Environmental Review Document

Cape Lambert Port A Marine Structures Refurbishment Project

Section 38 Referral

December 2018

RTIO-HSE-0328695

Disclaimer and Limitation

This report has been prepared by Rio Tinto's Iron Ore Group (Rio Tinto), on behalf of Robe River Mining Co. Pty Limited (the Proponent), specifically for the Cape Lambert Port A Marine Structures Refurbishment Project. Neither the report nor its contents may be referred to without the express approval of Rio Tinto, unless the report has been released for referral and assessment of proposals.

Document Status					
Rev	Author	Reviewer/s	Date	Approved for Issue	
				To Whom	Date
1-2	B. Ovens	A. Kerswell	10 Dec 2018	P. Royce	19 Dec 2018
3	C. Evans	A. Kerswell	17 Dec 2018	P. Royce	19 Dec 2018

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1. Introduction

1.1 Purpose and scope of the Environmental Review Document (ERD)

Robe River Mining Co Pty. Limited on behalf of the Robe River Iron Associates (RRIA) Joint Venture (the Proponent), a wholly owned subsidiary of the Rio Tinto Group, own and operate the Cape Lambert Port which consists of two operational areas; Cape Lambert Port A (CLA) and Cape Lambert Port B (CLB). CLA was constructed in 1972, with construction of CLB completed in 2012. The CLB facilities underwent environmental assessment and approval in 2008 under the *Environmental Protection Act 1986* (EP Act) and the *Environment Protection and Biodiversity Act 1999* (EPBC Act) (Ministerial Statement No. 840 and EPBC 2008/4032).

The Proponent proposes to undertake essential maintenance works on the CLA wharf facility and associated jetty. The Proposal consists of two components, the CLA Dolphin Life Extension Project and the CLA Jetty Strengthening Project, collectively referred to as CLA Marine Structures Refurbishment Project (the Proposal).

This document has been prepared to support the referral of the Proposal under Section 38 of the EP Act. It provides information on the Proposal characteristics, existing environment, potential environmental impacts and proposed management commitments. This document has been prepared in accordance with the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016*.

This document has been prepared for Rio Tinto which is acting on behalf of the Proponent. The Rio Tinto Group (Rio Tinto) is managing the environmental impact assessment and approvals process (for which this report is prepared) on behalf of the Proponent.

1.2 Proponent

The Proponent for the Proposal is Robe River Mining Co Pty. Limited (ABN: 71 008 694 246, ACN: 008 694 246, Address: GPO Box A42 Perth WA 6837) which is a member of the Rio Tinto Group of companies.

Robe River Mining Co Pty. Limited is the manager and agent for the RRIA which is an unincorporated joint venture comprising the following partners:

- Robe River Mining Co Pty. Limited (30% share)
- North Mining Limited (35% share)
- Mitsui Iron Ore Development Pty Ltd (20% share)
- Pannawonica Iron Associates, a partnership carried on by Nippon Steel & Sumitomo Metal Australia Pty Ltd, Nippon Steel & Sumikin Resources Australia Pty Ltd (10% share)
- Cape Lambert Iron Associates, a partnership carried on by Nippon Steel & Sumitomo Metal Australia Pty Ltd, Nippon Steel & Sumikin Resources Australia Pty Ltd and Mitsui Iron Ore Development Pty Ltd (5% share).

The Rio Tinto Group (Rio Tinto) is managing the environmental impact assessment and approvals process on behalf of the Proponent. The Rio Tinto contact person in relation to the environmental approvals process for this referral is:

Peter Royce

Principal Advisor Environmental Approvals

Rio Tinto

Telephone: +61 (0) 438 946 858

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1.3 Proposal terminology

The following terminology is used throughout this document:

- **Proponent** – Robe River Mining Co Pty. Limited as manager and agent for the RRIA Joint Venture as set out in Section 1.2
- **Proposal** – The works associated with the CLA Marine Structures Refurbishment Project including the CLA Dolphin Life Extension Project and the CLA Jetty Strengthening Project
- **Proposal Footprint** – the direct impact footprint of the Proposal, which includes the existing CLA jetty and the laydown area
- **Proposal Area** – Proposal footprint plus a 2 km radius, which encompasses the extent of potential direct and indirect (predominantly noise) impacts of the Proposal
- **Study Area** – includes areas surveyed / studied beyond the Proposal Area.

1.4 Environmental impact assessment process

The EP Act is Western Australia's primary environmental legislation. Part IV of the EP Act provides for the consideration and assessment of proposals that may or will have a significant impact on the environment. The impact assessment process is administered by the Environmental Protection Authority Services (EPA Services) within the Department of Water and Environmental Regulation (DWER). EPA Services provides support to the Environmental Protection Authority (EPA), which is an independent statutory body established under the EP Act.

The Cape Lambert Port facilities have been upgraded several times since shipment of iron ore commenced in 1972. Approvals obtained under Part IV of the EP Act for each of these upgrades are summarised in Table 1-1 of Section 1.5.2 along with applicable licences under Part V of the EP Act. Relevant approvals under the EPBC Act are also listed.

The Cape Lambert Port facilities have been developed under an existing State Agreement with the Western Australian Government under the *Iron Ore (Robe River) Agreement Act 1964*. This agreement is managed by the Department of Jobs, Tourism, Science and Innovation (JTSI) on behalf of the Western Australian Government.

Rio Tinto is referring the Proposal under Section 38 of the EP Act as a proposal which may, if not appropriately managed, have a significant environmental impact on environmental factors including:

- Marine Fauna
- Social Surroundings
- Marine Environmental Quality
- Benthic Communities and Habitats.

Rio Tinto is committed to avoiding, minimising and managing potential impacts to the environment and has developed an Environmental Management Plan (EMP) for the Proposal to avoid impacts to the identified environmental factors (Appendix A).

Rio Tinto is of the view that the potential environmental impacts of the Proposal can be adequately managed such that any residual impacts will be low to negligible and considered acceptable.

1.5 Other approvals and regulation

1.5.1 Land tenure

The Proposal is located within the existing Cape Lambert Port lease areas which cover both land based and marine infrastructure and include:

- Cape Lambert Industrial Area Special Lease (Lease 123396)
- Cape Lambert Marine Structure Special Lease (Lease 890081)
- Cape Lambert DoT Seabed Lease (Lease M644282)
- Railway Special Lease (Lease 123390).

The land surrounding the Proposal Area is largely designed to support the iron ore industry. The town of Wickham was established to service the needs of the mining industry since the 1970s and continues to be the principal support town for port operations, in addition to the larger service and administrative town of Karratha. The town of Point Samson is a small fishing and tourist town, comprised of residential homes, holiday homes, several restaurants, a caravan park, a small harbour and commercial fishing fleet.

1.5.2 Other approvals

The Cape Lambert facilities have been upgraded several times since shipment of ore commenced in 1972. Approvals obtained under Part IV of the EP Act for each of the upgrades are summarised in Table 1-1 along with applicable licences under Part V of the EP Act. Relevant approvals under the EPBC Act are also listed.

Table 1-1: Other approvals and regulations

Proposed activities	Land tenure/access	Type of approval	Legislation regulating activity
Upgrade of CLA to accommodate ore from the West Angelas mine site and increase throughput to 55 Mtpa. Included marine and terrestrial works.	Cape Lambert Port lease areas	Ministerial Statement 514 (28 June 1999)	Part IV of the EP Act
Upgrade of CLA to increase throughput to 85 Mtpa. Included terrestrial works only. Subsequent change to proposal amendment under MS 741 for 105 Mtpa throughput.	Cape Lambert Port lease areas	Ministerial Statement 741 (18 May 2007) Ministerial Statement 1050 (30 December 2016) – s46 change of conditions (dust and noise)	Part IV of the EP Act
Dredging for upgrade of CLA to 85 Mtpa. Included marine works only.	Cape Lambert Port lease areas	Ministerial Statement 743 (12 July 2007)	Part IV of the EP Act
Construction of the CLB project with 130 Mtpa capacity. Both terrestrial and marine works.	Cape Lambert Port lease areas	Ministerial Statement 840 (30 September 2010) and Ministerial Statement 876 (31 October 2010) Ministerial Statement 1049 (30 December 2016) – s46 change of conditions (dust) EPBC 2008/4032 (26 October 2010)	Part IV of the EP Act Sections 130 (1) and 133 of the EPBC Act

Proposed activities	Land tenure/access	Type of approval	Legislation regulating activity
Category 5 – Processing or beneficiation of metallic or non-metallic ore Category 12 – Screening etc of material Category 52 – Electrical Power Generation Category 58 – Bulk material loading or unloading Category 73 – Bulk storage of chemicals, etc	Crown Land Title (LR3153/692, LR3062/529, LR3062/531, LR3062/518, LR3122/588, LR3114/871, LR3164/506, LR3164/424, LR3119/871 and LR3119/863)	Prescribed Premises Licence (L5278/1973/13)	Part V of the EP Act

The Cape Lambert port facilities operate under a number of management plans, with the most relevant to this assessment being the Cape Lambert Operations Marine Environmental Quality Management Plan (MEQMP) (a requirement of Ministerial Statement 743) and the Marine Turtle Management Plan (a requirement of Ministerial Statement 840).

1.5.3 Commonwealth environmental approvals

The EPBC Act is the principal federal environmental legislation protecting matters of national environmental significance (MNES). The EPBC Act is administered by the Commonwealth Department of the Environment and Energy (DoEE).

The Proposal is also being referred under the EPBC Act as an ‘action’ that has the potential to impact Matters of National Environmental Significance (MNES).

2. The Proposal

This chapter describes the Proposal and provides context for its development.

2.1 Background

The Cape Lambert Port currently consists of two fully operational areas, CLA and CLB, located on the Pilbara coast of Western Australia approximately 5 km from Point Samson, 12 km from Wickham and 60 km from Karratha (**Figure 2-1**) CLA was constructed in 1972, with construction of CLB completed in 2012. The CLB facilities underwent environmental assessment and approval in 2008 under the EP Act and EPBC Act (Ministerial Statement No. 840, EPBC 2008/4032). The key components of the port facilities include:

- Five car dumpers
- Eight shipping berths
- Two wharfs
- Nine stackers
- Six reclaimers
- Four ship loaders.

Other infrastructure and facilities at the Cape Lambert Port include:

- Ore handling facilities – rail tracks, conveyors, stockpiles and screenhouses
- Supporting operational infrastructure - offices, warehouses, workshops
- Supporting infrastructure – laydown and storage areas
- Marine facilities – berth pockets, turning basins, shipping channel and tug harbour.

A number of upgrades to the Cape Lambert facilities to increase the throughput of the port have occurred since 1972 and these are summarised in Table 1-1 of **Section 1.5.2**.

2.2 Justification

The CLA dolphins were constructed between 1972 and 2002, with recent structural integrity inspections indicating that the current dolphins are near end of life and need replacement. In addition to this, the existing jetty is approximately 40 years old and reinforcement of the structure is required to ensure continued resilience to future adverse weather events (e.g. cyclones).

Modelling undertaken for a pre-feasibility study indicated that the current dolphin piles are not structurally sufficient for current design criteria (i.e. strength and corrosion allowances). There are also additional safety concerns associated with the ladder access currently used to access the dolphins. The Proposal will also include the installation of new walkways between dolphins to improve safety and access around the wharf.

Considering the safety concerns, the do-nothing / business as usual approach is not an option in this instance. Structural failure of any one dolphin could cause a significant safety and/or environmental incident. It may also result in a significant reduction of total loading capacity over time due to the loss of berthing capacity during un-planned remediation works. It is not feasible to shut the jetty for remediation works, which is why a non-disruptive approach (e.g. off-set supports) has been selected.

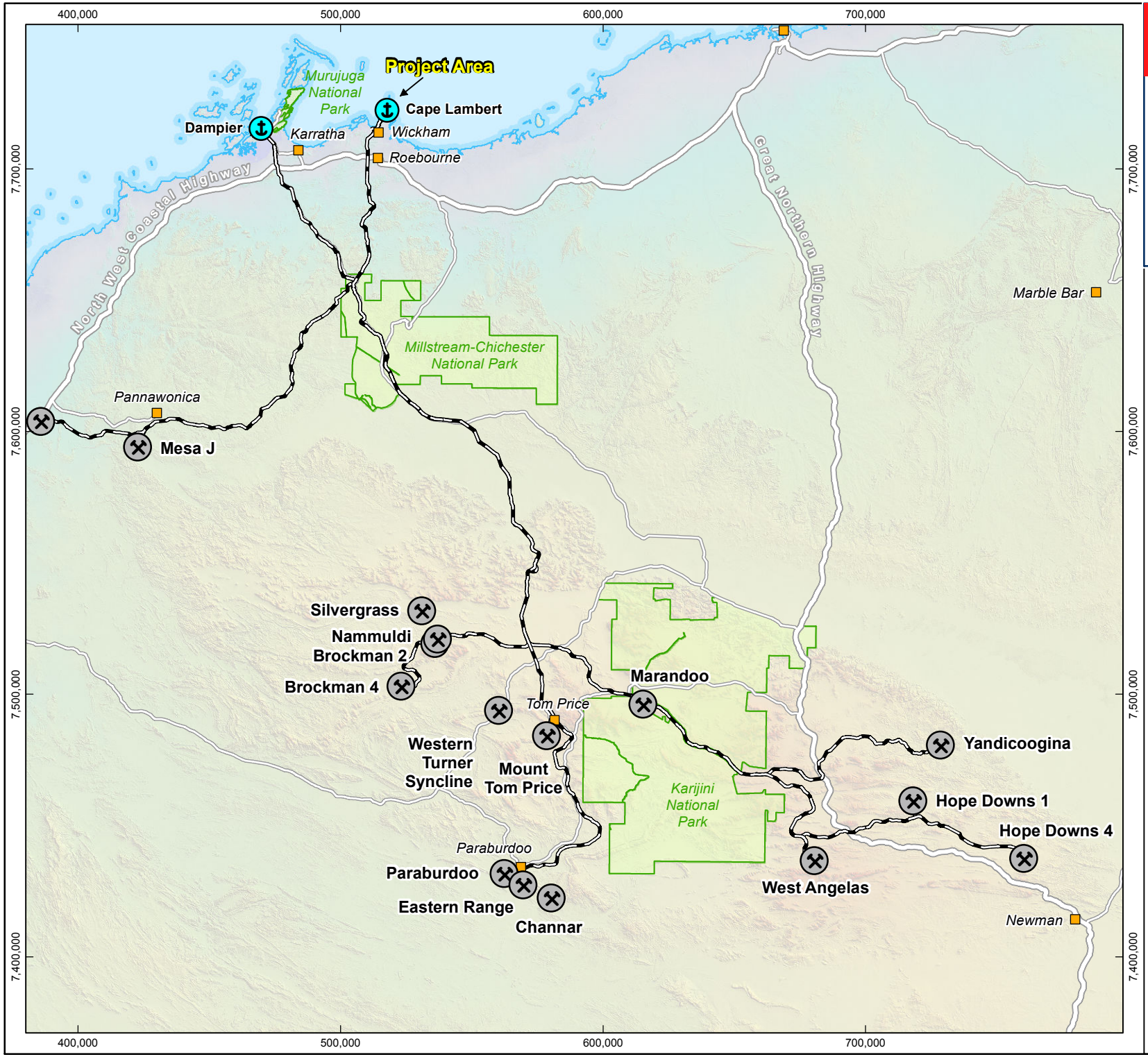
Once implemented, the Proposal will restore the structural integrity of the dolphins and extend the asset life of the CLA wharf/jetty structures by 50 years, assuming that protective coating and cathodic protection is maintained.

2.3 Proposal description

The Proposal involves undertaking refurbishment (maintenance) works on the CLA wharf and associated jetty to extend the life of the wharf asset and strengthen the jetty structure. The Proposal consists of two components, the CLA Dolphin Life Extension Project and the CLA Jetty Strengthening Project, collectively referred to as CLA Marine Structures Refurbishment Project. The activities associated with the Proposal are predominantly nearshore works, located within the existing port facility. Specifically, the Proposal includes:

- **Site preparation:** Prior to the commencement of any activities, site establishment will occur and involves the offsite fabrication and delivery of all necessary piles, caps, fenders and mooring equipment required for 18 berthing dolphins and two mooring dolphins. The onshore component of the Proposal will involve the establishment of two laydown areas for pile storage, within already cleared areas located within the Proposal Footprint. The piles will be loaded aboard barges at the existing CLA Service Wharf for haulage to the nearshore worksite.
- **Replacement of existing dolphins:** The replacement of 20 dolphins will be undertaken via the installation of new dolphins alongside the existing structure; these will be connected by a steel jetty walkway between the new dolphins to enhance safe access around the wharf. A total of 108 new piles will be driven into the seabed using a hydraulic pile hammer supported by a crane and jack-up barges. Following the installation of the new replacement dolphins, the redundant dolphins will be mechanically cut above seabed level and transported to shore with the intention to be recycled as scrap metal.
- **Jetty strengthening:** the existing jetty will be strengthened through the installation of an additional 36 piles with tie-ins back into the jetty. The piles will be installed in groups of four (two either side) at nine locations along the jetty. These piles will be installed using a hydraulic pile hammer supported by a crane and jack-up barges.

As the Proposal involves refurbishment works to an existing operational structure, there are no additional activities associated with operations and therefore no resulting increase to the volume of iron ore shipping traffic from the Proposal. All operational activities already exist as part of the current operation in the Proposal Area. Access to berths to undertake the dolphin replacement will be dependent on schedules determined by Operations and will involve progressive berth access being granted.



RioTinto

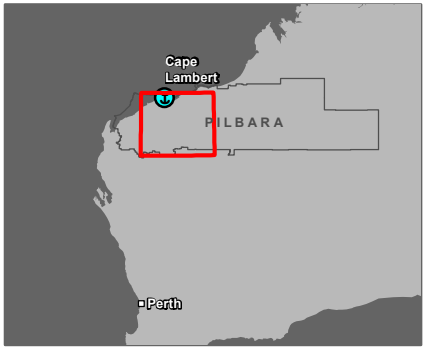
Figure 2-1: Locality

T. Murphy
December, 2018

Plan No: PDE0164793v1
Proj: MGA94 Zone 50

Legend

- Rio Tinto Mine
- Port
- Town
- National Park
- Rio Tinto Railway
- Highway
- Major Road



N

0 20 40 60 80 100
Kilometres

Map units in metres

2.4 Key Proposal characteristics

Table 2-1 formally identifies the Proposal and Proponent and provides a short description of the Proposal. Further details of the Proponent's identity were provided in **Section 1.2**. Table 2-2 sets out the key physical and operational elements of the Proposal and the locations and proposed extents of these elements.

Table 2-1: Summary of the Proposal

Proposal title	Cape Lambert Port A Marine Structures Refurbishment Project
Proponent name	Robe River Mining Co Pty. Limited
Short description	The Proposal involves refurbishment works on the CLA wharf and associated jetty to extend the life of the wharf asset and strengthen the jetty structure.

Table 2-2: Location and proposed extent of physical and operational elements

Element	Location	Proposed extent
Laydown	Figure 2-2	Storage of piles and other equipment and materials in two existing cleared laydown areas.
Movement of materials	Figure 2-2	Piles, materials and redundant piles/dolphins loaded onto a barge and transported between the existing Service Wharf and CLA wharf/jetty.
CLA dolphin replacement	Figure 2-2	Driving of 108 new piles using a hydraulic pile hammer supported by a crane and jack-up barges. Removal of existing piles – cut above seabed level and capped. Direct marine footprint of <0.2 ha.
CLA jetty strengthening	Figure 2-2	Driving of 36 new piles to depth in groups of four (two either side of the jetty) at nine locations along the jetty using a hydraulic pile hammer supported by a crane and jack-up barges. Direct marine footprint of <0.1 ha.

2.4.1 Timing

Works are scheduled to commence once all approvals have been secured. It is anticipated that the Proposal will commence implementation in Q3 2019 and extend for approximately 12-18 months. This will be dependent on the scheduling of periods when access to CLA berths is granted to undertake the works so as not to disrupt ongoing port operations. Given good working conditions, completion of a single dolphin could take around 4-5 days, while installation of pile arrangements for the jetty strengthening works could take around 1-2 days per pile location.

Piling will not be required over this whole 12-18 month period. Outside the period of piling, the implementation phase will involve delivery of piles, stockpiling of piles, loading barges with piles, delivery to the work area, positioning piles, installation of above water infrastructure (e.g. walkways between dolphins, caps, jetty tie-ins) and removal of redundant dolphins.

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eco logical AUSTRALIA
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Figure 2-2: Proposal Area and Proposal Footprint

Drawn: NR
Date: 18-Dec-18

Proj: GDA 1994 MGA Zone 50
Scale: 1:20,000 @ A4 page size

LEGEND

- Proposal Area
- Proposal Footprint
- Jetty Piles

N

0 0.5 1
Kilometres

Map units in metres

Work hours are defined in accordance with the *Environmental Protection (Noise) Regulations 1997* and are as follows:

- Daytime – 7 am to 7 pm Monday to Saturday
- Evening – 7 pm to 10 pm all days
- Daytime – 9 am to 7 pm Sunday and public holidays
- Night time – 10 pm on any day to 7 am Monday to Saturday and 9 am Sunday and public holidays.

Work hours will generally be during daytime hours; however, some works may occasionally be required during evening and night time hours. If required, night time works will be limited to support services such as the movement of equipment and barges and movement of piles. No night time impact piling is proposed and impact piling in the evening will only be undertaken when required for safety or emergency reasons to ensure that recently positioned piles remain safe and stable when left overnight. This scenario is not anticipated to occur, and it remains the intention to not pile outside the day time period.

2.5 Local and regional context

2.5.1 Terrestrial

The Proposal is located within the City of Karratha in the Pilbara region. The closest town to Cape Lambert is Point Samson, a small fishing and tourist town with a population of under 250. The town of Wickham was established to service the needs of the mining industry in the 1970s. It remains the principal support town for the Cape Lambert port operations, in addition to the town of Karratha.

The climate in the Pilbara is characterised by high temperatures, low rainfall, high evaporation rates and regular cyclonic activity. There are two distinct seasons: hot summers from October to April, when the majority of rainfall occurs and mild winters from May to September. Rainfall in the region is characterised by frequent, low intensity rainfall events related to localised thunderstorms and occasional high intensity events associated with cyclones.

The Pilbara is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges. Vegetation is predominantly mulga low woodlands or snappy gum (*Eucalyptus leucophloia)* over bunch and hummock grasses. Within the Pilbara bioregion, Cape Lambert is located in the Chichester subregion. The subregion comprises undulating Archaean granite and basalt plains including significant areas of basaltic ranges. The plains support a shrub steppe characterised by *Acacia inaequilatera* over *Triodia wiseana* hummock grasslands, while *E. leucophloia* tree steppes occur on ranges. No RAMSAR wetlands and no Commonwealth or state terrestrial conservation areas occur in the Cape Lambert area.

The soil profile consists of silty sands and clays overlying weathered, fractured basalt of low to moderate permeability. Groundwater at Cape Lambert is saline and occurs in surficial deposits and fractured basalt at a depth of 1.5 to 3.0 m above Australian Height Datum. The main surface water body at Cape Lambert is an open drainage channel that runs along the western side of the railway line. This channel captures runoff from the majority of the site and directs the flow into Sam's Creek via culverts under the railway. Sam's Creek is tidal and extends primarily eastwards to the ocean.

