Utah Point Mangrove Health Assessment

Pilbara Ports Authority

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O2 MARINE

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1. Introduction

1.1. Project Description

Pilbara Ports Authority (PPA) are seeking to install a dust monitor (labelled M10 in Figure 1-1) for their Part V licence and are proposing to clear a small stand of benthic communities and habitat, dominated by mangroves at Utah Point. The proposed clearing parcel and pad construction (Figure 1-2) has a footprint of up to 15m x 15m (inclusive of a buffer zone) and will tie into existing infrastructure (a compacted stone track leading out to one of PPA's existing beacons).

Figure 1-1: Utah Point proposed dust monitoring location (M10)

Figure 1-2: Proposed construction footprint of dust monitoring pad

1.2. Study Area

The assessment of intertidal mangrove habitat focussed on the specific footprint of the proposed development area (Figure 1-2) as well as a 5m buffer zone.

1.3. Scope and Objectives

The scope of this report is to provide an account of the current health of mangrove stands around the proposed construction area at Utah Point, as well as determining species composition and canopy cover.

Key objectives of this assessment are:

- Complete a desktop review to provide context for this investigation and evaluation of mangrove communities;
- Obtain field data for assessment of mangrove community health;
- Undertake ground-truthing and digital habitat mapping; and
- Conduct cumulative loss calculations and an assessment of the functional ecological value and regional significance of mangrove communities within the proposed footprint area.

1.4. Legislative Framework

The Environmental Protection Agency (EPA), outlines what is required for all new proposal via their Environmental Quality Management Framework (EQMF). The EPA (2016) document outlines what

information is needed to assess a projects temporary, short terms and long term impacts. Where mangrove BCH has been identified as an environmental factor the EPA may require information or studies including, but not limited to:

- Mapping showing the types of benthic communities, habitats and their distribution within the zone of influence.
- Assessment of the environmental values and significance of the benthic communities at various scales (local, regional, state-wide etc.) and to describe likely consequences for ecological integrity and biological diversity.
- Cumulative impacts from other existing and approved developments to determine whether new proposals, in combination with existing developments, will have a significant impact on benthic communities and potential flow on impacts to ecological integrity and biodiversity.

Furthermore, all proponents should follow guidance (EPA, 2016) to demonstrate how the impact mitigation steps have been applied;

1. Consideration of options to avoid impacts on BCH, by providing the rationale for selection of the preferred site and layout.
2. Where impact avoidance is unavoidable, show that the proposal has been designed to minimise damage/loss of BCH. All proposals must justify any design in terms of operational needs against environmental constraints.
3. How ‘best practicable’ design, construction and environmental management methods aimed at minimising further damage/loss of BCH and maximising potential for recovery, have and will be applied.

2. Desktop Review

O2 Marine completed a desktop review of existing readily available literature on BCH around Utah Point and the greater Port Hedland Port locality, as a preliminary component of this report.

Existing documents reviewed during the preparation of this report included:

- Pilbara Ports Authority (2018). Mangrove Rehabilitation Guidelines. A382466. Report prepared for Director Environment and Heritage, February 2018.
- V & C Semeniuk Research Group (2007). The mangroves of Utah Point, Port Hedland - regional setting, description, processes, significance, prediction of port construction impacts, and mitigation. Report prepared for Sinclair Knight Merz, May 2007.
- Worley Parsons (2013). *Lumsden Point General Cargo Facility Ecosystem and Cumulative Impact Assessment*. Prepared for Port Hedland Port Authority, September 2013.

The above documents and other relevant literature were reviewed to achieve the following aims:

- Identify existing and historical mapping of the project area and adjacent potentially impacted areas to spatially characterise the known distribution of mangroves habitat within the study area,
- Provide context to evaluate the environmental values and significance of mangrove BCH in the proposed area.

2.1. Literature Review Key Findings

Existing data on mangrove species composition in the Pilbara region outline that there are seven generally accepted species inhabiting the bioregion. These species, in order of prevalence are; *Avicennia marina, Rhizophora stylosa, Ceriops australis, Aegialitis annulata, Aegiceras corniculatum, Osbornia octodonta* and *Bruguiera exaristata* (PPA, 2018). Of these seven species, previous studies (V & C Semeniuk Research Group, 2007) have identified all except *Osbornia octodonta* being present (in various densities) within the Utah Point locality.

