Objective
To provide guidance on assessing impacts to dugong within the permission system.

Target audience
Primary: Great Barrier Reef Marine Park Authority officers assessing applications for permission.
Secondary: Groups and individuals applying for permission; interested members of the public.

CONSULTATION NOTES:
1. These guidelines form part of a broader package which has been released for public comment and should be read in conjunction with:
   a. The draft revised Environmental impact management policy: permission system (Permission system policy) explains how the management of the permission system ensures consistency, transparency and achievement of the objects of the Act.
   b. The draft Risk assessment procedure explains how GBRMPA determines risk level and the need for avoidance, mitigation or offset measures.
   c. The draft Guidelines: Applications for permission (Application guidelines) explain when permission is required and how to apply.
   d. The draft Checklist of application information proposes information required to be submitted before an application is accepted by GBRMPA.
   e. The draft Guidelines: Permission assessment and decision (Assessment guidelines) explain how applications are assessed and decisions made.
   f. The draft Information sheet on deemed applications under the Environment Protection and Biodiversity Conservation Act (EPBC deemed application information sheet) explains how application, assessment and decision processes work for those applications that require approval under both the Great Barrier Reef Marine Park Act and the Environment Protection and Biodiversity Conservation Act (EPBC Act).
   g. The draft Information sheet on joint Marine Parks permissions with Queensland (Joint Marine Parks permissions information sheet) explains how GBRMPA and the Queensland Government work together to administer a joint permission system.
   h. The draft Guidelines: Value impact assessment in the permission system (Value assessment guidelines) provide further detail on specific values of the Marine Park, including how to determine risk and possible avoidance, mitigation or offset measures.
   i. The draft Guidelines: Location-specific assessment in the permission system (Location-specific assessment guidelines) highlight places in the Marine Park that have site-specific management plans, policies or other information which may be relevant to decisions.
   j. The draft Guidelines: Activity impact assessment in the permission system (Activity assessment guidelines) provide further detail on how GBRMPA assesses and manages specific activities.
   k. The Managing facilities discussion paper and draft Guidelines: Activity impact assessment in the permission system – Fixed facilities propose changes to how GBRMPA manages facilities in the Marine Park.

2. Amendments are underway to the Great Barrier Reef Marine Park Regulations 1983, as outlined in the Response Document prepared after consultation in December 2015. These guidelines have been written to reflect the proposed amendments.

3. You can provide feedback on this document via our online survey, which can also be accessed from our webpage at www.gbrmpa.gov.au/zoning-permits-and-plans/permits/improving-permissions

Purpose
1. Permission decisions contribute to maintaining and enhancing the condition of dugong within the Great Barrier Reef Marine Park (the Marine Park).
Context

Description of the value

2. The dugong (Dugong dugon) is a medium-sized marine mammal, growing to about three metres and 300 kilograms. It is one of four living species of the Order Sirenia, which also includes three species of manatees.

3. Dugongs inhabit waters of more than 40 countries, including tropical and subtropical coastal and island waters from east Africa to Vanuatu. Throughout much of this range, the dugong is believed to be represented by relict populations separated by large areas where its numbers have been greatly reduced or already locally extinct. A significant proportion of the world’s dugongs are found in northern Australian waters from Moreton Bay in the east to Shark Bay in the west.

4. Dugongs can live for up to about 70 years, but most dugongs die at a younger age. Their late maturity (they start breeding at 4-17 years), low fecundity (generally only one young at a time), long interval between successive breeding events (3-7 years) and long gestation period (13-15 months) result in a low potential rate of population increase even under ideal environmental conditions. Adult survivorship must be very high (more than 95 per cent per year) for dugong numbers to be maintained.

5. Depleted dugong populations are slow to recover because the species is so long-lived and slow breeding. Even a slight reduction in adult survivorship can cause a critical decline in a dugong population. In optimum conditions (for example low natural mortality and no human-induced mortality), a dugong population can increase at only about five percent per year maximum. Dugongs normally mate and give birth between July and December.

6. Dugongs feed primarily on seagrass species with a high protein and low fibre content. Dugongs generally uproot whole plants, producing distinctive feeding trails. They prefer delicate, pioneer species that are high in nitrogen like Halophila and Halodule. They can manipulate seagrass beds to encourage the regeneration of these fast-growing species. Maintaining a palatable feeding area in this way has been termed ‘cultivation grazing’.

7. Lush seagrass meadows are not favoured for foraging, and the total area of seagrass may not be a good indication of its value to dugongs. Other factors that influence seagrass quality, such as protein concentration or the ability to regenerate quickly, determine the value of a seagrass bed to dugongs.

8. Dugongs are vulnerable to human impacts because of their life history and their dependence on seagrass which grows in shallow, coastal habitats, often near human settlements. Dugongs are seagrass community specialists, and their health depends on access to healthy coastal seagrass meadows.

Population estimates

9. Individual dugongs can move over long distances (hundreds of kilometres) and genetic studies suggest that dugong populations in the Marine Park may be connected with dugongs in neighbouring regions. This situation means that complementary management arrangements are required at the regional, state, national and international levels to ensure that dugongs are protected throughout their range.

10. For the Marine Park, two dugong management units are recognised given the distinct differences in population dynamics, based on the nature and scale of human impacts on dugong populations and their habitats:
11. A series of aerial surveys conducted about every five years since the 1980’s provides standardised minimum population estimates for the remote and urban coast dugong management units.

