are</p>	7	001005T7_S09; 001005T9_S06; 001206W8_S04; 001206W8_S01; 010516T16_S11; 010516T17_S07; 010516T15_S08

Site name (and identification number) ¹	Total Area in GIS layer (km ²)	Great Barrier Reef Marine Park Bioregion(s) ²	Management Area of Great Barrier Reef Marine Park	Justifications	Linked BOPs Number ³	Survey / workshop source identifier
				<p>of international significance representing a) non-human existence rights; b) connectivity; c) conservation of yet to be discovered/studied species; d) preservation of rare and endangered species e.g. Irrawaddy river dolphin, pacific humpback habitat; e) spiritual values;and f) aesthetic values. Richest coastal wetland habitat, typical of the coastal wet-dry tropics of NE Australia. Extremely important bait fish, finfish and crustacean nursery. Feeding grounds for threatened species (dugongs, estuarine crocodiles, green turtles). Regularly supports substantial numbers of all Australian waterbird groups (eg: 1% [4000] of Australian broilga population, 10,000 magpie geese).</p> <p>Contains incipient fringing reefs and non-reefal habitat and three geologically high continental islets (Bray, Bare, Bald).</p> <p>The bay is adjacent to Queensland National Park.</p> <p>The beaches on the western shore of the bay host low density nesting by flatback turtles. There is also some turtle nesting on Cape Bowling Green sand spit.</p>		
Boydong Islet (16)	3.67	NB1, RD	Far northern	<p>Boydong Island is part of the Denham Group National Park and is located approximately 20 kilometres east from the mainland. Boydong Island Reef is a planar reef covering 340 hectares. Unusual, dense populations (1-2/sq.m) of the sea urchin, <i>Diadema setosum</i>, have been found on this reef in the past.</p> <p>The island and adjacent planar reef is significant hawksbill turtle nesting habitat and inter-nesting habitat, respectively. It is the second largest hawksbill turtle nesting site in the Great Barrier Reef World Heritage Area. Green turtles are also known to nest on the island.</p> <p>Estuarine crocodiles are frequently seen on the shores of this island.</p> <p>Boydong Island has international significance for roosting shorebirds for Ruddy Turnstones, Mongolian Plovers and Grey-tailed Tattlers. Caspian Terns, Eastern Reef Egret, Gull-billed Terns, Pied Imperial Pigeons, White-bellied Sea Eagles</p>	7	Scientists (Reef or Non-reef Panel): 10-9; 11-10

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				and Ospreys have also been known to breed at Boydong Island		
Brook Islands and Reefs (20)	2.20	NB3, RF1	Townsville / Whitsundays	<p>The Brook Islands are a National Park. They are low and rocky — North Brook has a maximum altitude of 62m, and South Brook a maximum of 42m. They are covered in a dense vine-forest. Their eastern shores are rocky while their western shores feature a few beaches of coarse sand and coral rubble. The islands support a well-documented breeding colony of more than 40 000 pied imperial-pigeons and significant breeding colonies of bridled terns, black-naped terns, little terns and roseate terns. Beach stone-curlews, a vulnerable bird species, are also present and are believed to breed on North Brook Island beaches.</p> <p>The Brook Islands (Map 2) is a group of four continental islands and a few rocks located about 7km north-east of Cape Richards on Hinchinbrook Island and about 30km from the nearest mainland town of Cardwell. The largest is North Brook Island (65ha) and the smallest Tween Island (6ha). North, Tween and Middle Brook Islands were first gazetted as national parks in 1936. South Brook Island is a Commonwealth Lighthouse Reserve and forms part of the Great Barrier Reef Marine Park.</p> <p>The islands have representative fringing reef communities with surrounding corals among the world's oldest. The islands are connected by a continuous coral reef. The islands are considered to meet four criteria of outstanding universal value under the World Heritage Convention. That is, the island group is:</p> <ul style="list-style-type: none"> – an example of a major stage of the earth's evolutionary history; – an outstanding example of geological processes, biological evolution and people's interaction with their natural environment; – a place with unique, rare and superlative natural phenomena; and – a place which provides habitats for rare and endangered species of plants and animals. 		001025L4_S01; 010516T17_S05; 010504T13_S01 Scientists (Reef or Non-reef Panel): 65-64; 66-65; 67-66; 68-67; 69-68

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Bushy-Redbill Reef (370)	0.14	RK	Mackay / Capricorn	<p>Bushy Island National Park is a geographic and biological anomaly being the only wooded cay within a 900km section of the Great Barrier Reef World Heritage Area. The closest other such islands are North Reef Island to the south and Green Island to the north. Bushy Island is also unusually high, recorded as being 12m above the reef flat. This is higher than any other cay within the Great Barrier Reef World Heritage Area.</p> <p>Bushy Island is the only island to contain an almost monospecific stand of <i>Pisonia grandis</i> in the south to Douglas Island, east of Cape York Peninsula in the north.</p> <p>It is the only coral cay in the Great Barrier Reef supporting a population of orange-footed scrubfowl and is an important green turtle rookery. The park provides a nesting habitat for the vulnerable beach stone curlew.</p> <p>Bushy island is a n important seabird roosting area with estimates of 10,000 birds roosting overnight with the potential to become a more substantial nesting area.</p> <p>Adjacent Redbill Island is an important nesting area for the bridled tern and white bellied sea eagle and has a significant population of roosting and nesting reef herons.</p> <p>Bushy Island has a significant population of waders including pied and sooty oystercatchers, along with season migratory birds.</p>		010227M13_S02
Bylund Cay (410)	0.07	RSW-M	Mackay / Capricorn	<p>Located in the Swains Reefs area. The Swains Reefs form the only breeding sites on the Great Barrier Reef for the Least Frigatebird ; Masked booby breeding sites in the Swains Reefs are the only ones that occur apart from Raine Island & Moulter Cay and may account for 10% of the total Great Barrier Reef population ; and the area contains significant shearwater foraging sites. Recoveries of banded masked & brown boobies indicate links from Swains Reefs to the Queensland central & southern coasts for both species and Papua New Guinea and the Solomon Islands for the brown booby. Significant declines in the # of adults & nests of brown boobies & adult silver gulls were reported from Swains Reefs from 1982-1994. A major</p>	7	010227S4_S04

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				<p>reason for the declines may have been a reduction in available food supply associated with elevated sea surface temperatures induced by El Nino and may be part of long-term population fluctuations.</p> <p>Loggerhead turtles nest in 'large numbers' on Price and Frigate Cays; also in smaller numbers on Thomas, Bacchi, Gannet and Bylund Cays. Loggerhead turtle nesting in the Swains Reef cays are of extreme importance and represent 20-25% of the total annual nesting effort for eastern Australia. Tag recoveries from some loggerhead turtles indicate foraging areas for breeding turtles occur at Heron Island/Wistari Reefs and Moreton Bay.</p>		
Capricorn Bunker Group (22)	1690.50	NB8, NN, NU, RCB1, RCB2, X4	Mackay / Capricorn	<p>May have fish populations that are genetically distinct from elsewhere. Important differences (highly relevant to fisheries) in the life history traits.</p> <p>Between Wistari and Heron Reefs there are deep channels containing species that are characteristic of the Far North around Lizard Island. These species are not apparent anywhere else in southern region, possibly signifying unique recruitment patterns to this region.</p> <p>Critical breeding sites for green and loggerhead turtles and critical foraging habitat for green, loggerhead and hawksbill turtles.</p> <p>The Capricorn and Bunker groups encompass 22 reefs straddling the Tropic of Capricorn, at the Great Barrier Reef's southern end. There are 16 coral cays, on these reefs. The Capricornia Cays National Park protects eight vegetated coral cays—Lady Musgrave, North West, Masthead, Wilson, Heron, Erskine and Tryon islands, and part of Heron Island. A further six cays form Capricornia Cays National Park (Scientific). These are Wreck, One Tree, East Hoskyn, West Hoskyn, East Fairfax and West Fairfax islands.</p> <p>Typically the islands rise only a few metres above high water mark, except North West Island, which rises to six metres at its eastern end.</p>	5, 7	001127G3_S12 Scientists (Reef or Non-reef Panel): 128-127; 129-128; 130-129; 131-130; 132-131; 133-132; 134-133; 135-134; 136-135; 137-136; 138-137; 139-138; 140-139; 141-140; 142-141; 143-142; 145-144; 146-145; 147-146; 148-147; 149-148; 150-149; 151-150; 152-151; 153-152; 154-153; 162-161; 163-162

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				<p>Capricornia Cays National Park's eight islands are part of the Great Barrier Reef World Heritage Area. Their biological diversity, exceptional beauty and endangered plants and animals are internationally significant.</p> <p>The stunning white beaches and outstanding coral reefs of these small, relatively untouched cays make them popular destinations. Rich forests of <i>Pisonia grandis</i>, which are typically only found on coral cays, dominate the island vegetation. A fringe of tough, small trees and shrubs such as coastal she-oak, octopus bush, native grasses and pandanus surround the cays' pisonia forests. On North West Island, strangling figs and native elms are scattered through the forest, and native mulberries, sandpaper figs and lantern bushes grow in small clearings.</p> <p>Capricornia Cays and the adjacent Bundaberg coast support the largest breeding population of endangered loggerhead turtles in the South Pacific region. North West, West Hoskyn and Wreck islands are important nesting sites for green turtles. The annual nesting population is highly variable and influenced by climatic conditions in the previous year or earlier.</p> <p>Seventy per cent of the total breeding population of wedge-tailed shearwaters on the east coast of Australia nest on North West Island. Hundreds of thousands of these birds and black noddies arrive in October. Shearwaters nest in burrows, leaving at dawn to feed at sea and returning at dusk. Their mournful howling call at night is hard to miss, and some campers find it disturbing. Noddies nest throughout the islands' pisonia trees, including those in campgrounds. Camping in summer provides constant close encounters with shearwaters and noddies. This can be a wonderful experience for many campers.</p> <p>The Capricornia Cays support 84 percent of Australia's pisonia forests (with half of that being on North West Island alone). These pisonia forests provide shelter and breeding habitat for a variety of birds, particularly nesting sites for black noddies and open ground for shearwaters to burrow. Noddy and shearwater numbers are so great in the Capricornia Cays that</p>		

