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Lindeman Island Resort Safe Harbour and Temporary Barge Access: Marine Ecology Survey

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Lindeman Island Resort Safe Harbour and Temporary Barge Access: Marine Ecology Survey

Prepared for:	White Horse Australia
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Synopsis: **This report provides a constraint-based site-selection for the development of a safe harbour and temporary barge access associated with the redevelopment of Lindeman Island. The marine ecology, habitat characteristics, and potential impacts of development at these sites are described.**

REVISION/CHECKING HISTORY

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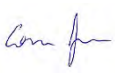
0	25/10/2013		Darren Richardson		Conor Jones

DISTRIBUTION

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White Horse Australia	PDF										
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Executive Summary

White Horse Australia (WHA) purchased Lindeman Island Resort and intends to develop it and integrate the resort with a residential community. The proposed development includes an upgrade to the marine facilities and establishment of a safe harbour and temporary barge access for movement of materials and equipment during the construction phase.

Maritime access is currently *via* a south-east facing fixed jetty which is difficult and unsafe to use in an animated sea state. Establishment of a safe harbour is critical for emergency evacuation scenarios. Based on environmental and engineering constraint investigations, the existing jetty area was considered the least constrained location from the perspectives of required approvals, finance, and based on engineering design to the extreme weather events. After investigating potential locations for the safe harbour, three design options were proposed that utilised existing infrastructure and attempted to reduce the footprint of the harbour and the costs of construction.

Desktop-based marine ecology, legislative, and marine ecology constraint mapping was performed to evaluate the relative suitability of a range locations around Lindeman Island as potential safe harbour locations. These studies modelled extreme weather events to determine preliminary design heights, provided cost implications of safe harbour designs, and described legislative and marine ecology constraints to safe harbour development. All assessment criteria suggested that the area surrounding the existing jetty was best site for safe harbour development, while temporary barge access would be possible at a range of potential locations.

Preliminary marine ecology field surveys were conducted at five study regions which included the existing jetty location, Boat Port and at range of other potential barge landing sites on the northern, western and eastern sides of the island. Rapid assessment methods were used to map and quantify benthic habitats and communities at each site. A total of 167 spot dives were undertaken across the five study regions. Bathymetry data were collected and interpolated to give a Digital Elevation Model (DEM), as were spatial distributions for per cent cover values of hard corals, soft corals, seagrass, and macroalgae to give “heat maps” of benthic cover.

The highest density living coral communities were found on the reef directly south of the jetty and surrounding the existing dredged channel. Other reef areas generally had sparse living coral communities consisting of coral skeletons dominated by macroalgae or sand and rubble substrates.

Following the field assessment, three safe harbour design options were created at the jetty location to utilise existing infrastructure and minimise impacts to corals. Direct loss of macroalgal and seagrass communities within and adjacent to the proposed design option footprints will not be likely to constitute a major impact due to the small extent of seagrass to be affected, and the extreme abundance of macroalgae elsewhere.

The extent of significant living coral communities present within the proposed design option footprints at the jetty site will likely represent a point of concern for GBRMPA given their emphasis on the preservation of corals and other habitats of biodiversity significance. Of the three layouts considered, Options 1 and 2 had the advantage of affecting areas already disturbed by the existing dredged channel, jetty, and ramp infrastructure. While the footprint of Option 3 had lower coral cover that at Options 1 and 2, this area was in a largely undisturbed condition.

Seagrass and coral communities of Boat Port (and Gap Beach to a lesser degree) are situated offshore from beach landing site and would not likely be degraded by a regular high-tide barge service. While there will need to be management of impacts to turtle nesting and human users of the site, the distribution of seagrasses and corals, and the derived bathymetry at Boat Port are not prohibitive to the establishment of the high-tide barge access. Depending on where the road access point meets the beach, there may be some marine plant disturbances (mangroves) required.

It is recommended that consultation with GBRMPA occur prior to any further re-configuration or field work to determine their preferences for design modification, mitigation, or offsetting within the realised limitations of the project. Other construction and operational impacts can foreseeably be mitigated and are not likely to represent significant challenges to the project.

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1 Introduction

1.1 Background

White Horse Australia (WHA) purchased Lindeman Island Resort in August 2012 and intends to develop the island as a premium tourist resort and integrated residential community. As part of this development, an upgrade to the marine facilities is proposed through the establishment of a safe harbour.

