Appendix D

Noise and Vibration Impact Assessment

MARINUS LINK

MARSHALL DAY Acoustics

MARINUS LINK
TASMANIAN TERRESTRIAL & COASTAL PROCESSES
TECHNICAL NOISE AND VIBRATION REPORT

Rp 005 20191171 | 21 November 2024

Marshall Day Acoustics Pty Ltd
ABN: 53 470 077 191
10/50 Gipps Street
Collingwood VIC 3066
Australia
T: +613 9416 1855
www.marshallday.com

Project: **MARINUS LINK – TASMANIAN TERRESTRIAL & COASTAL PROCESSES**

Prepared for: **Tetra Tech Coffey Pty Ltd**
Level 11, 2 Riverside Quay
Southbank VIC 3006

Attention: **K W**

Report No.: **Rp 005 20191171**

Document Control

Status:	Rev:	Comments:	Date:	Author:	Reviewer:
Complete	-	-	21 Nov 2024	JA / BK	JA / BK

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Marinus Link Pty Ltd (MLPL) proposes to construct, operate and maintain a 1500 megawatt high voltage direct current (HVDC) electricity interconnector between Tasmania and Victoria. The interconnector is referred to as Marinus Link (the project) and would provide a second link between Tasmania's renewable energy resources and the Victorian electricity grid. The project would be implemented as two 750 MW circuits to meet transmission network operation requirements in Tasmania and Victoria, and would extend from Heybridge in northwest Tasmania to the Latrobe Valley in Victoria. The link is intended to enable efficient energy trade, transmission and distribution from a diverse range of generation sources to where it is most needed, and increased energy capacity and security across the National Electricity Market (NEM).

The Australian, Tasmanian and Victorian governments determined that an environmental impact assessment of the project was required. As the project is proposed to be located within three jurisdictions, the Tasmanian Environment Protection Authority (Tasmanian EPA), Victorian Department of Transport and Planning (DTP) and Australian Department of Climate Change, Energy, Environment and Water (DCCEEW) have agreed to coordinate the administration and documentation of the three assessment processes. Two EISs are being prepared to address the Tasmanian EPA requirements for the Heybridge converter station and shore crossing. A separate EIS/EES is being prepared to address the requirements of DTP and DCCEEW.

This report presents the technical noise and vibration assessment of the Tasmanian terrestrial component of the project. Specifically, the converter station and proposed interconnector shore crossing at Heybridge. This report has been prepared for submission with the two EISs being prepared for the project by Tetra Tech Coffey Pty Ltd (Tetra Tech Coffey).

The assessment considers sources of environmental noise and vibration associated with both the construction and operational stages of the project.

At the end of its operational lifespan (anticipated to be at least 40 years), the project will either be decommissioned or upgraded to extend the operational lifespan. If the project is decommissioned, all above-ground infrastructure would be removed, and associated land returned to the previous land use or as agreed with the landowner. All underground infrastructure would be decommissioned in accordance with the requirements of the time. This may include removal of infrastructure or some components remaining underground where it is safe to do so (or the impact of infrastructure remaining in the ground being lower than removing it). The types of equipment and processes associated with decommissioning are similar to construction but the works are generally less intensive (and therefore noise and vibration emissions are generally comparable or lower). A separate assessment for the decommissioning phase has therefore not been conducted as part of this study, but associated noise levels would be readily manageable with the types of noise mitigation and management measures used to address construction noise.

The report addresses the assessment requirements of the:

- EPA Tasmania (EPA) publication *Environmental Impact Statement Guidelines – Marinus Link Pty Ltd – Converter Station for Marinus Link* dated September 2022 (the Tasmanian converter station EIS guidelines);
- EPA publication *Environmental Impact Statement Guidelines – Marinus Link Pty Ltd – Heybridge shore crossing for Marinus Link* dated September 2022 (the Tasmanian shore crossing EIS guidelines);
- *Environmental Management and Pollution Control Act 1994* (Tas) (the EMPCA);
- *Environmental Management and Pollution Control (Noise) Regulations 2016* (Tas) (the EMPC Noise Regulations); and
- *Environment Protection Policy (Noise) 2009* (Tas) (the Noise EPP).

A risk-based assessment was used to evaluate noise and vibration impacts associated with construction and operation of the project. Given that noise and vibration is an inevitable consequence of the construction and operation of a major infrastructure project, it is the risk of unacceptable impacts from noise and vibration which is assessed in this study. Risks are assessed by accounting for both their consequence (having regard to the noise level, character and duration) and likelihood. The objective of the risk assessment was to determine the appropriate risk controls.

The sensitive locations addressed in this report comprise buildings used by people for purposes that may be sensitive to noise and vibration. These locations are collectively referred to as receivers in this report. The assessment accounts for all receivers comprising both existing dwellings and proposed future dwellings identified in the vicinity of the project.

Noise and vibration effects on fauna (terrestrial) are addressed in a separate technical study of ecology. Similarly, the Victorian and subsea components of the project are addressed in separate noise and vibration studies.

Construction of the project would broadly involve transitory noise and vibration generating activities which occur along, and in the vicinity of, the project. Off-site truck movements on public roads are also a relevant environmental noise consideration.

The key source of operational noise associated with the project addressed in this study is the proposed converter station which would comprise indoor and outdoor plant including transformers and cooling systems.

Construction noise and vibration

An assessment of construction noise has been conducted based on noise modelling for the types of activities that are likely to result in the highest noise levels during construction. The noise modelling is based on empirical noise emission data sourced from Australian and British standards and the contractor for the project, and includes conservative assumptions about the amount of equipment operating at any given time.

The project is proposed to be constructed in two stages over approximately five years.

The construction noise assessment addresses all relevant Tasmanian legislative and policy requirements, including the EMPC Noise Regulations. In lieu of set criteria for construction noise in Tasmanian legislation and policy, the noise management levels detailed in the NSW government publication *Interim Construction Noise Guideline* dated July 2009 (NSW ICNG) were discussed with the Tasmanian EPA and agreed as a suitable basis for the assessment. Project-specific standard working hours, which comply with the EMPC Noise Regulations, have been defined for consistency with a recent Tasmanian project approval. The proposed standard working hours for the project are:

- Monday-Friday: 0700 – 1800 hrs
- Saturday: 0800 – 1800 hrs

Extended working hours resulting from unavoidable works relate to:

- drilling for shore crossings which is expected to involve horizontal directional drilling (HDD) works occurring 24 hours per day, 7 days per week, for a combined period of up to 6 months to ensure the stability of the bore hole;
- works that need to be undertaken without a break in program, such as concrete pouring;
- delivery of essential, oversized plant or equipment;
- time sensitive maintenance or repair of public infrastructure;
- emergency works required due to unforeseen circumstances;
- protection and control commissioning work within the switching station; and
- project activities that would be scheduled to reduce the need for night-time work.

Where extended hours are required for any of the above reasons, noise management would be factored in the planning of the work. The relevant authorities and the affected receivers would be consulted on the nature and duration of planned works.

Construction noise modelling was conducted to:

- provide an indication of the range of noise levels that can be expected at the nearest receivers;
- identify the locations where noise levels are predicted to be highest; and
- inform the selection of suitable noise controls for construction of the project.

In relation to the noise of construction activities during the proposed standard working hours, the assessment demonstrates the risk rating is medium.

The main noise consideration for construction is work that needs to be conducted outside of the proposed standard working hours. In particular, the need for continuous HDD works for the shore crossing to ensure the stability of the boreholes. HDD works are expected to occur continuously for a total period of up to 6 months. The assessment demonstrates the risk of noise impacts from HDD works outside of the proposed standard working hours, particularly during the night, is high.

Management and mitigation measures have been recommended to control the risk of construction noise and vibration as far as reasonably practical. The measures comprise:

- **NV01: Conduct additional background noise monitoring**

  A requirement to obtain additional background noise data which will then inform the development of a construction noise and vibration management plan.

- **NV02: Develop and implement a construction noise and vibration management plan**

  A requirement for a comprehensive plan which describes all measures that would be used to minimise the impact of construction noise and vibration as far as reasonably practical, based on updated information for the planned construction works and equipment selections.

- **NV03: Conduct construction noise monitoring**

  A requirement to conduct construction noise monitoring at locations specified in the construction noise and vibration management plan, and requirements concerning construction noise monitoring reports.

Provided that the management and mitigation measures are adhered to, and the construction noise and vibration management plan (CNVMP) is fully implemented, the residual risk of noise impacts from construction during the proposed standard working hours, and HDD shore crossing works conducted at night, would be reduced to low and medium respectively.

In relation to construction vibration, the assessment considers potential effects in terms of both the potential for cosmetic building damage and disturbance of human comfort. Based on the separating distances to construction activities, vibration from construction activities is not a material consideration for the project.

Operational noise

Operational noise levels from the converter station have been assessed on the basis of a concept design incorporating a range of noise mitigation measures to address site-specific constraints.

The assessment addresses all relevant Tasmanian legislative and policy requirements, including the *Environment Protection Policy (Noise) 2009* as referenced in the Tasmanian EIS Guidelines. Design targets that the project would ultimately be designed and assessed against have been proposed. The proposed design targets are based on guidance sourced from EPA Victoria Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*, and are more stringent than the reference levels sourced from Tasmanian policy. Separate design targets are proposed for typical operations and the testing periods for the emergency standby generator plant.

The predicted operational noise levels are well below the reference levels from Tasmanian policy, and achieve the proposed design targets at all receivers. However, in recognition of the extent of noise mitigation required to achieve the design targets, and the requirement for mitigation to prevent noise characteristics which could attract penalties, the risk of operational noise impacts has been assessed as medium. Accordingly, noise controls to minimise the risk have been recommended and comprise the following management and mitigation measures:

- **NV01: Conduct additional background noise monitoring**

  A requirement to obtain additional background noise data which will inform the design noise assessment report and operational noise management plan for the converter station.

- **NV04: Prepare a design noise assessment report for the final converter station design**

  A requirement to prepare a detailed assessment and report, based on the final converter station design and equipment selections, demonstrating that the impact of operational noise would be minimised to the extent reasonably practical.

- **NV05: Prepare an operational noise management plan for the converter station site**

  A requirement to document all measures to be implemented and maintained to control operational noise, including noise monitoring requirements and procedures for investigating noise complaints and potential compliance issues.

- **NV06: Prepare an operational noise compliance assessment report**

  A requirement to prepare a report verifying that the measures documented in the operational noise management plan have been fully implemented and that operational noise levels comply with the applicable noise limits.

Adhering to the recommended management and mitigation measures reduces the consequence of the risk to minor. However, in recognition of the stringency of the design requirements, and the need for verification measures at the design and commissioning stages of the project, the residual impacts of operational noise remain medium.

The assessment findings indicate that environmental noise will be an important consideration to address for the construction and operational stages of the project. However, the risks of noise impacts can be reduced to acceptable levels by implementing the recommended mitigation and management measures.

GLOSSARY AND ABBREVIATIONS

Term	Description
Ambient noise level	The noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
A-weighting	A set of adjustments which are applied to sound pressure levels to account for variations in the human ear's perception of sound at different frequencies. The A-weighting may also be applied to sound power levels. Sound pressure levels or sound power levels that are adjusted by the A-weighting are expressed as dB L_A in accordance with international standard conventions. Alternative ways of expressing A-weighted decibels such as dBA or dB(A) are therefore not used within this report.
Decibel (dB)	The unit of sound pressure level and sound power level.
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMPCA	Environmental Management and Pollution Control Act 1994 (Tas)
EMPC Noise Regulations	Environmental Management and Pollution Control (Noise) Regulations 2016 (Tas)
EPA	Environment Protection Authority (of Tasmania)
Noise EPP	Environment Protection Policy (Noise) 2009 (Tas)
Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
Hertz (Hz)	Hertz is the unit of frequency. One hertz is one cycle per second. One thousand hertz is a kilohertz (kHz).
HDD	Horizontal directional drilling, a trenchless construction method that installs ducts under obstacles and environmentally sensitive features by drilling, subject to suitable geotechnical conditions.
L_{A90}	The A-weighted noise level exceeded for 90% of the measurement period, measured in dB. This is commonly referred to as the background noise level.
L_{Aeq}	The A-weighted equivalent continuous sound level, measured in dB. This is commonly referred to as the average noise level.
MDA	Marshall Day Acoustics Pty Ltd ATF Marshall Day Unit Trust
MLPL	Marinus Link Pty Ltd
NSW CNVG	NSW Roads and Maritime Services publication *Construction Noise and Vibration Guideline* dated August 2016
NWTD	North West Transmission Developments
PPV	Peak Particle Velocity
The project	The proposed Marinus Link interconnector between Tasmania and Victoria, comprising land-based infrastructure in both Tasmania and Victoria, and subsea cable connections.
Sound power level (L_w)	A measure of the total sound energy emitted by a source and is independent of the distance from the source (it is therefore different to the sound pressure level which depends on distance from the source)

Term	Description
Sound pressure level	The change in atmospheric pressure caused by a sound wave. The sound pressure level (along with the frequency of the sound) relates to the perceived loudness of a sound source.
TNMG	*Tasmanian State Road Traffic Noise Management Guidelines* revision 1 dated October 2015
Tetra Tech Coffey	Tetra Tech Coffey Pty Ltd
VDV	Vibration Dose Value

1.0 INTRODUCTION

The proposed Marinus Link (the project) comprises a high voltage direct current (HVDC) electricity interconnector between Tasmania and Victoria, to allow for the continued trading and distribution of electricity within the National Electricity Market (NEM).

The project was referred to the Australian Minister for the Environment 5 October 2021. On 4 November 2021, a delegate of the Minister for the Environment determined that the proposed action is a controlled action as it has the potential to have a significant impact on the environment and requires assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) before it can proceed. The delegate determined that the appropriate level of assessment under the EPBC Act is an environmental impact statement (EIS).

In July 2022 a delegate of the Director of the Environment Protection Authority Tasmania determined that the project be subject to environmental impact assessment by the Board of the Environment Protection Authority (the Board) under the *Environmental Management and Pollution Control Act 1994* (Tas) (EMPCA).

On 12 December 2021, the former Victorian Minister for Planning under the *Environment Effects Act 1978* (Vic) (EE Act) determined that the project requires an environment effects statement (EES) under the EE Act, to describe the project's effects on the environment to inform statutory decision making.

As the project is proposed to be located within three jurisdictions, the Tasmanian Environment Protection Authority (Tasmanian EPA), Victorian Department of Transport and Planning (DTP), and Australian Department of Climate Change, Energy, Environment and Water (DCCEEW) have agreed to coordinate the administration and documentation of the three assessment processes. Two EISs are being prepared to address the Tasmanian EPA requirements for the Heybridge converter station and shore crossing. A separate EIS/EES is being prepared to address the requirements of DTP and DCCEEW.

This report has been prepared by Marshall Day Acoustics Pty Ltd (MDA) for the Tasmanian jurisdiction as part of the two EISs being prepared for the project.

1.1 Purpose of this report

This document presents the technical noise and vibration assessment of the Tasmanian component of the project. The assessment considers sources of environmental noise and vibration associated with both the construction and operational stages of the project. Noise and vibration levels associated with decommissioning activities (i.e. decommissioning of the project) are expected to be similar to or lower than those experienced during the construction phase. A separate assessment for the decommissioning phase is therefore not warranted. The relevant noise and vibration controls nominated for the construction phase should also be applied during decommissioning.

Construction of the project would broadly involve transitory noise and vibration generating activities which occur along, and in the vicinity of, the project. Off-site truck movements on public roads are also a relevant environmental noise and vibration consideration. The primary source of operational noise associated with the project is the proposed converter station at Heybridge which would comprise indoor and outdoor plant including transformers and cooling systems.

This report presents:

- details of the environmental noise and vibration criteria that apply to the project;
- the noise and vibration sensitive locations in the vicinity of the project;
- predicted construction noise and vibration levels at sensitive locations;
- a risk assessment of the potential noise and vibration impacts of the project; and

- recommended management and mitigation measures for the control of noise and vibration.

The sensitive locations addressed in this report comprise buildings and areas used by people for purposes that are sensitive to noise and vibration. These locations are collectively referred to as receivers in this report.

Noise and vibration effects on fauna (terrestrial) are addressed in a separate technical study of ecology. Similarly, the Victorian and subsea components of the project are addressed in separate noise and vibration assessment reports.

1.2 Project overview

The project is a proposed 1500 megawatt (MW) HVDC electricity interconnector between Heybridge in North West Tasmania and the Latrobe Valley in Victoria (Figure 1). Marinus Link is proposed to provide a second link between the Tasmanian renewable energy resources and the Victorian electricity grids enabling efficient energy trade, transmission and distribution from a diverse range of generation sources to where it is most needed, and will increase energy capacity and security across the NEM.

