# 9. Marine Ecosystems

## 9.1 Dugong and Turtles

### 9.1.1 Boat Strike

A boat speed limit of 4 knots will be placed on vessels in the marina access channel. This speed limit is based on discussions with GBRMPA and dugong researchers at James Cook University (Helene Marsh, pers. com. Amanda Hodgson, pers. com. 11 February 2003).

### 9.1.2 Visual Monitoring during Dredging

During dredging of the channel, visual monitoring of the dredging area will be carried out to detect dugong and turtles that may swim into the area before or during dredging activities. Observations will take place from the dredge vessel and a smaller support vessel as necessary where visibility from the dredge vessel is poor. Observations will probably include a sweep of the area prior to commencement of each dredging session in a small boat. Frequency of additional sweeps to be carried out during the dredging sessions will be determined in the Dredge Management Plan.

In the event that a turtle or dugong is observed, the small boat will gently drive the animal away from the dredging area and keep watch to ensure that it does not return. Turtles and dugongs frequently move from one feeding ground to another so this action is unlikely to cause any particular distress to the animal. Dredging will not commence if dugong and turtles have not been driven away and if animals observed in the vicinity of the dredging vessel cannot be driven away, dredging may cease.

### 9.1.3 Impacts on Dugongs

An independent review of the proposal by Dr Helene Marsh of James Cook University was commissioned by Environmental Protection Agency. A copy of this review is attached as Appendix A.

The review states that the Whitsunday region supports a relatively small population of dugongs compared to other areas such as Hinchinbrook and Shoalwater Bay. The small numbers of dugong who might currently graze in Boathaven Bay may be displaced by the reduction in seagrass, however they would be able to relocate to other seagrass areas within the Whitsunday region and Great Barrier Reef generally (as is evidenced by results of dugong tagging studies).

The loss of seagrass in Boathaven Bay would contribute slightly to the overall cumulative impact of anthropogenic seagrass losses along the Queensland Coast. Whether this loss would actually result in reductions in the overall dugong population would depend on the adequacy of alternative seagrass habitat. Dugongs are known to travel long distances between food sources and would certainly be able to relocate to other areas.

The main concern in relation to the proposed development is the potential for increase in boat strike in the immediate vicinity of the marina, particularly if they were to continue to graze on remaining seagrasses in Boathaven Bay. The most important response to this risk is to impose boat speed restrictions in the channel leading to the

marina/boat ramp and ensure that boats do not move outside the channel. This is also discussed in **Section 9.1.1** of this Addendum.

## 9.2 Impacts on Fisheries

The likely adverse impact of the project on fisheries is expected to be small and proportional to the scale of loss of habitat associated with the project.

It is recognised that mangrove systems provide breeding areas and nurseries for a range of commercial and recreational fish species. The area of mangrove to be lost due to this project is approximately 1 ha. This area consists of a narrow strip of mangrove adjacent to Shute Harbour Road with some connectivity to larger areas of mangroves in the Campbell's Creek estuary. The area has been disturbed and is subject to freshwater flows from stormwater drains under Shute Harbour Road.

The habitat value of this area for fish is expected to be low and consequently the impact on fisheries is expected to be low also. This is discussed further in **Section 16.4** of this Addendum.

## 9.3 Carrying Capacity for Boat Traffic

Commercial vessels accessing the GBRMP from the proposed Port of Airlie will be subject to GBRMPA permits which are issued in accordance with a quota identified by GBRMPA. The activities of these vessels in the marine park are limited by both the conditions of the permits and the general zoning restrictions in the marine park. Any new vessels to be introduced by tour operators operating from the proposed Port of Airlie will be subject to both these constraints. The overall management of these vessels to protect the marine park is the responsibility of GBRMPA.

It is likely that there will be some increase in private vessels using the area as a result of the availability of the modern and well located facilities at the proposed Port of Airlie. GBRMPA is unable to advise on appropriate visitor carrying capacity for the marine park or World Heritage Area. Access to many popular visitor destinations has been controlled by GBRMPA through limited provision of moorings.

The proposed Port of Airlie will also contribute to a reduction of some impacts associated with boat use, including the provision of sewage pump out facilities, properly designed and operated boat maintenance facilities and interpretive material aimed at educating boat users on minimising environmental impacts of boat use on the GBRMP and GBRWHA.