2.5.2 Marine

Cape Lambert is located on the North West Shelf, which comprises 95,000 km^2 of continental shelf extending from the North West Cape of Western Australia to the Arafura Sea. The dominant influence on the circulation in the waters off Cape Lambert is the north-west shelf tides and the

regional winds. Tides are semi-diurnal with a spring tidal range of approximately 5 m. Water movement in the region during spring tides are more influenced by tidal currents than local wind conditions. The bathymetry off Cape Lambert is complex, with depths generally less than 20 m. There is a broad, shallow (<10 m) near shore region with several exposed islands and reefs, generally lying between 1 and 10 m depth and typically orientated in an east–west direction.

The area immediately north of Cape Lambert is defined by a broad, shallow intertidal flat that gently slopes to a shallow bank stretching for a few hundred metres before quickly sloping down to a uniform depth of approximately 7 to 9 m. A further 1.5 to 2 km beyond this area, the seabed steeply slopes to 12 to 14 m depth.

The water quality of the shallow nearshore waters of the Proposal Area are influenced by the tidal and regional wind conditions of the wider Cape Lambert area. Tidal changes and wind generated water movement re-suspends fine sediments, which results in naturally elevated levels of turbidity. Turbidity levels are also seasonally dependent with high levels of natural turbidity occurring during and after cyclones and rainfall events, as a result of major wave action and episodic freshwater run-off from the mainland or islands.

Within the Proposal Area much of the benthic zone has been mapped as sand and silt. Benthic communities include 'coral' and ‘pavement partly covered by macroalgae and coral’, predominantly located in near-shore areas and surrounding islands (Hydrobiology 2018).

There are no existing Commonwealth marine protected areas in the Cape Lambert area. The closest is the Dampier Marine Park, which occurs within 10 km of Cape Lambert and is part of the North-west Marine Parks Network. Cape Lambert is not situated in a State marine reserve, with the closest being the proposed Dampier Archipelago Marine Park, located less than 20 km from Cape Lambert. Other marine parks and management areas associated with the Montebello and Barrow Islands are located approximately 170 km west of Cape Lambert. The local and regional context for the Proposal is presented **Figure 2-1**.

3. Stakeholder engagement

3.1 Key stakeholders

Key stakeholders were identified based on the Rio Tinto's experience in project developments in the Pilbara region, especially recent port expansions and upgrades at Dampier and Cape Lambert. The following key stakeholders were identified:

State and Local Government agencies

- City of Karratha
- Department of Jobs Tourism, Science and Innovation
- Department of Transport
- Environmental Protection Authority Services of the Department of Water and Environmental Regulation
- Pilbara Ports Authority

Commonwealth Government agencies

- Department of the Environment and Energy

Non-government organisations

- Point Samson Community Association
- Coastal Community Environmental Forum
- Dampier Technical Advisory and Consultative Committee

3.2 Stakeholder engagement process

The Proponent is cognisant of the need to identify any concerns of stakeholders and has sought to take into account stakeholder views during the consultation process undertaken.

Consultation commenced in September 2018 and the most recent consultation was completed in November 2018. It is anticipated that further consultation will continue with key State Government and Commonwealth Government agencies and non-government organisations (mainly the Point Samson Community Association) during the environmental assessment process and in the lead up to, and during, the implementation of the works.

The consultation program has enabled issues to be raised and discussed with stakeholders, and where appropriate, issues considered in the planning phase of the Proposal, during the determination of management measures and in preparing this referral document.

3.3 Stakeholder consultation

Consultation undertaken with key government and community stakeholders to date is summarised in **Table 3-1**.

Table 3-1: Record of stakeholder consultation

Stakeholder (and attendees)	Date	Format/Venue	Topics discussed	Outcomes/Proponent responses
Department of Jobs, Tourism, Science and Innovation • JTSI: Paul Platt, Leanne Spencer, Eliza Ryan. • Rio Tinto: Nicola Fleming, Lindsay Dodd, Rosemary Avery, Jennell Sorensen, Lynley Bear-Norton, Helen Lancaster	20 September 2018	Format: Discussion as part of regular JTSI/Rio Tinto monthly meeting Venue: JTSI office, Perth	• Project scope. • Timing for referrals. • Environmental approval and consultation process.	• Rio Tinto outlined the broad scope, environmental approvals approach, schedule and consultation program. • Rio Tinto indicated that the dolphins/jetty were structures that have all previously been approved under State Agreement proposals. • Rio Tinto was keen to notify JTSI of this work as the referral will likely be provided to JTSI as an outcome of the scheduled Rio Tinto-EPA Services discussions. • JTSI confirmed project scope was covered within existing State Agreement approvals for Cape Lambert and that no further State Agreement approval are required. • JTSI thanked Rio Tinto for the notification and did not express any concern. • Rio Tinto committed to providing further updates at future JTSI/Rio Tinto monthly meetings at key milestones. • JTSI and Rio Tinto undertook a Cape Lambert site visit in early November 2018.
Environmental Protection Authority Services of the Department of Water and Environmental Regulation • EPAS: Hans Jacob, Kevin McAlpine and two others • Rio Tinto: Peter Royce	3 October 2018	Format: Meeting and briefing/presentation Venue: EPAS office, Perth	• Marine Environmental Quality Management Plan (MEQMP) for Cape Lambert. • Possible level of assessment (LoA) under WA Environmental Protection Act. • Provisions for local council to approve Management Plan covering pile driving project. • Turbidity generated from pile driving	• EPA Services queried whether Cape Lambert Operation had an existing MEQMP. Subsequent information provided to EPA Services by Rio Tinto on 8 October 2018 clarified that MS 743 required a MEQMP and that it had been approved and amended several times and was currently being amended by Rio Tinto for EPA Services Compliance. • Preliminary and non-binding view from EPA Services was that the project appears to be able to be adequately managed without formal assessment but determination on LoA would depend on adequacy of referral and EMP. • EPA Services sought clarification whether local council could approve EMP and whether Rio Tinto could get view from City of Karratha (CoK) on that when consulting them. Rio Tinto provided response received from CoK to EPA

Stakeholder (and attendees)	Date	Format/Venue	Topics discussed	Outcomes/Proponent responses
				Services on 16 October 2018. CoK advice was that its preference was for any management plan to be submitted to DWER (possibly the regional office) rather than the CoK.
Pilbara Ports Authority (PPA) • PPA: Captain Vikas Bangia (Harbour Master and Port Security Officer Dampier) • Rio Tinto: Shane Goggin, Peter Royce	4 October 2018	Format: Meeting and briefing/presentation Venue: PPA office, Dampier	• Status of PPA jurisdiction for Port Walcott/Cape Lambert. • Requirements for Emergency Management Plan, covering planned response to cyclones. • Pilot requirements for vessels operating in Port Walcott port limits. • Potential sensitive noise receptors. • Requirements for temporary project moorings for use in event of cyclones.	• PPA currently has no jurisdiction over Port Walcott/Cape Lambert, but this will change at some point, with PPA believing it is likely early next year and certainly sometime during the course of the project, hence PPA will have an active role at some stage. • PPA will require an Emergency Management Plan (if and when PPA assumes the regulatory function over Port Walcott waters), incorporating a detailed cyclone management plan which must consider cyclone moorings including back up moorings with consideration given to towing times of vessels from Cape Lambert to Dampier. • PPA Harbour Master indicated that vessels over 35m (total towed vessel length) will require a pilot or pilot exempt master while operating in Port Walcott port limits. • PPA advised that noise from pile driving activities needed to consider all potential sensitive receptors, including vessel crews alongside the wharf. • PPA recommended that during its meeting with the DoT Rio Tinto discuss 'temporary' cyclone project moorings at Port Walcott (to avoid transit time which is critical for cyclone avoidance), including the removal of such moorings at the end of the project.
City of Karratha • CoK: Jerom Hurley (Manager Planning Services) and Leon Myburgh (Environmental Health Co-ordinator) for part of meeting • Rio Tinto: Shane Goggin,	4 October 2018	Format: Meeting and briefing/presentation Venue: CoK office, Karratha	• Noise complaints and management. • Council powers to sign off Environmental Management Plans.	• Rio Tinto will apply its existing 1800 community complaints line (and Communities and Partnerships email contact addresses) and make publicly available to the Point Samson community Rio Tinto contact personnel for any complaints or concerns. • The CoK will follow up the query put by Rio Tinto (originating from the EPAS) regarding whether the CoK can approve management plans (see response above).

Stakeholder (and attendees)	Date	Format/Venue	Topics discussed	Outcomes/Proponent responses
Peter Royce, Ross Humphries				
Point Samson Community Association • PSCA: around 10 members • Rio Tinto: Shane Goggin, Peter Royce, Ross Humphries	4 October 2018	Format: Briefing/presentation at PSCA regular monthly meeting Venue: Point Samson Community Hall	• Assigned noise levels. • Noise monitoring approach. • Management of whales during southern migration. • Light spill on turtles. • Engagement of local workforce. • Workforce accommodation.	• Rio Tinto stated assigned noise levels for Point Samson at each receptor. PSCA stated they would Google to determine comparable noise levels. • Rio Tinto advised that periodic noise monitoring was planned for model verification rather than continuous monitoring (PSCA preference). Based on perception from previous CLB monitoring, PSCA preference was for engagement of noise consultant, not main contractor to do monitoring - Rio Tinto will engage consultant for noise monitoring. • Rio Tinto stated that management of pile driving during southern whale migration season would be similar to that adopted for CLB, with good success. Under water noise modelling will assist determine monitoring and exclusion zones. • Rio Tinto stated that given location of main marine turtle nesting is at Bell's Beach (well away from CLA) and given low incremental light spill from pile driving barges within the existing Cape Lambert port operational light environment, any influence on mis-orientation of hatchings from the project will be negligible. • Rio Tinto commented that as for all projects, there are requirements for local procurement and these will be applied to this project. Engagement for some project roles/services from local providers or workforce will be likely but will be dependent on the appointed contractor. • Rio Tinto advised that the project workforce will be accommodated in existing facilities in Wickham – sufficient rooms will be available by mid 2019.
Department of Transport • DoT: Harbour Master	15 October 2018	Format: Meeting and briefing/presentation	• Timing for changes to regulatory control over Port	• DoT believed that timing for changes to the regulatory control over Port Walcott is uncertain and may be 2-3 years

Stakeholder (and attendees)	Date	Format/Venue	Topics discussed	Outcomes/Proponent responses
(Captain Steven Wenban) and Deputy Harbour Master (Captain Martin Toohey) • Rio Tinto: Shane Goggin, Peter Royce		Venue: DoT offices, Fremantle	Walcott. • Emergency Management Plan requirements. • Johns Creek marina usage and DoT contacts for Johns Creek marine. • Pilotage requirements in Port Walcott. • Further consultation on the Project and during implementation.	away. • DoT would want to be involved in any Emergency Management Plan (cyclone management) covering the Project – and would want to liaise with Rio Tinto/Contractors in that process. • DoT provided the contact details for the Karratha DoT based officer (John Drummond) for Rio Tinto/Contractor to liaise with over use and capacity of Johns Creek marine, including provisions for temporary cyclone moorings. • DoT confirmed the standard requirement for a pilot or pilot exempt master for operating vessels (within Port Walcott port limits) for vessels over 35m (total towed vessel length), as per PPA advice. • DoT expressed invitation to meet again on the Project and to provide inductions/advice to Rio Tinto/Contractor as required.
Department of the Environment and Energy • DoEE: Rod Whyte, Dionne Cassanell, Mallory Owen • Rio Tinto: Hermione Scott, Melinda Brand, Peter Royce • Consultant (ELA): Ailsa Kerswell	18 October 2018	Format: Meeting and briefing/presentation on a number of Rio Tinto projects, including CLA marine Structures Refurbishment Project Venue: DoEE office, Allara Street, Canberra	• Presentation covered: • Project overview/scope. • State assessment status. • Existing information for referral and other documentation. • MNES listed bird, reptile, marine species overview – potential, likely, known occurrences. • Potential impacts of the proposal. • Environmental management approaches. • Predicted environmental outcomes.	A presentation was given covering the topics outlined, in addition to a briefing memo issued in advance of the meeting. DoEE queries and discussion points raised included: • Timeframes – Rio Tinto advised 12-18 months, but piling not scheduled over that whole period, will be subject to availability of berths. • DoEE queried whether environmental windows could be applied – Rio Tinto advised cessation of piling during period of key marine fauna species migration is not feasible due to operational requirements and contractual implications. • Project rationale – essentially maintenance, not expansion. • Project footprint – Rio Tinto advised the effective footprint of wharf/jetty will not be increased. • Turbidity – Rio Tinto advised that vessel movements around wharf cause turbidity that make pile driving effects negligible.

Stakeholder (and attendees)	Date	Format/Venue	Topics discussed	Outcomes/Proponent responses
			• Timeframes and consultations.	• EMP will be issued with the referral. • Rio Tinto advised that scope of work was similar to CLB pile driving but CLB installed 600 piles, CLA will involve ~150 piles, much shorter duration and that same pile driving management controls successfully applied for CLB will be adopted, including for Introduced Marine Organisms. • Rio Tinto is targeting 'Not Controlled Action – Particular Manner' determination – DotEE advised this not commonly used and may not be preferred by the Delegate – Rio Tinto highlighted a number of precedence existed for this approach – DoEE advised a number of options were available to achieve a similar approach – DoEE will discuss options with Delegate upon receipt of referral. • Rio Tinto raised timing for Commonwealth approval process – based on current information, DoEE advised it was possible approval could be April 2019 – Rio Tinto highlighted time constraints for proposal. • DoEE requested the cetacean survey report completed under the CLB Ecosystem Research and Monitoring Program be submitted with the referral – Rio Tinto agreed to include report with referral.
Coastal Community Environmental Forum • City of Karratha: Peter Long, Craig Watts, Jerom Hurley, Georgia Evans • Pilbara Development Commission: Justin Fromm • Dampier Seafarers: Jake De Salis • Dampier Community Association: Rachel	12 November 2018	Format: site tour of heritage and rock art in Deep Gorge near Dampier and presentations Venue: Rio Tinto Operations, Dampier (meeting venue location alternates between Dampier and Cape Lambert)	• Introductions. • Review of previous action items from July 2018 CCEF meeting. • Cape Lambert Port Operations update (covering Air Quality, Water Management and Projects). • Projects update included Burrup Senate Enquiry, Cape Lambert Port A Marine Structures Refurbishment	No comments or queries were raised, or actions required, from the Cape Lambert Port A Marine Structures Refurbishment Project component of the Cape Lambert update, covering scope, potential impacts, proposed management and other matters as presented.

Stakeholder (and attendees)	Date	Format/Venue	Topics discussed	Outcomes/Proponent responses
Grant • Department of Biodiversity Conservation and Attractions: Steve Moore • Department of Primary Industries and Regional Development: Mike Dunne • Department of Water and Environmental Regulation: Justine Shailes • Pilbara Ports Authority: Clancie Webster • Energy Developments Ltd: Jack Barnett • Rio Tinto: Nate Foster, Jamie Heit, Rabi Singh, Martin Buck, Shontay Cardew, Simon Smith			(three slides), and the Parker Point Artificial Reef. • Dampier Port Operations update (covering Air Quality, Water management, Noise management). • Community Engagement. • General business. • Summary of new actions.	
Pilbara Ports Authority's Dampier Technical Advisory and Consultative Committee (Meeting #27) • Pilbara Ports Authority: Brad Kitchen, Dan Pedersen, Clancie Webster, David Pozzari, Vikas Bangia, Jodie Leahy, Charles Kretzmann, Sarah Glasson, Geordie Hall	29 November 2018	PPA offices Burrup Peninsula/video link to PPA's West Perth offices	• Matters relating to proposed and planned dredging and spoil disposal programs in and near Dampier Harbour. • Commonwealth marine parks related matters. • Other Business item – short briefing on CLA Marine Structures Refurbishment Project provided by Rio Tinto (technically outside scope of the Dampier TACC but in the	No comments or queries raised on the CLA Marine Structures Refurbishment Project item.

Stakeholder (and attendees)	Date	Format/Venue	Topics discussed	Outcomes/Proponent responses
• DoEE: Leo Rose • Department of Jobs, Tourism, Science and Innovation: Steve Dawson • Woodside: Bart Hollemans, Paul Nichols, Tegan Box, Chris Coffey • Toll Group: Clint Cork • Department of Biodiversity Conservation and Attractions: Tim Hunt • Murujuga Land and Sea Unit: Kyle Wilson • Department of Primary Industries and Regional Development: Mike Dunne • Department of Transport: Leane Steele • Hampton Harbour Boat and Sailing Club: Katie Meadows • Rio Tinto: Storm Nuttall			absence of a Cape Lambert TACC equivalent, Cape Lambert items are often presented to the Dampier TACC representatives by Rio Tinto for information only).	

4. Environmental principles and factors

4.1 Principles

The five principles of environmental protection set out in the EP Act have been considered during the development of the Proposal. Table 4-1 provides a description of how the Proposal has considered each of these principles.

4.2 Preliminary key environmental factors

The preliminary key environmental factors for the Proposal were determined by Rio Tinto in consultation with the EPA Services. The preliminary key environmental factors are:

- Marine Fauna
- Social Surrounding
- Marine Environmental Quality
- Benthic Communities and Habitats.

These factors are addressed separately in **Sections 4.3** to **Section 4.6**. Other environmental factors are considered in **Section 5**.

Table 4-1: Consideration given to environmental principles

Principle	Description of principle	Consideration
1. The precautionary principle	Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In application of this precautionary principle, decisions should be guided by: (a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and (b) an assessment of the risk-weighted consequences of various options.	This Proposal has been underpinned by extensive environmental studies which have been conducted in the Cape Lambert area for the CLB project (Ministerial Statement 840 and EPBC 2008/4032). A significant amount of environmental information has also been gathered during the implementation of an Ecosystem Research and Monitoring Program, or ERMP (a requirement of Condition 10 of EPBC 2008/4032). The key studies and reports reviewed for this assessment include: • Public Environmental Review and Draft Public Environment Report (SKM 2009) • Assessment of lighting effects on turtles (Bassett 2009) • Species specific surveys for *Lerista nevinae* (Biota 2008a) • Flora and vegetation survey (Biota 2008b) • Marine turtle assessment (Biota 2008c) • Seasonal fauna survey (Biota 2008d) • Sediment sampling and analysis report (MScience 2015) • Humpback whale aerial surveys 2012-2016 review (BMT Oceanica 2017) • Underwater noise literature review addendum (ERM and JASCO 2018) • Underwater noise modelling (Li and McPherson 2018) • Underwater noise report (ERM 2018a) • Ambient noise impact assessment (ERM 2018b) • CLA jetty habitat assessment (Hydrobiology 2018) • Water and sediment quality monitoring (Hydrobiology 2014) Rio Tinto has engaged with relevant government agencies and other stakeholders to minimise any uncertainty surrounding the environmental impact of the Proposal. Rio Tinto is also committed to avoiding, minimising and managing potential impacts to the environment and has developed an EMP for the Proposal (Appendix A) to minimise impacts to the identified environmental factors.

Principle	Description of principle	Consideration
2. The principle of intergenerational equity	The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.	The purpose of this Proposal is to mitigate future environmental and safety risks associated with infrastructure that is either approaching the end of its life or does not meet current design standards. This will prolong the life of the assets, thereby providing economic benefits to future generations and ensuring infrastructure is in safe working order. The Proposal has been designed to address the EPA's objectives for the identified environmental factors, with mitigation measures provided to reduce residual environmental impacts in an EMP for the Proposal (Appendix A). The assessment contained in this referral demonstrates that the Proposal can be implemented to avoid significant impacts on the health, diversity or productivity of the environment for the benefit of future generations.
3. Principles relating to improved valuation, pricing and incentive mechanisms	(1) Environmental factors should be included in the valuation of assets and services. (2) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement. (3) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste. (4) Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	Environmental factors were considered when evaluating design and management options for the Proposal. The refurbishment/maintenance works are essential to reduce the risk of structural failures which may cause a serious environmental or safety incident. Rio Tinto is also committed to avoiding, minimising and managing potential impacts to the environment and has developed an EMP for the Proposal (Appendix A) to minimise impacts to the identified environmental factors.

Principle	Description of principle	Consideration
4. The principle of the conservation of biological diversity and ecological integrity	Conservation of biological diversity and ecological integrity should be a fundamental consideration.	A significant amount of environmental information for the Cape Lambert area has been gathered both as part of the CLB project (EPBC 2008/4032 and Ministerial Statement 840) and during the implementation of Condition 10 (ERMP) of EPBC 2008/4032. In addition, detailed underwater and terrestrial noise modelling studies and impact assessments have also been undertaken for the Proposal (ERM 2018a and 2018b), as well as benthic habitat mapping along the CLA jetty (Hydrobiology 2018). Information from these studies has been used to inform the design of this Proposal including the management measures and controls to ensure potential impacts to ecological factors are minimised.
5. The principle of waste minimisation	All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	Waste will be minimised during implementation of the Proposal by adopting the hierarchy of waste controls: avoid, minimise, reuse, recycle and safe disposal. Redundant piles will be transported to shore with the intention to be recycled as scrap metal.

4.3 Marine Fauna

4.3.1 EPA objective

The EPA's objective for marine fauna is to protect marine fauna so that biological diversity and ecological integrity are maintained (EPA 2018)

4.3.2 Policy and guidance

The following policies and guidance are relevant to the marine fauna factor:

- Environmental Factor Guideline: Marine Fauna (EPA 2016a)

4.3.3 Receiving environment

For the purposes of this environmental impact assessment, marine fauna are defined as: animals that live in the ocean or rely on the ocean for all or part of their lives (EPA 2016a).

The wider Cape Lambert area is utilised by a range of marine fauna including turtles, whales and dolphins. Whales and dolphins are well documented in the Commonwealth Dampier Marine Park, which is less than 10 km from Cape Lambert. Whale and dolphin species are also known through the Dampier Archipelago, with species observed including the minke whale, Bryde's whale, blue whale, humpback whale, killer whale, false killer whale, common dolphin, striped dolphin, bottlenose dolphin, Indo-Pacific humpback dolphin and Risso's dolphin. The majority of larger whale species tend to remain in deep water, even during migratory periods, and as such they are not commonly sighted within the vicinity of Cape Lambert.

Four species of marine turtles are known to nest in the Cape Lambert region; flatback, green, hawksbill and loggerhead. Of these four species, three (flatback, green and hawksbills, with the latter two very rarely) nest on Bell's Beach and occasionally on Cooling Water Beach in the Cape Lambert area (**Figure 4-1**) (Biota 2008c). The loggerhead turtle and an additional turtle species, the leatherback, may potentially be present periodically as either migratory or foraging species. There is no significant foraging habitat within the Proposal Area, and turtle populations are generally transient in the Proposal Area based on their breeding cycle.

There are several nesting beaches for turtle species in the vicinity of Cape Lambert, including Bell's Beach and Cooling Water Beach. Nesting occurs between November and March and occurs in relatively low numbers at these beaches compared to beaches in the nearby Dampier Archipelago (SKM 2009).

Thums et al. (2018) provide the findings of a satellite tracking study of tagged flatback turtles, which was undertaken to address two projects (Projects 4.3 and 4.4) of the ERMP. The study analysed data from 35 satellite transmitters deployed on adult female flatback turtles nesting in the vicinity of Cape Lambert to understand the spatial and temporal components of the main phases of their breeding cycle and assessed overlap with this industrial activity. The results of this research provided an objective and quantitative assessment of the spatial and temporal extent of the biologically important areas for flatback turtles, and the study found that flatback turtles from the Cape Lambert region did not use a discrete migratory corridor and dispersed widely to foraging grounds that had low spatial overlap. These foraging grounds are widely distributed beyond the Cape Lambert area and the Proposal Area; flatback turtles are only present during nesting and those present during the implementation of the Proposal will only be one cohort of that population. Furthermore, the data collected by this study suggest that industrial activities in the Cape Lambert area are likely to be of low risk to flatback turtles that use the area for nesting (Thums et al. 2018) primarily because the turtle populations are transient and mostly based around the breeding/nesting cycle.

