Hummock Hill Island Development

EPBC SUPPLEMENTARY REPORT

- Final
- 24 July 2009

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1. Introduction

Eaton Place Pty Ltd (ACN: 110 480 772) is proposing to construct a master planned integrated tourist and residential development located on Hummock Hill Island, 30 km south-east of Gladstone City on the Central Queensland Coast (refer to **Figure 1-1**). The proposed master planned integrated tourist and residential development built on environmentally sustainable development principles over a 17 year period.

The proposal to construct and operate a master planned integrated tourist and residential development on Hummock Hill Island (the proposed action) was referred to the Commonwealth Minister for the Environment and Heritage (now the Minister for the Environment and Water Resources) for a decision as to whether the project constitutes a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) ('the EPBC Act').

The Commonwealth Department of the Environment and Water Resources determined on 13 January 2006 that the project is a controlled action and therefore the Project will require approval under Part 9 of the EPBC Act before it can proceed. The controlling provisions are:

- Sections 12 and 15A (World Heritage);
- Sections 18 and 18A (Listed threatened species and communities); and
- Sections 20 and 20A (Listed Migratory species).

This report considers the likely impacts of the proposed action on the relevant controlling provisions and addresses matters raised by the Department of the Environment, Water, Heritage and the Arts, agencies and the community in response of the EIS.

LEGEND

Town — Major Road

Railway — Dam

Figure 1.1 - Site Location - Hummock Hill Island

This figure must be read in conjunction with the data disclaimers located at the front of this report . The data acquired for this project is known to be of low spatial resolution and as such no representation or warranties about its accuracy, reliability or suitability can be made. Assumptions and conclusions made from this figure and the associated data must be made with full understanding of the data limitations.

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Hummock Hill

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2. Description of the Proposed Action

2.1. Description of the project area

The proposed integrated tourist and residential development on Hummock Hill Island will take place on Lot 3 on FD841442 over which the proponent holds Special Lease 19/52155. Other lots affected by the proposed development include:

- Lot 1 on FD841442 – boat ramp on Colosseum Inlet and access track connecting this to the western edge of the proposed development;
- Lot 1 USL 43258 – bridge and causeway – mainland side; and
- Lot 10 FD 841442 – boat ramp and bridge – Island side.

It is noted that Clarks Road is currently nominated as a dedicated road reserve extending from Foreshores Road to the current causeway. This will be extended to cover the bridge across to Hummock Hill Island. Native title has been extinguished over Lot 3 on FD841442 (development lease). Infrastructure such as the bridge and road corridors will be dedicated as road reserves and thus not be subject to Native Title. A Cultural Heritage Management Plan has been approved for Hummock Hill Island and the proposed Project.

Hummock Hill Island is situated within the Great Barrier Reef World Heritage Area and Great Barrier Reef Coastal Marine Park. The boundary of the Mackay Capricorn section of the Great Barrier Reef Marine Park is located at the low water line along the northern coastline of the Island. The southern limit of Port Curtis is located to the north of the Island. Adjacent tidal waters of Colosseum Inlet, Boyne Creek (bar a 200 m easement), Sandfly Creek and Seven Mile Creek are included in the Colosseum Fish Habitat Area.

Vehicular access to Hummock Hill Island is currently via a man made causeway (only passable at spring low tides) and Clarks Road, an unimproved road that joins Foreshores Road 12 km to the south. Foreshores Road is connected to the Bruce Highway via Turkey Beach Road.

Previous human disturbance to Hummock Hill Island has occurred as a result of cattle grazing and logging. This activity ceased in the late 1980's. Much of the central part of the Island consists of regrowth of areas cleared for logging and pasture. Fences, a cattle dip, several sheds and other remnants of this activity remain. A single access track running from the causeway to the headland remains in reasonable condition and a grass airstrip is still discernible on aerial photographs and on the ground. A dam located in a saddle of the main range bisecting the Island appears to hold water throughout the dry season. A number of other turkey nest dams have been created on the site but do not hold permanent water.

Natural systems and features of Hummock Hill Island include:

- Open beaches along the northern coastline;
- A coastal transition zones incorporating dunes and she oaks;
- Littoral vine forest on relict sand ridges;
- Open eucalypt woodland;
- Endangered, of concern, threshold and not of concern regional ecosystems;
- Ephemeral creeks draining the central granodiorite ridge;
- Coastal wetlands including clay pans, salt flats, mangrove areas and tidal channels;
- A cleared northern headland which once supported a house, stockyards and a cattle dip; and
- Fenced paddocks that have been cleared for cattle grazing with various degrees of regrowth.

The Master Planning approach to ensuring sympathy and harmony with the natural environment has been to propose a number of different development “precincts” which provide a combination of high, medium and lower density development and various recreational, educational and commercial activity centres which have been arranged to fit with the natural environmental features.

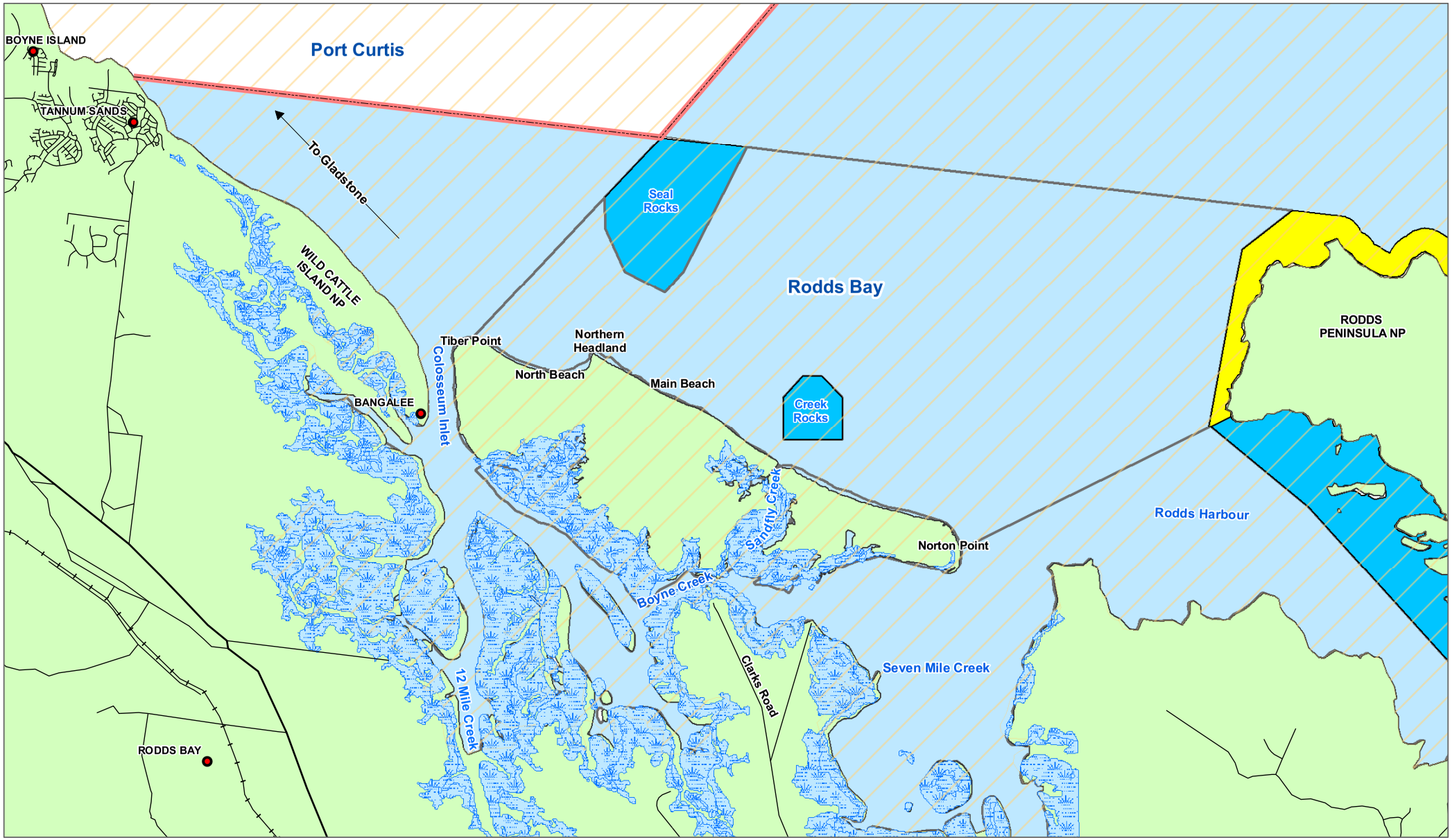
Figure 2-1. Hummock Hill Island Master Plan

HUMMOCK HILL

JOB NO: 4489-01-C 01/12/08 A-MP-00-03(G) SCALE: 7500 @ A0 0 50 100 200 300 600

EATON PLACE Pty ltd

MLDesign architects planners interior designers



LEGEND

- Town
- Major Road
- Railway
- Marine Park Boundary
- Great Barrier Reef World Heritage Area
- Intertidal Wetland

Marine Park Zoning

- Conservation Park Zone
- General Use Zone
- Habitat Protection Zone

Figure2.2- Great Barrier Reef Zoning

0 0.5 1 2 3 4 Km

N W E S

Hummock Hill

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2.2. Description of the Proposed Action

The proposal is for the establishment of a residential community comprising residential development of various forms, a golf course, education precinct, a small commercial centre, and waterfront industrial opportunities (see **Figure 2-1**).

The project will include a range of tourist, recreation and community facilities, listed below. These facilities will be available to residents of the Hummock Hill Island Development and those living in the nearby communities on the mainland.

Tourist and recreational facilities

- 240 room resort hotel - 4 star;
- 150 room beachfront tourist hotel - 3 star;
- 70 room motel;
- tourist park;
- large range of self-catered holiday properties in 1, 2, 3 and 4 bedroom configurations;
- restaurants and cafes;
- conference centre;
- health spa;
- golf course;
- sports centre;
- tennis courts;
- squash courts/lawn bowling club;
- jet ski/boat/canoe hire;
- tourist information Centre;
- community market;
- Traditional Owners cultural heritage interpretive centre;
- helicopter transfers to Gladstone Airport and to the GBR Islands;
- gift shops;
- bait and tackle shop;
- sailing club;
- camping ground; and
- Hummock Hill lookout.

Community Facilities and Social Services

- community centre;
- emergency services including fire and ambulance and police facilities;
- medical centre;
- education and research centre;
- boat ramps;
- airport/aero club;
- kindergarten;
- picnic and barbecue areas;
- boat storages;
- surf life saving club;
- public bus service;
- cycle paths; and
- post office.

3. Description of Matters of NES

3.1. Status as a Controlled Action

The project is a controlled action under the EPBC Act. The Part 3, Division 1 controlling provisions are:

- Sections 12 and 15A (World Heritage);
- Sections 18 and 18A (Listed threatened species and communities); and
- Sections 20 and 20A (Listed migratory species).

This section will describe the features of the Hummock Hill Island development area that are of National Environmental Significance (NES) and therefore protected under the EPBC Act.

3.2. World Heritage Values

Hummock Hill Island is located within the Great Barrier Reef Marine Park. The Great Barrier Reef World Heritage Area is 348 000 km^2 in area and is the largest World Heritage Area in the world. It is listed for four natural criteria including:

- Outstanding examples of stages of earth's history;
- Outstanding examples of on-going evolution;
- Contains superlative natural phenomena; and
- Important habitats for conservation of biological diversity.

Values associated with these criteria are listed in Appendix B.

3.3. Likely Occurrence of Listed Threatened Species and Communities

An EPBC Protected Matters Report was run in January 2007 and the results of this research are listed below. Overall there were 23 threatened species listed as likely to occur in the study area. The likelihood of occurrence of these species is considered below in **Table 3-1**.

Table 3-1 Threatened Flora and Fauna Species Occurring on Hummock Hill Island

Common Name	Scientific Name	EPBC Status	Likelihood of Occurrence
Reptiles			
Yakka Skink	*Egernia rugosa*	V	Species or species habitat likely to occur within area (DEH 2006). Possible – broadly suitable habitat present in the study area.
Loggerhead Turtle	*Caretta caretta*	E, Marine, Listed Migratory	Breeding known to occur within area (DEH 2006) Probable – preferred habitat is present in the study area and there are recent records from the locality.
Green Turtle	*Chelonia mydas*	V, Marine, Listed Migratory	Species or species habitat may occur within area (DEH 2006) Probable – preferred habitat is present in the study area and there are recent records from the locality.
Leathery Turtle. Leatherback Turtle	*Dermochelys coriacea*	V, Marine, Listed Migratory	Species or species habitat may occur within area (DEH 2006) Probable – preferred habitat is present in the study area and there are recent records from the locality.
Hawksbill Turtle	*Eretmochelys imbricate*	V, Marine, Listed Migratory	Species or species habitat may occur within area (DEH 2006) Probable – preferred habitat is present in the study area and there are recent records from the locality.
Pacific Ridley, Olive Ridley	*Lepidochelys olivacea*	E, Marine, Listed Migratory	Species or species habitat may occur within area (DEH 2006) Probable – preferred habitat is present in the study area and there are recent records from the locality.
Flatback Turtle	*Natator depressus*	V	Breeding likely to occur within area (DEH 2006) Known –recorded nesting in the study area
Birds			
Southern Squatter Pigeon	*Geophaps scripta scripta*	V	Species or species habitat likely to occur within area (DEH 2006) Possible – broadly suitable habitat present in the study area.
Southern Giant-Petrel	*Macronectes giganteus*	E, Marine, M	Species or species habitat may occur within area (DEH 2006) Unlikely - Oceanic species, unlikely to occur in the immediate study area.
Kermadec Petrel (Western)	*Pterodroma neglecta neglecta*	V	Species or species habitat may occur within area (DEH 2006) Unlikely - Oceanic species, unlikely to occur in the immediate study area.
Red Goshawk	*Erythrotriorchis radiatus*	V	Species or species habitat likely to occur within area (DEH 2006) Unlikely - Oceanic species, unlikely to occur in the immediate study area.

Common Name	Scientific Name	EPBC Status	Likelihood of Occurrence
Australian Painted Snipe	*Rostratula australis*	V, Marine, Listed Migratory.	Species or species habitat may occur within area (DEH 2006) Possible – may occur in habitats outside the development area.
Black-breasted button quail	*Turnix melanogaster*	V	Species or species habitat likely to occur within area (DEH 2006) Known to occur in Littoral Vineforest communities on the Island.
Mammals			
Blue Whale	*Balaenoptera musculus*	E, Cetacean, M	Species or species habitat may occur within area (DEH 2006) Unlikely - Oceanic species, unlikely to occur in the immediate study area.
Large-eared Pied Bat, Large Pied Bat	*Chalinolobus dwyeri*	V	Species or species habitat may occur within area (DEH 2006) Possible – broadly suitable habitat present in the study area.
Northern Quoll	*Dasyurus hallucatus*	E	Species or species habitat may occur within area (DEH 2006) Unlikely – appears to be locally extinct based on lack of recent records from the region.
Humback Whale	*Megaptera novaeangliae*	V, Cetacean, M	Breeding known to occur within area (DEH 2006) Unlikely - Oceanic species, unlikely to occur in the immediate study area.
Water Mouse, False Water Rat	*Xeromys myoides*	V	Species or species habitat likely to occur within area (DEH 2006) Possible – may occur in habitats outside the development area.
Sharks			
Whale Shark	*Rhincodon typus*	V, M	Species or species habitat may occur within area (DEH 2006) Unlikely - Oceanic species, unlikely to occur in the immediate study area.
Plants			
Minature Moss-orchid	*Bulbophyllum globuliforme*	V	Species or species habitat likely to occur within area (DEH 2006) Unlikely – specialist inhabitant of Hoop Pine vine forest types. Suitable habitat absent.
Wedge-leaf Tuckeroo	*Cupaniopsis shirleyana*	V	Species or species habitat likely to occur within area (DEH 2006) Possible – may occur in littoral vineforest.
	Cycas megacarpa	E	Species or species habitat likely to occur within area (DEH 2006) Unlikely- suitable dry forest habitat is present, but not recorded despite conspicuous nature of the species.