## 9.4 Ecological and Conservation Significance of Boathaven Bay

### 9.4.1 A Comparison of Boathaven Bay with Other Bays of the Region

Boathaven Bay supports a variety of intertidal and shallow subtidal habitats (e.g. mangrove, seagrass, unvegetated soft sediment) that are characteristic of the north Queensland coast. Each habitat has a range of ecological values (refer to Section 9 of the Supplementary Environmental Impact Statement) and contribute either directly or indirectly to fauna of economic or cultural value, or of conservation significance.

Boathaven Bay does not support habitat that is unique or in decline within the region (recent DPI mapping of seagrasses within the region indicates that there has been a slight increase in the areal extent of seagrasses since 1987 (Campbell et al. 2002)). Other mainland bays within the region have:

- Greater areal extent, depth distribution and species diversity of seagrass; greater areal extent and species diversity of mangroves;
- Greater areal extent and diversity of coral communities;
- More abundant dugong and turtle; and
- Greater significance to commercial and recreational fisheries.

Elements of the flora and fauna (either resident or transitory) of Boathaven Bay are protected under existing Commonwealth and State government legislation and regulation (see Sections 8 and 9 of the Supplementary EIS). Of these, it is likely that the dugong and turtles are of greatest conservation interest.

Dugong are listed as 'vulnerable' under Schedule 3 of the Queensland *Nature Conservation Act 1992*, *Nature Conservation (Wildlife) Regulation 1994*, and protected under the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, under the 'migratory' and 'marine' provisions. Dugong populations in the southern Great Barrier Reef (GBR) region are listed as 'critically endangered' by the IUCN (Marsh et al. 1996, cited in WBM 1998).

Only the green turtle (*Chelonia mydas*) and flatback turtle (*Natator depressa)*, both listed as 'vulnerable' under Schedule 3 of the *Nature Conservation Act 1992*, *Nature Conservation (Wildlife) Regulation 1994* and the *Commonwealth's Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)* have been recorded from Boathaven Bay, but a number of other species have been recorded from the region (see Section 9 of the Supplementary EIS).

Marsh (2003, Appendix A) reports that the Whitsunday region supports only a relatively small population of dugong, some of which feed in Boathaven Bay. Whilst the seagrasses of Boathaven Bay include species preferred by dugong, the area of seagrass within the bay is relatively small. The loss of a portion of the seagrass meadows from Boathaven Bay may result in the (unassisted) relocation of dugong: Marsh comments that this is certainly possible. Any increase in boat traffic will potentially increase the incidence of 'boat strike' on dugong. This potential may be significantly mitigated through speed limits in the vicinity of preferred habitat (see also **Section 9.1.1** of this Addendum).

Dugong are more abundant in adjoining Pioneer Bay, and in Charlie's Bay (approx. 5km to the north) than in Boathaven Bay (J Thorogood, pers. obs.). This is likely to be a consequence of the greater areal extent of seagrass in these two bays, and the relative isolation of Charlie's Bay.

No 'Fish Habitat Areas' have been declared under the provisions of the *Fisheries Act 1994* within Boathaven Bay; and Boathaven Bay is not recognised as a site of significance for migratory wader birds.

### 9.4.2 Prior Impacts on Boathaven Bay

Boathaven Bay has been subjected to significant recent, and ongoing human impacts. Development of the Proserpine – Shute Harbour Road, and the complex of sporting fields to the south has resulted in the loss of mangroves from the bight of the bay, although mangroves are currently extending seawards (pers. obs.). Secondary treated sewage effluent has been discharged to the bay from the nearby Jubilee Pocket Sewage Treatment Plant. A variety of cruising yachts and local craft in various conditions are 'permanently' moored on the intertidal flats within the bay's north-west corner. Hull cleaning, antifouling and repainting are undertaken at low tide, in an environment that is both unregulated and that has no means of preventing associated pollutants from entering the marine environment. A variety of craft are kept on 'swing moorings' within the bay: ground tackle associated with swing moorings characteristically 'sweep clean' a radius around the mooring block, removing seagrass and providing a chronic impact upon epi- and inbenthos.

### 9.4.3 Overall Assessment

Whilst Boathaven Bay lies partly within the Great Barrier Reef World Heritage Area, both its ecological and conservational significance are low relative to a number of nearby bays on the Pioneer Coast. Boathaven Bay does not lie within, nor nearby to a Fish Habitat Area. Whilst the bay's seagrass meadows, fringing mangroves and extensive unvegetated soft sediments have a recognised fisheries value, nearby bays contain significantly greater extents of each habitat. It is understood that the only commercial fishing practiced within the bay is some crabbing within Campbell's Creek (unlikely to be impacted by the proposed development; again a number of nearby bays are more popular recreational fishing destinations.