12. The dugong population in the remote coast is considered in good condition (more than 4000 animals when last surveyed in 2013) and relatively stable with no evidence of a statistically significant decline.

13. The remote coast supports globally significant populations of dugongs and is the most important dugong habitat within the Great Barrier Reef World Heritage Area, and one of the most important locations in Australia. Specific areas supporting dugongs along the northern Great Barrier Reef coast include:
   a. Shelburne Bay
   b. Temple Bay
   c. Lloyd Bay
   d. the waters between Friendly Point and Port Stewart
   e. Princess Charlotte Bay
   f. Bathurst Bay
   g. the waters between Cape Bowen and Cape Flattery.

14. The urban coast dugong population has declined over many decades and is believed to be at only a small fraction of pre-European levels. While commercial harvest of the population ceased in 1969, the population was adversely affected by incidental mortality in shark nets set for bather protection and commercial gill nets, especially from the 1960s. The urban coast dugong population was thought to have stabilised by 2005 as a result of the establishment of a series of Dugong Protection Areas and green zones from which net fishing was banned or modified to reduce the risk of dugongs being incidentally captured and drowned. However, the urban coast dugong population has recently (per 2011 surveys) suffered further decline due to:
   a. the decline in the abundance of seagrasses — the primary food resource for dugongs — which have been adversely affected by weather (high levels of freshwater runoff and cyclones) and
   b. direct human-related impacts on dugongs such as drowning in mesh nets set by commercial fishers, vessel strike, marine debris and illegal hunting.

15. The 2011 survey results showed the lowest relative abundance of dugongs along the urban coast since surveys began in 1986. Specific areas supporting dugongs along the urban coast of the Great Barrier Reef Marine Park include:
   a. Hinchinbrook Island (Missionary Bay)
   b. Cleveland Bay
   c. Upstart Bay
   d. Shaol Water Bay and
   e. Port Curtis.

16. In 2011, the standardised minimum population estimate was only 600 animals on the urban coast, compared with an estimate of around 2000 from the previous survey in 2005. The decline is likely to be caused by increased mortality plus dugongs moving out of the survey area to seagrass meadows elsewhere. In 2011, an unprecedented number of dead and/or stranded dugongs were recorded along the urban coast.

Importance to the Marine Park

17. The Great Barrier Reef Marine Park supports globally significant populations of dugongs that are connected with dugong populations in Torres Strait to the north and south-east Queensland to the south of the Marine Park. The significance of the Great Barrier Reef for the dugong was one of the reasons for its World Heritage listing in 1981.

18. Australia has international, national, and state obligations to conserve dugongs. The dugong is listed as vulnerable to extinction at a global scale on the Red List of Threatened Species by The World Conservation Union IUCN.

19. Dugongs have a high biodiversity conservation value because they are the only surviving species in the Family Dugongidae and the only herbivorous mammal that is strictly marine. Dugongs play a fundamental ecological role in the functioning of coastal marine habitats, particularly seagrass systems, through the effects of their feeding behaviour on the microbial processes, above- and below-ground
plant biomass, plant species composition, plant nutrients, invertebrate community composition and detritus of seagrass communities. Thus the status of dugong populations is an indicator of the ecosystem health of seagrass in the Marine Park.

20. Like other marine mammals, dugongs also have a high public profile reflecting the general public’s interest in their conservation and welfare. While dugongs are threatened on a worldwide scale, Australia has a large proportion of the remaining population. This makes Australia the largest, and globally most important, refuge for the dugong. The sensitive ecological status of these animals globally highlights the need for effective management strategies to protect and conserve the Australian population.

Management

21. Refer to Appendix A of this document for a full list of related legislation, standards and policy.

22. The key pieces of legislation governing the Marine Park are:

Zoning and legislation

23. In Australia, the dugong is protected under the Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act) as a Matter of National Environmental Significance as a listed migratory species. However, there is no wildlife conservation plan for dugongs nor any conservation advices about dugongs published under the EPBC Act or by the Commonwealth Department of the Environment and Energy.

24. The dugong is listed as a protected species in the Regulations (see regulation 29). As a result, the following regulations also apply:
   a. Regulation 15 – Fishing or collecting of dugong is prohibited, except in accordance with Part 5.3 of the Zoning Plan (or under rights established through the Native Title Act).
   b. Regulation 88S – Permission to take dugong (including for research purposes) must not be granted unless GBRMPA is satisfied that this would not adversely impact the conservation status of dugong. Note that the definition of ‘take’ includes any disturbance, interference or contact.
   c. Regulation 89D - Applications for Traditional Use of Marine Resources Agreements (TUMRAs) that propose the take of dugong must specify the number to be taken and how this would be monitored and managed.
   d. Regulation 89F – In assessing a TUMRA application, GBRMPA must consider the need for conservation of dugong, particularly their capability to sustain any proposed level of take.

25. Part 5.3 of the Zoning Plan establishes that dugong can only be taken:
   a. if permission has been granted by GBRMPA
   b. in accordance with an accredited TUMRA
   c. in accordance with an accredited harvest fishery (Note – none exists).

26. Traditional hunting of dugong is provided for in Section 211 of the Native Title Act 1993.

27. The Shoalwater Bay (Dugong) Plan of Management aims to specifically manage activities in the bay that threaten the dugong population or impact on the seagrass meadows, particularly large mesh gill netting.

28. The Regulations establish nine (9) different Special Management Areas specifically for dugong protection. See the Location-specific assessment guidelines for more information.