Marinus Link Pty Ltd (MLPL) is the proponent for the project and is a wholly owned subsidiary of Tasmanian Networks Pty Ltd (TasNetworks). TasNetworks is owned by the State of Tasmania and owns, operates and maintains the electricity transmission and distribution network in Tasmania.

Tasmania has significant renewable energy resource potential, particularly hydroelectric power and wind energy. The potential size of the resource exceeds both the Tasmanian demand and the capacity of the existing Basslink interconnector between Tasmania and Victoria. The growth in renewable energy generation in mainland states and territories participating in the NEM, coupled with the retiring of baseload coal-fired generators, is reducing the availability of dispatchable generation that is available on demand.

Tasmania’s existing and potential renewable resources are a valuable source of dispatchable generation that could benefit electricity supply in the NEM. Marinus Link will allow for the continued trading, transmission and distribution of electricity within the NEM. It will also manage the risk to Tasmania of a single interconnector across Bass Strait and complement existing and future interconnectors on mainland Australia. Marinus Link is expected to facilitate the reduction in greenhouse gas emissions at a state and national level.

Interconnectors are a key feature of the future energy landscape. They allow power to flow between different regions to enable the efficient transfer of electricity from renewable energy zones to where the electricity is needed. Interconnectors can increase the resilience of the NEM and make energy more secure, affordable and sustainable for customers. Interconnectors are common around the world including in Australia. They play a critical role in supporting Australia’s transition to a clean energy future.

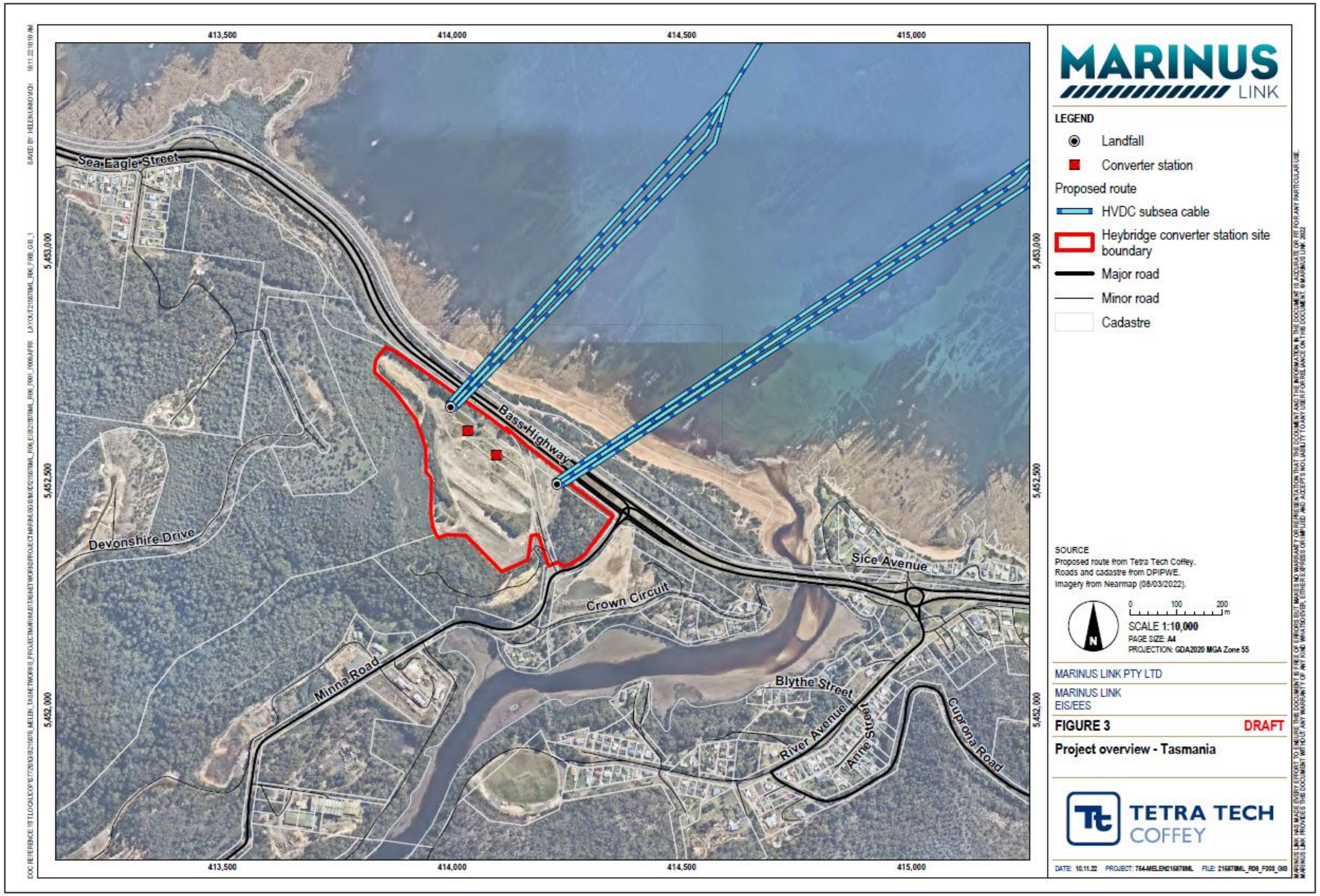


Figure 1: Project overview
(figure courtesy of Tetra Tech Coffey)

1.3 Assessment context

Construction and operation of the project has the potential to result in noise and vibration impacts at receivers in the area around the project, primarily consisting of residential dwellings.

The impacts can range from annoyance and minor disturbance of domestic and recreational activities (e.g. speech interference), potentially resulting in behavioural changes to adapt to the noise (e.g. avoiding outdoor areas or closing windows), through to complete disruption of typical residential activities and health impacts such as sleep disturbance.

Environmental noise and vibration are therefore important considerations to be addressed as part of the EIS. Specifically, an assessment is required to identify and quantify the risk of noise and vibration impacts, and determine the types of management and mitigation measures that should apply to the project to minimise the risks.

2.0 ASSESSMENT GUIDELINES

This section outlines the assessment guidelines relevant to noise and vibration and the linkages to other technical assessments completed for the project. Two separate EISs are being prepared to address the EIS guidelines published by EPA Tasmania for the Heybridge converter station and shore crossing.

2.1 EPA Tasmania Guidelines

EPA Tasmania has published two sets of guidelines (September 2022) for the preparation of an EIS for the Marinus Link converter station and shore crossing. A separate set of guidelines have been prepared for each of these project components:

- *Environmental Impact Statement Guidelines Marinus Link Pty Ltd Converter Station for Marinus Link, September 2022*, Environment Protection Authority Tasmania (Tas converter station EIS guidelines)
- *Environmental Impact Statement Guidelines Marinus Link Pty Ltd Shore Crossing for Marinus Link, September 2022,* Environment Protection Authority Tasmania (Tas shore crossing EIS guidelines)

The section titled *Potential Impacts and their Management* in the EIS guidelines for both the converter station and the shore crossing identifies key environmental issues associated with the project. The Tasmanian EIS guidelines note that all potential effects of the proposal should be evaluated, but that the key issues should be the principal focus. Key issue 3 is defined as noise and vibration:

> *Potential impacts of noise and vibration emissions on sensitive receptors.*

The EIS guidelines establish assessment requirements that are specific to noise and vibration (see section 6.3 of the Tasmanian converter station EIS guidelines and section 10.3 of the Tasmanian shore crossing EIS guidelines). The guidance is equivalent in each of the EIS guidelines, with the only difference being a reference to maintenance work for the shore crossing, and cross-references in each document to the converter station and shore crossing with respect to cumulative noise. The combined requirements of the EIS guidelines are reproduced in Table 1 along with the section of this report where each requirement is addressed.

In terms of the legislative and policy requirements, the Tasmanian converter station EIS guidelines state that:

> *Consideration should be given to the requirements of the Tasmanian Environment Protection Policy (Noise) 2009.*

Table 1: Combined requirements of the Tasmanian EIS guidelines

Requirement	Report section
Discuss impacts on human sensitive receptors of the proposal on ambient (surrounding) noise levels during both the construction and operational phases (e.g., maintenance works), including:	
• Identifying and describing all sources of noise with the potential to cause nuisance, including vehicle movements;	Section 4.1, Section 4.2, Section 4.3 and Section 4.4
• A map of the location of all such sources of noise;	Section 4.3 and Section 7.2.1
• Considering the potential for noise emissions during both the construction and operational phases to cause nuisance for nearby land users, particularly at noise sensitive premises, including:	
– Establishing the baseline (pre-existing) noise in the area with particular focus on sensitive receptors likely to be influenced by the proposal;	Section 6.0 and Appendix C
– Establishing noise level criteria for the operational phases of the proposal;	Section 5.4.1
– Predicting noise levels at noise sensitive premises;	Section 7.1.3 and Section 7.2.2
– Consideration of timing and duration of noise;	Section 7.1.4, Section 7.1.5 and Section 7.2.3
– Consideration of existing noise levels to determine whether predicted noise levels are likely to result in nuisance for sensitive premises;	Section 7.1.2 and Section 7.2.3
– Consideration of the potential for cumulative noise impact from the Heybridge converter station and shore crossing works;	Section 7.1.4
– Development of a construction noise and vibration management plan, including management of noise complaints and options for noise and vibration monitoring, if required;	Section 7.1.8 and Section 7.5
– Discussion of proposed mitigation measures for operational noise.	Section 7.2.1, Section 7.2.5 and Section 7.5

2.2 Linkages to other reports

This report is informed by or informs the technical assessments outlined in Table 2.

Table 2: Relevant technical assessments

Technical assessment	Relevance to this assessment
Heybridge Converter Station Terrestrial Ecology Baseline and Impact assessment report, Entura 2024	Noise level data presented in this report may be referenced in the biodiversity and ecology study.
Marinus Link Project, Environmental Impact Statement (Tasmania) Technical Report – Traffic & Transport, Stantec 2024	Provides details of transport routes and heavy vehicle numbers during the construction of the project and informs the assessment of off-site transportation noise.

3.0 LEGISLATION, POLICY AND GUIDELINES

This section presents:

- legislation and guidelines for the assessment of environmental noise; and
- guidelines for the assessment of vibration (in lieu of formal polices or legislation that apply to vibration).

3.1 Noise legislation and guidelines

The following publications are relevant to the assessment of environmental noise levels in Tasmania:

- *Environmental Management and Pollution Control Act 1994* (Tas) (the EMPCA);
- *Environmental Management and Pollution Control (Noise) Regulations 2016* (Tas) (the EMPC Noise Regulations);
- *Environment Protection Policy (Noise) 2009* (Tas) (the Noise EPP); and
- *Noise Measurement Procedures Manual 2008* (Tas) (the Tasmanian noise measurement manual).

The EMPCA represents the overarching legislation for the prevention, reduction and remediation of environmental harm.

The EMPC Noise Regulations and the Noise EPP subsequently define requirements that are specific to the management of noise.

The Tasmanian noise measurement manual does not specify noise limits or noise control requirements but sets the procedures that are to be used for *measuring, estimating, calculating and assessing sound pressure levels* as required by the EMPC Noise Regulations and the Noise EPP.

The requirements of the EMPC Noise Regulations and the Noise EPP are presented in the following sub-sections, along with supplementary guidance referenced in this assessment for construction noise and off-site traffic movements.

3.1.1 EMPC Noise Regulations

The EMPC Noise Regulations apply to noise that is not controlled by measures specified in an approved instrument, such as a permit under the *Land Use Planning and Approvals Act 1993* (Tas).

The following sections outline provisions relevant to construction noise and fixed plant.

Construction noise

The EMPC Noise Regulations' primary mechanism for controlling construction noise is the definition of prohibited hours for equipment and machinery used on construction and demolition sites (excluding road construction) which can be heard in any neighbouring residential premises. Specific requirements also apply to the operation of chainsaws powered by an internal combustion engine operated within 300 m of residential premises.

Unless dedicated noise control requirements are established via an approved instrument, construction work that could result in audible noise inside neighbouring residential premises (with windows open) must not occur during the prohibited hours. An approval instrument is required for the operation of chainsaws on land other than residential premises that is within 300 m of residential premises, regardless of the hours of use.

The relevant restrictions of use are summarised in Table 3 based on times of the day.

Table 3: EMPC Noise Regulations – relevant provisions relating to operation of equipment

Equipment	Day of the week	Prohibited hours of use
(2) Mobile machinery, forklift or portable equipment	Monday – Friday	Before 0700 hrs and after 1800 hrs
	Saturday	Before 0800 hrs and after 1800 hrs
	Sunday or public holiday	Before 1000 hrs and after 1800 hrs
(3) Motor vehicles (unless the vehicle…is being operated to move into or out of…a construction or demolition site)	Monday-Friday	Before 0700 hrs and after 1800 hrs
	Saturday	Before 0900 hrs and after 1800 hrs
	Sunday or public holiday	Before 1000 hrs and after 1800 hrs
Chainsaws within 300 m of residential premises (when operated on a non-residential premises)	Sunday – Saturday	Requires approved instrument

Fixed equipment

The EMPC Noise Regulations define requirements for fixed equipment which is defined as including:

> *domestic heating equipment, systems for the production of hot water, air conditioners, evaporative coolers, pumps, generators or wind turbines, that are affixed at the location at which they are in use.*

These definitions are not specifically stated as applicable to commercial or industrial activities. Conversely, unless noise control requirements for the operation of the project are established via an approved instrument, the EMPC Noise Regulations do not specifically exclude application of the fixed plant requirements to the operational noise of the project.

Clause 7 establishes the following requirements for fixed plant:

> *(1) A person must not operate fixed equipment on any premises –*
>
> *(a) from 7.00 a.m. until 10.00 p.m., if the fixed equipment, when so operated, emits noise that is greater than 45dB(A); or*
>
> *(b) from 10.00 p.m. until 7.00 a.m., if the fixed equipment, when so operated, emits noise that is greater than 40dB(A).*

The fixed plant noise limits are defined for locations adjacent the external walls of residential premises that are nearest to the fixed plan (specifically, at 1 m from the external wall, unless the property boundary is less than 1 m from the external wall).

3.1.2 Environment Protection Policy (Noise) 2009

Overview

The Noise EPP is a strategic framework document which defines overarching principles and objectives to provide a basis for reducing health risks and amenity impacts associated with environmental noise.

For specific requirements relating to noise levels and hours of operation, the Noise EPP notes that these are principally covered by the EMPC Noise Regulations and permits issued for particular activities.

In setting the strategic framework, the Noise EPP notes the following important points of context:

> *Establishing suitable benchmarks for what are acceptable levels of noise is difficult for a number of reasons. These include the fact that different people have differing tolerance to noise in loudness and frequency, different situations can justify different noise levels and tolerance to noise can vary depending on the time of day or the day of the week.*
>
> *There are number of different authorities which have a role in regulating noise in different situations, and different approaches may be taken to the various noise issues.*
>
> *…*
>
> *This policy does not exist in isolation and its provisions should be considered in the context of other policy frameworks, in particular Tasmania Together and the Resource Management and Planning System. Other environmental issues and the social and economic needs of the community should be taken into account when addressing noise issues.*

The Noise EPP therefore identifies that a range of factors need to be considered when setting appropriate noise controls, including both the protection of amenity and the wider economic and social benefits of new development (note: the publications Tasmania Together and the Resource Management and Planning System referred to above do not set additional noise criteria or provide specific guidance on noise assessment requirements that are relevant to this study).

The objectives of the Noise EPP are defined in Part 2 under sub-clause 6 (1):

> *(a) to further the objectives of the Act as they relate to the acoustic environment; and*
>
> *(b) to protect the environmental values specified in clause 7.*

Clause 7 of the Noise EPP then defines the environmental values as follows:

> *(1) Environmental values are the values or uses of the environment that are to be protected.*
>
> *(2) The environmental values to be protected under this policy are the qualities of the acoustic environment that are conducive to –*
>
> *(a) the wellbeing of the community or a part of the community, including its social and economic amenity; or*
>
> *(b) the wellbeing of an individual, including the individual's –*
>
> *(i) health; and*
>
> *(ii) opportunity to work and study and to have sleep, relaxation and conversation without unreasonable interference from noise.*
>
> *(3) It can be assumed that the environmental values specified in sub-clause (2)(b) will be protected for the majority of the human population where the acoustic environment indicator levels are not exceeded, and there are no individual sources of noise with dominant or intrusive characteristics.*

The acoustic environment indicator levels referred to in sub-clause 7 (3) are provided as a reference for considering the condition of the acoustic environment and the effectiveness of noise control measures and strategies. The Noise EPP notes that they are indicative, not mandatory noise levels.

