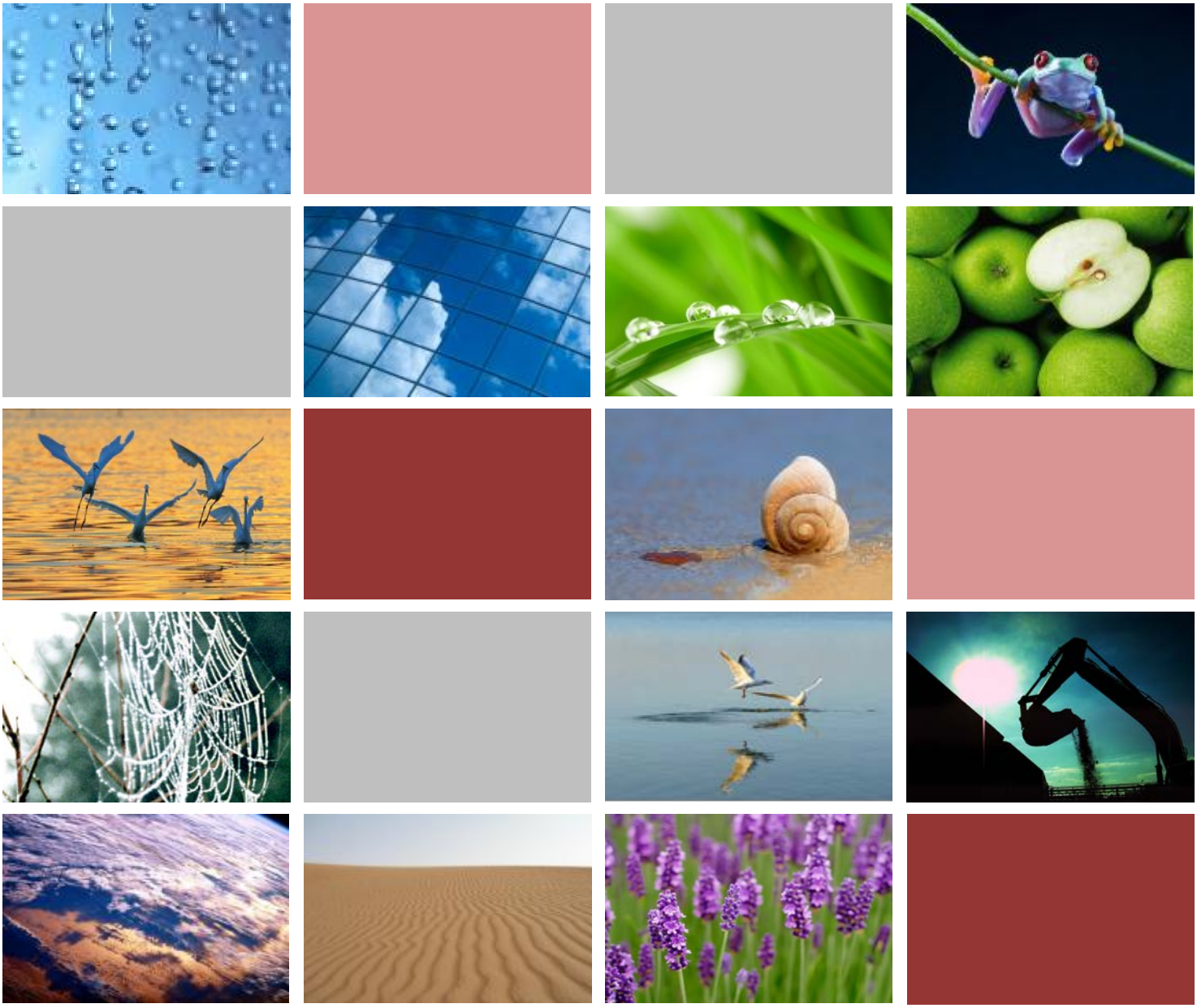

Rio Tinto

Cape Lambert Port A - Marine Structures Refurbishment Project

Noise Impact Assessment

0460694RP01

24 October 2018

The business of sustainability

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ERM Document Control Record

0460694RP01 – CLA Marine Structures Refurbishment Project – Noise Impact Assessment

Version	Revision	Author	Reviewed by	ERM Approval to Issue		Comments
				Name	Date	
DRAFT	D01	SD	NL	Toby Whincup	1 August 2018	Draft prepared by ERM
FINAL	F01	SD	NL	Toby Whincup	8 October 2018	Final prepared by ERM
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Position:	Principal Consultant
Signed:	
Date:	24 October 2018
Approved by:	Toby Whincup
Position:	Partner
Signed:	
Date:	24 October 2018

Cape Lambert Port A - Marine Structures Refurbishment Project

Noise Impact Assessment

Rio Tinto

24 October 2018

ERM Reference: 0460694

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FINAL REPORT

Rio Tinto

Cape Lambert Port A - Marine Structures Refurbishment Project

Noise Impact Assessment

October 2018

Reference: 0460694RP01

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EXECUTIVE SUMMARY

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Rio Tinto to conduct a Noise Impact Assessment (NIA) for works and activities associated with the proposed Cape Lambert Port A (CLA) - Marine Structures Refurbishment Project (the project).

The objective of the project is to extend the design life of the Port A wharf facility and associated jetty. As part of the project scope, 20 dolphins and associated piles (108 piles) will be replaced at the CLA wharf, and 36 piles will be installed along the jetty in nine locations (in groups of two either side of the jetty). Piles will be installed using two hydraulic pile hammers (one operating at the wharf and one along the jetty), supported by cranes and jack-up barges.

Eight receptor locations have been identified to be the closest and/or potentially most affected locations situated within the potential area of influence of the project, refer Section 2.4 of this report. Project-specific noise criteria have been developed with due regard to and in accordance with the Government of Western Australia (WA) Environmental Protection (Noise) Regulations 1997. The project-specific noise criteria are provided for each identified receptor location in Chapter 3.

Applicable project assessment scenarios were developed based on project information provided by Rio Tinto and likely noise levels were predicted, and compared to criteria to establish compliance, evaluate potential impacts and establish potential mitigation measures if necessary to reduce levels and minimise impacts.

The assessment identified that noise levels associated with the impact piling activity (Tables 4.3, 4.4, 4.7 and 4.8) have the potential to exceed the applicable criteria if they are not suitably mitigated/managed. Based on the predicted noise levels and preliminary discussions with Rio Tinto, it was determined that impact piling works would be limited to the day time period (Monday to Saturday) to minimise impacts at the nearest receptors at Point Samson and evenings (but only when required for emergency/safety reasons).

For activities associated with all other refurbishment works, predicted noise levels are compliant during all assessment periods and can therefore be conducted across all periods without the need for further mitigation.

Based on the predicted noise levels during enhancing meteorological conditions, the noise levels are increased by up to 2dBA at the most affected receptor locations. In the unlikely event that worst-case (noise enhancing) meteorological conditions do occur during the project, noise levels will still remain below the assigned noise levels if high noise generating works (i.e. impact piling) is limited to the daytime period (Monday to Saturday). Therefore noise enhancing meteorological conditions are unlikely to result in additional noise impacts.

Project noise impacts (if any) will be minimised with the successful implementation of the recommendations provided in Chapter 5. The recommendations are considered suitable to the magnitude and extent of the predicted impacts. They are designed to minimise impacts as far as is commonly feasible and reasonable to do so and practical to implement. Noise impacts may not be reduced to imperceptible or negligible levels for all receptors during all activities; however the recommendations will ensure that any residual impacts are minimised as far as possible and commonly achievable via good management practices.

1 INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Rio Tinto to conduct a Noise Impact Assessment (NIA) for works and activities associated with the proposed Cape Lambert Port A (CLA) - Marine Structures Refurbishment Project (the project).

This NIA report has been prepared for Rio Tinto which is acting on behalf of the proponent Robe River Mining Co. Pty Limited, a member of the Rio Tinto Group of companies. The Rio Tinto Group (Rio Tinto) is managing the environmental impact assessment and approvals process (for the project) on behalf of the Proponent.

Based on the results of preliminary noise modelling Rio Tinto has committed to constraining high noise generating piling works to the daytime and evening periods (but only when required for emergency/safety reasons) i.e. they will not occur at night.

1.1 BACKGROUND

Rio Tinto operates two iron ore port facilities (termed A and B) at Cape Lambert, located approximately three-and-a-half kilometres northwest of Point Samson on the Pilbara coast of Western Australia.

Cape Lambert Operations consists of rail track networks, ore stockyards, screening and delivery systems, access jetties/wharves and various associated ancillaries.

Rio Tinto proposes to replace aging dolphins at the CLA wharf and extend the design life of the CLA wharf facility and to strengthen the associated CLA jetty. Rio Tinto required an assessment of potential project noise levels and impacts against the Government of Western Australia (WA) *Environmental Protection (Noise) Regulations 1997*.

1.2 PROJECT DESCRIPTION

The objective of the sustaining project is to extend the design life of the CLA wharf facility and associated jetty. As part of the project scope, 20 dolphins and associated piles (108 piles) will be replaced at the CLA wharf, and 36 piles will be installed along the jetty in groups of four.

Piles will be installed using two hydraulic pile hammers (one operating at the wharf and one operating along the jetty), supported by cranes and jack-up barges. This is essentially a replacement program of works for selected dolphins at the existing CLA wharf and a program of strengthening along the CLA jetty.

1.2.1 Project Locality

The CLA wharf facility is located at Cape Lambert on the Pilbara Coast in Western Australia (WA), approximately 40 kilometres (km) north east of Karratha. The Project site is zoned as Strategic Industry within the City of Karratha Local Planning Scheme (LPS).

The majority of land surrounding this Strategic Industry is zoned as conservation, recreation and natural landscapes.

The closest residence to the nearest section of the CLA wharf/jetty is located approximately 3.7 km to the south east on Meares Dr, Point Samson. There is also an industrial receptor located approximately 2.7 km to the south east on Sams Creek Rd, Point Samson. Other residential properties are located in the township of Point Samson approximately 5 km the south of the CLA wharf.

The location of the CLA wharf/jetty, surrounding area and other items of importance to this assessment are identified in *Figure 1.1* to *Figure 1.6*. *Figures 1.3, 1.5 and 1.6* include the dwelling (receptor) locations adopted for assessing the potential noise impacts from the project.