Over the past decade, Boathaven Bay has characteristically supported relatively little seagrass. Pioneer Bay and Charlie's Bay to the north and Shute Bay to the south support significantly greater extents (and diversity) of seagrass. As a consequence, whilst dugong have been anecdotally sighted within the bay, it is likely both dugong and turtle are significantly more abundant within a number of other bays to both the north and south. The mangroves of Shute Bay are also contiguous with the terrestrial habitats of the Conway National Park.

Whilst Charlie's Bay to the north and Shute Bay to the south have been relatively unimpacted by development within the immediate catchment, Boathaven Bay has been impacted by a number of significant developments: the Proserpine - Shute Harbour Road and reclamation to create sporting fields has truncated the mangroves within the bight of the bay; the Jubilee Pocket STP discharges secondary treated sewage effluent to the bay; moored vessels are likely to have physically impacted subtidal seagrasses; and the use of the north-west foreshore for un-managed boat maintenance is likely to have introduced a range of contaminants.

Whilst, as may be said of every embayment on every coast, Boathaven Bay does provide habitat of value to both fishes and conservationally significant dugong and turtle, each of the bays to the immediate north and south (including Pioneer Bay and Shute Bay) offer significantly greater habitat value, though greater extent and diversity of habitats.

Whilst the proposed development of a marina complex within Boathaven Bay will inevitably result in the loss of habitat, the impacts associated with the operation of the

marina are, within a regional context, not likely to be ecologically significant, not likely to significantly impact upon commercial fishing within the bay (recreational fishing may be enhanced), and, where appropriate management is affected, not likely to pose a significant threat to dugong or turtle.

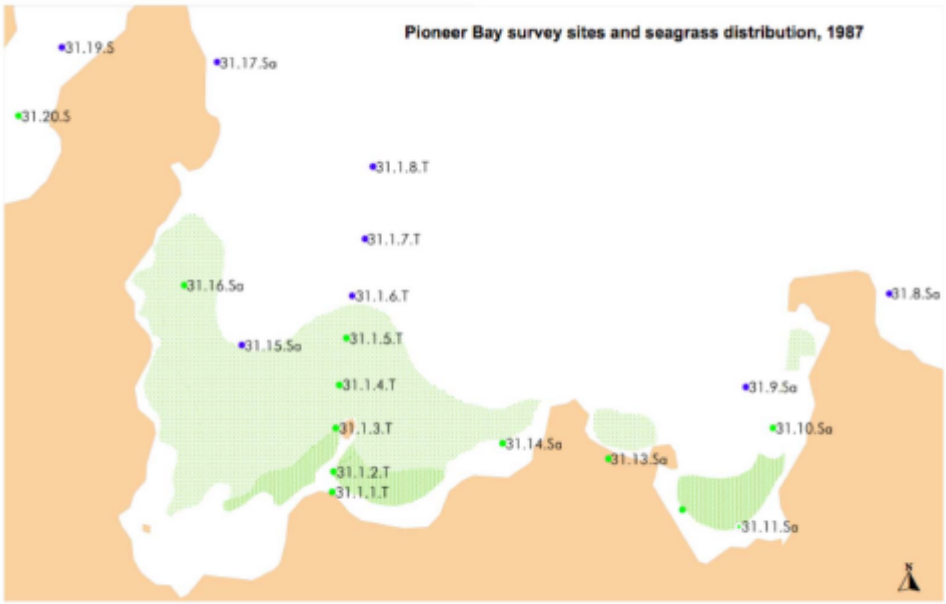
## 9.5 Historical Changes in Seagrass Distribution

### 9.5.1 Distribution Based on DPI's 1987 Survey

The seagrass meadows of Pioneer Bay were mapped by staff of the Queensland Department of Primary Industries, Fisheries Research Branch, following a broad-scale survey of the coast between Bowen and Waterpark Point in March 1987 (Coles et al 1987).

The maps produced in 1987 were drawn from information gained through diving at selected survey sites (see **Figure 9-1**), bathymetry lines on navigation charts, grab samples, echo-sounder interpretation, and visual observation at low tide (the majority of seagrass mapped in **Figure 9-1** is below LAT). A 100 m +/- error in the mapping exists as survey site locations were plotted using radar. Given that the DPI team surveyed the coast from Shute Harbour to George Point (encompassing Pioneer Bay) on a single day, it is likely that less than a half-day was spent surveying Pioneer Bay.

The result of DPI's 1987 survey of seagrass in Pioneer Bay is shown in **Figure 9-1**.