Common Name	Scientific Name	EPBC Status	Likelihood of Occurrence
	Germainia capitata	V	Species or species habitat likely to occur within area (DEH 2006) Possible – broadly suitable habitat present in the study area, but outside of development footprint.

Of these species listed in the EPBC protected matter search, only two species have been observed on the or near the Island, the Flatback Turtle and Black-breasted Button Quail.

3.4. Likely Occurrence of Listed Migratory Species

Migratory species that are protected under the Japan–Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA) are listed under the schedules of the EPBC Act.

Table 3-2 lists the migratory and other Commonwealth significant species (other than vulnerable or endangered species) known from the study area that have been identified from searches of the Queensland Museum, Birds of Australia and EPBC Act Protected Matters databases and observed from the field surveys. The table also provides an assessment of the likely occurrence of each species within the study area. This list includes:

- wetland species covered by migratory provisions of the EPBC Act comprising species listed under CAMBA and/or JAMBA;
- terrestrial species covered by migratory provisions of the EPBC Act; and
- species covered by marine provisions of the EPBC Act.

The EPBC Protected Matters Report (January 2007) indicated that 28 Migratory Terrestrial and Marine Species are potential occurrences on or near to Hummock Hill Island. An assessment of the likelihood of occurrence of these species is provided below.

- **Table 3-2 Listed Migratory Species located on Hummock Hill Island**

Common Name	Scientific Name / RE Number	EPBC Status	Likelihood of Occurrence
Migratory Terrestrial Species - Birds			
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	M, marine	Species or species habitat likely to occur within area (DEH 2006) Known
White-throated Needletail	*Hirundapus caudacutus*	M, Marine	Species or species habitat may occur within area (DEH 2006) Known

Common Name	Scientific Name / RE Number	EPBC Status	Likelihood of Occurrence
Barn Swallow	*Hirundo rustica*	M, Marine	Species or species habitat may occur within area (DEH 2006) Possible – potentially suitable habitat occurs in the study area.
Rainbow Bee-eater	*Merops ornatus*	M, Marine	Species or species habitat may occur within area (DEH 2006) Known
Black-faced Monarch	*Monarcha melanopsis*	M, Marine	Breeding may occur within area (DEH 2006) Known
Spectacled Monarch	*Monarcha melanopsis*	M, Marine	Breeding likely to occur within area (DEH 2006) Known
Satin Flycatcher	*Myiagra cyanoleuca*	M, Marine	Species or species habitat likely to occur within area (DEH 2006) Possible – potentially suitable habitat occurs in the study area.
Rufous Fantail	*Rhipidura rufifrons*	M, Marine.	Breeding may occur within area (DEH 2006) Known
Migratory Wetland Species - Birds			
Latham's Snipe, Japanese Snipe	*Gallinago hardwickii*	M, Marine.	Species or species habitat may occur within area (DEH 2006) Probable – broadly suitable habitat present in study area.
Australian Cotton Pygmy-goose	*Nettapus coromandelianus albipennis*	M, Marine	Species or species habitat may occur within area (DEH 2006) Unlikely – limited or no suitable habitat present within study area.
Little Curlew, Little Whimbrel	*Numenius minutus*	M, Marine	Species or species habitat may occur within area (DEH 2006) Possible – potentially suitable habitat occurs in the study area.
Painted Snipe	*Rostratula benghalensis s. lat.*	M, Marine, V	Species or species habitat may occur within area (DEH 2006) Possible – potentially suitable habitat occurs in the study area.
Migratory Marine Birds			
Southern Giant-Petrel	*Macronectes giganteus*	E, M, Marine	Species or species habitat may occur within area (DEH 2006) Unlikely – limited or no suitable habitat present within study area.
Migratory Marine Species - Mammals			
Bryde's Whale	*Balaenoptera edeni*	M, Cetacean.	Species or species habitat may occur within area (DEH 2006) Not on site, possible in surrounding waters during migration
Blue Whale	*Balaenoptera musculus*	E, M, Cetacean,	Species or species habitat may occur within area (DEH 2006) Not on site, possible in surrounding waters during migration
Dugong	*Dugong dugon*	M, Marine	Species or species habitat likely to occur within area (DEH 2006) Not on site, probable in surrounding waters
Humpback Whale	*Megaptera novaeangliae*	V, M, Cetacean.	Breeding known to occur within area (DEH 2006) Not on site, possible in surrounding waters during migration
Irrawaddy	*Orcaella*	M,	Species or species habitat may occur within area (DEH 2006)

Common Name	Scientific Name / RE Number	EPBC Status	Likelihood of Occurrence
Dolphin	*brevirostris*	Cetacean.	Unlikely – limited or no suitable habitat present within study area.
Killer Whale, Orca	*Orcinus orca*	M, Cetacean.	Species or species habitat may occur within area (DEH 2006) Not on site, possible in surrounding waters
Indo-Pacific Humpback Dolphin	*Sousa chinensis*	M, Cetacean.	Species or species habitat may occur within area (DEH 2006) Not on site, possible in surrounding waters
Reptiles			
Loggerhead Turtle	*Caretta caretta*	M, E, Marine.	Breeding known to occur within area (DEH 2006) Probable – suitable habitat present in study area.
Green Turtle	*Chelonia mydas*	M, V, Marine	Species or species habitat may occur within area (DEH 2006) Probable – suitable habitat present in study area.
Estuarine Crocodile, Salt-water Crocodile	*Crocodylus porosus*	M	Species or species habitat likely to occur within area (DEH 2006) Occasional vagrants likely in study area, not resident below tropic of Capricorn.
Leathery Turtle, Leatherback Turtle, Luth	*Dermochelys coriacea*	M, V, Marine	Species or species habitat may occur within area (DEH 2006) Probable – suitable habitat present in study area.
Hawksbill Turtle	*Eretmochelys imbricata*	M, V, Marine	Species or species habitat may occur within area (DEH 2006) Probable – suitable habitat present in study area.
Pacific Ridley, Olive Ridley	*Lepidochelys olivacea*	M, E, Marine.	Species or species habitat may occur within area (DEH 2006) Probable – suitable habitat present in study area.
Flatback Turtle	*Natator depressus*	M, V	Breeding likely to occur within area (DEH 2006) Probable – suitable habitat present in study area.
Sharks			
Whale Shark	*Rhincodon typus*	M, V	Species or species habitat may occur within area (DEH 2006) Not on site, possible in surrounding waters

4. EPBC Related Comments on EIS

Following the release of the EIS for public comment in December 2007, a total of 38 submissions were received from government agencies and the public.

A number of the submissions raised issues related to the EPBC Act. The issues raised in the submissions included:

- impacts on fisheries, coral and seagrass communities;
- water quality objectives and impacts of the surrounding waterways;
- impact of boating activities on marine life;
- impact of the desalination plant on marine life;
- impacts on threatened and migratory species; and
- management and protection of areas outside the development footprint.

DEWHA raised the water quality objectives for the project, 2-stroke engine emissions and the management and protection of areas outside the development footprint.

The Proponent's response to these matters is outlined below. Mitigation measures to manage project related impacts are presented in **Section 5**.

4.1. Impacts on fisheries, coral and seagrass communities

4.1.1. Fish stocks

Section 15.1.1.6 of the EIS describes the declared Fish Habitat Areas (FHA) of the estuarine and marine waters around Hummock Hill Island which includes a FHA in Colosseum Inlet (FHA-037), covering areas of Wild Cattle Creek, Colosseum Inlet, Boyne Creek, Seven Mile Creek and Thornton Creek. Information on recreational fishing is provided in Section 15.1.5 of the EIS, which identifies areas of Colosseum Inlet and Boyne Creek are used largely for recreational line fishing. Section 15.1.6 provides information on commercial fishing in the waters adjacent Hummock Hill Island.

Submissions were received that raised the issue of the potential for increased pressure on fish and mud crab stocks due to increased recreational fishing/trapping pressure. Based on population numbers and current boat ownership in Queensland, approximately 24 % (around 384) of the permanent population of Hummock Hill Island are likely to participate in recreational fishing, with at least 8 % (128 people) fishing on a weekly basis.

The issue of primary importance is the sustainability of the stocks. Queensland Department of Employment, Economic Development and Innovation (DEEDI) (previously DPIF) stated in consultations that, despite the anticipated increase in recreational fishing, they consider that current bag limits for recreational fishers are adequate to ensure sustainable catches. Potential impacts on recreational fish stocks from increased use of adjacent estuarine and marine waters are considered minimal.

Community comment made during community consultation suggested recreational fishing accounts for a decrease in commercial mud crab catch numbers during key holiday periods such as Christmas and Easter. DEEDI indicated in consultations that this may result from poaching of commercial crab pots rather than from increased crab harvest. As with fishes, DEEDI considers current commercial and recreational limits for mud crabs to be sustainable in the long term.

4.1.2. Coral communities

Submissions suggested that the project will result in adverse impacts on coral communities found off Main Beach.

Submissions raised the issue of potential impacts of land-based pollution on coral communities. The conceptual stormwater management plan in Appendix A7.2 of the EIS provides for stormwater flows from the development that features bioretention and detention ponds. All stormwater flows from the area of the project behind Main Beach, and closest to the coral communities, will be directed to inland, away from the beach, with no discharge of stormwater to be made directly to North Beach. As discussed below in **Section 4.2**, mitigation measures including Erosion and Sediment Control Plans, Water Sensitive Urban Design, integrated turf and pest management, the maintenance of a 100 m development buffer from Highest Astronomical Tide (HAT) and the elimination of septic tanks and discharges of treated sewage or desalination effluents to the marine environment are designed to prevent impacts on water quality. A water quality monitoring plan will be implemented to monitor the effectiveness of these measures.

Submissions also raised the matter of potential impacts of boat anchoring on coral communities. Public education and awareness efforts including signage at boat ramps and other public areas will promote the use of mitigation measures including voluntary avoidance of anchoring in coral areas and the use of “coral friendly” anchors (reef picks). The installation and maintenance of permanent moorings will be considered and discussed with the appropriate authorities.

Implementation of a Marine Ecological Monitoring Plan will allow assessment of the effectiveness of mitigation measures to protect coral communities and the need for alternative or additional measures.

4.1.3. Seagrass communities

Submissions raised the issue of potential impacts of the project on seagrass beds as a result of degradation of water quality from runoff, both in respect to the importance of seagrass beds for dugongs and turtles and also in relation to the inherent importance of seagrasses in relation to World Heritage and other ecological values.

The mitigation measures described in the EIS and listed in **Section 4.2**, including Erosion and Sediment Control Plans, Water Sensitive Urban Design, integrated turf and pest management, the maintenance of a 100 m development buffer from HAT, and the elimination of septic tanks and discharges of treated sewage or desalination effluents to the marine environment are designed to prevent impacts on water quality, including pollution from sediments, nutrients, and herbicides. A water quality monitoring plan will be implemented to monitor the effectiveness of these measures in maintaining water quality and the health of seagrass communities will be directly monitored through the implementation of a Marine Ecological Monitoring Plan.

4.2. Water quality objectives and impacts of the surrounding waterways

DEWHA has suggested that the water quality objectives (WQO's) and environmental values (EV's) for the project be determined against the ANZECC guidelines, Queensland Water Quality Guidelines 2006 and the GBRMPA Water Quality Guidelines. The Department also commented that it would be appropriate for the water quality objectives to be set relative to maximum loading for the system, particularly in regard to waste water.

Section 3.4.2.2 of the EIS summarises current existing water quality for waters surrounding Hummock Hill Island. Further detail on water quality is provided in Section 8 and Section 9 of the EIS. These Sections of the EIS also provide the results of modelling which show that water quality will be improved in the estuarine and marine waters around Hummock Hill Island, through the design of the stormwater management system.

The Environmental Values Assessment for the Hummock Hill Island Development is discussed in Section 9 of the EIS. Within this section, the key documents which identify regional EV's and WQO's are discussed, including:

- coastal management plans, including the Curtis Coast Regional Coastal management Plan and the Wide Bay Burnett Regional Coastal Management Plan (see Section 9.1.3.2 of the EIS); and
- guidelines and legislation pertinent to environmental values and water quality objectives for the region, including the Environmental Protection (Water) Policy 1997 (see Section 9.1.4 of the EIS) and the Great Barrier Reef Water Quality Protection Plan (see Section 9.1.5 of the EIS).

Draft EV's for the estuarine and coastal waters around Hummock Hill Island are detailed in Section 9.2.7 and were developed from the regional EV's identified in the documents outlined above.

In accordance with the EPP (Water) Act 1997, WQO's for estuarine and coastal water around Hummock Hill Island were established in order to protect the draft EV's. Section 9.2.8 of the EIS outlines the Draft WQO's. Section 9.2.9 provides information on factors which may affect water quality (Section 9.2.9.1 of the EIS) and existing water quality of the estuarine and marine water around Hummock Hill Island (Section 9.2.9.2 of the EIS). The potential impacts on water quality and mitigation measures to combat these are discussed in detail in Section 9.3.2 and Section 15.3.2 of the Draft EIS.

The main transport mechanism for pollutants would be via stormwater flows in ephemeral watercourses discharging to Boyne Creek and Colosseum Inlet from areas within the development.

Mitigation measures to control pollution entering the marine environment include the development of Erosion and Sediment Control Plans and Water Sensitive Urban Design for permanent storm water controls. These measures will be effective in managing sedimentation, suspended sediment, hydrocarbons, litter, nutrients, pesticides, herbicides and fungicides through various treatment trains. Pollutant export from the island is considered unlikely to increase significantly as a result of the development.

In addition to implementing Erosion and Sediment Control Plans and Water Sensitive Urban Design, the Proponent commitments (Section 18 of the Supplementary Report) include the development and implementation of a Water Quality Monitoring Plan (WQMP) to establish local water quality objectives (WQOs). The WQMP will be designed in accordance with the Queensland Water Quality Guidelines (QWQG) (EPA 2006) and the ANZECC/ARMCANZ (2000) Guidelines, which outline monitoring strategies and guideline values for water quality parameters. The established Port Curtis Integrated Monitoring Program (PCIMP), which includes yearly water quality monitoring at 16 sites around HHI and Colosseum Inlet, may provide background water quality data, which will be reviewed in detail during development of the WQMP. In any case, the WQMP will commence prior to construction in order to collect baseline water quality data and establish local WQOs.