Locality Map

F1.1

Drawing No:	0460694s_NIA_G001_R0.mxd		CLA Marine Structures Refurbishment Project
Date:	26/09/2018	Drawing Size: A4	
Drawn By:	GC	Reviewed By: SD	Client: Rio Tinto

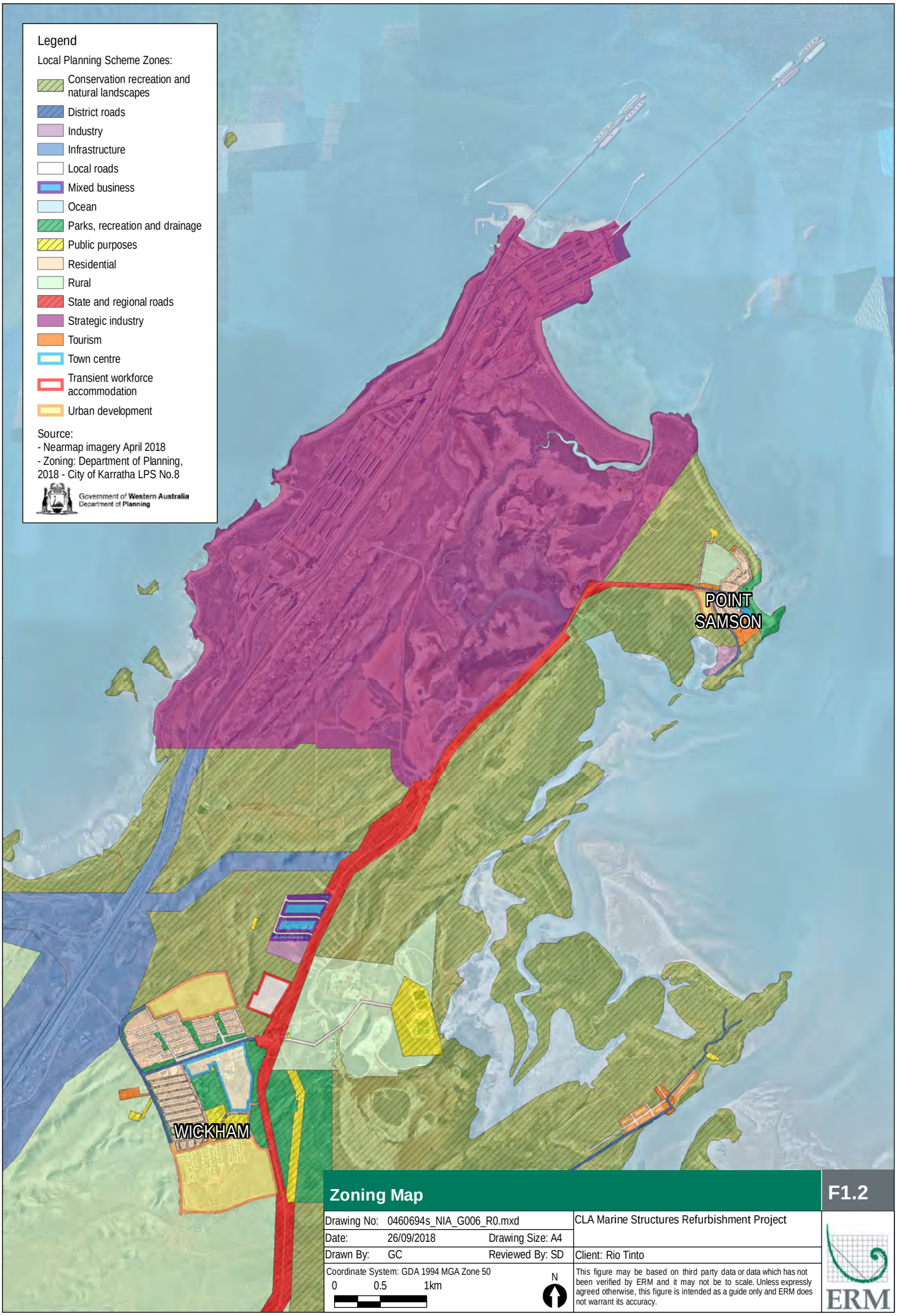
Coordinate System: GDA 1994 MGA Zone 50

0 0.5 1km

N

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM



Zoning Map

F1.2

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Drawn By:	GC	Reviewed By: SD
Client: Rio Tinto		

Coordinate System: GDA 1994 MGA Zone 50

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Noise Assessment Map – Overview

F1.3

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Project Layout

F1.4

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Drawn By:	GC	Reviewed By: SD	Client: Rio Tinto

Coordinate System: GDA 1994 MGA Zone 50

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Potentially Sensitive Receptors – North

F1.5

Drawing No:	0460694s_NIA_G004_R1.mxd		CLA Marine Structures Refurbishment Project
Date:	26/09/2018	Drawing Size: A4	
Drawn By:	GC	Reviewed By: SD	Client: Rio Tinto

Coordinate System: GDA 1994 MGA Zone 50

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Potentially Sensitive Receptors – South

F1.6

Drawing No:	0460694s_NIA_G005_R1.mxd		CLA Marine Structures Refurbishment Project
Date:	26/09/2018	Drawing Size: A4	
Drawn By:	GC	Reviewed By: SD	Client: Rio Tinto

Coordinate System: GDA 1994 MGA Zone 50

0 250 500m

N

ERM

2 ASSESSMENT METHODOLOGY

This chapter describes the assessment methodology adopted for potential noise impacts at nearby receptors. A glossary of relevant acoustical concepts and terminology is provided in *Annex A*.

All sound pressure levels presented in this report (e.g. noise levels predicted at a receptor) are in decibels referenced to 2×10^{-5} Pa. All sound power levels presented in this report (e.g. noise levels assigned to specific sources) are decibels referenced to 10^{-12}W.

2.1 OBJECTIVES AND SCOPE OF WORK

To assess project noise (including that from with piling and associated activities) the following scope of work has been completed:

- Review and validate the available project and third party data, and information considered relevant to the assessment;
- Review aerial photography, zoning data, cadastre data and third party assessments conducted in the area to identify potential residential and other sensitive receptors situated within the potential area of influence of the project;
- Identify significant noise generating plant, equipment and machinery that may be in use or activities that will be undertaken as part of the project and their likely/known emissions to develop applicable assessment scenarios;
- Review applicable regulations and establish project-specific noise criteria;
- Establish a noise model to predict noise levels associated with the CLA Marine Structures Refurbishment Project;
- Review existing Cape Lambert Port Operational noise monitoring assessment (RA, 2018) to determine a representative operational site noise contribution at the identified potentially sensitive receptors. This existing operational noise was added to refurbishment noise levels for all scenarios assessed. This additional and somewhat precautionary step was completed to ensure overall noise emissions and potential impacts were assessed.
- Provide a comparison of predicted levels to the project-specific noise criteria at receptors, identify any noise levels that exceed criteria and determine the magnitude and extent of any impacts; and
- Recommend mitigation, management measures and/or monitoring options suitable to the predicted levels and designed to minimise impacts as far as is feasible, reasonable and practicable to implement.

2.2 *RELEVANT DOCUMENTS, POLICY AND STANDARDS*

This assessment has been conducted with due regard to and in accordance with the following key policy, guidelines and standards:

- Government of Western Australia (WA*) Environmental Protection Act 1986*;
- Government of Western Australia (WA) *Environmental Protection (Noise) Regulations 1997*;
- International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) - Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation;
- Standards Australia AS 2436–2010™ (AS2436) – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites; and
- Relevant project data and information provided by (or on behalf of) the client for use in this assessment.

2.3 *KEY FEATURES, INPUTS AND ASSUMPTIONS*

Key features, inputs and assumptions that have informed the noise modelling and assessment are reproduced or outlined in *Table 2.1* below. Further discussion regarding the effects of meteorological conditions is provided in *Section 2.3.1* below as relevant to this assessment.

Table 2.1 Noise Modelling Features, Inputs and Assumptions

ID	Feature	Description
1	Noise Modelling	• Brüel and Kjær's Predictor 7810 (Version 12.0) noise modelling software package was utilised to calculate noise levels using the International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) - Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation noise propagation algorithms (international method for general purpose, 1/1 octaves). • For sound calculated using ISO9613:2, the indicated accuracy is ±3dBA at source to receiver distances of up to 1,000 metres and unknown at distances above 1,000 metres. • The Predictor software package allowed 3D elevation data to be combined with ground regions, water, significant building structures and receptor locations, to create a detailed and accurate representation of the site and surrounding area. The noise model allowed for the quantification of noise levels from multiple sources, based on sound power or pressure levels emitted from each source. The model computed the noise propagation in the assessment area of influence to specifically quantify A-weighted decibels (L10 and L_{max} in dBA) at identified receptors. • Sound Power Level (L_W, dBA) data incorporated into the project-specific noise models was provided by Rio Tinto, obtained from relevant Australian Standards or adapted from a proprietary source term database available at the time of the assessment, further information is provided in Section 2.5 of this report. • L_W is a measure of the total power radiated by a source; it is a fundamental property of the source and is independent of the surrounding environment. • L_W differs from a Sound Pressure Level (L_P), which is the level of sound pressure as measured at a distance by a standard sound level meter with a microphone. L_P is the received sound (e.g. L_{10} in dBA) as opposed to L_W, which is the sound 'intensity' at the source. • 3D elevation data, zoning data and cadastre (spatial data) was obtained from the WA Department of Planning, Lands and Heritage. • Noise levels were calculated at 1.5m above ground level for all receptors. It is noted that ambient, background and project noise levels may be higher at receptor heights above 1.5 m. • In all cases noise has been assessed at the most-affected point at or within the residential property boundary or, if that is more than 15 m from the residence, at the most-affected point within 15 m of the residence. • A ground factor of 0.7 was adopted for land areas and a ground factor of 0.0 was adopted for ocean areas within the model (0.0 is hard, 1.0 is soft). • A number of other modelling features have been adopted for noise modelling and are listed below, these features are outlined in the assessment scenarios: o Quantity is the number of equipment operating per 15 minute assessment period;

ID	Feature	Description
		○ Duty Factor is the percentage of time the equipment operates per 15 minute assessment period, or represents a reduced emission for part of the period; ○ Base LW Value is source emission or 'Sound Power Level' (LW) directly allocated to the equipment, unadjusted; ○ Penalty considers any annoying characteristic such as tonality, impulsiveness or modulation. (Note: in line with previous piling noise assessments for Rio Tinto (SVT, 2012a), previous piling noise measurement experience and the large distance between source and receptor locations for the project, no penalties have been applied for the assessment. Annoying characteristics such as tonality, impulsiveness and modulation are not anticipated at receptor locations.); and ○ Total LW Value is the overall equipment source emission (LW) adjusted for the quality, duty factor and penalty. • The noise assessment scenarios and modelling data are summarised in Chapter 4, however all LW, dBA values have considered the relevant penalties for offensive noise characteristics, prior to modelling; • Noise level predictions have been conducted to identify results for representative worst-case scenarios, as the predicted values consider the cumulative emission (and potential impact) of all equipment sources working concurrently; and • It is not possible or warranted to reflect potential impacts, to model every plausible activity, task or usage for each noise generating source and location, hence the conservative approach adopted here has been applied to ensure that representative worst-case noise predictions were conducted.
2	Meteorological Conditions	• The model included a temperature of 26°C, humidity of 62% and atmospheric pressure of 101.02 kPa, representative of conservative noise enhancing conditions derived from historical data from the Rio Tinto weather monitoring stations located at Cape Lambert and Point Samson. Further information is provided below regarding prevailing meteorological conditions.
3	Cape Lambert Port Operational noise	• Cape Lambert Port Operations noise monitoring assessment (RA, 2018) was reviewed to determine a representative operational site noise contribution at the identified potentially sensitive receptors. • The highest identified site noise contribution in (RA, 2018) was 33 dBA at Point Samson. Based on this noise level contribution and the average distance to the operation noise sources identified in the (RA, 2018) report, site noise level contributions were extrapolated to each of the potentially sensitive receptor locations identified in this assessment. • The estimated operational site noise level for each receptor (dB, LA10) are presented in *Table 4.1* to *Table 4.8* in *Chapter 4* of this report.

2.3.1 Meteorological Conditions

Prevailing meteorological conditions have the potential to increase noise levels at receptors influenced by the effects of wind and temperature inversions. Winds blowing between the source and the receptor, and temperature inversions can increase noise levels by between 1 dBA and approximately 7 dBA depending on the distance of the receptor from the source and condition.

These noise level increases are normally detectable (or quantifiable via modelling) for receptor distances greater than 100 m from the source, which is the case for this Project with all receptors more than 2,000 m from the project area.

The focus of this assessment is standard meteorological conditions for project noise. The noise model has adopted a Pasquill-Gifford stability Class-D (representing standard meteorological conditions) for all scenarios.

Prevailing (>30%) wind conditions were assessed against the Camp Lambert and Point Samson meteorological data from 2017 and 2018 provided by Rio Tinto. Based on the calculated results prevailing noise enhancing wind conditions were not determined to be a feature of the area. This means that no noise enhancing wind conditions were recorded to occur for more than 30% of the time during any assessment period (day, evening, night etc.) across each season (i.e. winter, spring, summer and autumn).