30. There exists a Threat Abatement Plan for the impacts of marine debris on vertebrate marine life (including Dugong), which aims to provide a coordinated national approach to the implementation of measures to prevent and mitigate the impacts of harmful marine debris on vertebrate marine life. See the "Threat abatement plan for the impacts of marine debris on vertebrate marine life" from the Commonwealth Department of the Environment and Energy's website for more information.

Policy


32. The GBRMPA Guidelines for commercial dugong watching outlines when commercial tour operations require a permit for dugong-watching, and a list of potential permit conditions that might apply to that permission.

33. GBRMPA’s Great Barrier Reef Biodiversity Conservation Strategy 2013 identifies dugongs as a species considered to be potentially at-risk within the Great Barrier Reef.

34. GBRMPA's approach to making decisions on applications for permission to take dugong (and other protected species) is outlined in the policy on managing activities that include the direct take of a protected species from the Great Barrier Reef Marine Park.

Management Objectives

35. The effective conservation of dugongs requires the protection of key habitats and management of key threats. Animals are particularly sensitive to impacts from human-related activities in and adjacent to key habitats (particularly seagrass meadows). It should not be assumed that dugongs will move from key habitats as a result of disturbance.

36. The values of the Marine Park, their integrity and their current condition are described in the Great Barrier Reef Outlook Report 2014 and the Great Barrier Reef Region Strategic Assessment Report 2014. Refer to Table 1 for summary assessment of dugongs.

Table 1. Summary assessment of dugong condition, trend and overall management objective based on the Outlook Report 2014 and the Great Barrier Reef Region Strategic Assessment Report.

<table>
<thead>
<tr>
<th>Area</th>
<th>Current Condition</th>
<th>Trend</th>
<th>Management Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Coast</td>
<td>Good</td>
<td>Stable</td>
<td>Maintain</td>
</tr>
<tr>
<td>Urban Coast</td>
<td>Poor</td>
<td>Deteriorating</td>
<td>Improve</td>
</tr>
</tbody>
</table>

Common assessment considerations

37. Pressures experienced by dugongs in the Marine Park vary in severity, spatially and/or over time. Applied or assessed separately, these pressures may not seem significant, but research indicates that their cumulative impacts present significant concern for the conservation and management of dugongs in the Marine Park.

38. Additional human impacts in areas where dugong populations are under pressure are of particular concern. Further impacts should be particularly avoided in areas where:
   a. seagrass communities are in poor condition as a result of a series of unusually wet years or extreme weather events, or
   b. netting or traditional hunting occurs.
39. In order to fulfil the management objectives for dugong, researchers have estimated a sustainable level of mortality (caused by human impacts) to dugongs in the GBR based on the Potential Biological Removal (PBR) conservation technique. This is summarised in Table 2.

Table 2. Sustainable levels of anthropogenic dugong mortality per year, as a percentage of the minimum estimated population (% of Nmin) from all causes.

<table>
<thead>
<tr>
<th>Dugong population under pressure</th>
<th>Urban coast</th>
<th>Remote coast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population experiencing pressures such as seagrass loss due to weather, incidental drowning in commercial mesh nets, or legal traditional hunting.</td>
<td>0.01%</td>
<td>0.25%</td>
</tr>
<tr>
<td>Dugong population not under pressure</td>
<td>0.15%</td>
<td>0.75%</td>
</tr>
<tr>
<td>Conditions listed above do not apply.</td>
<td></td>
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</table>

40. A Code of Practice for the sustainable management of dugong and marine turtle tourism in Australia was developed in 2005 by researchers for the Commonwealth Department of the Environment and Energy (then Department of Environment and Heritage). Further information on its development can be found on the project website [http://www.dugongturtletourism.org/](http://www.dugongturtletourism.org/). GBRMPA uses this code of practice when assessing applications for commercial dugong watching.

**Links to other values**

**Social Values**

41. Like other marine mammals, dugongs have a high public profile reflecting the general public’s interest in their conservation and welfare. Any impacts on dugongs may have flow-on impacts to social values such as understanding and enjoyment, appreciation and personal connection.

42. In remote coastal areas, dugongs also have a high social and economic value because they provide subsistence food to Indigenous communities where a nourishing diet is essential but food imported from outside the communities is very expensive.

43. Refer to the [Guidelines: Social impact assessment in the permission system](http://www.dugongturtletourism.org/) for more information.

**Indigenous Heritage Values**

44. Dugongs are an essential element of the living maritime culture of the Aboriginal and Torres Strait Islander peoples that live along the coast of the Marine Park. The use of marine food resources such as the dugong greatly strengthens Aboriginal and Torres Strait Islander culture and connection with traditional sea country.

45. The activities associated with the hunting of dugongs and preparing and sharing the meat have great significance as an expression of cultural traditions that have existed for millennia. Any impacts on dugongs may have flow-on impacts to Indigenous heritage values.

46. As outlined in the section on Legislation, traditional hunting of dugong is provided for (subject to certain limitations) in Section 211 of the Native Title Act 1993 and in the Great Barrier Reef Marine Park Act 1975, Zoning Plan and Regulations.

47. Traditional use of dugongs forms a very small component of the overall mortality of this species. Nominated levels of take in all accredited Traditional Use of Marine Resources Agreements are assessed by GBRMPA against the latest science and population models for the specific area. GBRMPA does not accredit Traditional Use of Marine Resources Agreements that propose unsustainable levels of take.
48. There is a need to continually monitor dugong populations including traditional use of dugongs, in partnership with Traditional Owner Groups, and to develop and revise management policies accordingly.

