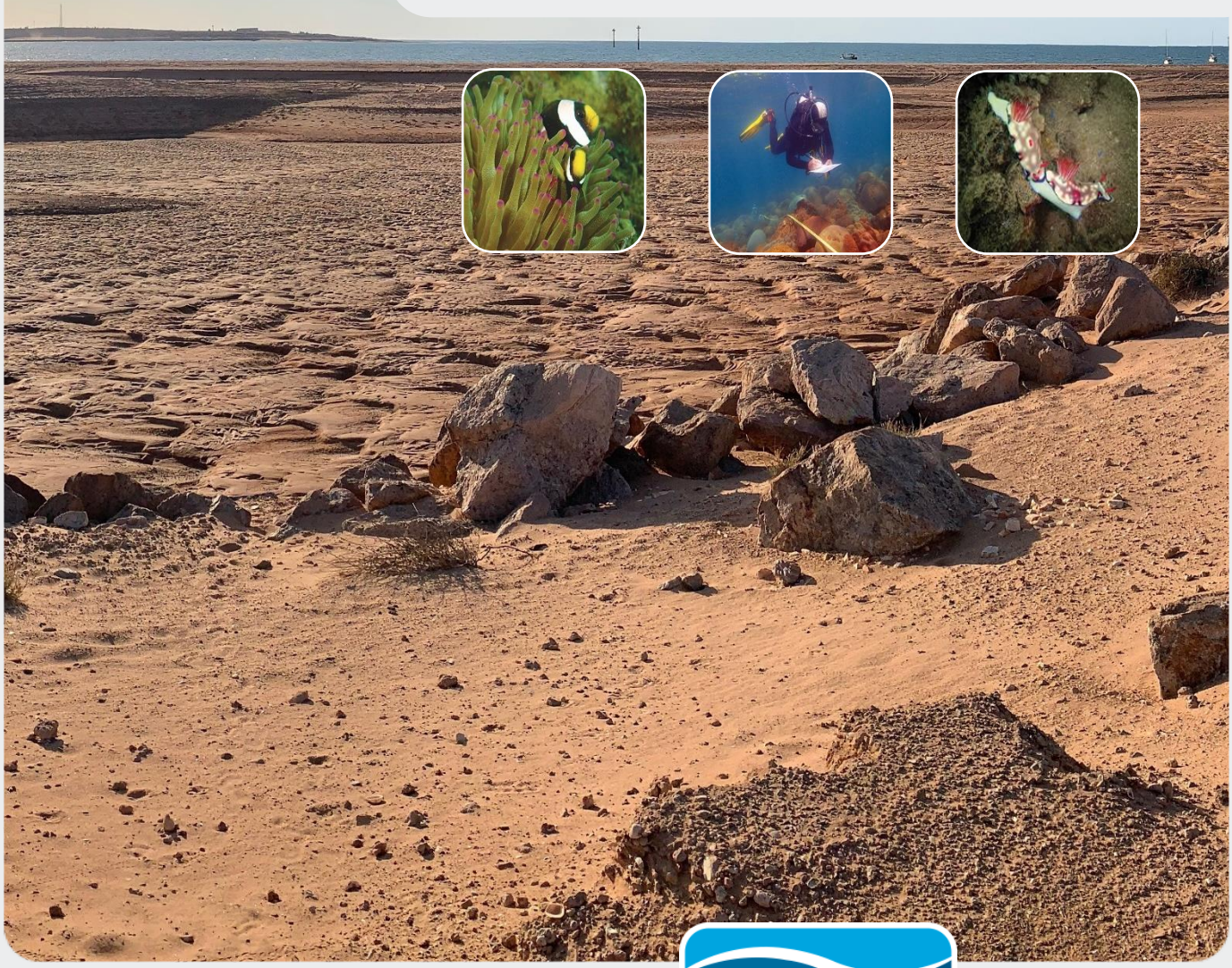
Port Hedland Spoilbank Marina

Benthic Communities & Habitat Cumulative Loss Assessment



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Transmission Register

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Acronyms and Abbreviations

Acronyms/Abbreviation	Description
%	Percentage
BCH	Benthic Communities and Habitats
CLA	Cumulative Loss Assessment
DMMA	Dredging and Material Management Areas
DEMP	Dredging Environmental Management Plan
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
ha	Hectares
km	Kilometers
Km^2	Square kilometer
LAU	Local Assessment Unit
LEPA	Low Ecological Protection Area
m	Meters
SSC	Suspended sediment concentration
ZoHI	Zone of High Impact
ZoMI	Zone of Moderate Impact

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1. Introduction

1.1. Project Description

The Port Hedland Spoilbank Marina development (the Marina) is located on Lot 5751 and Lot 5550 on a site commonly known as the 'Spoilbank' (Town of Port Hedland 2019). The Spoilbank is an artificial coastal landform created in the late-1960s/early-1970s from the disposal of material dredged from Port Hedland's inner harbour and shipping channel. The Project will replace the existing Richardson Street boat ramp (which will be closed) and redirect boating activities away from the commercial operations of Port Hedland's inner harbour and navigation channel.

The Marina will include a four lane boat ramps, 80 boat pens, 208 trailers parking, 86 parking bays, dry dock area for commercial vessels, public and pen holder amenities, public open space, and recreation and event space (Town of Port Hedland 2019) (Figure 1).