Maritime access is currently *via* a south-east facing fixed jetty which is difficult to access in an animated sea state and this is unacceptable on comfort and safety grounds, even for large ferries. There are concerns regarding the use of this access in cyclones or other emergency evacuation scenarios. For these reasons, establishment of a safe harbour is critical.

Barge access is also required for movement of materials and equipment during the construction phase, away from the reconstructed resort area. Depending on the final location of the barge loading site, unloaded material is proposed to be transported along existing roads, the golf course, and potentially via an access track (to be developed from an existing hiking track).

Landing of the barge at high tide along the beach allows for operations to be undertaken without any need to construct infrastructure or for blasting/dredging of the fringing reef. The only construction activities would be associated with the development of access tracks linking the beach to the golf course. These terrestrial activities are outside the scope of this report.

BMT WBM performed an initial desktop constraints study that investigated the engineering, legislative, and likely marine ecology constraints to the development of a safe harbour and temporary barge landing at a range of locations around Lindeman Island (Figure 1-1). The full details of the marine engineering components are provided in BMT WBM (2013; ref. R.B20346.003.00Engineering.docx), and a summary of the legislative and marine ecology constraints are provided in Section 2. All assessment criteria suggested that the area surrounding the existing jetty was the best site for safe harbour development, while temporary barge access would be possible at a range of potential locations.

These locations were then surveyed in greater detail to describe marine habitats and potential impacts of various aspects of development. After investigating potential sites for the safe harbour, a design was proposed that utilised existing infrastructure and attempted to reduce the footprint of the harbour (Figure 1-2). This design was modified subsequently into three different options to investigate how re-configuration might reduce footprint impacts.

This report presents the results of preliminary marine ecology survey that was conducted at Lindeman Island in relation to the proposed safe harbour development at the existing jetty location (Figure 1-2), and potential temporary barge access sites at Boat Port and at range of other potential barge landing sites on the northern, western and eastern sides of the island. Recommendations on the location and design of the proposed safe harbour and temporary barge landing site have been presented based on potential impacts to the marine environment.

LEGEND

Approximate Locations of Seawalls

Title:

Lindeman Island Locality Plan and Study Locations

Figure: 1-1

Rev: A

N

0 0.5 1km

Approx. Scale

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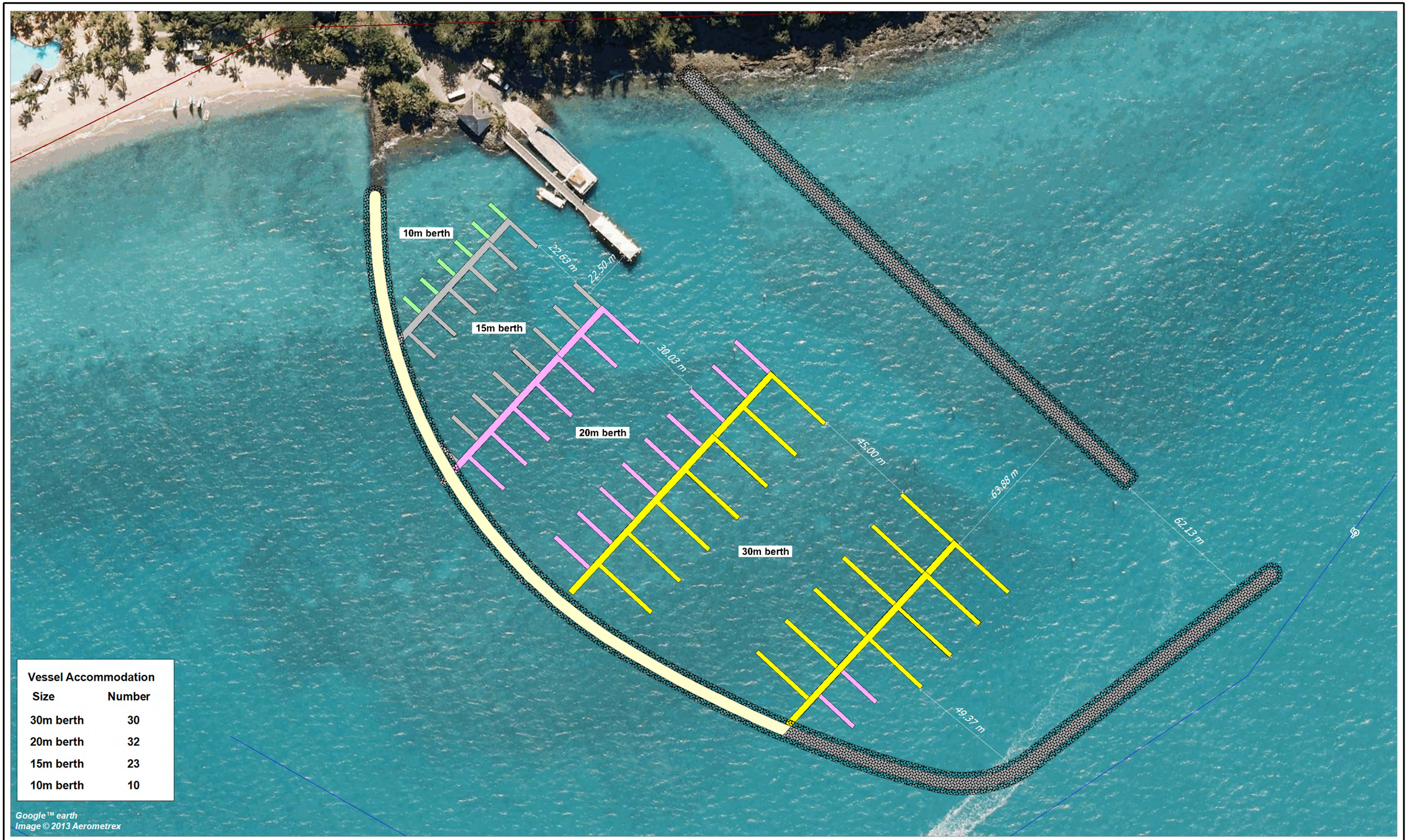