■ **Figure 9-1 Survey Points (• - seagrass; • - no seagrass) and resultant mapping of seagrass meadows within Pioneer Bay, March 1987 (Coles et al 2001)**

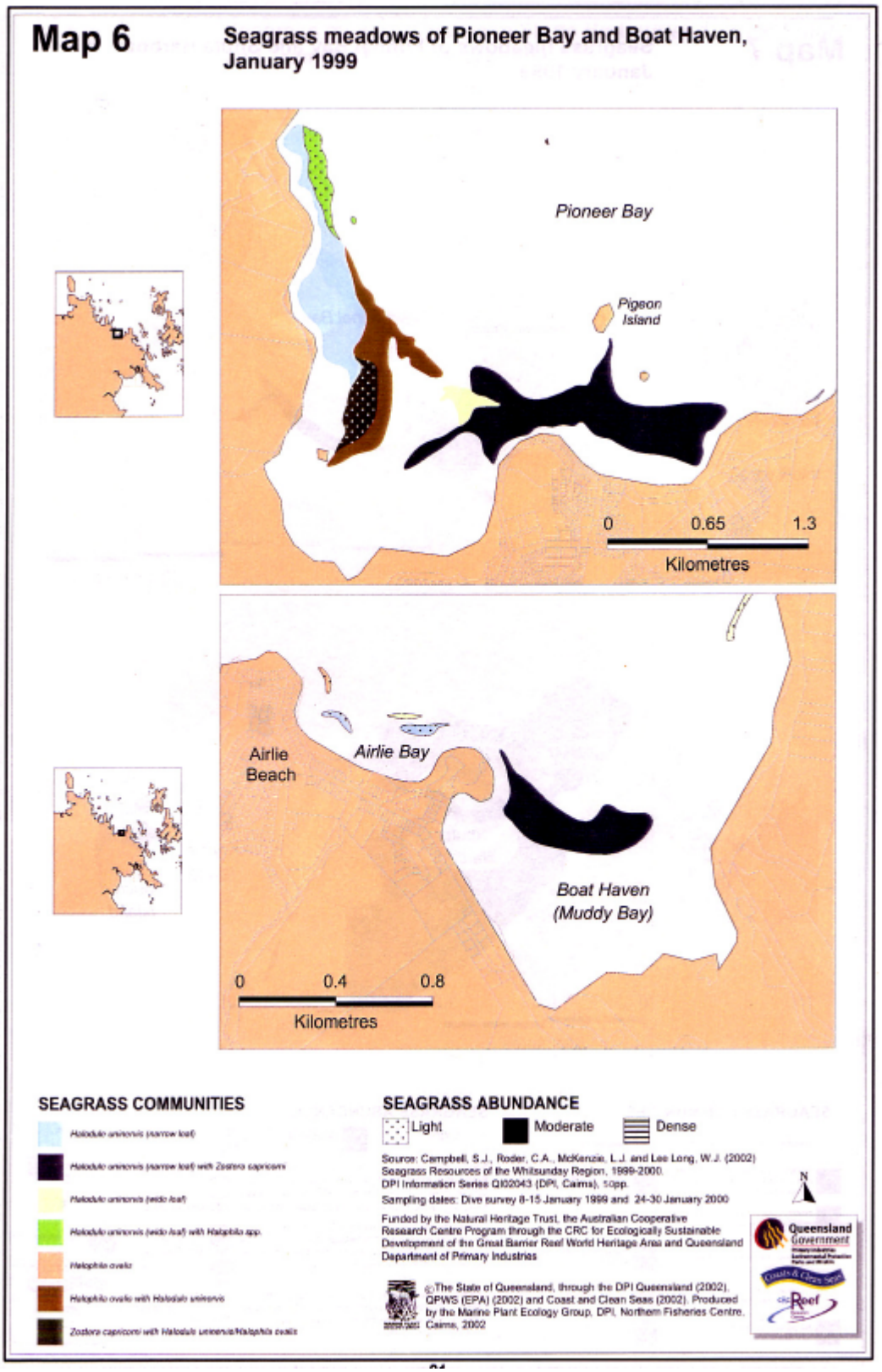
In 1987 seagrass meadows within Pioneer Bay were estimated to cover approx. 441.9 ha of intertidal and subtidal seabed (Roder 2002 pers. comm.). Based on

sampling, *Cymodocea serrulata* was found both towards the offshore and inshore margins of the meadows (31.1.5.T, 31.16.Sa, 31.1.2.T), whilst *Halophila ovalis* was found mid-way (31.1.4.T, 31.1.3.T, 31.1.2.T). *Halodule uninervis* was only found at the most inshore site sampled (31.1.1.T). A further 8 species of seagrass were recorded from other bays within the survey area (Bowen to Waterpark Point).