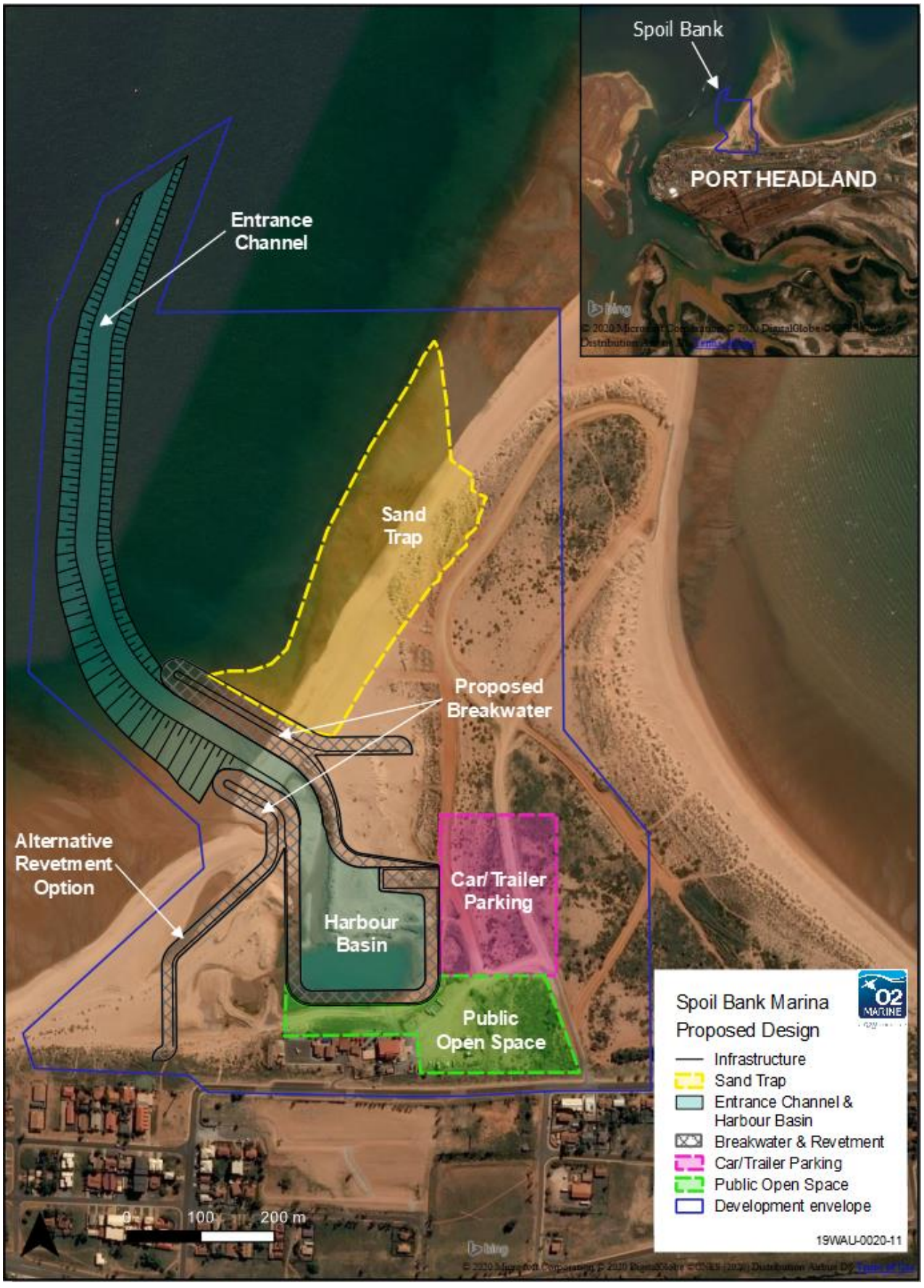


Figure 1 **Spoilbank marina concept**

1.2. Scope and Objectives

This report outlines the benthic communities and habitat cumulative loss assessment (CLA) undertaken for the Port Hedland Spoilbank Marina Project.

The marine benthic community in Port Hedland is known to support a sparse but diverse range of intertidal and subtidal BCH, including primary producer habitat such as coral and seagrass both within and adjacent to the proposed Spoilbank marina development (O2 Marine/Teal, 2019). The scope of this BCH CLA is to assess cumulative impact and losses of benthic habitat within the defined local assessment units (LAUs) (Refer Section 2) and potential impact to ecological integrity and biological diversity at local and regional scales.

1.3. Legislation and Regulatory Guidance

This study has been aligned with relevant state and federal legislation and technical guidance that will be applicable to BCH in the Project area. The relevant legislation specific to BCH, includes:

- Commonwealth *Environmental Protection and Biodiversity Act 1999* (EPBC Act);
- West Australian *Conservation and Land Management Act 1982* (CALM Act);
- West Australian *Environmental Protection Act 1986* (EP Act);
- West Australian *Biodiversity Conservation Act 2016* (BC Act); and
- West Australian *Fish Resources Management Act 1994* (FRM Act).

The EPA provides guidance on how an Environmental Impact Assessment (EIA) will be evaluated when determining whether or not an assessed proposal may be implemented. The EPA uses environmental principles, factors and associated objectives as defined within the Statement of Environmental Principles, Factors and Objectives (EPA 2018) as the basis for assessing whether a proposal's impact on the environment is acceptable.

1.3.1. Environmental Principles

The object of the EP Act is to protect the environment of the State and identifies five environmental principles. The third principle, regarding the conservation of biological diversity and ecological integrity, is directly relevant to subtidal BCH and is therefore a fundamental consideration for an EIA.

1.3.2. Environmental Factors and Objectives

The EPA list 13 environmental factors, which are divided into five themes: Sea, Land, Water, Air and People. The environmental factors are those parts of the environment that may be impacted by an aspect of a proposal and an environmental objective has been established by the EPA for each environmental factor. The EPA will then assess whether a project meets each environmental objective for the relevant environmental factors and whether the environmental impact of a proposal may be significant. BCH has been identified as one of the key environmental factors for the Project. The objective for BCH is *'to protect benthic communities and habitats so that biological diversity and ecological integrity are maintained'*.