While no prevailing winds have been identified to occur in the area, there is still potential that winds will occur in any given direction. For the purposes of the project, noise enhancing wind conditions have been determined as north, north west or westerly winds. It should also be noted that south, south east or easterly wind conditions would be favourable to the project (and the community) as noise impacts would be expected to be lower during these conditions.

Based on this, a potential worst case (noise enhancing) meteorological scenario was also modelled for reference in accordance with previous noise assessments undertaken for Rio Tinto (SVT, 2012a and 2012b) and the EPA Environmental Factor Guideline (EPA, 2016) which states that worst, best and most likely case scenarios should be modelled.

The following conditions were included in the noise model for each period:

- **Daytime**: 4 m/s source to receptor wind conditions and a Pasquill-Gifford stability Class-E;
- **Evening**: 4 m/s source to receptor wind conditions and a Pasquill-Gifford stability Class-E; and
- **Night time**: 3 m/s source to receptor wind conditions and a Pasquill-Gifford stability Class-F.

2.4 *POTENTIALLY SENSITIVE RECEPTORS*

Eight receptor locations have been identified to be the closest and/or potentially most affected locations situated within the potential area of influence of the project, as presented in *Table 2.2.*

These locations were established based on review of aerial photography, land use zoning and cadastre data, the results of preliminary noise modelling, where receptor positions were optimised to ensure representative worst-case levels were being predicted, and then confirmed with Rio Tinto personnel familiar with the site and surrounding area.

These locations do not represent all receptors located in the vicinity of the project but have been selected for the purposes of this noise impact assessment; they are considered to be representative of locations that will potentially experience the highest impacts associated with the project.

The scope of this noise impact assessment is limited to environmental noise. This report does not cover any assessment of other factors, for example, occupational health and safety (noise and vibration exposure). These factors would be managed by the contractors conducting the work, that are familiar with the noise hazards and risks (amongst other features) and the methods used to mitigate these.

Table 2.2 Potentially Sensitive Receptors

ID	Receptor Type	Description	Elevation (AHD, m)	Approximate Distance from CLA Wharf (km)	Direction from CLA Wharf	Approximate Distance from CLA Jetty (km)	Direction from CLA Jetty	Approximate Distance from CLA Jetty (km)	Direction from CLA Jetty	GPS Co-ordinates (UTM, Zone 50K)	
						Closest Pile	Closest Pile	Furthest Pile	Furthest Pile	Easting	Northing
R01	Industrial	Sams Creek Rd, Point Samson	4	4.5	South	2.8	South	4.3	South	519326	7720224
R02	Commercial	Wickham Yacht Club, Boat Beach	11	6.8	South west	4.8	South west	6.6	South west	515536	7720162
R03	Residential	Meares Dr, Point Samson	17	5.0	South	3.8	South	4.9	South	520338	7719414
R04	Residential	Fisher St, Point Samson	12	5.4	South	4.0	South	5.2	South	520304	7719103
R05	Residential	Cliff St, Point Samson	9	5.5	South	4.1	South	5.3	South	519982	7719030
R06	Commercial	Wilson Way, Wickham	10	10.4	South west	8.5	South west	10.3	South west	515768	7715310
R07	Residential	McCourt Way, Wickham	11	11.6	South west	9.7	South west	11.5	South west	514929	7714403
R08	Residential	Pearl St, Cossack	10	11.0	South	9.5	South	10.9	South	519590	7713522

1. Australian Height Datum (AHD) in metres.

2.5 *ASSESSMENT SCENARIOS*

Assessment scenarios were developed to identify significant noise generating plant, equipment and machinery that may be in use or activities that will be undertaken as part of the project works. These scenarios were informed through information provided by Rio Tinto.

Sound power levels (LW) were determined for each item of significant noise generating plant, equipment and machinery primarily based on Standards Australia AS 2436–2010™ (AS2436) – *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*. Where noise generating plant/equipment or activities were not specified within AS2436 or have previously been measured and sound power levels calculated by ERM (e.g. Impact piling with a Junttan Piling Hammer), the sound power levels from ERM's database were utilised.

A summary of the eight assessment scenarios that were considered in this assessment is provided in *Table 2.3* below with the full set of data presented in *Annex B* of this report.

Table 2.3 Assessment Scenarios

Scenario (SCN)	Area of Works	Activity Description	Equipment/Plant	Sound Power Level (LW)
SCN01	Laydown Area 1	Laydown Area Works	150T Crawler Crane	104
			25T Mobile Crane	104
			Truck	107
			Light Vehicle	106
SCN02	Laydown Area 2	Laydown Area Works	150T Crawler Crane	104
			25T Mobile Crane	104
			Truck	107
			Light Vehicle	106
SCN03	Load Out Area	Load Out Area Works	42T BP Tug Boat	106
			35T BP Multicat	107
			15m Crew Transfer Boat	100
			400T Load Out Crane	105
			Supply Barge	100
SCN04	Wharf	Removal of Dolphins/Wharf Piles	Jack-up Barge (FAVCO M2480D)	105
			Wharf-based Gantry Crane (FAVCO M1280D)	105
			Jack-up Barge Ancillary Equipment	105
			Gantry Crane Ancillary Equipment	105
			Hand Tools	102
			42T BP Tug Boat	106
			35T BP Multicat	107
			15m Crew Transfer Boat	100
			Underwater Noise Sources	-
SCN05	Wharf	Wharf Dolphin Installation (Pile Drilling)	Jack-up Barge (FAVCO M2480D)	105
			Wharf-based Gantry Crane (FAVCO M1280D)	105
			Jack-up Barge Ancillary Equipment	105
			Gantry Crane Ancillary Equipment	105
			Hand Tools	102
			42T BP Tug Boat	106
			35T BP Multicat	107
			15m Crew Transfer Boat	100
			LD408 Reverse Circulation Drill (RCD) Rigs	113

Scenario (SCN)	Area of Works	Activity Description	Equipment/Plant	Sound Power Level (LW)
SCN06	Wharf	Wharf Dolphin Installation (Impact Piling)	Jack-up Barge (FAVCO M2480D)	105
			Wharf-based Gantry Crane (FAVCO M1280D)	105
			Jack-up Barge Ancillary Equipment	105
			Gantry Crane Ancillary Equipment	105
			Hand Tools	102
			42T BP Tug Boat	106
			35T BP Multicat	107
			15m Crew Transfer Boat	100
			25T Junttan Piling Hammer	132
SCN07	Jetty	Jetty Pile Installation (Pile Drilling)	Jack-up Barge (FAVCO M2480D)	105
			Jack-up Barge Ancillary Equipment	105
			Gantry Crane Ancillary Equipment	105
			Hand Tools	102
			42T BP Tug Boat	106
			35T BP Multicat	107
			15m Crew Transfer Boat	100
			LD408 Reverse Circulation Drill (RCD) Rigs	113
SCN08	Jetty	Jetty Pile Installation (Impact Piling)	Jack-up Barge (FAVCO M2480D)	105
			Jack-up Barge Ancillary Equipment	105
			Gantry Crane Ancillary Equipment	105
			Hand Tools	102
			42T BP Tug Boat	106
			35T BP Multicat	107
			15m Crew Transfer Boat	100
			25T Junttan Piling Hammer	132

3 NOISE ASSESSMENT CRITERIA

In Western Australia the *Environmental Protection (Noise) Regulations 1997* (the Regulations) operate as a prescribed standard under the *Environmental Protection Act 1986* and sets limits on permissible noise emissions.

3.1 ENVIRONMENTAL PROTECTION (NOISE) REGULATIONS 1997

In accordance with the Regulations, assigned noise levels have been adopted at each receptor location and are determined based on the type of receptor (i.e. Residential, Commercial or Industrial). *Table 3.1* below outlines the assigned noise levels from the Regulations.

Table 3.1 Assigned Noise Levels

Type of premises receiving noise	Time of day	Assigned level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	55 + influencing factor
	0900 to 1900 hours Sunday and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises other than those in the Kwinana Industrial Area	All hours	65	80	90

1. *Environmental Protection (Noise) Regulations 1997*

Influencing Factor

The influencing factor was determined for noise received on noise sensitive premises (i.e. Residential) as per Schedule 3 of the Regulations.

Two concentric circles were drawn around each sensitive receptor location identified for the assessment with radii of 100 m and 450 m. The percentage of 'industrial and utility' or 'commercial' land use zones within each of the circles was then determined.

A transport factor was determined based on the following:

- for a major road where any point inside the road reserve is present in the relevant inner circle, a transport factor of 6 dB;
- for a major road where any point inside the road reserve is present in the relevant outer circle, a transport factor of 2 dB; and
- for each secondary road where any point inside the road reserve is present in the relevant inner circle, a transport factor of 2 dB.

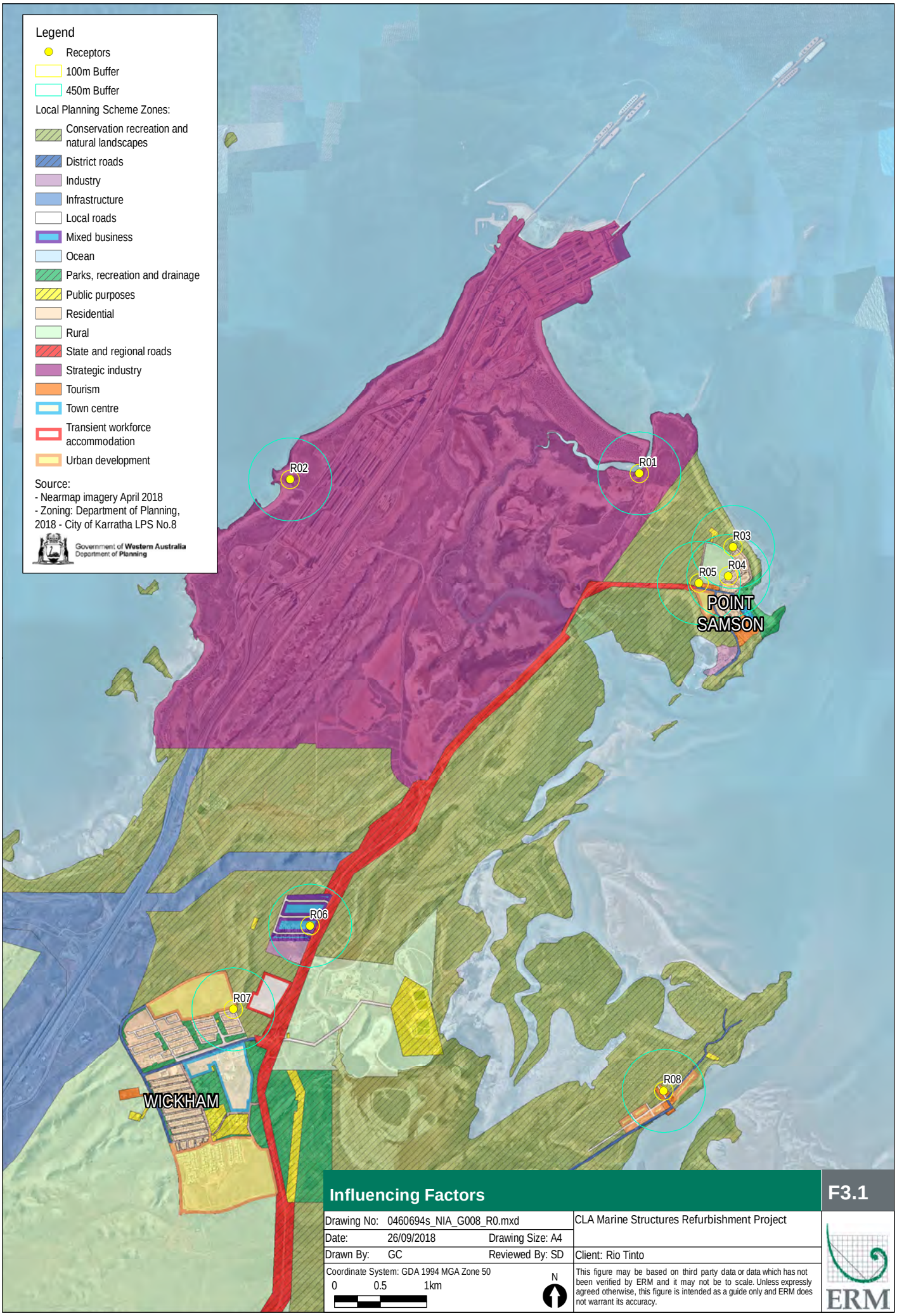
The influencing factors in dB were then calculated through the following formula:

Influencing Factor = *1/10 (sum of 'industrial and utility' percentages for both circles)*

+ 1/20 (sum of 'commercial' percentages for both circles)

+ transport factor or 6, whichever is the lesser amount

Figure 3.1 below presents the land use zoning map in relation to the determination of influencing factor on noise sensitive premises.