### 9.5.2 Distribution Based on DPI's 1999 Survey

The seagrasses of the region were re-surveyed in January 1999 again using divers, and the results of survey were mapped following helicopter reconnaissance (April 2000), and with reference to aerial photographs flown in 1993 and 1998.

In 1999, *Halodule* spp. and *Halophila ovalis* dominate the meadows of Pioneer Bay; no *Cymodocea serrulata* was recorded (nor has it ever been recorded from Pioneer Bay during FRC Environmental's twice yearly studies of the seagrasses of Pioneer Bay, initiated in 1996 (FRC Environmental 2001)). Within the Whitsunday region, *Cymodocea serrulata*-dominated meadows comprised less than 2% of the total seagrass area (Campbell et al 2002). The areal extent of seagrass meadows within Pioneer was estimated to be 122.2 +/- 28.5 ha (**Figure 9-2**). Results obtained by more recent surveys (though not aimed at determining areal extent) undertaken by FRC Environmental (FRC Environmental 2002), broadly reflect the seagrass distribution recorded by DPI in 1999, although FRC's studies suggest that the inshore (upper intertidal) distribution of seagrass is highly seasonally influenced, with the upper extent of meadows retreating over the summer months (anecdotal observations of seagrass distribution in Boathaven Bay in April 2003 indicate a significant retraction from the intertidal area distribution noted by FRC in September 2002).




■ **Figure 9-2 Mapping of Seagrass Based on DPI Surveys Undertaken in 1999 (Cambell et al, 2002)**

### 9.5.3 Comparison of the 1987 and 1999 Mapping

A simple comparison of the areal extent of seagrass mapped in 1987 and 1999 suggests there has been a loss of approximately 320 ha of seagrass. However, for reasons that are given below, this is likely to be an over-estimate. Any comparison of the results obtained by the two surveys should be approached with caution. Clearly, the limited resources and technology available to the 1987 survey significantly limit the confidence that can be placed on any extrapolation of the data beyond those locations actually sampled (refer **Figure 9-1**).

Use of bathymetric contours and sounder images could have provided only an indication of the suitability of the substrate to support seagrass – were the same tools used in the 1997 survey, the mapped extent of seagrass would likely be greater than it was (helicopter reconnaissance and more intense diver survey has shown there are large areas of substrate of suitable characteristics and at suitable depth that does not support seagrass).

It should also be noted that DPI's '1999' map of seagrass is actually based on field survey undertaken in 1999, but then aerial reconnaissance undertaken later in the season of the following year; and air photographs taken several years previous (unstated month): the resultant map is likely to be an amalgam of the variation in extent that would be expected between seasons and between years. Whilst it is apparent that seagrass meadows covered a greater area of Pioneer Bay (primarily of some 1.5 km of shallow subtidal seabed, adjacent to and seaward of Pigeon Island) in March 1987, than in January 1999, little more can be inferred. It is likely that the subtidal seagrasses meadows mapped in 1987 were patchily distributed, rather than presenting a continuous cover of all available substrate, and consequently DPI's estimate of areal extent for 1987 is likely to be an over estimate.

Both 1987 and 1999 surveys were undertaken over the wet season (summer months). Within the Whitsunday region, seagrass distribution characteristically retracts (FRC Environmental 2002), from both the intertidal due to the high intensity of solar radiation (seagrasses become desiccated at low tide), and the subtidal (due to elevated turbidity associated with heavy rainfall and seasonal winds) during the wet season. Consequently, both surveys are likely to have underestimated the seasonally averaged areal extent of seagrasses within Pioneer Bay.

### 9.5.4 Significance of Reduction in Areal Extent

Any difference in the extent of seagrass meadows subtidally is likely to be closely related to a difference in water quality. Seagrasses are able to grow in deeper waters when those waters allow a greater proportion of the light entering at the surface to reach the bottom. Water quality within the Whitsunday region fluctuates significantly with the weather, the seasons, and is also influenced by longer-time frame phenomena such as the ENSO cycle. Land use within the catchment also has the potential to influence coastal water quality. An ecologically significant deterioration in water quality over the period 1987 – 1999 cannot be necessarily attributed to human activity (there is insufficient evidence to reach this conclusion; and evidence exists to suggest that contemporary fluctuations are not principally related to human activity (FRC Environmental 2002)).