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				together they make up 75 percent of the seabird biomass in the Great Barrier Reef.		
Clack Reefs and island (25)	12.70	NB1, RCB2	Far northern	Significant Hawksbill and Green turtle foraging areas. Extensive seagrass beds on top of reef flat are know to occur. Important as having underwater topography and marine life of significant diversity and in some cases in very limited and fragile numbers.	7	001201P4_S04; 010410P9_S01 Scientists (AIMS): 39-38; 40-39 Scientists (Reef or Non-reef Panel): 32-31; 33-32; 34-33
Coastal Corio Bay to Water Park Point (49)	2.68	NA3B, RE8	Mackay / Capricorn	<p>RAMSAR WETLAND: The Shoalwater and Corio Bays Area (Shoalwater Bay Training Area, in part - Corio Bay) Ramsar site contains a wide diversity of landscape types including undulating lowlands and hills, riverine plains, swamps, estuarine inlets, old beach ridges, dunes, sand beaches flanked by coastal cliffs, and intertidal sand and mudflats. The wetland types on the site include freshwater lagoons, swamps and streams, leading into marine, estuarine and intertidal wetlands.</p> <p>The site is located in a zone where the temperate climate merges into tropical and sub-tropical climates. The climatic gradient, diversity of geomorphology and good condition of the site has resulted in a rich diversity of species. The site supports about 791 plant species and sub-species, 445 fish species, 22 frog species, 66 reptiles species, 226 birds species, 24 mammal species and 23 bat species.</p> <p>Nationally threatened species that occur at the site include the Green Turtle, Hawksbill Turtle, Flatback Turtle, Loggerhead Turtle, Honey Blue-eye fish and Oxleyan Pygmy Perch.</p> <p>Dozens of migratory bird species protected under international conservation agreements have been recorded at the site. The site has been identified as being of international importance to the migratory Eastern Curlew, Whimbrel and Great Knot. A range of other wetland birds and shorebirds feed and breed in the area.</p> <p>Corio Heads is a known aggregation site for black jew and</p>		002609R2_S06; 010226R11_S03; 010226R11_S08

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				<p>barramundi</p> <p>The Shoalwater and Corio Bays area is bounded by approximately 330km of coastline including all islands. The area's terrestrial and five major estuarine and marine environments represent the largest area in central east Queensland containing representative coastal, subcoastal, aquatic landscapes and ecosystems which are relatively undisturbed habitat areas for significant floral and faunal assemblages, including populations of rare and threatened species. The area represents a climatic overlap zone with an unusual mix of tropical, sub-tropical and temperate species. The area also represents the largest wilderness area within the Central Mackay Coast biogeographic area and on the central Queensland coast. Such places are rare on the eastern coastline of Australia</p>		
Coastal Round Head to Wreck Rock (457)	40.93	NA3B, RE8	Mackay / Capricorn	This stretch of coastal beach hosts both nesting loggerhead and leatherback turtles. It is the only beach within or adjacent to the Great Barrier Reef World Heritage Area that regularly had leatherback turtles nesting on it.	7	010227G17_S01
Coastal Starcke River Region Ninian Bay to Lookout Point (46)	420.53	NA1, NM, RE2, RF1	Far northern	<p>One of the most varied coastlines on Cape York Peninsula, including large areas of mangrove, fringing coral reefs, melaleuca forests, freshwater wetlands, tidal floodplains, sand dunes and rocky headlands; highly productive fisheries habitats in pristine or near pristine condition; Important dugong habitat.</p> <p>16 spp. of Mangrove, dominated by <i>Rhizophora</i>, <i>Avicennia</i> and <i>Ceriops</i>; salt pans and marsh; intertidal flats; extensive intertidal and subtidal seagrass meadows with up to 10 spp; melaleuca swamps; fringing coral reefs; rocky headlands.</p> <p>Extensive seagrass meadows and extremely high dugong numbers. Supports highest densities of dugongs in the Great Barrier Reef. Seagrasses are almost continuous from coast out to almost the Ribbons. Region very important for marine turtles, dugongs and fish.</p>	7	Scientists (Non-reef Panel)
Corbett Reef (51)	208.57	NH, RC2	Far northern	Significant Hawksbill and Green turtle foraging areas. Extensive seagrass beds on top of reef flat are know to occur	7	Scientists (Reef or Non-reef Panel):

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				<p>and important location for dugongs.</p> <p>Sand reef which is rare in the Marine Park and is important geomorphologically.</p> <p>Significant Hawksbill and Green turtle foraging areas. Extensive seagrass beds on top of reef flat are know to occur. Important as having underwater topography and marine life of significant diversity and in some cases in very limited and fragile numbers.</p> <p>47 genera of coral recorded from the reef.</p>		31-30
Curtis Island North (425)	11.23	NA3B, RE8	Mackay / Capricorn	<p>Curtis Island is a unique part of the central Queensland coast. Coastal heath and littoral rainforest scatter the sand dunes and beach ridges, while extensive salt flats make up the large plain on the northern section of the island.</p> <p>The endangered yellow chat has been recorded in remnant wetlands to the island's north.</p> <p>Eastern sections of the island which are recognised on the Register of National Estate;</p> <p>Beach ridge and swale systems along the eastern side of Curtis Island and a parabolic dune system occurring at Cape Capricorn;</p> <p>Large areas of 'endangered' and 'of concern' regional ecosystems including dry rainforests, paperbark woodlands, dune systems, coastal heath communities, headland grasslands, swamp coastal wetlands and areas associated with the marine plain between Cape Keppel and Cape Capricorn that are recognised in the Directory of Important Wetlands for their significance;</p> <p>Scenic coastal landscape values, particularly those associated with headlands, beaches and dune systems along the eastern side of the island;</p> <p>Eastern and northern beaches which are significant nesting habitat for flatback turtles;</p> <p>The bay formed by Cape Keppel and Cape Capricorn which is</p>		010226R11_S08; 010227G17_S11; 010531G16_S02

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				<p>highly significant, supports a small population of dugong and is a key shorebird feeding and roosting area;</p> <p>Key species found within the marine plain include the radjah shelduck, yellow chat, zitting cisticola, several hundred broilga that breed in the area, and several thousand magpie geese;</p> <p>The eastern side of Curtis Island supports a series of beach ridge and swale systems with a parabolic dune system at Cape Capricorn; coastal landscape values associated with the headlands and adjacent sandy beaches at Connors Bluff, Black Head, Cape Capricorn and Cape Keppel and the parabolic dune system at Yellow Patch; eastern beaches that provide significant nesting habitat for the flatback turtle.</p>		
Curtis Island South (56)	Outside the GBRMP		Mackay / Capricorn	<p>Curtis Is Reef (Keppel Rocks) - known and recognised barramundi aggregation site. Black Head - commercial and recreational winter school/spotted grey mackerel</p> <p>The threatened flatback turtle nests on the island's southern beaches.</p> <p>Adjacent significant coastal wetlands associated with The Narrows, Graham Creek and Gladstone Harbour;</p> <p>Coastal ranges providing a significant scenic coastal landscape feature able to be viewed from the mainland and forming part of the coastal landscape;</p> <p>Geology, borders a significant marine plain and is part of a strike ridge system that runs along the western side of Curtis Island</p>	7	001127G3_S11; 001127G5_S01; 002609R2_S03; 000000G1_U02; 000000G1_S01; 001127G3_S03; 010227G17_S08; 010227G17_S19 010227G17_S20 Scientists (Reef or Non-reef Panel): 144-143
Distant Cay (416)	0.11	RSW-N	Mackay / Capricorn	<p>Located in the Swains Reefs area. The Swains Reefs form the only breeding sites on the Great Barrier Reef for the Least Frigatebird ; Masked booby breeding sites in the Swains Reefs are the only ones that occur apart from Raine Island and Moulter Cay and may account for 10% of the total Great Barrier Reef population ; and the area contains significant shearwater foraging sites. Recoveries of banded masked & brown boobies indicate links from Swains Reefs to the Queensland central & southern coasts for both species and</p>	7	010227S4_S04