Influencing Factors

F3.1

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Date:	26/09/2018	Drawing Size: A4	
Drawn By:	GC	Reviewed By: SD	Client: Rio Tinto

Coordinate System: GDA 1994 MGA Zone 50

0 0.5 1km

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3.2 PROJECT-SPECIFIC NOISE CRITERIA

Project specific noise criteria (assigned noise levels - L_{A10}), presented below in *Table 3.2,* have been established for each potentially sensitive receptor location as outlined in *Section 3.1.*

Table 3.2 Project-Specific Noise Criteria

Receptor	Receptor Type	Assigned Noise Levels, dB (L_{A10})		
		Daytime[1]	Evening[2], Sunday and Public Holidays[3]	Night Time[4]
R01	Industrial	60	60	60
R02	Commercial	60	60	60
R03	Residential	45	40	35
R04	Residential	47	42	37
R05	Residential	51	46	41
R06	Commercial	60	60	60
R07	Residential	47	42	37
R08	Residential	47	42	37

1. 7AM to 7PM Monday to Saturday
2. 7PM to 10PM all days
3. 9AM to 7PM Sunday and public holidays
4. 10PM on any day to 7AM Monday to Saturday and 9AM Sunday and public holidays

4 PROJECT NOISE ASSESSMENT

Based on the methodology, inputs and assumptions described in *Chapter 2* of this report, (L_{A10}) noise levels have been predicted for the CLA Marine Structures Refurbishment Project.

A summary of the predicted noise levels are presented in *Table 4.1* and *Table 4.8* below. *Annex C* of this report presents all predicted noise levels and provides comparison to criteria. All noise levels have been rounded to one decimal place.

In accordance with the Environmental Protection (Noise) Regulations 1997 the assessment periods are defined as follows:

- Daytime - 7AM to 7PM Monday to Saturday;
- Evening - 7PM to 10PM all days;
- Daytime - 9AM to 7PM Sunday and public holidays; and
- Night time - 10PM on any day to 7AM Monday to Saturday and 9AM Sunday and public holidays.

Table 4.1 Support Services + Dolphin/Pile Removal (Standard Meteorological Conditions)

Receptor ID	Receptor Type	Predicted Noise Level, dB (LA10, period)				Estimated Operational Site Noise Level, dB (LA10)	Total Site Noise Level (Refurbishment Scenarios + Ops)	Assigned Noise Level (LA10, period)			Comparison to Assigned Noise Level		
		SCN01 (Laydown)	SCN02 (Laydown)	SCN03 (Load out)	SCN04 (Wharf Pile Removal)			Day	Evening, Sunday and Public Holidays	Night	Day	Evening, Sunday and Public Holidays	Night
R01	Industrial	16	17	21	17	36	36	60	60	60	-24	-24	-24
R02	Commercial	16	16	10	13	39	39	60	60	60	-21	-21	-21
R03	Residential	12	13	18	21	34	34	45	40	35	-11	-6	-1
R04	Residential	11	12	12	15	34	34	47	42	37	-13	-8	-3
R05	Residential	11	12	12	15	34	34	51	46	41	-17	-12	-7
R06	Commercial	4	5	4	8	33	33	60	60	60	-27	-27	-27
R07	Residential	3	3	2	7	32	32	47	42	37	-15	-10	-5
R08	Residential	2	3	2	8	31	31	47	42	37	-16	-11	-6

Table 4.2 Support Services + Pile Drilling (Standard Meteorological Conditions)

Receptor ID	Receptor Type	Predicted Noise Level, dB (LA10, period)					Estimated Operational Site Noise Level, dB (LA10)	Total Site Noise Level (Refurbishment Scenarios + Ops)	Assigned Noise Level (LA10, period)			Comparison to Assigned Noise Level		
		SCN01 (Laydown)	SCN02 (Laydown)	SCN03 (Load out)	SCN05 (Wharf Pile Drilling)	SCN07 (Jetty Pile Drilling)			Day	Evening, Sunday and Public Holidays	Night	Day	Evening, Sunday and Public Holidays	Night
R01	Industrial	16	17	21	20	29	36	37	60	60	60	-23	-23	-23
R02	Commercial	16	16	10	15	17	39	39	60	60	60	-21	-21	-21
R03	Residential	12	13	18	24	25	34	35	45	40	35	-10	-5	0
R04	Residential	11	12	12	18	19	34	34	47	42	37	-13	-8	-3
R05	Residential	11	12	12	18	19	34	34	51	46	41	-17	-12	-7
R06	Commercial	4	5	4	10	11	33	33	60	60	60	-27	-27	-27
R07	Residential	3	3	2	9	9	32	32	47	42	37	-15	-10	-5
R08	Residential	2	3	2	10	10	31	31	47	42	37	-16	-11	-6

Table 4.3 Support Services + Impact Piling (Nearest Jetty Pile) (Standard Meteorological Conditions)

Receptor ID	Receptor Type	Predicted Noise Level, dB (LA10, period)					Estimated Operational Site Noise Level, dB (LA10)	Total Site Noise Level (Refurbishment Scenarios + Ops)	Assigned Noise Level (LA10, period)			Comparison to Assigned Noise Level		
		SCN01 (Laydown)	SCN02 (Laydown)	SCN03 (Load out)	SCN06 (Wharf Piling)	SCN08a (Jetty Piling - Near)			Day	Evening, Sunday and Public Holidays	Night	Day	Evening, Sunday and Public Holidays	Night
R01	Industrial	16	17	21	32	44	36	45	60	60	60	-15	-15	-15
R02	Commercial	16	16	10	26	31	39	40	60	60	60	-20	-20	-20
R03	Residential	12	13	18	36	39	34	42	45	40	35	-3	**2**	**7**
R04	Residential	11	12	12	30	33	34	37	47	42	37	-10	-5	0
R05	Residential	11	12	12	30	33	34	37	51	46	41	-14	-9	-4
R06	Commercial	4	5	4	20	23	33	34	60	60	60	-26	-26	-26
R07	Residential	3	3	2	18	21	32	33	47	42	37	-14	-9	-4
R08	Residential	2	3	2	20	21	31	31	47	42	37	-16	-11	-6

Table 4.4 Support Services + Impact Piling (Furthest Jetty Pile) (Standard Meteorological Conditions)

Receptor ID	Receptor Type	Predicted Noise Level, dB (LA10, period)					Estimated Operational Site Noise Level, dB (LA10)	Total Site Noise Level (Refurbishment Scenarios + Ops)	Assigned Noise Level (LA10, period)			Comparison to Assigned Noise Level		
		SCN01 (Laydown)	SCN02 (Laydown)	SCN03 (Load out)	SCN06 (Wharf Piling)	SCN08b (Jetty Piling - Far)			Day	Evening, Sunday and Public Holidays	Night	Day	Evening, Sunday and Public Holidays	Night
R01	Industrial	16	17	21	32	33	36	39	60	60	60	-21	-21	-21
R02	Commercial	16	16	10	26	26	39	39	60	60	60	-21	-21	-21
R03	Residential	12	13	18	36	36	34	40	45	40	35	-5	0	**5**
R04	Residential	11	12	12	30	30	34	36	47	42	37	-11	-6	-1
R05	Residential	11	12	12	30	30	34	36	51	46	41	-15	-10	-5
R06	Commercial	4	5	4	20	20	33	34	60	60	60	-26	-26	-26
R07	Residential	3	3	2	18	18	32	33	47	42	37	-14	-9	-4
R08	Residential	2	3	2	20	20	31	31	47	42	37	-16	-11	-6

Table 4.5 Support Services + Dolphin/Pile Removal (Noise Enhancing Meteorological Conditions)

Receptor ID	Receptor Type	Predicted Noise Level, dB (LA10, period)				Estimated Operational Site Noise Level, dB (LA10)	Total Site Noise Level (Refurbishment Scenarios + Ops)	Assigned Noise Level (LA10, period)			Comparison to Assigned Noise Level		
		SCN01 (Laydown)	SCN02 (Laydown)	SCN03 (Load out)	SCN04 (Wharf Pile Removal)			Day	Evening, Sunday and Public Holidays	Night	Day	Evening, Sunday and Public Holidays	Night
R01	Industrial	18	20	24	19	36	36	60	60	60	-24	-24	-24
R02	Commercial	18	18	12	13	39	39	60	60	60	-21	-21	-21
R03	Residential	13	14	20	22	34	34	45	40	35	-11	-6	-1
R04	Residential	12	14	14	16	34	34	47	42	37	-13	-8	-3
R05	Residential	13	14	14	16	34	34	51	46	41	-17	-12	-7
R06	Commercial	4	5	3	7	33	33	60	60	60	-27	-27	-27
R07	Residential	2	3	1	6	32	32	47	42	37	-15	-10	-5
R08	Residential	2	2	2	7	31	31	47	42	37	-16	-11	-6

Table 4.6 Support Services + Pile Drilling (Noise Enhancing Meteorological Conditions)

Receptor ID	Receptor Type	Predicted Noise Level, dB (LA10, period)					Estimated Operational Site Noise Level, dB (LA10)	Total Site Noise Level (Refurbishment Scenarios + Ops)	Assigned Noise Level (LA10, period)			Comparison to Assigned Noise Level		
		SCN01 (Laydown)	SCN02 (Laydown)	SCN03 (Load out)	SCN05 (Wharf Pile Drilling)	SCN07 (Jetty Pile Drilling)			Day	Evening, Sunday and Public Holidays	Night	Day	Evening, Sunday and Public Holidays	Night
R01	Industrial	18	20	24	22	31	36	38	60	60	60	-22	-22	-22
R02	Commercial	18	18	12	16	19	39	39	60	60	60	-21	-21	-21
R03	Residential	13	14	20	25	27	34	35	45	40	35	-10	-5	0
R04	Residential	12	14	14	19	21	34	34	47	42	37	-13	-8	-3
R05	Residential	13	14	14	19	21	34	34	51	46	41	-17	-12	-7
R06	Commercial	4	5	3	9	11	33	33	60	60	60	-27	-27	-27
R07	Residential	2	3	1	7	9	32	32	47	42	37	-15	-10	-5
R08	Residential	2	2	2	9	9	31	31	47	42	37	-16	-11	-6

Table 4.7 Support Services + Impact Piling (Nearest Jetty Pile) (Noise Enhancing Meteorological Conditions)