The mangroves of the Utah Point area form four predominant types or patterns of assemblages related to habitat (V & C Semeniuk Research Group, 2007):

- Zone 1 (most dominant pattern): A narrow seaward fringe of *Avicennia marina* low forest to scrub; followed by a wide band of *Rhizophora stylosa* low forest to scrub, with mixed low forest scrub pockets of *Avicennia marina* and *Rhizophora stylosa*, followed by a wide and open scrubby zone of *Avicennia marina* heath.
- Zone 2: Narrow fringing Ceriops australis, with small portions of *Bruguiera exaristata* and *Avicennia marina*, where limestone ridges are present.
- Zone 3: Isolated clumps of Avicennia marina, with portions of habitat including *Ceriops australis, Bruguiera exaristata, Aegialitis annulata,* and *Aegiceras corniculatum* a, where sandy beaches or sand on limestone substrate is present.
- Zone 4. Skinny fringing *Aegialitis annulata*, *Aegiceras corniculatum*, and *Avicennia marina* in low open patches occurring in soft sediment zones.

When mapped (Figure 2-1) the mangrove assemblages can be broadly simplified into the following units (V & C Semeniuk Research Group, 2007):

- Vegetation 1: *Avicennia marina* low forest to scrub (where *Avicennia marina* formed closed formations with plants 3 m - 6 m high).
- Vegetation 2: mixed *Avicennia marina* and *Rhizophora stylosa* low forest to scrub (*Avicennia marina* and *Rhizophora stylosa* in a 50:50 mix, formed closed formations with plants 3 m - 6 m high).
- Vegetation 3: Rhizophora stylosa low forest to scrub (where *Rhizophora stylosa* formed closed formations with plants 3 m - 6 m high).
- Vegetation 4: *Avicennia marina* scrub to open heath, (where *Avicennia marina* formed closed formations with plants 3 m high, grading to open formation with 50% cover, with plants 1-2 m high).