The EPA provides the following relevant guidelines to explain how impacts on BCH, including from dredging projects, should be considered during EIA:

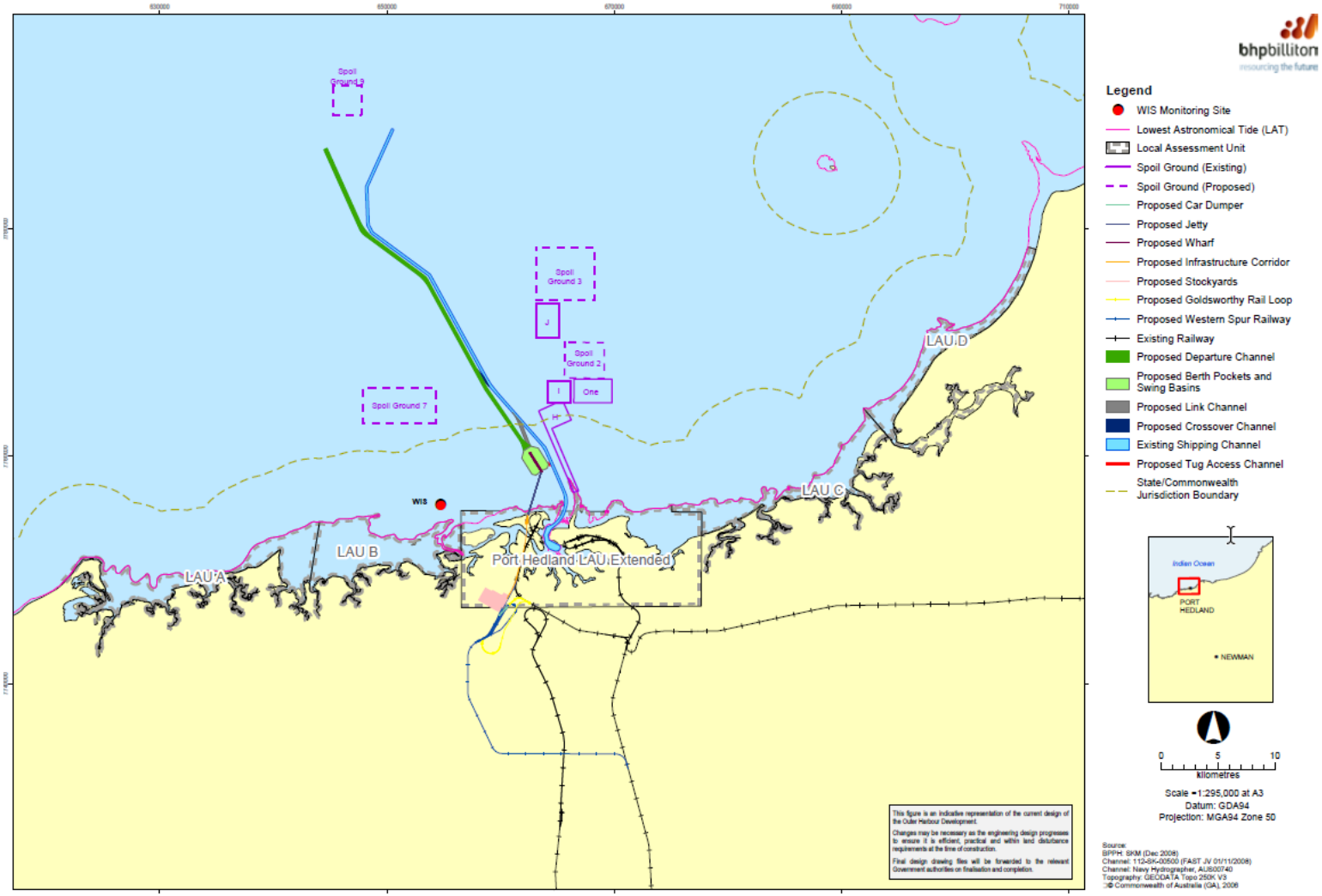
- Technical Guidance – Protection of Benthic Communities and Habitats (EPA 2016a);
- Environmental Factor Guideline – Benthic Communities and Habitats (EPA 2016b); and
- Technical Guidance – Environmental Impact Assessment of Marine Dredging Proposals (EPA 2016c).

2. Local Assessment Units

To undertake an EIA of BCH impacts requires a definition of a Local Assessment Unit (LAU) (EPA 2016a). The LAU is a spatial area within which cumulative losses for BCH can be calculated, assessed and presented. LAUs are required to be location specific and defined with consideration of bathymetry, substrate type, exposure, currents, biological attributes such as habitat types. LAUs should typically be established with an area of ~50 km^2 (EPA 2016a).