Receptor ID	Receptor Type	Predicted Noise Level, dB (LA10, period)					Estimated Operational Site Noise Level, dB (LA10)	Total Site Noise Level (Refurbishment Scenarios + Ops)	Assigned Noise Level (LA10, period)			Comparison to Assigned Noise Level		
		SCN01 (Laydown)	SCN02 (Laydown)	SCN03 (Load out)	SCN06 (Wharf Piling)	SCN08a (Jetty Piling - Near)			Day	Evening, Sunday and Public Holidays	Night	Day	Evening, Sunday and Public Holidays	Night
R01	Industrial	18	20	24	34	46	36	47	60	60	60	-13	-13	-13
R02	Commercial	18	18	12	27	32	39	40	60	60	60	-20	-20	-20
R03	Residential	13	14	20	37	41	34	43	45	40	35	-2	**3**	**8**
R04	Residential	12	14	14	31	35	34	38	47	42	37	-9	-4	**1**
R05	Residential	13	14	14	31	35	34	38	51	46	41	-13	-8	-3
R06	Commercial	4	5	3	19	23	33	34	60	60	60	-26	-26	-26
R07	Residential	2	3	1	17	20	32	33	47	42	37	-14	-9	-4
R08	Residential	2	2	2	19	21	31	31	47	42	37	-16	-11	-6

Table 4.8 Support Services + Impact Piling (Furthest Jetty Pile) (Noise Enhancing Meteorological Conditions)

Receptor ID	Receptor Type	Predicted Noise Level, dB (LA10, period)					Estimated Operational Site Noise Level, dB (LA10)	Total Site Noise Level (Refurbsihment Scenarios + Ops)	Assigned Noise Level (LA10, period)			Comparison to Assigned Noise Level		
		SCN01 (Laydown)	SCN02 (Laydown)	SCN03 (Load out)	SCN06 (Wharf Piling)	SCN08b (Jetty Piling - Far)			Day	Evening, Sunday and Public Holidays	Night	Day	Evening, Sunday and Public Holidays	Night
R01	Industrial	18	20	24	34	34	36	40	60	60	60	-20	-20	-20
R02	Commercial	18	18	12	27	27	39	39	60	60	60	-21	-21	-21
R03	Residential	13	14	20	37	37	34	41	45	40	35	-4	**1**	**6**
R04	Residential	12	14	14	31	31	34	37	47	42	37	-10	-5	0
R05	Residential	13	14	14	31	31	34	37	51	46	41	-14	-9	-4
R06	Commercial	4	5	3	19	19	33	34	60	60	60	-26	-26	-26
R07	Residential	2	3	1	17	17	32	33	47	42	37	-14	-9	-4
R08	Residential	2	2	2	19	19	31	31	47	42	37	-16	-11	-6

4.1.1 Summary of Results

The resultant noise levels are summarised below:

- The highest predicted L_{A10} noise levels for standard meteorological conditions are 45 dBA at R01 (industrial) and 42 dBA at R03 (residential) associated with impact piling works (*Table 4.3*). For activities associated with all other scenarios the highest predicted L_{A10} noise levels range between 31 and 39 dBA;

- The predicted noise level at R01 of 45 dBA is compliant with the assigned noise level for industrial sites of 60 dBA across all assessment periods (i.e. daytime, evening and night time);

- The predicted noise level at R03 of 42 dBA is compliant with the daytime assigned noise level of 45 dBA. Predicted noise levels at all other receptors during the evening and night time periods are at or below criteria during standard meteorological conditions;

- Based on the predicted noise levels during enhancing meteorological conditions, the noise levels are increased by up to 2 dBA at the most affected receptor locations;

- The predicted noise levels are below the assigned noise level at all receptor locations during the daytime period for both standard and noise enhancing meteorological conditions; and

- The predicted noise levels are below the assigned noise levels at all receptor locations during all support scenarios, pile removal scenarios and pile drilling scenarios (*Tables 4.1, 4.2, 4.5 and 4.6*) for both standard and noise enhancing meteorological conditions.

4.1.2 Discussion of Findings

Air-borne noise levels have been predicted via 3D noise modelling for a range of works and activities associated with the project as outlined in *Section 2.5*. These predicted noise levels are outlined above in *Table 4.1* to *Table 4.8* and further detailed in *Annex C* and address each work area/activity so that any mitigation and management measures may be defined for each representative worst-case assessment scenario or combination of scenarios that may occur.

These predicted noise levels are typical of maintenance/refurbishment works and activities undertaken in the vicinity of residential, industrial and commercial land use precincts. These predicted values do not represent a constant noise emission that would be experienced by the community on a daily basis throughout the project schedule.

The predicted noise levels will only be experienced for limited periods of time when works are occurring; they will not be experienced over whole daytime,

evening or night time periods. Project noise emissions from the refurbishment works will be temporary and do not represent a permanent impact on the community and surrounding environment.

Based on the predicted noise levels during enhancing meteorological conditions, the noise levels are increased by up to 2 dBA at the most affected receptor locations. As described in *Chapter 4* an increase of 2 dBA is hardly perceivable. It should also be noted that noise enhancing meteorological conditions (e.g. temperature inversions) would be anticipated to occur during the colder months of the year. As outlined in *Section 2.3.1* no prevailing wind conditions were determined based on the Cape Lambert Meteorological data from 2017 and 2018. Therefore worst case (noise enhancing) meteorological conditions are unlikely to result in additional noise impacts.

Some noise from the project sites is inevitable, these results and noted exceedances identify that best-practice noise management and control techniques will be required to reduce noise levels as far as practicable. Recommendations are provided in *Chapter 5* below. Based on the predicted noise levels and preliminary discussions with Rio Tinto, it was determined that impact piling works would be limited to the day time period (Monday to Saturday) to minimise impacts at the nearest receptors at Point Samson. Pile driving will only be undertaken into the evening period (7pm to 10pm, Monday to Saturday) when required for safety or emergency reasons to ensure that a recently positioned pile remains 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.

5 *RECOMMENDATIONS*

Based on the findings of the quantitative project noise impact assessment presented in *Chapter 4* of this report it is recommended that:

- High noise generating project works and activities (e.g. impact piling) should be limited to the daytime periods, where feasible and reasonable to do so;

- If any validated noise complaints are received, the problem source and any potential noise reducing measures should be identified and evaluated for implementation during the works. If the noise complaint cannot be validated, no further mitigation or management measures are required; and

- Prior to commencement of works, an Environmental Management Plan (EMP) should be prepared for the project. It should address all noise generating works and activities, once the detailed methodology is known. The EMP should document all feasible, reasonable and practical noise mitigation, management measures; or provisions for monitoring that will be implemented. The EMP should detail any noise monitoring that is to be undertaken and take into consideration measures for reducing the source noise levels of known equipment by planning and equipment selection, where reasonable and feasible. A standalone environmental noise management plan is not considered necessary and this noise mitigation, management and monitoring content can be incorporated into the overall EMP.

It is reiterated that predicted noise levels, for all other non-piling refurbishment works and activities associated with the project, are compliant during all assessment periods (daytime, evening and night time) and can therefore be conducted across all periods without the need for further mitigation.

Based on the results of preliminary noise modelling Rio Tinto have committed to constraining high noise generating piling works to the daytime period (and evening period for emergency or safety reasons only) - i.e. they will not occur at night.

No further recommendations for noise, mitigation and management measures to those established by the findings of this noise assessment, and documented in this report, are provided or warranted. Rio Tinto should incorporate these recommendations into the methodology and design of the project where feasible and reasonable to do so and practical to implement.

6 CONCLUSION

This report has been prepared by ERM on behalf of Rio Tinto. It presents the methodology, results and findings of the noise impact assessment conducted for the CLA Marine Structures Refurbishment Project.

Project-specific noise criteria (refer to *Chapter 3*) were developed with due regard to and in accordance with the *Environmental Protection (Noise) Regulations 1997*.

Applicable assessment scenarios were developed based on project information provided by Rio Tinto and likely noise levels were predicted, and compared to criteria to establish compliance, evaluate potential impacts and establish potential mitigation measures if necessary to reduce levels and minimise impacts.

The assessment identified that noise levels associated with the impact piling activity (*Tables 4.3, 4.4, 4.7 and 4.8*) have the potential to exceed the applicable criteria during the more sensitive periods under the worst case scenarios, where assigned noise levels are lower (e.g. evening and night time periods).

For activities associated with all other non-piling refurbishment works, predicted noise levels are compliant during all assessment periods and can therefore be conducted across all periods without the need for further mitigation.

Based on the findings summarised above noise management measures and monitoring options were recommended as considered suitable to the magnitude and extent of the predicted impacts. They are designed to minimise impacts as far as is commonly feasible and reasonable to do so and practical to implement. These measures and options are presented in *Chapter 5*.

Based on the predicted noise levels during enhancing meteorological conditions, the noise levels are increased by up to 2dBA at the most affected receptor locations. In the unlikely event that worst-case (noise enhancing) meteorological conditions do occur during the project, noise levels will still remain below the assigned noise levels if high noise generating works (i.e. impact piling) is limited to the daytime period (Monday to Saturday). Therefore noise enhancing meteorological conditions are unlikely to result in additional noise impacts.

Project noise impacts (if any) will be minimised with the successful implementation of the recommendations provided in *Chapter 5*. Project noise impacts may not be reduced to imperceptible or negligible levels for all receptors during all activities; however the recommendations will ensure that any residual impacts are minimised as far as possible and commonly achievable via good management practices.

REFERENCES

Environmental Protection Authority (EPA) of Western Australia (WA) *Environmental Factor Guideline: Social Surroundings*, date December 2016

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Standards Australia AS 2436–2010™ (AS2436) – *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*.

SVT Engineering Consultants (SVT, 2012a) *Cape Lambert Port B Expansion Project – Pile Driving, Out Of Hours Noise Management Plan*, dated March 2012.

SVT Engineering Consultants (SVT, 2012b) *Cape Lambert Port B Expansion Project – Construction Noise Management Plan*, dated June 2012.

Annex A

Acoustics Glossary

A.1 GLOSSARY – ACOUSTICAL CONCEPTS AND TERMINOLOGY

A.1.1 What Is Noise And Vibration?

Noise

Noise is often defined as a sound, especially one that is loud or unpleasant or that causes disturbance[1] or simply as unwanted sound, but technically, noise is the perception of a series of compressions and rarefactions above and below normal atmospheric pressure.

Vibration

Vibration refers to the oscillating movement of any object. In a sense noise is the movement of air particles and is essentially vibration, though in regards to an environmental assessment vibration is typically taken to refer to the oscillation of a solid object(s). The impact of noise on objects can lead to vibration of the object, or vibration can be experienced by direct transmission through the ground, this is known as ground-borne vibration.

Essentially, noise can be described as what a person hears, and vibration as what they feel.

A.1.2 What Factors Contribute To Environmental Noise?

The noise from an activity, like construction works, at any location can be affected by a number of factors, the most significant being:

- How loud the activity is?
- How far away the activity is from the receiver?
- What type of ground is between the activity and the receiver location e.g. concrete, grass, water or sand?
- How the ground topography varies between the activity and the receiver, is it flat, hilly, mountainous? Blocking the line of sight to a noise source will generally reduce the level of noise.

[1] Copyright © 2011 Oxford University Press

- Any other obstacles that block the line of sight between the source to receiver e.g. buildings or purpose built noise walls.

A.1.3 How to Measure and Describe Noise?

Noise is measured using a specially designed 'sound level' meter which must meet internationally recognised performance standards. Audible sound pressure levels vary across a range of 10^7 Pascals (Pa), from the threshold of hearing at 20μPa to the threshold of pain at 200Pa. Scientists have defined a statistically described logarithmic scale called Decibels (dB) to more manageably describe noise.

To demonstrate how this scale works, the following points give an indication of how the noise levels and differences are perceived by an average person:

- 0 dB - represents the threshold of human hearing (for a young person with ears in good condition);
- 50 dB – represents average conversation;
- 70 dB – represents average street noise, local traffic etc;
- 90 dB – represents the noise inside an industrial premises or factory; and
- 140 dB - represents the threshold of pain – the point at which permanent hearing damage may occur.