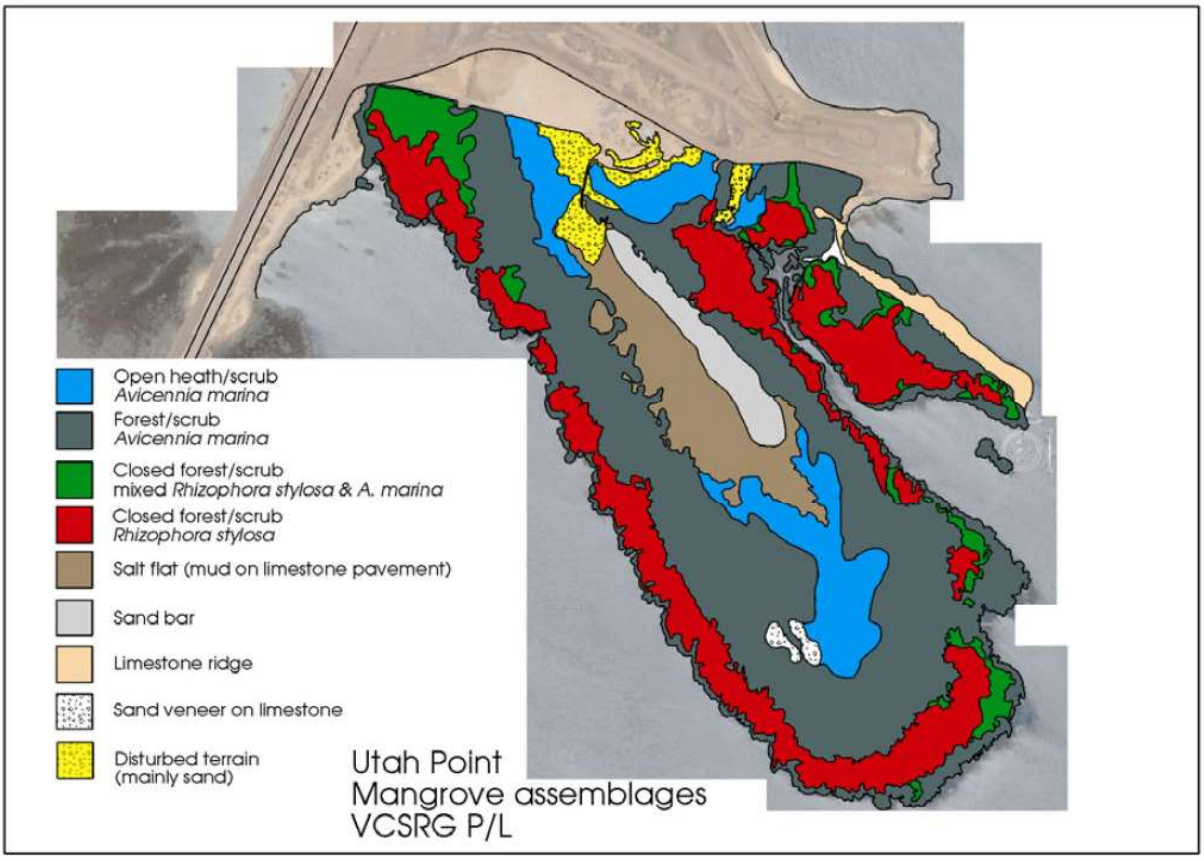

Figure 2-1: Simplified map of predominant mangrove assemblages and unvegetated substrates around Utah Point (V & C Semeniuk Research Group, 2007).

The Pilbara's tropical arid climate, moderate tidal variations, typically smaller creek systems, and poorly developed estuaries leads to lower species richness occupying a reduced variation of mangrove (and other BCH) habitat and are far less complex than those further north in the Kimberley region (URS 2010). The 16km^2 plus of mangrove habitat covering the Port Hedland harbour area is predominantly comprised of *Avicennia marina* forests, scrub, and heath, and slightly less abundant *Rhizophora stylosa* forests. The area of mangroves proposed to be cleared for the dust monitoring pad at Utah Point, in the context of the loss of the mangrove habitat from a regional perspective, is

relatively minor. None of the observed mangrove species are identified as having national or international significance and are typically widely distributed. Furthermore, from a biogeographic and scientific standpoint, the Utah Point mangrove communities are not unique or significant, as they are made up of species that are very well represented elsewhere, and no unusual assemblages or species are present (V & C Semeniuk Research Group, 2007).

3. Local Assessment Units

Section 4.2 of EPA 2016 outlines the requirement to clearly define spatially based LAUs within which cumulative losses for BCH can be calculated, assessed and presented. An existing LAU has been established for the Port Hedland Port area. This is presented in Appendix 1 of the Technical Guidance – Protection of Benthic Communities and Habitats (EPA, 2016) and was established due to Development of the port and other construction and industrial projects at Port Hedland incurring incremental loss of BCH. The cumulative losses of mangrove (and other key habitats) associated with development in and around Port Hedland are significant issues.

The current LAU and existing habitat mapping is presented in Figure 3-1. Port Hedland's LAU is currently undergoing a review to recalculate the amount of BCH coverage still present as it is thought that worst case scenario loss calculations from previous projects are currently overestimating the amount of habitat lost. The most recent calculation for mangrove community present within the LAU prior to 1964 is 2,676 ha. Of this, approximately 386.7 ha[1] have been either lost as a result of development or are planned to be disturbed by future approved projects (WorleyParsons, 2015c), which represents a cumulative loss of 14.45%.

[1] Figures are based of proposed losses and do not account for any accretion.

Figure 3-1: Port Hedland LAU (EPA, 2016)

4. Methodology

O2 Marine conducted a field survey on 11th December 2020 to collect detailed information for mangrove health assessment and ground-truth existing habitat maps.

4.1. Site Selection

One site was selected and assessed for mangrove health parameters. The site was essentially the footprint of the proposed construction area, including an additional buffer area. The total size of the surveyed area was approximately 10m^2. Observational data on the immediately surrounding habitat were also recorded to aid in giving context during the analysis.