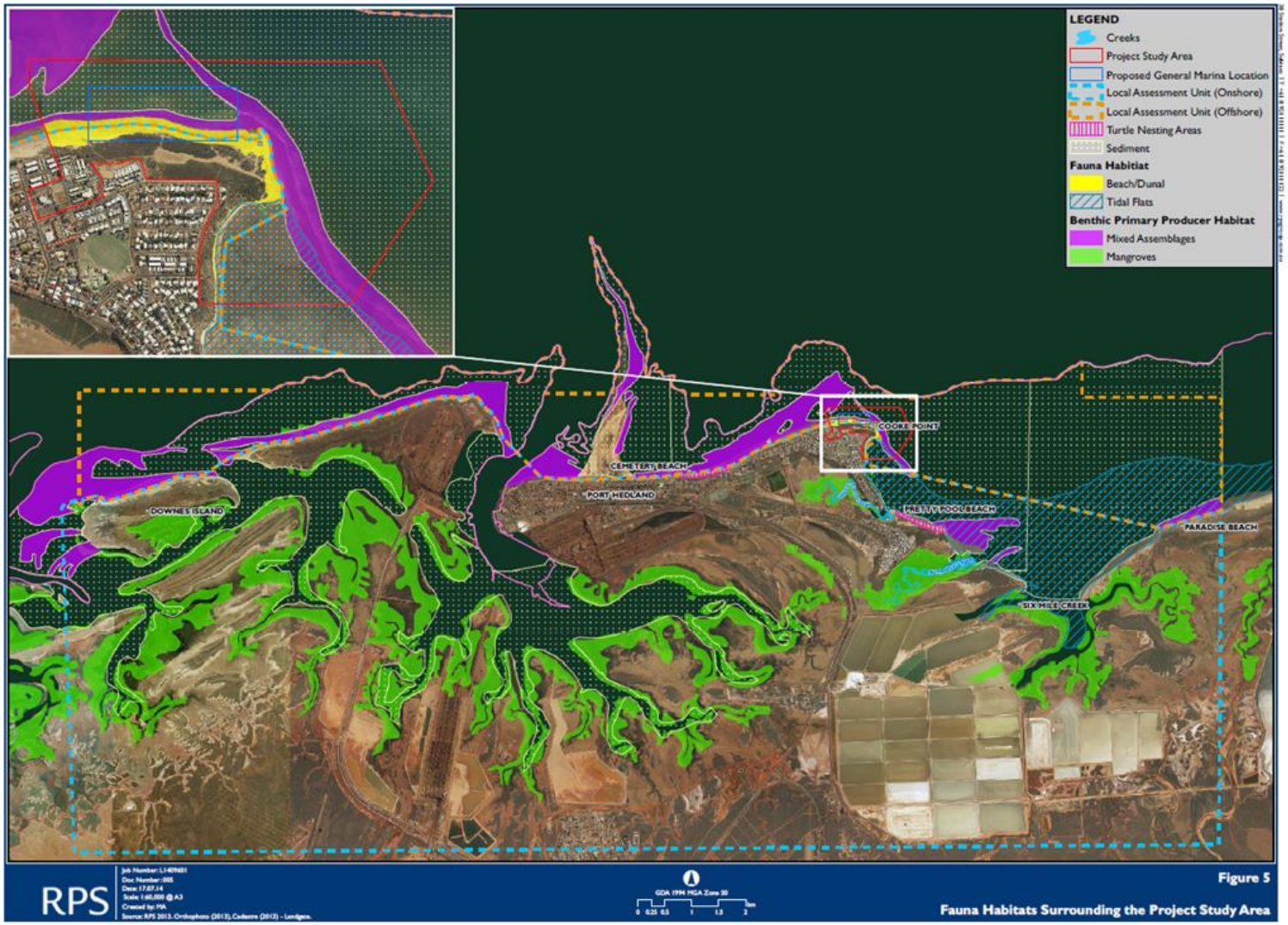
For the assessment of the Port Hedland Outer Harbour development five LAUs were defined for the coast between Cape Thouin and Spit Point (BHP, 2011). The largest of these, Port Hedland Extended LAU, included the Port Hedland and the inner harbour and extended along the Lowest Astronomical Tide (LAT) and in parts cut across embayment's (Figure 2). A preliminary environmental impact assessment of the Cooke Point Marina in Port Hedland (RPS, 2014) divided the Port Hedland Extended LAU (BHP, 2011) into an Onshore Port Hedland LAU and an Offshore Port Hedland LAU (Figure 3). The EPA presented an Inner Harbour LAU (Figure 4) in their technical guidance on the protection of benthic communities and habitats (EPA, 2016a). This was similar to the Port Hedland Extended LAU (BHP, 2011) but did not project as far offshore and does not include the area of the Spoilbank.

A modified version of the Offshore Port Hedland LAU (Figure 3) has been used for this Project. For most of its length the offshore boundary of the Cooke Point Marina LAU is aligned along the 0 m Chart Datum (CD) level and does not include any subtidal habitat. Hence, a new Spoilbank LAU has been defined for this project (Figure 5). The Spoilbank LAU is based on the Offshore Port Hedland LAU but the northern boundary was extended offshore to a depth of -2m CD; the southern boundary aligns with the northern boundary of the Inner Harbour LAU. Both the Spoilbank LAU and the Inner Harbour LAU were used in this assessment of benthic habitat impacts.



Source: BHP (2011)

Figure 2 Port Hedland Extended LAU



Source: RPS (2014)

Figure 3 Onshore Port Hedland LAU and Offshore Port Hedland LAU used for the Cooke Point Marina preliminary environmental impact assessment

Source: EPA (2016)