49. Refer to the Guidelines: Indigenous heritage impact assessment in the permission system for more information.

**Biophysical Values**

50. Seagrass and seagrass meadows are the main food source and nursing habitat of dugongs. Dugongs may be impacted by direct loss or physical damage to seagrass, including any degradation and/or loss of seagrass meadows, changes in seagrass species composition or changes in nutrient content. More often, it is the cumulative impact of many small losses of seagrass that impacts the resilience of the Dugong. Refer to the Guidelines: Seagrass impact assessment in the permission system (Seagrass value assessment guidelines) for more information.

51. Dugongs do not directly impact on many other species, due to their position in the food chain, with few predators and a herbivorous diet of only certain types of seagrass. In the Marine Park, they have few natural predators, although animals such as crocodiles, orcas, and sharks pose a threat to the young. In limited situations, impact to the dugong population might have flow-on impacts to these species, as a loss of a potential food source.

**Hazards**

52. Table 3 summarises the most common hazards and associated impacts to the value, along with avoidance, mitigation and monitoring measures that may be appropriate depending on the activity. Further detail on these impacts, listed by hazard, is discussed further in the text following the table.
Table 3. Summary of hazards, impacts and mitigation measures for dugongs

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Impact (effect on value)</th>
<th>Avoidance, Mitigation and Monitoring measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in noise</td>
<td>• Dugongs exhibit short-term behavioural responses to vessel noise including interruptions to feeding and local movements.</td>
<td>• Establish exclusion zones between noise source from the proposed site of action and critical habitats.</td>
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<tr>
<td></td>
<td>• There is also the potential for underwater noise to interfere with communication between individual dugongs (especially mothers and calves).</td>
<td>• Use noise attenuation or silencing devices on all machinery near sites of high dugong density.</td>
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<tr>
<td></td>
<td>• Excessive noise may also impact physically on the animal.</td>
<td>• Marine Fauna Observers (MFO) on-board any water-borne vessel undertaking noise-intensive activities.</td>
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<tr>
<td></td>
<td></td>
<td>• Use ‘Soft start’ procedures for noisy activities.</td>
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<tr>
<td></td>
<td></td>
<td>• Schedule noisy activities to avoid mating and calving seasons.</td>
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<tr>
<td></td>
<td></td>
<td>• Avoid overlap of acute sound impacts with sites of high dugong density and during periods of environmental stress.</td>
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<tr>
<td></td>
<td></td>
<td>• Develop and implement site-specific noise management guidelines.</td>
</tr>
<tr>
<td>Change in sediment</td>
<td>• The impact of a change in sediment on seagrass – the dugongs’ main food source – is well established. See the Seagrass value assessment guidelines for more information.</td>
<td>• Observe avoidance, mitigation and monitoring advice for limiting impact on seagrass habitat. See the Seagrass value assessment guidelines for more information.</td>
</tr>
<tr>
<td>Contamination of water or sediment</td>
<td>• Potential to directly poison dugong, leading to illness or death.</td>
<td>• Analyse potential contaminants to understand their short-and long-term impacts on dugong, including chain reactions if released into seawater.</td>
</tr>
<tr>
<td></td>
<td>• Potential to contaminate population with toxic elements and synthetic compounds, which may cause food chain impacts for other species/humans ingesting as a food source.</td>
<td>• Prevent runoff of turbid or polluted water.</td>
</tr>
<tr>
<td></td>
<td>• Bioaccumulation of toxins in fat and transmission through breast milk.</td>
<td>• Enact a robust monitoring plan that sets and acts on triggers for management intervention (e.g., death of dugong).</td>
</tr>
<tr>
<td></td>
<td>• Potential impacts to seagrass habitat with flow-on impacts on dugong. See the Seagrass value assessment guidelines for more information.</td>
<td>• Store and transport potential contaminations in appropriate containers, buffered from extreme weather.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Maintain incident response and rehabilitation plans and equipment.</td>
</tr>
<tr>
<td>Direct injury or disturbance of living things, including translocation and Direct death or removal of living things, including vessel strike</td>
<td>• Vessel interactions may interrupt feeding and cause movement to other areas resulting in a reduction of fitness and resilience. Vessel strike may cause physical injury and mortality. May also disturb socialising behaviour and communication or create separation stress. Research involving chasing, handling or sampling dugong may result in mortality. Facilities and moorings may contribute to larger amount of traffic, vessels, and human disturbance. Vessel movements through narrow channels at low tides potential to impact dugongs through collision and mortality. Dugong may suffer physical damage or death from entanglement in nets, ropes and other equipment.</td>
<td>• Time vessel activity to occur during high tide.</td>
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<tr>
<td></td>
<td></td>
<td>• Time works to avoid mating/calving season.</td>
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<td></td>
<td></td>
<td>• Consider alternative infrastructure design to avoid dugong or seagrass habitat.</td>
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<td>• Limit physical access and/or install moorings in areas away from known habitat.</td>
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<td></td>
<td>• Implement ‘Go Slow’ zones (less than 4 knots) for shallow areas (less than 10m) where dugong are likely to occur.</td>
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<td></td>
<td></td>
<td>• Design facilities and equipment to minimise entanglement hazards.</td>
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<tr>
<td></td>
<td></td>
<td>• Establish a monitoring program to identify changes to the population from the activity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Establish exclusion or shut-down zones for works.</td>
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NOT GOVERNMENT POLICY – Draft for consultation
## DRAFT Guidelines – Dugong value assessment