The WQMP will include water quality sampling at a minimum of five potential impact locations, plus a minimum of two reference locations. The impact locations will notionally correspond to locations W1, W2, W5, and W8, as shown on Figure 9.8 of the EIS, as well as an additional location at the mouth of Sandfly Creek. The precise monitoring locations, however, will be adjusted in order to integrate the water quality monitoring with ecological monitoring. For

example, it is envisaged that location W2 may be moved to the east side of the northern headland to provide better association with anticipated coral monitoring sites at the coral community described by Alquezar et al. (2007); this is also appropriate in light of the elimination of the previously planned stormwater discharge just west of the headland. It is also anticipated that location W5 may be moved slightly south to better reflect water quality conditions at seagrass meadows 84 and 85 as designated by Rasheed et al. (2003) (see EIS Figure 15.10). The monitoring locations for baseline and subsequent construction and operational monitoring will be determined on the basis of field surveys, and additional sites may be added during development of the WQMP.

The parameters to be monitored, relevant guideline values and laboratory levels of reporting (LORs) are shown in **Table 4-1**. Additional parameters may be added during development of the detailed WQMP.

Table 4-1 Water Quality Monitoring Program Monitoring Parameters

Parameter	Unit	Relevant Guideline Values	LOR
Total Suspended Solids	mg/L	10-20	<5
Chlorophyll-a	µg/L	1-4	<0.15
Nutrients			
Total Nitrogen	µg/L	140-300	<50
Ammonia (as N)	µg/L	6-10	<3
Oxides of nitrogen (as N)	µg/L	3-10	<2
Filterable reactive phosphorus	µg/L	6-8	<2
Total iron	µg/L	N/A	<10
Dissolved iron	µg/L	N/A	<10
Metals			
Zinc	µg/L	ANZECC 2000 Guideline trigger values for toxicants	<5
Selenium	µg/L	ANZECC 2000 Guideline trigger values for toxicants	<3
Nickel	µg/L	ANZECC 2000 Guideline trigger values for toxicants	<1
Manganese	µg/L	ANZECC 2000 Guideline trigger values for toxicants	<10
Copper	µg/L	ANZECC 2000 Guideline trigger values for toxicants	<1
Cobalt	µg/L	ANZECC 2000 Guideline trigger values for toxicants	<1
Aluminium	µg/L	ANZECC 2000 Guideline trigger values for toxicants	<0.5
Pesticides and Herbicides			
Diuron	µg/L	ANZECC 2000 Guideline trigger values for toxicants	3
Organochlorines	µg/L	ANZECC 2000 Guideline trigger values for toxicants	0.5-2
Organophosphates	µg/L	ANZECC 2000 Guideline trigger values for toxicants	0.5-2

LOR - Level of Reporting

Table 4-1 lists the guideline values for total suspended solids, chlorophyll-a and nutrients. These values have been included for information and sub-regional WQOs will be established on the basis

of bi-monthly sampling to generate a minimum of 24 data points over 12 months. WQO's for metals and pesticides, will be those specified within Table 3.4.1 of the ANZECC/ARMCANZ 2000 Guidelines (trigger values for toxicants) – 95% protection. Sampling will be performed on the same stage of the tide (2 hours after high tide) to provide consistent results. Future monitoring will require the same sampling approach for consistency in tidal conditions and hence comparison of results. All sampling will be conducted in accordance with the most recent available version of the Queensland EPA Water Quality Sampling Manual (currently 1999). Laboratory analysis will be conducted by a NATA-accredited laboratory, with field duplicate samples sent to a second laboratory for inter-laboratory quality control purposes at each sampling event. The Queensland Health Forensic and Scientific Services (QHFSS) laboratory will be used as the primary or quality-control laboratory. Each monthly water sampling event will also include profiling of temperature, salinity, dissolved oxygen, pH, and turbidity at each monitoring location. Sub-regional Water Quality Objectives (WQOs) for total suspended solids, chlorophyll-a, and nutrients will be derived as 20th and 80th percentiles of the baseline monitoring data, in accordance with ANZECC/ARMCANZ and Queensland Water Quality Guidelines. Depending on baseline monitoring results and other available information, separate WQOs may be established for sub-groups of monitoring locations to take into account variation in water quality among different water types.

In addition to the monthly monitoring described above, continuously recording in situ turbidity meters will be deployed at a minimum of two locations, one in Boyne Creek and one in Colosseum Inlet, for a minimum of one month during the summer and one month during the winter, during the baseline monitoring program. In situ turbidity meters will also be deployed for at least the first month of major phases of construction to assess the performance of sediment control measures.

4.2.1. Reef Water Quality Protection Plan

The Reef Water Quality Protection Plan (RWQPP) aims to address pollution from a range of diffuse sources within catchments that flow into the Great Barrier Reef. The Plan includes a number of strategies that set out actions to minimise pollutants from diffuse sources and reducing their entry to the Reef. The Plan has defined diffuse sources as those that enter the waterways through a wide range of different sources and which cannot be directly attributed to one point of dispersal, such as a pipe or waste outlet and include nutrients, chemicals and sediment which wash into waterways and ultimately flow into the Reef lagoon.

The RWQPP has the goal of halting and reversing the decline in water quality entering the Reef within 10 years. It has two objectives, which are:

- Objective 1 - reduce the load of pollutants from diffuse sources in the water entering the Reef; and

- Objective 2 - rehabilitate and conserve areas of the Reef catchment that have a role in removing water borne pollutants.

The RWQPP has identified a number of ways these objectives can be achieved. Objective 1 can be achieved through sustainable practices and better land use decisions, while Objective 2 can be meet through conservation and rehabilitation actions. **Table 4-2** shows how the HHI Development will work achieve these objectives.

- **Table 4-2 RWQPP objectives and HHI Development commitments**

Objective 1 - reduce the load of pollutants from diffuse sources in the water entering the Reef	
Sustainable Practices	▪ The project is committed to reducing the volume of water needed by the development by including rainwater tanks, grey water reuse to irrigate public areas such as golf course and airstrip, toilet flushing, external uses such as car washing and garden watering and fire fighting. ▪ Wastewater will not be deliberately released from the development, to the ocean. All wastewater will be collected and treated for reuse within the development. ▪ A comprehensive water sensitive urban design system will be designed and constructed to manage and treat stormwater from the development, using a system of constructed wetlands. ▪ Sediment and erosion control plans will be used within the project to reduce the limit erosion and reduce the loss of sediment from the development. ▪ The stormwater management system will incorporate capture of rainwater from rooftops (via rainwater tanks), maintain the hydrological characteristics of catchments/sub-catchments, removes those contaminants from stormwater that arise from urban development prior to release to surrounding environment, integrate water into the landscape to enhance visual, social, cultural and ecological values.
Better Land Use Decisions	▪ The project will be developed on the basis of a Master Plan that has been prepared in recognition of the natural values of the Island. ▪ The design of the development has been completed to protect waterways, wetlands, coastal systems and habitat, with substantial buffers around sensitive areas been allowed, to protect these areas.
Objective 2 - rehabilitate and conserve areas of the Reef catchment that have a role in removing water borne pollutants	
Conservation	▪ The part of HHI not included within the development footprint of the project will be managed for conservation purposes, with a nature refuge or similar covenant to be negotiated with the Queensland government. ▪ Covenants will be placed over areas of vegetation offsets secured by the Proponent, so that these offsets will be protected from clearing. ▪ The project will include a program of community engagement delivered by an environmental management contractor with the Proponent to engage the tourists and residents of the Island in conservation related programs, deliver a program of weed management, fire management and pest management to reduce threats to wildlife and habitat of the Island. ▪ The Proponent will work with the Island community to increase knowledge and awareness of the natural values of Hummock Hill Island

	and the Great Barrier Reef and will include programs on boat use, to reduce impacts on marine wildlife, understand of turtle use of Island beaches, values of wetlands in protecting the values of Hummock Hill Island and the Great Barrier Reef and how to live on the Island in a manner that recognises the Island's conservation and natural resource management values.
Rehabilitation	■ The Proponent will actively undertake the rehabilitation program to improve the quality of bushland and habitat through revegetation, weed control, fencing and management of access to areas being rehabilitated. ■ The Proponent will secure vegetation offsets, specifically to address the impact of vegetation clearing to be undertaken for the project. The Proponent will manage these offsets, to ensure that they reach remnant vegetation status. These areas of vegetation offsets will be located on both Hummock Hill Island and on the nearby mainland, within 20 kilometres of the Island. ■ All areas directly impacted during construction of the project will be rehabilitated using local native species, with the purpose of re-establishing native vegetation communities, providing habitat for local native species and protecting water quality, waterways and wetlands of the Island.

4.3. Irrigation modelling

MEDLI modelling will be undertaken for the development of the Irrigation and the Recycled Water Management Plan. A MEDLI model (which analyses the ability of the soil to manage quantities of effluent) was prepared for the feasibility study. It identified that irrigation with recycled water could be managed at a sustainable level on the island. Further MEDLI modelling will be required as in input to the formulation of Recycled Water Management Plans to provide for the sustainable use of the Recycled Water.

4.4. Impact of boating activities on marine life

4.4.1. Two stroke engine emissions

DEWHA has suggested that the EIS should discuss the establishment of an emissions rating system for outboard motors, which may be included in Hummock Hill Island's best practice commitments.

It is noted that two-stroke engines in outboard motors and personal watercraft can be a significant source of emissions to air and water. Such motors have been shown to be a significant source of oil inputs to coastal waters in the United States (NRC 2003), and the US EPA has established emissions standards for two-stroke marine engines. The establishment of emissions standards or an emissions rating system for outboard motors could help to reduce total emission from this source. This would only be practical at a state or national level, however, and not at the level of an individual development.

4.4.2. Boat traffic

Submissions raised the matter of the impact of boat traffic on marine life around Hummock Hill Island.

As stated in the EIS, it is estimated that approximately 190 small boats will be owned by the permanent population of the development based on boat ownership rates in the surrounding coastal communities, with an estimated 19 - 29 boats in use on any given day (See Table 9.10 in the EIS). The 190 additional boats represents an increase of about 3% over total 2006 boat ownership in the Gladstone local government area. In the event that the project does not proceed, it is expected that boat numbers will increase by 2,500 as a result of population increases in the region. Any increase in boat ownership attributable to the project is very minor, in comparison with expected overall increases in boat ownership. Consequently, the project will not cause a significant impact of marine life in the vicinity of the Island.

The appropriate mitigation measures to manage dugong and turtle boat strikes, which are within the Proponent's control, will be:

- restriction of vessel speed; and
- public education and signage to raise awareness.

The Proponent will also work with the Great Barrier Reef Marine Park Authority and the Queensland Boating and Fisheries Patrol to develop and deliver community education on avoiding impact of boat impacts on marine wildlife.

4.5. Impact of the desalination plant on marine life

The potable water requirement for HHI Development has been determined to be 441 kL/d. If the MVC desalination technology is adopted, the required volume of water to produce 441 kL/d is approximately 550 kL/d. This is a very small desalination plant requiring an intake pipe of approximately 250 mm.

It is proposed that seawater will be extracted from Boyne Channel via a seawater intake pump located on the northern (island side) pier of the bridge. The pump will be programmed to pump seawater during the upper half of the tidal cycle to ensure a consistent quality of raw water.

The Desalination Plant will be specifically designed to reduce entrainment of marine organisms by the intake pipes. Measures to reduce entrainment of marine organisms in the intake of the desalination plant will be determined during the detailed design phase. The measures to be considered include:

- design to achieve the minimal practical water velocity at the intake;

- a “velocity cap” that produces horizontal intake currents, which fish are able to detect better than vertical currents; and
- incorporation of a travelling screen/fish return system at the intake to prevent the entry of fish and where possible release them unharmed.

Such measures are considered by the California Coastal Commission (2004) as "Best Technology Available" for the purposes of compliance with the US Clean Water Act.

4.6. Impacts on threatened and migratory species

The discussion of the project’s impact on EPBC listed threatened and migratory species is outlined in **Section 5.5**.

4.7. Management of areas outside the development footprint

Submissions raised the matter of management of the Island outside the development footprint of the project.

The Proponent propose the Gladstone Regional Council impose a special area environmental levy on land owners to fund an environmental management company to undertake a range of land management and community engagement programs to manage these areas. The management team will have the following responsibilities:

- community engagement and education;
- fire management;
- weed management;
- pest management;
- fence maintenance;
- incidental rubbish removal;
- track maintenance; and
- enforcement of access restrictions.

The management team will have the authority to restrict access and the responsibility of maintaining fences and other infrastructure.

Human settlement and activity within and surrounding areas of environmental significance can be effectively managed to protect the environmental values of these areas. Substantial tourist activity on Fraser Island and the Central Eastern Rainforest Reserves is actively and effectively managed

by a range of State Agencies. It is intended that the environmental management company will have a similar role.

4.7.1. Tenure and Management of Balance Areas

The Proponent proposes to have the undeveloped parts of the island (84% - which includes the undeveloped parts of special lease area and Unallocated State Land) declared as Nature Refuge and protected under a formal agreement with the government agencies. The HHI Development boundary will be fenced and have a barrier to prevent vehicular access and uncontrolled pedestrian access to the Nature Refuge. The conserved areas will be maintained, protected and enhanced through a management contract between the Proponent and an appropriate environmental management company who will also be contracted to manage the offset areas. The Proponent propose the Gladstone Regional Council impose a special area environmental levy on land owners to cover the cost of theses environmental services.

Human settlement and activity within and surrounding areas of environmental significance can be effectively managed to protect the environmental values of these areas. Substantial tourist activity on Fraser Island and the Central Eastern Rainforest Reserves is actively and effectively managed by a range of State Agencies. It is intended that the environmental management company will have a similar role.

5. Assessment of Impacts on NES Matters and Mitigation Measures

5.1. Overview of Mitigation Strategies

5.1.1. Mitigation of Impacts - Terrestrial Flora and Fauna

5.1.1.1. Responsive Master Planning

The proposed Hummock Hill Island Development incorporates numerous design elements which seek to minimise or mitigate potential impacts on terrestrial flora and fauna communities, including the following (refer to Section 14.3.1.1):

- Location of proposed buildings and associated infrastructure outside of Endangered Regional Ecosystems particularly Poplar Box woodland and Littoral Vineforest communities;
- Exclusion of development from the habitat known to support significant fauna species, particularly Black-breasted Button Quail (Vineforest communities), which is the most significant vertebrate species known from Hummock Hill Island;
- Minimal disturbance to marine/tidal habitats, known to be of importance to both local and migratory shorebirds and potentially the Water Mouse;
- Incorporation of vegetated corridors within the master plan design to permit flora and fauna dispersal across the island particularly the maintenance of riparian corridors adjacent ephemeral creeks;
- Incorporation of formal fauna crossing points at potential road-strike points, particularly within the proposed corridors described above;
- Incorporation of fauna crossings in designed ephemeral watercourse crossings; and
- Maximisation of tree retention across the development area to increase landscape permeability for flora and fauna particularly in and around the proposed golf course.

5.1.1.2. Compensatory Habitat Strategy

A compensatory habitat strategy is to be developed for the HHI Development. The strategy objectives will be twofold (refer to Section 14.3.1.2 of the EIS):

- the strategy will seek to comply with the requirements of the Queensland *Vegetation Management Act (1999)* and associated Codes and Policies;
- the strategy will aim to provide tangible conservation benefits at the local and shire-wide scale, with an emphasis on threatened species conservation; and

- The ultimate compensatory habitat package will consider impacts on Matters of National Environmental Significance and the provision of appropriate offsets for impacts on those matters (EPBC **Section 5.1.1.3**).

The HHI Development will require the clearing of mapped remnant vegetation. In order to comply with the Regional Vegetation Management Code (RVMC) for Southeast Queensland Bioregion (DNRW, 2006), the applicant will be required to maintain the current extent of "Of Concern" REs (Performance Requirement [PR] S7), Threshold REs (PRS9), riparian (watercourse) REs (PRS3) and Essential Habitat (PRS8).