A.1.4 Human Response to Changes in Noise Levels

The following concepts offer qualitative guidance in respect of the average response to changes in noise levels:

- Differences in noise levels of less than approximately 2 dBA are generally imperceptible in practice. An increase of 2 dB is hardly perceivable;
- Differences in noise levels of around 5 dBA are considered to be significant;
- Differences in noise levels of around 10 dBA are generally perceived to be a doubling (or halving) of the perceived loudness of the noise. An increase of 10 dB is perceived as twice as loud. Therefore an increase of 20 dB is four times as loud and an increase of 30 dB is eight times as loud etc;
- The addition of two identical noise levels will increase the dB level by about 3 dB. For example, if one car is idling at 40 dB and then another identical car starts idling next to it, the total dB level will be about 43 dB;

- The addition of a second noise level of similar character which is at least 8 dB lower than the existing noise level will not add significantly to the overall dB level;

- A doubling of the distance between a noise source and a receiver results approximately in a 3 dB decrease for a line source (for example, vehicles travelling on a road) and a 6 dB decrease for a point source (for example, the idling car discussed above); and

- A doubling of traffic volume for a line source results approximately in a 3 dB increase in noise, halving the traffic volume for a line source results approximately in a 3 dB decrease in noise.

A.1.5 Terms to Describe the Perception of Noise

The following terms offer quantitative and qualitative guidance in respect of the audibility of a noise source:

- **Inaudible / Not Audible** - the noise source and/or event could not be heard by the operator, masked by extraneous noise sources not associated with the source. If a noise source is 'inaudible' its noise level may be quantified as being less than the measured L_{A90} background noise level, potentially by 10 dB or greater;

- **Barely Audible –** the noise source and/or event are difficult to define by the operator, typically masked by extraneous noise sources not associated with the source. If a source is 'barely audible' its noise level may be quantified as being 5 - 7 dB below the measured L_{A90} or L_{Aeq} noise level, depending on the nature of the source e.g. constant or intermittent;

- **Just Audible –** the noise source and/or event may be defined by the operator. However there are a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator;

- **Audible** - the noise source and/or event may be easily defined by the operator. There may be a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator; and

- **Dominant –** the noise source and/or event are noted by the operator to be significantly 'louder' than all other noise sources. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator.

The following terms offer qualitative guidance in respect of acoustic terms used to describe the frequency of occurrence of a noise source during an operator attended environmental noise measurements:

- **Constant** – this indicates that the operator has noted the noise source(s) and/or event to be constantly audible for the duration of the noise measurement e.g. an air-conditioner that runs constantly during the measurement;

- **Intermittent** – this indicates that the operator has noted the noise source(s) and/or event to be audible, stopping and starting intervals for the duration of the noise measurement e.g. car pass-bys; and

- **Infrequent** – this indicates that the operator has noted the noise source(s) and/or event to be constantly audible, however; not occurring regularly or at intervals for the duration of the noise measurement e.g. a small number of aircraft are noted during the measurement.

A.1.6 How to Calculate or Model Noise Levels?

There are two recognised methods which are commonly adopted to determine the noise at particular location from a proposed activity. The first is to undertake noise measurements whilst the activity is in progress and measure the noise, the second is to calculate the noise based on known noise emission data for the activity in question.

The second option is preferred as the first option is largely impractical in terms of cost and time constraints, notwithstanding the meteorological factors that may also influence its quantification. Furthermore, it is also generally considered unacceptable to create an environmental impact simply to measure it. In addition, the most effective mitigation measures are determined and implemented during the design phase and often cannot be readily applied during or after the implementation phase of a project.

Because a number of factors can affect how 'loud' a noise is at a certain location, the calculations can be very complex. The influence of other ambient sources and the contribution from a particular source in question can be difficult to ascertain. To avoid these issues, and to quantify the direct noise contribution from a source/site in question, the noise level is often calculated using noise modelling software packages. The noise emission data used in may be obtained from the manufacturer or from ERM's database of measured noise emissions.

A.1.7 Acoustic Terminology & Statistical Noise Descriptors

Environmental noise levels such as noise generated by industry, construction and road traffic are commonly expressed in dBA. The A-weighting scale follows the average human hearing response and enables comparison of the intensity of noise with different frequency characteristics. Time varying noise sources are often described in terms of statistical noise descriptors. The following descriptors are commonly used when assessing noise and are referred to throughout this acoustic assessment:

- **Decibel (dB is the adopted abbreviation for the decibel) –** The unit used to describe sound levels and noise exposure. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure;

- **dBA** - unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear;

- **dBC** – unit used to measure 'C-weighted' sound pressure levels. C-weighting is an adjustment made to sound-level measurements which takes account of low-frequency components of noise within the audibility range of humans;

- **dBZ or dBL** – unit used to measure 'Z-weighted' sound pressure levels with no weighting applied, linear;

- **Hertz (Hz)** - the measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz;

- **Octave –** a division of the frequency range into bands, the upper frequency limit;

- **1/3 Octave –** single octave bands divided into three parts;

- **Leq** - this level represents the equivalent or average noise energy during a measurement period. The $L_{eq, 15min}$ noise descriptor simply refers to the L_{eq} noise level calculated over a 15 minute period. Indeed, any of the below noise descriptors may be defined in this way, with an accompanying time period (e.g. $L_{10, 15\ minute}$) as required;

- **Lmax** - the absolute maximum noise level in a noise sample;

- **LN -** the percentile sound pressure level exceeded for N% of the measurement period calculated by statistical analysis;

- **L10 -** the noise level exceeded for 10 per cent of the time and is approximately the average of the maximum noise levels;

- **L90** - the noise level exceeded for 90 per cent of the time and is approximately the average of the minimum noise levels. The L90 level is often referred to as the "background" noise level and is commonly used as a basis for determining noise criteria for assessment purposes;

- **Sound Power Level (LW)** - this is a measure of the total power radiated by a source. The Sound Power of a source is a fundamental property of the source and is independent of the surrounding environment;

- **Sound Pressure Level (LP)** - the level of sound pressure; as measured at a distance by a standard sound level meter with a microphone. This differs

from L_W in that this is the received sound as opposed to the sound 'intensity' at the source;

- **Background noise** – the underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor;

- **Ambient noise** – the all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far. This is described using the L_{Aeq} descriptor;

- **Cognitive noise** – noise in which the source is recognised as being annoying; and

- **Masking** – the phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.

Annex B

Assessment Scenarios and Modelling Data

Timing Details - OOHW?	Area of Works	Activity	Assessment Scenario ID	Equipment	LW, Item	Quantity (Q)	Penalty (P)	Duty Factor (DF)	LW, Modified (Q / P / DF)	Spectral Data - dBA per 1/1 Octave - Frequency in Hertz (Hz)								
										31.5	63	125	250	500	1000	2000	4000	80000
24 hrs / 7 days	Laydown Area 1	Laydown Area Works	SCN 01-A	150T Crawler Crane (Laydown)	104.0	1.0	0.0	100%	104.0	66.4	77.5	87.1	89.3	97.0	97.0	92.9	100.3	89.9
			SCN 01-B	25T Mobile Crane (Laydown)	104.0	1.0	0.0	100%	104.0	66.4	77.5	87.1	89.3	97.0	97.0	92.9	100.3	89.9
			SCN 01-C	Truck	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6
			SCN 01-D	Light Vehicle	106.0	2.0	0.0	50%	106.0	80.1	88.2	90.6	95.9	98.6	97.1	91.3	86.0	103.0
24 hrs / 7 days	**Laydown Area 1**	**Laydown Area Works**	**↑ SCN 01**	**↑ TOTAL EMISSION (LW, 15minute in dBA)**	**111.5**	**-**	**-**	**-**	**110.6**	**80.5**	**90.4**	**94.8**	**99.8**	**104.1**	**102.9**	**100.9**	**103.5**	**103.4**
24 hrs / 7 days	Laydown Area 2	Laydown Area Works	SCN 02-A	150T Crawler Crane (Laydown)	104.0	1.0	0.0	100%	104.0	66.4	77.5	87.1	89.3	97.0	97.0	92.9	100.3	89.9
			SCN 02-B	25T Mobile Crane (Laydown)	104.0	1.0	0.0	100%	104.0	66.4	77.5	87.1	89.3	97.0	97.0	92.9	100.3	89.9
			SCN 02-C	Truck	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6
			SCN 02-D	Light Vehicle	106.0	2.0	0.0	50%	106.0	80.1	88.2	90.6	95.9	98.6	97.1	91.3	86.0	103.0
24 hrs / 7 days	**Laydown Area 2**	**Laydown Area Works**	**↑ SCN 02**	**↑ TOTAL EMISSION (LW, 15minute in dBA)**	**111.5**	**-**	**-**	**-**	**110.6**	**80.5**	**90.4**	**94.8**	**99.8**	**104.1**	**102.9**	**100.9**	**103.5**	**103.4**
24 hrs / 7 days	Load Out Area	Load Out Area Works	SCN 03-A	42T BP Tug Boa	106.0	1.0	0.0	75%	104.8	73.9	81.9	90.0	92.4	97.7	100.4	98.9	93.1	87.8
			SCN 03-B	35T BP Multica	107.0	1.0	0.0	75%	105.8	61.5	86.9	91.2	97.6	100.9	98.2	100.2	89.2	82.4
			SCN 03-C	15m Crew Transfer Boa	100.0	1.0	0.0	50%	97.0	66.1	74.1	82.2	84.6	89.9	92.6	91.1	85.3	80.0
			SCN 03-D	400T Load Out Crane	105.0	1.0	0.0	100%	105.0	64.4	83.1	91.3	91.9	102.8	97.7	93.9	89.1	82.6
			SCN 03-E	Supply Barge	100.0	2.0	0.0	100%	103.0	72.1	80.1	88.2	90.6	95.9	98.6	97.1	91.3	86.0
24 hrs / 7 days	**Load Out Area**	**Load Out Area Works**	**↑ SCN 03**	**↑ TOTAL EMISSION (LW, 15minute in dBA)**	**111.5**	**-**	**-**	**-**	**110.9**	**76.9**	**89.9**	**96.6**	**100.2**	**106.3**	**105.1**	**104.3**	**97.3**	**91.6**
24 hrs / 7 days	Wharf	Removal of Dolphins/Wharf Piles	SCN 04-A	Jack-up Barge (FAVCO M2480D)	105.0	1.0	0.0	100%	105.0	67.4	78.5	88.1	90.3	98.0	98.0	93.9	101.3	90.9
			SCN 04-B	Wharf-based Gantry Crane (FAVCO M1280D)	105.0	1.0	0.0	100%	105.0	67.4	78.5	88.1	90.3	98.0	98.0	93.9	101.3	90.9
			SCN 04-C	Jack-up Barge Ancillary Equipmen (Pump, Generator, Powerpack	105.0	1.0	0.0	100%	105.0	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6
			SCN 04-D	Gantry Crane Ancillary Equipmen (Pump, Generator, Powerpack	105.0	1.0	0.0	100%	105.0	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6
			SCN 04-E	Hand Tools	102.0	1.0	0.0	75%	100.8	57.5	81.2	86.3	86.0	96.6	96.7	92.0	80.3	70.2
			SCN 04-F	42T BP Tug Boa	106.0	1.0	0.0	50%	103.0	72.1	80.1	88.2	90.6	95.9	98.6	97.1	91.3	86.0
			SCN 04-G	35T BP Multica	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6
			SCN 04-H	15m Crew Transfer Boa	100.0	1.0	0.0	30%	94.8	63.9	71.9	80.0	82.4	87.7	90.4	88.9	83.1	77.8
			SCN 04-I	Underwater Noise Source (airborne noise contribution not anticipated)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24 hrs / 7 days	**Wharf**	**Removal of Dolphins/Wharf Piles**	**↑ SCN 04**	**↑ TOTAL EMISSION (LW, 15minute in dBA)**	**113.8**	**-**	**-**	**-**	**112.7**	**77.5**	**96.8**	**101.6**	**100.8**	**106.5**	**106.1**	**105.1**	**105.3**	**95.6**