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Impact (effect on value)</th>
<th>Avoidance, Mitigation and Monitoring measures</th>
</tr>
</thead>
</table>
|                         | • Flow-on impacts of habitat loss and degradation include alteration of feeding behaviour, or displacement of dugongs from habitats critical to survival. Limited food access can result in malnourishment, reduced fitness, reproduction and resilience, and even death. | • Marine Fauna Observers (MFO) on-board any water-borne vessel carrying out works to enforce pre-established exclusion/shut-down zones.  
• Establish or contribute to a long-term marine wildlife stranding program.  
• Observe avoidance, mitigation and monitoring advice for limiting impact on seagrass habitat. See the [Seagrass value assessment guidelines](#) for more information. |
| Marine Debris           | • Ingestion can lead to gut blockages, leading to infection and potentially death.       | • Minimise packaging and waste.  
• Implement appropriate measures for storing, transporting and disposing of wastes.  
• Create a marine debris source reduction plan (see guidance at [http://www.tangaroablue.org/resources/source-reduction-plan.html](http://www.tangaroablue.org/resources/source-reduction-plan.html)).  
• Remove debris from sites when encountered. |
53. Dugongs use underwater sound for communication. Frequency ranges are typically from 1 to 18 kHz, often with harmonics and non-harmonically related overtones. Adults of both sexes produce vocalisations, but exchanges of communication calls are most common between cows and their nursing calves\(^6\). Thus underwater noise pollution at frequencies of 1 to 18 kHz has the potential to interfere with communication between individual dugongs. There may also physical impacts from noise outside this hertz range.

54. Dugongs exhibit short-term behavioural responses to vessel noise\(^{15}\) including interruptions to feeding and local movements. However despite these short-term behavioural responses, there is no evidence that wild dugongs are displaced from key habitats by noise. Dugongs persist in noisy environments suggesting that they can habituate to chronic underwater shipping noise. There appear to be no field studies on the effects of anthropogenic noise, other than vessel noise, on dugongs.

55. Dugongs’ reaction to explosive sounds does not appear to have been formally tested. This lack of evidence does not prove that noise has negligible consequences, and a precautionary approach should be applied unless new evidence becomes available.

56. Suitably-sized exclusion zones should be established between noise sources and critical dugong habitats. Exclusion zone size will depend on the local topography, type of noise, intensity and duration and should be determined experimentally for the site.

57. Noise attenuation or silencing devices should be used on all stationary or mobile plant or construction machinery near sites of high dugong density identified from the long-term aerial surveys. Sound intensity should be minimised to levels that are As Low As Reasonably Practicable (ALARP) in inshore areas. Examples include:
   a. Gas turbines should have air inlet silencers, acoustic enclosures and exhaust gas silencers for exhaust stacks.
   b. Measures to reduce noise and vibration from any pumps, such as acoustic blanket and motor enclosures.
   c. Use of exhaust gas silencer for diesel engines should be required where possible.
   d. Emergency generators should include an acoustic enclosure and exhaust gas silencer.
   e. Piping within any permanent structures should have acoustic insulation, with vibration isolation between piping and pipe supports.

58. A suitable number of trained Marine Fauna Observers (MFO) should be on-board any water-borne vessel undertaking noise-intensive activities, such as piling or blasting, to enforce the agreed exclusion zones.

59. For activities within the hearing range of dugong and habitats identified as critical, use a ‘soft start’ procedure – slowly ramping up from the lowest possible power setting.

60. Activities should avoid overlap of acute sound impacts within critical habitats identified from the long-term aerial surveys\(^{10}\) (see section on Population estimates above) and during periods when the animals are likely to be under environmental stress as indicated by the condition of the seagrass meadows (e.g. after severe flooding or cyclones).

61. Noisy activities should be scheduled to avoid mating and calving seasons, which are typically around June to December.

62. Noise management guidelines should be observed if available. If not available, major projects should develop their own site-specific guidelines.
Change in sedimentation (indirect hazard)

63. The impact of reduced water quality caused by fine sediments on seagrass—the dugongs’ main food source—is well established (see the Seagrass value assessment guidelines). Any degradation and/or loss of seagrass has similar impacts on dugongs as those described in ‘Direct injury or disturbance of living things’ below.

64. Removal of sediment, smothering of seabed, and modification of sediment characteristics (e.g. sediment grain size) caused by deposition of dredged material on spoil dumping areas, causes physical damage to dugong habitat.

65. Observe avoidance, mitigation and monitoring advice for limiting impact on seagrass habitat. See Seagrass value assessment guidelines for more information.

Contamination of water or sediment

66. Little is known about the impacts of specific contaminants on dugongs. Where scientific evidence is lacking, proponents may be required to conduct further studies to demonstrate that a contaminant poses a low risk to dugongs.

67. Toxic elements and synthetic compounds that accumulate in plants may be ingested by dugongs, who feed extensively on bottom-growing vegetation such as seagrass. For example, polychlorinated dibenzodioxins (PCDDs) reported from tissues of dugongs in Queensland was sourced from contaminated sediments and associated seagrass. While the long-term effects of such contamination on dugongs are still mostly unknown, several studies have pointed out associations between some contaminants and disruptions in various biological processes in cetaceans and pinnipeds.

68. Any proposed activity should prevent runoff or discharge of turbid or polluted water. Clean-up strategies or pollution management plans should be in place for dealing with a water pollution event.