"Maintain the current extent" is defined as follows in the RVMC:

- not clearing; or
- ensuring the regional ecosystem structure and function are maintained; or
- providing an offset in accordance with the policy in force at the date the application was properly made for vegetation management offsets administered by the Department of Environment and Resource Management (DERM) (previously DNRW).

Not clearing is an unfeasible option for this project and it is difficult to satisfy clause (b) whilst clearing remnant vegetation. As such, the Eaton Place Pty Ltd has opted to provide an offset in accordance with the DERM Policy for Vegetation Offsets (the Offset Policy) released in November 2006.

The offset strategy will form the basis of the compensatory habitat strategy for the project and will seek to comply with the performance criteria set out in the Offset Policy.

The compensatory habitat strategy is likely to involve a combination of the following options (refer to Section 14.3.1.2) of the EIS:

- Securing advanced regrowth (near remnant) vegetation within and outside the Shire which is representative of the REs and essential habitat to be cleared for the project. The properties will be either be purchased by Eaton Place Pty Ltd or secured via registered covenant. In both cases the properties would be actively managed until such time as they reach remnant status;
- Securing REs of equivalent conservation status to those to be cleared for the project within and outside the shire and managing these areas until such time as they meet remnant status;
- Strategic purchase of key land parcels which have been identified as key linkages or habitats for EVR taxa at the local, sub-regional or regional scale; and
- Revegetation and rehabilitation of existing cleared areas of land within the study area, with a view to re-instating pre-clearing vegetation types.

Clearing within the HHI Development Boundary

The HHI Development footprint has been revised to reduce impacts on endangered regional ecosystems, increase the width of fauna corridors, increase buffers to tidal lands, wetlands and waterways.

Table 5-1 lists the regional ecosystem within the HHI Development boundary, its status under the Vegetation Management Act, whether the regional ecosystem provides essential habitat and the area of the regional ecosystem affected. The Proponent has used this table as the basis for securing offsets for the project.

- **Table 5-1 Regional Ecosystems within the Development Boundary**

RE	Vegetation Management Status	Essential Habitat	RE Affected Ha
12.3.10/12.3.3	Endangered - Dominant	Yes	8.915
12.3.3	Endangered - Dominant	Yes	4.039
clear	Non-remnant / regrowth	No	54.572
regrowth	Non-remnant / regrowth	No	2.032
12.1.2	Not Of Concern	No	0.453
12.1.3	Not Of Concern	No	0.107
12.12.7	Not Of Concern	No	86.415
12.2.11	Not Of Concern	No	134.882
12.2.14	Not Of Concern	No	0.091
12.12.12	Of Concern - Dominant	Yes	195.136
12.12.19	Of Concern - Dominant	No	0.286
12.12.28	Of Concern - Dominant	No	0.149
12.12.8	Of Concern - Dominant	No	5.461
12.2.11/12.1.1	Of Concern - Sub-dominant	No	25.425
12.2.11/12.2.2/12.2.11	Of Concern - Sub-dominant	No	0.103
Regional Ecosystems within the Development Boundary			**518.068**

The HHI Development will require clearing of vegetation. As such, the Proponent has opted to provide an offset in accordance with the DERM's Policy for Vegetation Management Offsets (the Offset Policy). The Offset Policy sets targets for the condition, area, configuration and status of vegetation offsets, and the Compensatory Habitat Strategy seeks to meet these targets.

The composition and total area of vegetation offset required has been re-assessed and is provided in **Table 5-2** below. The offset package for the project will offset impacts on the endangered, of concern and threshold regional ecosystems found within the HHI Development footprint. The minium area of offsets to be secured by the project is 602.8 ha. The offsets will be located on Hummock Hill Island, within the Special Lease held by the Proponent and on a number of

properties on the mainland. At this stage, the Proponent is in negotiation with DERM in the detail of the offset.

- **Table 5-2 Summary of Minimum Vegetation Offset Requirements**

RE	Description	Area (ha)	Multiplier	Offset Area (ha)
12.1.1	Casuarina glauca ± Melaleuca quinquenervia ± mangroves open-forest. Occurs on margins of Quaternary estuarine deposits.	1.270	1.5	**1.905**
12.2.2	Microphyll/notophyll vine forest. Characteristic species include Cupaniopsis anacardioides, Flindersia schottiana, Alectryon coriaceus, Elaeocarpus obovatus, Polyalthia nitidissima, Diospyros spp., Pleiogynium timorense and Mallotus discolor. Melaleuca spp. and eucalypt emergents may be present, e.g. Melaleuca dealbata and Corymbia tessellaris. Occurs on Quaternary coastal dunes and beaches.	0.040	1.5	**0.060**
12.3.3	Eucalyptus tereticornis open-forest to woodland. Eucalyptus crebra and E. moluccana are sometimes present and may be relatively abundant in places, especially on edges of plains and higher level alluvium.	4.930	2	**9.860**
12.3.7	Eucalyptus crebra grassy woodland. Other species such as Corymbia erythrophloia, Eucalyptus exserta, E. tereticornis, C. tessellaris, C. citriodora may be present in low densities or in patches. Mid layer generally sparse but can include low trees such as Acacia bidwillii, Alphitonia excelsa, Allocasuarina luehmannii, Petalostigma pubescens.	86.415	2	**172.830**
12.3.10	Eucalyptus populnea ± E. tereticornis grassy woodland/tall woodland ± patches of Acacia harpophylla and Melaleuca bracteata. Occurs on Quaternary alluvial plains.	8.020	2	**16.040**
12.12.8	Eucalyptus melanophloia, usually with E. crebra ± Corymbia erythrophloia grassy woodland. Other species such as Eucalyptus exserta, E. tereticornis, C. tessellaris, C. citriodora may be present in low densities.	5.460	2	**10.920**
12.12.12	Eucalyptus tereticornis, E. crebra (sometimes E. siderophloia) open-forest to woodland. Other species present can include Eucalyptus melanophloia	195.140	2	**390.280**
12.12.19	Vegetation complex of exposed rocky headlands. Vegetation types include Themeda triandra grassland and wind-sheared shrubland and woodland.	0.290	2	**0.580**
12.12.28	Eucalyptus moluccana ± E. crebra, Corymbia citriodora open-forest or woodland. Occurs on broad ridges and lower slopes on Mesozoic to Proterozoic igneous rocks.	0.150	2	**0.300**
Total Required Offset Area (Ha)		301.715		**602.775**

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5.1.1.3. Compensatory Offsets for Matters of NES

The EPBC Act does not make direct reference to the requirement for offsets. However, recent amendments made to the EPBC Act, have broadened the types of conditions that are attached to development approvals. This allows voluntary compensatory actions and financial contributions to be made to help offset the impacts of developments in situations where impacts are unavoidable.

A 'Draft Policy Statement: Use of environmental offsets under the Environment Protection and Biodiversity Conservation Act 1999', was recently released (August 2007). This document sets out the Governments position on the use of offsets under the EPBC Act. Essentially the document outlines eight principles used to assess proposed environmental offsets, these principles can also be used as a guide for deciding if offsets are required, and if so, there nature. The eight principles are:

1) Environmental offsets should be targeted to the matter protected by the EPBC Act that is being impacted.
2) A flexible approach should be taken to the design and use of environmental offsets to achieve long-term and certain conservation outcomes which are cost effective for proponents.
3) Environmental offsets should deliver a real conservation outcome.
4) Environmental offsets should be developed as a package of actions - which may include both direct and indirect offsets.
5) Environmental offsets should, as a minimum, be commensurate with the magnitude of the impacts of the development and ideally deliver outcomes that are 'like for like'.
6) Environmental offsets should be located within the same general area as the development activity.
7) Environmental offsets should be delivered in a timely manner and be long lasting.
8) Environmental offsets should be enforceable, monitored and audited.

The ultimate compensatory habitat package will consider impacts on matters of national environmental significance and the provision of appropriate offsets for impacts on those matters. One of the key aims of the project is to minimise impacts on matters of NES through responsive design and best practice environmental management during construction and operation. As such, major offset initiatives for matters of NES are considered unlikely to be required.

5.1.1.4. Construction and Operational Phase Management

A suite of management strategies are proposed to mitigate construction and operational impacts on terrestrial flora and fauna species, these have been detailed in Section 14 of the EIS.

5.1.2. Mitigation of Impacts - Marine Flora and Fauna

Identified impacts, whilst sourced from differing practices within the proposed development area, have a common theme via their transport mechanism to the marine environment – via storm water flows in identified ephemeral watercourses discharging to Boyne Creek and Colosseum Inlet from disturbed areas within the proposed development area. Development of erosion and sediment control plans (ESCP) and Water Sensitive Urban Design (WSUD) for permanent storm water controls will be effective in mitigating sedimentation, suspended sediment, hydrocarbons, litter, nutrients, pesticides, herbicides and fungicides through various proposed treatment trains (refer to Section 15.3 of the EIS). Proposed mitigation measures are discussed further below.

5.1.2.1. Minimisation of Habitat Clearing

Clearing within supratidal salt flats and mangroves will be minimised to the minimum width required to accommodate the road design and storm water controls (refer to Section 15.3.1.1 of the EIS). Clearing will be conducted in accordance with recommendations within the *Wetland Management Profile – Salt marsh Wetlands issued by the Queensland Wetlands Programme*. All relevant permits required by relevant legislation will be obtained prior to commencement of works.

5.1.2.2. Erosion and Sediment Controls

Erosion and sediment control during construction activities will be mitigated as follows (refer to Section 15.3.1.2 of the EIS):

- Construction activities within ephemeral watercourse catchments that discharge to estuarine or marine waters will utilise erosion and sediment controls in accordance with *Soil Erosion and Sediment Control Guidelines – Engineering Guidelines for Queensland Construction Sites* (IEAust (Qld) 1996);
- A 10 m buffer will be maintained on all ephemeral watercourses within the proposed construction area as required by the SE Qld RVMC. Maintenance of Riparian buffers will help reduce contaminant loads to adjacent marine waters derived from surface runoff;
- No construction activity will occur in the 100 m buffer zone above HAT, bar public access infrastructure such as boat ramps and the proposed Boyne Creek Bridge. These works will be subject to a site specific Erosion and Sediment Control Plan that will include additional controls for working in a sensitive marine environment;
- Construction activities within Boyne Creek for the proposed bridge and boat ramp will be conducted using construction methods and protection measures outlined in Section 8 of the EIS:
- Ephemeral watercourse discharges will be required to meet WQO for estuarine waters derived from existing and ongoing proposed monitoring.

5.1.2.3. Water Sensitive Urban Design

Water sensitive urban design (WSUD) principles will be used for all permanent control measures to mitigate litter, sediment, nutrient, hydrocarbon and chemical releases to adjacent estuarine and marine environments (refer to Sections 8.2.1.2 and 15.3.1.3 of the EIS). Construction of WSUD features will utilise ephemeral watercourse catchments that discharge to Boyne Creek, Colosseum Inlet and the Marine environment. Proposed control measures will be constructed in accordance with *Draft Water Sensitive Urban Design Engineering Guidelines: Stormwater (BCC, 2006).*

Based on modelled removal efficiencies and considering existing sediment and nutrient loads of stormwater flow from ephemeral watercourses on Hummock Hill Island to adjacent estuarine waters, minimal changes are anticipated during construction and developed estuarine and marine water quality objectives are expected to be met (refer to Section 15.3.1.3 of the EIS).

5.1.2.4. Integrated Turf and Pest Management

Construction and operation of the proposed golf course will utilise both Class A+ waste water for irrigation and supplementary fertilisers to maintain tees and greens. Turf pest management will utilise a range of pesticides, herbicides and fungicides (refer to Section 15.3.1.4 of the EIS).

The proposed golf course will operate watering, fertilising and pest control in accordance with the *Australian Golf Course Superintendent's Association and QLD EPA Improving the Eco-efficiency of Golf Course in Queensland* (2001) (AGCSA). The AGCSA handbook is designed to minimise the impacts of golf course management, basically an intensive form of horticulture.

Turf management will be a combination of sustainable irrigation practices and fertiliser practices (see Section 3.6.5.2 of the EIS). Irrigation of the proposed golf course will utilise Class A+ treated wastewater that contains <5 mg/L Total Nitrogen and <1 mg/L Total Phosphorous. A sustainable irrigation rate has been calculated (Cardno, 2007) at 14 Kl/day for soils within the golf course. This irrigation rate is designed to minimise runoff generation. Modern irrigation management programs utilise an array of in ground sensors combined with weather station readings to calculate the correct irrigation rate on a daily basis. During times of rainfall excess on site storage will be utilised in the form of ponds and water features within the golf course. Fertiliser applications will use slow release products that minimise leaching allowing full uptake by turf-grass species (see Section 3.6.5.1). Maintenance of quality turf will minimise nutrient losses from runoff. Buffer strips and maintenance of native vegetation will also minimise potential nutrient runoff from the proposed golf course.

5.1.2.5. Population Increases

Impacts from increased population will be controlled by (refer to Section 15.3.1.6 of the EIS):

- No access for vehicles to salt flats though the 100 m vegetation buffer zone. Community education programs and interpretative signs will raise public awareness of salt flats role in the estuarine system;
- Maintaining a 100 m buffer zone between HAT and housing within Colosseum Inlet and Boyne Creek to act as a buffer zone between residences and estuarine wetlands. This buffer zone will also raise house levels above the mangrove canopy eliminating the likely illegal clearing of mangroves for views;
- Clear interpretative signage will be placed on all boat ramps with maps of seagrass meadow locations within the estuarine system and also the likely risks of dugong and turtle collisions within these areas to increase public knowledge of potential harm that may occur from boat propeller damage;
- Speed restrictions will be recommended within Boyne Creek and high trafficked areas of Colosseum Inlet to reduce the occurrence of boat strike with marine mammals and turtles in areas of seagrass meadows;
- Consultation with Queensland Parks and Wildlife will be conducted with the view to designate special dugong and turtle areas within Colosseum Inlet and Seven Mile Creek where vessel operation restrictions will exist;
- Maintenance of current DEEDI size and bag limits are considered to be sustainable and are designed to maintain recreational fishing populations; and
- Negotiations between Queensland Rural Adjustments Authority and local commercial fishermen on buying out commercial licences.

5.1.2.6. Areas of State Significance (Natural Resources)

Areas of State Significance (Natural Resources) as classified under the Queensland State Coastal Management Plan are present within Colosseum Inlet and on Hummock Hill Island. These are identified as:

- Significant Coastal Wetlands: such as wetlands within adjacent estuarine waters listed on the Queensland Wetlands Map V01 and Directory of Important Wetlands in Australia (QLD129) as noted in Section 15 of the EIS – note these wetlands are entirely outside the development lease area.

- Significant Coastal Dune Systems such as Qb1 areas mapped on the Island are present but not considered to fully meet the criteria for these features. Refer to Section 5.2 of the EIS for an outline of the potential impacts to these areas;
- Endangered Regional Ecosystems identified as 12.3.3 - *Eucalyptus tereticornis* dominated forests on alluvial plains and 12.3.10 - *Eucalyptus populnea* dominated forests on alluvial plains. No development is proposed in endangered ecosystems as discussed in Section 14.2 of the EIS; and
- Critical habitat for marine species have been identified for dugong (*Dugong dugon*). However the proposed development will not directly impact the critical habitat for these species i.e. seagrass meadows.