Timing Details - OOHW?	Area of Works	Activity	Assessment Scenario ID	Equipment	LW, Item	Quantity (Q)	Penalty (P)	Duty Factor (DF)	LW, Modified (Q + P + DF)	Spectral Data - dBA per 1/1 Octave - Frequency in Hertz (Hz)								
										31.5	63	125	250	500	1000	2000	4000	80000
24 hrs / 7 days	Wharf	Wharf Dolphin Installation (Pile Drilling)	SCN 05-A	Jack-up Barge (FAVCO M2480D)	105.0	1.0	0.0	100%	105.0	67.4	78.5	88.1	90.3	98.0	98.0	93.9	101.3	90.9
			SCN 05-B	Wharf-based Gantry Crane (FAVCO M1280D)	105.0	1.0	0.0	100%	105.0	67.4	78.5	88.1	90.3	98.0	98.0	93.9	101.3	90.9
			SCN 05-C	Jack-up Barge Ancillary Equipmen (Pump, Generator, Powerpack	105.0	1.0	0.0	100%	105.0	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6
			SCN 05-D	Gantry Crane Ancillary Equipmen (Pump, Generator, Powerpack	105.0	1.0	0.0	100%	105.0	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6
			SCN 05-E	Hand Tools	102.0	1.0	0.0	75%	100.8	57.5	81.2	86.3	86.0	96.6	96.7	92.0	80.3	70.2
			SCN 05-F	42T BP Tug Boa	106.0	1.0	0.0	50%	103.0	72.1	80.1	88.2	90.6	95.9	98.6	97.1	91.3	86.0
			SCN 05-G	35T BP Multica	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6
			SCN 05-H	15m Crew Transfer Boa	100.0	1.0	0.0	30%	94.8	63.9	71.9	80.0	82.4	87.7	90.4	88.9	83.1	77.8
			SCN 05-I	LD408 Reverse Circulation Drill (RCD) Rigs	113.0	1.0	0.0	75%	111.8	64.8	79.5	101.3	102.6	103.7	107.3	105.7	96.6	89.8
24 hrs / 7 days	**Wharf**	**Wharf Dolphin Installation (Pile Drilling)**	**↑ SCN 05**	**↑ TOTAL EMISSION (LW, 15minute in dBA)**	**116.5**	**-**	**-**	**-**	**115.3**	**77.7**	**96.9**	**104.4**	**104.8**	**108.3**	**109.7**	**108.4**	**105.9**	**96.6**
24 hrs / 7 days	Wharf	Wharf Dolphin Installation (Impact Piling)	SCN 06-A	Jack-up Barge (FAVCO M2480D)	105.0	1.0	0.0	100%	105.0	67.4	78.5	88.1	90.3	98.0	98.0	93.9	101.3	90.9
			SCN 06-B	Wharf-based Gantry Crane (FAVCO M1280D)	105.0	1.0	0.0	100%	105.0	67.4	78.5	88.1	90.3	98.0	98.0	93.9	101.3	90.9
			SCN 06-C	Jack-up Barge Ancillary Equipmen (Pump, Generator, Powerpack	105.0	1.0	0.0	100%	105.0	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6
			SCN 06-D	Gantry Crane Ancillary Equipmen (Pump, Generator, Powerpack	105.0	1.0	0.0	100%	105.0	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6
			SCN 06-E	Hand Tools	102.0	1.0	0.0	75%	100.8	57.5	81.2	86.3	86.0	96.6	96.7	92.0	80.3	70.2
			SCN 06-F	42T BP Tug Boa	106.0	1.0	0.0	50%	103.0	72.1	80.1	88.2	90.6	95.9	98.6	97.1	91.3	86.0
			SCN 06-G	35T BP Multica	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6
			SCN 06-H	15m Crew Transfer Boa	100.0	1.0	0.0	30%	94.8	63.9	71.9	80.0	82.4	87.7	90.4	88.9	83.1	77.8
			SCN 06-I	25T Junttan Piling Hammer	132.0	1.0	0.0	75%	130.8	83.5	101.3	116.5	122.9	126.3	125.2	121.6	116.0	107.5
24 hrs / 7 days	**Wharf**	**Wharf Dolphin Installation (Impact Piling)**	**↑ SCN 06**	**↑ TOTAL EMISSION (LW, 15minute in dBA)**	**132.1**	**-**	**-**	**-**	**130.8**	**84.5**	**102.7**	**116.6**	**122.9**	**126.4**	**125.3**	**121.7**	**116.3**	**107.7**
24 hrs / 7 days	Jetty	Jetty Pile Installation (Pile Drilling)	SCN 07-A	Jack-up Barge (FAVCO M2480D)	105.0	1.0	0.0	100%	105.0	67.4	78.5	88.1	90.3	98.0	98.0	93.9	101.3	90.9
			SCN 07-B	Jack-up Barge Ancillary Equipmen (Pump, Generator, Powerpack	105.0	1.0	0.0	100%	105.0	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6
			SCN 07-C	Gantry Crane Ancillary Equipmen (Pump, Generator, Powerpack	105.0	1.0	0.0	100%	105.0	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6
			SCN 07-D	Hand Tools	102.0	1.0	0.0	75%	100.8	57.5	81.2	86.3	86.0	96.6	96.7	92.0	80.3	70.2
			SCN 07-E	42T BP Tug Boa	106.0	1.0	0.0	50%	103.0	72.1	80.1	88.2	90.6	95.9	98.6	97.1	91.3	86.0
			SCN 07-F	35T BP Multica	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6
			SCN 07-G	15m Crew Transfer Boa	100.0	1.0	0.0	30%	94.8	63.9	71.9	80.0	82.4	87.7	90.4	88.9	83.1	77.8
			SCN 07-H	LD408 Reverse Circulation Drill (RCD) Rigs	113.0	1.0	0.0	75%	111.8	64.8	79.5	101.3	102.6	103.7	107.3	105.7	96.6	89.8
24 hrs / 7 days	**Jetty**	**Jetty Pile Installation (Pile Drilling)**	**↑ SCN 07**	**↑ TOTAL EMISSION (LW, 15minute in dBA)**	**116.1**	**-**	**-**	**-**	**114.8**	**77.3**	**96.8**	**104.3**	**104.6**	**107.9**	**109.4**	**108.3**	**104.0**	**95.2**
24 hrs / 7 days	Jetty	Jetty Pile Installation (Impact Piling)	SCN 08-A	Jack-up Barge (FAVCO M2480D)	105.0	1.0	0.0	100%	105.0	67.4	78.5	88.1	90.3	98.0	98.0	93.9	101.3	90.9
			SCN 08-B	Jack-up Barge Ancillary Equipmen (Pump, Generator, Powerpack	105.0	1.0	0.0	100%	105.0	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6
			SCN 08-C	Gantry Crane Ancillary Equipmen (Pump, Generator, Powerpack	105.0	1.0	0.0	100%	105.0	70.9	93.1	97.4	93.4	98.7	97.2	98.2	93.8	84.6
			SCN 08-D	Hand Tools	102.0	1.0	0.0	75%	100.8	57.5	81.2	86.3	86.0	96.6	96.7	92.0	80.3	70.2
			SCN 08-E	42T BP Tug Boa	106.0	1.0	0.0	50%	103.0	72.1	80.1	88.2	90.6	95.9	98.6	97.1	91.3	86.0
			SCN 08-F	35T BP Multica	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6
			SCN 08-G	15m Crew Transfer Boa	100.0	1.0	0.0	30%	94.8	63.9	71.9	80.0	82.4	87.7	90.4	88.9	83.1	77.8
			SCN 08-H	25T Junttan Piling Hammer	132.0	1.0	0.0	75%	130.8	83.5	101.3	116.5	122.9	126.3	125.2	121.6	116.0	107.5
24 hrs / 7 days	**Jetty**	**Jetty Pile Installation (Impact Piling)**	**↑ SCN 08**	**↑ TOTAL EMISSION (LW, 15minute in dBA)**	**132.1**	**-**	**-**	**-**	**130.8**	**84.4**	**102.6**	**116.6**	**122.9**	**126.4**	**125.2**	**121.7**	**116.2**	**107.7**