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Figure 4-1: Turtle Nesting Locations

Drawn: NR
Date: 18-Dec-18

Proj: GDA 1994 MGA Zone 50
Scale: 1:30,000 @ A4 page size

LEGEND

- Proposal Area
- Proposal Footprint
- Jetty Piles

N

0 0.5 1 1.5
Kilometres

Map units in metres

As such, the two nesting beaches as not recognized as nationally or regionally significant turtle nesting beaches (Biota 2008c);however, they do meet the definition of 'critical habitat' as per the recovery plan for marine turtles (Commonwealth of Australia 2017).

Humpback whales are known to occur in the Cape Lambert area during their southern migration along the Pilbara coastline. The waters surrounding Cape Lambert are recognised as part of the species' core range that whales travel through on a seasonal basis (TSSC 2015a). Other areas to the north and south are recognised as key breeding and resting areas; however, these are a considerable distance from Cape Lambert being along the Kimberly coast and North West Cape. The humpback whale is well documented to occur within the proposed Dampier Archipelago Marine Park, which is less than 20 km from Cape Lambert.

Rio Tinto has undertaken a comprehensive 5-year whale monitoring program in the Cape Lambert region, via aerial surveys (BMT Oceanica 2017), as part of the ERMP for the CLB project (EPBC 2008/4032). The primary purpose of the surveys was to determine the whale use patterns around Nickol Bay and Cape Lambert; however, the presence of other significant marine fauna (whale sharks and dugongs) was also recorded (BMT Oceanica 2017).

Aerial surveys were conducted in the months of August (2013, 2015), September (2014, 2016) and October (2012), and there was a total of 2,273 humpback whale pods (defined as more than 1 adult) and 3,571 individual humpback whales recorded between 2012 and 2016. From these surveys, it was concluded that as breeding stock D humpback whale population transitions through Nickol Bay during their southern migration, and that whale densities near to shore are similar to known resting areas (such as Exmouth Gulf). However, the density of pods with calves within Nickol Bay and adjacent waters was consistently lower than in these known resting areas. Despite lower densities, many of the pods with calves appear to use Nickol Bay for resting and milling close to shore, indicating the area is potentially significant for this purpose (BMT Oceanica 2017). Cape Lambert is considered more of a transitory location than a resting or milling area like in Nickol Bay.

4.3.4 Potential impacts

The Proposal has the potential to impact both directly and indirectly on marine fauna through the following pathways:

- Indirect impacts to marine fauna from underwater noise resulting from piling works
- Direct impacts to larger marine animals through injury or death as a result of ship strike from increased vessel movements
- Indirect impacts to marine fauna as a result of changes to marine environmental quality or benthic communities and habitat
- Indirect impacts to native marine fauna species as a result of introduced marine pests
- Indirect impacts to marine fauna as a result of light spill
- Indirect impacts to turtles as a result of terrestrial vibration.

Each of these potential impacts is discussed in further detail in **Sections 4.3.4.1** to **4.3.4.6**.

4.3.4.1 Underwater noise

Plant, equipment and machinery used during pile driving works have the potential to result in significant noise generation. Marine fauna are reliant on their acoustic sense for a range of functions including foraging, communication, navigation and social interaction. Consequently, exposure to elevated levels of anthropogenic noise underwater can result in a variety of responses based on the noise levels and characteristics, distance from the noise source and the received noise levels, the

type and duration of exposure, and the context and activity of animals at the time of exposure (ERM and JASCO 2018).

The potential effects of noise can be broadly categorised as follows:

- Behavioural response – disturbance leading to behavioural changes, displacement, attraction or avoidance. The occurrence and intensity of behavioural responses is highly variable and depends on a range of factors relating to the animal and situation
- Masking or interfering with other biologically important sounds (including vocal communication, echolocation, signals and sounds produced by predators or prey)
- Stress – stress is an integral, necessary part of the body's homeostasis, and certain stress levels are tolerable. At higher levels, if repeated too often, or continued over long durations stress can, however, become deleterious and may reduce the individual's fitness
- Hearing impairment – subject to the nature and duration of the exposure, hearing impairment may be temporary (temporary threshold shift [TTS]) or permanent (permanent threshold shift [PTS])
- Injury – sound received at very close range to some high-intensity sound sources can potentially cause tissue damage resulting in recoverable or mortal injury.

JASCO (2011, 2018) undertook a comprehensive review of national and international literature relating to underwater noise and its potential effect on marine life. This review has been used to understand the potential impacts from underwater noise as a result of the Proposal, to provide context for noise modelling results, and to set appropriate noise impact thresholds.

ERM (2018a) undertook an acoustic modelling study of underwater sound generated by impact driving of piles associated with the Proposal. The study considered piles with a diameter of 1.2 m, 25 mm wall thickness and a length of 45 m. Two types of impact hammers were modelled (IHC S500 and Junttan HHHK 25s), for three separate sites along the CLA jetty and wharf structure. Modelling included predictions associated with the use of single hammers at representative jetty and wharf sites, as well as combined scenarios of two hammers operating concurrently.

Whilst both single strike and cumulative noise exposures were modelled (SEL – sound exposure level), it is more appropriate to consider the various cumulative noise scenarios when assessing the potential for auditory injury or behavioural effects in marine fauna. A single strike occurs in an ~2-second timeframe, meaning animals are likely to be exposed to multiple strikes before they can exit a zone of impact and/or before pile driving can be shut down if required. Noise modelling undertaken for the Proposal indicates that single strike noise levels will cause auditory injuries at very small distances from pile driving i.e. <10 m (ERM 2018a).

A number of scenarios were modelled for the rate and duration of piling that considered cumulative sound exposure levels including driving of the following four scenarios:

- Scenario 1 - One complete pile ([1]$SEL_{full\text{-}pile}$) in one day at one location (jetty or wharf)
- Scenario 2 - Two complete piles ([2]SEL_{24}) in one day at one location (2x jetty or 2x wharf; assumes consecutive piling)
- Scenario 3 - Two complete piles ($SEL_{full\text{-}pile}$) in one day at two locations (jetty and wharf; assumes simultaneous piling)
- Scenario 4 - Four complete piles (SEL_{24}) in one day at two locations (2x jetty and 2x wharf; assumes simultaneous piling)

[1] $SEL_{full\text{-}pile}$ – sound exposure level accumulated over driving of one pile
[2] SEL_{24} – sound exposure level accumulated over 24 hours of operation

From an operational perspective, scenarios 1 and 3 above are considered the most likely. Scenario 4 is worst-case from a noise generation perspective and is unlikely to be required from a schedule and work front complexity perspective. Reported onset distances for each scenario were predicted corresponding to noise reaching the thresholds for injury or behavioural responses in marine mammals, fish and turtles. Results for the most likely scenarios (1 and 3 above) are presented in **Table 4-2** below, with full results available in ERM (2018a).

Results showed that proposed pile driving will increase the level of underwater noise from background levels for the duration of that activity. However, increases in noise levels above ecologically relevant thresholds are restricted to waters within several kilometres of proposed works. Importantly, the $SEL_{full\text{-}pile}$ and SEL_{24} onset distances reported below all assume an animal is consistently exposed to above-threshold noise levels at a fixed position (in this instance, it is assumed that it takes ~27 mins to drive a full pile). Therefore the reported onset distances represent an unlikely worst-case scenario, since animals would not stay at the same location or within the same noise field for an extended time – they would swim away well before noise levels reach a level likely to cause auditory injury. Similarly, animals traveling within the specified onset distances will not (by definition) be injured. Rather, the animal may be injured if it were to remain within that noise field for the duration of the operation, which is again, considered highly unlikely.

Table 4-2: Summary of onset distances (in km) to behavioural effects and auditory injury for marine mammals, turtles and fish receptors (ERM 2018a)

	Onset distance (range for various sites and different hammers)	
Receptor and effects	**One complete pile ($SEL_{full\text{-}pile}$) in one day at one location (jetty or wharf)**	**Two complete piles ($SEL_{full\text{-}pile}$) in one day at two locations (jetty and wharf)***
Marine Mammals auditory injury (low frequency cetaceans)	2.9 – 4.5 km	4.3 – 5.2 km
Marine Mammals auditory injury (mid frequency cetaceans)	0.13 – 0.21 km	0.15 – 0.31 km
Fish and Turtles auditory injury	0.05 – 0.14 km	0.11 – 0.4 km

* assumes simultaneous piling

When considered spatially, results of modelling indicate that the potential for the onset of auditory injury in whales is confined to the area around the existing Cape Lambert Port operations. An important resting area at Nickol Bay is located outside of the injury threshold contour. A similar result was obtained for turtles, with shallow areas close to nesting beaches adjacent to the jetty facility located outside of the potential auditory injury zone. Thresholds for fish were confined to areas approximately 400 m from the jetty (see **Figure 4-2** for indicative example of $SEL_{full\text{-}pile}$ for piling at one jetty site).

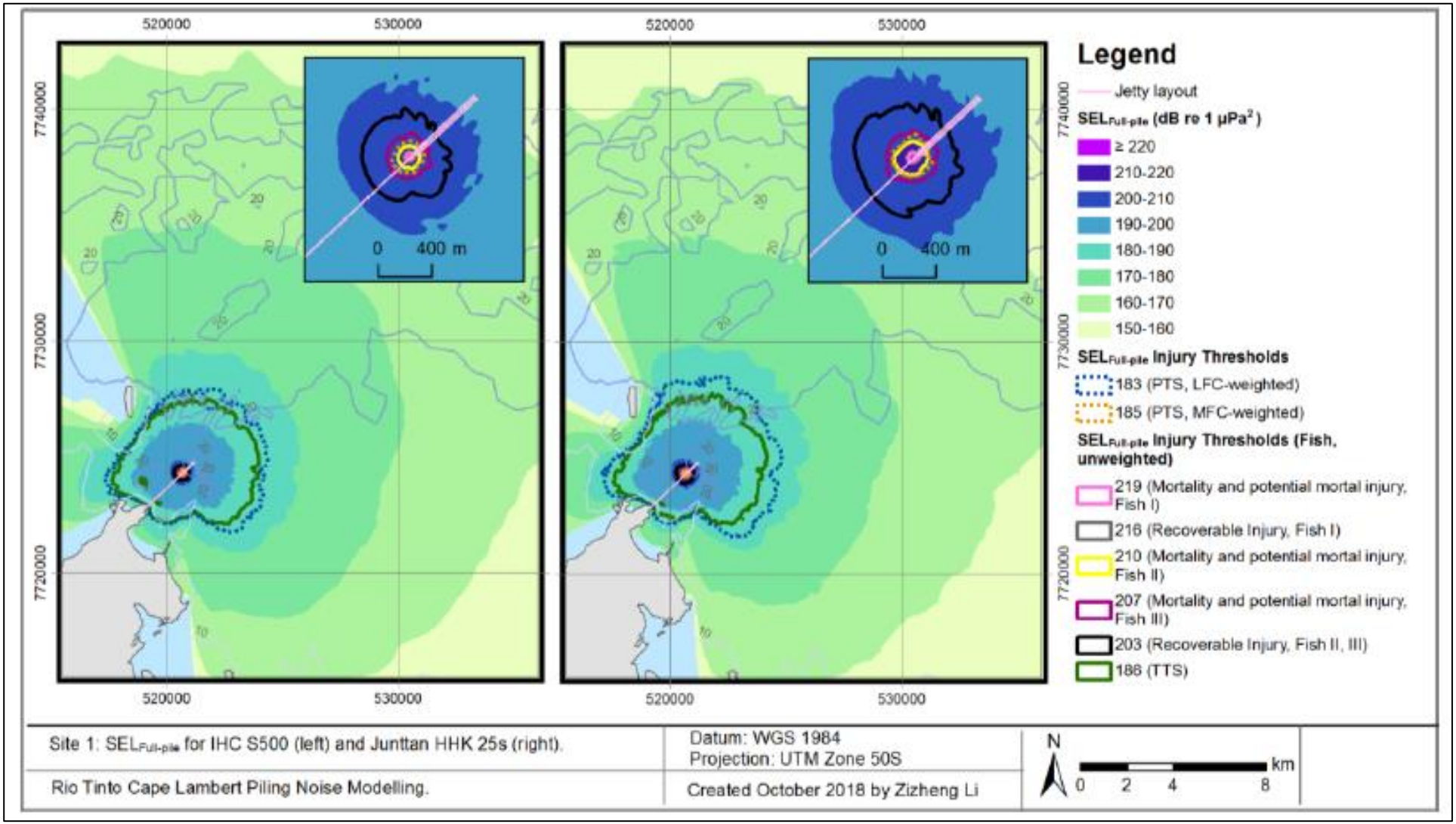

Figure 4-2: Site 1 – sound level contour maps showing maximum-over-depth $SEL_{full\text{-}pile}$ results (Li and McPherson 2018).

Given the potential for impacts to marine fauna from underwater noise, a range of management and mitigation measures will be implemented to reduce the risk of auditory injury and/or adverse behavioural effects.

A dedicated management framework has been developed to address these impacts and ensure they are managed to an acceptable level. The objective of the underwater noise management framework is to ensure marine fauna, particularly humpback whales and turtles are not injured or significantly disturbed due to underwater noise. This will be achieved primarily through procedural controls during pile driving activities.

4.3.4.2 Ship strike

Increased vessel movements from the Proposal could lead to an increase in the risk of collisions with marine fauna. Globally, ship strike is an acknowledged risk for marine species particularly larger marine animals, such as whales, dolphins, dugongs and turtles. These species appear particularly vulnerable due to their use of surface environments to breathe and feed. Fish (including sharks and rays) and other marine species that do not need to surface to breathe and feed appear less at risk.

4.3.4.3 Impacts to marine environmental quality and benthic habitats

Marine fauna rely on the maintenance of their habitat values including water quality, sediment quality and benthic habitat and communities. Changes to these values can affect marine fauna through pathways including loss of habitat, loss of food sources or impacts to reproduction and life cycle dynamics.

4.3.4.4 Introduced marine pests

Vessel movements within the Proposal Area have the potential to introduce new marine pests that are not native to Australia. Introduced marine pests are known to be introduced or translocated by a variety of vectors, including ballast water, biofouling, aquaculture operations, aquarium imports, marine debris and ocean current movements.

Ballast water is able to act as a vector for marine organisms when species are entrained in the ballast, able to survive the intervening voyage, and then successfully establish in the new environment after discharge from the conveying vessel. Dependent upon where and how the vessel loads ballast, the ballast water may also include sediments and sludges, which can also act as a vehicle for the transfer of exotic species.

4.3.4.5 Light spill

Artificial lighting will be required at certain times for the Proposal. Artificial light can alter the natural patterns of light and dark in ecosystems and is referred to as ‘ecological light pollution’. Ecological light pollution includes chronic or periodically increased illumination, unexpected changes in illumination and direct glare.

Fish and other marine animals are adapted to a few forms of night light; however, ecological light pollution can modify the intensity, spectra, frequency and duration of night time light reaching and penetrating water surfaces, which in turn can illicit unnatural biotic responses. Artificial light can affect both nocturnal and diurnal animals by disrupting natural behaviour, with quality of light (e.g. wavelength, colour), intensity and duration of exposure potentially evoking different responses.

Light pollution is of particular concern to marine turtles, with a specific terminology developed in regard to the various types of effects light has on turtles:

- Disorientation – used to describe turtles that repeatedly change direction in response to different light cues
- Misorientation – used to describe a turtle that has orientated on an artificial light source and move consistently toward this instead of the ocean
- Photopositive – movement response toward light source
- Photonegative – movement response away from a light source.

4.3.4.6 Terrestrial vibration

On-shore vibration resulting from piling could impact on marine turtles by decreasing the viability of turtle eggs in nests at Cooling Water Beach and Bell's Beach.

4.3.5 Assessment of impacts

The following Sections consider each of the potential impacts identified above and provides detail on the extent of predicted impacts, as well as identification of those impacts requiring mitigation.

4.3.5.1 Underwater noise

Marine fauna including humpback whales, marine turtles, dolphins and fish have the potential to be impacted by underwater noise at levels that may cause injury or behavioural disturbance. Noise modelling undertaken for the Proposal indicates that single strike noise levels will cause auditory injuries at very small distances from pile driving i.e. <10 m.

Analysis of cumulative noise impacts shows that auditory injury may be experienced at a range of distances, including (ERM 2018a):

- For humpback whales: between 2.9 – 4.5 km when one pile is driven at one location (jetty or wharf) or between 4.3 – 5.2 km when two piles are driven simultaneously at two locations (jetty and wharf)
- For dolphins: between 130 – 210 m when one pile is driven at one location (jetty or wharf) or between 150 – 310 m when two piles are driven simultaneously at two locations (jetty and wharf)
- For turtles and fish: between 50 – 140 m when one pile is driven at one location (jetty or wharf) or between 110 – 400 m when two piles are driven simultaneously at two locations (jetty and wharf).

However, as discussed in **Section 4.3.4.1** above, this assumes that animals will experience continuous exposure within the area of high noise, which is considered highly unlikely. There are no barriers to movement within the Cape Lambert region, and monitoring and research data show marine fauna using the entire marine region. Consequently, an animal is likely to move away from an area of high noise and would not be subject to continuous exposure.

Controls are required to ensure that whales and turtles (in particular) are allowed time to exit areas of intense noise before injury may occur. The underwater noise management framework presented in Section 4.3.6 below allows this via the implementation of both observation and exclusions zones. Works will not commence if whales/turtles are sighted within 2 km of piling (observation zone) and after commencement, works will be shut down (i.e. as soon as safely possible) if a whale is sighted within 500 m of piling or a turtle is sighted within 300 m of piling (exclusion zone). Further, soft starts are required to allow any animals in the area to recognise the start of noise and leave the area prior to full noise impacts beginning.

A similar management framework was implemented for pile driving that occurred for the CLB project, which was a large scale project (piling on 341 days over 28 months; 600 piles installed) compared

with 144 piles for this Proposal. Records show the successful implementation of exclusion zones and no records of marine fauna injury or stranding. Collectively, the management framework as detailed below and in the EMP (Appendix A) are considered appropriate to mitigate impacts to marine fauna within the Proposal Area such that injuries or significant behavioural effects will not occur.

The wider region including Nickol Bay (whale resting/milling area) will experience some levels of elevated noise compared to background. There are likely to be significantly more marine fauna in this area (Nickol Bay) surrounding the Proposal Area. However, noise impacts in these areas are well below thresholds that are likely to cause injury or behavioural disturbances. Also, monitoring results suggest Nickol Bay is a one-day resting area (BMT Oceanica 2017), such that whales in the wider Cape Lambert region will experience elevated noise levels on only a very restricted part of their migratory journey. Satellite tracking data also show that Flatback Turtles travel widely during the interesting period and will be able to access foraging and resting areas outside of noise impacted zones. In general, turtles are transient through the Proposal Area and forage widely outside of the nesting/breeding season.

For all marine fauna in both the Proposal Area and the wider Cape Lambert region, the timing of the Proposal will be such that elevated noise levels are for at most 18 months, reducing the potential of long term disruptions to habitat use and availability for longer lived species such as turtles, dolphins and whales.

4.3.5.2 Ship strike

In Australian waters, ship strike of whales is a very rare event. The IWC Ship Strikes Database (1981 – 2009) reports only 16 incidents of whale strike. And Australia's IWC Country Report for the five years between 2006 and 2010 report seventeen reported vessel strikes of humpback whales within Australian Waters (Australian Marine Mammal Centre 2018). Smaller marine fauna such as turtles and dugongs are at higher risk of vessel strike; however, these species are at most risk from small, fast watercraft (boats and jetskis) within shallow coastal waters, particularly in those areas that contain seagrass meadows (DoEE 2017, DoEE 2018a). Many marine regions across Australia have 'go slow zones' specifically designed to reduce the risk of injury to turtles and dugong by reducing watercraft speeds.

The number of vessels required for the Proposal will not be substantially higher than the number of vessels within the Proposal Area during normal operations. The majority of works associated with the Proposal will be undertaken from vessels, including the crane barge, piling barge(s) and associated smaller support vessels. The main vessels are slow moving (less than 4 knots near the wharf/jetty) and will predominantly be in static locations while installing piles. Support and fuel vessels will operate at a similar range of speeds (between 4 and 12 knots) depending on proximity to the wharf and the activities being performed (e.g. refuelling versus transit).

Within the Proposal footprint and wider Proposal Area, the marine fauna of most concern in regard to vessel movement and potential collisions are those most frequently sighted within 2 km of the Port, including turtles and humpback whales. Despite this, the potential for collisions is considered to be low for a number of key reasons:

- There will be only a small number of additional vessels (beyond those vessels currently in use for normal port operations) required for the Proposal and they will generally operate at slow speeds and will mostly be in static locations
- There are few marine fauna that are likely to occur within the path of vessel movements, particularly given the seasonal nature of their use of the marine environment at Cape Lambert

(i.e. ~ 2-month peak migration season for whales and a ~3 month peak nesting season for turtles)

- All marine fauna that may occur along vessel movement paths are highly mobile and able to avoid slow moving vessels
- Existing vessel traffic associated with current operations, recent major construction works (e.g. the CLB project) and periodic maintenance dredging programs (ore carriers, tugs, various support vessels, capital/maintenance dredge vessels) have not resulted in any reported fauna collisions.

The operation of vessels within the Proposal Area will be managed in accordance with the EMP (Appendix A) to reduce the risk of vessel and marine fauna collision.

4.3.5.3 Impacts to marine environmental quality and benthic habitats

A detailed assessment of potential impacts to marine environmental quality and benthic habitats is provided in **Sections 4.5** and **4.6**, with a summary provided below.

The work activities of the Proposal will generate some highly localised increases in turbidity and sedimentation and increased risk of accidental hydrocarbon spills. With the incorporation of mitigation strategies, the cumulative effect of the Proposal is likely to meet the environmental quality objectives and environmental quality criteria defined under the Cape Lambert MEQMP. Any changes in water or sediment quality are unlikely to be inconsistent with the limits of acceptable change defined for Moderate Levels of Environment Protection. It is considered that the EPA's objective for Marine Environmental Quality will be met and that there will be no significant residual impact to this Factor as a result of the Proposal.

Direct impacts are likely to affect small areas of benthic habitat associated with the footprint of new piles and jack-up barges. Overall, macro-benthic habitats in the vicinity of the CLA jetty are typical of the wider area, and benthic primary producer habitat in the area is patchy/localised in nature. For these reasons the piling works are unlikely to pose a significant threat to the benthic habitat present. Any indirect impacts through impacts to water quality will be highly localised and short-term in nature and is not expected to affect benthic communities and habitat. It is considered that the EPA's objective for Benthic Communities and Habitat will be met and that there will be no significant residual impact to this Factor as a result of the Proposal.

4.3.5.4 Introduced marine pests

Any vessels contracted to undertake piling works for the Proposal that are not permanently stationed at Cape Lambert will be required to comply with best hygiene practices, including Department of Agriculture, Fisheries and Forestry and the WA Department of Primary Industries and Regional Development requirements in relation to ballast water and marine pest management; this includes the National System for the Prevention and Management of Marine Pest Incursions, in particular the National Biofouling Management Guidance for Non-Trading Vessels.