69. Activities which may release contaminants should establish a robust monitoring plan for dugong habitats within and adjacent to the action to assess changes in water quality at regular intervals during construction and implementation of the activity. Such a monitoring plan should:
   a. Set and act on triggers for management intervention (such as death of dugong) and modify these through adaptive monitoring as required.
   b. Monitor and establish trigger values for key indicators such as organic compounds, heavy metals, persistent organic pollutants, dissolved oxygen and pH.

70. Store potential contaminants in appropriate containers and within bunded areas. Buffer storage and processing facilities from impacts of extreme weather and incorporate system redundancies. Use appropriate methods for storing, transporting and disposing of wastes.

71. Maintain incident response and rehabilitation plans and equipment to ensure appropriate and rapid containment and clean-up of any unplanned discharge.

Direct death or removal of living things, including vessel strike and Direct injury or disturbance of living things, including translocation

72. Vessel activity in an area used by dugongs can result in vessel strike causing physical injury and mortality of animals. Deaths of dugongs from collisions with vessels have been reported in Australia, and any mortality and injury due to vessel strikes could have serious impacts on small and patchy populations of dugongs. Vessel movements through narrow channels at low tide are particularly dangerous as the capacity of both dugongs and vessels to avoid collisions is limited.

73. Vessel interactions can also have serious disturbance impacts. Dugongs may detect watercraft as far as 1 kilometre away and interrupt their feeding. Some animals may be displaced from critical habitats, such as feeding grounds. Dugongs can be expected to ingest less food at preferred feeding sites and to expend more energy as they seek quieter locations, resulting in a reduction of fitness of the animals.
In addition to disturbing feeding behaviour, vessels can also disturb socialising behaviour and vessel noise can mask communication with other dugongs. Dugongs may be separated from mates or calves and this can cause additional stress. A dugong population that is under stress from vessel activity will be less resilient to other pressures (such as declining water quality) and also to natural extreme weather events (such as floods and cyclones).

Netting (other than bait netting) in the Princess Charlotte Bay Special Management Area requires permission from GBRMPA. Dugongs can become ensnared or caught in fishing nets resulting in physical damage or drowning of the animal. Net fishing permission holders in the Princess Charlotte Bay should observe avoidance, mitigation and monitoring advice outlined in Table 3.

Direct loss or physical damage to habitats such as seagrass and seagrass meadows has the potential to impact dugongs through flow-on effects. Impacts on dugong of habitat loss and degradation include alteration of feeding behaviour, or displacement of animals from habitats critical to survival in the search for more abundant nutrient rich seagrass meadows. Animals may become malnourished, resulting in and overall reduced fitness. As a result, dugongs’ resilience to other pressures (e.g. declining water quality) and to natural extreme weather events (such as floods and cyclones) can be reduced.

Since inter-calving intervals and the onset of sexual maturity in dugongs are affected by food availability, limited food access can result in a reduction in reproduction and therefore negatively affect the rate of population increase.

Monitoring programs should be established to identify changes to the population from the permitted activity by an appropriately qualified person (i.e. dugong experience). Survey and monitoring methods and protocols should follow best practice and should be commensurate with the potential scale of the impact both in space and time.

A suitable number of trained Marine Fauna Observers (MFO) should be on-board any water-borne vessel undertaking dredging or construction activities to enforce pre-established exclusion/shut-down zones. MFOs should remain operational whilst those activities are being carried out to monitor any disturbance to dugong.

Vessel activity should be timed to occur during high tide within narrow or shallow channels to avoid vessel collisions. Implement ‘Go Slow’ zones (less than 4 knots) for shallow areas (less than 10m) where dugong are likely to occur.

Timing for carrying out works should be considered to avoid mating/calving season in the latter half of the year.

Limit physical access and/or install moorings in areas away from critical habitat if possible.

Design fixed facilities to avoid changes in coastal profiles, including long-shore drift, erosion and accretion to prevent damage to habitat. Alternative infrastructure design should be considered that provides the smallest footprint and considers the conservation of the site and dugong in the area.

Observe avoidance, mitigation and monitoring advice for limiting impact on seagrass habitat. See the Seagrass value assessment guidelines for more information.

Marine debris

Digestion of debris can cause gut blockages, leading to infection and potentially death, while entanglement in marine debris can cause physical damage or even impair the animal and lead to drowning.

The total number of dugongs affected by marine debris is most likely higher than recorded since not all carcasses can be recovered and necropsied and not every dugong affected by marine debris will die from the interaction. In the Marine Park, most entanglements were caused by nets or net fragments, ropes and fishing lines, although it is unclear if the gear was active or derelict at the time of interaction.
87. Packaging and waste should be minimised, and equipment and nets should be labelled and tracked.

88. Appropriate measures for storing, transporting and disposing of wastes should be implemented.

89. A marine debris source reduction plan should be used where possible (see guidance at http://www.tangaroablue.org/resources/source-reduction-plan.html).

90. A long-term marine wildlife stranding program could be established or maintained, with access to specialist veterinarians in the areas the proposed activity.

**Permission types**

**Carrying out works**

91. The most likely impacts on dugong from carrying out works (such as dredging and spoil disposal) are:
   a. direct disturbance of animals due to vessels and noise
   b. direct disturbance of the seagrass habitats on which dugong depend
   c. indirect impacts on seagrass caused by sedimentation or contamination.