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				<p>Papua New Guinea and the Solomon Islands for the brown booby. Significant declines in the # of adults & nests of brown boobies & adult silver gulls were reported from Swains Reefs from 1982-1994. A major reason for the declines may have been a reduction in available food supply associated with elevated sea surface temperatures induced by El Nino and may be part of long-term population fluctuations.</p> <p>Loggerhead turtles nest in 'large numbers' on Price and Frigate Cays; also in smaller numbers on Thomas, Bacchi, Gannet and Bylund Cays. Loggerhead turtle nesting in the Swains Reef cays are of extreme importance and represent 20-25% of the total annual nesting effort for eastern Australia. Tag recoveries from some loggerhead turtles indicate foraging areas for breeding turtles occur at Heron Island/Wistari Reefs and Moreton Bay.</p>		
Egg Rock (438)	0.01	NB8, RE8	Mackay / Capricorn	<p>Wall dives to 30m on the seaward side, numerous types of corals and fish life - some up to 70kg. Well developed fringing reef. Coral Trout in abundance and Clown Fish (the size of your hand) in their Anemones in patches up to 10m in diameter. Sea Snakes, Cod, Barramundi, Hussar's, Sweetlip, Hump-headed Batfish and Red Emperor to name a few as well as sea snakes.</p>		010531R9_S02; 010531R9_S14
Eshelby Island (68)	0.12	NB6, RE4	Townsville / Whitsundays	<p>Important breeding area for several species of seabirds. Small breeding colonies of Noddys, and Silver Gulls while Bridled Terns have been known to congregate in large numbers on the rocky slopes above the shingle beach. Has been noted that the island probably has the most prolific bird life of any island in the Whitsundays.</p> <p>Birds are an integral part of the Marine Park and the Great Barrier Reef World Heritage Area and the Whitsundays are recognised internationally as an important stopover for migratory birds Eshelby Island probably has the most prolific bird life of any island in the Whitsundays. Eshelby Island is an important rookery for the bridled tern and the common noddy. Up to 10 000 bridled terns have been recorded on the island at one time. Both of these species are listed marine and migratory species under the <i>Environment Protection and</i></p>		001108W1_S04

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				<i>Biodiversity Conservation Act 1999</i> . Eshelby Island also hosts numerous other bird species, some of which are vulnerable, or at risk of becoming vulnerable, in the Whitsundays.		
Frigate Cay (409)	0.20	NL5, RSW-M	Mackay / Capricorn	<p>Planar Reef with vegetated sand cay with a seasonal closure.</p> <p>Open Mesh Reef Type (Maxwell's 1968 scheme) with small, irregular lagoonal areas; sand cay. Saenger (1977) recorded 5 species of subtidal algae.</p> <p>Located in the Swains Reefs area. The Swains Reefs form the only breeding sites on the Great Barrier Reef for the Least Frigatebird ; Masked booby breeding sites in the Swains Reefs are the only ones that occur apart from Raine Island and Moulter Cay and may account for 10% of the total Great Barrier Reef population ; and the area contains significant shearwater foraging sites. Recoveries of banded masked & brown boobies indicate links from Swains Reefs to the Queensland central & southern coasts for both species and Papua New Guinea and the Solomon Islands for the brown booby. Significant declines in the # of adults & nests of brown boobies & adult silver gulls were reported from Swains Reefs from 1982-1994. A major reason for the declines may have been a reduction in available food supply associated with elevated sea surface temperatures induced by El Nino and may be part of long-term population fluctuations.</p> <p>Loggerhead turtles nest in 'large numbers' on Price and Frigate Cays; also in smaller numbers on Thomas, Bacchi, Gannet and Bylund Cays. Loggerhead turtle nesting in the Swains Reef cays are of extreme importance and represent 20-25% of the total annual nesting effort for eastern Australia. Tag recoveries from some loggerhead turtles indicate foraging areas for breeding turtles occur at Heron Island/Wistari Reefs and Moreton Bay.</p>	7	010227S4_S04
Hedge Reef (464)	134.57	NH, RC2	Far northern	<p>Planar Reef with unvegetated sand cay.</p> <p>Hedge, Grub and Corbett Reefs: Special sand reef, which don't occur elsewhere in the Marine Park. They are important geomorphologically but also contain seagrass and are</p>		2 Scientists

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				important for turtle and dugong feeding.		
Heron Island Reef (447)	39.37	RCB1, X4	Mackay / Capricorn	<p>More research has been undertaken on Heron Island and Reef than anywhere else on the Great Barrier Reef. The area is of high scientific value, and is one of the most significant world scientific data benchmark areas in coral reefs. The lagoon occupies about 20% of the reef top surface and is divided into two major physiographic units; a Shallow Lagoon with low water depths of 0.3-1m and a noticeable absence of large coral growth, and a Blue Lagoon with an average low water depth of 3.5 m and numerous small patch reefs of 6-25m covering approximately half of the surface area. Aspects of the physiographic zonation of the reef have been described. The island is significant for nesting green and loggerhead turtles as well as containing important habitat for breeding seabirds.</p> <p>Well-developed <i>Pisonia grandis</i> forest over most of the island;</p> <p>A significant nesting area for wedge-tailed shearwaters and noddies. Black-naped terns have been reported to nest on the wreck of Protector;</p> <p>A regionally significant habitat for loggerhead and green turtle nesting; □ international importance as a green turtle rookery;</p> <p>A major whale migration route adjacent to Wistari channel.</p>	7	010227G17_S16
Hinchinbrook Channel (99)	Outside the GBRMP		Townsville / Whitsundays	<p>High habitat nursery area (middle to southern end of channel)</p> <p>Area used by spanish mackerel in winter (between the Haven and Five Mile Creek, Hinchinbrook passage)</p> <p>The mangroves which line Missionary Bay and Hinchinbrook Channel represent one of the largest mangrove areas on the Australian continent and include a diversity of types and some 31 species of mangrove.</p> <p>A survey of all the tropical lowlands from Ingham to Cooktown indicated that Hinchinbrook Island National Park and Hinchinbrook Channel are of outstanding importance because of the diversity of rare communities.</p>	7	001005T9_U07; 010312I12_S01; 010516T17_S01
Hinchinbrook	0.01	NA3A, NA3B,	Townsville /	Hinchinbrook Island National Park covers the entire island, an		000000L1_S06;

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Island (100)		RE3	Whitsundays	<p>area of 39E900 hectares. The largely mountainous island features a long chain of high peaks, culminating in Mt Bowen with an elevation of 1142 metres. Extensive mangrove areas occur in many locations, the largest being on the west coast and in Missionary Bay. One of the features which makes this national park unusual and significant is the large mangrove area included in the park.</p> <p>The island is considered to meet four criteria of outstanding universal value under the World Heritage Convention. That is, the island is:</p> <ul style="list-style-type: none"> - an example of a major stage of the earth's evolutionary history; - an outstanding example of geological processes, biological evolution and people's interaction with their natural environment; - a place with unique, rare and superlative natural phenomena; and - a place which provides habitats for rare and endangered species of plants and animals. <p>Thirty plant communities have been identified, some of which are restricted in their range. About 700 species have been recorded, but this is likely to be only a part of the flora actually present. Some small, but significant areas of <i>Melaleuca viridiflora</i> woodland occur on the north coast. Vegetation types such as this have assumed conservation importance as similar types on the mainland face increased rates of clearing. This is true of most of Hinchinbrook Island's plant communities, particularly lowland types, which may well be restricted to Hinchinbrook Island in years to come. A survey of all the tropical lowlands from Ingham to Cooktown indicated that Hinchinbrook Island National Park and Hinchinbrook Channel are of outstanding importance because of the diversity of rare communities. About 14 species of rare and threatened plants have been recorded on the island.</p> <p>As mainland habitats are cleared or fragmented, Hinchinbrook Island is becoming increasingly important as a refuge for animal species of the coastal lowlands. The topography from</p>		001005T7_S04; 001005T9_U01; 001005T7_S08; 001005T9_S04; 000000L1_S01 010516T17_S03 010606T12_S01 010606T12_S02 010606T12_S03

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				<p>mangroves to mountain top provides a wide range of habitats. While formal fauna surveys are yet to be carried out, 19 mammals, 32 reptiles and about 150 bird species have been recorded in the park.</p> <p>Significant species recorded include the cassowary, pied imperial-pigeon, beach stone-curlew, estuarine crocodile, dugong, Irrawaddy dolphin. Missionary Bay has also been reported to be a congregation area for Olive Ridley turtles.</p>		
Hinchinbrook Region (101)	425.06	NA3A, NA3B, NB3, RE3, RF1	Townsville / Whitsundays	<p>The Hinchinbrook Area is a place of rugged beauty and inspiration. The area's natural attractions include vast passage landscapes, cloud-covered mountaintops, luxuriant rainforests and small islands with dense tropical vegetation, sandy beaches and fringing reefs.</p> <p>The distinctive natural surroundings, unique plant and wildlife, and the nature-based experiences offered by the Hinchinbrook region have led to international recognition of this portion of the Great Barrier Reef World Heritage Area. The area exemplifies connectivity of rainforest to the reef.</p> <p>Seagrasses - importance already highlighted with respect to the Dugong Protection Area. Rich and productive seagrass meadows. Important nursery and food habitat. Very important area for turtles, dugong, prawns. Impacted heavily by downstream run-off.</p> <p>Some indicative values relating to the conservation of marine animals, plants and habitats in the Region are: the seagrass beds that: provide shelter and a nutrient-rich environment for a diverse array of flora and fauna, including dugong and marine turtles; and are nurseries for a variety of marine life; and estuarine communities that are of major ecological and economic importance; and soft bottom habitats that support a diversity of marine animals and plants; and dugongs, dolphins, whales, crocodiles, marine turtles and seabirds.</p> <p>The region contains habitat for rare and threatened species including the mahogany glider and southern cassowary (listed as endangered under the <i>Nature Conservation Act 1992</i>), and the dugong, estuarine crocodile, Apollo jewel butterfly and ant</p>	7	001005T5_S05; 010516T16_S11; 010516T17_S04; 010516T15_S03