Given these stringent controls and that few vessels that are not permanently stationed at Cape Lambert (only two pile driving barges are likely to be used) will be required during implementation of the Proposal, the risk of IMPs is considered negligible and is not considered further in this assessment. The above controls are included in the EMP and are consistent with the requirements of conditions of Ministerial Statement 840.

4.3.5.5 Light spill

No additional permanent light sources will be installed as part of the Proposal and as such overall light levels at the CLA wharf/jetty will not change from existing levels as a consequence of the

Proposal. There may be small temporary increases in light levels during the implementation phase of the Proposal in and around the works areas; however, significant or prolonged night works are not required for the Proposal. Pile set up (or emergency piling to stabilise a positioned but unstable pile) may occur between 7 – 10 pm, in which case temporary lighting will be required.

Turtle nesting beaches are located approximately 1 km (Cooling Water Beach) and approximately 4 km (Bell's Beach) from the nearest works locations along the jetty.

4.3.5.6 Terrestrial vibration

Excessive ground vibration has the potential to disturb terrestrial environments within the Proposal Area and can impact turtle nesting beaches by reducing the viability of turtle eggs. Overall nesting levels in the vicinity of the Proposal are low. Two previous assessments of terrestrial vibration impacts on the turtle nesting at Cooling Water Beach have been undertaken – one as part of the CLB project (SVT 2008) and another as one of the ERMP outputs (SKM 2013). In both instances, vibration measurements were taken at Cooling Water Beach during pile driving operations; in 2008 on the existing CLA wharf (where the current Proposal will also be implemented) and in 2012 as part of the CLB project construction works.

Both assessments concluded that vibration from pile driving at CLA and CLB was not detected at Cooling Water Beach. The 2012 assessment (SKM 2013) went further to compare vibration levels to those known to cause embryonic damage and reported that observed levels were below the documented threshold. Further, hatchling rates at Cooling Water Beach during 2012 were relatively high and comparable with reference sites at Bell's Beach (unaffected by piling). Collectively, these results suggest that the pile driving operations associated with this Proposal will not impact on marine turtle hatching rates.

4.3.6 Mitigation

Table 4-3 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to marine fauna to address the key potential impacts. An EMP has been developed for the Proposal which specifically addresses management actions to mitigate these impacts (Appendix A).

A dedicated management framework has been developed to address impacts to marine fauna as a result of underwater noise generated by pile driving, and ensure they are managed to an acceptable level. The objective of the underwater noise management framework is to ensure marine fauna, particularly humpback whales and turtles are not injured or significantly disturbed due to underwater noise. This will be achieved primarily through procedural controls during pile driving activities.

Specific management controls are:

- The underwater noise management procedure presented in **Figure 4-3** and described below will be implemented
- A suitably trained marine fauna observer will be located at an elevated location on the wharf/jetty immediately prior to and during all piling works
- An observation zone will be established 2 km from the piling activity
- An exclusion zone of 500 m for whales and 300 m for marine turtles will be established from the piling activity
- The observation zone will be checked for 30 minutes prior to the commencement of piling activities each day. If no whales/turtle are present, works can commence (soft start – see

below). If whales/turtles are present in the observation zone, commencement will be delayed until all animals have exited the observation zone or have not been seen for 20 minutes

- The suitably trained marine fauna observer will monitor the exclusion zone continuously during piling activities. If whales/turtles are sighted in the exclusion zone, works will cease (i.e. as soon as safely possible). Works will not commence until the animal(s) exit the exclusion zone or have not been seen for 20 minutes (soft start required)
- Soft start up procedures will be implemented for all piling activities, for a period of no less than 30 minutes
- During periods of low visibility (where a distance of 500 m cannot be clearly viewed), pile driving activities may be undertaken provided that during the preceding 24 hour period:
    - there have not been 3 or more shut down situations due to marine turtles or whale sightings
    - a 2 hour period of continual observations was undertaken in good visibility immediately prior to low visibility (to a distance of 500 m) and no marine turtles or whales sighted.
- Piling to occur during daylight hours unless in the case of a safety/emergency; at such times it will not extend beyond 10 pm
- Daily records of all marine fauna sighting and associated shut downs to be kept including:
    - record observed cetaceans in a format consistent with the National Cetacean Sighting and Strandings Database
    - other marine fauna observations, including fish kills and wildlife injuries within 500 m of piling operations
    - fauna behaviours, in particular any behaviours that could be attributed to piling activities
    - management responses in relation to dead and injured wildlife, including suspension of piling activities
    - observation effort in relation to piling activities.
- Herding of cetaceans from the area will not be undertaken using vessels
- Warning strikes will not be used to deter cetaceans from the area

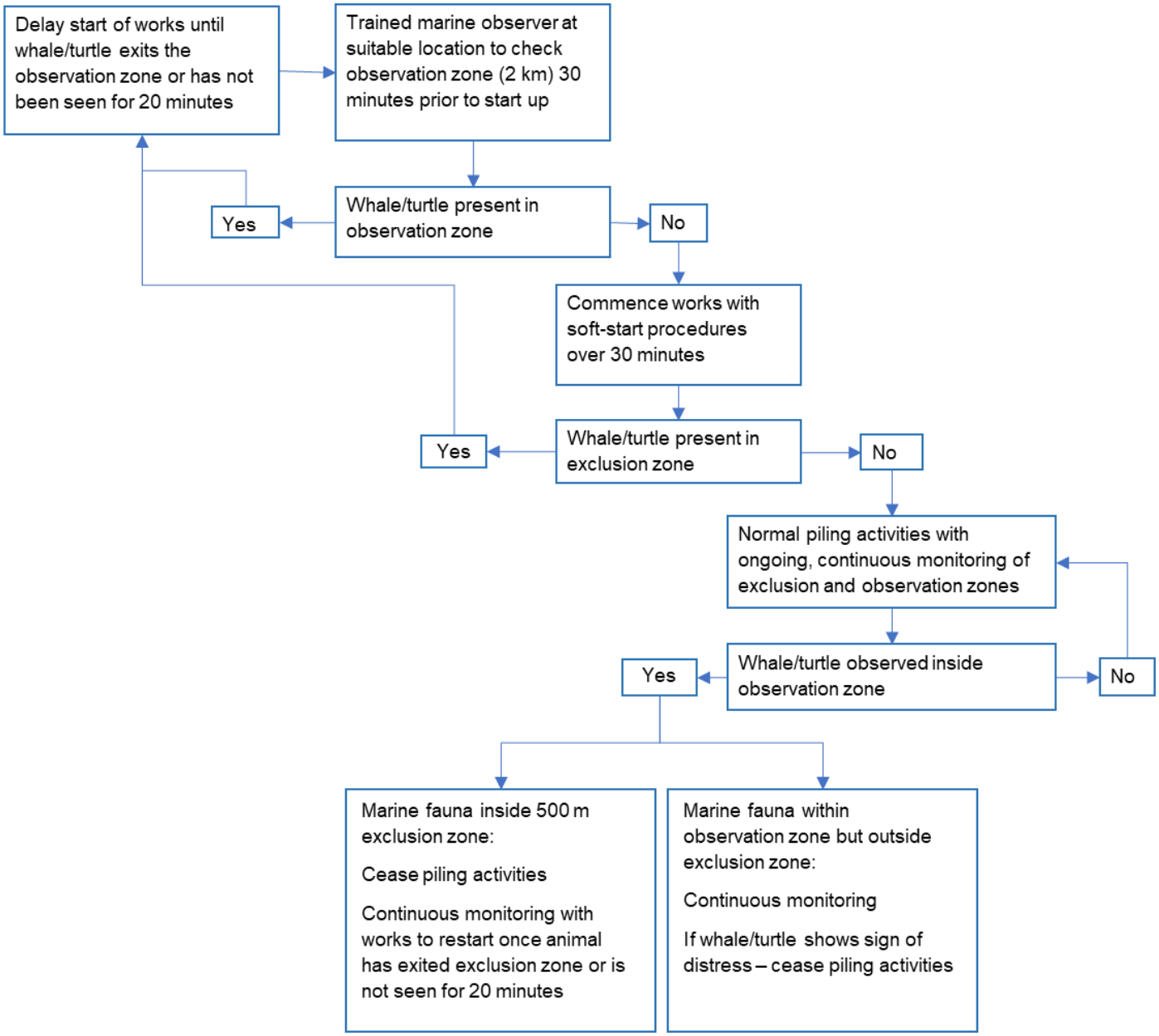

Figure 4-3: Flow diagram for underwater noise management

Table 4-3: Application of mitigation hierarchy for marine fauna

Potential impact	Avoidance	Minimisation	Rehabilitation	Residual impact
Underwater noise	Minimum number of piles are used to appropriately undertake strengthen jetty and replace dolphins	• Piling will be undertaken in accordance with a marine fauna management framework • No more than two pile driving operations will occur concurrently • Evening works will extend no later than 10 pm and will only be undertaken if required to safely secure piles/equipment	NA	Noise above background levels will occur in marine environment however injury to marine fauna will be prevented via implementation of management framework
Ship strike		• All vessels will travel between 4 -12 knots	NA	The risk of ship strike is negligible and no residual impacts are likely
Impacts to marine environmental quality or benthic communities	Minimum number of piles are used to appropriately undertake strengthen jetty and replace dolphins Redundant piles will be cut at the natural substrate level and removed. Sub-surface infrastructure will be capped and remain in place All redundant piles will be transported to shore with the intention to be recycled for scrap metal	• No more than two pile driving operations will occur concurrently (worst case) • Management, disposal and storage of hazardous materials to Australian Standards and consistent with MSDS • Port Walcott Cape Lambert Oil Spill Contingency Plan (OSCP) will be implemented as required • Spill kits will be available on all piling vessels and staff trained in their use • Solid waste will be placed in suitable containers and recycled or disposed of via a licensed contractor	NA	No significant residual impacts – see Section 4.5 and 4.6 below for detailed assessment
Introduced marine pests		• All non-local vessels will be assessed for the risk for IMPs • On-going implementation of existing Port-wide IMP monitoring and response protocols	NA	The risk of IMP introduction is negligible and no residual impacts are likely

Potential impact	Avoidance	Minimisation	Rehabilitation	Residual impact
Light spill	Works hours will be between 7 am & 7 pm Works are contained within the existing Cape Lambert setting, which already has an environment of light spill and the Proposal will not result in the increase of this existing light spill once implementation of the Proposal is completed	• Night works will extend no later than 10 pm and will only be undertaken if required to safely secure piles/equipment • Lighting will be localised on jetty/wharf/barge vessels	NA	The risk of light spill is negligible and no residual impacts are likely
Terrestrial noise and vibration	Minimum number of piles are used to appropriately undertake strengthen jetty and replace dolphins Previous studies have shown no impacts to turtles nesting beaches from vibration		NA	The risk of terrestrial noise and vibration impacts to marine fauna is negligible and no residual impacts are likely

4.3.7 Predicted outcome

With the implementation of mitigation and management measures presented in Table 4-3,, the following impacts are anticipated and will not result in any significant residual impacts to marine fuana:

- The risk of injury and mortality from vessel strike is considered negligible.
- The risk of introduced marine pests is considered negligible.
- Impacts to marine environmental quality or benthic communities are assessed in Section 4.5 and 4.6 below and as the Proposal is anticipated to have only minor, localised and temporary impacts, no flow on effects to marine fauna are expected.
- Localised and temporary lighting is not anticipated to have any detrimental impact to marine turtles or other fauna within the Proposal Area.
- As demonstrated by previous field assessments, vibration from pile driving is not detectable at turtle nesting beaches (Cooling Water Beach and Bell's Beach), thereby avoiding any impacts to turtle nests and hatchling emergence rates

Results of underwater noise modelling (ERM 2018a) showed that proposed pile driving will increase the level of underwater noise from background levels for the duration of the pile driving activities associated with the Proposal. However, increases in noise levels above ecologically relevant thresholds are restricted to waters within several kilometres of the proposed works. Importantly, the onset distances reported below all assume an animal is consistently exposed to above-threshold noise levels at a fixed position (in this instance, it is assumed that it takes ~27 mins to drive a full pile). Therefore, the reported onset distances represent an unlikely worst-case scenario, since animals would not stay at the same location or within the same noise field for an extended time – they would swim away well before noise levels reach a level likely to cause auditory injury. Similarly, animals traveling within the specified distances will not (by definition) be injured. Rather, the animal may be injured if it were to remain within that noise field for the duration of the operation, which is again, considered highly unlikely.

In order to further minimise the risk of auditory injury to marine fauna, a dedicated underwater noise management framework will be implemented. The combination of soft starts, observation and exclusion zones will be used to ensure that pile driving works do not occur when marine fauna are within close proximity of works. This approach has been successfully implemented during previous projects at Cape Lambert and is considered to be effective again for this Proposal.

Overall, no significant residual impacts are anticipated as a result of the Proposal and it is considered that the Proposal is able to be implemented consistent with the objective to protect marine fauna so that biological diversity and ecological integrity are maintained.

4.4 Social Surroundings

4.4.1 EPA objective

The EPA's objective for social surroundings is to protect social surroundings from significant harm (EPA 2018).

4.4.2 Policy and guidance

The following policies and guidance are relevant to the social surroundings factor:

- Environmental Factor Guideline: Social Surroundings (EPA 2016b)
- AS 2436-2010 - Guide to noise and vibration control on construction, demolition and maintenance sites

4.4.3 Receiving environment

Social surroundings include the aesthetic, cultural, economic and social values of the environment, which affect or are affected by physical and biological surroundings. They also include Aboriginal heritage and culture, natural and historic heritage and amenity (EPA 2016b).

4.4.3.1 Previous studies

A number of studies assessing and characterising the social and economic environment of Cape Lambert have been undertaken which are relevant to the Proposal Area and the potential impacts of the Proposal. These studies include:

- Cape Lambert Port A – Marine Structures Refurbishment Project – Noise Impact Assessment (ERM 2018b)
- Cape Lambert Port Operations Noise Monitoring and Assessment (Resonate Acoustics 2018)
- Cape Lambert Port B Expansion Project – Pile Driving, Out of Hours Noise Management Plan (SVT 2012a)
- Cape Lambert Port B Expansion Project – Construction Noise Management Plan (SVT 2012b)
- Potential Impact and Mitigation of Pile-Driving Noise at Cape Lambert; A Review of the Literature and International Regulations (Lucke et al. 2011)
- Rio Tinto Cape Lambert Port B Development – Public Environmental Review and Draft Public Environmental Report (SKM 2009)
- Social Impact Assessment (undertaken to support CLB project assessment) (URS & ACIL Tasman 2008in SKM 2009)
- Landscape and Visual Impact Assessment (undertaken to support CLB project assessment) (SKM 2008 in SKM 2009).

4.4.3.2 Social and economic profile

The Proposal Area is located in the City of Karratha in the Pilbara region of Western Australia (WA). The Pilbara is WA's and Australia's principal iron ore mining region accounting for around 94% of Australia's iron ore production.

The town of Wickham is located 12 km from Cape Lambert and was established to service the needs of the mining industry in the 1970s. It remains the principal support town for the port operations at Cape Lambert and has a total population of approximately 1,500 people. Point Samson is a small fishing town and tourist town with a resident population of under 250 approximately 5 km from Cape Lambert. Point Samson is comprised of residential homes, holiday homes, several restaurants, caravan park, a small harbour and commercial fishing fleet. Cossack is located approximately 7 km from Cape Lambert. Cossack was established in 1863 at the mouth of the Harding River near Roebourne and was once a thriving community servicing the pastoral and pearling industries. After

World War II the town was abandoned following failed attempts to revive the local pearling industry. Since the 2016 census there were no people living in the town.

The Proposal Area is zoned as Strategic Industry within the City of Karratha Local Planning Scheme (LPS). The majority of land surrounding the Strategic Industry is zoned as conservation, recreation and natural landscapes.

4.4.3.3 Cultural heritage

There are no World Heritage Properties, National Heritage Place or Commonwealth Heritage Places in or within the vicinity of the Proposal Area.

The Proposal Area is located within the Ngarluma/Yindjibarndi determined native title area (WCD2005/001). The Rio Tinto Ngarluma Indigenous Land Use Agreement (ILUA) was reached in 2011. This outlines monetary and other benefits by Rio Tinto for Ngarluma People in exchange for their ongoing support and agreement to Rio Tinto's operations and expansions of their iron ore business within their traditional country.

The ILUA provides for agreed processes for undertaking cultural heritage surveys ahead of any new ground disturbance activity. Appropriate archaeological and ethnographic heritage surveys have been previously undertaken with the full participation of Ngarluma representatives to locate and record all known sites of cultural and heritage significance, including Registered Heritage Sites and Other Places as defined under the *Aboriginal Cultural Heritage Act 1972* (WA)) (AHA 1972). All heritage sites will be avoided and managed *in situ* in accordance with the existing Cultural Heritage Management Plan (CHMP) which has been developed in close consultation with the Ngarluma Aboriginal Corporation (NAC).

The portions of land-based works have been covered by previous heritage surveys. No archaeological or ethnographic sites were identified during these surveys and nor do any Department of Planning, Lands and Heritage (DPLH) registered sites intersect these work areas. These land-based portions of the Proposal are now heavily disturbed by previous activities. Given the preceding comments, there is no need for Rio Tinto to seek consent under Section 18 of the AHA 1972 as all known heritage sites are entirely avoided.

There are no registered sites located within the Proposal footprint. Rio Tinto's standard approach dictates that should any sites be identified, appropriate cultural heritage management procedures will be undertaken. Should identified sites be unavoidable, a Section 18 approval (under the AHA 1972) to disturb those sites or portions of sites that cannot be avoided would be sought. In this area, the NAC would be consulted regarding any Section 18 application.

With regard to European heritage, places and buildings of heritage value are listed on the Australian Heritage Database (*Australian Heritage Council Act 2003*) and the State Register of the Heritage Council (*Heritage of Western Australia Act 1990*). A search of these databases indicated that there are no places or building of European heritage value located in or within the vicinity of the Proposal Area. Items of European heritage significance are located in the townships of Cossack and Roebourne (SKM 2009) and will not be directly affected by the Proposal.

4.4.3.4 Sensitive receptors

The closest residential receptor to the Proposal Area is located approximately 3.8 km to the south on Meares Drive, Point Samson. An industrial receptor is located approximately 2.8 km to the south on

Sams Creek Road, Point Samson. Other residential properties are located in the township of Point Samson approximately 5 km to the south of the Proposal Area.

The Cape Lambert area is popular with recreational fishers. The Nickol Bay Prawn Managed Fishery (NBPMF) is the main commercial fishery in the vicinity of the Proposal Area. Based on the latest available information, trawling activities in the NBPMF, no prawn trawling occurs currently in the waters adjacent to Cape Lambert (ERM 2018b). A pearl farm lease exists just to the southeast of the CLA jetty ~600 m due north from the mouth of Sams Creek; however, there is currently no known active pearl farming taking place within the lease area (ERM 2018b).

Further discussion of sensitive receptors, as they relate to noise is included in **Section 4.4.3.5**.

4.4.3.5 Noise

Background noise levels in the Proposal Area consists of operational noise from the Cape Lambert operations. The major noise sources within the Proposal Area include trains, ship loaders, conveyors, car dumpers, stackers and reclaimers. Noise is emitted from both the fixed plant and rail transportation located within the port facilities (ERM 2018b).

ERM was commissioned to undertake a noise impact assessment specific to the Proposal to predict likely noise impacts on sensitive environmental receivers surrounding the Proposal Area. The assessment involved a comprehensive review of existing data and third-party noise data including existing operational noise data from on-going monitoring at Cape Lambert (Resonate Acoustics 2018). A review of previous noise studies was also undertaken (SVT 2012a, 2012b) as well as review of aerial photography, zoning and cadastre data in order to identify potential residential and other sensitive receptors within the area of influence of the Proposal.

The noise assessment by ERM (2018b) established eight locations which were identified as the closest and/or potentially most affected locations situated within proximity to the Proposal Area. The locations do not represent all receptors located within the vicinity of the Proposal. For example, the local nearshore environment is used widely by recreational boaters for fishing, diving and other water recreational activities and therefore is considered a sensitive receptor. However, ERM (2018b) selected eight locations to ensure representative worst-case noise levels were being predicted. The eight locations used in the noise assessment are summarised in Table 4-4 and shown in **Figure 4-4**.

Table 4-4: Potentially sensitive receptors (from ERM 2018b)

ID	Receptor type	Description	Approximate distance from CLA (km)	Direction from CLA
R01	Industrial	Sams Creek Rd, Point Samson	2.8	South
R02	Commercial	Wickham Yacht Club, Boat Beach	4.8	South west
R03	Residential	Meares Dr, Point Samson	3.8	South
R04	Residential	Fisher St, Point Samson	4.0	South
R05	Residential	Cliff St, Point Samson	4.1	South
R06	Commercial	Wilson Way, Wickham	8.5	South west
R07	Residential	McCourt Way, Wickham	9.7	South west
R08	Residential	Pearl St Cossack	9.5	South

LEGEND

- Proposal Area
- Proposal Footprint
- Jetty Piles
- Receptors

N

0 0.5 1 1.5 2 2.5

Kilometres
Map units in metres

Rio Tinto

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Figure 4-4: Noise Assessment Overview

Drawn: NR
Date: 18-Dec-18

Proj: GDA 1994 MGA Zone 50
Scale: 1:55,000 @ A4 page size

4.4.4 Potential impacts

The Proposal has the potential to indirectly impact social surroundings during the Proposal implementation phase.

The following indirect impact has the potential to occur:

- Noise disturbance to nearby sensitive noise receptors.

Plant, equipment and machinery to be used for the Proposal have the potential to generate noise. ERM (2018b) developed eight work activity scenarios (SCN) based on the use of significant noise generating plant, equipment and machinery and activities that will be undertaken as part of the Proposal for utilisation in a noise model. These included:

- SCN 1 - Laydown area works - Area 1
- SCN 2 - Laydown area works - Area 2
- SCN 3 - Load out area works
- SCN 4 - Removal of dolphins/wharf piles
- SCN 5 - Wharf dolphin installation (pile drilling)
- SCN 6 - Wharf dolphin installation (impact piling)
- SCN 7 - Jetty pile installation (pile drilling)
- SCN 8 - Jetty pile installation (impact piling).

The model also considered prevailing meteorological conditions that may have the potential to increase noise levels at receptors influenced by the effects of wind and temperature inversions. For example, winds blowing between the source and the receptor, and temperature inversions may increase noise levels by between 1 dBA (A-weighted decibels) and approximately 7 dBA depending on the distance of the receptor from the source and condition (ERM 2018b).

Noise level predictions from the model consider the cumulative emission (and potential impact) of work activity scenarios which will likely operate concurrently, as well as ambient operational noise for the Cape Lambert operations (i.e. CLA and CLB) (ERM 2018b). A summary of the modelling results is provided below in **Table 4-5**.