**Conducting a tourist program**

92. The most likely impacts on dugong from conducting a tourist program include:
   a. direct disturbance of animals due to vessel activity and noise
   b. indirect impacts on seagrass caused by propeller scarring and anchor damage.

**Operation of a facility**

93. The most likely impacts on dugong from construction and operation of a facility include:
   a. direct disturbance of animals due to construction, increased vessel activity and noise
   b. physical damage and direct disturbance to the seagrass habitats on which dugongs depend.

**Consequence**

94. Examples of consequence of impact to the Dugong value are described in Table 4. The Risk assessment procedure provides information on how to determine risk and consequence.

95. Due to the population dynamics of dugong, all impacts are considered at the widespread scale. Local impacts are not recognised for this value.
Table 4. Consequence table for Dugong values

<table>
<thead>
<tr>
<th>Consequence to value</th>
<th>Degrees of Severity</th>
<th>Positive (Enhance)</th>
<th>Negligible (Maintain)</th>
<th>Minor</th>
<th>Moderate</th>
<th>Major</th>
<th>Extreme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species: Dugongs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Long-term research or monitoring of dugong which contributes to management.</td>
<td>No impact at the population or sub-population level, or impact is not discernible or not clearly linked to the activity.</td>
<td>Temporary (&lt;6 months) alteration of feeding or reproductive behaviour.</td>
<td>Loss of a single dugong in a population not under pressure.</td>
<td>Loss of a single dugong in a population under pressure.</td>
<td>Loss of two or more dugong in a population under pressure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Damaged or degraded important seagrass meadow is improved or rehabilitated.</td>
<td>Any change is within the natural variation of the population or sub-population.</td>
<td>Temporary periods of acoustic pollution interfering with communication between individual dugong.</td>
<td>Prolonged (&gt;6 months) displacement of animals from biologically important areas.</td>
<td>Loss of two or more dugong in a population not under pressure.</td>
<td></td>
</tr>
</tbody>
</table>

Assessment information

CONSULTATION NOTES:
The draft Checklist of application information provides a list of information that is proposed to be required before an application is accepted as valid. Following public consultation, the application forms will be updated to include the required information.

96. Additional information may be required depending on the type of activity. This is outlined based on the assessment process. Refer to the Application guidelines for more information on how assessment processes are determined.

97. Other examples of information that may be useful and could be requested through a further information request when assessing potential impacts on dugongs includes:
   a. explanation of proposed incident response plan and equipment
   b. explanation of proposed waste minimisation and waste management plans
   c. explanation of proposed noise reduction measures.

98. For higher risk or more complex proposals (those requiring public comment), an Environmental Management Plan should be submitted by the applicant with their application. Information useful to this EMP might include:
   a. Details and results of pre-disturbance bathymetric and topographic surveys to ascertain benthic ecology, including the identification of seagrass communities. Surveys should be conducted at the appropriate spatial and temporal scales and using accepted scientific protocols.
   b. Details of proposed monitoring and trigger values for potential contaminants (if relevant).
   c. Details of proposed Marine Fauna Observers – including credentials, experience or training; numbers; and reporting protocols.
   d. A long-term monitoring plan covering habitats within and adjacent to the action to assess changes in integrity or functionality, including monitoring for any unexpected changes.
   e. Explanation of proposed monitoring and response plan for dugong strandings. The plan should aim to rescue stranded animals, remove any debris from the ecosystem in a permanent manner, record details of stranding events, report the findings of the program to any relevant and encourage public involvement and awareness.

99. Other information that may be of use includes:
   e. Commonwealth of Australia, EPBC Act referral guideline for the Dugong (Dugong dugon), 2016
Implementation

99. These draft guidelines have been prepared for the purpose of seeking public feedback.

100. After the consultation closes, GBMRPA will consider public submissions in finalising the guidelines.

101. The final guidelines are planned for public release in July 2017, to coincide with amendments to the Regulations taking effect.

Definitions

ALARP
As Low As Reasonably Practicable. Refers to the balance between reducing risk and the resources required to achieve further risk reduction.

Avoidance measures
Actions that, if implemented, would avoid risk (usually by avoiding exposing a value to a hazard).

Consequence
The outcome of an event affecting objectives; to what degree an impact may affect a value of the Marine Park (and, as a result, the objects of the Act). Consequences may be certain or uncertain and can have positive or negative effects on objectives.

Event
A change in situation; something happening or not happening (when it was expected); an incident or occurrence that exposes a value to a hazard.

Hazard
A source of potential harm; a situation, action or behaviour that may negatively impact a Marine Park value, whether intentionally or unintentionally; some may be outside the ability of GBRMPA’s permission system to control (such as global greenhouse gas emissions).

Impact
The result or effect that happens when a Marine Park value is exposed to a hazard; may be positive or negative.

Likelihood
The chance of an event happening; may be determined based on probability or frequency.

Marine Park values
The values of the Marine Park as defined in the 5-yearly Outlook Report.

Mitigation measures
Actions that, if implemented, would reduce risk (by reducing the consequence and/or likelihood of impacts).

Offset measures
Actions that, if implemented, would compensate for likely impacts and therefore may counteract some consequences.

Permission system
The regulated system of managing activities in the Marine Park which require GBRMPA’s permission, accreditation, notification or exemption. Refer to GBRMPA’s Permission system policy for more information.

Population
A community of animals, plants, or humans among whose members interbreeding occurs.