Figure 4 Port Hedland Inner Harbour LAU

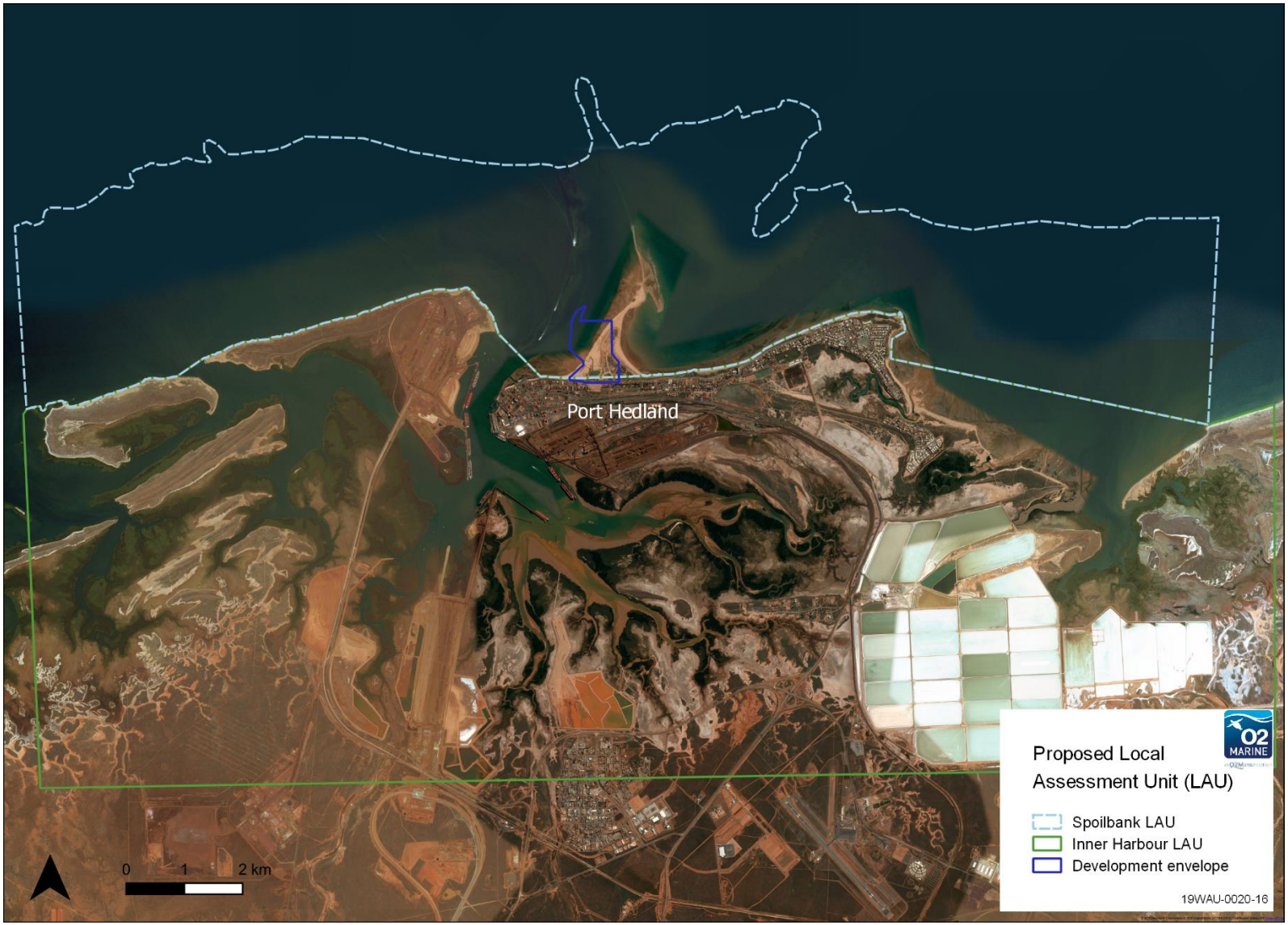


Figure 5 Spoilbank and Inner Harbour LAU

3. Benthic Communities & Habitat

3.1. Benthic Communities & Habitats

Extensive surveys of the BCH have been undertaken within and adjacent to the Project area (BHP 2011, Worley Parsons 2012, RPS 2014, O2M/Teal 2019). To assist in the benthic habitat impacts of the Spoilbank Marina ground-truthing and targeted surveys were undertaken in November 2019 (O2M/Teal 2019) with two levels of survey intensity:

1) Spoilbank LAU: A project-specific Local Assessment Unit (LAU) where drop camera surveys were undertaken to ground-truth previous mapping; and.
2) Detailed Mapping Zone: An area of the Spoilbank LAU, immediately adjacent to the proposed Spoilbank Marina, with where more detailed ground-truthing and side-scan sonar surveys were completed.

Three BCH classes (with six subclasses) were identified (Table 1). Whilst the majority of the LAUs were comprised on Bare Substrate, two subtidal, vegetated BCH classes were identified, being Mixed Assemblage and Mixed Assemblage with Seagrass. Within the Spoilbank Lau these BCH made up less than 10% of the total LAU area, whilst in the Inner Harbour LAU they comprised less than 1% of the total LAU area (Table 2, Figure 6 and Figure 7).

Table 1 Benthic habitats within the Spoilbank LAU

BCH Class	Sub-class & Description	Example Image
Bare Substrate	**Bare sand—coarse** Coarse sand with no BCH or occasional isolated sparse macroalgae with traces of shell grit and rubbles	
	Bare sand—fine Fine sand/silt with no BCH or occasional isolated sparse macroalgae. Silt areas often bioturbated	
Mixed assemblage	**Mixed assemblage—medium density** Low relief limestone reef and rubble substrate which supports medium density coral cover of diverse coral species, including *Faviidae, Mussidae, Portitidae*, and soft corals. Macroalgae, sponges and hydrozoan also present.	
	Mixed assemblage—low density Flat rocky relief and rubble with low to very low cover of macroalgae, and sparse soft and hard corals, including *Faviidae, Mussidae and Turbinaria*. Generally observed close to the coast in 1–5 m water depth	