Table 4-5: Assessment scenarios and predicted noise levels (ERM 2018b)

No	Assessment scenario based on concurrent work activities	Exceedance of the L_{A10}* Assigned Noise Level for sensitive receptors (Y/N)		
		Daytime	Evening, Sunday and Public Holidays	Night
1	Support services and dolphin/pile removal (Standard meteorological conditions) (SCN 1 + SCN 2 + SCN 3 + SCN 4)	N	N	N
2	Support services and pile drilling (Standard meteorological conditions (SCN 1 + SCN 2 + SCN 3 + SCN 5 + SCN 7)	N	N	N
3	Support services and impact piling based on nearest jetty pile (Standard Meteorological. Conditions) (SCN 1 + SCN 2 + SCN 3 + SCN 6 + SCN 8a)	N	Y (exceedance of 2dbA at R03)	Y (exceedance of 7dBA at R03)

No	Assessment scenario based on concurrent work activities	Exceedance of the L_{A10}* Assigned Noise Level for sensitive receptors (Y/N)		
		Daytime	Evening, Sunday and Public Holidays	Night
4	Support services and impact piling on furthest jetty pile (Standard meteorological conditions) (SCN 1 + SCN 2 + SCN 3 + SCN 6 + SCN 8b)	N	N	Y (exceedance of 5dBA at R03)
5	Support services and dolphin/pile removal (Noise enhancing meteorological conditions) (SCN 1 + SCN 2 + SCN 3 + SCN 4)	N	N	N
6	Support services and pile drilling (Noise enhancing meteorological conditions) (SCN 1 + SCN 2 + SCN 3 + SCN 5 + SCN 7)	N	N	N
7	Support services impact piling for nearest jetty pile (Noise enhancing meteorological conditions) (SCN 1 + SCN 2 + SCN 3 + SCN 6 + SCN 8a)	N	Y (exceedance of 3dBA at R03)	Y (exceedance of 8dBA at R03 and 1dBA at R04)
8	Support services and impact piling for furthest jetty pile (Noise enhancing meteorological conditions) (SCN 1 + SCN 2 + SCN 3 + SCN 6 + SCN 8b)	N	Y (exceedance of 1dBA at R03)	Y (exceedance of 6dBA at R03)

*L_{A10} is the level exceeded for 10% of the time and as such can be regarded as the average maximum level.

4.4.4.1 Other impacts

Given the scope of the works proposed comprises refurbishment of existing infrastructure, visual aesthetics are not expected to change as a result of the Proposal. During the implementation of the Proposal, the presence of additional vessels (barges, support vessels) will be a minor change to the usual visual landscape when viewing the Cape Lambert port operations from Point Samson; however, at times there will be some screening or background provided by the continued presence of large ore carriers being loaded in the berths at the wharf. As such, given the minimal impacts to visual aesthetics and that it is an active operational port, visual impacts are not considered in this assessment.

Some minor additional visitations to locations with European heritage significance by the workforce (total of around 80 personnel) during days off are anticipated; however, this is not expected to negatively affect these items as visitations are currently made by general members of the public and tourists. As such, impacts to cultural heritage items as a result of the Proposal are considered unlikely and are therefore not further discussed in this assessment.

4.4.5 Assessment of impacts

Through review of the *Environmental Protection (Noise) Regulations 1997* and applicable policy and guidance listed in Section 4.4.2, ERM (2018b) established specific noise criteria for the identified sensitive receptors (R01 to R08).

As shown in Table 4-5, the ERM (2018b) assessment determined that noise levels associated with the impact piling activities have the potential to exceed applicable criteria during the more sensitive periods under the worst-case scenarios, where assigned noise criteria are low (e.g. evening and night time periods). These exceedances were predicted to occur during both standard and noise enhancing meteorological conditions at the residential receptor R03 which is located at Point Samson approximately 3.8 km to the south of the Proposal Area. An exceedance was also predicted at R04

(residential) during the night time period under enhanced meteorological conditions for impact piling on the nearest jetty works.

No exceedances of the assigned noise criteria were predicted at any other residential, commercial or industrial receptors. For all other activities associated with non-piling works, ERM (2018b) predicted that noise levels will be compliant during all assessment periods (i.e. daytime, evening and night time) and all meteorological conditions.

With regard to enhanced meteorological conditions, although modelling suggests that noise levels are increased by up to 2 dBA at the most affected receptors, based on the Cape Lambert Meteorological Data from 2017 to 2018 it is considered unlikely that enhanced conditions would occur and therefore result in additional noise impacts (ERM 2018b). In the unlikely event that enhanced meteorological conditions do occur, ERM (2018b) consider an increase in noise levels of 2dBA as hardly perceivable.

Predicted exceedances at the two sensitive receptors during discrete assessment periods do not represent a constant noise emission that would be experienced by the community on a daily basis throughout the Proposal works. The predicted noise levels will only be experienced for limited periods of time when works are occurring (especially active pile driving), they will not be experienced over whole daytime, evening or night time periods. Noise emissions will be temporary and do not represent a permanent impact on the community and surrounding environment. Given the scale of impacts and the temporary nature of the works, when the potential and likelihood of impacts to sensitive receptors are considered, the implementation of the Proposal is not anticipated to be significant. None the less, noise generation from the Proposal is inevitable and requires best practice noise management and control techniques to be implemented to reduce noise levels as far as practicable.

Section 4.4.6 below demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to social surroundings to address the key potential impacts.

It should be noted that ERM's (2018b) study and this assessment of noise impacts covers social values of the environment only, as outlined in the relevant EPA guidance. Consideration has not been given to occupational noise exposure to vessel and crew movements. Occupational noise considerations will be dealt with through Occupational Health and Safety regulations and procedures applicable to contractors.

4.4.6 Mitigation

Table 4-6 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to social surroundings to address the key potential impacts.

The EMP developed for the Proposal (Appendix A) specifically addresses management actions to mitigate indirect impacts to social surroundings. These include avoiding impact piling works during night time periods and only pile driving during the evening period when required for safety and emergency reasons (i.e. to make the pile safe and stable before completion the next available piling day).

Table 4-6: Application of mitigation hierarchy for social surroundings

Potential impact	Avoidance	Minimisation	Rehabilitation	Residual impact
Noise disturbance to nearby residential, commercial and industrial areas	No impact piling works during night time periods (10 pm on any day to 7am Monday to Saturday and 9 am Sunday and public holidays)	• Impact piling works to be limited to daytime periods (7 am to 7 pm Monday to Saturday). • Pile driving will only be undertaken during the evening period (7 pm to 10 pm, Monday to Saturday) when required for safety or emergency reasons. • If noise complaints are received, the problem source and potential noise reducing measures will be identified and evaluated for implementation during the works. • The existing Rio Tinto 1800 community complaints hotline (and Communities and Partnerships email contact addresses) will be applied and made publicly available to the Point Samson community. • An EMP has been prepared to incorporate the above best practice mitigation measures to reduce noise levels as far as practicable.	No rehabilitation is proposed or required	Predicted noise levels will remain below assigned noise levels in accordance with the *Environmental Protection (Noise) Regulations 1997*.

4.4.7 Predicted outcome

The work activities of the Proposal will generate noise emissions. Noise impacts (if any) may not be reduced to imperceptible or negligible levels for all receptors; however, mitigation measures will ensure that any residual impacts are minimised as far as possible via good management practices. Predicted noise levels will only be experienced for limited periods of time when works (mainly pile driving) are occurring, and will not be experienced over whole daytime, evening or night time periods. In addition, noise emissions from the Proposal will be temporary and do not represent a permanent impact on the community and surrounding environment

Exceedances of noise criteria ranging from 2 dBA to 8 dBA were predicted during evening and night time periods at Point Samson (residential receptors R03 and R04) during works associated with impact piling activities. Control measures have been applied to avoid impact piling works during night time periods and only pile driving during the evening period when required for safety and emergency reasons (i.e. to make the pile safe and stable before completion the next available piling day) to ensure compliance with assigned noise levels. For all other activities associated with non-piling works, noise levels will be compliant during all assessment periods (i.e. daytime, evening and night time) and all meteorological conditions.

Through the implementation of the EPA's mitigation hierarchy (Table 4-6), the residual impacts of potential indirect impact of the Proposal to social surroundings is as low as reasonably practicable. It is considered that the EPA's objective for social surroundings will be met and that there will be no significant residual impact to social surroundings as a result of the Proposal.

4.5 Marine Environmental Quality

4.5.1 EPA objective

The EPA's objective for marine environmental quality is to maintain the quality of water, sediment and biota so that environmental values are protected (EPA 2018).

4.5.2 Policy and guidance

The following policies and guidance are relevant to the marine environmental quality factor:

- Environmental Factor Guideline: Marine Environmental Quality (EPA 2016c)
- Technical Guidance: Protecting the Quality of Western Australia's Marine Environment (EPA 2016d)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2018)
- Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives (DoE 2006).

4.5.3 Receiving environment

The term 'environmental quality' refers to the level of contaminants in water, sediments or biota or to changes in the physical or chemical properties of waters and sediments relative to a natural state.

4.5.3.1 Previous monitoring

Various water quality and sediment monitoring programs were undertaken in the Cape Lambert area between 2007 and 2013. These included:

- Baseline monitoring to support upgrades to the CLA operation
- Baseline monitoring to support the CLB project
- Monitoring in accordance with the Dredging and Spoil Disposal Management Plan for the CLA and CLB project dredging programs under MS 743 and MS 840
- Sediment assessments to support maintenance dredging programs (Mscience 2015)
- Monitoring in accordance with the MEQMP under MS 743 (Rio Tinto 2011).

Information from these studies has been used below in conjunction with regional data to describe the environmental quality of Cape Lambert coastal waters.

4.5.3.2 Water and sediment characterisation

Waters of the North West Shelf are usually temperature stratified, with sea surface temperatures averaging 30.4 °C in February and 22.5 °C in July/August. The degree of seasonal variability varies between years, depending on factors such as the strength of the Leeuwin Current. Water quality monitoring has shown strong seasonal variability, with monthly median temperatures ranging from 19.4 °C in June to 31.8 °C in February. Salinity remains relatively uniform ranging from 35.2 to 35.7 practical salinity units (psu) for most of the year, rising to 36.1 psu between December and February off the North West Shelf.

A regional study of Pilbara coastal waters found dissolved metal concentrations were generally low, meeting all requirements of the ANZECC Guidelines for 99% ecological protection (Wenziker et al 2006). The Cape Lambert region is an exposed, open water environment which is largely influenced by the macrotidal environment and prevailing regional winds. These physical processes potentially limit the retention time of detectable concentrations of trace metals suspended in the water column, as the turbulent mixing associated with high velocity tidal and surface currents would quickly dilute the contaminants.

Water quality samples collected for dredging and spoil disposal programs (Mscience 2015) were assayed for a suite of trace metals and, at the PQL assayed, most trace metals did not exceed the 99% species protection level, with the exception of copper, lead, zinc and tributyltin. Exceedances of the ANZECC trigger levels for these particular trace metals were consistent between monitoring locations throughout the baseline, dredging and spoil disposal period, and post dredging period.

In water quality monitoring undertaken, turbidity levels were found to be highly variable. Turbidity at the shallow nearshore sites is largely influenced by the tidal and prevailing regional wind conditions. Tidal and wind generated water movement re-suspends fine sediments resulting in naturally elevated levels of turbidity. Turbidity levels are seasonally dependant, with high levels of natural turbidity occurring during and after cyclones and rainfall events, as a result of major wave action and episodic freshwater run-off from the mainland or islands.

The recorded levels of total suspended sediments (TSS) varied considerably between each monitoring location. The CLA wharf appears to have consistently high levels of TSS, especially in near seabed samples, which can be attributed to the close proximity to the wharf and associated shipping/tug movements and dredging and spoil disposal activities.

There are no known published studies on nutrient levels in inshore waters at Cape Lambert; however, it is likely to resemble the Dampier Archipelago, where waters are considered oligotrophic (having low nutrient levels). On occasions, blooms of nitrogen-fixing microbes such as *Trichodesmium* or tidal mud-flat cyanobacteria may contribute significant amounts of nutrients into the marine environment.

There has been no evidence of contamination by organic substances such as polychlorinated biphenyls (PCBs), organo-chlorine pesticides (OCPs) or polycyclic aromatic hydrocarbons (PAHs). No contaminants with a high oxygen demand in the water column are known.

4.5.3.3 Environmental values

The EPA's guidance *Protecting the Quality of Western Australia's Marine Environment* describes an environmental quality management framework for assessing impacts to marine environmental values. Under this framework Rio Tinto has an active MEQMP which covers the Proposal Area footprint. The MEQMP was developed as a result of development approvals and has been approved and amended several times since its inception. The MEQMP is currently being revised.

The MEQMP defines environmental values, environmental quality objectives and environmental quality criteria for the Cape Lambert Operations Management Area (CLOMA). The MEQMP recognises areas around existing infrastructure, including the current Proposal footprint, as "highly disturbed", while the remainder of the CLOMA is considered 'slightly to moderately' disturbed.

Environmental values and objectives relevant to the Proposal Area, as defined by the MEQMP are listed in **Table 4-7**.

Table 4-7 Environmental values, environmental quality objectives and environmental quality criteria from the MEQMP (Rio Tinto 2011)

Environmental value	Environmental Quality Objective	Environmental Quality Criteria
EV1. Ecosystem Health *Maintain structure and function of marine ecosystems consistent with the efficient function of the port and nearshore industry*	EQO1. Biodiversity is maintained	EQC1. Populations of corals retain their current distribution and diversity EQC2 Populations of regionally significant mangroves retain their current distribution and diversity EQC3. Water and sediment quality meet ANZECC & ARMCANZ (2000) guidelines
	EQO2. Marine animals maintained	EQC4. As specified in the Marine Turtle Management Plan
	EQO3. No introduced marine pests establish	EQC5. Nominated marine pests not detected
EV2 Recreation and aesthetics	EQO4. Water is safe for swimming – disease free and aesthetic criteria are met	EQC6. Recreational primary microbial water quality criteria are met
	EQO5. Secondary contact and aesthetic criteria are met	EQC7. Recreational primary microbial water quality criteria are met
EV3 Cultural and spiritual	Not applicable as there are no EQOs in the Cape Lambert Area relating to cultural use of marine waters	
EV4 Fishing and aquaculture	EQO6. Seafood caught within the operational area is safe to eat	EQC8. Relevant criteria from Food Standards Australian New Zealand code
	EQO7 Water quality suitable for aquaculture purposes	EQC9 Water quality criteria are met
EV5 Industrial use	EQO8. Water is suitable for power station cooling water	No EQC adopted. The power station has since been decommissioned.

4.5.4 Potential impacts

The Proposal has the potential to directly impact marine environmental quality through the following impacts:

- Highly localised and short term impacts to marine environmental quality from temporary increased turbidity or sedimentation during installation and removal of piles
- Highly localised and short term impacts to marine environmental quality through the release of contaminants contained in disturbed sediments
- Impacts to marine environmental quality through accidental hydrocarbon or hazardous chemical spills during construction.

4.5.5 Assessment of impacts

The EPA is primarily concerned with marine environmental quality impacts that result in a lower level of environmental quality that may cause a change to an environmental value, including degradation in the level of ecological protection for a portion of the marine environment, or an environmental value not being protected over a portion of the marine environment (EPA 2016c).

Levels of Environment Protection (LEPs) constitute the primary management objective for maintenance of ecosystem integrity. The majority of waters surrounding Cape Lambert have been allocated a High LEP (DoE 2006). Relatively small areas of regionally significant arid zone mangroves, south-east of Point Samson and at Dixon Island and a proposed marine conservation reserve have been allocated as Maximum LEP (DoE 2006). These areas are outside the CLOMA. Under the approved MEQMP, the waters in the vicinity of the nearshore infrastructure (wharf, berth pockets, tug pens, turning basin, channel and power station) which include the Proposal footprint have been allocated a Moderate LEP to allow for elevated levels of contaminants and moderate changes in biological indicators that are associated with shipping and other operational activities (Rio Tinto 2011).

Potential impacts are assessed in the context of the relevant LEP. Under the environmental quality management framework, elevated level of contaminants and moderate changes in biological indicators from natural variation are permitted in Moderate LEPs (**Table 4-8**).

Table 4-8 Environmental Quality Condition limits of acceptable change under the various Levels of Ecological Protection

Level of Ecological Protection	Environmental Quality Condition (limit of acceptable change)	
	Contaminant concentration indicators	**Biological indicators**
Maximum	No contaminants - pristine	No detectable change from natural variation
High	Very low levels of contaminants	No detectable change from natural variation
Moderate	Elevated levels of contaminants	Moderate changes from natural variation
Low	High levels of contaminants	Large changes from natural variation

The installation of piles to support the replacement of dolphins will occur within the operational area (berth pockets) of the port. This area is dredged and receives daily disturbance through propeller action as a result of ship movements. As such, any change in turbidity or sedimentation in this area is not expected to be measurable and is unlikely to impact on marine environmental quality.

Installation of piles to support jetty strengthening will occur along the length of the CLA wharf. Whilst this area is subject to less regular disturbance, it will also occur in an area recognised by the MEQMP as “highly disturbed”. In addition, any increase in sedimentation of turbidity in this area will be highly localised in the vicinity of the piles and jack-up barge legs. As noted in **Section 4.5.3.2**, the marine environment is characterised by high levels of natural turbidity during and after cyclones and rainfall events, as a result of major wave action and episodic freshwater run-off from the mainland or islands. Previous monitoring has recorded consistently high levels of TSS, especially in near seabed samples. Therefore, it is not considered that the installation of piles for jetty strengthening will cause changes to environmental values or impact on the currently assigned level of environmental protection.

Increased vessel activity in the Proposal Area as a result of the Proposal implementation represents an elevated risk for contaminant spills. Potential sources of contaminant releases into the marine environment are collisions between vessels or between a vessel and fixed infrastructure. Potential contaminants include hydrocarbons such as diesel fuel, heavy fuel oil, hydraulic oils, engine oils, greases and lubricants.

Hydrocarbon spills can lead to mortality of exposed benthic organisms through smothering, or to reduced capacity to feed, grow and reproduce. Fuel oil on the sea surface could negatively affect organisms, including their larvae and eggs, which are restricted to the upper few centimetres of the water column. However, the effects are likely to be highly localised to the spill location. Also, contaminant spills to the marine environment from the Proposal remain unlikely and would be limited to small scale events. Any increased risk would be limited to the duration of the works (intermittent over a period of 12 to 18 months).

In the event of a spill reaching the coastline at Cape Lambert, hard corals and other benthic communities, which occur predominantly in the subtidal environment, should have limited exposure to high concentrations of the fuel because much of the spill will remain near the surface. Observations and modelling of small diesel spills in the marine environment (NOAA, undated) show that diesel spreads rapidly, and approximately 40% of the initial mass is lost to evaporation over the first 24 hours. In the Cape Lambert area, the risk of wind moving a spill directly to the shoreline is low because prevailing winds during winter are south-easterly, whilst westerly winds dominate during spring and summer. Further, the direction of an oil spill during spring tides will be under considerable influence of strong tidal currents which move parallel to shore, and consequently the spill is likely to be moved parallel to the coastline, rather than directly onto it.

4.5.6 Mitigation

Table 4-9 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to marine environmental quality.

Table 4-9: Application of mitigation hierarchy for marine environmental quality

Potential impact	Avoidance	Minimisation	Rehabilitation	Residual impact
Temporary increases in turbidity or sedimentation	Cut piles at the seafloor rather than complete removal to avoid sediment disturbance	• Undertake pile driving as efficiently as possible to minimise the duration of disturbance	No rehabilitation is proposed or required	No on-going impact
Impacts to water quality through accidental spills		• Ensure industry practise measures are employed to prevent and, if necessary, respond to spills	No rehabilitation is proposed or required	Small increased risk of spills over the construction period

4.5.7 Predicted outcome

The work activities for the Proposal may generate some highly localised increases in turbidity and sedimentation and increased risk of accidental hydrocarbon spills. With the incorporation of mitigation strategies, the cumulative effect of the Proposal is likely to meet the environmental quality objectives and environmental quality criteria defined under the Cape Lambert MEQMP. Any changes in water or sediment quality are unlikely to be inconsistent with the limits of acceptable change defined for Moderate LEPs.

It is considered that the EPA's objective for Marine Environmental Quality will be met and that there will be no significant residual impact to this Factor as a result of the Proposal.

4.6 Benthic Communities and Habitats

4.6.1 EPA objective

The EPA's objective for benthic communities and habitats is to protect benthic communities and habitats so that biological diversity and ecological integrity are maintained (EPA 2018).

4.6.2 Policy and guidance

The following policies and guidance are relevant to the benthic communities and habitats factor:

- Environmental Factor Guideline: Benthic Communities and Habitats (EPA 2016e)
- Technical Guidance: Protection of Benthic Communities and Habitats (EPA 2016f)

4.6.3 Receiving environment

Benthic communities are biological communities that live in or on the seabed (EPA 2016e). Benthic habitats are the seabed substrates that benthic communities grow on or in. They can range from unconsolidated sand to hard substrates such as limestone or igneous rock and occur either singly or in combination (EPA 2016e).

4.6.3.1 Previous studies

Various mapping of benthic habitat has been undertaken in the vicinity of the Proposal Area. This mapping was undertaken primarily in relation to expansion of CLA operations and construction of CLB. In 2014 BMT Oceanica combined this data with information from Conservation and Land Management mapping to compile a combined habitat map illustrating the distribution and composition of benthic communities in the Cape Lambert region. Studies utilised in this combined habitat mapping are listed in Table 4-10.

Table 4-10: Previous benthic habitat studies undertaken in the Proposal Area

Survey year	Source	Season	Resolution	Approximate spatial coverage	Benthic classification technique
2002	Conservation and Land Management	Unknown	Unknown	Dampier Archipelago	Interpolation of ground truth points
2006/2007	Sinclair Knight Merz	Unknown	Drop camera held 1–2 m off seabed along a 50–100 m transect	1000 km2	Real-time
2010	Sinclair Knight Merz	August	High-resolution video camera	~35 km2	Real-time
2013	Sinclair Knight Merz	March	High-resolution video camera	~35 km2	Real-time
2014	BMT Oceanica				Composite of data from above listed studies
2015	EOMAP				Satellite imagery analysis

Much of the Cape Lambert area has been mapped as sand and silt. Benthic habitats described in the Proposal Area include 'coral' and 'pavement partly covered by macroalgae and coral', predominantly located in near-shore areas and surrounding islands (Hydrobiology 2018). Field surveys show rapid transitions between adjacent areas dominated by different kinds of benthic primary producers,

sometimes only metres in diameter and ranging from high levels of cover to virtual absence, particularly in the intertidal zone.

Biological responses to natural disturbance events, such as a cyclone or freshwater plume, are seasonally common in the Cape Lambert area, which is a naturally highly dynamic system. Most habitats and organisms exhibit resilience to natural disturbances. However, natural disturbances can still significantly influence the abundance and distribution of marine organisms, such as hard coral, seagrasses and macroalgae.

Coral surveys show highly variable cover at nearshore sites and typically higher cover at offshore sites. More than 50 species of hard corals from 23 genera have been recorded from the Cape Lambert region (SKM 2009). The dominant nearshore corals, in terms of their per cent cover, belong to the genera *Favia*, *Fungia*, *Goniastrea*, *Hydnophora*, *Lobophyllia*, *Pectinia*, *Platygyra*, *Turbinaria* and *Porites* (SKM 2009).

4.6.3.2 CLA jetty habitat

The installation of piles to support the replacement of dolphins will occur within the berth pockets in a key operational area of the port. This area is dredged and receives daily disturbance through propeller action as a result of ship movements. EOMAP did not map benthic habitat within this zone. As such, it is assumed this particular area does not support any sensitive benthic communities or habitat.

Further mapping and description of benthic habitat in this section refers to the area where piles are to be installed for the purpose of jetty strengthening only. Benthic habitats in the wharf area (i.e. where piling will be undertaken for the replacement of dolphins) are comprised of sediments that are highly disturbed and regularly resuspended as ships enter and depart the port. As such, there will be few, if any, habitat values in these areas.