5.2. Mitigation of Impacts - Threatened Species

- **Table 5-3 Mitigation Measures for Potential Impacts on Threatened Species**

Species/Group	Mitigation Measure
Marine Reptiles	▪ Avoidance of direct impacts on the habitat of this group. ▪ Development and implementation of a Erosion and Sediment Control Plan (prepared in accordance with Soil Erosion and Sediment Control, Engineering Guidelines for Queensland Construction Sites, 1996). ▪ Preparation and implementation of a Stormwater Management Plan based on WSUD principles that is integrated with the Erosion and Sediment Control Plan ▪ Development and implementation of an acid sulfate soil management plan ▪ The use and storage of hazardous substances according to their recommendations and specifications (eg MSDS). ▪ Fuel storage areas should be constructed according to the standards set out by the Australian Petroleum Institute. ▪ Hazardous materials management plans will be developed for both construction and operation of the development. Storage, handling and transport will be in accordance with Australian Standards and accepted best practice (GHD 2006). ▪ Management of lighting impacts. To protect sea turtles, light sources can simply be turned off or they can be minimized in number and wattage, repositioned behind structures, shielded, redirected, lowered, or recessed so that their light does not reach the beach. ▪ Maintaining a 100m buffer zone between HAT and housing within Colosseum Inlet and Boyne Creek to act as a buffer zone between residences and estuarine wetlands. This buffer zone will also raise house levels above the mangrove canopy eliminating the likely illegal clearing of mangroves for views. ▪ Clear interpretative signage will be placed on all boat ramps with maps of seagrass meadow locations within the estuarine system and also the likely risks of Dugong and turtle collisions within these areas to increase public knowledge of potential harm that may occur from boat propeller damage; ▪ Speed restrictions will be recommended within Boyne Creek and high trafficked areas of Colosseum Inlet to reduce the occurrence of boat strike with marine mammals and turtles in areas of seagrass meadows. ▪ Work with the Great Barrier Reef Marine Park Authority and the Queensland Boating and Fisheries Patrol to develop and deliver community education on

Species/Group	Mitigation Measure
	avoiding impact of boat impacts on marine wildlife.
Black-breasted Button Quail	■ No disturbance to known or potential habitat. ■ No development adjacent to preferred or known habitat. ■ Development of sympathetic open space and fire management plans (ie management plans which consider the ecological requirements of this species).
Grey-headed Flying Fox	■ Maximum possible retention of existing vegetation within development areas. ■ Landscape planting of appropriate native species within development areas.
Migratory Shorebirds	■ Limited disturbance to known or likely habitats. ■ No recreational activity proposed within or adjacent to preferred habitats, which are located on the landward side of the island, and primarily comprise tidal mudflats.
Oceanic avifauna	■ There will be no direct impact on the habitats of greatest significance to this group. ■ A suite of EMP's will be developed which will establish formal controls (and response measures) for potential sources of sedimentation, nutrient enrichment, chemical and physical pollutants.
Marine Mammals	■ Avoidance of direct impacts on the habitat of this group. ■ Development and implementation of an Erosion and Sediment Control Plan (prepared in accordance with Soil Erosion and Sediment Control, Engineering Guidelines for Queensland Construction Sites, 1996). ■ Preparation and implementation of a Stormwater Management Plan based on WSUD principles that is integrated with the Erosion and Sediment Control Plan ■ Development and implementation of an acid sulfate soil management plan ■ The use and storage of hazardous substances according to their recommendations and specifications (eg MSDS). ■ Fuel storage areas should be constructed according to the standards set out by the Australian Petroleum Institute. ■ Hazardous materials management plans will be developed for both construction and operation of the development. Storage, handling and transport will be in accordance with Australian Standards and accepted best practice (GHD 2006). ■ Maintaining a 100m buffer zone between HAT and housing within Colosseum Inlet and Boyne Creek to act as a buffer zone between residences and estuarine wetlands. This buffer zone will also raise house levels above the mangrove canopy eliminating the likely illegal clearing of mangroves for views. ■ Clear interpretative signage will be placed on all boat ramps with maps of seagrass meadow locations within the estuarine system and also the likely risks of Dugong and turtle collisions within these areas to increase public knowledge of potential harm that may occur from boat propeller damage; ■ Speed restrictions will be recommended within Boyne Creek and high trafficked areas of Colosseum Inlet to reduce the occurrence of boat strike with marine mammals and turtles in areas of seagrass meadows. ■ Work with the Great Barrier Reef Marine Park Authority and the Queensland Boating and Fisheries Patrol to develop and deliver community education on avoiding impact of boat impacts on marine wildlife.

5.3. Likely Impacts on World Heritage Values

Proposed mitigation measures outlined in the Hummock Hill Island EIS will negate or minimise impacts to World Heritage values as outlined in **Table 5-4**.

- **Table 5-4 Potential Impacts and Mitigation Measure for World Heritage Values**

Criteria	Response
N(I) Outstanding examples of stages of earth's history	The proposed action will not impact on any coral reefs or coral cays. It will impact on one of the 600 continental islands of the WHA. Coral reef structures and ecosystems will not be affected directly or indirectly. The proposed Hummock Hill Island development will not affect the geological and scientific information and examples for which the GBR WHA was prescribed. The proposed action will not compromise processes of geological evolution or record of changing sea levels. The geological formation of Hummock Hill Island will not be affected by the proposed development. Other geological features will not be directly or indirectly affected by the proposed development. The presence and distribution of flora and fauna on Hummock Hill Island will not be significantly altered. Data and studies undertaken for the proposed development will provide additional information on the distribution and characteristics of ecosystems and species on Hummock Hill Island.
N(II) Outstanding examples of on-going evolution	The proposed development on Hummock Hill Island will be designed, constructed and managed to ensure that there are no adverse impacts on coastal and aquatic ecosystems or on the geological and geomorphological characteristics of the region that underlie the ecological diversity of the Great Barrier Reef. Coastal and estuarine processes that shape these habitats will not be affected by the proposed development. The value of the reef and its diverse habitats and ecosystems as an example of evolutionary processes or species evolution will not be diminished. The wide range of species (and their habitat) that exist in the habitats offered by the reef ecosystem will not be diminished by the proposed development. The proposed development will almost entirely take place within terrestrial zones of the WHA, the only exceptions being the proposed bridge and boat ramps which will affect about 200m of coastline in total. Clearing of less than 30 % terrestrial ecosystems within the development lease will be required to allow the proposed development to go ahead. A no net loss of vegetation will occur through vegetation off-sets proposed as part of the project and as required under the South east Queensland Regional Vegetation Management Code (2006). A significant proportion of not of concern vegetation will also be retained within the development. Flora and fauna surveys of the Development Lease have not indicated a high proportion of listed rare and threatened species, nor any particularly unusual assemblages of species. Nearby terrestrial islands (Wild Cattle Island) and coastal mainland areas are protected as National Parks, providing protection for examples of terrestrial flora and fauna recognised in the World Heritage listing. Hummock Hill Island does not support a unique biodiversity. There are no flora or fauna known to be endemic to the island, and patterns of vegetation and fauna assemblages mirror those of the adjacent mainland. Batianoff and Dillewaard (1996) investigated the flora of Great Barrier Reef Continental Islands, with some surprising results, including the following: There are only three endemic species across the entire Great Barrier Reef Marine Park, of a total of 2195 species known from the continental islands. The vast

Criteria	Response
	majority of the continental island flora (99.86%) is also represented on the mainland; There are low levels of dissimilarity (in terms of species composition) between and across continental islands of the Great Barrier Reef, spanning from the wet tropics south to the Capricorn region. There are three regional ecosystems on Hummock Hill Island which are restricted (in terms of extent) within the subregion or region, namely RE 12.2.7 (Broad-leaved Paperbark on sand), RE 12.12.8 (Silver-leaved Ironbark on Igneous Rocks) and RE 12.3.10 (Poplar Box on alluvium). RE 12.2.7 and RE 12.12.8 are relatively extensive at the bioregional (Southeast Queensland [SEQ]) level, however, RE 12.3.10 is restricted in its occurrence in SEQ, and is generally restricted to the overlap zone between SEQ and the Brigalow Belt Bioregion. *Eucalyptus populnea* is one of the species characteristic of the broad overlap between the Southeast Queensland and Brigalow Belt bioregions, and is a dominant component of numerous RE's in the Brigalow Belt Bioregion, including RE 11.3.2, 11.3.17, 11.3.18, 11.4.2, 11.4.2, 11.4.7, 11.4.12, 11.5.3, 11.5.13 and 11.9.7. While the northern beaches of Hummock Hill Island appear suitable for turtle breeding and egg laying, there is evidence that turtles use these beaches infrequently and at low densities. Beaches on the Island will not be directly impacted by the development, and techniques have been successfully used at other locations to ensure that public access to turtle breeding beaches does not affect breeding, egg laying and egg hatching components of the turtle life cycle. The proposed action will not impact on the heterogeneity and interconnectivity of the reef assemblage, ongoing processes of accretion and erosion of coral reefs, sand banks and coral cays, erosion and deposition processes along the coastline, river deltas and estuaries and continental islands. The proposed action will not impact on the Halimeda. The proposed action will not modify or remove evidence of the dispersion and evolution of hard corals and associated flora and fauna from the "Indo-West Pacific centre of diversity" along the north-south extent of the reef. The proposed action will not sever inter-connections with the Wet Tropics via the coastal interface and Lord Howe Island via the East Australia current. The proposed action will not compromise any populations of indigenous temperate species derived from tropical species. The proposed action will not adversely impact living coral colonies, including inshore coral communities of southern reefs. The diversity of flora and fauna will not be diminished by the proposed action, which seeks to conserve a representative suite of vegetation and habitat types across the island. The integrity of the inter-connections between reef and island networks in terms of dispersion, recruitment, and the subsequent gene flow taxa will not be compromised. Processes of dispersal, colonisation and establishment of plant communities within the context of island biogeography (e.g. dispersal of seeds by air, sea and vectors such as birds are examples of dispersion, colonisation and succession) will not be compromised. The proposed action will not interfere with the process of speciation. Mangrove and seagrass flora will not be adversely impacted by the proposed action; and The proposed action will not impact adversely on the feeding and/or breeding grounds for international migratory seabirds, cetaceans or sea turtles.
N(III) Contains	The proposed development on Hummock Hill Island will be visible from the air. Hummock Hill Island is visible from a few locations on the mainland and also to

Criteria	Response
superlative natural phenomena	boat traffic passing to seaward of the Island. However the Island faces the main channel into the port of Gladstone and forms part of the general landscape that is dominated by large industrial structures of Gladstone and Boyne Island as well as large ships using Gladstone Port. Proposed mitigation and strict controls over the built form will minimise potential visual impacts to the Island. Some aspects of the development will be visible in views within and to the World Heritage Area. The potential visual impacts of the proposed development on viewers from air, sea and land positions will be controlled through proposed visual impact mitigation measures and strict building controls. No "superlative natural phenomena" are expected to be impacted by the proposed development on Hummock Hill Island.
N(IV) Important habitats for conservation of biological diversity	As discussed above, the proposed development will be designed and constructed to ensure that impacts are contained within the development lease. Thus, coastal and aquatic ecosystems, and the individual species within these ecosystems are not expected to be directly or indirectly impacted by the proposed development. Detailed investigations into human settlement, infrastructure and services to be provided as part of the proposed development will identify the measures required to ensure that adverse impacts on coastal and aquatic ecosystems do not occur as a result of the proposed development. As discussed above, clearing of about 313 ha of terrestrial vegetation will be required. This will not affect any of the identified bioregions of the WHA (Map of bioregions in the GBRWHA - <*http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/rep_areas/documents/bioregions_2001_06.pdf*>) Hummock Hill Island lies wholly within Bioregion NA3 – High Nutrients Coastal Strip: Terrigenous Mud and high levels of nutrients from adjoining land. Seagrasses in sheltered sites only. Good turtle and dugong feeding habitat. Wet tropical influence for much of the coast [note that the wet tropics region does not extend as far south as Hummock Hill Island].

5.4. Likely Impacts on Listed Threatened Species and Communities

Proposed mitigation measures outlined in the Hummock Hill Island EIS will negate or minimise impacts to listed threatened species as outlined in **Table 5-5**.

In accordance with the EPBC Act Policy Statement 1.1, an action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population,
- or reduce the area of occupancy of the species, or fragment an existing population into two or more populations,
- or adversely affect habitat critical to the survival of a species,
- or disrupt the breeding cycle of a population, or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat, or interfere with the recovery of the species.

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- lead to a long-term decrease in the size of an important population of a species,
- or reduce the area of occupancy of an important population, or
- fragment an existing important population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of an important population, or
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat, or
- interferes substantially with the recovery of the species.

An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal,
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

- **Table 5-5 Listed Threatened Species Impacts and Mitigation Measures**

Common Name	Habitat Requirements	Discussion of Likely Impacts (after mitigation)
Yakka Skink	Queensland Museum (unpub. report): common in rabbit warrens within Mulga associations on deep red earths; favours Poplar box on duplex soils within the Brigalow Belt, often concealed in areas of tunnel erosion; within other woodland/open forest communities, such as those dominated by Brigalow or Callitris sp., it uses fallen timber for shelter. The species is alert & extremely secretive, taking shelter at the early approach of danger. DEH (2006): Usually found in open dry sclerophyll forest or woodland. Skinks often take refuge among dense ground vegetation, hollow logs, cavities in soil-bound root systems of fallen trees and beneath rocks. Alternatively, skinks may also excavate burrow systems among low vegetation. Like many other Egernia species, the skinks defecate in a pile near shelter sites. Wilson (2005): Dry, open forests and woodlands, particularly rocky areas. Lives in communal burrows under heaped dead timber, and in deep rock crevices. Presence indicated by communal defecation site.	Not recorded in area based on several previous surveys. There may be no impact on this species. Should it occur on the island it will incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species. If this species currently uses the island, it is likely to continue to do so post-development.
Loggerhead Turtle	Marques 1990: This species has a global distribution throughout tropical, sub-tropical and temperate waters. Nesting is mainly concentrated on subtropical beaches. Prince 1994b; Limpus et al 1992, 1995a: It occurs in the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. Cogger et al 1993: It has been recorded in the coastal waters of all states. Adults and large juveniles, greater than 70 cm curved carapace length (Limpus *et al.* 1994a) occur in waters with both hard and soft substrates including rocky and coral reefs (Limpus *et al.* 1984b), muddy bays (Conway 1994), sandflats, estuaries and seagrass meadows (Limpus *et al.* 1994a; Preen 1996; McCauley & Bjorndal 1999).	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures; ■ shielding; ■ redirecting the light source; ■ physically lowering the light, and ■ recessing so the light does not reach the beach.