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				<p>plant (listed as vulnerable). The mahogany glider is endemic to the region between Crystal Creek and the Hull River.</p> <p>The Cardwell Range (Mount Arthur Scott 914m), Hinchinbrook Channel and Hinchinbrook Island (Mount Bowen 1121m) have very high scenic coastal landscape values.</p>		
Howick Group (108)	3.89	NM, RF1	Far northern	Drying fringing reef with high continental islands. Large areas of deep-water corals. Nationally significant hawksbill turtle foraging area with tag recoveries linking with significant hawksbill turtle nesting beaches (e.g. Milman Island). In the north - Howicks, Switz and Waining area is very important for solitary corals. Adjacent to National Park islands.	7	10 Scientists
Lady Elliott Island Reef (119)	0.79	RCB1	Mackay / Capricorn	<p>Southernmost reef in Great Barrier Reef Region.</p> <p>The corals at Lady Elliot Island Reef are diverse and are one of the important values of the area. Coral resources vary around the location, with the bommies and platform reefs away from the reef crest containing the best examples of coral cover and diversity.</p> <p>On the southern and south-western sides, a series of large coral platforms form a distinct outer edge of a gutter from the reef crest, with the platforms containing some large examples of table corals and staghorn. The eastern and southern sides are exposed to prevailing winds and there is a distinct reef crest above a steep drop off. The reef crest and much of the steep slope has good coral cover atypical of weather facing coral reefs, however as the slope levels out, coral cover significantly reduces. The north-western side is the most sheltered and shallowest part of the reef. The scattered bommies and larger coral platforms in the shallows are interspersed with sand patches and are important snorkelling and shallow dive sites, whilst the deeper bommies provide a diversity of diving opportunities. This area is the most suitable and more heavily used area for shore-based diving and snorkelling.</p> <p>Green and loggerhead turtles can regularly be seen foraging around Lady Elliot Island. Between November and February, female turtles come ashore at night to nest. The turtles that</p>	7	001127G3_S09; 010227G17_S05

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				<p>use Lady Elliot Island and Reef are an extremely important component of the turtle populations of the southern Great Barrier Reef.</p> <p>Lady Elliot Island is one of the most significant seabird breeding sites in the Great Barrier Reef World Heritage Area, and it is the southern most extent of many species' breeding distribution. Large numbers of seabirds can be found at this site between October and April each year and although around 57 species can be found on Lady Elliot Island through the year, only approximately 14 of these species use the site to breed. Some of these species include black and common noddies; black-naped, bridled, crested, roseate and sooty terns; pied and sooty oystercatchers; wedge-tailed shearwaters, silver gulls and the threatened red-tailed tropic bird¹.</p> <p>A large manta ray population inhabits the waters around the island.</p>		
Lagoon westward of Hicks, Day, Carter, Yonge, No Name and Ribbon Reef #10 (125)	430.60	NL1, RA2	Cairns	The edge of the continental shelf lies only 20 kilometres to the east of Lizard Island. Here ocean depths plunge over 2000–3000 metres into the Coral Sea. Ribbon reefs lie along the edge of the shelf, forming a broken barrier. Huge ocean swells buffet the wall-like reefs and strong tidal currents surge relentlessly through the narrow passages between them. One of the few areas in the world where dwarf minke whales are known to occur on an annual basis and regularly interact with snorkelers and divers.		001116C10_S03
Lizard Island (137)	8.47	NM, RG1	Cairns	<p>Over 350 species of hard corals form the framework of the intricate and complex reef communities that surround the islands. Narrow fringing reefs rise steeply from depths of 20 metres along the steep eastern and north-eastern coastline of Lizard Island. A more extensive reef has developed on the south coast, connecting Seabird Islets with Palfrey and South islands, enclosing a deep lagoon (Blue Lagoon). The reef slopes are dominated by branching and plate corals (<i>Acropora</i> spp.) and other corals including boulder corals (<i>Porites</i> spp.) and fleshy soft corals.</p> <p>In Watsons Bay, close to the beach, is the well-known 'Clam</p>		Scientists (Non-reef Panel)

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				<p>Gardens', a popular snorkelling location featuring large specimens of giant clams (<i>Tridacna gigas</i>) as well as many soft and hard corals. The sandy sea floor in outer Watsons Bay, at depths below 15 metres, is home to a diverse array of specialised marine life such as feather stars, sea pens and sponges as well as a unique assemblage of eight species of free-living (or solitary) corals.</p> <p>Lizard Island almost is completely surrounded by well-developed fringing reefs. The lagoonal system formed within a complex of continental islands is very unusual in the Great Barrier Reef Region. Lizard Island region very important for solitary corals and apparently peculiar inter-reef benthos. 292 spp. of coral have been collected on the Lizard Island reefs. 235 shell-bearing molluscs from inter-tidal and sub-tidal habitats around Lizard Island have been recorded. More than 80 spp. marine benthic plants have been recorded including a new species of seagrass from this reef.</p> <p>Depressions in sand hold significant number species of sponge very unique not found elsewhere. The Special Management Zone (SMZ) supports a diverse invertebrate community (echinoids, solitary corals), and an unusual seagrass morphology occurs here.</p> <p>The reef slopes are populated by dense growth of branching and platey <i>Acropora</i> species, other corals including <i>Montipora</i>, <i>Porites</i>, <i>Lobophyllia</i>, and fleshy alcyonarians. The upper surfaces consist of large masses of <i>Porites</i> with pools and channels between. The back-reef area contains a few granite boulders, quartz sand, coral debris, and shingle partly obscured by a dense growth of <i>Sarcophyton</i>, <i>Lobophytum</i>, and <i>Sinularia</i>. The extensive fringing reef has a large, well-developed lagoonal area.</p>		
Masthead Island Reef (454)	13.81	RCB2	Mackay / Capricorn	Masthead Island is an internationally important rookery for green and loggerhead turtles, who come ashore to lay eggs on the island's beaches during spring and summer, from late October to late February. An internationally important rookery for loggerhead turtles; and a regionally important nesting site	7	010227G17_S16

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				<p>for green turtle.</p> <p>The cay also supports a diverse seabird population. The Black Noddy and Wedge-tailed Shearwater are most common, while the Black-naped Tern, Bridled Tern, Capricorn Silvereye, Roseate Tern and Silver Gull are also regularly seen on the island.</p> <p>The coral reef around the cay is a habitat for a vast array of marine life, the most common including angelfish, parrotfish, butterflyfish, sweetlips, batfish, sting rays, bronze whalers, sea snakes and stonefish.</p> <p>Masthead was the discovery ground of an entirely new species of fish, the Masthead Island Pipefish.</p> <p>Masthead Island supports the second largest <i>Pisonia grandis</i> forest in the Great Barrier Reef;</p> <p>A nationally important seabird nesting site due to high species diversity and numbers (including shearwaters, noddies, bridled terns, roseate terns, black-naped terns and silver gulls).</p>		
Michaelmas Reef (358)	31.46	NL2, RG2	Cairns	<p>Michaelmas Cay National Park is one of the most important seabird breeding sites in the Great Barrier Reef. It is the only destination within the Cairns area of the Great Barrier Reef providing an opportunity for visitors to experience a seabird rookery with high species diversity and large populations. The small, low sand cay covered by grasses and low-growing plants is an ideal habitat for thousands of ground nesting seabirds.</p> <p>Over 16 species of seabirds have been recorded on Michaelmas Cay, with up to nine of those using the island for breeding. During the summer months, when nesting is at its peak, more than 20 000 birds have been observed. Common noddies, sooty terns, crested terns and lesser crested terns are the main breeding species. Other species recorded on Michaelmas Cay include the endangered little terns, brown boobies, lesser frigate birds, ruddy turnstones, silver gulls, bridled terns, black-naped terns, reef herons, and roseate</p>		010410N7_S01

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				<p>terns.</p> <p>Has underwater topography and marine life of significant diversity and in some cases in very limited and fragile numbers</p> <p>Spinner dolphin <i>Stenella cf. longirostris</i> has been recorded from Michaelmas Reef.</p>		
Myrmidon Reef (154)	5.76	RA3	Townsville / Whitsundays	<p>Myrmidon Reef is 120km or 74 miles North East of Townsville. It is situated on the outer edge of the Great Barrier Reef and because it is close to the continental shelf it drops to depths of over 500m, not far from the Reef ledge.</p> <p>Heaps of manta rays, large pelagic fish, renowned for big game fish (e.g. marlin, tuna) offshore of reef.</p> <p><i>Acropora azurea</i> coral known only from here</p>		001005T9_U04; 001005T2_S04; 001005T7_S11; 001005T9_S09 Scientists (AIMS): 60-59 Scientists (Reef or Non-reef Panel): 70-69
North West Island Reef (445)	67.29	RCB1, X4	Mackay / Capricorn	<p>Planar Reef with vegetated sand cay. The largest reef in the Capricorn-Bunker Group. An elongate platform reef approximately 11 km long and 3 km wide running almost east-west, with the cay at its western end. It has irregular (not markedly linear) coral growth and has sand bank development on its northern side. It is slightly centrally depressed forming a lagoon, and has prolific coral growth at and behind its rim with good spur and grooves development.</p> <p>The largest cay on the Great Barrier Reef, and support for an extensive <i>Pisonia grandis</i> forest of international significance; the highest plant species diversity in the Capricorn Group; the nesting site for 70 percent of the total breeding population of wedge-tailed shearwaters on the east coast of Australia and a nationally important rookery for black noddies; a regionally significant rookery for loggerhead turtles and internationally significant rookery for green turtles.</p>	7	010227G17_S16
Offshore Moulter Reef to Jukes/Raine Reefs and south to Five	757.25	NE, NF, NO, RA2, RB1, X3	Far northern	<p>Mobile <i>Halimeda</i> beds</p> <p>Bryde's whales, whale sharks</p>	7	001116F7_S02