LEGEND

Berth Fingers

- 30m
- 20m
- 15m
- 10m

- Seawall
- Walkway

Contours

- Land
- Bathymetry

Title:

Proposed Safe Harbour Development at the Existing Jetty Site, Option 1

Figure: 1-2

Rev: D

N

0 25 50m

Approx. Scale

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Filepath : I:\B20346_I_BRH Lindeman LBL\DRG\GIS_010_131002_30m_Lindeman_South_Marina_revD.wor

1.2 Study Aims and Objectives

The study was undertaken in two stages:

- A preliminary desk-top assessment of environmental and legislative constraints; and
- A more detailed ecological assessment and field investigtation.

The aim of the desktop constraint mapping exercise was to identify and assess environmental and legislative constraints that need to be considered in the selection of a safe harbour and temporary barge landing site.

The aim of the ecological assessment was to characterise and map marine communities and habitats at and adjacent to the proposed safe harbour and potential temporary barge landing locations, in order to refine the initial desk-top based constraints assessment. The specific objectives of this component were to:

- Undertake mapping of marine habitats and communities to ground-truth the findings of the desk-top constraints assessment.
- Provide supplementary information that will be required to support preliminary development approval documentation (i.e. maps and other information required for EPBC Act Referral).
- Provide input to the design team for the safe harbour and temporary barge access in order to minimise environmental impacts.

Note that while the information collected in this field assessment is sufficient to inform (for example) a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), it has not been scoped to provide a comprehensive baseline as would be required for EIS reporting purposes. In this regard, it would be expected that more detailed analysis of collected data and possibly additional (seasonal) surveys would be required to satisfy EIS reporting requirements.

1.3 Study Area Context

Lindeman Island is an island in the Lindeman Island Group of the Whitsunday Islands off the central coast of Queensland. It is an area of high ecological value and is of recognised conservation significance.

Areas of high conservation significance that occur in the study area include:

- Great Barrier Reef Marine Park (GBRMP) Conservation Zone and Public Appreciation areas (the latter having site specific management requirements).
- GBR World Heritage Area (WHA) and National Heritage Place.
- The terrestrial area of Lindeman Island is also protected as part of the Lindeman Islands National Park, with the exception of the excised area of the resort.

2 Desktop Constraints Assessment

2.1 Marine Engineering Constraint Summary

BMT WBM (2013) modelled ambient winds at gale forces (40 knot from 8 major directions) and 3 cyclones (approx. 1:100 ARI) with outputs at each of the potential safe harbour locations shown in Figure 1-1. Existing data (storm tide levels, bathymetry, winds and waves) were used to set up models to determine wave climates at each location. Marina designs considered the height of breakwaters to resist cyclonic conditions, given macro-tidal conditions environment and significant storm surge. The ability to provide safe passage in storm conditions was also considered. Some designs provided berths for larger vessels (in the order of 50m length, which require around 4.2m of clear water depth). The volume of rock required to build marina infrastructure above and below -5 m LAT contours, and the volume of dredging required for these berths and access channels and fairways, were also calculated. Preliminary estimates of breakwater arrangements, armour size and volumes were made. A cost estimate of $\$250/m^3$ of breakwater was applied to all calculations.