Installation of piles to support jetty strengthening will occur at nine locations (each containing four piles/sites, two either side of the jetty) along the length of the jetty, outside of the berth pockets. An assessment of marine habitat at each of the individual locations/sites where piling will occur along the CLA jetty has been undertaken (Hydrobiology 2018). Habitat at each of the pile locations was characterised using sonar, drop camera and sediment grabs. Sonar data was used to map bathymetry, relative hardness and roughness of the substrate surrounding the jetty. Results of the habitat assessment are summarised in **Table 4-11**. Nine locations were described along the length of the jetty, distributed at approximately 240 m intervals, each encompassing four proposed pile sites.

Table 4-11: Summary of habitat assessment finding for 9 locations along CLA (Hydrobiology 2018).

Location	Site	Depth (m)	Roughness (relative)	Hardness (relative)	Substrate
1	5-8	7m	Moderate-rougher	Moderate-harder	Sand, rock with turf algae, macroalgae, soft and sparse hard coral (Sites 7 & 8)
2	1-4	11m	Smooth-moderate	Moderate	Sand, grit, rock, macroalgae
3	9-12	11m	Smooth-moderate	Moderate-harder	Sand, rock with turf algae, sponge
4	13-16	10m	Moderate	Softer	Sand, mud, gravel
5	17-20	9.5m	Moderate	Softer-moderate/harder mix	Sand, mud, gravel, macroalgae, seagrass - *Halophila* (Site 17)
6	21-24	9m	Moderate	Moderate	Sand, mud, gravel, macroalgae

Location	Site	Depth (m)	Roughness (relative)	Hardness (relative)	Substrate
7	25-28	9m	Moderate-rougher	Softer-moderate	Sand, mud, gravel, macroalgae, soft coral (Site 25)
8	29-32	12m	Moderate-smooth	Moderate- harder	Sand, gravel, macroalgae
9	33-36	12.5m	Smooth	Softer	Sonar indicates smooth mud-sand type bottom (low-moderate hardness; no surface features)

The benthic habitat surrounding the CLA jetty is typical of the Pilbara region, represented by sub-tropical/semi-arid, nearshore tidally driven waters, and consistent with regional scale mapping. It is largely characterised by sand and muddy substrates which are sparsely scattered with hard pavement/rock covered by turf algae, macroalgae, sponges and lesser amounts of hard and soft coral (Hydrobiology 2018). The distribution of relative hardness and roughness reflects the dominant habitat type of bare sand and mud. The depth of the water ranges from approximately 7 m at the southernmost point of the CLA jetty, to 13 m at the deepest proposed pile location (Location 9).

The following three habitat classes were described within the study area (**Figure 4-5**):

- Smooth sediment - sand and silt
- Soft coral and macroalgae over pavement
- Patchy hard coral, soft coral, macroalgae and smooth sediment/pavement.

Apart from Location 1 and Location 7, all other pile areas were mapped as Smooth sediment – sand and silt. Macroalgae was found to become sparser as depth increased along the jetty, particularly beyond Location 7 (>10m depth). Location 1, closest to the shore in shallow waters, where light penetration is greatest, is the only area with hard coral species that was identified. The sonar imagery indicated areas of smooth substrate interspersed with low corals. Location 7 included rocky patches covered with turf algae at all four sites, soft coral at sites 25 and 26 and, sponges and macro algae at sites 27 and 28.

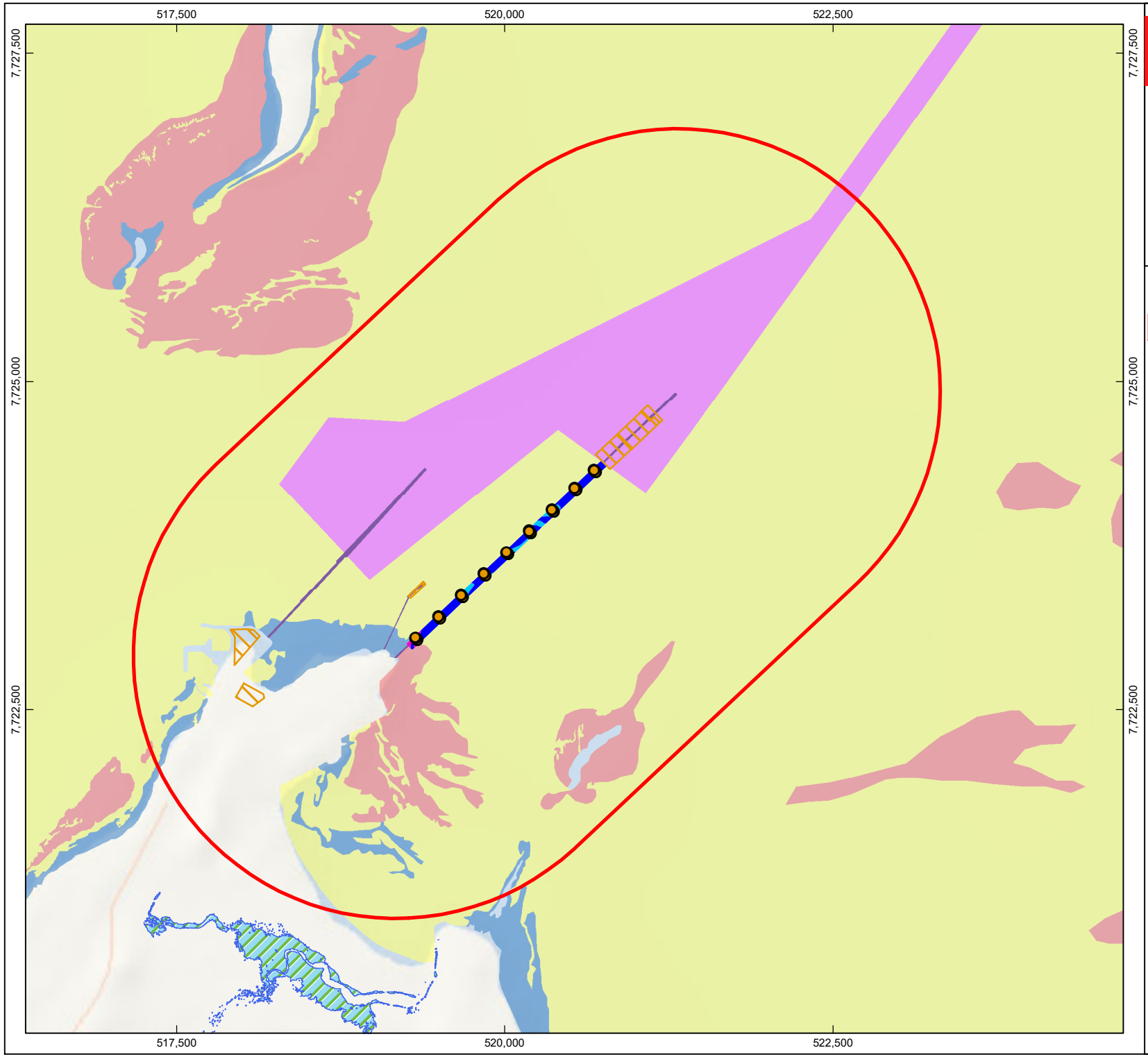

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Figure 4-5: Marine habitats in the Proposal Area

Drawn: NR
Date: 18-Dec-18

Proj: GDA 1994 MGA Zone 50
Scale: 1:40,000 @ A4 page size

LEGEND

- Proposal Area
- Jetty Piles
- Proposal Footprint
- Mangrove Area

Benthic Habitat

- Patchy hard coral, soft coral, macroalgae
- Smooth sediment - sand
- Soft coral and macroalgae over pavement
- Coral
- Dredged Area / channel
- Marine construction
- Pavement partly covered by macroalgae and coral
- Sand and silt

N

0 0.5 1 1.5 2
Kilometres

Map units in metres

4.6.4 Potential impacts

The Proposal has the potential to directly and indirectly impact benthic habitat and communities.

The following direct impacts have the potential to occur:

- Highly localised removal or impact to benthic communities and habitat through location of new piles and placement of jack-up barge legs.

Direct impacts are estimated to cover areas limited to within 20 m of existing infrastructure.

Table 4-12 Estimated direct impacts to benthic habitats

Habitat class (Hydrobiology 2018)	Estimated direct impact
Smooth sediment - sand and silt	<0.28 ha
Soft coral and macroalgae over pavement	<0.01 ha
Patchy hard coral, soft coral, macroalgae and smooth sediment/pavement	<0.01 ha

In addition, the following indirect impacts have potential to occur:

- Highly localised and short term impact to water quality from turbidity but as this is very short term during installation of piles, there is no impact expected to benthic communities and habitats
- Indirect impacts to benthic communities and habitat by impacting on water quality through any accidental hydrocarbon or hazardous chemical spills.

4.6.5 Assessment of impacts

The installation of piles to support jetty strengthening will potentially result in small areas of direct benthic habitat loss (**Table 4-12**) within the footprint of the pile itself and due to the placement of jack-up barge legs. These impacts will be limited to within 20 m of the existing jetty infrastructure. The dominant habitat type within this area is sand and silt. Very small areas of hard coral, soft coral and macroalgae assemblages are likely to be impacted in some inshore locations.

The Cape Lambert Operations MEQMP (see **Section 4.5.3.3**) identifies hard coral communities as a high value benthic habitat type to be used as an indicator of benthic health with associated monitoring to detect changes in abundance and diversity. Local and regional benthic mapping illustrates that communities and habitat to be impacted are widely distributed and well represented within the Cape Lambert region. The coral habitat to the south of the study area is well represented in this area as well as in the wider Cape Lambert region (**Figure 4-5**). Hard coral communities exist on reefs along the western and northern shoreline of Cape Lambert, reefs fringing Point Samson, at Bezout Island, Bezout Rock, Boat Rock, Bell's Reef, Middle Reef, and at several locations near Dixon Island.

Due to the small scale of impacts to benthic habitats and communities a Local Assessment Unit has not been defined to report total cumulative losses. However, the CLB PER (SKM 2009) reported cumulative impacts to benthic communities within the Cape Lambert Region covering an area of approximately 140,000 ha. Cumulative losses were described for the benthic habitat characterised as "hard substrate occupied by a mosaic of corals, turf and macroalgae". Based on predicted impacts reported in the CLB PER this habitat type historically covered an area of 4,013.5 ha, of which 4,002 ha remains (SKM 2009). The contribution of the Proposal to permanent cumulative losses is considered insignificant.

Potential indirect impacts to benthic communities and habitat are associated with impacts to water quality, which is discussed in **Section 4.5.5**.

4.6.6 Mitigation

Table 4-13 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to benthic communities and habitat.

Table 4-13: Application of mitigation hierarchy for benthic communities and habitat

Potential impact	Avoidance	Minimisation	Rehabilitation	Residual impact
Direct removal or impact to benthic communities and habitat		• Minimise the footprint of disturbance during piling	No rehabilitation is proposed or required	Permanent loss of small (<0.3 ha) and highly localised areas of benthic communities
Temporary increases in turbidity or sedimentation	Ensure redundant piles are removed and taken to shore with the intention to be recycled as scrap metal	• Undertake pile driving as efficiently as possible to minimise the duration of disturbance	No rehabilitation is proposed or required	No on-going impact
Impacts to water quality through accidental spills		• Ensure industry practise measures are employed to prevent and, if necessary, respond to spills	No rehabilitation is proposed or required	Small increased risk of spills over the construction period

4.6.7 Predicted outcome

Direct impacts are likely to affect very small areas of benthic communities associated with the footprint of new piles and jack-up barges due principally to the general paucity of benthic habitat and communities in the immediate vicinity of the Proposal footprint. The total approximate area of benthic habitat loss is 0.3 ha. Overall, macro-benthic habitats in the vicinity of the CLA jetty are typical of the wider area, and the benthic primary producer habitat in the area is patchy/localised in nature. For these reasons the piling works are unlikely to pose a significant risk to the benthic primary producer habitat communities present. Any indirect impacts through impacts to water quality will be highly localised and short-term in nature and is not expected to affect benthic communities and habitat.

It is considered that the EPA's objective for Benthic Communities and Habitat will be met and that there will be no significant residual impact to this Factor as a result of the Proposal.

5. Other environmental factors

The other environmental factor that may have some relevance to the Proposal is Terrestrial Fauna. As the Proposal is confined to existing operational areas and there is no requirement to clear native vegetation, impacts to the environmental factor Flora and Vegetation are considered unlikely and irrelevant and are therefore not further discussed in this assessment.

All other factors (Coastal Processes, Landforms, Subterranean Fauna, Terrestrial Environmental Quality, Inland Waters, Air Quality, Human Health) are not considered relevant to the Proposal.

5.1 Terrestrial Fauna

5.1.1 EPA objective

The EPA's objective for Terrestrial Fauna is to protect terrestrial fauna so that biological diversity and ecological integrity are maintained (EPA 2018).

5.1.2 Policy and Guidance

The following guidance is relevant to the Terrestrial Fauna factor:

- Environmental Factor Guideline: Terrestrial Fauna (EPA 2016g)

5.1.3 Receiving environment

A two-phase fauna survey was undertaken in October 2007 and March 2008 (Biota 2008b) as part of the CLB project. A further two-phase survey targeting *Lerista nevinae* was undertaken in January and July 2008 (Biota 2008c). The Proposal is entirely located within the area surveyed for CLB or within previously disturbed operational areas. Four Priority species listed under the *Wildlife Conservation Act 1950* were recorded in or adjacent to the survey area:

- *Lerista nevinae* (Priority 1)
- Little northern freetail bat (*Mormopterus loriae cobourgiana*) (Priority 1)
- Eastern curlew (*Numenius madagascariensis*) (Priority 4)
- Star finch (*Neochmia ruficauda subclarescens*) (Priority 4).

Based on a search of Western Australian and Commonwealth databases, a further six species of Schedule or Priority fauna that were not recorded during the surveys may occur within the Cape Lambert area:

- Northern quoll (*Dasyurus hallucatus*) (Schedule 1)
- Pilbara olive python (*Liasis olivaceus barroni*) (Schedule 1)
- Peregrine falcon (*Falco peregrines*) (Schedule 4)
- Australian bustard (*Ardeotis australis*) (Priority 4)
- Bush stone-curlew (*Burhinus grallarius*) (Priority 4)
- Flock bronzewing (*Phaps histrionic*) (Priority 4).

Potential short range endemic (SRE) invertebrate species, specifically mygalomorph spiders of the family Nemesiidae and Idiopidae, were recorded in the CLB survey area. As the Proposal is confined to existing operational and hard paved areas, there is no requirement to alter fauna habitats.

ERM (2018b) has also undertaken a specific noise impact assessment to predict the likely noise impacts of the Proposal on sensitive environmental receivers. Whilst the scope of that study was focused on human receptors, the results are applicable to terrestrial fauna surrounding the Proposal footprint. The scope of the study and methodology used by ERM (2018b) are discussed in detail in **Section 4.4**.

5.1.4 Potential impacts

The proposal does not include any clearing and as such will not impact directly on terrestrial fauna habitat. The following impacts have the potential to occur:

- Noise disturbance to nearby terrestrial fauna
- Vehicle strike of terrestrial fauna.

Noise may impact terrestrial fauna in two general ways, either by masking (i.e. where noise affects communication between individuals of a species) or by eliciting a reaction, which may range from a mild alert response through to avoidance or abandonment of habitat. Noise from the Proposal will be generated by piling and equipment including marine vessels, trucks and light vehicles. In addition, ground vibration has the potential to disturb terrestrial environments within the Proposal Area.

The Proposal will require additional bus services to operate between Wickham and Cape Lambert to transport workers and contractors during construction. Although bus services will mostly operate on existing public roads, there is the potential for additional short-term impacts with regard to localised loss of fauna from vehicle strikes.

Potential impacts to turtles as a result of terrestrial vibration are discussed under Marine Fauna.

5.1.5 Assessment of impacts

Noise thresholds for terrestrial fauna are not well understood, although Manci et al. (1988) suggest that sound levels above ~90 dBA are likely to be adverse to mammals and are associated with a number of behaviours such as retreat from the sound source, freezing, or a strong startle response, whilst sound level below about 90 dBA usually cause much less adverse behaviour. More recent studies on the impact of noise of fauna species in Australia indicate that birds are more likely to be affected and will move away from habitat areas, as opposed to mammal and reptile species (Lindenmayer at al. 2016). Other studies in Europe have shown that noise levels up to 60 dBA do not result in negative or adverse response in some terrestrial fauna (Helldin et al 2012).

Noise levels greater than existing noise emissions from the Cape Lambert port operations are expected within the Proposal footprint during the implementation phase. The noise assessment undertaken for the Proposal (ERM 2018b) modelled noise at sensitive receptor sites ranging from 4.5 to 11.0 km from the work areas. Whilst these receptors were based largely around the potential for human disturbance, the closest site (R01) is located near Sam's Creek, where there are some habitat values for terrestrial fauna. At this site, the greatest noise estimate was 47 dBA under noise enhancing meteorological conditions. This is well below the 90 dBA levels suggested by Manci et al (1988) as likely to be adverse to mammals. Whilst birds are considered more likely to be affected by noise levels, birds are more likely to move away from the area (Lindenmayer at al. 2016) and no sensitive habitat or communities (roosting or nesting areas) are known to occur within the Proposal Area. In addition, the predicted increased noise levels will only be experienced for limited periods of time during pile driving activities. Noise emissions will be temporary and do not represent a permanent impact on the surrounding environment (ERM 2018b).

Whilst some localised loss of fauna may occur due to direct mortality arising from Proposal-related vehicle movements, it is considered minor relative to the level of existing vehicle movements between Wickham and Cape Lambert. Therefore it is considered unlikely that direct mortalities will be significant enough to affect the overall conservation status of any fauna species.

5.1.6 Predicted outcome

The noise generated is not anticipated to have any detrimental impact to terrestrial fauna within or surrounding the Proposal Area. Terrestrial noise will be managed in accordance with the mitigation measures outlined in the EMP (Appendix A).

It is considered that the EPA's objective for Terrestrial Fauna will be met and that there will be no significant residual impact to this Factor as a result of the Proposal.

6. Holistic impact assessment

The preliminary key environmental factors considered relevant to the Proposal are:

- Marine Fauna
- Social Surroundings
- Marine Environmental Quality
- Benthic Communities and Habitats.

These factors are addressed separately in **Sections 4.3** to **4.6** and the predicted outcomes described in relation to the EPA's environmental objectives, after the application of the EPA's mitigation hierarchy (avoid, minimise, rehabilitate). Other environmental factors are considered in **Section 5**. The Proponent acknowledges the linkages between environmental factors and that those relationships may require consideration and management to achieve good environmental outcomes.

6.1 Connections and interactions

The three marine factors discussed in this impact assessment are closely interlinked. Protection of Marine Environmental Quality is recognised as a cornerstone for meeting environmental objectives for other marine factors including Benthic Communities and Habitat and Marine Fauna. Similarly, Benthic Communities and Habitat are key elements in protection of Marine Fauna. Due to the nature of the receiving environment and the scope of impacts to Marine Environmental Quality and Benthic Communities and Habitat as a result of the Proposal, is not expected that the Proposal will result in flow on effects through these inter-relations.

Noise, which is a key potential impact identified as a result of the Proposal, has the potential to impact more than one environmental factor. Potential impacts from noise span Marine Fauna, human receptors (Social Surroundings) and Terrestrial Fauna. As a result of this, emphasis has been placed on obtaining an accurate assessment of the likely scale and nature of increased noise. Specialist studies were commissioned to model increased noise levels both underwater and at the surface at sensitive receptors. It is likely that temporary increases in noise levels are able to be managed without significant impact to EPA objectives for the relevant factors.

6.2 Environmental principles

A review of how the Proposal addresses the principles of the EP Act is provided in Table 4-1**.** When considered as a holistic proposal, there are a number of key elements to the Proposal consistent with these principles including:

- **The intrinsic nature of the Proposal –** The Proposal aims to prolong the life of existing infrastructure, ensuring these assets remain economically productive, environmentally stable and safe to users into the future. This is consistent with the following principles:
    - the precautionary principle
    - the principle of intergenerational equity
    - the principle of waste minimisation.
- **The spatial footprint of the Proposal within existing operational areas –** The Proposal activities are limited to existing operational areas of the current Cape Lambert port operations, including cleared laydown areas, existing Service Wharf and the existing CLA jetty, wharf and berths. This is consistent with the precautionary principle and the principle of the conservation of biological diversity and ecological integrity.
- **A strong scientific basis –** This Proposal has considered the outcomes of specialist studies for impact piling as well as extensive background studies for the Cape Lambert area. This is consistent with the following principles:
    - the precautionary principle

- the principle of intergenerational equity
- the principle of the conservation of biological diversity and ecological integrity.

6.3 Conclusion

The linkages between environmental factors have been identified and the mitigation proposed in this ERD is considered sufficient to meet the principles contained in the EP Act and the EPA's objectives for individual factors, as set out in **Table 4-1** and **Sections 4.3** to **4.6** respectively. As no significant impacts have been identified in the assessment, offsets are not proposed.

Based on the proposed avoidance and mitigation strategies and the continued implementation of existing management strategies, the Proponent considers that the EPA objectives can be met for all environmental factors and the Proposal is environmentally acceptable and can be adequately managed through the EMP (Appendix A). As such, environmental impacts as a result of the Proposal are considered unlikely to be significant enough to warrant assessment of the Proposal under Part IV of the EP Act.

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Appendix A – Environmental Management Plan (EMP)

RioTinto

Environmental Management Plan

Cape Lambert Port A Marine Structures Refurbishment Project

December 2018

Contents page

1. Background

1.1 Project description

The Project is situated within the existing Cape Lambert Port, located on Pilbara coast of Western Australia approximately 5 km from Point Samson, 12 km from Wickham and 60 km from Karratha (**Figure 1-1**). The Cape Lambert Port consists of two operational areas, Cape Lambert Port A (CLA) and Cape Lambert Port B (CLB).

1.1.1 Project area

The Project area (**Figure 1-2**), comprising the works area (CLA jetty/wharf, service wharf and two laydown areas) plus a 2 km radius, encompasses the extent of potential direct and indirect impacts of the Project.