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Reefs (166)						
Outer Rocks (437)	2.63	NA3B	Mackay / Capricorn	Outer Rocks, in the Keppel Group of Islands on the Great Barrier Reef, has entry at 8m over superb ridges rich in hard and soft coral. With high continental rock lying on the NW edge. The ridge is known as Snake Paradise due to the resident population of olive sea snakes. There are many gutters to explore, ledges, and a good variety of marine life. Green and loggerhead turtles are also regular visitors.		010531R9_S01
Palm Island Group (174)	357.09	NB3, NB5, RHC	Townsville / Whitsundays	<p>Geomorphologically unique (Palm Islands), with high beta-diversity (habitat) and high alpha-diversity (benthos) due to exposure to clear water by the Palm Passage on the eastern sides, very sheltered and muddy coastal habitats on the protected sides, and current-swept channels between the islands. In general (in particular Palm Island group, Whitsundays) habitat diversity around the high continental island complexes is often unusually high, probably due to very diverse geomorphology, and some habitats are not found anywhere else.</p> <p>Unique habitat types include very sheltered leeward bays, rocky exposed intertidal and subtidals (some with granite as substrate), funnelling between the islands thus current-swept channels, and other features such as the inlets in the Whitsundays. We have a poor understanding what the soils of the high islands leak into the reefs (e.g. trace elements which may be even rarer on reefs away from soils). This leakage may be just what a few odd creatures need.</p> <p>High diversity of epibenthos and algae; unique in terms of sponges and gorgonians, many species of sponges not yet seen elsewhere on Great Barrier Reef, and only low similarities in species composition with adjacent in-shore benthos, such as Low Isles. Richer than anywhere else, matching Torres Strait in algal density. <i>Acropora kirstyae</i> known only (and abundant) here.</p> <p>GREAT PALM ISLAND, Rainforest occurs on steep ridges and in sheltered gullies. Lower and drier ridges support an open Eucalyptus forest, which is subject to frequent fires that have replaced the usual under storey with grasses. On level ground</p>	5	001005T7_S03, 001005T9_S01, 001005T9_U02, 001005T6_U10, 001005T5_S02 Scientists (Reef or Non-reef Panel): 72-71, 73-72, 80-79, 81-70, 82-81, 83-82, 84-83, 85-84, 86-85, 87-86, 88-87, 89-88, 90-89, 91-90, 92-91, 93-92, 94-93, 95-94, 96-95, 97-96

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				<p>this open forest gives way to a savannah type, and uncommonly, to grassland. Swampy land supports <i>Melaleuca leucadendron</i> and <i>Phragmites consumins</i>. Mangroves occur along several tidal creeks and on intertidal shorelines. There are extensive <i>Rhizophora stylosa</i> stands in the sheltered bays, and a narrow zone of mixed species on the landward side of the <i>Rhizophora</i>.</p> <p>8 spp. land birds (none breeding): Brown Hawk, Eastern Grass Owl, Noisy Pitta, Little Cuckoo-Shrike, Black-throated Warbler, Spectacled Flycatcher, Rufous Shrike Thrush, Spangled Drongo. Brown Hawk - 1 of 3 Great Barrier Reef records. Eastern Grass Owl - only Great Barrier Reef record. Noisy Pitta - 1 of 4 Great Barrier Reef records.</p>		
Peak Island Reef (419)	2.28	RE8	Mackay / Capricorn	The island is one of three significant nesting beaches for the eastern Australian flatback turtle breeding population. This breeding stock is the only marine turtle population on the Great Barrier Reef that is not exhibiting declines. The flatback turtle is endemic to the Australian continental shelf and is not known to nest elsewhere in the world.	7	010227R10_S03; 010226R11_S02
Price Cay (411)	0.05	RSW-M	Mackay / Capricorn	<p>Located in the Swains Reefs area. The Swains Reefs cays form the only breeding sites on the Great Barrier Reef for the Least Frigatebird ; Masked booby breeding sites in the Swains Reefs are the only ones that occur apart from Raine Island and Moulter Cay and may account for 10% of the total Great Barrier Reef population ; and the area contains significant shearwater foraging sites. Recoveries of banded masked & brown boobies indicate links from Swains Reefs to the Queensland central & southern coasts for both species and Papua New Guinea and the Solomon Islands for the brown booby. Significant declines in the # of adults & nests of brown boobies & adult silver gulls were reported from Swains Reefs from 1982-1994. A major reason for the declines may have been a reduction in available food supply associated with elevated sea surface temperatures induced by El Nino and may be part of long-term population fluctuations.</p> <p>Loggerhead turtles nest in 'large numbers' on Price and Frigate Cays; also in smaller numbers on Thomas, Bacchi,</p>	7	010227S4_S04

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				Gannet and Bylund Cays. Loggerhead turtle nesting in the Swains Reef cays are of extreme importance and represent 20-25% of the total annual nesting effort for eastern Australia. Tag recoveries from some loggerhead turtles indicate foraging areas for breeding turtles occur at Heron Island/Wistari Reefs and Moreton Bay.		
Princess Charlotte Bay (198)	1371.22	NA1, NB1, NK, RE1	Far northern	<p>Adjacent QLD National Park islands. High diversity of habitats (e.g. wetlands, seagrass beds) in a confined area. A number of large marine animals including irrawaddy dolphins, turtles and dugong are found in the waters of Princess Charlotte Bay. The inshore waters support high-density seagrass meadows and high seagrass species diversity.</p> <p>Princess Charlotte Bay and adjacent Bathurst Bay to the east have been identified as important areas for dugong. Results of four aerial surveys (1985, 1990, 1995, 2000) conducted in the northern Great Barrier Reef (GBR) indicate that the number of dugongs in the regions has not changed significantly since the mid 1980s.</p>	7	Scientists (Reef or Non-reef Panel): 98-97; 99-98; 100-99; 101-100; 102-101
Raine Island Reef (203)	2.42	NP, RA2	Far northern	<p>MARINE TURTLES: Raine Island has been a nesting site for green turtles for over 1000 years (the longest known marine turtle rookery anywhere in the world). The green turtles that nest at Raine Island are part of the world's largest remaining stocks. They belong to the northern Great Barrier Reef genetic stock that nests throughout the northern Great Barrier Reef (north of Princess Charlotte Bay) and eastern Torres Strait. The numbers of turtles using Raine Island fluctuates by orders of magnitude (100s to 10 000s) between years. This fluctuation is correlated with the El Niño Southern Oscillation measured in the previous 18 months.</p> <p>SEABIRDS: Eighty-four bird species have been recorded at Raine Island - five of these are considered uncommon/rare in Queensland. Sixteen species are known to breed on the island. The most significant breeding species is the herald petrel, listed as Critically Endangered in Australia under the <i>Environment Protection and Biodiversity Conservation Act 1999</i>, with the red-tailed tropicbird listed as Vulnerable in Queensland under the <i>Nature Conservation Act 1992</i></p>	7	001201F4_S01; 010410F10_S01 Scientists (AIMS): 6-5; 7-6 Scientists (Reef or Non-reef Panel): 23-22; 24-23

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				(Queensland). Historically it was thought that killer whale aggregations used to occur in the area.		
Repulse Bay Northern (204)	94.42	NA3B, RE4	Townsville / Whitsundays	<p>Conway Peninsula has high wilderness values, seagrass beds and is adjacent to Conway National Park</p> <p>Proserpine River - highest population of breeding crocodiles on east coast.</p> <p>DUGONGS: Dugong Protection Area 'B' Zone (northern Repulse Bay). 2.3% of the dugongs in the Central Section were found in the Repulse Bay.</p> <p>TURTLES: Adult Green turtles use Repulse Bay as a foraging ground between periodic reproductive migration. Separate and distinct seagrass beds within Repulse Bay (Coles et al. 1987).</p> <p>INSHORE (Irrawaddy & Indo Pacific Humpback) DOLPHINS: Australia may hold the most secure population of Irrawaddy & Indo-Pacific Humpback dolphins in the SE Asian region. Generally found close to shore, within 7km from the nearest shallow area (either point of land or reef), waters generally less than 10m deep.</p> <p>NATIONALLY IMPORTANT WETLAND: Nationally important wetland. Goorganga Plain is the largest floodplain in the Central Queensland Coast bioregion. Significant for the continuity and quality of habitats from marine to freshwater environments and the diversity of the biota. Part of a coastal floodplain, with low beach ridges, coastal foreshores, intertidal areas and associated shallow marine waters, and extends from Rocky Point to the mouth of the O'Connell River.</p>	7	001108W3_S01; 001105W1_S01; 001108W3_S02; 010504W19_S05; 010504W19_S06; 000000W9_S11; 000000W9_S13; 000000W9_S12; 000000W9_S14; 000000W9_S15
Ribbon Reef #10 (206)	113.25	NL1, RA2, RG1	Cairns	<p>Closed ring reef, extremely long (35,030 m) but only 610-1300m wide. Important habitat for dwarf minke whales especially from May to August at the southern end. Cod Hole at Northern End.</p> <p>Important as having underwater topography and marine life of significant diversity and in some cases in very limited and</p>		001115C3_S02; 010410C12_S01 Scientists (AIMS): 49-48