Due to the relatively slight slope of the seabed within Pioneer Bay, even a relatively minor increase in light attenuation (due for example to an increase in suspended solids

or phytoplankton concentration), may result in a significant decrease in the areal extent of seagrass. This is the principal reason why the preferred protocols for monitoring seagrasses are based on depth distribution rather than areal extent.

There is no evidence to suggest there has been a significant decline in water quality in the Pioneer Bay region post 1987; there is no evidence to suggest the areal extent of seagrass mapped in 1987 was 'typical' or 'average' for the decades preceding the survey. Surveys undertaken of the seagrasses of Pioneer Bay on a seasonal basis since 1996 have shown a slight increase in the depth distribution (inferring an improvement in coastal water quality). Comparison of the results of the 1987 and 1999 DPI seagrass surveys show an approx. 20% increase in the areal extent of seagrass within the region. The results for Pioneer Bay go against this regional trend. On balance, there is insufficient evidence to support a claim that the seagrasses of the region are either in decline or under threat. However, the evidence does support the conclusion that the seagrasses of the region, and of Pioneer Bay in particular, are dynamic and highly responsive to changing conditions. Our appreciation of the dynamics of the region's seagrass meadows, and our understanding of the limitations of the data produced by the 1987 survey, suggest that DPI's assertion that "Seagrass meadows in Pioneer Bay …. appear to have declined since the 1987 survey with a 74% decline in seagrass meadow area …" (Campbell et al. 2002) must be applied with caution. 'A trend of decline' based on two points, one of which is acknowledged as being a rough estimate, should not form the basis of prudent management of the coastal zone.

## 9.6 Indirect Impacts

Construction activities likely to indirectly impact the marine environment include dredging, spoil consolidation, pile driving and similar activities. These construction activities may result in:

- Increased suspended sediment levels and consequent sediment deposition within the bay and adjoining waters;
- A release of nutrients from the disturbed sediments;
- Spills of hydrocarbons and other contaminants;
- Disturbance of acid sulphate or potential acid sulphate sediments (ASS / PASS); and
- Increased human activity, including changes in light and noise levels.

The manner in which these impacts might be affected has been discussed in detail in the Supplementary EIS (Sections 7 and 9).

The sediments of the site are not considered to contain contaminant levels of concern (refer Supplementary EIS Section 6.1.4 and 6.2.1). **Sections 6.1** and **6.2** of this Addendum describe the intended management of contaminated sediments should these be identified in further investigations.

The marina basin will be excavated in dry conditions behind sheet piling. There will consequently be little impact on sedimentation or turbidity of adjoining waters during excavation. When the area is re-inundated there may be small, short-term increases in turbidity due to the suspension of the newly exposed sediment.

The access channel will be dredged using a cutter-suction dredge, with the spoil pumped to the nominated spoil disposal area (refer Supplementary EIS). It is anticipated that capital dredging will be completed within 2 months. Maintenance dredging is expected to take place every 10-15 years and will take approximately 1 month (refer Supplementary EIS Section 2.8.2).

Properly managed, both capital and maintenance dredging can be expected to have no long-term impact on the flora and fauna of Boathaven Bay and the region. Indeed, where dredging is accompanied by silt curtains, and the spoil deposition site incorporates both settlement ponds and silt curtains around the discharge (as is the practice associated with the current dredging of the expansion of Able Point Marina), short-term impacts are likely to be ecologically negligible – perhaps equivalent to a 'wet week' for a small proportion of the bay's seagrass.

Any release of nutrients from sediment disturbed by dredging is unlikely to have a significant ecological impact within the bay. Boathaven Bay has historically received the release of treated sewage effluent, and the delivery of stormwater from the road and upslope residential and tourism-related development. It is likely that any nutrients released by dredging would make only a minor and short-term contribution to overall nutrient levels within the bay.

Boat traffic and associated activity in the vicinity of the marina is unlikely to significantly effect seagrasses, corals and other benthic fauna. Prior to the current expansion of the Able Point Marina, seagrasses grew between the marina and Shingly Beach and hard and soft corals have colonised (pers. obs.). Dense seagrass meadows existed to the edge of the scarp of the swing basin at Shute Harbour prior to dredging in 2000, and have effectively recolonised (FRC Environmental 2003). Dense seagrass meadows exist adjoining major boat traffic routes within southern Moreton Bay (FRC Environmental 2002).