The relevant acoustic environment indicator levels for external noise at residential locations are reproduced in Table 4.

Table 4: Residential locations – outdoor acoustic environment indicator levels

Specific environment	Critical health effect(s)	Average noise levels and time base (hours)	Maximum noise levels
Outdoor living area	Serious annoyance, daytime and evening	55 dB $L_{Aeq,16h}$	-
	Moderate annoyance, daytime and evening	50 dB $L_{Aeq,16h}$	-
Outside bedrooms	Sleep disturbance, window open	45 dB $L_{Aeq,8h}$	60 dB L_{AFmax}

The acoustic environment indicator levels correspond to criteria defined by the World Health Organisation (WHO)[1] that are applied to long-term/permanent sources of noise. This is a key point of context, as the acoustic environment indicator levels do not differentiate between short-term and long-term/permanent noise sources.

Construction noise

The Noise EPP does not set requirements or define principles that are specific to construction noise, however Part 6 provides guidance relating to domestic and miscellaneous activities, the latter being defined as an activity that is neither domestic, commercial, industrial nor related to transport infrastructure. The provisions of Part 6 therefore do not specifically exclude construction noise, and may be referenced when assessing construction noise. The following general principles are noted:

- regulatory authorities should assess, manage and regulate proposed domestic and miscellaneous activities that are sources of noise with the objective of protecting environmental values
- best practice environmental management should be employed in every activity to reduce noise emissions to the greatest extent reasonably practical
- dominant or intrusive noise characteristics of noise emission from an activity should be reduced by the greatest extent reasonably practical.

These types of principles are consistent with construction noise requirements in other Australian jurisdictions where the emphasis is on limiting construction to standard working hours where practical, and the use of practical measures to manage and reduce the noise of activities. In particular, this type of management approach is commonly used in lieu of rigidly defined compliance limits for construction activity during standard working hours.

[1] World Health Organization publication *Guidelines for Community Noise* dated 1999

Commercial and industrial activities

Commercial and industrial activities are addressed in Part 5 of the Noise EPP. In particular, clause 12 outlines the following key requirements that are directly relevant to operational noise associated with the project:

> *(1) Regulatory authorities should assess, manage and regulate proposed commercial and industrial activities that are sources of noise with the objective of protecting the environmental values.*
>
> *(2) Best practice environmental management should be employed in every activity to reduce noise emissions to the greatest extent that is reasonably practical.*
>
> *(3) Dominant or intrusive noise characteristics of noise emissions from an activity should be reduced to the greatest extent that is reasonably practical.*
>
> *(4) To retain a reserve capacity in the acoustic environment at a particular location, no activity should be permitted to emit noise at a level or in a manner that, allowing for other reasonable emissions of noise in the vicinity, would prejudice the protection of the environmental values at that location.*
>
> *(5) Notwithstanding sub-clause (4), regulatory authorities may determine not to require a reserve capacity if –*
>
> *(a) (i) best practice environmental management is employed in the activity; and*
>
> *(ii) it is highly unlikely that there will be significant additional sources of noise in the vicinity; or*
>
> *(b) this would prevent a proposal that is clearly in the public interest from proceeding.*

Clause 12 also set out provisions for activities that are not able to meet the above requirements and the measures that regulatory authorities are able to adopt to address these situations.

Measurement and monitoring

The Noise EPP Part 7 establishes requirements for noise monitoring and noise impact studies.

In terms of noise monitoring, the Noise EPP specifies that any noise measurements for the purposes of the policy should made in accordance with the relevant requirements of the Noise Measurement Procedures Manual, as amended from the time to time.

In relation to noise impact studies, the following requirements are specified:

> *(1) If a regulatory authority has reasonable grounds to consider that a proposed or existing emission of noise from an industrial, commercial or infrastructural activity might prejudice protection of the environmental values, it should, where possible and appropriate, require any person responsible for the activity to undertake a noise impact study in accordance with an approved methodology.*
>
> *(2) Where a noise impact study is carried out, it should consider –*
>
> *(a) noise levels at appropriate locations compared with noise limits applicable to the activity in any legislation, approval or proposed approval;*
>
> *(b) compliance with any other relevant requirements of legislation, approval or proposed approval;*
>
> *(c) the potential for reducing the impact of the activity's noise emissions or proposed emissions on the acoustic environment; and*
>
> *(d) the cumulative effect of the noise emissions or proposed emissions from the activity.*

3.1.3 Supplementary noise guideline documents

The requirements and principles set out in the EMPC Noise Regulations and the Noise EPP provide the primary references for assessing construction noise associated with the project.

To supplement these documents for the assessment of the project, the following additional guidelines have been referenced where applicable for informative purposes:

- Australian Standard AS 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites* (AS 2436)

  This standard provides empirical noise emission data for a range of different construction activities and is frequently referenced as a basis for predicting construction noise levels at receiver locations. The standard also provides general guidance on good practice measures for the management and control of construction noise

- British Standard BS 5228-1:2009+A12014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* (BS 5228-1)

  This standard is commonly used in conjunction with AS 2436 as an additional noise emission data reference for a much wider range of activities and plant than is documented in AS 2436

- NSW government publication *Interim Construction Noise Guideline* dated July 2009 (NSW ICNG)

  This document provides guidance on managing noise from construction sites which is specific to the NSW regulatory setting. The document was developed with a *focus on applying a range of work practices most suited to minimum construction noise impacts, rather than focussing only on achieving numeric noise levels*. The NSW ICNG does however provide an example approach to quantitative assessment of noise levels when required.

- NSW Roads and Maritime Services publication *Construction Noise and Vibration Guideline* dated August 2016 (NSW CNVG)

  This document provides additional guidance on reasonable and practical measures for controlling construction noise and vibration, as well as guidance on typical minimum working distances to satisfy human comfort and structural damage criteria at receivers.

- EPA Victoria Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Victorian Noise Protocol)

  This document defines a procedure for setting noise limits that apply to the operation of industry premises in Victoria. This publication has been referenced for additional guidance on design targets for operational noise levels associated with the project.

3.1.4 Guidelines for noise from off-site vehicle movements

There is no Tasmanian guidance document for the assessment of construction traffic noise levels on public roads[2].

The *Tasmanian State Road Traffic Noise Management Guidelines* revision 1 dated October 2015 (the TNMG) provides target noise levels for public roads. Specifically, target criteria of 63 dB to 68 dB $L_{A10,18h}$ are specified for public roads, along with the Noise EPP acoustic indicator levels (as presented in Section 3.1.2) as alternative criteria for sheltered assessment locations.

[2] The Tasmanian TNMG does provide target noise limits for public roads but does not address temporary increases associated with construction traffic.

However, the criteria represent targets for normal traffic flows, and the TNMG does not address temporary increases associated with construction traffic. The target criteria are therefore not directly applicable to construction related traffic. However, given that noise criteria applied to construction activity are normally less stringent than those applied to long-term/permanent sources of noise (on account of the temporary nature of construction activity), the target noise levels can be used as a conservative reference for contextualising predicted construction traffic noise levels.

3.2 Vibration guidelines

There is no standard or regulation that specifies criteria for the control of construction vibration levels in Tasmania.

In lieu of Tasmanian guidance for construction vibration, for assessment purposes, reference is made to the NSW CNVG.

In general, empirical limits relating to vibration from commerce or industry generally distinguish between the effects on humans and the effects on buildings. For example, effects on humans depend on whether the vibration is continuous, intermittent or occasional. For buildings, the effect depends on whether the vibration is short term or long term. Also, human perception of vibration is evident at levels well below the thresholds for structural effects on a building and thus the assessment parameters commonly differ.

The safe working distances detailed in the NSW CNVG are the primary reference for assessing construction vibration related risks at the planning stage. The relevant criteria that would subsequently apply to any compliance monitoring are defined in separate guidelines presented in Section 3.2.2 and Section 3.2.3.

3.2.1 NSW Construction Noise and Vibration Guideline (CNVG)

The NSW CNVG sets out minimum working distances from receivers for typical items of vibration intensive plant. The minimum distances are specified in Section 7.1 of the guidance and are quoted for effects relating to cosmetic damage and human comfort. In relation to cosmetic damage, the guidance contained in the NSW CNVG is based on the criteria contained in BS 7385[3]. For human comfort, the guidance is based on criteria on guidance from the former NSW Department of Environment and Conservation titled *Assessing Vibration: a technical guideline* dated February 2006.

The minimum working distances are reproduced below in Table 5.

The NSW CNVG notes that the minimum working distances are indicative and will vary depending on the particular item of plant and local geotechnical conditions. The guideline also notes the values are defined in relation to cosmetic damage of typical buildings under typical geotechnical conditions and recommends vibration monitoring to confirm the minimum working distances at specific sites.

In relation to human comfort, the NSW CNVG notes that the minimum working distances relate to continuous vibration. The guideline further notes that for most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods are allowed.

The data presented in Table 5 indicates that the minimum working distances for human comfort are significantly greater than for the avoidance of cosmetic damage. This is based on the thresholds for human exposure to vibration being generally well below accepted thresholds for minor cosmetic damage to lightweight structures.

[3] BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings* Part 2

Table 5: Recommended minimum working distances for vibration intensive plant from receivers (reproduced from Table 2 of Section 7.1 of the NSW CNVG)

Plant item	Rating / description	Minimum working distance	
		Cosmetic damage	Human response
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg – 5 to 12 t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18 t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34 t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	4 m
Jackhammer	Handheld	1 m (nominal)	2 m

3.2.2 Human response to vibration

The NSW CNVG provides indicative minimum working distances that are a suitable guide for planning stage assessments of vibration and potential impacts to human comfort.

However, if construction vibration monitoring is found to be warranted during the construction stage of a project (e.g. as a result of activity occurring at distances less than or comparable to the indicative minimum working distances), it is necessary to refer to alternative guidance that specifies criteria that can be used to assess measured vibration levels.

In lieu of current Australian Standards that present vibration criteria for human responses, there are a number of international standards and reference documents available that provide relevant guidance. Of these, BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings* (BS 6472-1) is the most current of the relevant standards and is widely accepted within the industry.

BS 6472-1 provides a range of vibration dose value (VDV) levels to assess the likelihood of adverse comment from different types of vibration (constant, impulsive, occasional, and intermittent). These are reproduced in Table 6. The VDV levels can be applied to all types of vibration and take into account the duration of exposure. This has practical benefits for situations where vibration may be generated from multiple different sources operating at different times and different locations.

Table 6: Vibration dose value ranges which might result in various probabilities of adverse comment within residential buildings

Place and time	Low probability of adverse comment $m{\cdot}s^{-1.75}$	Adverse comment possible $m{\cdot}s^{-1.75}$	Adverse comment probable $m{\cdot}s^{-1.75}$
Residential building 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential building 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Note: The guideline targets are non-mandatory; they are goals that should be sought to be achieved through the application of feasible and reasonable mitigation measures.

The VDVs recommended in the document for vibration of an intermittent nature (i.e. construction works) are presented in Table 7. These represent the values which could be nominated in a Construction Noise and Vibration Monitoring Plan (CNVMP) for the project, for reference in the event of construction vibration monitoring being warranted.

Table 7: Acceptable vibration dose values for intermittent vibration (VDV $m/s^{1.75}$)

Location	Day (0700 to 2200 hrs)		Night (2200 to 0700 hrs)	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20	0.40	0.10	0.20
Offices, schools, educational institutions, places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Note: The guideline targets are non-mandatory; they are goals that should be sought to be achieved through the application of feasible and reasonable mitigation measures.

3.2.3 Vibration damage to buildings and structures

The NSW CNVG provides indicative minimum working distances that are a suitable guide for planning stage assessments of vibration with respect to potential structural damage.

However, if construction vibration monitoring is found to be warranted during the construction stage of a project (e.g. as a result of activity occurring at distances less than or comparable to the indicative minimum working distances), it is necessary to refer to alternative guidance that specifies criteria that can be used to assess measured vibration levels.

There are no current Australian Standards that present vibration criteria for building damage. A widely referenced and accepted international standard for the assessment of building vibration is the German Standard DIN 4150-3:2016-12 *Vibrations in buildings – Part 3: Effects on structures* (DIN 4150-3). The structural damage criteria specified by DIN 4150-3 over the range 1–100 Hz are presented in Table 8. DIN 4150-3 specifies Peak Particle Velocity (PPV) as the assessable vibration parameter.

Table 8: Vibration limits according to DIN 4150-3

Line	Type of building	Guideline values for velocity, v_i, in mm/s (peak)				
		Foundation, all directions, i = x, y, z, at a frequency of			Topmost floor, horizontal direction, i = x, y	Floor slabs, vertical direction, i = z
		1-10 Hz	10-50 Hz	50-100 Hz[a]	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20-40	40-50	40	10
2	Residential buildings and buildings of similar design and/or occupancy	5	5-15	15-20	15	5
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings)	3	3-8	8-10	8	2.5[b]

NOTE Even if guideline values as in line 1, columns 2 to 5, are complied with, minor damage cannot be excluded.

[a] At frequencies above 100 Hz, the guideline values for 100 Hz can be applied as minimum values.
[b] Paragraph 2 of DIN 4150-3 5.1.2 shall be observed.

4.0 PROJECT DESCRIPTION

This section presents:

- an overview of the project;
- the main construction activities that are relevant to noise and vibration; and
- the main sources of operational noise associated with the project.

4.1 Overview

Marinus Link is proposed to be implemented as two 750 MW circuits to meet transmission network operation requirements in Tasmania and Victoria. Each 750 MW circuit will comprise two power cables and a fibre-optic communications cable bundled together in Bass Strait and laid in a horizontal arrangement on land. The two 750 MW circuits will be installed in two stages with the western circuit being laid first as part of stage one, and the eastern cable in stage two.

The key project components for each 750 MW circuit, from south to north are:

- HVAC switching station and HVAC-HVDC converter station at Heybridge in Tasmania. This is where the project will connect to the North West Tasmania transmission network being augmented and upgraded by the North West Transmission Developments (NWTD).
- Shore crossing in Tasmania adjacent to the converter station.
- Subsea cable across Bass Strait from Heybridge in Tasmania to Waratah Bay in Victoria.

In Tasmania, a converter station is proposed to be located at Heybridge near Burnie. The converter station would facilitate the connection of Marinus Link to the Tasmanian transmission network. There will be two subsea cable landfalls at Heybridge with the cables extending from the converter station across Bass Strait to Waratah Bay in Victoria. The preferred option for shore crossings is horizontal directional drilling (HDD) to about 10 m water depth where the cables would then be trenched, where geotechnical conditions permit.

Approximately 255 kilometres (km) of subsea HVDC cable would be laid across Bass Strait. The preferred technology for Marinus Link is two 750 megawatt (MW) symmetrical monopoles using ±320 kV, cross-linked polyethylene insulated cables and voltage source converter technology. Each symmetrical monopole is proposed to comprise two identical size power cables and a fibre-optic communications cable bundled together. The cable bundles for each circuit will transition from approximately 300 m apart at the HDD (offshore) exit to 2 km apart in offshore waters.

This assessment is focused on the Tasmanian terrestrial and shore crossing section of the project. This report will inform the two EISs being prepared to assess the project’s potential environmental effects in accordance with the legislative requirements of the Tasmanian government (Figure 2).

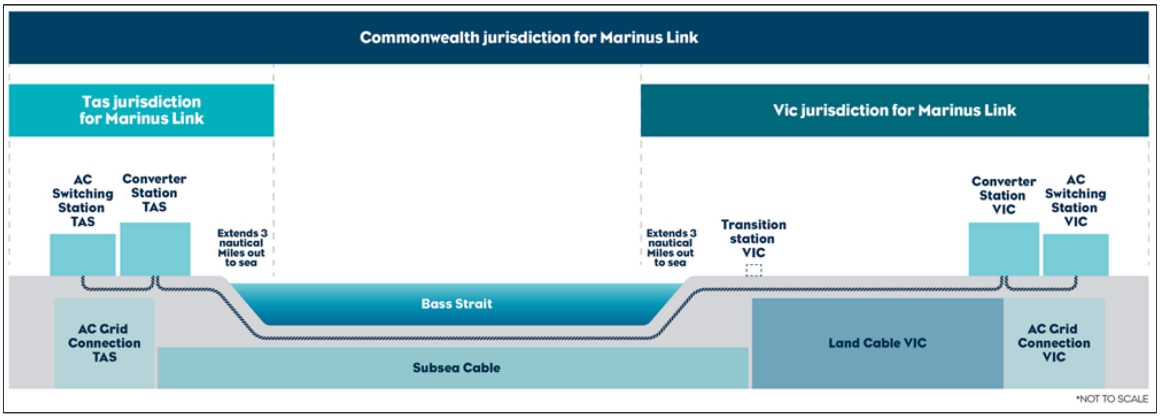


Figure 2: Project components considered under applicable jurisdictions (Marinus Link Pty Ltd 2022)

Marinus Link is proposed to be constructed in two stages over approximately five years following the award of works contracts to construct the project. On this basis, stage one of the project is expected to be operational by 2030 and stage two will follow with final timing to be determined by market demand. The project will be designed for an operational life of at least 40 years.