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				fragile numbers Described as one of the reefs in the Lizard Is. area that is "legendary" among Black Marlin fishermen.		
Sandbank No 7 (215)	0.08	NQ, RA2	Far northern	High number of masked and brown boobies, high number of nesting turtles. A regionally important green turtle nesting site. As there are few Great Barrier Reef nesting colonies of Lesser Crested Tern, the cay should be considered of moderate importance for seabird nesting.	7	001201P4_S01
Sandbank No. 8 (216)	0.09	NQ, RA2	Far northern	Important seabird breeding site in terms of numbers and diversity of birds.. Brown Booby - Breeding occurs throughout the year with the greatest number of nests in summer. Sooty Tern - Breeds in mid-year. At other times there only may be a few or there may be thousands of birds present. At night thousands of birds roost on the cay. Bridled Tern - Breeding in variable numbers during most visits. Nests are difficult to find and count because they usually are concealed under the shelter of the vegetation. Crested Tern - Recorded breeding during most visits with the greatest numbers in summer. Lesser Crested Tern - Two nests were present amongst the Crested Terns in Dec., 1981. Common Noddy - Breeding in the winter months when up to 4000 nests have been recorded. The other seabird species that have been recorded on the cay are the Least Frigatebird, Silver Gull and Black-naped Tern. A regionally important green turtle nesting site.	7	001201P4_S01
Shelburne Bay (219)	61.77	NA1, NB1	Far northern	Mangrove-lined estuaries, with at least 23 spp of mangrove dominated by <i>Rhizophora</i> , <i>Bruguiera</i> and <i>Ceriops</i> ; marshes and salt pans; intertidal banks; extensive, diverse and dense seagrass meadows containing at least 8 spp; extensive macro-algal beds; coral reefs; islands; rocky shores; freshwater wetlands; perched dune lakes. The area hosts consistently significant dugong populations based on aerial surveys. The perched dune lakes in the region are recognised as among the best examples of these natural features in the	7	010112F8_S02

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				<p>world.</p> <p>The Australian Directory of Important Wetlands lists both the wetlands of Cape Grenville (7304 hectares) and Harmer River-Shelburne Bay Aggregation (31 751 hectares) as nationally important wetlands. This is on the basis of the diversity of wetland types within the white sand country.</p> <p>An identified conservation value of the wetlands is that large 'concentrations of wading birds gather in the wetlands during winter. This is one of the two places on the eastern coast of Cape York Peninsula where this happens.'</p> <p>The Harmer River - Shelburne Bay wetlands meet three of the six criteria of national significance including the importance of the region as a refuge during drought, the existence of an important habitat for animal taxa at a vulnerable stage in their life styles and that the region supports nationally endangered or vulnerable plant and animals communities.</p> <p>The Australian Heritage Commission has noted the following features of conservation significance: (1) The Olive River - Shelburne Bay area is of particular note for its wilderness quality and the extensive nature of the dune areas and the diversity of lakes and dune types in the region. Its dunefields are a world-class example of the evolution of sandy landscapes in the humid tropics. It is one of the most extensive and least disturbed areas of active parabolic dunes in the world. The pear shaped and triangular dune lakes are amongst the best examples of their type in the world. The area is a nationally important dunefield, heath and eucalypt woodland wilderness area. The dunefields support a regional rich collection of vegetation communities, which is likely to support a rich fauna. It contains a high diversity of wetland types and coastal wetland features. It is important for the high diversity of its wetland types and coastal wetland features and is particularly rich in dune lakes and dune swamps. The Shelburne - Olive River dunefields are a landscape of outstanding aesthetic significance; White Point, a large parabolic dune and the large adjacent intertidal sand shoal are</p>		

Site name (and identification number) ¹	Total Area in GIS layer (km ²)	Great Barrier Reef Marine Park Bioregion(s) ²	Management Area of Great Barrier Reef Marine Park	Justifications	Linked BOPs Number ³	Survey / workshop source identifier
				particularly prominent features		
Shoalwater Bay (221)	395.40	NA3B, NA4, RE7	Mackay / Capricorn	<p>The Shoalwater and Corio Bays area is bounded by approximately 330km of coastline including all islands. The area's terrestrial and five major estuarine and marine environments represent the largest area in central east Queensland containing representative coastal, subcoastal, aquatic landscapes and ecosystems which are relatively undisturbed habitat areas for significant floral and faunal assemblages, including populations of rare and threatened species. The area represents a climatic overlap zone with an unusual mix of tropical, sub-tropical and temperate species. The area also represents the largest wilderness area within the Central Mackay Coast biogeographic area and on the central Queensland coast. Such places are rare on the eastern coastline of Australia</p> <p>DUGONGS: The Area supports the most important dugong seagrass habitat in the southern region of the Marine Park, and the largest dugong population in the Park south of Cardwell.</p> <p>MARINE TURTLES: Shoalwater Bay supports a large foraging population of green turtles in one of the least disturbed major embayments in eastern Australia. It represents one of the least impacted foraging populations for the species in eastern Australia.</p> <p>RAMSAR WETLAND: The Shoalwater and Corio Bays Area (Shoalwater Bay Training Area, in part - Corio Bay) Ramsar site contains a wide diversity of landscape types including undulating lowlands and hills, riverine plains, swamps, estuarine inlets, old beach ridges, dunes, sand beaches flanked by coastal cliffs, and intertidal sand and mudflats. The wetland types on the site include freshwater lagoons, swamps and streams, leading into marine, estuarine and intertidal wetlands.</p> <p>The site is located in a zone where the temperate climate merges into tropical and sub-tropical climates. The climatic gradient, diversity of geomorphology and good condition of the</p>	7	010227R10_S05; 010226R11_S04; 010226R11_S06; 010226R11_S08; 010226R11_S12; 010531R9_S10

Site name (and identification number) ¹	Total Area in GIS layer (km ²)	Great Barrier Reef Marine Park Bioregion(s) ²	Management Area of Great Barrier Reef Marine Park	Justifications	Linked BOPs Number ³	Survey / workshop source identifier
				<p>site has resulted in a rich diversity of species. The site supports about 791 plant species and sub-species, 445 fish species, 22 frog species, 66 reptiles species, 226 birds species, 24 mammal species and 23 bat species.</p> <p>Nationally threatened species that occur at the site include the Green Turtle, Hawksbill Turtle, Flatback Turtle, Loggerhead Turtle, Honey Blue-eye fish and Oxleyan Pygmy Perch.</p> <p>Dozens of migratory bird species protected under international conservation agreements have been recorded at the site. The site has been identified as being of international importance to the migratory Eastern Curlew, Whimbrel and Great Knot. A range of other wetland birds and shorebirds feed and breed in the area.</p> <p>The bay is important and unique in terms of algae. 10 taxa are present that are not recorded elsewhere; corals are similar. Rich and productive seagrasses, some unusual seagrass morphologies possibly new species. High planktonic productivity, reasonable correlation between water column nutrients and occurrence of significant densities of epibenthos. Cited as highly important areas for a range of taxa and habitats. It is essential that these areas be given high levels of protection.</p>		
Thomas (Twin) Cay (407)	0.04	RSW-M	Mackay / Capricorn	<p>Located in the Swains Reefs area. The Swains Reefs cays form the only breeding sites on the Great Barrier Reef for the Least Frigatebird ; Masked booby breeding sites in the Swains Reefs are the only ones that occur apart from Raine Island and Moulter Cay and may account for 10% of the total Great Barrier Reef population ; and the area contains significant shearwater foraging sites. Recoveries of banded masked & brown boobies indicate links from Swains Reefs to the Queensland central & southern coasts for both species and Papua New Guinea and the Solomon Islands for the brown booby. Significant declines in the # of adults & nests of brown boobies & adult silver gulls were reported from Swains Reefs from 1982-1994. A major reason for the declines may have been a reduction in available food supply associated with elevated sea surface temperatures induced by El Nino and</p>	7	010227S4_S04; 010226S5_S01

Site name (and identification number) ¹	Total Area in GIS layer (km ²)	Great Barrier Reef Marine Park Bioregion(s) ²	Management Area of Great Barrier Reef Marine Park	Justifications	Linked BOPs Number ³	Survey / workshop source identifier
				<p>may be part of long-term population fluctuations.</p> <p>Loggerhead turtles nest in 'large numbers' on Price and Frigate Cays; also in smaller numbers on Thomas, Bacchi, Gannet and Bylund Cays. Loggerhead turtle nesting in the Swains Reef cays are of extreme importance and represent 20-25% of the total annual nesting effort for eastern Australia. Tag recoveries from some loggerhead turtles indicate foraging areas for breeding turtles occur at Heron Island/Wistari Reefs and Moreton Bay.</p>		
Three Reefs (240)	7.52	RA2, X3	Far northern	<p>Important as having underwater topography and marine life of significant diversity and in some cases in very limited and fragile numbers</p> <p>The profile of Three Reefs differs greatly from all other ribbon reefs observed. The reef surface consisted almost entirely of limestone with deep spur and groove formations on the eastern side. These grooves extended across to the western side of the reef flat, decreasing gradually in depth. Corals and calcareous algae were nowhere abundant. These reefs appear to be in the path of strong tidal currents; they are also exposed to very strong wave action. Perhaps as a consequence, the depth of water over the reef was approximately 1 m greater than that over the main transect of Great Detached Reef, itself approximately 0.5 m deeper than corresponding areas of the protected north end of Great Detached Reef.</p>		010410F10_S01 Scientists (Reef or Non-reef Panel): 21-20
Tryon Island Reef (451)	2.23	RCB1, X4	Mackay / Capricorn	<p>With vegetated sand cay at its western end. Small, drying platform reef, without lagoon, with linear growth of coral (windrows, or coral alignments) well marked resulting from strong wave action across the entire reef flat. Unique diving, tidal flat surrounding reef very diverse. Planar Reef.</p> <p>Support for the southernmost limit of a small shore plant <i>Timonius timon</i>, and colonies of wedge-tailed shearwaters and bridled terns;</p> <p><i>Pisonia grandis</i> forests that are highly significant;</p> <p>International importance for loggerhead turtles with the reef flat an important feeding area for young turtles; Regional</p>	7	010227G17_S16; 010606G15_S01