Mixed assemblage with seagrass	**Low density mixed assemblage with seagrass on sand** Flat substrate constituting either fine to coarse sands with occasional shell grit. Sparse Macroalgae, corals hydrozoan and sponge species are equally dispersed throughout this habitat although benthic cover is low occasional very sparse isolated leaves of *Halodule sp*. seagrass was also observed at some locations	
	Low density mixed assemblage with very sparse seagrass on sand This habitat class occurs on patches of fine to coarse sands with sparse bioturbated bedforms. Seagrass (*Halodula* sp) present in very sparse groups (1–4 leaves). Scattered and Isolated macroalgae, and filter-feeders also occasionally present	

Table 2 Benthic habitat areas within the Spoilbank and Inner Harbour LAUs

	Spoilbank LAU		Inner Harbour LAU	
Benthic Habitat	**Area (ha)**	**%**	**Area (ha)**	**%**
Mixed assemblage	516.2	7.9	141.7	0.9
Mixed assemblage with seagrass	90.1	1.4	0	0
Other BCH Areas, (e.g. Mangroves, Bare Substrate, etc)[1]	5892.0	90.6	14960.8	99.1
Total Area of LAU	6498.3	**100**	**15102.5**	**100**

[1] *It is noted that other BCH classes (e.g. mangroves, algal mats, etc.) are present within the Inner Harbour LAU, However, as these classes are not predicted to be impacted by the proposal they have been excluded from mapping and CLA analysis.*

Figure 6 **Benthic communities and habitats adjacent to the Spoilbank Marina**

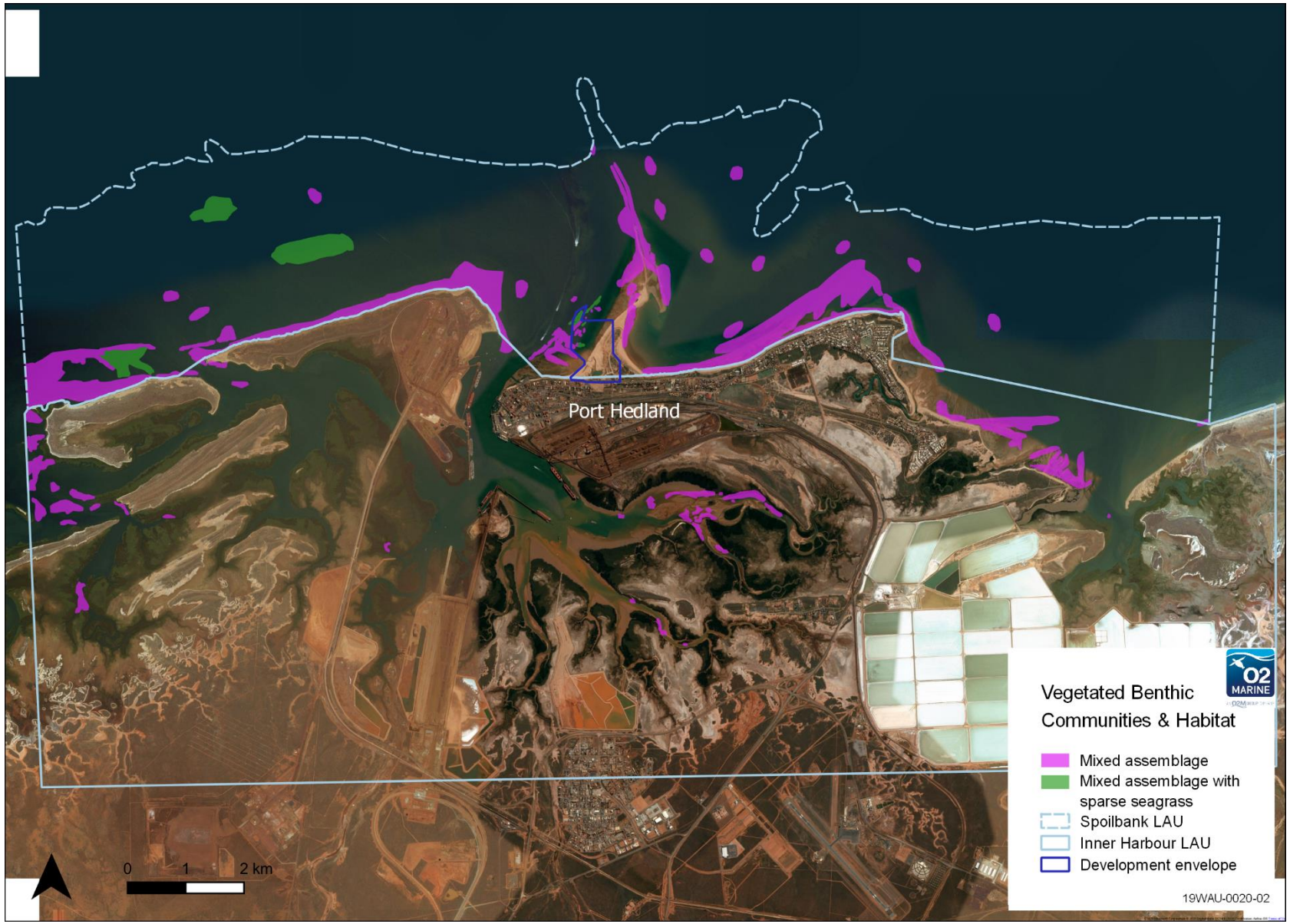


Figure 7 Benthic communities and habitat across the Spoilbank and Inner Harbour LAUs

3.2. Local & Regional Values

3.2.1. Tenure & Conservation

The proposed Spoilbank Marina will be located in State Waters within the harbour limits of the Port of Port Hedland. The conservation of ecologically-significant marine, estuarine or terrestrial ecosystems is managed through the Conservation and Land Management Act 1984 and the Biodiversity Conservation Act 2016. The subtidal habitats within the Project area have not been identified as containing significant ecological communities requiring protection through the introduction of marine conservation reserves. The nearest State Marine Park is the Eighty Mile Beach Marine Park, which is located ~100 km east of Port Hedland. No Listed Threatened Ecological Communities are known to occur within the Spoilbank or Inner Harbour LAUs.