4.2 Construction

This section of the report provides information about construction of the project that is relevant to the noise and vibration assessment.

4.2.1 Proposed works

The project would be constructed in two 750 MW stages, with each stage having three cables bundled. The western circuit is referred to as stage one and would be commissioned first. The eastern circuit is referred to as stage two and would be commissioned after stage one.

Construction of the Heybridge converter station (the converter station) includes works associated with the HVDC converter station plant, the switching station, and the two launch points for the shore crossings. The construction stage of the project would involve the following activities:

- site preparation, surveying and vegetation clearing as needed.
- establishing construction site offices and amenities, and laydown areas.
- civil works to construct the converter station bench (bulk earthworks), including remediation or disposal of contaminated soils disturbed during bulk earthworks.
- civil works including construction of the access road to the site and the internal roads, stormwater drainage system, foundations, cable trenches and transformer bays.
- construction of two horizontal directional drilling (HDD) pads within the boundary of the converter station site, and subsequently HDD works from these pads to construct the two shore crossings (followed by conduit and cable installation works)
- infrastructure works including structural steelwork for buildings and installation of electrical apparatus and infrastructure such as the DVDC converter equipment, HVAC switchgear and auxiliary transformers.
- testing and commissioning of the converter station, switching station and ancillary site systems (e.g. fire systems).

Construction of the converter station is expected to take up to three (3) years / 36 months for each stage, including up to 6 months of HDD drilling to construct both of the 750 MW circuits.

A plan of the site illustrating a conceptual arrangement of the plant and the location of the shore crossings is provided in Section 4.3.

4.2.2 Proposed construction hours

Construction activities would adhere to the following proposed standard working hours (see further discussion subsequently in Section 5.3.1), unless unavoidable works are required:

- Monday-Friday: 0700 – 1800 hrs
- Saturday: 0800 – 1800 hrs

Extended working hours resulting from unavoidable works relate to:

- drilling for shore crossings which is expected to involve HDD works occurring 24 hours per day, 7 days per week, for a combined period of up to 6 months to ensure the stability of the bore hole;
- works that need to be undertaken without a break in program, such as concrete pouring;
- delivery of essential, oversized plant or equipment;
- time sensitive maintenance or repair of public infrastructure;
- emergency works required due to unforeseen circumstances;

- protection and control commissioning work within the switching station; and
- project activities would be scheduled to reduce the need for night-time work.

4.3 Operation

The primary sources of operational noise associated with the project are the fixed items of plant to be located at the converter station.

The converter station would consist of two HVDC converters each housed in a separate building and a switching station.

A plan of the site illustrating a conceptual arrangement of the plant and the location of the shore crossings is provided in Figure 3.

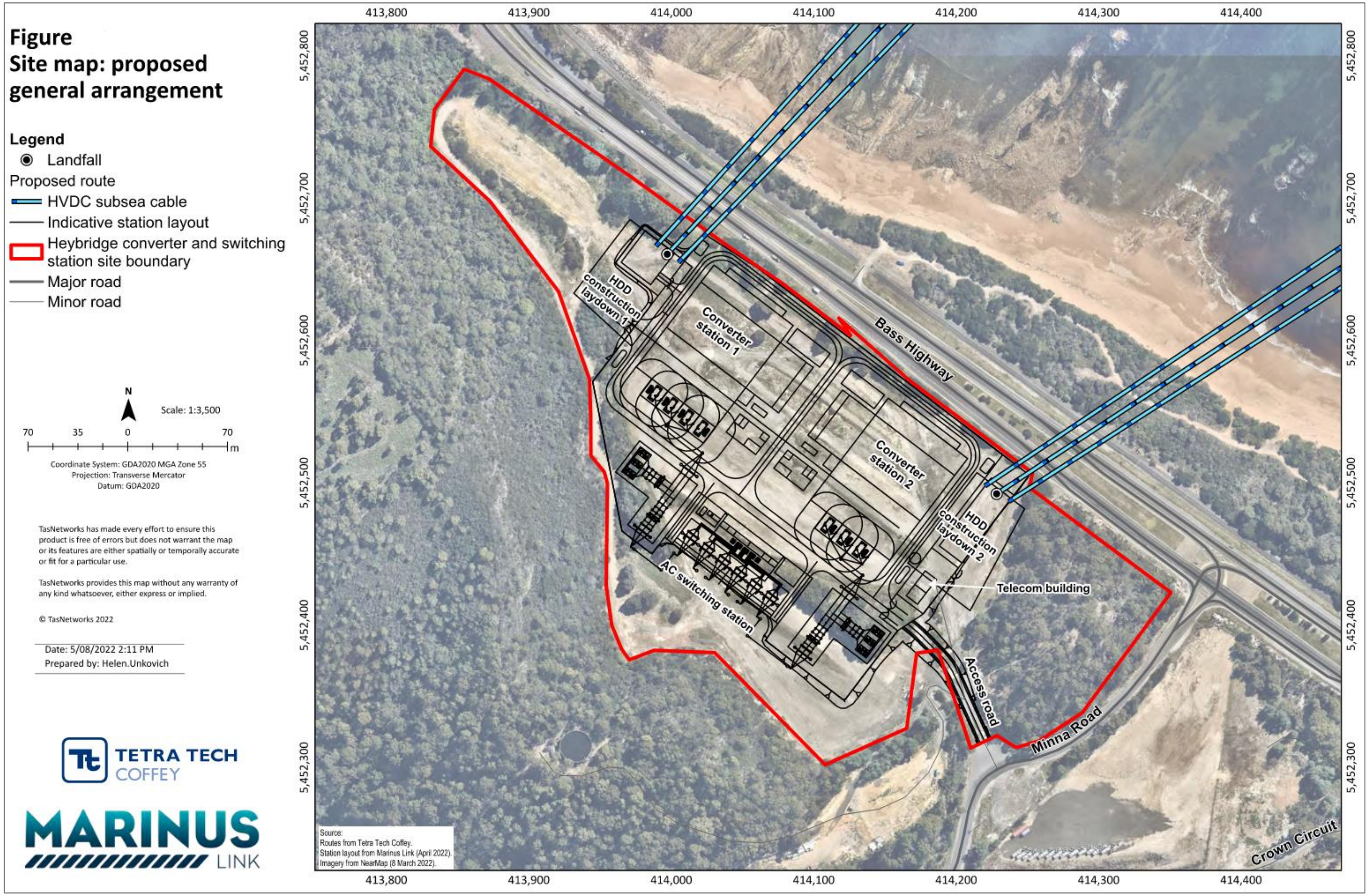


Figure 3: Heybridge Converter Station Site – indicative concept plan (figure courtesy of Tetra Tech Coffey)

4.4 Decommissioning

The operational lifespan of the project is a minimum of 40 years. At this time the project would be either decommissioned or upgraded to extend its operational lifespan.

Decommissioning would be planned and carried out in accordance with regulatory requirements at the time. A decommissioning plan in accordance with approvals conditions would be prepared prior to planned end of service and decommissioning of the project.

Requirements at the time would determine the scope of decommissioning activities and impacts. The key objective of decommissioning is to leave a safe, stable and non-polluting environment.

In the event that the project is decommissioned, all above-ground infrastructure would be removed and the site rehabilitated.

Decommissioning activities required to meet the objective would include, as a minimum, removal of above ground buildings and structures. Remediation of any contamination and reinstatement and rehabilitation of the site would be undertaken to provide a self-supporting landform suitable for the end land use.

Decommissioning and demolition of project infrastructure would implement the waste management hierarchy principles being avoid, minimise, reuse, recycle and appropriately dispose. Waste management would accord with applicable legislation at the time.

Decommissioning activities may include recovery of land and subsea cables. The conduits and shore crossing ducts would be left in-situ as removal would cause significant environmental impact. Subsea cables would be recovered by water jetting or removal of rock mattresses or armouring to free the cables from the seabed.

A decommissioning plan would be prepared to outline how activities would be undertaken and potential impacts managed.

5.0 ASSESSMENT METHOD

This section presents a summary of the methods used to assess noise and vibration associated with construction and operation of the project.

5.1 Study area – receivers

The converter station site is located near the coast at Heybridge, on land adjacent to the Bass Highway which was previously occupied by the former Tioxide factory.

The areas adjoining the site consist of a residential area to the east and southeast, existing commercial uses to the south, and conservation areas to the west and further south beyond the adjoining commercial uses.

The receivers considered in this report comprise the existing residential locations to the east, and approved residential developments sites to the west and southwest. The approved residential developments include:

- the Heybridge Residential Nature Reserve which consists of six hamlets for residential subdivision, the nearest being the Devonshire Drive Hamlet where local roads have been constructed (the remaining hamlets set further back from the site form the Eagle Sea Estate, some of which are currently in construction); and
- a residential development located just north of the Heybridge Residential Nature Reserve on George Street.

A total of 151 existing receivers in the areas to the east and southeast of the project have been identified by Tetra Tech Coffey and are shown as receiver points in Figure 4. Due to the large number of receivers in the area, a subset of these receivers has been selected to represent the distribution of residential dwellings in the area and provide the basis for the assessment of noise and vibration. This subset is listed in Table 9 and is shown in Figure 5.

Additional receiver points were defined from inspection of aerial imagery and cadastral parcels to represent a selection of potential future dwelling locations at the nearest approved residential development sites, the Devonshire Drive Hamlet and the George Street development. These locations are listed in Table 9 and are also shown in Figure 5, along with an indication of the Devonshire Drive Hamlet lot boundaries. Note that the lot boundaries have been estimated based on LISTMAP parcel boundaries for Lot 93 & Lot 94 Minna Road, Heybridge and are indicative only.

Table 9: Representative assessment receivers – existing and potential dwelling locations

Receiver	Description	Distance to site boundary, m
B1539	Existing dwelling	233
B1540	Existing dwelling	305
B1544	Existing dwelling	302
B1550	Existing dwelling	138
B1551	Existing dwelling	375
B1557	Existing dwelling	186
B6195	Existing dwelling	482
B7585	Existing dwelling	558
B7591	Existing dwelling	645
B7606	Existing dwelling	691
B7610	Existing dwelling	693
B7636	Existing dwelling	618
B7641	Existing dwelling	518
B7647	Existing dwelling	525
B7716	Existing dwelling	526
B7722	Existing dwelling	477
B7734	Existing dwelling	575
B7740	Existing dwelling	581
B7744	Existing dwelling	374
B4853*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	131
B4854*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	123
B4855*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	164
B4856*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	267
B4857*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	154
B4858*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	252
B4859	George Street residential development	436

Figure 4: Existing receivers in the vicinity of the project

Figure 5: Assessment points for existing and potential future receivers

5.2 Baseline characterisation

The baseline noise environment at receivers near the project is relevant to the assessment of both the construction and operational stages of the project. In both cases, the baseline noise environment provides context to the predicted noise levels associated with the project. The baseline noise levels also inform the selection of management levels for the assessment of construction noise and design targets for the assessment of operational noise.

The receivers around the project are located in different environments and the baseline noise conditions vary due to factors such as the presence of localised background sources and proximity to natural and anthropogenic sources in the wider area (e.g. proximity to the coast and arterial roads such as the Bass Highway).

To characterise the baseline noise environment, a survey of background noise levels was conducted at a selection of locations to represent different environments. The scope of the survey was selected to obtain a broad indication of baseline noise conditions for the purposes of this assessment.

Baseline vibration levels at receivers near the project are expected to be very low. The assessment of potential vibration impacts from construction of the project is also solely based on the level of vibration which may be produced by different works (i.e. the criteria are not set at values relative to the background vibration levels). Accordingly, a survey of baseline vibration levels was not warranted and was not undertaken as part of this study.

5.3 Construction noise

5.3.1 Assessment basis

Construction of the project would involve temporary noise generating activities in proximity to existing and approved receivers in the area.

The majority of the works are proposed to occur during daytime hours. Tasmanian environmental noise legislation and guidelines summarised in Section 3.1 do not set mandatory noise level requirements for construction activities which are proposed to occur during the daytime (i.e. outside of the time periods specified as prohibited hours). Instead, the legislation and guidelines promote the use of reasonable and practical measures to reduce environmental noise in all instances.

In lieu of mandatory noise requirements for construction activity during the day, reference has been made to supplementary guidance provided by the NSW ICNG discussed in Section 3.1.3. The NSW ICNG defines noise management levels which can be used to inform the extent of noise controls required for construction activities. During consultations with EPA Tasmania (see Section 5.6), the NSW ICNG noise management levels were discussed and agreed as a suitable basis for assessing construction activity during daytime hours.

While most construction activity is proposed to be restricted to daytime hours, drilling works associated with the shore would occur during the evening and night. Specifically, HDD work associated with the shore crossing is proposed to occur almost continuously for a total period of up to 6 months, and would therefore involve drilling activity 24 hours a day for 7 days a week. MLPL advises that the requirement for continuous drilling is to ensure the stability of the borehole. Under Tasmanian environmental noise legislation, an approved instrument would be required to enable these works to occur at night. Works conducted at night also generally represent the greatest environmental noise risk for construction. The noise management levels of the ICNG for the night period were also discussed with the EPA and agreed as an appropriate basis for the assessment.

Noise management levels based on the NSW ICNG are summarised in Table 10. Some of the noise management levels are set at a margin above the rating background level (RBL) which is a measure of the background noise environment in the absence of the noise being assessed. The RBL is defined in NSW policy documents but is determined using very similar procedures to those which apply under the Tasmanian noise measurement manual. For practical assessment purposes, the two are considered equivalent in this report.

In addition to management levels, the NSW ICNG refers to recommended standard working hours which are broadly equivalent to the permissible working hours defined under Tasmanian legislation, with the main difference being that the NSW ICNG defines more restrictive standard working hours for weekend works (i.e. standard working hours under the NSW ICNG do not include Saturday afternoons or Sundays). A recent Tasmanian approval for a major development included project-specific standard working hours which retained work on Saturday afternoons, consistent with permissible work hours under the EMPC Regulations, but excluded construction work on Sundays, consistent with the NSW ICNG. For consistency, the same modified standard working hours are proposed for the assessment of project construction activities.

In addition to the NSW ICNG noise management levels, and the modified standard working hours, the assessment of noise levels during the night period also refers to the Noise EPP acoustic environment indicator. This indicator is based on guidance from the WHO publication *Guidelines for Community Noise* dated 1999 (1999 WHO Guidelines[4]) which is commonly used to inform an assessment of the risk of sleep disturbance. The EPP acoustic indicator and 1999 WHO guidelines are set at a value of 45 dB at a facade location which includes the noise reflected from the dwelling. This is broadly equivalent to a level of 42 dB measured at a free-field location away from the facade.

It is noted that a more recent publication from the WHO in 2018 provides updated guidance on noise levels at night related to transportation noise. However, the 2018 publication notes that 1999 WHO guidelines remain valid for sources not covered by the publication (noting that construction and noise are not covered by the 2018 publication).

4 The 1999 WHO Guidelines provides guidance on thresholds for health-related impacts of noise levels including sleep disturbance and community annoyance, expressed in noise metrics that are commonly considered in noise impact assessments (e.g. the equivalent noise level). More recent publications by the WHO in 2009 and 2018 are based on updated research findings, however the recommendations relate to strategic noise parameters (e.g. average night noise levels over a period of one year) and remain complementary to the guidance contained in the 1999 publication.