The existing jetty location was relatively well protected from gale-force and cyclonic conditions and had with a preliminary estimate of breakwater and dredging costs of $25M. The location south of Billy Goat Point could be developed without reef dredging but the breakwater costs may be in the order of $200-300M because of the deeper water at the site and exposure to extreme wave conditions. Boat Port and Gap Beach would both require significant breakwaters to protect against extreme northerly fetches, and dredging with development costs are in the order of $100M and $50M, respectively.

2.2 Legislative and Marine Ecology Constraints

2.2.1 Approach

The basic approach of the marine approvals and ecology constraint mapping was to collate relevant spatial information describing environmental features and legislative tenure and overlay these layers to show areas of highest and lowest constraint to safe harbour/barge access site development. Constraints were also tabulated in a 'traffic light' approach to show the detail behind the assessment. The review considered the ecological character of the study area, including the distribution, extent and abundance of marine flora and fauna species, and their habitats. The following datasets were analysed:

- Historical seagrass survey data carried out by Hyland et al (1988) and coarse spatial layers available from the Federal Government (CAMRIS);
- Reef habitat included in GBRMPA Reef Gazetteer;
- Historic shipwrecks (Historic shipwrecks database) or otherwise;
- Other existing spatial data mapping (bathymetry, regional ecosystem mapping, conservation zone/area mapping etc.);
- Marine flora and fauna database records (protected matters search, DEHP database); and
- High ecological value habitats such as coral reefs, seagrass and mangroves;
- Associated foreshore vegetation, including threatened vegetation communities

- Habitats and features of high amenity and social value, including reefs and beaches;
- Marine park and World Heritage Area boundaries;
- Marine park management areas;
- Known or likely habitat for threatened or migratory marine species;
- Known or likely habitat for marine species of fisheries significance;
- Protected area boundaries;
- Any other matters of State Environmental Significance (MSES) or National Environmental Significance (MNES) available from Government databases;
- Native Title mapping by Commonwealth Native Title Tribunal;
- Local government overlays.

Spatial data analysed were used to derive a constraints map (covering all proposed safe harbour/barge access sites), and provide broad definition of suitable and unsuitable areas for development of a safe harbour and/or temporary barge access along the coastline of Lindeman Island. Hectares of coral reef beneath the footprint of each of the safe harbour arrangements shown in Figure 1-1 were calculated using GBRMPA coral reef polygons, navigation charts and visible reef areas from available aerial photography. Hectares of seagrass were not calculated due to the unreliability and poor temporal currency of the available data.

2.2.2 Constraint Maps

Figure 2-1 to Figure 2-5 provide the available environmental and planning spatial data layers for the study area, illustrating the key marine ecological and associated legislative constraints. A summary map based on this preliminary constraints assessment is provided in Figure 2-6, demonstrating that the least constrained area for the marine development is the nearshore area along the south of Lindeman Island, near the existing jetty. This conclusion was reached prior to any field surveys.

Key constraints identified were the Whitsundays Plan of Management zoning (for vessel and aircraft restrictions) and the GBR Marine Park zoning plan (Conservation Park zone and Marine National Park zones). This effectively prohibits the establishment of a safe harbour within these areas, as legislative changes and other approvals would be required.

Lindeman Island

Gaibirra Island

Shaw Island

Google™ earth
Image © 2013 TerraMetrics
Image Landsat
Image © 2013 Aerometrex

LEGEND

- Seawall
- Reef (GBRMPA)
- Developed (70m, no limits)
- Moderate Use (35m, 40 pax)
- Natural (35m, 15pax)