Common Name	Habitat Requirements	Discussion of Likely Impacts (after mitigation)
Green Turtle	Marques 1990; Bowen et a 1992; Marques 1990: Green Turtles are found in tropical and subtropical waters throughout the world but normally remain within the northern and southern limits of the 20°C isotherms. Cogger et al 1993: Individuals stray into temperate waters. Limpus et al 1984b: In the southern GBR major nesting occurs in the Capricorn Bunker Group of Islands. Musick & Limpus 1997; Limpus & Reed 1985b; Limpus et al 1994a; Whiting 2000a: At a size between 30 and 40 cm curved carapace length they move to shallow benthic foraging habitat containing seagrass and/ or algae. These habitats include coral and rocky reefs, and inshore seagrass beds.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures; ■ shielding; ■ redirecting the light source; ■ physically lowering the light, and ■ recessing so the light does not reach the beach.
Leathery Turtle. Leatherback Turtle, Luth	Cogger et al 1993: This species has the widest distribution of any marine turtle, occurring from the North Sea and the Gulf of Alaska in the Northern Hemisphere, to Chile and New Zealand in the Southern Hemisphere. Marquez 1990: The Leatherback Turtle is a pelagic feeder, found in tropical, subtropical and temperate waters throughout the world. Nesting is mainly confined to tropical beaches although some nesting occurs on subtropical beaches. Cogger et al 1993: It has been recorded feeding in the coastal waters of all Australian States. Limpus & McLachlan 1979, 1994; Limpus *et al.* 1984b: No major nesting has been recorded in Aust., although scattered isolated nesting (1-3 nests per annum) occurs in southern Qld. Lazell 1980; Musick & Limpus 1997: Large juvenile and adult turtles are found in both pelagic and coastal waters from tropical to temperate and boreal waters.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures; ■ shielding; ■ redirecting the light source;

Common Name	Habitat Requirements	Discussion of Likely Impacts (after mitigation)
	Limpus & McLachlan 1979, 1994: In Aust., they occur in the temperate waters of NSW, Vic., Tas. and WA.	■ physically lowering the light, and ■ recessing so the light does not reach the beach.
Hawksbill Turtle	Marquez 1990: Hawksbill Turtles are found in tropical, subtropical and temperate waters in all the oceans of the world. Nesting is mainly confined to tropical beaches. Broderick *et al.* 1994: In Aust. there are two nesting populations (Great Barrier Reef (GBR)/Arnhem Land and NW Shelf) that are genetically distinct from each other and from populations in other countries, indicating little interbreeding between populations. Major nesting in Aust. occurs at Varanus I. and Rosemary I. in WA (Prince 1993, 1994b), and in the northern GBR and Torres Strait (Limpus *et al.* 1989; Dobbs *et al.* 1999). Limpus et al 1994e; Carr 1987b: Post-hatchling turtles spend several years in the pelagic environment often in association with rafts of *Sargassum*. Limpus 1992; Whiting 2000; Witzell 1983: Once Hawksbill Turtles reach 30-40 cm curved carapace length they enter benthic foraging habitat on coral and rocky reefs habitat in tropical and subtropical waters (sometimes temperate waters) where they will remain for decades. Witzell 1983: Nesting habitat is mostly on tropical beaches.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures; ■ shielding; ■ redirecting the light source; ■ physically lowering the light, and ■ recessing so the light does not reach the beach.
Pacific Ridley, Olive Ridley	Marquez 1990: The species is found in tropical and subtropical waters throughout the world. Large nesting aggregations are found in the eastern Pacific and in India. Cogger & Lindner 1969; Guinea 1990, 1994c; Chatto 1998: No concentrated nesting has been found in Aust., although low density nesting occurs along the Arnhem Land coast of the NT, including the Crocodile, McCluer and Wessel Is, Grant I. and Coburg Peninsula. Env. Aust. 1998: Irregular nesting in eastern Qld and NSW. Musick & Limpus 1997: Large juveniles and adults of this species have been recorded in both benthic and pelagic foraging habitats. Limpus 1995a: Nesting occurs mainly on the beaches of inshore islands in Arnhem Land and the Gulf of Carpentaria.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures;

Common Name	Habitat Requirements	Discussion of Likely Impacts (after mitigation)
		■ shielding; ■ redirecting the light source; ■ physically lowering the light, and ■ recessing so the light does not reach the beach.
Flatback Turtle	Spring 1982; Zangerl *et al.* 1988: This species is found only in the tropical waters of northern Aust. and PNG and Irian Jaya and is one of only two species of sea turtle without a global distribution. Limpus 1995a; Limpus *et al.* 1981, 1983b; Prince 1994b: Nesting is confined to Aust. and six major aggregations are recognised. These include: the southern GBR, north eastern Gulf of Carpentaria, southern Gulf of Carpentaria, western Arnhem Land and the Kimberley region of WA, and the NW shelf, WA around Barrow I. Limpus 1971; Limpus *et al.* 1981, 1983b: In southern Qld nesting occurs at Peak, Wild Duck and Curtis Is. Walker & Parmenter 1990: Post-hatchlings and juveniles do not have the wide dispersal phase in the oceanic environment like other sea turtles. Spring 1982; Zangerl *et al.* 1988: Adults inhabit soft bottom habitat over the continental shelf of northern Australia, extending into PNG and Irian Jaya although the extent of their range is not fully known. Robins 1995: Capture locations from trawlers indicate that Flatbacks feed in turbid, shallow inshore waters N of latitude 25°S in depths from less than 10 m to depths of over 40 m. Limpus 1995a: Nesting habitat includes sandy beaches in the tropics and subtropics with sand temperatures between 25°C and 3°C at nest depth.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures; ■ shielding; ■ redirecting the light source; ■ physically lowering the light, and ■ recessing so the light does not reach the beach.
Southern Squatter Pigeon	Houston, Melzer and Black (2005): Squatter Pigeons favour sparse grassy woodlands near water. It is a ground-nesting species. HANZAB (1990-2006): Ground foraging within open dry sclerophyll woodlands. Appear to prefer areas of sandy soil dissected by low gravelly ridges, with sparse, short grass cover to allow ease of movement. Less common on heavier soils with dense cover of grasses. Nearly always near permanent water. Ground nesting sometimes sheltered by vegetation comprising short dry grass, grass tussocks or bushes.	Not recorded in area based on several previous surveys. There may be no impact on this species. Should it occur on the island it will incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species. If this species currently uses the island, it is likely to continue to do so post-development.

Common Name	Habitat Requirements	Discussion of Likely Impacts (after mitigation)
	QDNR (2001): Dry woodland and open woodland close to permanent water, with ground cover of grasses varying in height and structure, although tending to avoid dense grass cover. The species displays a preference for sandy soils dissected by low gravelly ridges, which support a cover of open and short grasses. Also occurs on sown grasslands and pastures with scattered trees.	
Southern Giant-Petrel	DEH 2006: Within Australia, the Southern Giant Petrel is limited to breeding colonies on Heard and Macquarie Is. and in Australian Antarctic Territory. Beyond Australia it breeds on islands in the Southern Pacific, Indian and Atlantic Oceans, at Cape Horn and on the Antarctic Peninsula. Environment Australia 2001: Southern Giant-Petrels range widely throughout the southern oceans however their distribution is variable seasonally. In summer they occur predominantly in sub-Antarctic to Antarctic waters, usually below 60° S in the South Pacific and south-east Indian Oceans, or 53° S in the Heard Island and Macquarie Island regions. Some adults are mainly sedentary, remaining close to their breeding islands throughout the year. In winter they are rare in the southern waters of the Indian Ocean, and more common off South America, South Africa, Australia and New Zealand. Marchant and Higgins 1990: The waters off south-east Australia may be particularly important wintering grounds.	This is an oceanic species which nests on remote islands and forages in waters at the Continental Shelf. It is therefore unlikely to be adversely impacted by the proposal.
Kermadec Petrel (Western)	Marchant and Higgins 1990: Breeding on islands across southern Pacific Ocean from Easter I. west to Lord Howe I. Foraging in tropical and subtropical Pacific Ocean, both north and south of equator. No historical estimates of population size in Australian territory, but sub-population on Raoul I., N. Z. was estimated at 500,000 in 1908, and is now virtually extinct. The Kermadec Petrel breeds on high islands among rocks and vegetation, and forages far out to sea, taking cephalopods and crustaceans from waters of 15-25°C. Fullagar and Disney 1975: Species is now extinct from Lord Howe I. Merton 1970: Its nests are generally on the ground, so are particularly vulnerable to predation.	This is an oceanic species which nests on remote islands and forages in waters at the Continental Shelf. It is therefore unlikely to be adversely impacted by the proposal.
Red Goshawk	EPA (2006): The red goshawk has an enormous home range covering between 50 and 220 km^2. It prefers a mix of vegetation types with its	Not recorded in area based on several previous surveys. There may be no impact on this species. Should it occur on the island it will incur the loss of

Common Name	Habitat Requirements	Discussion of Likely Impacts (after mitigation)
	habitat including tall open forest, woodland, lightly treed savannah and the edge of rainforest. For a nest, it builds a large platform of dead sticks lined with twigs and green leaves. The nest is located in an exposed fork in the top of a living tree between 10 and 20 m above the ground. The same nest sites are used each year. HANZAB (1990-2006): Open wooded and forested lands, coastal and sub coastal. Prefer forest with a mosaic of vegetation types, large populations of birds and permanent water; riverine vegetation much used. Forests of intermediate density favoured, or ecotones between habitats of different densities e.g. rainforest-eucalypt, gallery forest-woodland, woodland-grasslands. Avoid either very dense or very open habitats. Nest in tall trees within 1km of, or beside, permanent water, usually in open, biologically rich forest or woodland.	habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species. If this species currently uses the island, it is likely to continue to do so post-development.
Australian Painted Snipe	DEH 2003a: The Australian Painted Snipe is usually found in shallow inland wetlands, either freshwater or brackish, that are either permanently or temporarily filled. It is a cryptic bird that is hard to see and often overlooked. Usually only single birds are seen, though larger groups of up to 30 have been recorded. It nests on the ground amongst tall reed-like vegetation near water, and feeds near the water's edge and on mudflats, taking invertebrates, such as insects and worms, and seeds. The species has a scattered distribution throughout many parts of Australia, with a single record from Tasmania. Though some individuals are apparently resident in some areas, other individuals appear to be nomadic, temporarily occupying areas where suitable habitat exists. The Murray–Darling drainage system appears to have been a key area for this species, as many records of this species come from this region. Although the Australian Painted Snipe can occur across Australia, the areas of most sensitivity to the species are those wetlands where the birds frequently occur and are known to breed.	Not recorded in area based on several previous surveys. There may be no impact on this species. No suitable habitat will be impacted by the proposed development.
Black-breasted quail	Department of Environment and Conservation New South Wales 2005: Regularly found in south-east Queensland, where it extends to the western slopes and north to coastal Bundaberg. In north-east NSW, there are few reliable records, all north of the Bruxner Highway and east of the Great Divide. Prefers drier rainforests and viney scrubs, often in association with Hoop Pine and a deep, moist leaf litter layer. During drought the bird may	Species has been indirectly observed through the presence of characteristic platelets on site in several surveys. No direct impact will occur through the proposed development.

Common Name	Habitat Requirements	Discussion of Likely Impacts (after mitigation)
	move into adjacent wetter rainforests. Garnett 1992: The Black-breasted Button-quail is patchily distributed in coastal and sub-coastal valleys from Rockhampton in Queensland to northern NSW. The species has been recorded at only 50 sites over its contracted range, with a total population estimated at less than 2000 individuals. Marchant & Higgins 1993: In dry rainforest, vine scrub and Lantana thickets, the Black-breasted Button-quail is considered a rare vagrant, especially in the southern part of its range.	
Blue Whale	Yochem & Leatherwood 1985: The most aggregations of blue whales are generally associated with feeding areas. This has been confirmed in observations in the Channel Islands off California by Fiedler et al. (1998), in the southern Chilean fjords by Thiele et al (1998), in the Antarctic and off Southern Hemisphere continents (Kato et al. 1995, 1996; Thiele et al. 2000), and off south-east Australia (Gill 2002; Gill & Morrice 2003) and south-west Australia (McCauley et al. 2001). DEH 2006: Sighting records indicate that the species may occur right around Australia. Blue whales have been seen from the northern tip of Western Australia, down the west coast, through the Great Australian Bight, around the Victorian coast, throughout Bass Strait and off Tasmania, and along the continental shelf of eastern Australia to southern Queensland. Strandings have been recorded in Victoria, South Australia, Tasmania, Western Australia and Queensland (Bannister et al. 1996).	This is an oceanic species which is unlikely to occur in near coastal waters. It is therefore unlikely to be adversely impacted by the proposal.
Large-eared Pied Bat, Large Pied Bat	Department of Environment and Conservation NSW 2005c: The species is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. The species roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Hirundo ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same	Not recorded in area based on several previous surveys. There may be no impact on this species. Should it occur on the island it will incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species. If this species currently uses the island, it is likely to continue to do so post-development.

Common Name	Habitat Requirements	Discussion of Likely Impacts (after mitigation)
	cave over many years. The species is also found in well-timbered areas containing gullies.	
Northern Quoll	DEH 2005: Historically the Northern Quoll was common across northern Australia occurring almost continuously from the Pilbara, Western Australia to near Brisbane, Queensland. The species' preferred habitat consists of rocky escarpment, open forest and open woodland. The species was once found from north of Brisbane right across to the northern WA coast. It is now reduced to small populations in the Northern Territory's (NT) Top End, WA's Kimberley and Pilbara regions, and Queensland's Cape York, Wet Tropics and a small area just north of Brisbane. Braithwaite ad Griffiths 1994: A 75% reduction in the Northern Quoll's range between 1900-1990 has been suggested such that, during this time, the Northern Quoll has been reduced to six major geographical centres: Drummond Range, central Queensland; wet tropics Northern Queensland; northern Cape York Peninsula; northern and western Top End, Northern Territory; north Kimberley and Pilbara, Western Australia. The Northern Quoll is absent from Bathurst and Melville Islands but present on other smaller islands.	Not recorded in area based on several previous surveys. There may be no impact on this species. Should it occur on the island it will incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species. If this species currently uses the island, it is likely to continue to do so post-development.
Humpback Whale	Bannister et al. 1996: Humpback whales are distributed throughout Australian Antarctic waters, and Commonwealth offshore waters, and have been sighted in all State waters and recently in the Northern Territory. Simmons & Marsh 1986: Humpback whales have been sighted in the northern waters of the Great Barrier Reef (GBR) between October and January. Chaloupka and Osmond 1999: During the southern migration a large number of whales on the east coast use Hervey Bay and the Whitsundays as resting areas. Humpback whale feeding primarily occurs in Antarctic waters south of about 55°S. Bannister and Hedley 2001: In general, most feeding occurs between 70°E and 130°E for west coast population, and 130°E and 170°W for the east coast population. Vang 2002: Some feeding behaviour has also been reported near mainland Australia i.e. off Fraser Island, Qld. Warneke 1995: Feeding may also occur in northern waters of the Great Barrier Reef and in Victoria as sightings of humpbacks have been reported	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures.

Common Name	Habitat Requirements	Discussion of Likely Impacts (after mitigation)
	in summer months. Calving occurs in tropical coastal waters However, exact locations have not yet been identified and births are rarely observed.	
Water Mouse, False Water Rat	DEH 2003: The False Water Rat lives near shallow water close to the coast. It forages in mangrove forests for small crabs, shellfish and worms. The only known False Water Rat populations in Australia are in coastal areas of the Northern Territory and Queensland. It is found in coastal wetlands such as lagoons, swamps and sedged lakes close to fore dunes. It forages amongst the mangroves at night when the tide is low, and when the tide rises it returns to the adjacent sedgelands for shelter. The False Water Rat builds large mud nests like termite mounds, up to 60 centimetres high and usually in areas where they can escape the highest of tides. They often use exposed tree roots to form the foundation for the mounds.	Not recorded in area based on several previous surveys. There may be no impact on this species. No suitable habitat will be impacted by the proposed development.
Whale Shark	DEH 2005b: Whale sharks have a broad distribution in tropical and warm temperate seas. In Australian waters, they are known to aggregate at Ningaloo Reef and in the Coral Sea. The whale shark is a highly migratory fish and only visits Australian waters seasonally. Pogonoski, Pollard and Paxton 2002: Whale Sharks are known to occur in New South Wales, Queensland, Northern Territory, Western Australia, Christmas Island, Indian ocean and occasionally South Australia and Victoria. Norman, 2004: In Australian waters, Whale Sharks seasonally aggregate in coastal waters off Ningaloo Reef between March and July each year, at Christmas Island between December and January, and in the Coral Sea between November and December.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures.