Table 10: Proposed project-specific standard working hours and noise management levels, dB $L_{Aeq,15min}$

Time of day	Noise management level	Description
Standard working hours: Monday to Friday 0700 to 1800 hrs Saturday 0800 to 1800 hrs No work on Sundays or public holidays	RBL + 10 dB	Above this level, locations are categorised as 'noise affected' and the NSW ICNG guidance notes that all feasible and reasonable work practices to minimise noise should be applied. In addition, all potentially impacted residents should be informed of the nature of the works to be carried out, the expected noise levels and duration, as well as contact details. As the noise management level is based on the RBL, different levels apply to different receivers.
	75 dB	Corresponds to the NSW ICNG definition for 'highly noise affected' locations. Above this level, the NSW ICNG guidance indicates there may be strong community reaction to noise, and additional noise controls are warranted (such as the introduction of respite periods, and consultation with the community around the times of day when the work would be least disruptive and possible changes to the duration of the work).
Outside recommended standard hours	RBL + 5 dB	Corresponds to the NSW ICNG noise management level outside recommended standard hours. The NSW ICNG guidance notes that all feasible and reasonable work practices should be applied to meet the noise management level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should consult with the community.

5.3.2 Assessment process

The level of noise at each receiver as a result of construction of the project would vary significantly throughout the construction period, according to the stage of the construction, the proximity of the activities as the works progress, the types of equipment being used for each activity, and the duration of operation of each equipment item. Predicting construction noise levels therefore necessitates a number of practical assumptions which result in a conservative assessment of construction noise levels.

The following provides a summary of the process for predicting and assessing construction noise levels associated with the project:

- The proposed construction activities and methods were reviewed to identify a subset of activities for assessment purposes which represent the highest noise levels associated with construction.
- Based on data from AS 2436, BS 5228-1, and the contractor for the project, an inventory of representative noise emission data was developed for major noise generating plant items associated with each construction activity to be assessed. In instances where data was not available in the standards, reference was made to historical MDA measurement data for similar types of equipment. This information was then used to develop overall aggregated noise emission values for each construction activity.
- Environmental noise modelling was carried out to predict the highest noise level at each assessment receiver for each construction activity (see section 5.3.3 for further details regarding noise predictions).
- The predicted noise levels were then compared with the NSW ICNG noise management levels and, where appropriate, the reference level for evaluating the risk of sleep disturbance.

The results of the above assessments and comparisons were used to assess the impact of construction noise and the types of mitigation and management measures that are likely to be required for the control of construction noise.

5.3.3 Noise prediction method

The standards AS 2436 and BS 5228-1 that are referenced for equipment noise emission data also define methods for predicting noise levels at receiver locations. However, the methods are relatively simple and are primarily intended for relatively short separating distances. As a result, the methods tend to overestimate noise levels at distant locations. In this respect, AS 2436 cautions against using calculation method for separating distances greater than 100 m, as is the case for the receivers around the project.

Given the above, and the complex terrain profile of the area around the project, a more detailed noise prediction method has been used for the study. Specifically, noise predictions have been calculated using ISO 9613-2:1996 *Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2). ISO 9613-2 defines a general-purpose noise prediction method that has become established as the primary international standard for calculating environmental noise from commercial and industrial plant.

ISO 9613-2 predicts noise levels for atmospheric conditions which increase receiver noise levels comprising either:

- a wind directed from the noise source to the receivers; or
- a moderate ground-based thermal inversion (a condition when temperatures increase with height above ground, as may occur on clear and still nights).

The calculations were made using the octave band calculation method of ISO 9613-2 using proprietary noise modelling software SoundPLANnoise version 9.0. The adjustments are applied within the noise modelling software and relate to the influence of terrain screening and ground effects on sound propagation.

Conservative assumptions were adopted in applying ISO 9613-2 to predict noise levels from construction of the project. The following key aspects are noted:

- All equipment associated with each construction activity is assumed to operate continuously, simultaneously and at maximum operating duty. This is conservative as the intensity of equipment use would vary, and in many cases, equipment would not operate simultaneously or continuously.
- Atmospheric conditions are set at a temperature of 10 °C and a relative humidity of 70%. These values are commonly adopted across Australia to represent conditions which result in low levels of atmospheric absorption of sound, in turn leading to slightly higher predicted noise levels.

The following additional details of the modelling are noted:

- Ground conditions in the surrounding area were assigned a ground factor of G = 0.5

  The adopted value of G = 0.5 assumes that 50% of the ground cover is acoustically hard (G = 0) to account for potential variations in ground porosity. This is a conservative assessment choice since the ground conditions strictly correspond to porous conditions according to ISO 9613-2 (G = 1.0), which tend to result in lower predicted noise levels.

- Ground profiles around the site were accounted for using a 3D digital terrain model

  The data for this model was sourced from the Land Information System Tasmania (LIST) and comprises ground elevation contours at 1 m height intervals.

- Receiver calculation height of 1.5 m

  This corresponds to the normal measurement height for compliance measurements at receivers.

The modelling is used to predict the total A-weighted noise levels associated with the project.

5.4 Operational noise

5.4.1 Assessment basis

The Tasmanian EIS guidelines specify that consideration should be given to the requirements of the Noise EPP.

The Noise EPP notes that specific requirements relating to noise levels and hours of operation are principally covered by the EMPC Noise Regulations and permits issued for particular activities. The Noise EPP also identifies that a range of factors need to be considered when setting appropriate noise controls, including both the protection of amenity and the wider economic and social benefits of new development.

If the project is approved, permit requirements defining allowable noise levels are envisaged. The specific noise requirements that would apply to the project would be determined by the approval authority. For the purpose of this assessment, predicted noise levels are compared to:

- the acoustic environment indicator levels defined by the Noise EPP;
- the fixed plant noise limits detailed in the EMPC Noise Regulations; and
- design targets sourced from guidance contained in the Victorian Noise Protocol, corresponding to the base noise limits for noise sources located in major urban areas.

Table 11: Assessment basis – reference levels

Reference	Periods	Reference levels
Noise EPP acoustic environment indicator levels	• Day (0700 – 2200 hrs):	55 dB $L_{Aeq,16h}$
	• Night (2200 – 0700 hrs):	45 dB $L_{Aeq,8h}$
EMPC Noise Regulations fixed plant limits	• Day (0700 – 2200 hrs):	42 dB L_{Aeq} [1]
	• Night (2200 – 0700 hrs):	37 dB L_{Aeq} [1]
Victorian Noise Protocol design targets	• Day[2]:	45 dB $L_{Aeq,30-min}$
	• Evening[3]:	40 dB $L_{Aeq,30-min}$
	• Night[4]:	35 dB $L_{Aeq,30-min}$

Note 1: Free-field values equivalent to the facades value specified in the EMPC Noise Regulations

Note 2: Monday to Saturday 0700 – 1800 hrs

Note 3: Monday to Saturday 1800 – 2200 hrs, and 0700 – 2200 hrs on Sundays and public holidays

Note 4: Monday to Sunday 2200 – 0700 hrs

The documents and reference levels listed above are used to provide context to the predicted noise levels and address the Tasmanian EIS guidelines' requirement to consider the Noise EPP. However, the design targets sourced from the Victorian Noise Protocol (the design targets) are proposed as the criteria that typical operations (normal full-power operation of the site during elevated temperatures, excluding emergency standby generators and overload conditions) would ultimately be designed and assessed against. These design targets were selected for the following reasons:

- The design targets were referenced in the concept design assessment and during the initial consultations with EPA Tasmania (see stakeholder engagement details in Section 5.6).
- The low background noise levels measured in the area (see baseline characterisation in Section 6.0) support the use of criteria that are lower than the acoustic environment indicator levels of the Noise EPP to reduce the risk of disturbance as a result of clearly audible noise.

- The project is proposed to operate up to 24 hours per day, 7 days per week, and the operational characteristics of the project are similar during the day, evening and night (i.e. same equipment operating at varying loads according to the requirements of the electricity network and ambient temperatures). This means that the criteria for the evening and night periods will determine the noise control requirements for the project. In this respect, the design targets provide the most stringent criteria for the evening and night period.
- The design targets are suitable for the protection of both external and internal amenity at residential locations, and the avoidance of sleep disturbance during the night. In particular, the design target of 35 dB L_{Aeq} is significantly lower than the 42 dB sleep disturbance criterion reflected in both the Noise EPP and the 1999 WHO Guidelines.
- The design targets for the evening and night are within 5 dB of the background noise levels determined in accordance with the Tasmanian noise measurement manual (an assessment approach commonly used in Australia to assess the risk of the noise being considered intrusive in background noise environments above 30-35 dB L_{A90}).

Community attitudes to environmental noise are highly subjective and vary between individuals and local circumstances. However, the design targets represent stringent requirements which are consistent with the lowest criteria typically applied to major infrastructure projects in Australia. Complying with the design targets, accounting for both the level and character of the noise, will provide a high level of amenity protection for neighbouring residents. Based on the above, the design targets are considered to represent reasonable and practicable levels for minimising the risk of community annoyance from normal operation of the converter station.

In lieu of Tasmanian guidance that is specific to emergency standby plant (for use in emergencies or periodic testing), the following guidance from the Victorian Noise Protocol has also been referenced:

> *Where the noise source under consideration is equipment used solely in relation to emergencies, the relevant noise limit applying to the testing or maintenance of such equipment … is increased by 10 dB for a day period and by 5 dB for all other periods.*

The Victorian Noise Protocol notes the following in relation to emergency equipment and standby generators:

> *… a standby generator means a generator for electrical power used as an alternative to the mains supply in emergencies, or for a maximum period of 4 hours per month for maintenance purposes*

The standby generators associated with the project are solely for emergency purposes, and are proposed to be tested one (1) hour every three (3) months during the daytime on weekdays. These operations are consistent with the emergency equipment provisions of the Victorian Noise Protocol. Accordingly, for consistency with the design targets used for normal operation, the Victorian Noise Protocol provisions for emergency plant are referenced for the emergency standby generators. The proposed requirements for periods of emergency standby generator plant testing are summarised in Table 12.

Table 12: Emergency standby generator plant testing periods

Test scheduling	Assessment criterion
Daytime on weekdays / one (1) hour every three (3) months	55 dB $L_{Aeq,30\text{-}min}$

5.4.2 Assessment process

The converter station is the primary operational noise consideration for the project.

Operational noise levels associated with the converter station were assessed by:

- collating representative noise emission data provided by MLPL for the converter station plant, based on manufacturer data provided for comparable projects;
- reviewing the noise emission data and noise control strategy;
- preparing a 3D digital model of the site using SoundPLAN proprietary noise modelling software;
- predicting environmental noise levels using international standards for the calculation of environmental sound propagation; and
- comparing the predicted noise levels with a range of reference levels, including guidance levels from the Tasmanian legislation presented in Section 3.1, and design targets discussed with EPA Tasmania as part of consultations conducted during the assessment process.

5.4.3 Noise prediction method

The octave band calculation method of ISO 9613-2 has been used to predict noise levels, as used for the construction noise modelling. Consistent with the calculations for construction noise, the method calculates predicted noise levels for atmospheric conditions which increase receiver noise levels.

The operational noise assessment is based on noise modelling for normal full-power operating conditions of stage one and stage two of the project. Specifically, the noise modelling accounts for:

- ambient temperatures of up to 40 °C during the day (0700 to 2200 hrs) and 35 °C during the night (2200 to 0700 hrs), when cooling demands would be high. In practice, ambient temperatures would regularly be lower, particularly at night, and cooling demands would be lower and equate to lower noise emissions; and
- brief periods of increased noise associated with routine testing (once every three months) and emergency use of the standby generator system.

Noise levels during atypical operating conditions, such as atypically high ambient temperatures or a network failure, are addressed qualitatively in the assessment.

5.5 Impact assessment

5.5.1 Risk assessment

A risk-based assessment is used to evaluate noise and vibration impacts associated with construction and operation of the project. Given that noise and vibration is an inevitable consequence of the construction and operation of a major infrastructure project, it is the risk of community disturbance as a result of noise which is assessed in this study. Risks are assessed by accounting for both their consequence (having regard to the noise level, character and duration) and likelihood. The objective of the risk assessment is to determine the appropriate risk controls.

There are multiple factors which influence both the consequence and likelihood of noise and vibration related risks. These include:

- the type of noise or vibration source being assessed and its characteristics (e.g. a continuous or varying noise source and its frequency characteristics);
- the nature of the noise or vibration source (e.g. an activity that can be readily modified or relocated versus an essential activity with limited opportunity to modify, relocate or reschedule);
- the environment in which the noise or vibration is produced (e.g. the context and the background level of noise or vibration);
- the time, duration and regularity of the noise or vibration;
- environmental factors which may change the background noise environment and/or the noise level of the source in question (e.g. wind conditions);
- the type and number of receivers potentially affected by the noise or vibration;
- the type of assessment being used to evaluate the risks (e.g. prediction or measurement-based assessments), and the level of information available for the assessment;
- the assessment framework which applies to each noise and vibration source, and whether acceptable levels of noise and vibration are clearly defined (e.g. legislation which defines prescriptive compliance requirements in quantitative terms or management-based guidance); and
- the options available to mitigate or manage the noise or vibration source.

Alternative methods are available for conducting a combined assessment of risk consequence and likelihood, such as AS ISO 3100:2018 *Risk management – Guidelines*. An adapted version of the risk consequence and likelihood guidance of AS ISO 3100:2018 has been generally adopted for the project EIS. The risk consequence and likelihood descriptors of the adapted version of AS ISO 3100:2018 are relevant to noise and vibration, however their definitions are based on prescriptive comparisons or events which are practically challenging to apply to noise and vibration. Key complicating factors are the varied and subjective reactions of individuals to sound and the challenge of distilling varied noise levels over large study areas into singular outcomes; particularly for effects related to the unavoidable noise of construction which is assessed and managed on the basis of a balance between amenity impacts and the benefits of new development.

In light of these factors, reference was made to EPA Victoria Publication 1695.1 *Assessing and controlling risk: A guide for business* (EPA Victoria Publication 1695.1). for guidance on definitions that could be practically applied to the assessment of noise and vibration. EPA Victoria Publication 1695.1 provides an example framework as depicted in Figure 6 and Figure 7 which includes the same number and range of descriptors for risk consequence and likelihood, but are defined more broadly in terms related to harm and health; considerations which are relevant to the assessment of noise and vibration under Victorian legislation.

Given the above, and in the interest of maintaining a consistent risk assessment framework for the noise and vibration studies of Marinus Link more broadly[5], the consequence and likelihood definitions of *EPA Publication 1695.1* have been adopted for the noise and vibration study of the project. Further, for consistency with *EPA Publication 1695.1*, the corresponding risk rating matrix has also been adopted for the noise and vibration assessment.

Description	Consequence		Rare	Unlikely	Possible	Likely	Certain
Permanent or long-term serious environmental harm / life threatening or long-term harm to health and wellbeing.	Consequence	Severe	Medium	High	High	Extreme	Extreme
Serious environment harm / high-level harm to health and wellbeing.		Major	Medium	Medium	High	High	Extreme
Medium level of harm to health and wellbeing or the environment over an extended period of time.		Moderate	Low	Medium	Medium	High	High
Low environmental impact / low potential for health and wellbeing impacts.		Minor	Low	Low	Medium	Medium	High
No or minimal environmental impact, or no health and wellbeing impacts.		Low	Low	Low	Low	Medium	Medium
		Likelihood	Could happen but probably never will	Not likely to happen in normal circumst-ances	May happen at some time	Expected to happen at some time	Expected to happen regularly under normal circumst-ances

Figure 6: Example risk matrix reproduced from EPA Publication 1695.1

Risk level	Description
Extreme	Totally unacceptable level of risk. Stop work and/or take action immediately.
High	Unacceptable level of risk. Controls must be put in place to reduce to lower levels.
Medium	Can be acceptable if controls are in place. Attempt to reduce to *low*.
Low	Acceptable level or risk. Attempt to eliminate risk but higher risk levels take priority.

Figure 7: Description of risk ratings reproduced from EPA Publication 1695.1

[5] EPA Victoria Publication 1695.1 was adopted for the noise and vibration assessment of the Victorian terrestrial components of the project

Quantitative assessments of noise and vibration, such as measurement and prediction-based studies, inform the assessment of both consequence and likelihood. For example, where there are clearly defined noise limits, low and minor consequence ratings are generally assigned to a compliant noise level. A moderate or higher consequence is generally only applicable to a non-compliant noise level, although a moderate rating may be applicable if there are multiple contributing factors which individually increase the consequence.

Defining quantitative thresholds to further separate consequence levels according to the wide range of factors outlined earlier is complex and subject to considerable uncertainty. Given these uncertainties, defining quantitative boundaries between each consequence level would involve the assignment of arbitrary thresholds which could be misleading and imply a greater level of assessment accuracy than is afforded by the current state of knowledge.

To enable consequence levels to be practically assigned, it is therefore necessary for an element of the consequence ratings to be informed by qualitative assessment, accounting for the range of relevant factors.

A similar level of qualitative assessment is also required to determine the likelihood of the risk, accounting for the range of relevant factors.