Contours

- Land
- Reef
- Bathymetry

Title:
Lindeman Island - Whitsunday Planning Area

Figure: 2-1

Rev: A

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

N

0 0.5 1km

Approx. Scale

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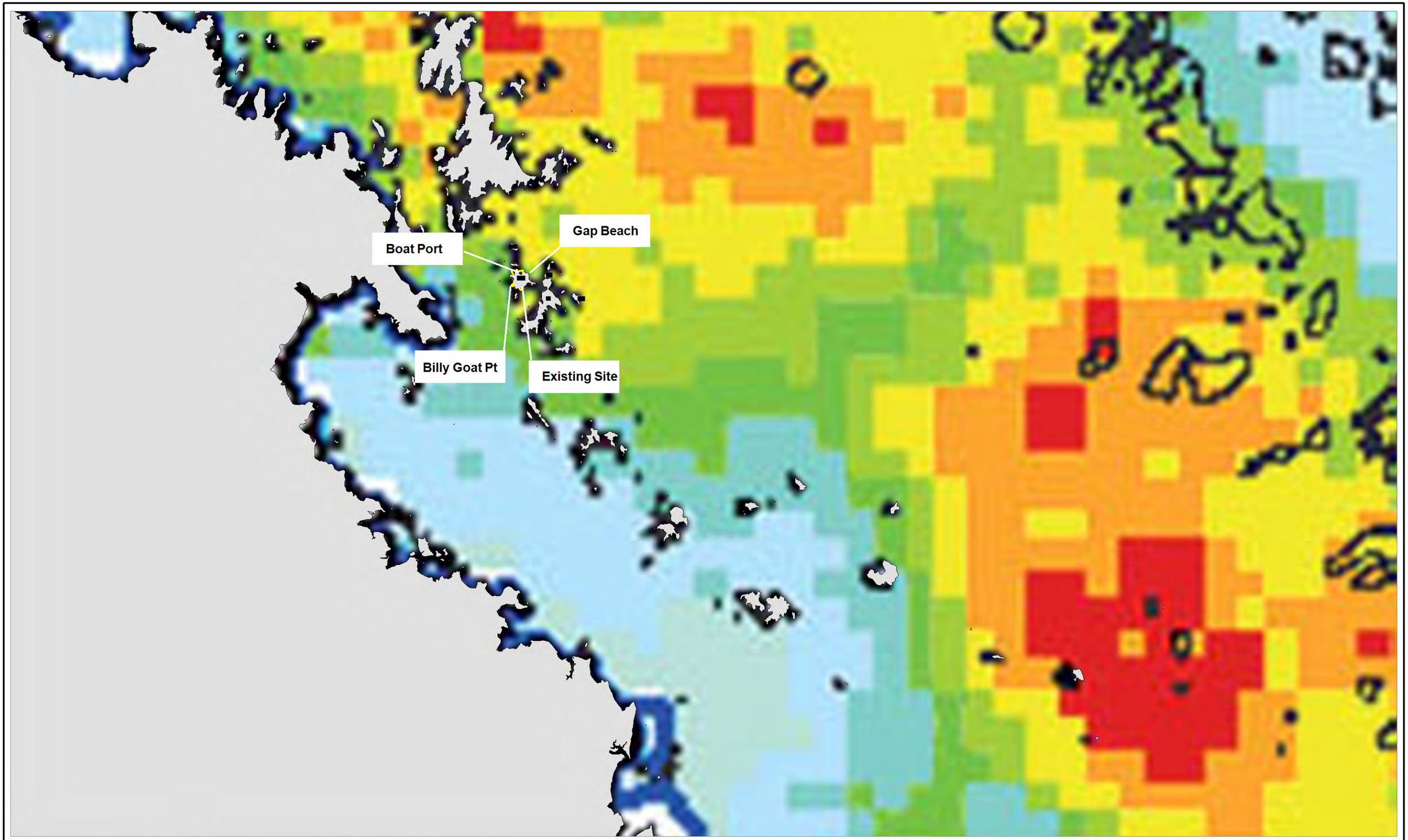

LEGEND

Seawall

Land

Contours

Reef

Environmental suitability

- 0.7 - 0.82
- 0.6 - 0.7
- 0.5 - 0.6
- 0.4 - 0.5
- 0.3 - 0.4
- 0.2 - 0.3
- 0.1 - 0.2
- 0 - 0.1

Title:

Lindeman Island - Humpback Whale Habitat (Smith et al. 2012)

Figure: **2-2**

Rev: **A**

N 0 15 km 30 km

Approx. Scale

BMT WBM
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Lindeman Island

Gaibirra Island

Shaw Island

LEGEND

- Seawall
- Reef
- Land
- National Park
- Conservation Park
- Marine National Park

Remnant Vegetation

- Remnant with Endangered REs
- Remnant with "of Concern" REs
- Remnant with "least concern" REs

Title:

Lindeman Island - GBRMPA Zones (Marine) and Remnant Vegetation (Terrestrial)

Figure: 2-3

Rev: A

N 0 0.5 1km

Approx. Scale

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