3.2.2. Regional Significance

Within the Port Hedland region, the only BCH that is recognised to be of regional significance is the extensive mangrove communities. However, mangroves are confined to the southern (intertidal) portion of the Inner Harbour LAU and are not predicted to be impacted by the Spoilbank Marina proposal. Other than Bare Substrate, the BCH identified within the Spoilbank and Inner Harbour LAUs is composed of a mixed assemblage of corals, algae and sparse ephemeral seagrass commonly distributed throughout the wider Port Hedland and Pilbara region. Therefore, these BCH in the area are not considered to be either locally or regionally significant.

3.2.3. Functional Ecological Values

The function ecological values of the two vegetated BCH types are presented below.

Mixed Assemblage

This Mixed Assemblage BCH is mainly comprised of low-density coral and macroalgal species. This BCH class is sparsely distributed across the Port Hedland region and is present within both the Spoilbank and Inner Harbour LAUs. In proximity of the Project area, this BCH occurs primarily on the hard rocky platform which extends from the shoreline to the west and northwest of the Spoilbank and the west and northwest of Finucane Island to a depth of ~-2 m CD. Coral communities can be significant contributors to primary productivity and provide habitat for a variety of fish and benthic fauna species. However, this BCH class is only present in very low densities in the immediate vicinity of the Spoilbank and is sparsely distributed across the Port Hedland Region. The highest densities of the Mixed Assemblage BCH in the region are located outside of the Spoilbank LAU at Manilya Bank (~19 km northeast of the project area); Little Turtle Island (40 km northeast of the project area) and North Turtle Island (85 km northeast of the project area) (SKM 2011).

Mixed Assemblage with Seagrass

Seagrass was present within the project area in very low densities (i.e. typically <1% cover) and represented a subdominant taxon within the Mixed Assemblage with Seagrass BCH class. This BCH is dominated by microalgae with sporadic soft and hard corals mixed at patches of low-density seagrass (i.e. *Halophila* sp.) and its mainly established on flat sandy or gravelly substrate. Within the Port Hedland region seagrass has been historically described to have high temporal variability

and it believed to be ephemeral (RPS, 2014, SKM,2009). Within the Port Hedland region several areas with sparse seagrass have been observed (SKM,2009) mainly in protected water around island groups (including Finucane Island, Weerdee Island, North Turtle Island) and the most commonly observed seagrass species are *Halophila ovalis* and *Halophila uninervis*. Despite the ephemeral nature of seagrass in this region, this BCH class is considered to be of important ecological value as it functioning as habitat for diverse communities including fish, turtles and various benthic fauna. These ephemeral seagrasses are primary producers, they stabilise coastal sediments and provide a mechanism for carbon storage. However, it is noted that this habitat is sparsely distributed cross the Pilbara Region and was only observed in very low density in proximity of the Project area.

3.3. Pre-European Extent

The historical cumulative loss of BCH in the Port Hedland is not known. However due to the history of anthropogenic influences within the harbour (dredging campaigns date back to the mid-1960s) it is assumed that these communities are relatively resilient. Previous estimates of the pre-European extent of BCH within the nominated LAUs have focussed on quantifying the extent of mangrove BCH prior to development. However, the Mixed Assemblage BCH class (or an appropriate equivalent) has not previously been considered in these cumulative loss estimates. This is most likely due to the limited extent of these habitats and the difficulty in accurately mapping this BCH.

In addition, previous studies have not mapped seagrass as occurring within the Inner Harbour LAU (RPS 2014; Worley Parsons 2012). Therefore, for the purpose of this assessment, the pre-European extent of the Mixed Assemblage BCH (i.e. without seagrass) has conservatively been estimated to include up to 60 ha of Mixed Assemblage BCH within the footprint of the Spoilbank (i.e. within Spoilbank LAU) and 10 ha across the entrance to the inner harbour (i.e. within Inner Harbour LAU). These estimates are based on consideration of impacts to this BCH from dredging the shipping channels and disposal of dredge material to the Spoilbank.

4. Potential Impacts

4.1. Mitigation

To ensure impacts to BCH areas have been avoided or minimised a risk-based approach has been and developed based on the mitigation hierarchy as presented below.

The size of the development footprint has been determined to be as small as practical to yet still enable the facility to function as required. Where possible, infrastructure has been preferentially located within areas of bare substrate to reduce the amount of BCH removal. A Dredge Environmental Management Plan (DEMP) has been developed (O2M/Teal, 2020) which includes the following project specific Management Targets to mitigate the potential impacts on BCH:

- Dredging operations not to occur outside the defined dredge footprint;
- Manage return water quality to achieve a High Level of Ecological Protection at the return water discharge point.
- No detectable impact on BCH within the predicted Zone of Influence (ZoI) best-case scenario;
- Recovery of BCH within the Zone of Moderate Impact (ZoMI) worst-case scenario within three years following disturbance;

The DEMP also includes plume extent monitoring during the dredging works and a management action hierarchy (O2M/Teal, 2020).

4.2. Predicted Impacts on BCH

4.2.1. Direct Habitat Loss—Marina Footprint

Dredging of the channel and marina basin and placement of the breakwater/revetment structures will result in irreversible loss due to direct footprint loss of 2.0 ha of the following vegetated subtidal BCH (Table 3):

- 1.1 ha 1.2%) of Mixed Assemblage with Seagrass Habitat; and
- 3 ha (0.1%) of Mixed Assemblage Habitat.