Risk
Defined by the Australia/New Zealand Standard for Risk Management (AS/NZS 31000:2009) as “effect of uncertainty on objectives;” within the permission system, ‘risk’ relates to uncertainty as to whether the objects of the Act can be achieved.

Sensitivity
The degree to which a Marine Park value is responsive to a specific impact.

Severity
How serious a consequence would be if it occurred; the degree of degradation that would occur to the value if that consequence occurred.

Vulnerability
The degree to which a Marine Park value is susceptible to degradation from impacts. Vulnerability is a function of the value’s exposure, sensitivity and adaptive capacity.
Supporting information


2. Marsh, H., De’ath, G., Gribble, N.A. and Lane, B. 2001, Shark control records hindcast serious decline in dugong numbers off the urban coast of Queensland, Great Barrier Reef Marine Park Authority research publication No. 70, Townsville


5. Sobtzick, S., Hagihara, R., Grech, A. and Marsh, H. 2012, Aerial survey of the urban coast of Queensland to evaluate the response of the dugong population to the widespread effects of the extreme weather events of the summer of 2010-11, Final report to the Australian Marine Mammal Centre and the National Environmental Research Program, James Cook University, Townsville


14. Calculating Sustainable Levels of Anthropogenic Mortality to Dugongs (as developed by H.Marsh for this Dugong Assessment Guideline.). A summary is provided below:

   The Potential Biological Removal (PBR) method was developed to estimate sustainable human-caused mortality limits for marine mammals (Wade 1998). This conservative technique estimates the anthropogenic mortality that should enable the population to reach or exceed maximum net productivity without depletion. PBR is calculated as: \( PBR = N_{\text{min}} \times \frac{1}{2} R_{\text{max}} \times F_R \)

   \( R_{\text{max}} \) requires information on life history parameters (e.g., age of first calving, mean calving interval, adult survivorship). Kwan (2002) estimated the first two of these parameters for Torres Strait dugongs from carcass analysis conducted in 1997, 1998 and 1999. However, there is no contemporary
information on any of the dugong life history parameters for Torres Strait. Accordingly, we adjusted for this uncertainty using $R_{\text{max}}$ of 0.01 (calving intervals of ca. 10 years) for a population under pressure and 0.03 (calving intervals of ca. 3 years) for normal conditions. The estimates of growth rate used by Marsh et al. (2004) were based on the survivorship of the Florida manatees (Trichechus manatus latirostris) (dependent calves = 0.822 per annum (p.a.); independent young = 0.965 p.a.; reproductive adult = 0.965 p.a.; Boyd et al. 1999). In calculating the PBR, the US National Marine Fisheries Service has used values for $F_R$ of 0.1 for endangered species, 0.5 for threatened stocks or stocks of unknown status, and 1.0 for secure stocks. The dugong is listed as Vulnerable by the IUCN (Marsh and Sobtzick, 2015) and in Queensland but is not listed as threatened at the scale of Australia. Thus we used values of $F_R$ of 0.1 for the urban coast and 0.5 for the remote coast.

Thus the estimate of the sustainable levels of anthropogenic dugong mortality (% of $N_{\text{min}}$ as defined above) from all causes follow:

<table>
<thead>
<tr>
<th>Dugong population under pressure</th>
<th>Urban coast</th>
<th>Remote coast</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.01%</td>
<td>0.25%</td>
</tr>
<tr>
<td>Dugong population not under pressure</td>
<td>0.15%</td>
<td>0.75%</td>
</tr>
</tbody>
</table>

1. Dugong population experiencing seagrass loss due to weather, incidental drowning in commercial mesh nets and legal traditional hunting
2. Conditions listed in 1 above do not apply


21. Department of the Environment 2016, Dugong dugon in Species Profile and Threats Database, Department of the Environment, Canberra.


Further information

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APPENDIX A: Related Legislation, Standards and Policy

2. Marine Park Act 2004 (QLD)
5. Great Barrier Reef Marine Park Zoning Plan 2003 (C’th)
6. Marine Parks (Great Barrier Reef Coast) Zoning Plan 2004 (QLD)
7. Great Barrier Reef Intergovernmental Agreement
8. Environment Protection and Biodiversity Conservation Act 1999
13. Hinchinbrook Plan of Management 2004
15. Shoalwater Bay (Dugong) Plan of Management 1997
17. Privacy Act 1988
18. Native Title Act 1993
20. Great Barrier Reef Region Strategic Assessment Report (the Strategic Assessment)
21. Great Barrier Reef Region Strategic Assessment Program Report (the Program Report)
22. Policy on Moorings in the Great Barrier Reef
23. Cruise Shipping Policy for the Great Barrier Reef Marine Park (under review)
24. Managing Tourism Permissions to Operate in the Great Barrier Reef Marine Park (including Allocation, Latency and Tenure)
27. Managing Scientific Research in the Great Barrier Reef Marine Park
28. Managing Activities that Include the Direct Take of a Protected Species from the Great Barrier Reef Marine Park
30. Dredging and Spoil Disposal Policy
31. Dredging coral reef habitats policy
32. Sewage Discharges from Marine Outfalls to the Great Barrier Reef Marine Park
33. Guidelines on Coral Transplantation
34. Guidelines for the Emergency Disposal of Foreign Fishing Vessels
35. Guidelines for the Management of Artificial Reefs in the Great Barrier Reef Marine Park
36. Guidelines for Managing Visitation to Seabird Breeding Islands
37. Management of Commercial Jet Ski Operations Around Magnetic Island
38. Indigenous Participation in Tourism and its Management