5.5.2 Cumulative impact assessment

The EIS guidelines and EES scoping requirements both include requirements for the assessment of cumulative impacts. Cumulative impacts result from incremental impacts caused by multiple projects occurring at similar times and within proximity to each other.

To identify possible projects that could result in cumulative impacts, the International Finance Corporation (IFC) guidelines on cumulative impacts have been adopted. The IFC guidelines (IFC, 2013) define cumulative impacts as those that 'result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones.'

The approach for identifying projects for assessment of cumulative impacts considers:

- Temporal boundary: the timing of the relative construction, operation and decommissioning of other existing developments and/or approved developments that coincides (partially or entirely) with the project.
- Spatial boundary: the location, scale and nature of the other approved or committed projects expected to occur in the same area of influence as the project. The area of influence is defined at the spatial extent of the impacts a project is expected to have.

Proposed and reasonably foreseeable projects were identified based on their potential to credibly contribute to cumulative impacts due to their temporal and spatial boundaries. Projects were identified based on publicly available information at the time of assessment. The projects considered for cumulative impact assessment in Tasmania are:

- Remaining North West Transmission Developments
- Guilford Windfarm
- Robbins Island Renewable Energy Park
- Jim's Plain Renewable Energy Park
- Robbins Island Road to Hampshire Transmission Line
- Bass Highway upgrades between Deloraine and Devonport
- Bass Highway upgrades between Cooee and Wynard

- Hellyer Windfarm
- Table Cape Luxury Resort
- Youngmans Road Quarry
- Port Latta Windfarm
- Port of Burnie Shiploader Upgrade
- Quaylink – Devonport East Redevelopment.

The projects relevant to this assessment have been determined based on the potential for cumulative noise and vibration impacts. Out of the projects identified above, only the Remaining North West Transmission Developments project is relevant to this assessment, due to the interface with the Heybridge converter station site. All other projects have not been considered in the cumulative impact assessment as they have no noise or vibration interface with the project.

Further information on each of the projects is included in Section 7.3.

5.6 Stakeholder engagement

Table 13: Stakeholder engagement summary

Stakeholder	Engagement activity and timing	Discussion topics	Outcomes
EPA	Teleconference with EPA representatives on 17 January 2023	Project site and receivers, background noise levels, design constraints, converter station operational noise control strategy, and preliminary operational noise assessment findings.	The noise and vibration report for the converter station is to present: • baseline noise data in terms of the rating specified in the Tasmanian noise measurement manual; • a description of the noise control strategy; • a list of the number of sources contained in the model; and • an assessment of low frequency noise levels based on C-weighted predictions. A design target of 35 dB L_{Aeq} for the operation of the converter station at night was agreed subject to: • further review of the assessment presented in the noise and vibration report; • an updated assessment being conducted during the design phase of the project when the site layout is finalised and equipment selections have been made, accounting for any applicable adjustments for noise character; and • a post-construction noise assessment based on compliance monitoring conducted in accordance with the Tasmanian noise measurement manual, accounting for any applicable adjustments for noise character. Design targets for standby generator plant testing were discussed on the basis of preliminary details about the timing of tests. Revised test timing limited to once every 3 months was discussed and is confirmed in this report.
EPA	Teleconference with EPA representatives on 5 August 2024	Construction noise management levels	Use of management levels for construction activity in accordance with NSW ICNG

5.7 Assumptions and limitations

The assessment is based on the following assumptions:

- construction plant noise emissions: the make and model of equipment used to construct the project is unknown at this stage. Empirical noise emission data from standards and previous measurements are therefore assumed to represent the types of construction plant that are expected to be required. To provide a conservative assessment which is likely to overestimate construction noise levels, representative noise emission data was selected from the mid to upper range of the available empirical data.
- construction noise modelling: all plant associated with each of the construction activities are assumed to be operating simultaneously and producing their highest noise emissions for 100% of an assessment time period. In particular, HDD shore crossing works are assumed to involve two HDD rigs operating simultaneously and continuously for a period of up to 6 months. In practice, the noise emissions of individual plant items are likely to vary during an assessment time period (i.e. produce noise emissions lower than the assumed values) and some plant items would only operate for a portion of the time. The assessment assumption is therefore conservative and lead to higher predicted noise levels than is likely to occur in practice.
- converter station plant noise emissions: the equipment selections for the project would be the subject of a commercial tender process during the detailed design phase of the project. Representative noise emission data (sound power levels) provided by MLPL, based on manufacturer data provided for similar projects, has therefore been assumed for this assessment. The assumed data generally represents low noise emission equipment that has been selected to address site-specific noise constraints associated with the Heybridge converter station. The assumed emission data is expected to involve the use of proprietary noise attenuation systems and plant enclosures. The actual noise emissions of candidate plant items would need to be verified as part of the commercial tender process, and equipment selected to achieve assessment outcomes that are consistent with the findings of this study.

6.0 EXISTING CONDITIONS

A survey of existing noise levels was conducted at the following locations:

- on the site of the proposed converter station; and
- at the site of one of the proposed hamlets within the residential nature reserve to the west.

A more detailed description of each location is provided in Table 14. Each location is indicated on the aerial photo in Figure 8 below along with the location of nearest receivers considered in the assessment.

Table 14: Noise monitoring locations – description

Area	Nearest tower location and description
Site 1	Proposed converter station Disused commercial/industrial site amid a mixed-use suburban area affected by noise from local and main roads.
Site 2	Residential nature reserve Natural environment on the fringe of suburban areas, subject to a mix of noise influences from local natural sources and distant road traffic. The site is elevated and relatively exposed, and wind disturbed vegetation is also a feature of the ambient noise environment.

At each location, an unattended monitor was used to continuously sample noise levels during the day, evening and night periods. Measurements were conducted over a period of 1-2 weeks between Friday, 6 May and Wednesday, 25 May 2022.

Wind and rainfall were assessed based on a combination of publicly available data from the Bureau of Meteorology monitoring station at Burnie and local weather stations deployed as part of a simultaneous study for the Remaining NWTD project.

The measured background noise levels for each location were analysed in accordance with the *Tasmanian Noise Measurements Procedures Manual, Second Edition* dated 2008 (the *Tasmanian noise measurement manual*). This involved collating noise and weather measurement data for each 10-minute period of the survey and producing an aggregated single figure value to represent the day, evening and night background noise level for each location. Any 10-minute period in which rain fall was recorded, or the average wind speed was equal to or greater than 5 m/s, was removed from the analysis. The datasets were also reviewed to identify any potential systematic or anomalous trends which may relate to unrepresentative/extraneous noise influences; no clearly identifiable trends of this nature were evident in the measurements.

The derived background noise levels for the day, evening and night periods, as defined by the Tasmanian noise measurement manual, are summarised in Table 15.

Table 15: Measured background noise levels, dB L_{A90} per period

Location	Day (0700 – 1800 hrs)	Evening (0700 – 2200 hrs)	Night (2200 – 0700 hrs)
Site 1	42	36	32
Site 2	38	35	32

Full survey details, including images of the monitoring locations, daily survey results and graphical results are presented in Appendix C.

The background noise levels summarised in Table 15 are generally low. While the background noise levels represent the underlying, or quiet periods, at each location, the total ambient noise levels (average/equivalent noise levels) during the day at both locations were in the range of 40-50 dB $L_{Aeq,10min}$, except on days when noise is likely to have been elevated by high winds and rain. Existing noise levels are therefore below the Noise EPP indicator noise levels (see Section 3.1.2).

These results are consistent with expectations for the areas and are likely to be representative of the range of background noise levels at most receivers near the project. However, in recognition of the extent of adverse weather conditions during the survey, and to enable a more detailed account of background noise levels around the project, the management and mitigation measures discussed subsequently in Section 7.5 include a recommendation for further background noise monitoring before the commencement of construction activities which may result in environmental noise in the surrounding areas, such as vegetation clearance and civil works.

Figure 8: Background noise survey locations

7.0 IMPACT ASSESSMENT

This section presents assessment of:

- noise and vibration levels associated with construction of the project;
- noise levels associated with operation of the project (environmental vibration is not a relevant consideration for the operational stage of the project);
- recommended management and mitigation measures for controlling noise and vibration risks; and
- a summary of the environmental noise and vibration risk assessment.

7.1 Construction noise and vibration

This section presents the noise emission data which has been used to predict noise levels from key construction activities, followed by an assessment of construction noise and vibration.

The construction noise assessment considers the following activities:

- converter station earthworks and infrastructure construction;
- shore crossing construction; and
- off-site transportation.

These activities selected for assessment provide a representation of the range of upper noise levels of construction, and are suitable for informing the overall assessment of risk and defining recommended management and mitigation measures.

7.1.1 Noise emission data

Noise emission data for the proposed construction equipment associated with the HDD shore crossing has been provided by the contractor. Spectral data was not provided and was therefore estimated based on similar equipment from BS 5228-1.

Representative noise emission data for the proposed construction equipment associated with the converter station earthworks and infrastructure construction have been determined based on AS 2436 and BS 5228-1 as well as measured equipment noise levels sourced from historic MDA measurements.

Table 16 summarises the noise emissions (sound power levels) for the main noise generating plant items associated with construction of the project.

Table 16: Construction noise sources sound power data, dB L_{WA}

Noise source	Sound power level
Shore crossing construction	
Drill rig crawler	98
Drill rig powerpack*	108
Excavator 36T	104
High pressure mud pump	98
Isuzu D-Max light vehicles (4WD)	106
Isuzu NPS crew bus	106
Mud mixing System	104
Mud separation system	100

Noise source	Sound power level
Telehandler	104
Tensioner PowerPack	90
Water winning pump*	93
60KvA generator*	100
100KvA generator*	103
250KvA generator*	103
500KvA generator*	106
Converter station earthworks	
Concrete agitator	109
Concrete saw	117
Dozer	108
Dump truck	117
Excavator	107
Light vehicles	100
Roller	108
Tipper	107
Wheeled loader	113
Converter station infrastructure	
Hand tools	116
Light vehicles	100
Mobile crane	113
Non-slewing crane	104

* fitted with an acoustic enclosure

Overall aggregated total sound power levels for key construction activities have been determined based on the indicative equipment schedule presented in Table 17. Actual equipment choices and quantities for each task would vary as the design and construction method for the project is refined. Importantly, many items of equipment would only operate part of the time while the activity is taking place. The equipment quantities and choices therefore provide a conservative representation of the activity for risk assessment purposes.

The overall total aggregated sound power levels for each of the main construction activities are detailed in Table 17. The assessment assumes that each item of plant associated with a task operates simultaneously at the same point; this is appropriate for construction activity occurring at distance from the receivers, but will overestimate the noise of activity occurring close to the receivers (i.e. at reduced working distances where it is not physically possible for all of the equipment to be simultaneously working at the reduced distance).

Table 17: Overall sound power levels of main construction activities, dB L_{WA}

Construction activity	Plant/equipment	Approximate overall sound power level
Shore crossing	1x Drill Rig Crawler, 1x Drill Rig Powerpack, 1x Isuzu NPS crew bus, 4x Isuzu D-Max LVs (4WD), 1x Mud mixing system, 1x mud separation system, 1x telehandler, 1x water winning pump, 2x excavator, 1x 60KvA generator, 1x 100KvA generator, 1x 250KvA generator, 1x 500KvA generator, 1x high pressure mud pump, 1x tensioner power pack	117
Earthworks and civil works	2x excavator, 1x dozer, 1x wheeled loader, 2x dump truck, 1x roller, 2x tipper, 5x light vehicles, 1x concrete agitator, 1x concrete saw	120
Infrastructure works	5x light vehicles, 1x mobile crane, 4x hand tools, 3x non-slewing crane	125

7.1.2 Noise management levels

The noise management levels used to assess the predicted construction noise levels have been determined based on the method and standard working hours discussed in Section 5.3.1 and the background noise levels presented in Section 6.0.

As discussed in Section 5.3.1, the noise management levels referred to in the NSW ICNG are based on a measure of the background noise environment referred to as the rating background level, as defined in NSW policy documents. However, the RBL is determined using very similar procedures to those which apply under the Tasmanian noise measurement manual. For practical assessment purposes, the two are considered equivalent in this report and, for this reason, have been adopted as the basis for determining the noise management levels.

Section 6.0 also notes that, while the background noise levels are likely to be representative of the range of background noise levels at most receivers near the project, further background noise monitoring is recommended prior to the commencement of construction. This recommendation is reflected in the management and mitigation measures discussed subsequently in Section 7.5.

Accordingly, the noise management levels are indicative for assessment purposes, and would be subject to refinement based on updated background noise measurement data. For this reason, and in recognition of the night-time being the critical period for the assessment of construction outside standard working hours, the noise management levels are defined for the proposed standard working hours and the night-time only. Updated background noise data obtained in the future may be used to separately define noise management levels for the evening and Sundays.

Based on the above, the key noise management levels for the assessment are presented in Table 18. Note that the noise management levels based on the site 1 data are primarily relevant to existing receivers to the south, southeast and east of the project, whereas the noise management levels based on the site 2 data are primarily relevant to potential future receivers to the west.

Table 18: Noise management levels (indicative), dB $L_{Aeq,15min}$

Period	Noise management level Site 1	Noise management level Site 2	Brief description
Standard working hours	52	48	Above this noise management level, locations are categorised as noise affected. All feasible and reasonable work practices to minimise noise should be applied. In addition, all potentially impacted residents should be informed of the nature of the works to be carried out, the expected noise levels and duration, as well as contact details.
	75	75	Above this noise management level, locations are categorised as highly noise affected. Above this level, there may be strong community reaction to noise, and additional noise controls are warranted (such as the introduction of respite periods, and consultation with the community around the times of day when the work would be least disruptive and possible changes to the duration of the work).
Night	37	37	All feasible and reasonable work practices should be applied to meet the noise management level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should consult with the community.

7.1.3 Predicted noise levels

The predicted noise levels for each receiver and assessed construction activity are presented in Table 19. The predicted noise levels are based on the combined simultaneous operation of all listed plant associated with the activity (as detailed in Table 17 Section 7.1.1).

For the shore crossing, only one rig would be working at a time. Hence, the predicted noise levels are shown separately for construction of the eastern and western shore crossings.

The results for construction activity are also presented as predicted noise contours in Figure 9, Figure 10, Figure 11 and Figure 12. These figures also show the location of the area sources used in the modelling to represent each activity.

The predicted noise levels do not include adjustments for noise characteristics such as tonality, impulsiveness or low frequency. These types of characteristics are a relevant risk factor for construction noise and may be applicable in some instances. Conversely, the predicted noise levels are based on very conservative scenarios involving simultaneous noise generation from all plant and activities for the entire duration of an assessment window. Applying penalties to these predictions is therefore likely to result in an unrealistic level of conservatism in many cases. However, character related adjustments are a relevant risk to consider and are discussed further in the subsequent assessment sections.