Spills of fuels and oils could potentially have a significant localised impact. However, there are numerous examples on the Queensland coast of corals, seagrass and mangroves flourishing in close proximity to large commercial marinas. Examples include: Trinity Wharf, Cairns; Abel Point Marina, Airlie Beach; Shute Harbour; Urangan Harbour, Hervey Bay; Manly Marina, Moreton Bay and; Runaway Bay Marina, Gold Coast.

Acid sulfate soils and potential acid sulfate soils are commonly encountered within the coastal zone in Queensland. Methods for the effective management of acid sulfate soils are well established and have been demonstrated to avoid any impacts on marine and coastal ecosystems.

Increased human activity is likely to influence the distribution and abundance of dugong, turtle and wader birds. Dugong and turtle are characteristically shy animals and preferentially use waters subject to low human activity. The likely reduction in the number of dugong and turtle visiting the bay (existing numbers are considered to be low) is considered desirable, further lessening the likelihood of boat strike. The bay is currently subject to light and noise emanating from: traffic along the Proserpine – Shute Harbour Road; the coach terminal located on the bay's northern shore; the yacht club located on the bay's northern headland; the sporting fields located on the

bay's southern shore; and moored yachts, including those beached on the intertidal flats adjacent to Coconut Grove.

In summary, each of the potential indirect impacts of construction and the potential impacts associated with marina operation are considered unlikely to have an ecologically significant effect on either the flora and fauna of the bay or the region. As a specific comment, replacement of the currently unmanaged moorings, particularly on the intertidal flats of the bay's northern shore, with a managed marina, may result in a diminution of ongoing significant (water and sediment quality-mediated) environmental impact on the bay.

## 9.7 Resilience of Inshore Corals to Turbidity

### 9.7.1 Introduction

Along the rocky shores of the Whitsunday coast there is a discontinuous fringe of coral communities. Sparse coral communities are associated with the rocky headland at the north-western extent of Boathaven Bay, and along the Mandalay promontory to the north east (FRC Coastal Resource & Environmental 1998; WBM 1998).

The dominant species of the region include *Goniastrea* spp., *Turbinaria* spp, *Favia* spp. and *Goniopora* spp..

### 9.7.2 Effects of Turbidity and Sediment Deposition on Corals

The effects on corals of increased sedimentation and light attenuation associated with sediment plumes, can range from mild coral stress to subtle changes in reef community structure, to outright coral mortality and ecological collapse of the reef (Raaymakers and Oliver, 1993). Continual resuspension and transport of sediments can cause reef degradation years after the delivery of the sediments ceases.

The impacts of increased sediment deposition on coral communities can include reduced algal and coral diversity and reductions in epifaunal densities (Hatcher et al., 1989). Sedimentation is a major controlling factor in the distribution of reef organisms and in overall reef development (Hubbard, 1986; Macintyre, 1988, cited in Rogers, 1990). Reefs are generally better developed, are more diverse, and with greater coral cover and rates of coral growth the lower the sediment load is in overlying waters (Rogers, 1990).

Increased turbidity and sediment deposition, as may result from poorly managed dredging operations may affect corals in five ways:

- Through decreasing light availability to zooxanthellae;
- Through a possible unfavourable influence of suspended sediments;
- Through acting on the planktonic food supply of corals (this is unlikely to be significant for hermatypic (reef building) corals);
- Through abrasion;
- Through stimulation of energy-consuming sediment rejection behaviour; and
- Through the reduction of available sites for larval settlement (Hubbard, 1988; Rogers, 1979; Johannes, 1975).

There is little quantitative information on the sub-lethal effects of chronic elevated turbidity and sedimentation. The consequence of these effects may be the suppression of growth rates of the corals for varying periods of time. Reductions in both growth and calcification have been reported for corals subjected to significant increases in turbidity and sediment deposition (Dodge and Brass, 1984).

Reports in the literature of decreased growth rates of corals that were apparently the result of turbidity and sediment deposition, are generally only associated with chronic impacts. (e.g. Dodge and Vaisnys, 1977, cited in Pastorok & Bilyard, 1985) or for operations conducted in close proximity to the corals (Bak, 1978).

Coral communities within Australia's inner Great Barrier Reef, chronically experience sediment deposition rates considerably in excess of rates reported to be catastrophic for coral communities in other parts of the world. Despite this these communities continue to flourish and are healthy (e.g. Marshall and Orr, 1931; Rogers, 1990).