4.2. Mangrove Health Assessment

One flora quadrat 10m x 10m (10 m2) was surveyed at low tide. The boundary of the quadrat was measured and marked using fluorescent flagging tape. The position of the quadrat targeted an area which comprised more than one mangrove species. The following metrics were recorded during the assessment of the quadrat:

- Coordinates,
- Mangrove species,
- Number of Trees,
- Species Composition,
- Dead branches,
- Canopy Height,
- Canopy Density (using a densiometer)
- Canopy Condition,
- Diameter at Breast Height (DBH), and
- General observations.

Photos were also collected using a digital camera.

4.3. Mangrove Mapping

Site walk observations were collected during December 2020. The survey methodology provided a ground-truthing/mapping exercise to delineate the intertidal habitat boundaries in the area and validate existing imagery. The information in the notes included habitat characteristics, health, and vegetation type.

The boundaries of intertidal habitats and mangrove associations identified from ground-truthing and post fieldwork imagery analysis were geographically registered in QGIS. Fine-scale 'habitat' polygons were then digitised on-screen in QGIS by using high spatial resolution digital imagery as background to inform the mapping and corrected for any local spatial inaccuracies. The mangrove habitat was mapped into five (5) dominant vegetation associations in accordance with Paling *et al.* (2003) shown in Table 4. Polygons were assigned the appropriate habitat classification, and the total areas for each habitat class were then calculated using QGIS.

Spatial data was then assessed using ArcGIS to calculate the areas of each mapped mangrove community to inform the cumulative loss assessment.

Table 3-1 Mangrove classifications and their description used to prepare mangrove association maps derived Paling *et. al.* 2003

Code	Classification	Description
Am1	*A. marina* (Seaward edge)	Typically closed canopy cover and usually big, spreading trees and often with limbs that bend down onto the substrate - this is usually only a few 10's meters wide and backed by *Rhizophora* (Rs either in a monospecific stand or mixed association with Am)
Rs	*R. stylosa* (Behind Am)	Typically closed canopy and dense, often just 10's of meters wide and may extend as fingers into the landward Am where there are narrow shallow tidal channels.
Rs/Am	*R. stylosa* / *A. marina* closed canopy mixed	This is usually a transition zone between the Rs monospecific stands and the monospecific stands of the landward edge Am closed canopy. *R. stylosa* / *A. marina* (closed canopy, mixed) was allocated where either species contributed approximately between 20% to 80% of the mangrove stand.
Am2	*A. marina* closed canopy (Landward edge)	Typically the largest area of mangrove association and comprises trees that show a decline in height moving from seaward to landward.
Am3	*A. marina* scattered.	The point where Am landward edge displays canopy gaps and these gaps eventually become larger in total area than the surrounding Am. Individual scattered mangroves were excluded if tree density was approximately less than five trees per 100 m^2.

5. Results

5.1. Mangrove Health Assessment

Species composition of the Utah Point site was 85% *Avicennia marina* and 15% *Aegiceras corniculatum.* The overall health of the mangroves present within the quadrat was good, with <10% leaf insect damage, <10% yellowing leaves, and <10% dust cover[2]. Canopy cover (using a concave spherical densitometer) across the quadrat was 50%, with average canopy height between 2.5 and 3m. Total tree (>0.5m) counts within the quadrat were 22, including 18 *Avicennia marina* and 4 *Aegiceras corniculatum.* Mean diameter at breast height (DBH) was 4.97cm, with 44 stems counted across 10 trees. Mangrove health data is presented in Table 4-1.

Both *Avicennia marina* and *Aegiceras corniculatum* were budding, with some flowers starting to open towards the top of the canopy. Recruitment was prevalent across the site with a large number of seedlings (<0.5m in height) present. Over 40 *Avicennia marina*, 14 *Aegiceras corniculatum* and 3 *Rhizophora stylosa* seedlings were counted within the site.

Table 4-1: Mangrove health data for Utah Point site.

Health Metric	*Avicennia marina*	*Aegiceras corniculatum*	*Rhizophora stylosa*
Species composition	85%	15%	0%
Insect damage	<10%		N/A
Dust coverage	<10%[2]		N/A
Yellow leaves	<10%		N/A
Canopy Density	50%		N/A
Canopy Height	2.5 – 3.0 m		N/A
No. of trees	18	4	N/A
Seedlings (<0.5m)	40+	14	3
Mean DBH (± SD)	4.97 ± 2.33		N/A

5.1.1. Photography

Some representative images taken during the survey are displayed in Figure 4-1.