5.5. Likely Impacts on Listed Migratory Species

Proposed mitigation measures outlined in the Hummock Hill Island EIS will negate or minimise impacts to listed migratory species as outlined in **Table 5-6**.

In accordance with the EPBC Act Policy Statement 1.1, an action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

1) habitat by a migratory species occasionally or periodically within a region that supports an *ecologically significant proportion* of the population of the species, or
2) habitat by a migratory species which is at the limit of the species range, or
3) habitat within an area where the species is declining.

- **Table 5-6 Listed Migratory Species Impacts and Mitigation**

Common Name	Habitat Requirements	Discussion of likely impacts
White-bellied Sea-Eagle	Australian Museum Online 2003a: White-bellied Sea-Eagles are a common sight in coastal and near coastal areas of Australia. Birds form permanent pairs that inhabit territories throughout the year. They have a loud "goose-like" honking call. Birds are normally seen, perched high in a tree, or soaring over waterways and adjacent land.	This species may incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species. Exclusion zones can be established around any nest sites which are discovered during future site works if required. Areas of important habitat (within the meaning of the EPBC Act 1999) not known from the island.
White-throated Needletail	Australian Museum Online 2003b: White-throated Needletails often occur in large numbers over eastern and northern Australia. They arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. They are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity. White-throated Needletails are non-breeding migrants in Australia. Breeding takes place in northern Asia from May to August.	This species may incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species.
Barn Swallow	Ubiquitous, exploiting a wide variety of habitats across open country, cultivated land and urban areas.	This species may incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species.
Rainbow Bee-eater	Australian Museum 2006a: The Rainbow Bee-eater is found throughout mainland Australia, as well as eastern Indonesia, New Guinea and, rarely, the Solomon Islands. In Australia it is widespread, except in desert areas, and breeds throughout most of its range, although southern birds move north to breed. The Rainbow Bee-eater is most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels.	This species may incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species.
Black-faced Monarch	Australian Museum 2006b: The Black-faced Monarch is found along the coast of eastern Australia, becoming less common further south. The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal	This species may incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped,

Common Name	Habitat Requirements	Discussion of likely impacts
	scrub and damp gullies. It may be found in more open woodland when migrating. Resident in the north of its range, but is a summer breeding migrant to coastal south-eastern Australia, arriving in September and returning northwards in March. It may also migrate to Papua New Guinea in autumn and winter.	and the balance area is suitable for this species.
Spectacled Monarch	Australian Museum 2006c: The Spectacled Monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. It is also found in Papua New Guinea, the Moluccas and Timor. The Spectacled Monarch prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	This species may incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species.
Satin Flycatcher	Australian Museum 2006d: The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. It is also found in New Guinea. The Satin Flycatcher is not a commonly seen species, especially in the far south of its range, where it is a summer breeding migrant. The Satin Flycatcher is found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. The Satin Flycatcher is a migratory species, moving northwards in winter to northern Queensland and Papua New Guinea, returning south to breed in spring.	This species may incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species.
Rufous Fantail	Australian Museum 2006e: The Rufous Fantail is found in northern and eastern coastal Australia, being more common in the north. It is also foind in New Guinea, the Solomon Islands, Sulawesi and Guam. The Rufous Fantail is found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas.	This species may incur the loss of habitat across the development area. However, a substantial proportion of the island will remain undeveloped, and the balance area is suitable for this species.
Latham's Snipe, Japanese Snipe	Australian Museum 2006f: Latham's Snipe is a non-breeding migrant to the south east of Australia including Tasmania, passing through the north and New Guinea on passage. Latham's Snipe breed in Japan and on the east Asian mainland. Latham's Snipe are seen in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on	Habitat for this species will remain unaffected by the proposed action.

Common Name	Habitat Requirements	Discussion of likely impacts
	migration. They also use crops and pasture. Latham's Snipe is a migratory wader, moving to Australia in our warmer months. Birds may fly directly between Japan and Australia, stopping at a few staging areas. They leave their breeding areas from August to November, arriving in Australia mainly in September. They leave the south-east by the end of February, moving northwards along the coast. Most have left Queensland by mid-April.	
Australian Cotton Pygmy-goose	Marchant & Higgins 1990: The Cotton Pygmy-goose is a rare vagrant in the southern part of its range on the north coast of NSW. However, the species is relatively common on lily-covered lagoons, dams and ponds in north-eastern Queensland. Preferred habitat is deep freshwater lagoons, swamps and dams, particularly those with waterlilies or other floating vegetation, such as hydrilla, ceratophyllum, vallisneria, najas, lemna and chara. NSWNPWS 1999a: The Cotton Pygmy-goose is an almost entirely aquatic species. Grazing may benefit the species by reducing the number of dense reeds and encouraging the growth of open diverse freshwater aquatic emergents. Beruldsen 1977: The species tends to avoid running water where deep–water vegetation cannot grow. The species requires dead trees with hollows near water for nesting and roosting sites.	Habitat for this species will remain unaffected by the proposed action.
Little Curlew, Little Whimbrel	Australian Museum 2006g: The species is widespread in the north of Australia and scattered elsewhere. Little Curlews may gather in large flocks on coastal and inland grasslands and black soil plains in northern Australia, near swamps and flooded areas. They also feed on playing fields, paddocks and urban lawns. Little Curlews breed in Siberia, moving south to the non-breeding areas in northern Australia and southern New Guinea. They are dispersive in Australia, probably in response to rainfall. They arrive in the north from mid to late September, then disperse, leaving again mainly in early April.	Habitat for this species will remain unaffected by the proposed action.
Painted Snipe	NSW NPWS 1999b: The Painted Snipe has a scattered distribution in Australia. This species primarily occurs along the east coast from north Queensland (excluding Cape York) to the Eyre Peninsula in South Australia, including the majority of Victoria and NSW.	Habitat for this species will remain unaffected by the proposed action.

Common Name	Habitat Requirements	Discussion of likely impacts
	Marchant & Higgins 1993: Scattered records indicate that it may also occur in western Queensland, throughout Western Australia and the Northern Territory. A single record is known from Tasmania. Individuals have also been known to use artificial habitats, such as sewage ponds, dams and waterlogged grassland. The Painted Snipe nests on the ground amongst tall vegetation, such as grass tussocks or reeds. Nests are often located on small islands.	
Southern Giant-Petrel	DEH 2006: Within Australia, the Southern Giant Petrel is limited to breeding colonies on Heard and Maquarie Is. and in Australian Antarctic Territory. Beyond Australia it breeds on islands in the Southern Pacific, Indian and Atlantic Oceans, at Cape Horn and on the Antarctic Peninsula. Environment Australia 2001: Southern Giant-Petrels range widely throughout the southern oceans however their distribution is variable seasonally. In summer they occur predominantly in sub-Antarctic to Antarctic waters, usually below 60° S in the South Pacific and south-east Indian Oceans, or 53° S in the Heard Island and Macquarie Island regions. Some adults are mainly sedentary, remaining close to their breeding islands throughout the year. In winter they are rare in the southern waters of the Indian Ocean, and more common off South America, South Africa, Australia and New Zealand. Marchant and Higgins 1990: The waters off south-east Australia may be particularly important wintering grounds.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures.
Bryde's Whale	Bannister, Kemper & Warneke 1996: The least migratory balaenopterid, restricted to tropical and temperate waters, from the equator to ca 40°S. Recorded in all Australian states except Northern Territory. The species is found in temperate to tropical waters, both oceanic and inshore, bounded by latitudes 40°N and S, or the 20°isotherm. In Indian Ocean, concentrations found south-west of Indonesia, and off Australian west coast; in west Pacific, concentrations off Queensland, south-east of PNG, and between Solomons and New Zealand.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones.
Blue Whale	Yochem & Leatherwood 1985: The most aggregations of blue whales are generally associated with feeding areas. This has been confirmed in observations in the Channel Islands off California by Fiedler et al. (1998), in	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps

Common Name	Habitat Requirements	Discussion of likely impacts
	the southern Chilean fjords by Thiele et al (1998), in the Antarctic and off Southern Hemisphere continents (Kato et al. 1995, 1996; Thiele et al. 2000), and off south-east Australia (Gill 2002; Gill & Morrice 2003) and south-west Australia (McCauley et al. 2001). DEH 2006: Sighting records indicate that the species may occur right around Australia. Blue whales have been seen from the northern tip of Western Australia, down the west coast, through the Great Australian Bight, around the Victorian coast, throughout Bass Strait and off Tasmania, and along the continental shelf of eastern Australia to southern Queensland. Strandings have been recorded in Victoria, South Australia, Tasmania, Western Australia and Queensland (Bannister et al. 1996).	and speed control zones.
Dugong	Australian Museum 2003h: The dugong is found over a broad range of the coastal and inland waters of the western Indo-Pacific region. In Australia, they occur in an arc from Morton Bay in southern Queensland across northern Australia to Shark bay in northern Western Australia. They prefer wide shallow bays and areas protected by large inshore islands. Vagrant animals will occasionally appear as far south as southern New South Wales and near Perth in Western Australia. DECNSW 2005b: Major concentrations of Dugongs occur in wide shallow protected bays, wide shallow mangrove channels and in the lee of large inshore islands. The species will also occupy deeper waters if their sea grass food is available. They have a low reproductive rate. Shallow waters such as tidal sandbanks and estuaries have been reported as sites for calving.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones.
Humpback Whale	Bannister et al. 1996: Humpback whales are distributed throughout Australian Antarctic waters, and Commonwealth offshore waters, and have been sighted in all State waters and recently in the Northern Territory. Simmons & Marsh 1986: Humpback whales have been sighted in the northern waters of the Great Barrier Reef (GBR) between October and January. Chaloupka and Osmond 1999: During the southern migration a large number of whales on the east coast use Hervey Bay and the Whitsundays as resting areas. Humpback whale feeding primarily occurs in Antarctic	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones.

Common Name	Habitat Requirements	Discussion of likely impacts
	waters south of about 55°S. Bannister and Hedley 2001: In general, most feeding occurs between 70°E and 130°E for west coast population, and 130°E and 170°W for the east coast population. Vang 2002: Some feeding behaviour has also been reported near mainland Australia i.e. off Fraser Island, Qld. Warneke 1995: Feeding may also occur in northern waters of the Great Barrier Reef and in Victoria as sightings of humpbacks have been reported in summer months. Calving occurs in tropical coastal waters However, exact locations have not yet been identified and births are rarely observed.	
Irrawaddy Dolphin	Bannister, Kemper & Warneke 1996: Occurs (coastally) from the Bay of Bengal, through the Indo–Malay Archipelago to northern Australia; mainly coastal but in some places up rivers (e.g. Mandalay, Burma, and Lake Murray, PNG). In Australia, reported in Western Australia north of and including Broome (18°S), Northern Territory, and in Queensland, north of Gladstone (23°50'S). The species can be found in coastal, estuarine and riverine habitats in both tropical and subtropical environments. The species is generally found in shallow areas however they may occur several km from shore. There are no key localities known in Australian waters.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones.
Killer Whale, Orca	*Bannister, Kemper & Warneke 1996:* Cosmopolitan, from polar regions to equator in all oceans. Recorded from all states but not Northern Territory. Concentrations believed to occur around Tasmania; sightings frequent in South Australia and Victoria. Frequently seen in the Antarctic south of 60°. Recorded from Heard and Macquarie Islands. Not known to be migratory but seasonal movements may be made, possibly related to food supply. Oceanic, pelagic and neritic, in warm and cold waters. May be more common in cold, deep waters. Off Australia, often seen along continental slope and on shelf. Often seen near seal colonies.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones.
Indo-Pacific Humpback Dolphin	Corkeron et al. 1997: In Australia, the species occurs in northern coastal waters from the NSW-Queenland border to Exmouth Gulf. *Bannister, Kemper & Warneke 1996: The species occurs in c*oastal, estuarine abd occasionally riverine habitats in tropical and subtropical environments. It occurs close to the coast, in less than 20 m depth. Aerial surveys in the Great Barrier Reef region may have located the species in	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones.

Common Name	Habitat Requirements	Discussion of likely impacts
	waters between the outer reef and the mainland, further from shore than has been reported in the literature. Key localities of the species includes Moreton Bay, Queensland and adjacent offshore waters as well as Tin Can Inlet, Great Sandy Strait, Queensland.	
Loggerhead Turtle	Marques 1990: This species has a global distribution throughout tropical, sub-tropical and temperate waters. Nesting is mainly concentrated on subtropical beaches. Prince 1994b; Limpus et al 1992, 1995a: It occurs in the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. Cogger et al 1993: It has been recorded in the coastal waters of all states. Adults and large juveniles, greater than 70 cm curved carapace length (Limpus *et al.* 1994a) occur in waters with both hard and soft substrates including rocky and coral reefs (Limpus *et al.* 1984b), muddy bays (Conway 1994), sandflats, estuaries and seagrass meadows (Limpus *et al.* 1994a; Preen 1996; McCauley & Bjorndal 1999).	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures; ■ shielding; ■ redirecting the light source; ■ physically lowering the light, and ■ recessing so the light does not reach the beach.
Green Turtle	Marques 1990; Bowen et a 1992; Marques 1990: Green Turtles are found in tropical and subtropical waters throughout the world but normally remain within the northern and southern limits of the 20°C isotherms. Cogger et al 1993: Individuals stray into temperate waters. Limpus et al 1984b: In the southern GBR major nesting occurs in the Capricorn Bunker Group of Islands. Musick & Limpus 1997; Limpus & Reed 1985b; Limpus et al 1994a; Whiting 2000a: At a size between 30 and 40 cm curved carapace length they move to shallow benthic foraging habitat containing seagrass and/ or algae. These habitats include coral and rocky reefs, and inshore seagrass beds.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources;

Common Name	Habitat Requirements	Discussion of likely impacts
		▪ wattage reduction; ▪ repositioning lights behind structures; ▪ shielding; ▪ redirecting the light source; ▪ physically lowering the light, and ▪ recessing so the light does not reach the beach.
Estuarine Crocodile, Salt-water Crocodile	EPA 2007: Estuarine crocodiles are found from India, throughout south-east Asia and New Guinea, across to northern Australia, Vanuatu and the Solomon Islands. In Queensland, they are known to occur between Gladstone and Cape York Peninsula, and throughout the Gulf of Carpentaria. Although most commonly seen in tidal reaches of rivers, they also occur in freshwater lagoons, rivers, and swamps hundreds of kilometres inland from the coast. They can even be found along beaches and around offshore islands in the Great Barrier Reef and Torres Strait. Parks and Wildlife Commission of the Northern Territory 2000: Crocodylus porosus inhabits coastal rivers and swamps, the open sea and island shorelines, and extends well inland via major rivers and floodplain billabongs into freshwater rivers, creeks and swamps. They occur in high densities in the tidal portions of some mangrove-lined rivers, particularly those associated with extensive freshwater wetlands or floodplains. Saltwater crocodiles may therefore occur in any salt or fresh water within their range.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ▪ turning off light sources; ▪ wattage reduction; ▪ repositioning lights behind structures; ▪ shielding; ▪ redirecting the light source; ▪ physically lowering the light, and ▪ recessing so the light does not reach the beach.
Leathery Turtle, Leatherback Turtle, Luth	Cogger et al 1993: This species has the widest distribution of any marine turtle, occurring from the North Sea and the Gulf of Alaska in the Northern Hemisphere, to Chile and New Zealand in the Southern Hemisphere. Marquez 1990: The Leatherback Turtle is a pelagic feeder, found in tropical, subtropical and temperate waters throughout the world. Nesting is	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The