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				significance for green turtle nesting.		
Whitsundays (278)	3182.02	NA3B, NB6, NB7, RE4, RHC	Townsville / Whitsundays	<p>The Whitsundays is well known for its spectacular island scenery, especially its fringing and offshore reefs. The reefs and islands support a variety of wildlife, including protected species such as humpback whales, dugong and turtle. A range of marine habitats including significant seagrass beds, mangroves, coral reefs and mudflats all play an important role in protecting the amazing plants and animals that call the Whitsundays home.</p> <p>Geomorphologically unique (Whitsunday Islands). In addition to cross-shelf gradient, there is a south-to north gradient in benthos communities from depauperate muddy reefs close to the Proserpine, to areas away from the Proserpine. Unique and very fragile hard and soft coral communities in the Inlets. In general (in particular Palm Island group, Whitsundays) habitat diversity around the high continental island complexes is often unusually high, probably due to very diverse geomorphology, and some habitats are not found anywhere else. Unique habitat types include very sheltered leeward bays, rocky exposed intertidal and subtidals (some with granite as substrate), funnelling between the islands thus current-swept channels, and other features such as the inlets in the Whitsundays. Cited as highly important areas for a range of taxa and habitats. It is essential that these areas be given high levels of protection.</p> <p>Humpback whale calving area.</p> <p>The following values relating to corals and associated biota are noted: corals and associated biota are an integral part of the Marine Park and the Great Barrier Reef World Heritage Area; the relatively clear waters of the northern part of the Area have allowed for the growth and development of extensive and diverse reef structures and corals that are relatively uncommon on fringing reefs; surveys of fringing reefs have identified a number of reefs of outstanding species richness, coral cover, uniqueness and aesthetic appeal; a previously undescribed coral species (<i>Goniastrea</i> sp.) has been recorded at Double Bay, and a species of sponge (<i>Rhabdermia sorokiniae</i>) has</p>	5	Scientists

Site name (and identification number) ¹	Total Area in GIS layer (km ²)	Great Barrier Reef Marine Park Bioregion(s) ²	Management Area of Great Barrier Reef Marine Park	Justifications	Linked BOPs Number ³	Survey / workshop source identifier
				<p>been recorded at Deloraine Island reef.</p> <p>The following values relating to whales and dolphins are noted: whales and dolphins are an integral part of the Marine Park and the Great Barrier Reef World Heritage Area; the Area is an important calving ground for humpback whales which migrate north from the Southern Ocean during winter; several species of dolphin inhabit the area.</p> <p>The following values relating to birds nesting or roosting are noted: birds are an integral part of the Marine Park and the Great Barrier Reef World Heritage Area; the area is recognised internationally as an important stopover area for migratory birds; there are a number of significant bird sites in the area: Bird Island, East Rock, EdwinRock, Eshelby Island, Little Eshelby Island, Armit Island, (southern beach only), Double Cone Island (western island only), Grassy Island (southern beach only), Little Armit Island, Olden Rock (south of Olden Island), Shaw Island (beach east of Burning Point), South Repulse Island (western beach only).</p>		
Wild Duck Island (381)	5.72	NA4, RE6	Mackay / Capricorn	<p>The island is one of the significant nesting beaches for the eastern Australian flatback turtle breeding population. This breeding stock is the only marine turtle population on the Great Barrier Reef that is not exhibiting declines. The flatback turtle is endemic to the Australian continental shelf and is not known to nest elsewhere in the world.</p> <p>In 1980, the Queensland Government declared most of Wild Duck Island (a continental island off the central Queensland coast inshore from the Great Barrier Reef) a national park. The national park includes the important nesting beaches for flatback turtles on the island.</p>	7	010226M14_S01; 010227R10_S03; 010226R11_S02; 010531R9_S08
Wilson Island Reef (448)	33.41	RCB1, X4	Mackay / Capricorn	<p>Connected to Wreck Island reef by underwater reef systems.</p> <p>Small planar reef about 1700m long and 1000m wide with vegetated sand cay at its western corner.</p> <p>Nationally important breeding colonies of ground-nesting black-naped and roseate terns.</p>		010227G17_S16; 010226G18_S01

Site name (and identification number) ¹	Total Area in GIS layer (km ²)	Great Barrier Reef Marine Park Bioregion(s) ²	Management Area of Great Barrier Reef Marine Park	Justifications	Linked BOPs Number ³	Survey / workshop source identifier
Wreck Island Reef (449)	5.61	RCB1, X4	Mackay / Capricorn	<p>Triangular-shaped drying platform reef about 4.5 km long and 2.5 km wide at its widest point with the sand cay at the SW corner.</p> <p>A green turtle rookery of international importance and the most important offshore rookery for loggerhead turtles in eastern Australia;</p> <p>Significant seabird breeding colonies (black-naped terns and silver gulls) and active sea eagle nests.</p>	7	010227G17_S16; 010227G17_S07

Zoning results

An analysis of the protection under previous zoning afforded to many of the *special or unique* sites indicated that many had already been acknowledged as having biophysical attributes that set them apart from other locations within the Great Barrier Reef Marine Park (Table 2) and hence already had a high level of protection.

In total, the area of no-take protection of the *special or unique* sites in the GBRMP increased from 1,614 km² to 4,013 km². Twenty-two of the *special or unique* sites were already zoned as no-take or highly protected. The large majority of these sites had been previously zoned because of seabird or marine turtle nesting significance or importance as dugong foraging habitat. Of the remaining sites, 25 increased in overall protection with regard to no-take zoning. Full discussion about the zoning results is provided in Fernandes et al. 2009.

Table 2. Zoning arrangements for *special or unique* sites under previous and current zoning plans for the Great Barrier Reef Marine Park.

For ease of presentation, the term 'Pre-RAP' is used to collectively refer to the zoning arrangements under the five Zoning Plans in effect prior to 1 July 2004. The term 'Post-RAP' is used to refer to the *Great Barrier Reef Marine Park Zoning Plan 2003*, which came into effect on 1 July 2004.

Site		Percentage of each zone type							
		Unzoned	GUZ	HPZ	CPZ	BZ	SRZ	MNPZ	PZ
Avoid Island	Pre RAP			100					
	Post RAP			100					
Bacchi Cay	Pre RAP						100		
	Post RAP							100	
Bathurst Bay - Flinders Group	Pre RAP		0.1		99.9				
	Post RAP				100				
Bowling Green Bay	Pre RAP		99.2		0.4		0.4		
	Post RAP		50.8	6.5	14.6		0.6	27.4	
Boydong Islet	Pre RAP							100	
	Post RAP							100	
Brook Islands and Reefs	Pre RAP							100	
	Post RAP							100	
Bushy-Redbill Reef	Pre RAP							100	
	Post RAP							100	
Bylund Cay	Pre RAP							100	
	Post RAP								100
Capricorn Bunker Group	Pre RAP			90.8	3.9			2.9	0.7
	Post RAP		0.1	20.3	40.2	0.0	4.1	33.8	1.4
Clack Reefs and island	Pre RAP							100	
	Post RAP							100	
Coastal Corio Bay to Water Park Point	Pre RAP		100						
	Post RAP		14.2		85.8				
Coastal Round Head to Wreck Rock	Pre RAP	8.8	91.2						
	Post RAP		15.0		10.1			74.9	
Coastal Starcke River Region Ninian Bay to Lookout Point	Pre RAP	2.4	7.0	0.1				57.4	33.2
	Post RAP		2.4		0.8			67.5	29.3
Corbett Reef	Pre RAP							100	
	Post RAP							100	
Curtis Island North	Pre RAP		100						
	Post RAP		25.7	67.0	7.3				
Curtis Island	Pre RAP	Outside the GBRMP							

Site		Percentage of each zone type							
		Unzoned	GUZ	HPZ	CPZ	BZ	SRZ	MNPZ	PZ
South	Post RAP								
Distant Cay	Pre RAP							100	
	Post RAP							100	
Egg Rock	Pre RAP							100	
	Post RAP							100	
Eshelby Island	Pre RAP								100
	Post RAP								100
Frigate Cay	Pre RAP							100	
	Post RAP								100
Hedge Reef	Pre RAP			100					
	Post RAP							100	
Heron Island Reef	Pre RAP			12.4	82.4			5.2	
	Post RAP				66.5		28.2	5.2	
Hinchinbrook Channel	Pre RAP	Outside the GBRMP							
	Post RAP	Outside the GBRMP							
Hinchinbrook Island	Pre RAP	Outside the GBRMP							
	Post RAP	Outside the GBRMP							
Hinchinbrook Region	Pre RAP		51.5	46.4	1.0			1.2	
	Post RAP		14.7	0.8	55.7			28.8	
Howick Group	Pre RAP				100				
	Post RAP				100				
Lady Elliott Island Reef	Pre RAP				84.2			15.8	
	Post RAP							100	
Lagoon westward of Hicks, Day, Carter, Yonge, No Name and Ribbon Reef #10	Pre RAP		30.2	69.8					
	Post RAP			94.5		0.1		5.3	0.1
Lizard Island	Pre RAP				19.7	23.5		56.9	
	Post RAP				5.3		94.5	0.2	
Masthead Island Reef	Pre RAP			88.2				11.8	
	Post RAP				100				
Michaelmas Reef	Pre RAP							100	
	Post RAP							100	
Myrmidon Reef	Pre RAP				100				
	Post RAP							100	
North West Island Reef	Pre RAP			95.0				5.0	
	Post RAP				93.3			6.7	
Offshore Moulter Reef to Jukes/Raine Reefs and south to Five Reefs	Pre RAP			6.1				93.9	
	Post RAP			3.3				96.7	
Outer Rocks	Pre RAP			100					
	Post RAP				100				
Palm Island Group	Pre RAP			74.2	20.4			5.4	
	Post RAP		0.3	54.8	35.7		3.0	6.1	
Peak Island Reef	Pre RAP								100
	Post RAP								100
Price Cay	Pre RAP							100	
	Post RAP								100
Princess Charlotte Bay	Pre RAP	4.4	30.4	4.4	56.6			4.2	
	Post RAP		30.4	26.2	5.1			38.3	
Raine Island Reef	Pre RAP							100	
	Post RAP							100	
Repulse Bay Northern	Pre RAP	46.5	53.5						
	Post RAP		100						
Ribbon Reef #10	Pre RAP			86.7		3.7		9.6	
	Post RAP			16.7		2.0		81.3	
Sandbank No 7	Pre RAP							100	