1.2 Proposed activities

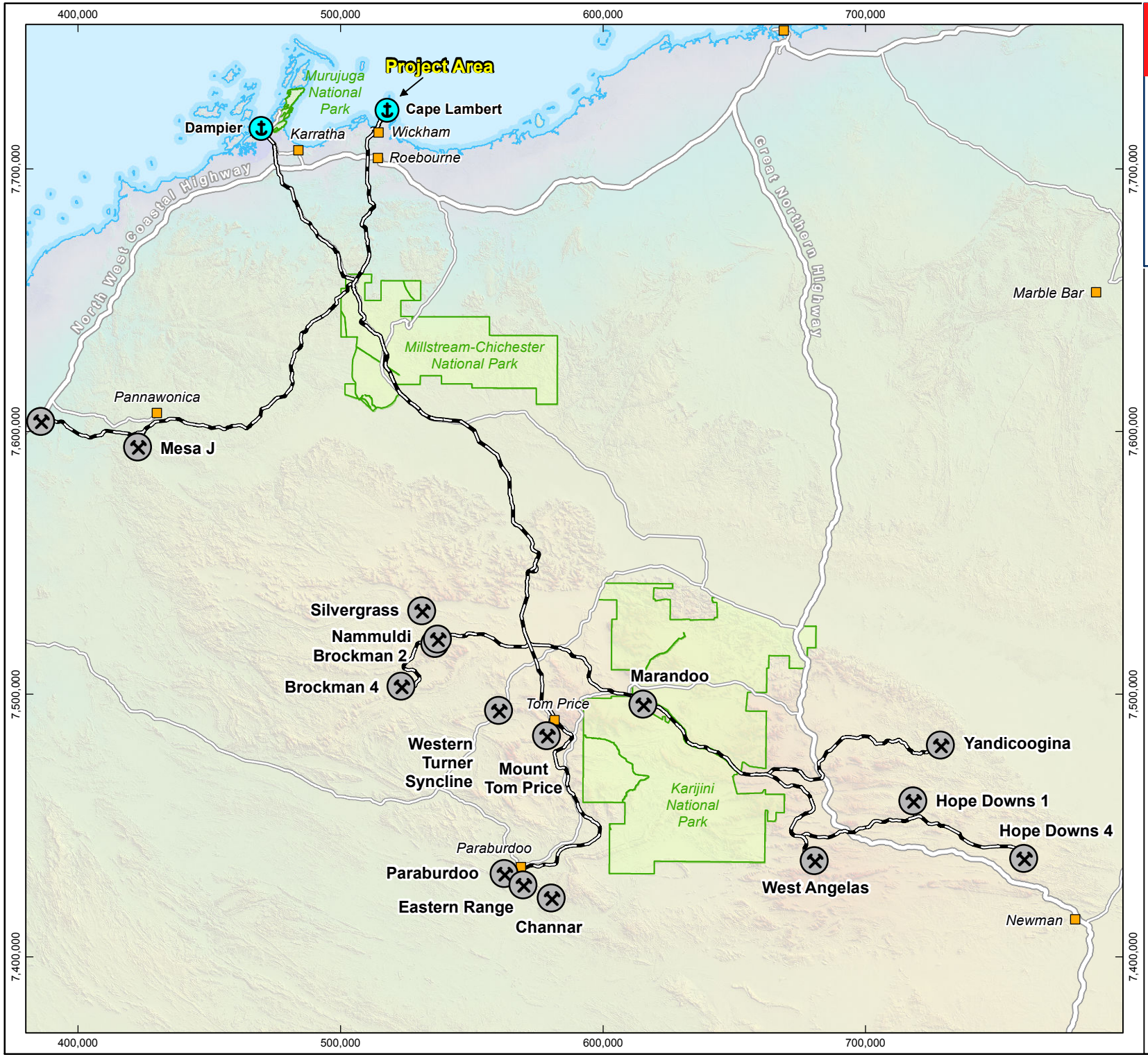
The proposed activities associated with the Project are predominantly nearshore works, located within the existing port facility and include:

- Offsite fabrication and delivery of piles, caps, fenders and mooring equipment required for 18 berthing dolphins and two mooring dolphins at the CLA wharf. Piles will be 1.2 m in diameter. The onshore component of the Project will involve the use of two existing laydown areas within the Lease Area for storage of piles and associated equipment. The piles will be loaded aboard barges at the existing CLA Service Wharf for haulage to the nearshore worksites at the CLA wharf and jetty.
- Replacement of dolphins via the installation of new dolphins alongside the existing structures; these will be connected by a steel jetty walkway between the new dolphins to enhance safe access around the wharf. A total of 108 new piles will be driven into the seabed using a hydraulic pile hammer supported by a crane and jack-up barges. Following the completion of installation of the new replacement dolphins, the redundant dolphins will be mechanically cut above seabed level and transported to shore with the intention to be recycled as scrap metal.
- Strengthening the CLA jetty by the installation of an additional 36 piles with tie-ins back into the jetty. The piles will be installed in groups of four (two either side of the jetty) at nine locations along the jetty. These piles will also be installed using a hydraulic pile hammer supported by a crane and jack-up barges.

1.3 Purpose and scope

This Environmental Management Plan (EMP) informs how the Project will manage impacts to sensitive environmental values as required under the Western Australian *Environmental Protection Act 1996 (EP Act)*, and the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. The EMP will be implemented for the duration of the Project and:

- Describes the environmental values of the Project area
- Identifies potential impacts on species and other sensitive environmental values that may occur as a result of the Project
- Undertakes a risk assessment to evaluate the potential impacts that pose the most risk to environmental values and those that require detail management measures to reduce the risk
- Identifies the measures to be applied to avoid and minimise environmental impacts from the Project
- Details the objectives, triggers and performance targets to be achieved by the implementation of this management plan.



RioTinto

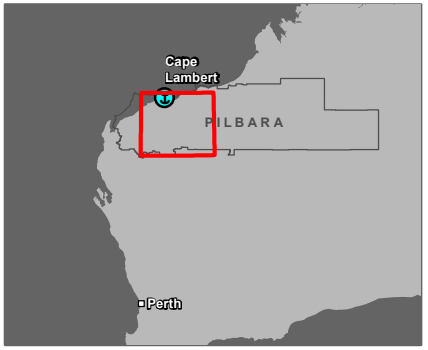
Figure 1-1: Locality

T. Murphy
December, 2018

Plan No: PDE0164793v1
Proj: MGA94 Zone 50

Legend

- Rio Tinto Mine
- Port
- Town
- National Park
- Rio Tinto Railway
- Highway
- Major Road



N

0 20 40 60 80 100
Kilometres

Map units in metres

RioTinto

eco logical AUSTRALIA
www.ecoaus.com.au

Figure 1-2: Project Area

Drawn: NR
Date: 18-Dec-18

Proj: GDA 1994 MGA Zone 50
Scale: 1:20,000 @ A4 page size

LEGEND

- Project Area
- Works Footprint
- Jetty Piles

N

0 0.5 1
Kilometres

Map units in metres

1.4 Timeframes

1.4.1 Project timeframes

The Project will be implemented once all external and internal approvals have been obtained and the tendering/contract process has been finalised.

It is anticipated that the Project will commence in Q3 2019 and extend for approximately 12-18 months. This will be dependent on the scheduling of periods when access to CLA berths is granted to undertake the works so as not to disrupt ongoing port operations. Given good working conditions, completion of a dolphin could take around 4-5 days, while installation of pile arrangements for the jetty strengthening works could take around 1-2 days per pile location.

1.4.2 Work timeframes

Piling will be undertaken during day-time (7 am to 7 pm, Monday to Saturday). Piling will only be undertaken in the evening (7 pm to 10 pm, Monday to Saturday) in the unlikely event that a pile that has been positioned during the day-time is not secure or stable and is at risk of toppling. In such a scenario, sufficient piling will be undertaken to make the pile safe and stable before completion the next available piling day. No piling will be undertaken during night-time (10 pm to 7 am).

Piling will not be required over this whole period. Outside the period of piling, the implementation phase will involve delivery of piles, stockpiling of piles, loading barges with piles, delivery to the work area, positioning piles, installation of above water infrastructure (e.g. walkways between dolphins, caps, jetty tie-ins) and removal of redundant infrastructure.

Depending on progress, the CLA jetty strengthening works will be undertaken at the same time as the CLA dolphin replacement works. This may result in up to two pile driving barges operating concurrently for short periods.

1.5 Stakeholders

Key stakeholders were identified based on Rio Tinto's experience in project developments in the Pilbara region, especially recent port expansions and upgrades at Dampier and Cape Lambert. The following key stakeholders were identified:

State and Local Government agencies

- City of Karratha
- Department of Jobs Tourism, Science and Innovation
- Department of Transport
- Environmental Protection Authority Services of the Department of Water and Environmental Regulation (EPA)
- Pilbara Ports Authority

Commonwealth Government agencies

- Department of the Environment and Energy (DoEE)

Non-government organisations

- Point Samson Community Association
- Coastal Community Environmental Forum
- Dampier Technical Advisory and Consultative Committee

1.6 Structure of the EMP

The objective of this EMP is to create a risk-based usable document that is clear and structured to assist the regulator during the assessment process, and a document that can be readily implemented by a Contractor. The EMP structure is summarised below:

- Project description
- An overview of the existing environment
- Identification of activities and potential impacts to populate the risk assessment
- Risk assessment to identify activities that are the highest risk and need active management
- Specific management measures
- Reporting and review.

This EMP has been prepared to identify and assess project activities and risks while tailoring management actions. The EMP attempts to meet the objectives of the Commonwealth DoEE's Environmental Management Plan Guidelines and the Western Australia EPA's Instruction on how to prepare *Environmental Protection Act 1986* Part IV Environmental Management Plans.

1.6.1 Relationship to other plans

To ensure the EMP is easily implemented by a Contractor, the document has focussed on project activities that may impact on sensitive receptors, and associated management actions to be implemented. Information such as the existing environment (terrestrial and marine) can be found in the Cape Lambert Port A EPBC Act referral (2018) with its associated technical reports, the Cape Lambert Port A EP Act referral (2018) with its associated technical reports, and the Cape Lambert Port B (CLB) Development Public Environment Review and Draft Public Environmental Report and its associated technical reports (SKM 2009).

Table 1-1 outlines the existing approvals and management plans that apply to the Cape Lambert lease area.

Table 1-1: Existing approvals and management plan related to the Cape Lambert lease area

Existing approvals / management plan	Description
Ministerial Statement 514 (28 June 1999)	Upgrade of CLA to accommodate ore from the West Angelas mine site and increase throughput to 55 Mtpa. Included marine and terrestrial works
Ministerial Statement 741 (18 May 2007) Ministerial Statement 1050 (30 December 2016) – s46 change of conditions (dust and noise)	Upgrade of CLA to increase throughput to 85 Mtpa. Included terrestrial works only. Subsequent change to proposal amendment under MS 741 for 105 Mtpa throughput
Ministerial Statement 743 (12 July 2007)	Dredging for upgrade of CLA to 85 Mtpa. Included marine works only
Ministerial Statement 840 (30 September 2010) and Ministerial Statement 876 (31 October 2010) Ministerial Statement 1049 (30 December 2016) – s46 change of conditions (dust) EPBC 2008/4032 (26 October 2010)	Construction of the CLB project with 130 Mtpa capacity. Both terrestrial and marine works
Sea Dumping Permit No. SD2016/3242 (16 June 2016)	Dumping up to 400,000 m^3 (in-situ) of dredged material derived from maintenance dredging of Cape Lambert from 16 June 2016 to 31 May 2019

Existing approvals / management plan	Description
Prescribed Premises Licence (L5278/1973/13)	Category 5 – Processing or beneficiation of metallic or non-metallic ore Category 12 – Screening etc of material Category 52 – Electrical Power Generation Category 58 – Bulk material loading or unloading Category 73 – Bulk storage of chemicals, etc
Cape Lambert Operations Marine Environmental Quality Management Plan (MEQMP)	Developed as part of management goals for the area and in fulfilment of condition 13 of Ministerial Statement No. 743. The MEQMP seeks to reconcile the need for protection of the marine environment with the operations of the area as a designated operations facility adjacent to a centre of population
Marine Turtle Management Plan	Developed as a requirement of Ministerial Statement No. 840 and EPBC 2008/4032. Plan was also aligned the requirements of Ministerial Statement No. 743. Covers both operational and construction (CLB) related issues
Ecosystem Research and Monitoring Program (ERMP)	Condition 10 of EPBC 2008/4032 required development of an ERMP to acquire a detailed ecological understanding of the marine environment of the Cape Lambert region The ERMP works have been completed and is relevant only in that the information gathered has been used to develop this EMP

2. Existing environment

Extensive environmental studies were conducted in the Cape Lambert area as part of the CLB project (EPBC 2008/4032 and Ministerial Statement 840). A significant amount of environmental information has also been gathered during the implementation of Condition 10 (ERMP) of EPBC 2008/4032. Some additional studies have been specifically undertaken to inform the assessment of the CLA Marine Structures Refurbishment Project. The key studies and reports include:

- Public Environmental Review and Draft Public Environment Report (SKM 2009)
- Assessment of lighting effects on turtles (Bassett 2009)
- Species specific surveys for *Lerista nevinae* (Biota 2008a)
- Flora and vegetation survey (Biota 2008b)
- Marine turtle assessment (Biota 2008c)
- Seasonal fauna survey (Biota 2008d)
- Sediment sampling and analysis report (MScience 2015)
- Humpback whale aerial surveys 2012-2016 review (BMT Oceanica 2017)
- Underwater noise literature review addendum (ERM and JASCO 2018)
- Underwater noise modelling report (Li and McPherson 2018)
- Underwater noise report (ERM 2018a)
- Ambient noise impact assessment (ERM 2018b)
- CLA jetty habitat assessment (Hydrobiology 2018).

The following sections present a summary of the existing environment of the Project area, with further information available in those documents cited above. Table 2-1 summarises the environmental values for the region. The summary is focused on the key environmental factors that may be impacted and will be managed through the implementation of the EMP.

The focus of the sensitive receptors relevant to the project activities are the subject of a risk assessment. The risk ratings are assessed in Section 5 for each environmentally sensitive receptor and project activity using the risk matrix as per ISO 31000:2009.

Table 2-1: Summary of environmental values at Cape Lambert

Environmental factor of value	Description within Project area
Terrestrial	
Terrestrial flora and fauna	• The Project area consists of large portions of previously disturbed areas, where terrestrial vegetation has been cleared to allow for the infrastructure associated with Cape Lambert operations. • A search of the EPBC Protected Matters Search Tool (PMST) indicated that no threatened ecological communities or threatened flora species' habitat was known to occur or had the potential to occur within a 10 km radius of the Project area. • The terrestrial habitat of highest value is located at Bells Beach and Cooling Water Beach and is mostly comprised of primary dunes.
Terrestrial environment	• Local light environment at Cape Lambert is well lit due to the requirements of the operational port facility. • Eight receptor locations have the potential to be impacted by noise generated from the Project. The receptors are a mix of industrial, commercial and residential premises and range from between 4.5 km to 11.5 km away from the CLA wharf (ERM 2008b).

Environmental factor of value	Description within Project area
Marine	
Protected areas	• Marine protected areas of relevance to the Project is the Commonwealth Dampier Marine Park, which is located within 10 km of the Project area. • The State proposed Dampier Archipelago Marine Park is also located within 20 km of Cape Lambert.
Oceanography and bathymetry	• Cape Lambert is located on the North West Shelf, which comprises 95,000 km^2 of continental shelf extending from the North West Cape of Western Australia to the Arafura Sea. • The regional bathymetry is complex with depths generally less than 20 m. There is a broad, shallow (<10 m) near shore region with several exposed reefs and islands. • The area immediately north of Cape Lambert is defined by a broad, shallow intertidal flat that gently slopes to a shallow bank stretching for a few hundred metres before quickly sloping down to a uniform depth of approximately -7 to -9 m below Chart Datum (m CD). A further 1.5 to 2 km beyond this area, the seabed steeply slopes to -12 to -14 m CD.
Sediment characteristics[1]	• Sediment material within the Cape Lambert area has been previously assessed and considered suitable for ocean disposal when compared to the National Assessment Guidelines for Dredging (NAGD; DEWHA 2009) • Tributyltin levels, polycyclic aromatic hydrocarbons and total recoverable hydrocarbons have been all below NAGD screening guidelines. • Elevated nickel and chromium concentrations have been located throughout proposed dredging areas, which is consistent with marine sediments within the Pilbara region. Further eco-toxicity testing has not found evidence of acute of chronic toxicity. • The risk of actual and potential acid sulphate soils has been low, with the buffer capacity of the material found to be sufficiently high to neutralise any potential acidity. • Physical sediment characteristics has varied in composition. Material targeted for maintenance dredging, which comprises predominantly unconsolidated sediments, have been typical of surrounding sediments. Particle size distributions showed a predominance of fines and fine sand in sediments of the nearshore berths and swing basins, while sediments from the reference sites further offshore contained less fines and more sand.
Water quality	• Water quality of the shallow nearshore waters of the Project area are influenced by the tidal and regional wind conditions of the wider Cape Lambert area. • Turbidity and total suspended solids with the Project area have been highly variable and can be attributed to a variety of factors including storms events and tides, as well as vessel movements.

Marine habitats	• The marine habitats in the Cape Lambert area can be sub-divided into four broad types:
	  ○ intertidal hard substratum (rocky shores)
	  ○ subtidal hard substratum (reefs, shoals and pavement)
	  ○ intertidal soft substratum (beaches, tidal flats)

[1] As per Cape Lambert Maintenance Dredging Program Sampling and Analysis Plan Implementation Report: December 2015 (MScience Marine Research 2015)

Environmental factor of value	Description within Project area
	○ subtidal soft substratum (seafloor sediments). • The benthic habitat within the Project footprint is typical of the Pilbara region, represented by sub-tropical/semi-arid, nearshore tidally driven waters. • The most widespread marine habitat in the Project area (including within the majority of the Project footprint) is subtidal soft substratum, comprising smooth sediments of sand and silt (SKM 2008e; Hydrobiology 2018). A small portion of patchy hard coral, soft coral, macroalgae and smooth sediment/pavement is present at the southern end of the existing wharf (Hydrobiology 2018). Additional patches of soft coral and macroalgae over pavement are patchily distributed along the remainder of the wharf footprint (Hydrobiology 2018).
Marine fauna	• The wider Cape Lambert area is utilised by a range of marine fauna including turtles, whales and dolphins. Whales and dolphins are well documented in the proposed Dampier Archipelago Marine Park, < 20 km from the Project area. • Four species of marine turtles are known to nest in the Cape Lambert region; flatback, green, hawksbill and loggerhead (but nests very rarely). Of the four species known to nest in the region, three species (flatback, green and hawksbills, the latter nesting rarely with <1% of all nests annually being hawksbills) nest on Bell's Beach and Cooling Water Beach in the Project area. • Humpback whales are known to occur in the Project area during their migration along the Pilbara coastline.
MNES	• Threatened species that are known or have the potential to occur in the Project area include: ○ Humpback whale (*Megaptera novaeangli*) ○ Whale shark (*Rhincodon typus*) ○ Loggerhead turtle (*Caretta caretta* ○ Green turtle (*Chelonia mydas*) ○ Leatherback turtle (*Dermochelys coriacea*) ○ Hawksbill turtle (*Eretmochelys imbricata*). • Migratory marine species that are known or have the potential to occur in the Project area include: ○ Bryde's whale (*Balaenoptera edeni*) ○ Dugong (*Dugong dugong*) ○ Reef manta ray (*Manta alfredi*) ○ Giant manta ray (*Manta birostris*) ○ Indo-Pacific humpback dolphin (*Sousa chinensis*) ○ Spotted bottlenose dolphin (*Tursiops aduncus).*

3. Work activities and potential impacts

If left unmanaged, the Project has the potential to result in impacts to environmental values during implementation. As the port facility is already operating and the Project essentially consists of maintenance/refurbishment works (with no ongoing changes to current operation once commissioned), there are no potential impacts from the operation phase of the Project.

The potential impacts associated with the Project are summarised below and discussed in more detail in the EPBC Referral Supporting Document to the Commonwealth (DoEE) and the Environmental Review Document supporting the referral to the State (EPA).

The potential impacts presented below (Table 3-1) are further considered via a formal risk assessment process in **Section 5**. The risk assessment has been used to inform the potential impacts that require tailored management and mitigation measures.

Table 3-1: Potential impacts associated with the Project

Potential impact	Description within the Project area	Species or sensitive receptor
Underwater noise	Increased underwater noise resulting from pile driving activities Potential for noise above injury/behavioural change thresholds within and adjacent to Project area	Marine fauna, especially humpback whales and turtles
Ambient noise and vibration	Potential for slight increases in background noise levels associated with general work activities Considered negligible in context of operating port	Neighbouring residential areas Terrestrial environment
Light spill	Localised and temporary lighting associated with work activities during restricted work hours	Marine turtles
Vessel strike	Very low risk of vessels strike from small number of vessel movements including crane barge, piling barge, support vessels moving at restricted speeds (4 – 12 knots)	Marine megafauna
Impacts to water quality and benthic communities	Localised reduction in water quality during pile driving as sediments are disturbed Potential for turbidity increases, but within ambient conditions of operational port Potential for release of contaminants bound in sediment, although sediments considered suitable for ocean disposal and wharf environment continually resuspended via ship movements Highly localised removal of benthic habitat (within footprint of new piles and jack-up barge supports) Very low risk for potential for localised smothering of a portion of benthic habitat. Species present are likely to be resilient to periodic sedimentation	Marine environment
Introduced marine pests (IMP)	IMPs may be introduced via vessels that are not resident at the Port	Marine environment
Waste and spills (terrestrial and/or marine)	Waste may be released into the terrestrial or marine environment via spills or inappropriate disposal of waste materials	Marine and terrestrial environment

4. Risk assessment

4.1 Method and scope

A risk assessment for the Project was undertaken to identify the potential impacts with a greater environmental risk and where assessment and management controls should be focussed.

This assessment was an iterative process where potential impacts were considered from both a likelihood and consequence perspective to understand the risk in the absence of management controls. Any risks with a rating of intermediate or above were determined to require controls to prevent adverse effects on environmental values. Risk levels were then re-evaluated to consider whether controls adequately reduced the risk of activity and/or if there are issues which remain a high risk item despite the introduction of controls.

The risk assessment was undertaken using a systematic approach based on international best practice standards, including:

- AS/NZS ISO 31000:2009: Risk management – Principles and Guidelines (Standard).
- HB 158:2010: Delivering assurance based on ISO 31000:2009 Risk management – Principles and Guidelines (Handbook).
- HB 203:2012: Managing environment-related risk (Handbook).
- HB 436:2004: Risk Management Guidelines Companion to AS/NZS 4360:2004 (Handbook).

The scope of this risk assessment includes activities associated with the implementation phase of the Project. Activities subject to this risk assessment include:

- Underwater noise
- Ambient noise and vibration
- Vessel strike
- Impacts to water quality & benthic communities
- Introduced marine species
- Light spill
- Waste

The risk ratings were assessed for each environmentally sensitive receptor and project activity using the risk matrix in **Table 4-1** below. Inherent risk ratings were assessed assuming minimum industry standard would be achieved without the implementation of additional management controls or risk assessment.

Management controls relevant to each inherent risk were identified, applying the management response criteria (**Table 4-2**) and particularly focussing on those inherent risks rated as 'intermediate' and above. Controls employed as industry standard practise and/or those currently operating at CLA/CLB were applied initially to determine initial residual risk ratings. These ratings were further informed by impact analysis and specific project controls developed within this EMP. The ratings were revised iteratively to reduce the residual risks to as low as reasonably possible.

Table 4-3 and **Table 4-4** defines the likelihood and consequence relating to the activity.

Table 4-1: Risk matrix

		Consequence	1	2	3	4	5
			Trivial	Minor	Severe	Major	Catastrophic
Likelihood	A	Almost certain	Low	Intermediate	High	Extreme	Extreme
	B	Likely	Low	Low	Intermediate	High	Extreme
	C	Possible	Negligible	Low	Intermediate	High	High
	D	Unlikely	Negligible	Negligible	Low	Intermediate	High
	E	Rare	Negligible	Negligible	Negligible	Low	Intermediate

Table 4-2: Risk rating, risk class and associated risk management response

Rating	Risk management response
Extreme	Risks that significantly exceed the risk acceptance threshold and need urgent and immediate attention. Modify the threat, likelihood or consequence so that the risk is reduced to 'Intermediate' or lower.
High	Risks that exceed the risk acceptance threshold and require proactive management. Modify the threat, likelihood or consequence so that the risk is reduced to 'Intermediate' or lower.
Intermediate	Risks that lie on the risk acceptance threshold and require active monitoring. The implementation of additional measures could be used to reduce the risk further. Modify the threat, the likelihood or consequence to reduce the risk to 'Low' or 'Negligible' if practicable
Low	Determine the management plan for the threat to prevent occurrence and monitor changes that could affect the classification.
Negligible	Review at the next review interval Manage by routine procedures – reassess at the next review

Table 4-3: Definition of likelihood

Likelihood/probability		
A	Almost certain	Common repeating occurrence that is ongoing. Is expected to occur with port maintenance/upgrade projects of this scale
B	Likely	Will probably occur at some time and in most circumstances. Known to occur with port maintenance/upgrade developments.
C	Possible	Could occur at some time but not often. Sometimes occurs with port maintenance/upgrade developments.
D	Unlikely	Could potentially occur at some time. Uncommonly occurs in port maintenance/upgrade developments.
E	Rare	Practically impossible. Will only occur in very rare circumstances. Not known to occur in port maintenance/upgrade developments.