Common Name	Habitat Requirements	Discussion of likely impacts
	mainly confined to tropical beaches although some nesting occurs on subtropical beaches. Cogger et al 1993: It has been recorded feeding in the coastal waters of all Australian States. Limpus & McLachlan 1979, 1994; Limpus *et al.* 1984b: No major nesting has been recorded in Aust., although scattered isolated nesting (1-3 nests per annum) occurs in southern Qld. Lazell 1980; Musick & Limpus 1997: Large juvenile and adult turtles are found in both pelagic and coastal waters from tropical to temperate and boreal waters. Limpus & McLachlan 1979, 1994: In Aust., they occur in the temperate waters of NSW, Vic., Tas. and WA.	Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures; ■ shielding; ■ redirecting the light source; ■ physically lowering the light, and ■ recessing so the light does not reach the beach.
Hawksbill Turtle	Marquez 1990: Hawksbill Turtles are found in tropical, subtropical and temperate waters in all the oceans of the world. Nesting is mainly confined to tropical beaches. Broderick *et al.* 1994: In Aust. there are two nesting populations (Great Barrier Reef (GBR)/Arnhem Land and NW Shelf) that are genetically distinct from each other and from populations in other countries, indicating little interbreeding between populations. Major nesting in Aust. occurs at Varanus I. and Rosemary I. in WA (Prince 1993, 1994b), and in the northern GBR and Torres Strait (Limpus *et al.* 1989; Dobbs *et al.* 1999). Limpus et al 1994e; Carr 1987b: Post-hatchling turtles spend several years in the pelagic environment often in association with rafts of *Sargassum*. Limpus 1992; Whiting 2000; Witzell 1983: Once Hawksbill Turtles reach 30-40 cm curved carapace length they enter benthic foraging habitat on coral and rocky reefs habitat in tropical and subtropical waters (sometimes temperate waters) where they will remain for decades. Witzell 1983: Nesting habitat is mostly on tropical beaches.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures; ■ shielding; ■ redirecting the light source; ■ physically lowering the light, and ■ recessing so the light does not reach the beach.
Pacific Ridley, Olive	Marquez 1990: The species is found in tropical and subtropical waters	No direct impacts on this species. Potential indirect impacts can be

Common Name	Habitat Requirements	Discussion of likely impacts
Ridley	throughout the world. Large nesting aggregations are found in the eastern Pacific and in India. Cogger & Lindner 1969; Guinea 1990, 1994c; Chatto 1998: No concentrated nesting has been found in Aust., although low density nesting occurs along the Arnhem Land coast of the NT, including the Crocodile, McCluer and Wessel Is, Grant I. and Coburg Peninsula. Env. Aust. 1998: Irregular nesting in eastern Qld and NSW. Musick & Limpus 1997: Large juveniles and adults of this species have been recorded in both benthic and pelagic foraging habitats. Limpus 1995a: Nesting occurs mainly on the beaches of inshore islands in Arnhem Land and the Gulf of Carpentaria.	effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures; ■ shielding; ■ redirecting the light source; ■ physically lowering the light, and ■ recessing so the light does not reach the beach.
Flatback Turtle	Spring 1982; Zangerl *et al.* 1988: This species is found only in the tropical waters of northern Aust. and PNG and Irian Jaya and is one of only two species of sea turtle without a global distribution. Limpus 1995a; Limpus *et al.* 1981, 1983b; Prince 1994b: Nesting is confined to Aust. and six major aggregations are recognised. These include: the southern GBR, north eastern Gulf of Carpentaria, southern Gulf of Carpentaria, western Arnhem Land and the Kimberley region of WA, and the NW shelf, WA around Barrow I. Limpus 1971; Limpus *et al.* 1981, 1983b: In southern Qld nesting occurs at Peak, Wild Duck and Curtis Is. Walker & Parmenter 1990: Post-hatchlings and juveniles do not have the wide dispersal phase in the oceanic environment like other sea turtles. Spring 1982; Zangerl *et al.* 1988: Adults inhabit soft bottom habitat over the continental shelf of northern Aust., extending into PNG and Irian Jaya although the extent of their range is not fully known. Robins 1995: Capture	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones. Impacts of artificial night lighting require specific consideration. The Proponent will minimise the impacts associated with artificial lighting through a range of methods including: ■ turning off light sources; ■ wattage reduction; ■ repositioning lights behind structures; ■ shielding; ■ redirecting the light source; ■ physically lowering the light, and

Common Name	Habitat Requirements	Discussion of likely impacts
	locations from trawlers indicate that Flatbacks feed in turbid, shallow inshore waters N of latitude 25°S in depths from less than 10 m to depths of over 40 m. Limpus 1995a: Nesting habitat includes sandy beaches in the tropics and subtropics with sand temperatures between 25°C and 3°C at nest depth.	▪ recessing so the light does not reach the beach.
Whale Shark	DEH 2005: Whale sharks have a broad distribution in tropical and warm temperate seas. In Australian waters, they are known to aggregate at Ningaloo Reef and in the Coral Sea. The whale shark is a highly migratory fish and only visits Australian waters seasonally. Pogonoski, Pollard and Paxton 2002: Whale Sharks are known to occur in New South Wales, Queensland, Northern Territory, Western Australia, Christmas Island, Indian ocean and occasionally South Australia and Victoria. Norman, 2004: In Australian waters, Whale Sharks seasonally aggregate in coastal waters off Ningaloo Reef between March and July each year, at Christmas Island between December and January, and in the Coral Sea between November and December.	No direct impacts on this species. Potential indirect impacts can be effectively managed through a suite of standard environmental management measures such as public education signage at boat ramps and speed control zones.

6. Conclusions

The Great Barrier Reef WHA has been inscribed on the World Heritage List on the basis of meeting four Criteria. The Island contains some features that may be considered aligned with the listing criteria as summarised below:

1) An outstanding example of a major stage of the earths evolutionary history;
   - Fringing reefs are absent from the Island together with major evolutionary geological processes or evolutionary history that have isolated unique flora and fauna from mainland populations. The proposed development will not impact the WHA listing under this criterion.
2) An outstanding example representing significant ongoing geological processes, biological evolution and mans interaction with his natural environment;
   - In general features listed under this criterion have limited representation on the Island in the context of the sub-region and/or entire WHA. Surrounding waters do contain features listed under this criterion, such as mangroves and seagrass meadows, the latter being habitat for Dugong and turtles. Impact to these features from the proposed development and human interaction are minimal and do not impact the overall WHA values.
3) Contain unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty;
   - In general unique, rare and superlative natural phenomena listed under this criterion are not represented on the Island in the context of the sub-region and/or entire WHA. In comparison to other areas in the WHA such as the Whitsunday region or Great Keppel Island, Hummock Hill would not be considered "*superlative*". Adjacent waters contain mangroves systems and habitat for dugong and turtles that will have minimal impact from the proposed development following management and mitigation measures; and
4) Provide habitats where populations of rare and endangered species of plants and animals still survive.
   - In general features listed under this criterion have limited representation on the Island in the context of the sub-region and/or entire WHA. Mangroves and seagrass meadows are present in adjacent estuarine and marine waters. Species of conservation significance that have representative habitat on the Island and/or adjacent waters include the black breasted button quail, dugong and marine turtles. Habitat for these species is outside the special lease and development area. Mitigation and management measures proposed for these species will minimise impacts to the WHV.

The proposed action has been considered in the context of potential impacts on the World Heritage Values of the Great Barrier Reef. Although some impact on world heritage values, it is considered unlikely that the proposed action would result in significant adverse impacts on those values.

Several Threatened species listed under the EPBC Act are either known or likely to occur within or adjacent to the study area. The proposed action generally avoids direct impacts on the habitats of those species. Potential indirect impacts can be mitigated effectively through a suite of standard management measures, formalised in s suite of Environmental Management Plans.

Numerous Migratory species are known from the study area, or could occur over time. Based on the best available information, it is considered that there are no important populations of any migratory species on the island. Furthermore, the island does not support an ecologically significant proportion of the population of any migratory species.

Proposed management strategies are considered adequate to mitigate the adverse impacts of the proposed action on matters of national environmental significance, such that a significant adverse impact on those matters is avoided.

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Appendix A World Heritage Values

Values of World Heritage Listed Areas

Criteria	Values
N(I) Outstanding examples of stages of earth's history	The Great Barrier Reef is by far the largest single collection of coral reefs in the world. The World Heritage values of the property include: ■ 2904 coral reefs covering approximately 20,055km^2; ■ 300 coral cays and 600 continental islands; ■ reef morphologies reflecting historical and on-going geomorphic and oceanographic processes; ■ processes of geological evolution linking islands, cays, reefs and changing sea levels, together with sand barriers, deltaic and associated sand dunes; ■ record of sea level changes and the complete history of the reef's evolution are recorded in the reef structure; ■ record of climate history, environmental conditions and processes extending back over several hundred years within old massive corals; ■ formations such as serpentine rocks of South Percy island, intact and active dune systems, undisturbed tidal sediments and "blue holes"; and ■ record of sea level changes reflected in distribution of continental island flora and fauna.
N(II) Outstanding examples of on-going evolution	Biologically the Great Barrier Reef supports the most diverse ecosystem known to human[s] and its enormous diversity is thought to reflect the maturity of an ecosystem, which has evolved over millions of years on the northeast Continental Shelf of Australia. The World Heritage values include: ■ the heterogeneity and interconnectivity of the reef assemblage; ■ size and morphological diversity (elevation ranging from the sea bed to 1142m at Mt. Bowen and a large cross-shelf extent encompass the fullest possible representation of marine environmental processes); ■ on going processes of accretion and erosion of coral reefs, sand banks and coral cays, erosion and deposition processes along the coastline, river deltas and estuaries and continental islands; ■ extensive Halimeda beds representing active calcification and sediment accretion for over 10 000 years; ■ evidence of the dispersion and evolution of hard corals and associated flora and fauna from the "Indo-West Pacific centre of diversity" along the north-south extent of the reef; ■ inter-connections with the Wet Tropics via the coastal interface and Lord Howe Island via the East Australia current; ■ indigenous temperate species derived from tropical species; ■ living coral colonies (including some of the world's oldest); ■ inshore coral communities of southern reefs; ■ five floristic regions identified for continental islands and two for coral cays; ■ the diversity of flora and fauna, including: • Macroalgae (estimated 400-500 species); Porifera (estimated 1500 species, some endemic, mostly undescribed); Cnidaria: Corals - part of the global centre of coral diversity and including: • hexacorals (70 genera and 350 species, including 10 endemic species); • octocorals (80 genera, number of species not yet estimated); • Tunicata: Ascidians (at least 330 species); • Bryozoa (an estimated 300-500 species, many undescribed); • Crustacea (at least 1330 species from 3 subclasses); • Worms: • Polychaetes (estimated 500 species);

Criteria	Values
	• Platyhelminthes: include free-living Tubelleria (number of species not yet estimated), polyclad Tubelleria (up to 300 species) and parasitic helminthes (estimated 1000's of species, most undescribed); • Phytoplankton (a diverse group existing in two broad communities); • Mollusca (between 5000-8000 species); • Echinodermata (estimated 800 extant species, including many rare taxa and type specimens); • fishes (between 1200 and 2000 species from 130 families, with high species diversity and heterogeneity; includes the Whale Shark *Rhynchodon typus*); • seabirds (between 1.4 and 1.7 million seabirds breeding on islands); • marine reptiles (including 6 sea turtle species, 17 sea snake species, and 1 species of crocodile); • marine mammals (including 1 species of dugong (*Dugong dugon*), and 26 species of whales and dolphins); • terrestrial flora: see "Habitats: Islands" and; • terrestrial fauna, including: • invertebrates (pseudoscorpions, mites, ticks, spiders, centipedes, isopods, phalangids, millipedes, collembolans and 109 families of insects from 20 orders, and large over-wintering aggregations of butterflies); and • vertebrates (including seabirds (see above), reptiles: crocodiles and turtles, 9 snakes and 31 lizards, mammals); ▪ the integrity of the inter-connections between reef and island networks in terms of dispersion, recruitment, and the subsequent gene flow of many taxa; ▪ processes of dispersal, colonisation and establishment of plant communities within the context of island biogeography (e.g. dispersal of seeds by air, sea and vectors such as birds are examples of dispersion, colonisation and succession); ▪ the isolation of certain island populations (e.g. recent speciation evident in two subspecies of the butterfly *Tirumala hamata* and the evolution of distinct races of the bird *Zosterops spp);* ▪ remnant vegetation types (hoop pines) and relic species (sponges) on islands. ▪ evidence of morphological and genetic changes in mangrove and seagrass flora across regional scales; and ▪ feeding and/or breeding grounds for international migratory seabirds, cetaceans and sea turtles.
N(III) Contains superlative natural phenomena	The Great Barrier Reef provides some of the most spectacular scenery on earth and is of exceptional natural beauty. The World Heritage values include: ▪ the vast extent of the reef and island systems which produces an unparalleled aerial vista; ▪ islands ranging from towering forested continental islands complete with freshwater streams, to small coral cays with rainforest and unvegetated sand cays; ▪ coastal and adjacent islands with mangrove systems of exceptional beauty; ▪ the rich variety of landscapes and seascapes including rugged mountains with dense and diverse vegetation and adjacent fringing reefs; ▪ the abundance and diversity of shape, size and colour of marine fauna and flora in the coral reefs; ▪ spectacular breeding colonies of seabirds and great aggregations of over-wintering butterflies; and ▪ migrating whales, dolphins, dugong, whale sharks, sea turtles, seabirds and concentrations of large fish.
N(IV) Important habitats for conservation of biological	The Great Barrier Reef contains many outstanding examples of important and significant natural habitats for *in situ* conservation of species of conservation significance, particularly resulting from the latitudinal and cross-shelf completeness of the region.

Criteria	Values
diversity	The World Heritage values include: ■ habitats for species of conservation significance within the 77 broadscale bioregional associations that have been identified for the property and which include: • over 2900 coral reefs (covering 20 055 km^2) which are structurally and ecologically complex; • large numbers of islands, including: • 600 continental islands supporting 2195 plant species in 5 distinct floristic regions; • 300 coral cays and sand cays; • seabird and sea turtle rookeries, including breeding populations of green sea turtles and Hawksbill turtles; and • coral cays with 300-350 plant species in 2 distinct floristic regions; • ·seagrass beds (over 5000 km^2) comprising 15 species, 2 endemic; • mangroves (over 2070 km^2) including 37 species; • Halimeda banks in the northern region and the unique deep water bed in the central region; and large areas of ecologically complex inter-reefal and lagoonal benthos; and • species of plants and animals of conservation significance