A further 7.8 ha of Bare Substrate will also be directly removed as a result of dredging. However as Bare Substrate will remain post-dredging this has not been considered as part of the cumulative loss assessment.

4.2.2. Indirect Habitat Loss—Dredge Plume Impacts

BCH are likely also likely to be impacted indirectly due to the increase in suspended sediment concentration during the construction period which will result in increased turbidity, reduction in available benthic light and localised increase in sedimentation. A dredge plume impact assessment was undertaken to determine the Zone of Influence (ZoI), Zone of Moderate Impact (ZoMI) and Zone of High Impact (ZoHI) for BCH in the vicinity of the project (Baird 2020) (Figure 8). The definition of

these zones was based on the possible and probable coral mortality sedimentation tolerance limits for corals in clear water (Jones *et al*. 2019) which are considered conservative for corals in naturally turbid areas and also for seagrasses (Baird 2020, O2M/Teal, 2020).

The worst-case ZoHI was used to determine the extent of irreversible loss and the worst-case ZoMI was used to determine the extent of recoverable impacts to subtidal BCH (Table 3 and Figure 8).

Table 3 Vegetated BCH impact areas

LAU	Area	Benthic Communities & Habitat (ha)	
		Mixed Assemblage	Mixed Assemblage with Seagrass
Spoilbank LAU (6,498 ha)	Total BCH Areas	516.2	90.1
	Direct Impacts (Footprint) (*Irreversible Loss*)	0.9	1.1
	ZoHI (*Irreversible Loss*)	11.7	1.2
	ZoMI (*Recoverable Impact*)	18.8	3.2
Inner Harbour LAU (15,102 ha)	Total BCH Areas	141.7	0
	Direct Impacts (Footprint) (*Irreversible Loss*)	0	0
	ZoHI (*Irreversible Loss*)	0	0
	ZoMI (*Recoverable Impact*)	2.9	0
TOTAL (21,600 ha)	***Total BCH Areas***	***657.9***	***90***
	Direct Impacts (Footprint) (*Irreversible Loss*)	***0.9***	***1.1***
	ZoHI (*Irreversible Loss*)	***11.7***	***1.2***
	ZoMI (*Recoverable Impact*)	***21.7***	***3.2***

Figure 8 **Dredge plume impact zones**

5. Cumulative Loss Assessment

The predicted irreversible losses and reversible impacts on vegetated BCH are presented in Table 4. The majority of the impact area consists of Bare Substrate located within and adjacent to the existing Port Hedland shipping channel and Port Hedland harbour and represented by dredge channel substrate. The following key findings are made for the vegetated BCH types at risk from the proposed construction of the Spoilbank Marina:

- Irreversible loss (direct and indirect) within the Spoilbank LAU of:
  - 12.6 ha (2.2% of the BCH within the Spoilbank LAU) of *Mixed Assemblage* BCH; and
  - 2.3 ha (2.6% of the BCH within the Spoilbank LAU) of *Mixed Assemblage with sparse seagrass* BCH.
- Potential recoverable impact within the predicted ZoMI the Spoilbank LAU of:
  - 18.8 ha (3.3% of the BCH within the Spoilbank LAU) of *Mixed Assemblage* BCH; and
  - 3.2 ha (3.6% of the BCH within the Spoilbank LAU) *Mixed Assemblage with Seagrass* BCH.
- Potential recoverable impact within the predicted ZoMI the Inner Harbour LAU of:
  - 2.9 ha (1.9% of the BCH within the Inner Harbour LAU) of *Mixed assemblage* BCH.

Table 4 Irreversible loss and recoverable impacts[1] on vegetated BCH

LAU	Loss Assessment	Benthic Communities & Habitats (ha and %)			
		Mixed Assemblage		Mixed Assemblage with Seagrass	
Spoilbank LAU	Pre-European Extent	576.2	-	90.1	-
	Current Extent	516.2	-	90.1	-
	Irreversible Loss	12.6	2.2%	2.3	2.6%
	Recoverable Impact	18.8	3.3%	3.2	3.6%
	Cumulative Loss	**12.6**	**2.2%**	**2.3**	**2.6%**
Inner Harbour LAU	Pre-European Extent	**151.7**	-	**0**	-
	Current Extent	**141.7**	-	**0**	-
	Irreversible Loss	**0**	0%	**0**	**0%**
	Recoverable Impact	**2.9**	1.9%	**0**	**0%**
	Cumulative Loss	**0**	**0%**	**0**	**0%**
TOTAL	Pre-European Extent	*727.9*	-	*90.1*	-
	Current Extent	*657.9*	-	*90.1*	-

	Irreversible Loss	*12.6*	*1.7%*	*2.3*	*2.6%*
	Recoverable Impact	*21.7*	*3.7%*	*3.2*	*3.6%*
	Cumulative Loss	***12.6***	***1.7%***	***2.3***	***2.6%***

[1] *It is noted that recoverable impacts are excluded from the calculation of cumulative loss.*

6. Consequences

An irreversible loss of 12.6 ha of Mixed Assemblage BCH (1.7% of this BCH within the Spoilbank and Inner Harbour LAUs) and of 2.3 ha of Mixed Assemblage with Seagrass BCH (2.6% of this BCH within the Spoilbank and Inner Harbour LAUs) is predicted to occur as a result of the proposal. Both BCH are well represented throughout the designated LAUs and more broadly across the Port Hedland and Pilbara Region (Teal/O2M 2019; BHP 2011). Whilst this BCH provides suitable habitat for a variety of marine fauna species the small losses predicted are not considered to represent a significant risk to the ecological integrity and biological diversity of this BCH.

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