Annex C

Predicted Noise Levels

TABLE C.1 - STANDARD METEOROLOGICAL CONDITIONS						Assigned Noise Level (LA10, period)			Comparison to Assigned Noise Level		
Scenario	Description	Receptor ID	Receptor Description	Receptor Type	Predicted Noise Level (LA10, period)	Daytime[1]	Evening[2], Sunday and Public Holidays[3]	Night Time[4]	Daytime[1]	Evening[2], Sunday and Public Holidays[3]	Night Time[4]
SCN01	Laydown Area 1	R01	Sams Creek Rd, Point Samson	Industrial	16	60	60	60	-44	-44	-44
		R02	Wickham Yacht Club	Commercial	16	60	60	60	-44	-44	-44
		R03	Meares Dr, Point Samson	Residential	12	45	40	35	-33	-28	-23
		R04	Fisher St, Point Samson	Residential	11	47	42	37	-36	-31	-26
		R05	Cliff St, Point Samson	Residential	11	51	46	41	-40	-35	-30
		R06	Wilson Way, Wickham	Commercial	4	60	60	60	-56	-56	-56
		R07	McCourt Way, Wickham	Residential	3	47	42	37	-44	-39	-34
		R08	Pearl St, Cossack	Residential	2	47	42	37	-45	-40	-35
SCN02	Laydown Area 2	R01	Sams Creek Rd, Point Samson	Industrial	17	60	60	60	-43	-43	-43
		R02	Wickham Yacht Club	Commercial	16	60	60	60	-44	-44	-44
		R03	Meares Dr, Point Samson	Residential	13	45	40	35	-32	-27	-22
		R04	Fisher St, Point Samson	Residential	12	47	42	37	-35	-30	-25
		R05	Cliff St, Point Samson	Residential	12	51	46	41	-39	-34	-29
		R06	Wilson Way, Wickham	Commercial	5	60	60	60	-55	-55	-55
		R07	McCourt Way, Wickham	Residential	3	47	42	37	-44	-39	-34
		R08	Pearl St, Cossack	Residential	3	47	42	37	-44	-39	-34
SCN03	Load Out Area	R01	Sams Creek Rd, Point Samson	Industrial	21	60	60	60	-39	-39	-39
		R02	Wickham Yacht Club	Commercial	10	60	60	60	-50	-50	-50
		R03	Meares Dr, Point Samson	Residential	18	45	40	35	-27	-22	-17
		R04	Fisher St, Point Samson	Residential	12	47	42	37	-35	-30	-25
		R05	Cliff St, Point Samson	Residential	12	51	46	41	-39	-34	-29
		R06	Wilson Way, Wickham	Commercial	4	60	60	60	-56	-56	-56
		R07	McCourt Way, Wickham	Residential	2	47	42	37	-45	-40	-35
		R08	Pearl St, Cossack	Residential	2	47	42	37	-45	-40	-35
SCN04	Wharf Dolphin/Pile Removal	R01	Sams Creek Rd, Point Samson	Industrial	17	60	60	60	-43	-43	-43
		R02	Wickham Yacht Club	Commercial	13	60	60	60	-47	-47	-47
		R03	Meares Dr, Point Samson	Residential	21	45	40	35	-24	-19	-14
		R04	Fisher St, Point Samson	Residential	15	47	42	37	-32	-27	-22
		R05	Cliff St, Point Samson	Residential	15	51	46	41	-36	-31	-26
		R06	Wilson Way, Wickham	Commercial	8	60	60	60	-52	-52	-52
		R07	McCourt Way, Wickham	Residential	7	47	42	37	-40	-35	-30
		R08	Pearl St, Cossack	Residential	8	47	42	37	-39	-34	-29
SCN05	Wharf Dolphin Installation (Pile Drilling)	R01	Sams Creek Rd, Point Samson	Industrial	20	60	60	60	-40	-40	-40
		R02	Wickham Yacht Club	Commercial	15	60	60	60	-45	-45	-45
		R03	Meares Dr, Point Samson	Residential	24	45	40	35	-21	-16	-11
		R04	Fisher St, Point Samson	Residential	18	47	42	37	-29	-24	-19
		R05	Cliff St, Point Samson	Residential	18	51	46	41	-33	-28	-23
		R06	Wilson Way, Wickham	Commercial	10	60	60	60	-50	-50	-50
		R07	McCourt Way, Wickham	Residential	9	47	42	37	-38	-33	-28
		R08	Pearl St, Cossack	Residential	10	47	42	37	-37	-32	-27
SCN06	Wharf Dolphin Installation (Impact Piling)	R01	Sams Creek Rd, Point Samson	Industrial	32	60	60	60	-28	-28	-28
		R02	Wickham Yacht Club	Commercial	26	60	60	60	-34	-34	-34
		R03	Meares Dr, Point Samson	Residential	36	45	40	35	-9	-4	1
		R04	Fisher St, Point Samson	Residential	30	47	42	37	-17	-12	-7
		R05	Cliff St, Point Samson	Residential	30	51	46	41	-21	-16	-11
		R06	Wilson Way, Wickham	Commercial	20	60	60	60	-40	-40	-40
		R07	McCourt Way, Wickham	Residential	18	47	42	37	-29	-24	-19
		R08	Pearl St, Cossack	Residential	20	47	42	37	-27	-22	-17
SCN07	Jetty Pile Installation (Pile Drilling - Near)	R01	Sams Creek Rd, Point Samson	Industrial	29	60	60	60	-31	-31	-31
		R02	Wickham Yacht Club	Commercial	17	60	60	60	-43	-43	-43
		R03	Meares Dr, Point Samson	Residential	25	45	40	35	-20	-15	-10
		R04	Fisher St, Point Samson	Residential	19	47	42	37	-28	-23	-18
		R05	Cliff St, Point Samson	Residential	19	51	46	41	-32	-27	-22
		R06	Wilson Way, Wickham	Commercial	11	60	60	60	-49	-49	-49
		R07	McCourt Way, Wickham	Residential	9	47	42	37	-38	-33	-28
		R08	Pearl St, Cossack	Residential	10	47	42	37	-37	-32	-27
SCN08a	Jetty Pile Installation (Impact Piling - Near)	R01	Sams Creek Rd, Point Samson	Industrial	44	60	60	60	-16	-16	-16
		R02	Wickham Yacht Club	Commercial	31	60	60	60	-29	-29	-29
		R03	Meares Dr, Point Samson	Residential	39	45	40	35	-6	-1	4
		R04	Fisher St, Point Samson	Residential	33	47	42	37	-14	-9	-4
		R05	Cliff St, Point Samson	Residential	33	51	46	41	-18	-13	-8
		R06	Wilson Way, Wickham	Commercial	23	60	60	60	-37	-37	-37
		R07	McCourt Way, Wickham	Residential	21	47	42	37	-26	-21	-16
		R08	Pearl St, Cossack	Residential	21	47	42	37	-26	-21	-16
SCN08b	Jetty Pile Installation (Impact Piling - Far)	R01	Sams Creek Rd, Point Samson	Industrial	33	60	60	60	-27	-27	-27
		R02	Wickham Yacht Club	Commercial	26	60	60	60	-34	-34	-34
		R03	Meares Dr, Point Samson	Residential	36	45	40	35	-9	-4	1
		R04	Fisher St, Point Samson	Residential	30	47	42	37	-17	-12	-7
		R05	Cliff St, Point Samson	Residential	30	51	46	41	-21	-16	-11
		R06	Wilson Way, Wickham	Commercial	20	60	60	60	-40	-40	-40
		R07	McCourt Way, Wickham	Residential	18	47	42	37	-29	-24	-19
		R08	Pearl St, Cossack	Residential	20	47	42	37	-27	-22	-17

1. 0700 to 1900 hours Monday to Saturday
2. 1900 to 2200 hours all days
3. 0900 to 1900 hours Sunday and public holidays
4. 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays

TABLE C.2 - NOISE ENHANCING METEOROLOGICAL CONDITIONS						Assigned Noise Level (LA10, period)			Comparison to Assigned Noise Level		
Scenario	Description	Receptor ID	Receptor Description	Receptor Type	Predicted Noise Level (LA10, period)	Daytime[1]	Evening[2], Sunday and Public Holidays[3]	Night Time[4]	Daytime[1]	Evening[2], Sunday and Public Holidays[3]	Night Time[4]
SCN01	Laydown Area 1	R01	Sams Creek Rd, Point Samson	Industrial	18	60	60	60	-42	-42	-42
		R02	Wickham Yacht Club	Commercial	18	60	60	60	-42	-42	-42
		R03	Meares Dr, Point Samson	Residential	13	45	40	35	-32	-27	-22
		R04	Fisher St, Point Samson	Residential	12	47	42	37	-35	-30	-25
		R05	Cliff St, Point Samson	Residential	13	51	46	41	-38	-33	-28
		R06	Wilson Way, Wickham	Commercial	4	60	60	60	-56	-56	-56
		R07	McCourt Way, Wickham	Residential	2	47	42	37	-45	-40	-35
		R08	Pearl St, Cossack	Residential	2	47	42	37	-45	-40	-35
SCN02	Laydown Area 2	R01	Sams Creek Rd, Point Samson	Industrial	20	60	60	60	-40	-40	-40
		R02	Wickham Yacht Club	Commercial	18	60	60	60	-42	-42	-42
		R03	Meares Dr, Point Samson	Residential	14	45	40	35	-31	-26	-21
		R04	Fisher St, Point Samson	Residential	14	47	42	37	-33	-28	-23
		R05	Cliff St, Point Samson	Residential	14	51	46	41	-37	-32	-27
		R06	Wilson Way, Wickham	Commercial	5	60	60	60	-55	-55	-55
		R07	McCourt Way, Wickham	Residential	3	47	42	37	-44	-39	-34
		R08	Pearl St, Cossack	Residential	2	47	42	37	-45	-40	-35
SCN03	Load Out Area	R01	Sams Creek Rd, Point Samson	Industrial	24	60	60	60	-36	-36	-36
		R02	Wickham Yacht Club	Commercial	12	60	60	60	-48	-48	-48
		R03	Meares Dr, Point Samson	Residential	20	45	40	35	-25	-20	-15
		R04	Fisher St, Point Samson	Residential	14	47	42	37	-33	-28	-23
		R05	Cliff St, Point Samson	Residential	14	51	46	41	-37	-32	-27
		R06	Wilson Way, Wickham	Commercial	3	60	60	60	-57	-57	-57
		R07	McCourt Way, Wickham	Residential	1	47	42	37	-46	-41	-36
		R08	Pearl St, Cossack	Residential	2	47	42	37	-45	-40	-35
SCN04	Wharf Dolphin/Pile Removal	R01	Sams Creek Rd, Point Samson	Industrial	19	60	60	60	-41	-41	-41
		R02	Wickham Yacht Club	Commercial	13	60	60	60	-47	-47	-47
		R03	Meares Dr, Point Samson	Residential	22	45	40	35	-23	-18	-13
		R04	Fisher St, Point Samson	Residential	16	47	42	37	-31	-26	-21
		R05	Cliff St, Point Samson	Residential	16	51	46	41	-35	-30	-25
		R06	Wilson Way, Wickham	Commercial	7	60	60	60	-53	-53	-53
		R07	McCourt Way, Wickham	Residential	6	47	42	37	-41	-36	-31
		R08	Pearl St, Cossack	Residential	7	47	42	37	-40	-35	-30
SCN05	Wharf Dolphin Installation (Pile Drilling)	R01	Sams Creek Rd, Point Samson	Industrial	22	60	60	60	-38	-38	-38
		R02	Wickham Yacht Club	Commercial	16	60	60	60	-44	-44	-44
		R03	Meares Dr, Point Samson	Residential	25	45	40	35	-20	-15	-10
		R04	Fisher St, Point Samson	Residential	19	47	42	37	-28	-23	-18
		R05	Cliff St, Point Samson	Residential	19	51	46	41	-32	-27	-22
		R06	Wilson Way, Wickham	Commercial	9	60	60	60	-51	-51	-51
		R07	McCourt Way, Wickham	Residential	7	47	42	37	-40	-35	-30
		R08	Pearl St, Cossack	Residential	9	47	42	37	-38	-33	-28
SCN06	Wharf Dolphin Installation (Impact Piling)	R01	Sams Creek Rd, Point Samson	Industrial	34	60	60	60	-26	-26	-26
		R02	Wickham Yacht Club	Commercial	27	60	60	60	-33	-33	-33
		R03	Meares Dr, Point Samson	Residential	37	45	40	35	-8	-3	2
		R04	Fisher St, Point Samson	Residential	31	47	42	37	-16	-11	-6
		R05	Cliff St, Point Samson	Residential	31	51	46	41	-20	-15	-10
		R06	Wilson Way, Wickham	Commercial	19	60	60	60	-41	-41	-41
		R07	McCourt Way, Wickham	Residential	17	47	42	37	-30	-25	-20
		R08	Pearl St, Cossack	Residential	19	47	42	37	-28	-23	-18
SCN07	Jetty Pile Installation (Pile Drilling - Near)	R01	Sams Creek Rd, Point Samson	Industrial	31	60	60	60	-29	-29	-29
		R02	Wickham Yacht Club	Commercial	19	60	60	60	-41	-41	-41
		R03	Meares Dr, Point Samson	Residential	27	45	40	35	-18	-13	-8
		R04	Fisher St, Point Samson	Residential	21	47	42	37	-26	-21	-16
		R05	Cliff St, Point Samson	Residential	21	51	46	41	-30	-25	-20
		R06	Wilson Way, Wickham	Commercial	11	60	60	60	-49	-49	-49
		R07	McCourt Way, Wickham	Residential	9	47	42	37	-38	-33	-28
		R08	Pearl St, Cossack	Residential	9	47	42	37	-38	-33	-28
SCN08a	Jetty Pile Installation (Impact Piling - Near)	R01	Sams Creek Rd, Point Samson	Industrial	46	60	60	60	-14	-14	-14
		R02	Wickham Yacht Club	Commercial	32	60	60	60	-28	-28	-28
		R03	Meares Dr, Point Samson	Residential	41	45	40	35	-4	1	6
		R04	Fisher St, Point Samson	Residential	35	47	42	37	-12	-7	-2
		R05	Cliff St, Point Samson	Residential	35	51	46	41	-16	-11	-6
		R06	Wilson Way, Wickham	Commercial	23	60	60	60	-37	-37	-37
		R07	McCourt Way, Wickham	Residential	20	47	42	37	-27	-22	-17
		R08	Pearl St, Cossack	Residential	21	47	42	37	-26	-21	-16
SCN08b	Jetty Pile Installation (Impact Piling - Far)	R01	Sams Creek Rd, Point Samson	Industrial	34	60	60	60	-26	-26	-26
		R02	Wickham Yacht Club	Commercial	27	60	60	60	-33	-33	-33
		R03	Meares Dr, Point Samson	Residential	37	45	40	35	-8	-3	2
		R04	Fisher St, Point Samson	Residential	31	47	42	37	-16	-11	-6
		R05	Cliff St, Point Samson	Residential	31	51	46	41	-20	-15	-10
		R06	Wilson Way, Wickham	Commercial	19	60	60	60	-41	-41	-41
		R07	McCourt Way, Wickham	Residential	17	47	42	37	-30	-25	-20
		R08	Pearl St, Cossack	Residential	19	47	42	37	-28	-23	-18

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