### 9.7.3 Resilience of Corals to Turbidity and Sediment Deposition

Corals are able to reject sediment landing on the surface of the colony by four mechanisms (Pastorok and Bilyard, 1985):

- Polyp distension by uptake of water through the stomodeum;
- Tentacular movements;
- Ciliary action; and
- Mucous production.

Species of corals which are found in coastal habitats are generally more efficient at sediment clearance than those species typically found on offshore reefs (Salvat, 1987). Corals with large polyps are relatively more successful at ridding themselves of sediment (Endean, 1976). Particularly efficient genera include *Favia*, *Favites*, *Leptoria*, *Platygyra*, *Goniastrea*, *Turbinaria*, *Symphyllia*, *Goniopora* and *Fungia* (Brown, 1972, cited in Salvat, 1987; Endean, 1976).

It is just these genera that dominate the coral communities of Pioneer Bay (inclusive of Boathaven Bay and the Mandalay Peninsula). That is, the coral communities that may be acutely influenced by sediments suspended through dredging and spoil deposition within Boathaven Bay, reflect a natural environment characterised by often *chronic* elevation of suspended solids concentrations and consequent elevated rates of sediment deposition. During the wet season, significant quantities of sediment are delivered to coastal waters from the catchment. The corals of Pioneer Bay are likely to be influenced by sediments discharged by river systems as distant as the Pioneer, O'Connell and Proserpine Rivers. The fine sediments of Boathaven Bay are frequently resuspended by wind and wave action. Despite these often severe natural 'impacts', the coral communities survive, and between catastrophic events such as major floods and cyclones, thrive. Catastrophic events will commonly result in high mortalities. Yet, these communities quickly re-establish, with distant, unaffected colonies providing planktonic recruits that are carried by prevailing currents.

Examination of the rock breakwaters of nearby Abel Point Marine provides clear evidence that marina operations are not in themselves likely to adversely impact upon

nearby coral communities: abundant corals have colonised the breakwaters both within and outside of the marina.

## 9.8 Compensation for Loss of Habitat

Section 9.3.4 of the Supplementary EIS includes discussion on compensation for loss of habitat. It is noted in this section that there are few if any opportunities for restoration of degraded habitat in the Whitsunday Region and that, in accordance with DPI Policy, alternative forms of compensation including support of research activities, community based conservation initiatives and provision of educational and interpretive material.

The proponent has committed to a compensation package that will include actions selected from the following list:

- Making space available within the development for interpretive material on environmental and social issues in the Whitsunday Region. This space will probably be made available in the ferry terminal as this will provide the greatest contact with visitors. Possible topics to be covered by interpretive material could include:
  - General information on protection of the reef by visitors, aimed at enhancing understanding of the anthropogenic impacts on the reef and actions that individuals can undertake to reduce these impacts
  - Information on dugongs and turtles, including the possibility of research projects such as animal tracking
  - Traditional Indigenous presence and uses in the area
  - Community initiatives and activities such as Seagrass Watch
- Exploring the possibility of constructing a boardwalk through the Campbells Creek mangroves. The boardwalk would include interpretive material on mangroves and their conservation and provide an opportunity for residents and visitors to experience mangroves first hand that is not currently available elsewhere within the region. The boardwalk would connect to the proposed Port of Airlie and thence to existing walking paths within Airlie Beach. An added advantage would be the provision of pedestrian access to the sports fields and PCYC.
- Financial support of research initiatives or monitoring programs by DPI, GBRMPA or James Cook University
- Financial support of community initiatives such as Seagrass Watch and the Order of Underwater Coral Heroes (OUCH) (note that discussions with these organisations as to the acceptability of such funding has not taken place)
- Further surveys in Campbell's Creek to determine whether water mice occur in the estuary.

It is anticipated that the details of the compensation package will be resolved during the process of applying for a permit to remove marine plants (Section 51 of the *Fisheries Act 1994*). Department of Primary Industries is the lead agency in this regard.

It is noted that the proponent is not in a position to rectify other activities that might be having an adverse impact on the ecosystem in Boathaven Bay. These include:

- Uncontrolled boat maintenance activities
- Swing moorings.

Control of these activities must be undertaken by the State Government.

## 9.9 Blasting in the Marine Environment

It is not anticipated that blasting will be required. However if blasting of any rock outcrops is required, the blasting will be carried out behind the sheet pile or bunded coffer dams. There will be no blasting in the open sea.

## 9.10 Provision of New Habitat

The marina itself will provide some habitat for fish and other marine species, particularly associated with the rock walls. It is acknowledged that this is not a full or even substantial compensation for the habitat lost as a result of the proposal but does provide some partial compensation.