Site		Percentage of each zone type							
		Unzoned	GUZ	HPZ	CPZ	BZ	SRZ	MNPZ	PZ
	Post RAP							100	
Sandbank No. 8	Pre RAP							100	
	Post RAP							100	
Shelburne Bay	Pre RAP							100	
	Post RAP							100	
Shoalwater Bay	Pre RAP		8.6	91.4					
	Post RAP			0.0	11.1			88.9	
Thomas (Twin) Cay	Pre RAP							100	
	Post RAP								100
Three Reefs	Pre RAP							100	
	Post RAP							100	
Tryon Island Reef	Pre RAP			87.7				12.3	
	Post RAP							100	
Whitsundays	Pre RAP	0.4	45.9	46.4	6.8			0.4	
	Post RAP		27.0	46.9	11.7			14.4	
Wild Duck Island	Pre RAP			100					
	Post RAP							100	
Wilson Island Reef	Pre RAP			100					
	Post RAP				80.9			19.1	
Wreck Island Reef	Pre RAP								100
	Post RAP								100

From the perspective of an ecosystem based approach to management, it is important to note that ensuring the future protection of an ecosystem, as a whole, including its entirety of values, species, and processes requires far more than protection of its *special or unique* sites. In the case of the Great Barrier Reef Marine Park, this principle in the Representative Areas Program was just one of 11 used to guide planning for a new network of no-take and other protection zones (Fernandes et al. 2005).

The benefits of the *Great Barrier Reef Marine Park Zoning Plan 2003* are already being exhibited by increased density and size of targeted fish in no-take zones, fewer outbreaks of the coral-eating crown-of-thorns starfish in no-take zones resulting in higher coral cover and potential benefits to some species of conservation concern (McCook et al. 2009). However, the incorporation of every *special or unique* site into a network of 'no take' marine reserves was not necessarily the type of management action required for the protection of the particular natural value. Other actions that the Great Barrier Reef Marine Park Authority is using to further protect *special or unique* sites in the Marine Park include improving water quality, promoting compliance with fisheries management plans, encouraging responsible use practices by reef users, developing reef stewardship initiatives, being involved in regional and international initiatives (e.g. Convention on Conservation of Migratory Species of Wild Animals) and implementing a Climate Change Action Plan.

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Appendix 1 – Biophysical Operational Principles used in the Representative Areas Program

Biophysical Operational Principle	Explanation
1. Ensure local integrity Have no-take areas the minimum size of which is 20km along the smallest dimension (except for coastal bioregions)	While no-take areas may be of various shapes and sizes, 20km should be the minimum distance across any no-take area in order to ensure that the size of each area is adequate to provide for the maintenance of populations of plants and animals within no-take areas and to insure against edge effects resulting from use of the surrounding areas.
2. Maximise amount of protection Have larger (versus smaller) no-take areas	For the same amount of area to be protected, protect fewer, larger areas rather than more smaller areas, particularly to minimise 'edge effects' resulting from use of the surrounding areas. This principle must be implemented in conjunction with principle 3.
3. Replicate Have sufficient no-take areas to insure against negative impacts on some part of a bioregion	"Sufficient" refers to the amount and configuration of no-take areas and may be different for each bioregion depending on its characteristics. For most bioregions, 3-4 no-take areas are recommended to spread the risk against negative human impacts affecting all no-take areas within a bioregion. For some very small bioregions fewer areas are recommended, whilst for some very large or long bioregions, more no-take areas are recommended.
4. Avoid fragmentation Where a reef is incorporated into no-take zones, the whole reef should be included	Reefs are relatively integral biological units with a high level of connectivity among habitats within them. Accordingly, reefs should not be subject to 'split zoning' so that parts of a reef are 'no-take' and other parts are not.
5. Set minimum amount of protection Represent a minimum amount of each reef bioregion in no-take areas Represent a minimum amount of each non-reef bioregion in no-take areas	In each reef bioregion, protect at least 3 reefs with at least 20% of reef area and reef perimeter ⁴ included in no-take areas. The number and distribution of no-take areas per bioregion is described in principle 3. In each non-reef bioregion, protect at least 20% of area. Two coastal bioregions ⁵ , which contain finer scale patterns of diversity due to bays, adjacent terrestrial habitat and rivers, require special provisions. The number & distribution of no-take areas is described in principle 3.
6. Maintain geographic diversity Represent cross-shelf and latitudinal diversity in the network of no-take areas	Many processes create latitudinal and longitudinal (cross-shelf) differences in habitats and communities within the GBR World Heritage Area. This diversity is reflected partly in the distribution of the bioregions, but care should be taken to choose no-take areas that include differences in community types and habitats that cover wide latitudinal or cross-shelf ranges.
7. Represent all habitats Represent a minimum amount of	This principle is to ensure that all known communities and habitats that exist within bioregions are included in the

⁴ These bioregions are excepted:

- Capricorn-Bunker Mid-Shelf Reefs (RCB2) – include one of the inner 2 and one of the outer 2 reefs. This exception exists because RCB2 has only 4 reefs;
- Deltaic Reefs (RA1) – minimum 25% and minimum 15 reefs in one continuous area. This exception exists because the bioregion is too small for multiple no-take areas;
- High Continental Island Reefs (RHC) – 20% of reef perimeter only. This exception exists because reef perimeter makes more biological sense for fringing reefs; and
- Central Open Lagoon Reefs (RF2) – 3 reefs. There are very few reefs in this bioregion.

⁵ For coastal bioregions:

- Coastal Strip-Sand (NA1) – protect at least six no-take areas, each at least 10km in length, spaced approximately every 70-100km apart. (This bioregion is approx. 800 km long); and
- High Nutrient Coastal Strip (NA3) – at least eight no-take areas, each at least 10km in length, spaced approximately every 70-100 km apart. (This bioregion is approximately 1400 km long).

Biophysical Operational Principle	Explanation
each community type and physical environment type in the overall network taking into account principle 7 (see footnote 3)	network of no-take areas. Communities and habitats were identified for protection in no-take areas based upon the reliability and comprehensiveness of available data. Footnote ⁶ helps implement this principle, which is intended to ensure that particularly important habitats are adequately represented in the network of no-take areas.
8. Apply all available information on processes Maximise use of environmental information to determine the configuration of no-take areas to form viable networks	The network of areas should accommodate what is known about migration patterns, currents and connectivity among habitats. The spatial configurations required to accommodate these processes are not well known and expert review of candidate networks of areas will be required to implement this principle.
9. Protect uniqueness Include biophysically special/unique places	These places might not otherwise be included in the network but will help ensure the network is comprehensive and adequate to protect biodiversity and the known special or unique areas in the GBRMP. Aim to capture as many biophysically special or unique places as possible.
10. Maximise natural integrity Include consideration of sea and adjacent land uses in determining no-take areas	Past and present uses may have influenced the integrity of the biological communities and the GBRMPA should consider these effects, where known, when choosing the location of no-take areas. For example, existing no-take areas and areas adjacent to terrestrial National Parks are likely to have greater biological integrity than areas that have been used heavily for resource exploitation.

⁶ Data and objectives to implement principle 7:

- *Halimeda* beds – ensure no-take areas represent 10% of known *Halimeda* beds;
- shallow water seagrass – ensure no-take areas represent 10% of shallow water seagrass habitat;
- deepwater seagrass – ensure no-take areas represent 10% of known deepwater seagrass habitat;
- algae – ensure no-take areas represent 10% of known algal habitat;
- epibenthos – ensure no-take areas represent different faunal classes (5% each of echinodermata, sponges, bryozoans, solitary corals, soft corals, foraminifera, brachyura);
- dugong – ensure no-take areas represent identified dugong habitat areas summing to about 50% of all high priority dugong habitat; Further information on the implementation of this principle is contained in Dobbs et al. 2008.
- cays – where cays exist within a bioregion, try to include at least two examples of them in potential no-take areas;
- reefs size - capture 5% of reef area in each of five reef-size classes;
- inter-reef channels - capture at least one inter-reef channel in bioregions where they exist;
- exposure - ensure the entire network captures 5% of reef and non-reef area in each of five wave exposure classes;
- islands – where islands exist within a bioregion try to include one example of them in no-take areas;
- oceanographic diversity in water quality – ensure representation of reefs within the “natural” diversity of water quality (5% of reef and non-reef area in each of nine oceanographic “bioregions”; 5% of reef and non-reef area in each of four flood frequency classes);
- adjacent coastal and estuarine habitats (including islands) – locate no-take areas adjacent to mangroves, wetlands and protected areas rather than adjacent to suburbs; and
- major turtle sites – ensure no-take areas include known major turtle nesting and foraging sites (100% of about 30 sites of the 115 identified – these include both nesting sites and foraging sites). Further information on the implementation of this principle is contained in Dobbs et al. 2007.