Table 19: Existing receivers – predicted construction noise levels, dB L_{Aeq}

Receiver	Direction	Type	Shore crossing HDD western rig	Shore crossing HDD eastern rig	Earthworks and civil	Infrastructure
B1539	Southeast	Existing dwelling	35	32	45	50
B1540	Southeast	Existing dwelling	41	30	43	48
B1544	Southeast	Existing dwelling	41	31	44	49
B1550	South	Existing dwelling	39	35	42	48
B1551	South	Existing dwelling	41	37	45	50
B1557	South	Existing dwelling	34	41	41	47
B6195	Southeast	Existing dwelling	39	32	44	49
B7585	Southeast	Existing dwelling	38	29	43	48
B7591	Southeast	Existing dwelling	37	28	41	46
B7606	Southeast	Existing dwelling	37	32	40	45
B7610	Southeast	Existing dwelling	37	36	39	44
B7636	East	Existing dwelling	37	33	33	38
B7641	East	Existing dwelling	39	36	38	43
B7647	East	Existing dwelling	41	41	39	44
B7716	Southeast	Existing dwelling	38	29	43	48
B7722	Southeast	Existing dwelling	35	29	42	47
B7734	Southeast	Existing dwelling	38	34	38	43
B7740	East	Existing dwelling	38	38	37	42
B7744	Southeast	Existing dwelling	40	33	45	50
Range – existing receivers			**34 - 41**	**28 - 41**	**33 - 45**	**38 - 50**

Table 20: Potential future receivers – predicted construction noise levels, dB L_{Aeq}

Receiver	Direction	Type	Shore crossing HDD western rig	Shore crossing HDD eastern rig	Earthworks and civil	Infrastructure
B4853*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (southeast corner)	60	54	58	64
B4854*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (southeast corner)	49	54	56	61
B4855*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (south end)	41	54	53	59
B4856*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (southwest corner)	39	49	46	51
B4857*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (centre)	42	43	37	43
B4858*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (north end)	34	37	38	43
B4859	West	George Street residential development (east boundary)	29	32	30	35
Range – potential future receivers			**29 - 60**	**32 - 54**	**30 - 58**	**35 - 64**

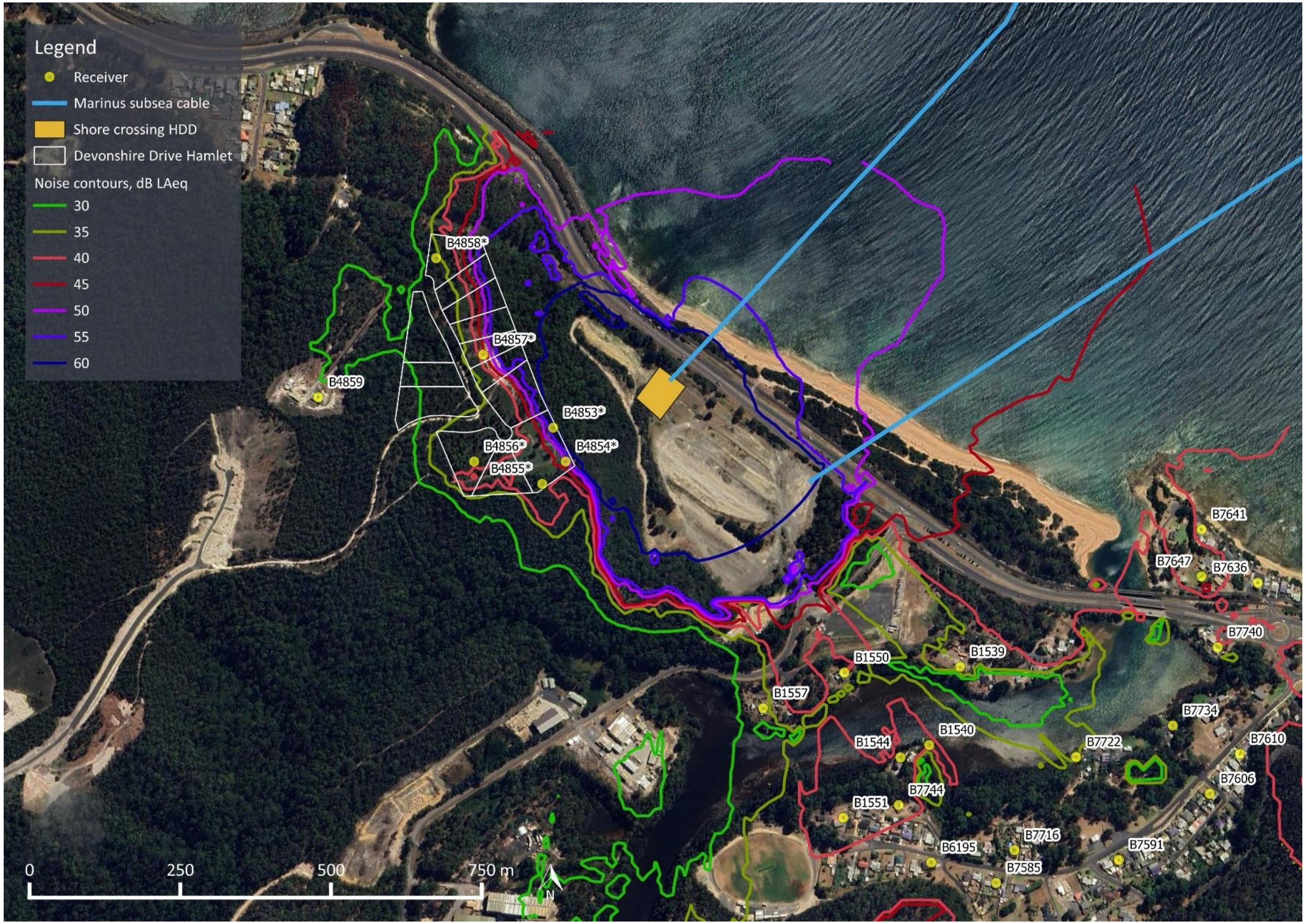


Figure 9: Heybridge converter station site – predicted noise contours for shore crossing HDD western rig, dB L_{Aeq}

Figure 10: Heybridge converter station site – predicted noise contours for shore crossing HDD eastern rig, dB L_{Aeq}

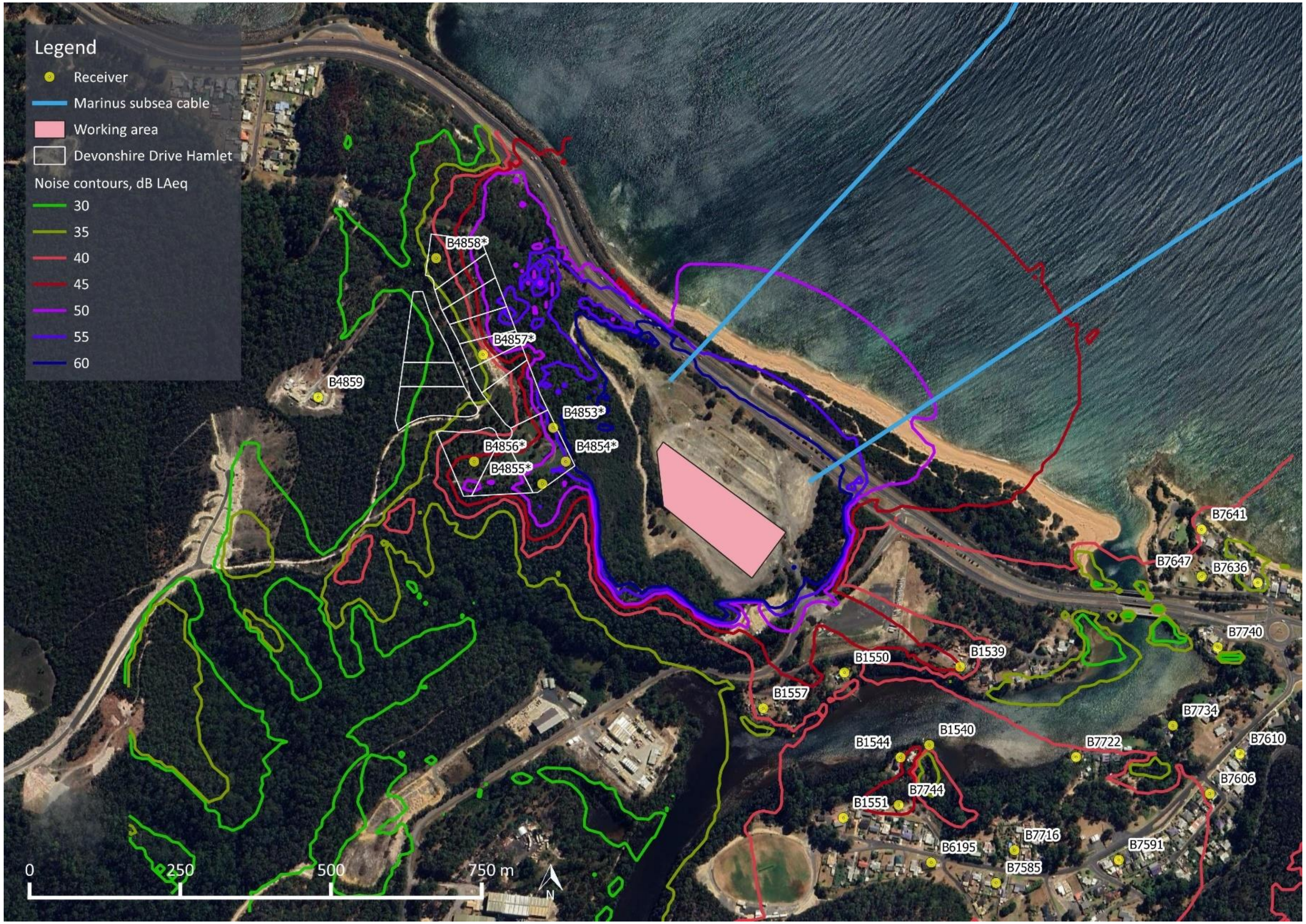


Figure 11: Heybridge converter station site – predicted noise contours for earthworks and civil works, dB L_{Aeq}

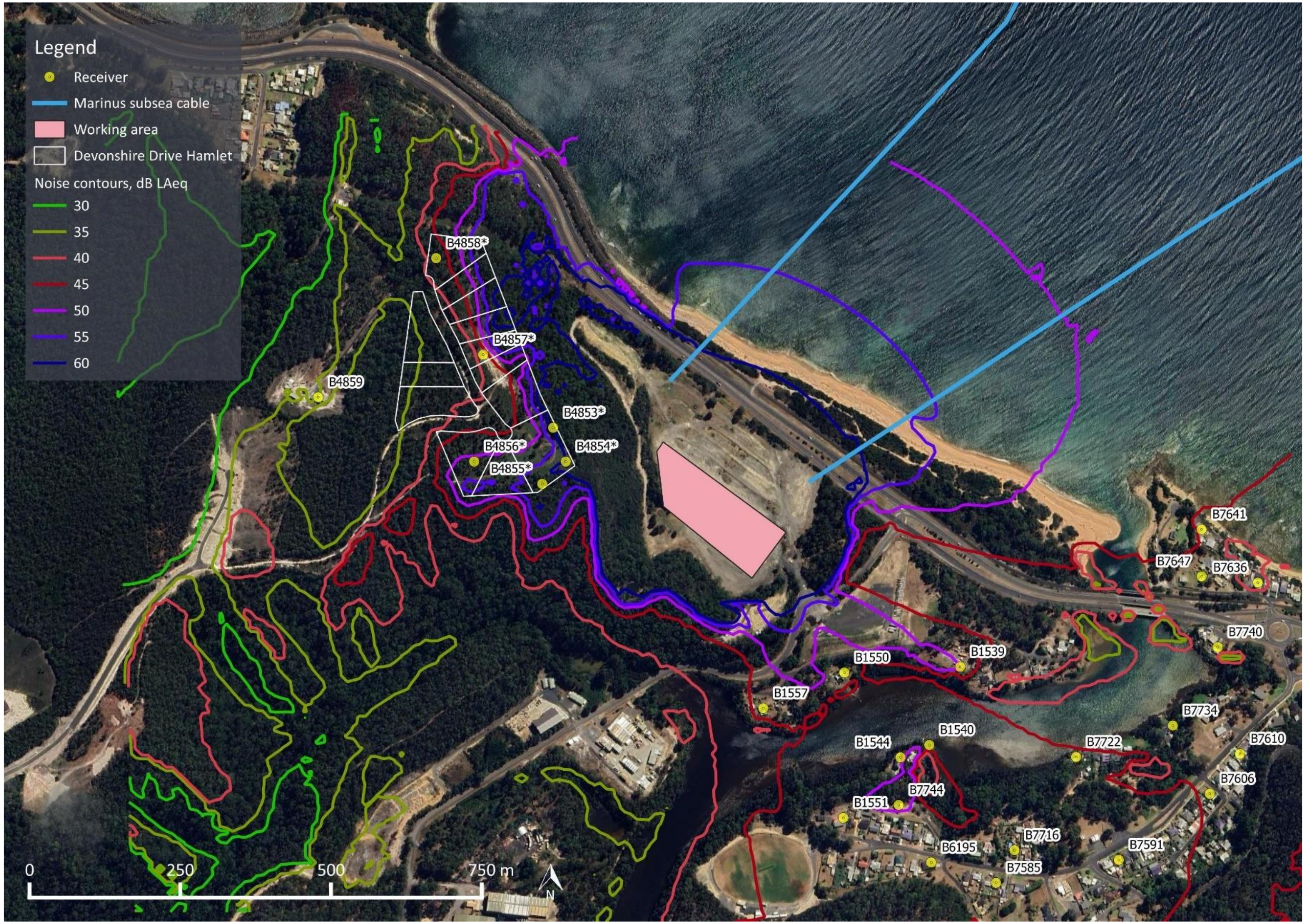


Figure 12: Heybridge converter station site – predicted noise contours for infrastructure works, dB L_{Aeq}

7.1.4 Assessment – works during the standard working hours

This section presents an assessment of the predicted noise levels presented in Section 7.1.3 against the relevant noise management levels for standard working hours.

In relation to existing receivers, the predicted noise levels for all of the assessed activities are below the relevant noise management level of 52 dB L_{Aeq}. Further, for most activities and receivers, the predictions are below the noise management level by a margin of at least 5 dB such that the application of an adjustment for noise character would not alter the assessment finding.

At the nearest existing receivers to the south and southeast, the predicted noise levels are within 5 dB of the noise management level for infrastructure works. Infrastructure works are among the activities which could attract adjustments for noise character, such as impulsive noise from metal impacts/contact and tonal noise from grinding and saws. While the prediction is inherently conservative, particularly for infrastructure works (activity is likely to be more sporadic than the continuous/simultaneous activity assumed in the modelling), there is a risk of noise levels above the noise management levels for these locations.

In relation to potential future receivers within the approved developments to the west, the predicted noise levels at the nearest locations of the Devonshire Drive Hamlet are above the relevant noise management level of 48 dB L_{Aeq} for all activities. The highest predicted noise levels for the various activities range from 54 to 64 dB L_{Aeq}, and the elevated noise levels increase the risk of character adjustments being applicable. In all cases though, the predicted noise levels are below the highly affected noise management level of 75 dB L_{Aeq}, including consideration of the risk of character related adjustments. Construction noise levels are predicted to be highest at the south and southeast section of the Devonshire Drive Hamlet. The site is presently undeveloped, and the risk of construction noise impacts to future dwellings depends on the timing of construction of these dwellings (i.e. whether the hamlet would be occupied at the time when constructions works are occurring). In relation to the George Street Development where construction work has commenced, the predicted construction noise levels are well below the noise management level, irrespective of any considerations relating to noise character (which are less likely for this location given the low predicted noise levels).

The predictions in Section 7.1.3 are listed separately for the three activities assessed, with the shore crossing activity further divided into the eastern and western rig. However, if HDD works associated with the shore crossing occur at the same time as the noisiest phases of the civil works or infrastructure works, the cumulative construction noise levels associated with the project could be higher than indicated. Specifically, cumulative construction noise levels during noisier phases of construction may be approximately 1-3 dB higher than indicated for civil works, infrastructure works or shore crossing if the works occur at the same. However, the existing locations with the potential for the greatest cumulative increases are the locations with lower predicted noise levels. Specifically, at all locations where the predicted cumulative noise increase is more than 1 dB, the highest predicted noise levels of each construction activity are at least 5 dB lower than the applicable noise management level. In relation to potential future receivers to the west, the effect of cumulative noise would increase the number of receivers where noise levels are predicted to be above the noise management level. These findings do not alter the management and mitigation measures which apply to each of the assessed construction activities.

It is however important to note that the predictions represent the upper noise levels of construction activities based on worst-case scenarios for each activity. In practice, noise levels are likely to be lower than predicted in most instances.

These findings represent a common outcome for construction work in semi-urban areas, particularly for a major infrastructure project. However, the results indicate there is a risk of community disturbance from construction noise, particularly given the duration of the construction program. Mitigation and management of construction noise impacts would therefore need to be prioritised during the development of detailed construction plans. This would need to address best practice measures for the control of both overall noise levels and noise characteristics, including selection of low noise emission plant, localised screening where practicable and effective, and use of broadband or visual warning signals to minimise potential disturbance from tonal sounds.

An assessment of risk based on these findings is presented in Table 21.

Table 21: Construction during standard working hours – risk assessment

Item	Rating	Comments
Risk consequence	Low to Moderate	Predicted noise levels are typical of the range expected for construction of a major infrastructure project in a semi-urban area. However, some activities could result in noise levels above the noise management level at the nearest existing receivers, and predicted noise levels at the nearest locations of the Devonshire Drive Hamlet are well above the noise management level, and are sufficient to represent a risk of disturbance to future residents in this area, particularly given the duration of construction works.
Likelihood	Possible	The predicted construction noise levels are based on conservative assumptions. Noise levels in practice are expected to be lower than predicted for most of the time. Further, the highest noise impacts relate to the Devonshire Drive Hamlet which remains undeveloped and it is presently unclear whether dwellings would be established at the time of the proposed construction works.
Overall risk	Low to Medium	The applicable guidance for this rating is that the risk can be acceptable if controls are in place, and attempts should be made to reduce the risk to low.

The medium risk rating determined in Table 21 supports that dedicated noise mitigation and management measures are warranted for construction activities at the converter station. Further discussion of controls is provided subsequently in Section 7.1.8 and Section 7.5.