Table 4-4: Consequence definitions for fauna, marine/terrestrial environment and sensitive human receptors

1	2	3	4	5
TRIVIAL	**MINOR**	**SEVERE**	**MAJOR**	**CATASTROPHIC**
Fauna				
No impact to fauna species habitat Minor (local) temporary habitat modification[1] and/or lifecycle disruption[2] for a fauna species	Minor local impact of fauna species habitat Moderate local habitat modification[1] and/or lifecycle disruption[2] for a fauna species	Moderate local impact of fauna species habitat Substantial local habitat modification[1] and/or lifecycle disruption[2] for a fauna species	Substantial local impact of fauna species habitat Moderate regional habitat modification[1] and/or lifecycle disruption[2] for a fauna species	Moderate or substantial regional impact of fauna species habitat Substantial regional habitat modification[1] and/or lifecycle disruption[2] for a fauna species
No temporary impact to individuals of threatened fauna species	Minor (local) temporary decrease in size of population(s) of threatened fauna species	Moderate local impact to population(s) behaviour of threatened fauna species	Substantial local impact to population(s) behaviour of threatened fauna species	Moderate or substantial regional impact to population(s) behaviour of threatened fauna species
Marine and terrestrial environments				
No detectable (visual) change to background water quality; no exceedance of background	Local, short-term, minor exceedance of background water quality (e.g. turbidity).	Local, long-term OR widespread, short-term, exceedance of background water quality (e.g. turbidity).	Local, permanent OR widespread, long-term exceedance of background water quality (e.g. turbidity).	Major exceedance of background water quality that is widespread and permanent Widespread, permanent exceedance of background water quality (e.g. turbidity).
Minor leak or spill contained within vessel or bunded area	Minor leak or spill affecting soil around vessels or bunded area; minimal response and clean-up required	Leak or spill affecting surrounding waters or terrestrial areas; Clean-up procedures required	Major leak or spill affecting surrounding waters or terrestrial areas, some minor permanent impacts	Leak or spill causing widespread environmental impact to surrounding waters or terrestrial areas in the region, some permanent impacts
Noise (underwater and ambient)				
Noise emissions do not impact to marine megafauna behaviour.	Minor (local) impact to marine megafauna behaviour.	Short-term, local impact to marine megafauna behaviour.	Long-term, local impact to marine megafauna behaviour.	Long-term, regional impacts to marine megafauna behaviour.
Noise emissions do not impact sensitive human receptors	Minor (local) impact to sensitive human receptors	Short-term, local impact and disruption to sensitive human receptors.	Long-term, local impact and disruption to sensitive human receptors.	Long-term, major exceedance of ambient noise conditions causing widespread disruption to sensitive human receptors.

[1] Habitat modification can include fragmentation, and alteration of feeding or habitat resources including water quality; [2] Lifecycle disruptions can include disruption of breeding, feeding, migration, resting behaviour, etc

4.2 Results

Inherent risks of the Project were intermediate to high for all Project activities, barring vessel strike, for which the inherent risk was low. If left unmanaged, underwater noise, changes in water quality and introduced marine species have the potential to result in impacts on sensitive marine environs and fauna. Increases in ambient noise can also cause substantial disruption to local communities if left unmanaged.

With the application of the proposed management controls the residual risk of all potential impacts was reduced to low or negligible.

The full risk assessment is presented in **Table 4-5** below.

Table 4-5: Risk assessment of project activities and management controls

POTENTIAL IMPACT (CHANGE/EFFECT)	GENERATING ACTIVITY	ENVIRONMENTAL RECEPTOR	CONSEQUENCE	LIKELIHOOD	INHERENT RISK	ASSUMPTIONS/COMMENTS	MANAGEMENT CONTROLS	CONSEQUENCE	LIKELIHOOD	RESIDUAL RISK
Increase in underwater noise levels beyond injury or behavioural thresholds	Pile driving	Marine turtles and mammals	3	B	I	Noise behaviour in line with modelling (ERM 2018a) Maximum two pile driving operations operating concurrently	Tailored management controls required, including soft starts and marine fauna observation & exclusion zones (see this EMP Section 6)	2	B	L
Ambient noise and vibration	Loading, stock-piling, offload of materials Pile driving	Nearby residential communities	3	B	I	Increased noise levels may disturb local residential communities	Tailored management controls required, including confirmation of modelling, restricted works hours and community engagement (see this EMP Section 6)	2	B	L
Collisions between vessels and marine fauna	Increased vessel movements	Large marine fauna including whales, turtles, dugong, dolphins	2	C	L	Required vessels limited in number and include only crane barge, piling barge(s) and support vessels All vessels will travel at restricted speeds (4-12 knots) as required within the Port limits Crane and piling barges will be stationary for the majority of works	Adherence to Port operating rules regarding vessel speeds	2	E	N
Impacts to water quality & benthic communities	Pile driving	Marine environment	2	A	I	Minimum number of piles are used to adequately strengthen jetty and replace dolphins Disturbance is localised within immediate vicinity of pile driving At most two pile driving operations undertaken concurrently (worst case)	No additional management controls required	1	A	L

POTENTIAL IMPACT (CHANGE/EFFECT)	GENERATING ACTIVITY	ENVIRONMENTAL RECEPTOR	CONSEQUENCE	LIKELIHOOD	INHERENT RISK	ASSUMPTIONS/COMMENTS	MANAGEMENT CONTROLS	CONSEQUENCE	LIKELIHOOD	RESIDUAL RISK
						Redundant piles will be cut off at natural substrate level and sub-surface structures remain in place Increases in turbidity are within ambient levels of operating port Sediments are not contaminated and regularly resuspended around operational areas (i.e. berths) from ship/tug vessel movements				
Introduction of introduced marine species	Arrival of vessels with IMPs	Marine environment	4	C	H	All vessels for the Project will either be locally sourced or assessed for the risk of introduced marine pests Escalation to vessel inspection/cleaning if a high risk of introducing IMP determined	Assessment of the risk of IMPs for all non-local vessels On-going implementation of existing Port-wide IMP monitoring and response protocols	4	E	L
Light spill	Lighting during night works	Marine turtles	3	C	I	Majority of works will be undertaken between 7 am and 7 pm Evening works until 10 pm permitted only where required to safely secure piles/equipment Lighting will be localised on jetty/wharf/barge vessels Works are contained within the existing CLA setting, which already has an environment of light spill and the Project will not result in the increase of this existing light spill	No additional management controls required	1	D	N

POTENTIAL IMPACT (CHANGE/EFFECT)	GENERATING ACTIVITY	ENVIRONMENTAL RECEPTOR	CONSEQUENCE	LIKELIHOOD	INHERENT RISK	ASSUMPTIONS/COMMENTS	MANAGEMENT CONTROLS	CONSEQUENCE	LIKELIHOOD	RESIDUAL RISK
Release of waste into marine or terrestrial environments	Spills Inappropriate disposal of waste	Marine and/or terrestrial environment	3	C	I	Management, disposal and storage of hazardous materials to Australian Standards and consistent with MSDS All redundant piles will be transported to shore with the intention to be recycled as scrap metal Appropriate containment and disposal of ancillary waste materials (e.g. asbestos from pile caps and gilsomastic paints) Port Walcott Cape Lambert Oil Spill Contingency Plan (OSCP) will be implemented as required	Solid waste will be placed in suitable containers and recycled or disposed of via a licensed contractor Any hazardous waste will be stored in an appropriate manner prior to disposal Spill kits will be available on all piling vessels and staff trained in their use	2	D	N

5. Environmental management and mitigation procedures

The risk assessment in Section 4 identified that the majority of potential impacts from the project will result in negligible risk to environmental values, if undertaken in line with the planned project framework and industry standard controls. However, both underwater and ambient (terrestrial) noise were identified as potential impacts that requires specific management controls to be implemented in order to reduce risks to an acceptable level.

A summary of the general project activities and industry standard controls that will be implemented to avoid and reduce impacts is provided in **Table 5-1**. Tailored frameworks for addressing underwater noise and ambient noise are provided in **Table 5-2** and **Table 5-3** respectively.

Table 5-1: General project activities and industry standard controls that will be implemented to avoid and reduce impacts

Measures to avoid and reduce impacts	Potential impacts addressed
All vessels undertaking works associated with the Project will travel at 4 - 12 knots	Vessel strike
No more than two pile driving operations will occur concurrently (worst case)	Impacts to water quality, underwater noise and ambient noise
Minimum number of piles will be used to undertake jetty strengthening and dolphin replacement activities	Impacts to water quality and benthic communities, underwater noise, ambient noise
Works will be undertaken as close to existing infrastructure as possible while ensuring maximum effectiveness	Impacts to water quality and benthic communities
Redundant piles will be cut at the natural substrate level and removed. Sub-surface infrastructure will be capped and remain in-situ	Impacts to water quality and benthic communities
All non-local vessels will be assessed for the risk of IMPs	IMPs
On-going implementation of existing Port-wide IMP monitoring and response protocols	IMPs
Works hours will be between 7 am and 7 pm. Night works will extend no later than 10 pm and will only be undertaken if required to safely secure piles/equipment	Light spill, underwater noise and ambient noise
All lighting will be localised on jetty/wharf/barge vessels	Light spill
The existing Rio Tinto complaints hotline will be available for community to register concerns	Ambient noise
All redundant piles will be transported to shore with the intention to be recycled as scrap metal	Waste
Management, disposal and storage of hazardous materials will be to Australian Standards and will be consistent with Material Safety Data Sheets	Waste
Port Walcott Cape Lambert Oil Spill Contingency Plan will be implemented as required	Waste
Spill kits will be available on all piling vessels and staff trained in their use	Waste
Solid waste will be placed in suitable containers and recycled or disposed of via a licensed contractor	Waste

Table 5-2: Underwater noise management framework

Performance Objective	Management strategy/target	Key Performance Indicators
To ensure marine fauna, particularly humpback whales and turtles are not injured or significantly disturbed due to underwater noise	Underwater noise to be managed primarily through procedural controls during pile driving, with no impacts to marine animals as a result of piling activity	No works to commence if whales/turtles present in observation zone Cessation of piling if whales/turtles observed in exclusion zone No reported strandings of sick, injured or decreased marine turtles or whales within the Project area for the life of the Project Daily records of marine fauna observations kept when piling undertaken

Management component	Responsibility	Timing
Specific management controls • The underwater noise management procedure presented in • **Figure 5-1** and described below will be implemented. • A suitably trained marine fauna observer will be located at an elevated location on the wharf/jetty immediately prior to and during all piling works. • An observation zone will be established 2 km from the piling activity. • An exclusion zone of 500 m for whales and 300 m for marine turtles will be established from the piling activity. • The observation zone will be checked for 30 minutes prior to the commencement of piling activities each day. If no whales/turtle are present, works can commence (soft start – see below). If whales/turtles are present in the observation zone, commencement will be delayed until all animals have exited the observation zone or have not been seen for 20 minutes. • The suitably trained marine fauna observer will monitor the exclusion zone continuously during piling activities. If whales/turtles are sighted in the exclusion zone, works will cease (i.e. as soon as safely possible). Works will not commence until the animal(s) exit the exclusion zone or have not been seen for 20 minutes (soft start required). • Soft start up procedures will be implemented for all piling activities, for a period of no less than 30 minutes.	Contractor/ Proponent's delegate	On-going

Management component	Responsibility	Timing

• During periods of low visibility (where a distance of 500 m cannot be clearly viewed), pile driving activities may be undertaken provided that during the preceding 24 hour period:
  ○ there have not been 3 or more shut down situations due to marine turtles or whale sightings
  ○ a 2 hour period of continual observations during pile driving works was undertaken in good visibility immediately prior to low visibility (to a distance of 500 m) and no marine turtles or whales sighted.
• Piling to occur during daylight hours unless in the case of a safety/emergency; at such times it will not extend beyond 10 pm.
• Daily records of all marine fauna sighting and associated shut downs to be kept including:
  ○ record observed cetaceans in a format consistent with the National Cetacean Sighting and Strandings Database
  ○ other marine fauna observations, including fish kills and wildlife injuries within 500 m of piling operations
  ○ fauna behaviours, in particular any behaviours that could be attributed to piling activities
  ○ management responses in relation to dead and injured wildlife, including suspension of piling activities
  ○ observation effort in relation to piling activities.
• Herding of cetaceans from the area will not be undertaken using vessels.
• Warning strikes will not be used to deter cetaceans from the area.		

Monitoring • Daily review of records and compliance to marine fauna procedure (i.e. marine fauna observations undertaken, piling logs demonstrating soft start-up being undertaken). • Marine fauna observations ongoing for duration of works.	Trained marine fauna observer	Duration of piling
Reporting • A log of all visual observations of whales, marine turtles, and other marine fauna maintained daily. • All operational shut down events to be logged and maintained. • Report any stranding of sick, injured or deceased marine turtles or whales recorded in 2 km radius (i.e. in the Project area).	Contractor/ Proponent's delegate	Duration of piling
Adaptive implementation (corrective actions) • Cease piling works as indicated by controls. • Any reports of strandings of sick, injured or deceased marine turtles or whales investigated immediately.	Contractor/ Proponent's delegate	Duration of piling

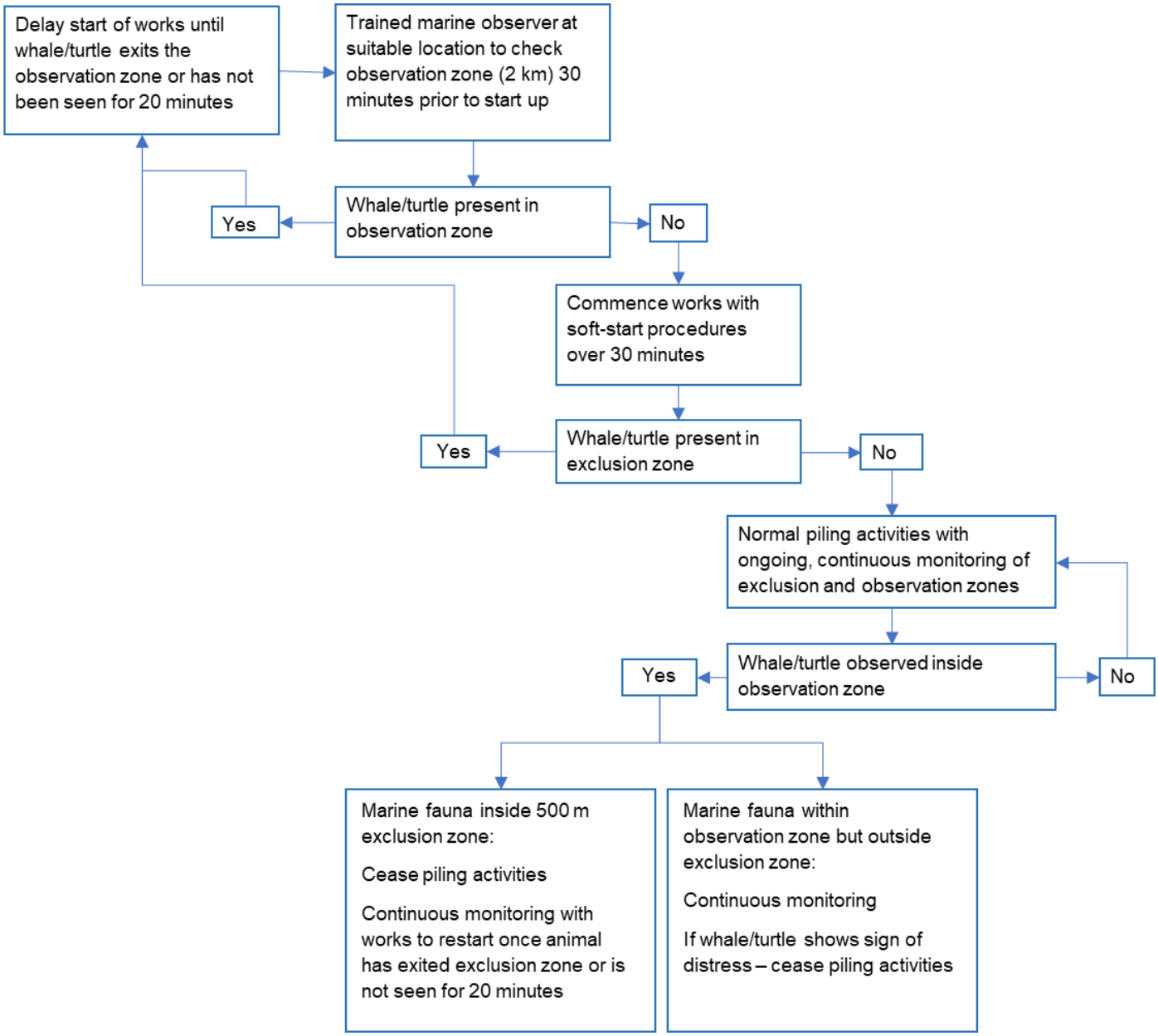


Figure 5-1: Flow diagram for underwater noise management

Table 5-3: Ambient noise management framework

Performance Objective	Management strategy/target	Key Performance Indicators
To minimise the impact of Project generated noise emissions on nearby sensitive receptors and the environment	Ambient noise to be managed through procedural controls during noise generating activities, with no complaints lodged and compliance maintained with relevant noise regulations	Number of complaints No exceedance of modelled average noise levels for all receivers

Management component	Responsibility	Timing
Specific management controls • Piling activities will only be undertaken during daytime hours (7 am to 7 pm). Piling will only occur in evening hours in the case of an emergency or safety concern (7 pm to 10 pm). • Noise generating activities not associated with pile driving itself (e.g. unloading of piles from ship to shore) will only be undertaken during daytime hours. • Induction package will include noise management procedures, piling hours, complaints handling procedures and the location of noise sensitive receptors. • Formal notification to Point Samson Community Association and the City of Karratha prior to the commencement of piling works. • Rio Tinto's community hotline/email will be made available to Point Samson Community Association	Contractor/ Proponent's delegate	On-going

Monitoring
• Noise validation monitoring will be undertaken at Point Samson to confirm noise modelling results. Monitoring will be managed by suitably qualified technicians and may include:
  ○ attended noise measurements conducted using a hand held Type 1 or Type 2 'integrating-averaging' sound level meter
  ○ unattended noise measurements using a Type 1 or Type 2 environmental noise logger.
	Contractor/ Proponent's delegate	Periods over duration of piling

Reporting • Updates to Point Samson Community Association on the results of noise model confirmation monitoring • Complaints will be recorded and reported as per Rio Tinto incident reporting procedure	Contractor/ Proponent's delegate	Duration of piling

Management component	Responsibility	Timing
Adaptive implementation (corrective actions)		
• If noise modelling confirmation monitoring shows exceedances, the monitoring and action protocol in **Figure 5-2** will be followed	Contractor/ Proponent's delegate	Duration of piling

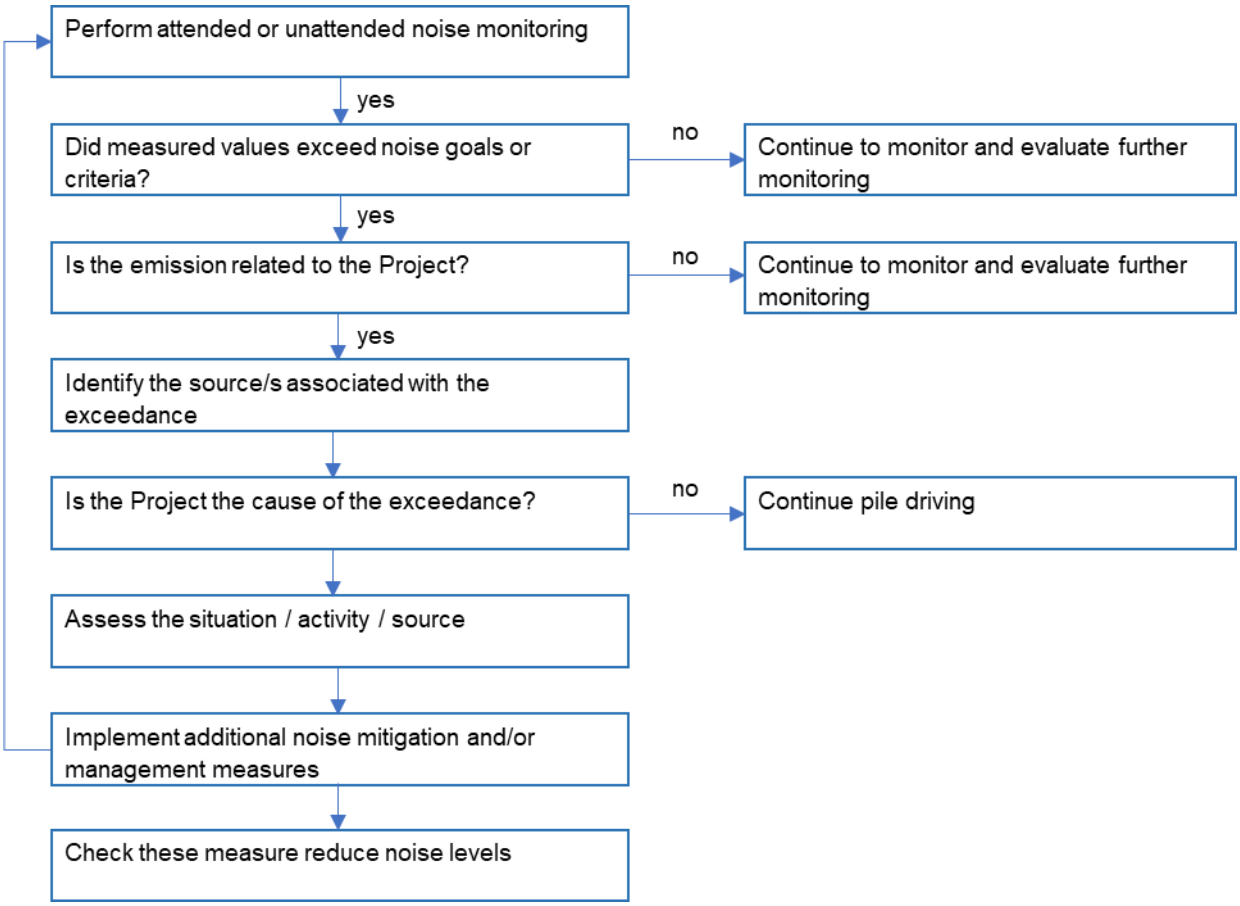


Figure 5-2: Noise monitoring and action protocol

6. Reporting and review process

Reporting will be undertaken as per the reporting requirements outlined in **Table 5-2** and **Table 5-3** in **Section 5** above.

The EMP will be reviewed in response to any significant changes in Project scope, legislative requirements, risk profile or occurrence of major environmental incidents.

If considered necessary, Rio Tinto will update the EMP and submit an amendment for approval to the DoEE and the Department of Water and Environmental Regulation.

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