[2] The mangrove survey was undertaken during a rain event, thus it is not expected dust coverage is a true representation of normal conditions.

Figure 5-1: Clockwise from top left - *Avicennia marina* and *Aegiceras corniculatum* mixed strands (x2), *Rhizophora stylosa* seedlings, *Aegiceras corniculatum* bud, *Avicennia marina* bud, *Avicennia marina* and *Aegiceras corniculatum* mixed strand.

5.2. Habitat Mapping

Figure 4-1 displays the mapped substrate cover types occurring within the project footprint. Table 4-1 presents the total area (164m^2), as well as coverage area and relative percentages for each mapped substrate cover within proposed footprint and surround areas.

Within the project footprint *Avicennia marina* and *Aegiceras corniculatum* dominated habitat classification, accounting for 75m^2 or 45% of mapped area. The areas covered by this mixed species category was the fringing areas to the existing rock wall structure. Am3 (scattered) association was the only other habitat present within the area. The scattered Avicennia marina habitat dominates the landward fringe comprising 36m^2 or 21% of the total proposed project footprint area. The remaining cover within the footprint was mud and/or sand flats (41m^2 or 25%) or the existing rock wall structure (12m^2 or 7%).

Rhizophora stylosa seedlings (Figure 4-1) were not counted in the assessment as they were below the 0.5m cut off for classification as an established tree.

Table 4-2: Total area (m^2) and relative percentages for each mapped substrate cover within proposed footprint.

Substrate Cover Class	Description	Total Area	
		m^2	%
Am/Ac	*Avicennia marina / Aegiceras corniculatum*	75	46%
Am3	*Avicennia marina (Scattered)*	36	22%
Mudflat	Mud/sand flat	41	25%
Rock	Rock barrier	12	7%
Total		**164**	**100%**

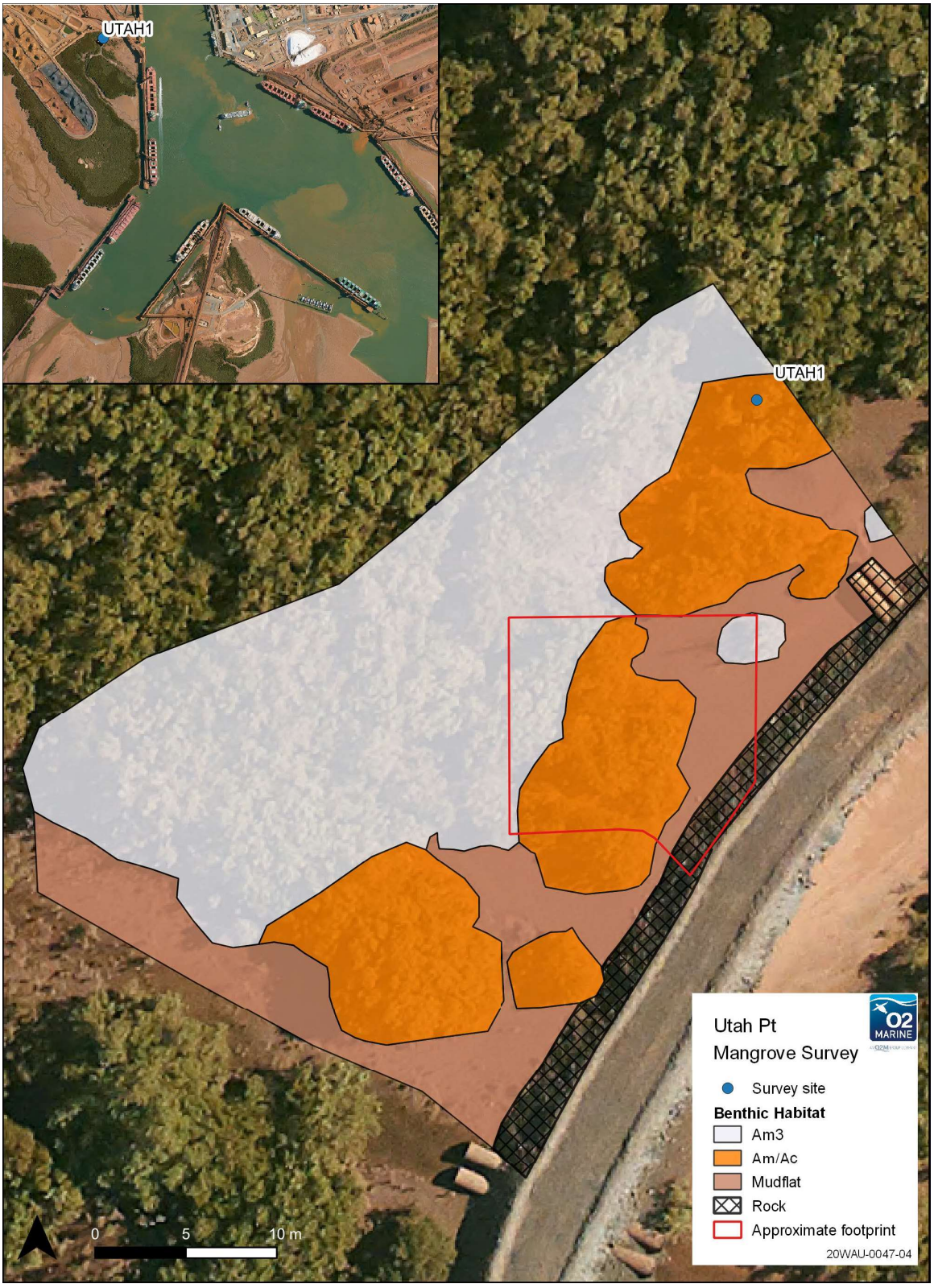

Figure 5-2: Utah Point substrate cover class map

6. Cumulative Loss Assessment

6.1. Indirect Impacts

6.1.1. Construction

During construction of the proposed concrete pad, measures should be put in place to ensure use of existing roads to avoid further damage or loss of BCH. Access to nearby mangrove stands during construction should also be restricted to further ensure the preservation of surrounding habitats. Considering the locality of the proposed project footprint to the adjacent access road, there should be no indirect impacts if due care is undertaken.

Due to the small size of proposed pad, it is highly unlikely to indirectly impact surrounding mangrove through altering any tidal flows or altering sedimentation or accretion. Tidal flows in this area are already heavily influenced by the built up access road, and since the proposed footprint is on the landward side of the road, limited further impact is predicted.

6.2. Direct Impacts

6.2.1. Direct Irreversible Loss

For the purpose of this report, the maximum loss of BCH from the proposed development at Utah Point is 111m^2 (0.011 ha) or an additional loss of 0.00041% of the Port Hedland LAU.

7. Discussion and Conclusion

The mixed mangrove habitat present at the proposed development location is well represented throughout the greater Utah Point area, as well as further abroad within Port Hedland harbour. Canopy height and density was inline with what is expected from an area classified as am3, with scattered small to medium sized trees present with a low moderate canopy cover density (50%).

High levels of recruitment seen at the site may also be due to changes in hydrology caused by anthropogenic influences, such as the pre-existing raised rock wall (road) and intermittent culverts. This altered water flow and reduction of tidal influence has likely allowed heavy recruitment in an area which was partially cleared to allow the construction of the now existing rock wall. It would be expected that as young mangroves in newly colonised habitat become established, competition for space and light will increase, with further successful recruitment reducing.

The location of the proposed project footprint has ensured minimal loss of mangroves, as well as limiting any further influence of the hydrology of the area. Construction activities should be able to be executed with zero of very minor indirect impacts or disturbance.

Habitats assessed within the Utah Point survey area are commonly distributed throughout the wider Pilbara region, as well as being widely distributed further within the Australian tropics or internationally. All species identified during the assessment are also typically found within a broader geographical distribution.

While the general health of the mangroves present within the surveyed site is excellent, the loss of such a small area (0.01 ha) is not considered significant in the context of the Port Hedland LAU. Assessment of the value of this habitat to be disturbed specifically in a regional context, as well as the spatial area of habitat to be removed, is likely that impacts on mangrove BCH for the project are minimal.

8. References

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