7.1.5 Assessment – unavoidable works outside standard working hours

Civil and infrastructure works would be restricted to standard working hours generally. Exceptions to this would be unavoidable works for atypical tasks which occur infrequently (e.g. a concrete pour which needs to continue uninterrupted).

The primary consideration for works outside standard working hours is the shore crossing HDD works which could occur 24 hours per day, 7 days per week, for a period of up to 6 months in total. MLPL advises that these works would need to be continuous to ensure the stability of the bore holes.

The predicted HDD works noise levels at existing receivers in Table 19 range from 28 to 41dB L_{Aeq}, indicating noise levels below the relevant noise management level of 37 dB L_{Aeq} at most locations, but above the noise management level at various positions to the southeast and east of the site. The complexity of the terrain around the project is a key contributor to this variation, with some locations afforded shielding from the noise as a result of being located at a lower ground elevation, while others are shielded by the effect of a large mound in the terrain (proposed to be retained) directly to the east of the eastern drill rig work location.

The above findings are based on the predicted noise levels without adjustments for characteristics such as tonality or low frequency. The guidance of the NSW ICNG does note the application of adjustments for certain types of drilling activities, and there is a risk of penalties being applicable for tonality or low frequency, particularly diesel-powered drive systems for the drilling rig and standby power. If these penalties were applicable, noise levels would be above the noise management level for a greater portion of the existing receivers, and by a margin of more than 5 dB at the locations where predicted noise levels are highest.

At all of the existing receivers, the predicted noise levels are below the sleep disturbance reference level of 42 dB L_{Aeq}, based on the Noise EPP acoustic environment indicator and the 1999 WHO Guidelines.

In relation to potential future receivers within the approved developments to the west, the predicted noise levels at most of the Devonshire Drive Hamlet indicated in Table 20 are above the relevant noise management level of 37 dB L_{Aeq}, with the nearest locations being considerably higher at levels up to 60 dB for the western HDD location and 54 dB for the eastern HDD location. These findings would be exacerbated if adjustments were applicable for noise character. The predicted noise levels are also well above the sleep disturbance reference level of 42 dB L_{Aeq}. This indicates a risk of sleep disturbance at these locations if a dwelling was to be developed and occupied by the time the HDD works occur.

In terms of the George Street residential development where construction work has commenced, the predicted noise levels range between 29 and 32 dB for the two HDD locations and are therefore well below both the noise management level and the reference level for sleep disturbance.

Based on the findings for both existing and proposed future receivers, noise control for HDD works at night is a critical consideration.

Noise modelling was conducted to investigate the potential effectiveness of barriers located to the south and east of each drilling location to shield existing receivers. The results demonstrated the potential for noise reductions of up to 4 to 6 dB at some of the nearest existing receivers. However, the benefits at other locations were limited (less than 2 dB), and the effectiveness of this type of barrier configuration is likely to be limited in practice by the effect of access points for large vehicles and plant. Further, barriers are not a practical option for addressing noise levels to the potential future receivers of the Devonshire Drive Hamlet, due to the position of the development site at a much higher elevation. Large scale noise enclosures can be a viable consideration for certain types of projects involving works during the night, however this is typically more relevant for works over much longer periods than the 3 months of drilling proposed at each of the shore crossings.

Given the above, the priorities for noise control and noise management are expected to comprise:

- avoidance or limiting of HDD works at night where reasonably practicable;
- selection of HDD plant with the lowest available noise emissions and, where available, adoption of a noise mitigation kit such as exhaust silencers and treatment of engine enclosures;
- elimination or mitigation of annoying noise characteristics which could attract penalties, with particular attention to the frequency characteristics of the drive systems of the HDD rigs (i.e. addressing low frequency and tonality of diesel engines);
- localised noise barriers around specific plant items (as distinct from the broader barrier structures reviewed above) where effective noise reductions are achievable and local circumstances permit;
- efficient work practices to minimise the duration of the works; and
- advance communications with all potentially affected residents to advise them of planning works, and where scheduling is flexible, potentially identify scheduling options and dates which would be least disruptive for the local community.

An assessment of risk based on these findings is presented in Table 22.

Table 22: Shore crossing HDD works outside standard working hours – risk assessment

Item	Rating	Comments
Risk consequence	Moderate to major	Shore crossing HDD works are predicted to result in noise levels above the noise management level for the nearest existing receivers, and well above the noise management level for potential future receivers within the Devonshire Drive Hamlet. The predicted noise levels are also above the sleep disturbance reference level in the Devonshire Drive Hamlet. As HDD works may need to occur for a total period of up to 6 months, there is potential for noise levels above sleep disturbance thresholds for an extended period.
Likelihood	Possible to likely	The predicted construction noise levels are based on conservative assumptions, and noise levels in practice are expected to be lower than predicted for most of the time. Irrespective, the results are sufficient to indicate that noise levels above the reference level for sleep disturbance are likely to occur at receivers within the Devonshire Drive Hamlet, and possible at existing receivers, if dedicated noise control measures are not implemented.
Overall risk	High	The applicable guidance for this rating is that there is unacceptable level of risk and controls must be put in place to reduce to lower levels.

The high risk rating determined in Table 22 indicates that dedicated noise mitigation and management measures would be required to enable HDD shore crossing works to occur at night. Management and mitigation measures are discussed subsequently in Section 7.1.8 and Section 7.5, including examples of the measures that are expected to meet the requirements.

7.1.6 Construction vibration

Predicting vibration propagation through the ground is complex and subject to considerable uncertainty due to the variable influence of ground conditions at the source, propagation path and receiver.

At this stage in the assessment process, the indicative minimum working distances presented in the NSW CNVG provide a reference for risk assessment purposes. The indicative minimum working distances are reproduced in Table 5 of Section 3.2.1 and equate the following range of distances for different types of construction activity:

- indicative minimum working distance to avoid cosmetic building damage: up to 25 m; and
- indicative minimum working distance for human comfort: up to 100 m (greatest distance relates to vibratory rollers).

The nearest existing dwellings to the project are located approximately 138 m from the project boundary and are therefore beyond the indicative minimum working distances provided by the NSW CNVG for both cosmetic building damage and human comfort.

The nearest proposed residential lot boundaries (Devonshire Drive Hamlet) are located approximately 90 m from the project boundary. The exact dwelling locations are not known at this stage but are likely to be located further away, accounting for setback distances from the lot and project boundaries. Vibration may be perceptible at a receiver located less than 100 m from vibration intensive construction activities. However, the brief periods in which vibration may be perceived are expected to be acceptable, accounting for relevant international guidance concerning transient sources of vibration. In addition, the number of receivers where this is a risk is small and can be appropriately managed through a combination of appropriate plant selection, consultation with potentially affected receivers, and vibration monitoring if/where required.

Vibration from construction activities is therefore not a material consideration for the project.

An assessment of risk based on the findings is presented in Table 23.

Table 23: Construction vibration – risk assessment

Item	Rating	Comments
Risk consequence	Minor	All receivers are located well beyond the indicative distance where there is a risk of cosmetic building damage as a result of vibration intensive construction plant. However, some of the proposed receivers may be close enough for there to be the potential for disturbance of human comfort.
Likelihood	Unlikely	At the small number of receivers that may be within the indicative distance where there is a risk of disturbance of human comfort, the risk can be appropriately managed though suitable plant selections and vibration monitoring if/where required. Given that the receivers are significantly further than the distances for cosmetic building damage, vibration impacts are unlikely.
Overall risk	Low	The applicable guidance for this rating (the lowest risk rating under the Victorian EPA Publication 1695.1 guidance) is that the level of risk is acceptable. Attempts to eliminate the risk should be made, but higher risk levels take priority.

7.1.7 Off-site transportation noise

It is the aim to source all civil works materials for the Heybridge converter station locally. No air or sea transportation will be required. It is assumed the HVDC converter station components will be shipped to Port of Burnie and trucked to site.

The EIS (Tasmania) Technical Report – Traffic & Transport shows that during the construction stage the estimated number of heavy vehicles return trips would peak at 60 per day, based on the number of heavy vehicle trips for construction. The indicative transport routes are shown in Figure 13.

The majority of the routes to the project site are along the Bass Highway from either Burnie (west of the site), Devonport or Launceston (East of the site). Vehicles would turn off the Bass Highway into the site at the Minna Road intersection.

Noise levels from pass by of heavy vehicles have been estimated to assess the noise levels at receivers along the route. It is not considered practical or warranted for this type of noise source to review in detail the proximity of all potential receivers along each transport route. Accordingly, the estimates have been determined for example setbacks from the edge, ranging from 15 m to 100 m. It is expected that some receivers may be located less than 15 m from the transport route and may experience noise levels from the heavy vehicle movements that are higher than those presented in Table 24.

The prediction method is based on a simple model of a moving point source of noise and does not account for potential site-specific factors such as ground attenuation and shielding. These predictions are primarily intended as an indication of the potential contribution of construction related vehicle movements to total road traffic noise levels along the routes. The estimated off-site construction traffic noise levels at various distances are presented in Table 24.

Table 24: Estimated heavy vehicle noise levels at varying distances, dB $L_{Aeq,1hr}$

Distance from road	15 m	25 m	50 m	100 m
Average noise level	55	53	50	47

The TNMG noise targets are not directly applicable to short-term increases in noise levels from construction traffic, and also apply to noise levels over longer periods of the day and upper noise level metrics (i.e. 16 hour and 18 hour noise levels, described in terms of both equivalent L_{Aeq} and upper L_{A10} noise levels). However, the range of predicted equivalent noise levels presented in Table 24 indicate the following:

- The predicted noise contribution of off-site construction traffic is well below the 63 – 68 dB $L_{A10,\ 18\ hour}$ targets which apply to long-term / permanent road traffic noise levels
- The predicted noise contribution of off-site construction traffic is comparable to or lower than the 50 – 55 dB $L_{Aeq,16\ hour}$ range of acoustic indicator levels that are also referenced in the TNMG as an alternative assessment criterion for long-term / permanent road traffic noise levels.

The above are simplified comparisons given that the TNMG criteria apply to total noise levels. Conversely, noise criteria applied to construction activity are normally less stringent than those applied to long-term/permanent sources of noise.

However, in lieu of specific requirements, or information about baseline traffic flows, the comparison is sufficient to indicate that off-site traffic related to construction of the project is unlikely to warrant dedicated noise mitigation measures, particularly given the temporary nature of the associated impact.

Figure 13: Construction transport routes to the project site (image courtesy of Coffey)

7.1.8 Management and mitigation measures

The assessment of construction noise related risks presented in Section 7.1.4 and Section 7.1.5 generally indicate risk ratings ranging from low to medium, except for potential night works associated with the construction of the shore crossing which is rated as a high risk. The construction vibration risk is rated as low.

Noise mitigation and management measures are therefore required to minimise the risk as follows:

- **NV01: Conduct additional background noise monitoring**

  The purpose is to establish the requirement to obtain additional background noise data which will then inform the development of controls under (NV02).

- **NV02: Develop and implement a construction noise and vibration management plan**

  The purpose is to establish the requirement of a comprehensive plan which describes all measures that would be used to minimise the impact of construction noise and vibration as far as reasonably practical, based on updated information for the planned construction works and equipment selections.

- **NV03: Conduct construction noise monitoring**

  The purpose is to establish the requirement to conduct construction noise monitoring at locations specified in the construction noise and vibration management plan, and requirements concerning construction noise monitoring reports.

Each of the above measures are specified in detail in Section 7.5.

7.1.9 Residual impacts

Provided that the management and mitigation measures are adhered to, the risk rating of the residual impacts would be limited to low to medium. The inherent and residual risks for each aspect of construction noise are summarised in Section 7.6.

7.2 Operational noise

This section presents:

- details of the converter station noise sources and their noise emissions;
- predicted noise levels associated with operation of the converter station;
- discussion of the predicted noise levels and the impacts;
- recommended management and mitigation measures to control operational noise; and
- residual impacts based on compliance with the management and mitigation measures .

7.2.1 Converter station noise sources and noise control strategy

Environmental noise associated with operation of the converter station was identified as a key design consideration during the concept development for the project, primarily due to the proximity of potential future dwellings to the west of the site at the Devonshire Drive Hamlet of the Residential Nature Reserve. A particular consideration for these receivers is their elevated position relative to the site of the project; a ground elevation difference of more than 80 m. The effect of this height difference is that barriers are not a practical noise control measure. The main noise control options for the project therefore comprise strategic equipment placement, selection of low noise emission plant, and the use of acoustically-rated enclosures for certain equipment items.

MLPL collated noise emission data (sound power levels) for the plant from example vendor data for similar types of projects, including standard and noise attenuated plant options. The sound power levels nominated for the assessment generally range from 70 dB L_{WA} for auxiliary transformers through to 87 dB L_{WA} for the valve coolers. The key items of external plant with respect to noise emissions are the valve coolers and the converter transformers. The noise emissions provided for these equipment items are very low, and were selected by MLPL in recognition of the stringency of the noise constraints for the site. Achieving these emissions is expected to involve selection of inherently low noise emission design solutions and, in the case of the converter transformers, the use of proprietary noise attenuation measures such as enclosures.

Based on the results of iterative noise modelling, additional noise controls were identified for the operation of the valve coolers during the night. Specifically, an 8 dB reduction in noise levels has been accounted for in the noise modelling (i.e. 8 dB lower than the attenuated values referenced for operation during the day and evening periods) of the valve coolers at night, and would likely involve the use of reduced fan speeds (implemented via variable speed control systems specified for the valve coolers).

To facilitate the lowest practicable noise levels, the iterative noise modelling also included identification and evaluation of options to upgrade the sound insulation of the project's buildings. The objective of these upgrades was to reduce the noise contribution from plant located within buildings to levels that are significantly lower than the contribution of external plant (i.e. to enable the lowest overall total noise level with the proposed external plant by practically eliminating the contribution of internal plant).

The key noise emitting external plant associated with the converter station are listed in Table 25. These sources have been modelled as point or area source in the noise model, as appropriate. The relevant building structures, modelled as industrial buildings in the noise model, are summarised in Table 26. The noise control measures are also noted within these tables. A plan of this site is provided in Figure 14.

A switching station would also be included as part of the converter station, however this would not include any power transformers or any other significant operational noise sources that are relevant to a noise assessment.

Table 25: Key external noise generating plant and noise controls (where applicable)

Plant	Total number of items (stage one and stage two of Marinus Link combined)
Converter transformers	Six (6) Low noise emission specification envisaged to involve the use of proprietary acoustic enclosures.
Converter transformer coolers	Six (6)
Auxiliary transformers	Four (4)
Standby generators	Two (2)
Valve cooling banks	Two (2) (each bank comprising 7 cooling units) Low noise emission fan selections, with variable speed control systems to enable reduced fan speeds and lower noise emissions at night.

Table 26: Converter station buildings and noise controls (where applicable)

Building/room	Description
Two (2) AC phase reactor halls	One (1) hall for each stage of the project, with each hall containing six (6) valve reactors. The following sound insulation upgrades were identified for these halls: • walls: tilt-up concrete panel walls • ventilation openings: acoustic louvres (allowance made for two ventilation openings for each hall – 2 m^2 each on the west and east elevations of the halls) • roof: suspended mass layer ceiling and an acoustically insulated ceiling void.
Two (2) DC side halls	One (1) hall for each stage of the project, with each hall containing two (2) DC reactors. The walls and roof have been assessed as lightweight sheet steel cladding, and allowance made for two ventilation openings (approximately 2 m^2 each on the west and east elevations of the halls).
Two (2) Valve halls	One (1) hall for each stage of the project. Each hall would contain converter modules and valves which are understood to produce low noise emissions relative to other plant at the site. Noise emission data is not available for the equipment located within these halls. For the purposes of this assessment, noise levels within these halls are assumed to be low and not contribute to the total predicted noise levels.
Two (2) Handling Unit (AHU) rooms	One (1) room for each stage of the project, with each room containing two (2) air handling units (1 each for the AC phase reactor halls and the DC side halls). The walls and roof have been assessed as lightweight sheet steel cladding, and allowance made for two ventilation openings (approximately 2 m^2 each on the west and east elevations of the halls).
Two (2) filter buildings	One (1) building for each stage of the project, with each building containing three (3) AC filter banks. The following sound insulation upgrades were identified for these buildings: • walls: tilt-up concrete panel walls • roof: suspended mass layer ceiling and an acoustically insulated ceiling void.

A schedule of the equipment sound power levels used in the noise modelling is presented in Appendix D. Performance data for building attenuation measures is provided in Appendix E.

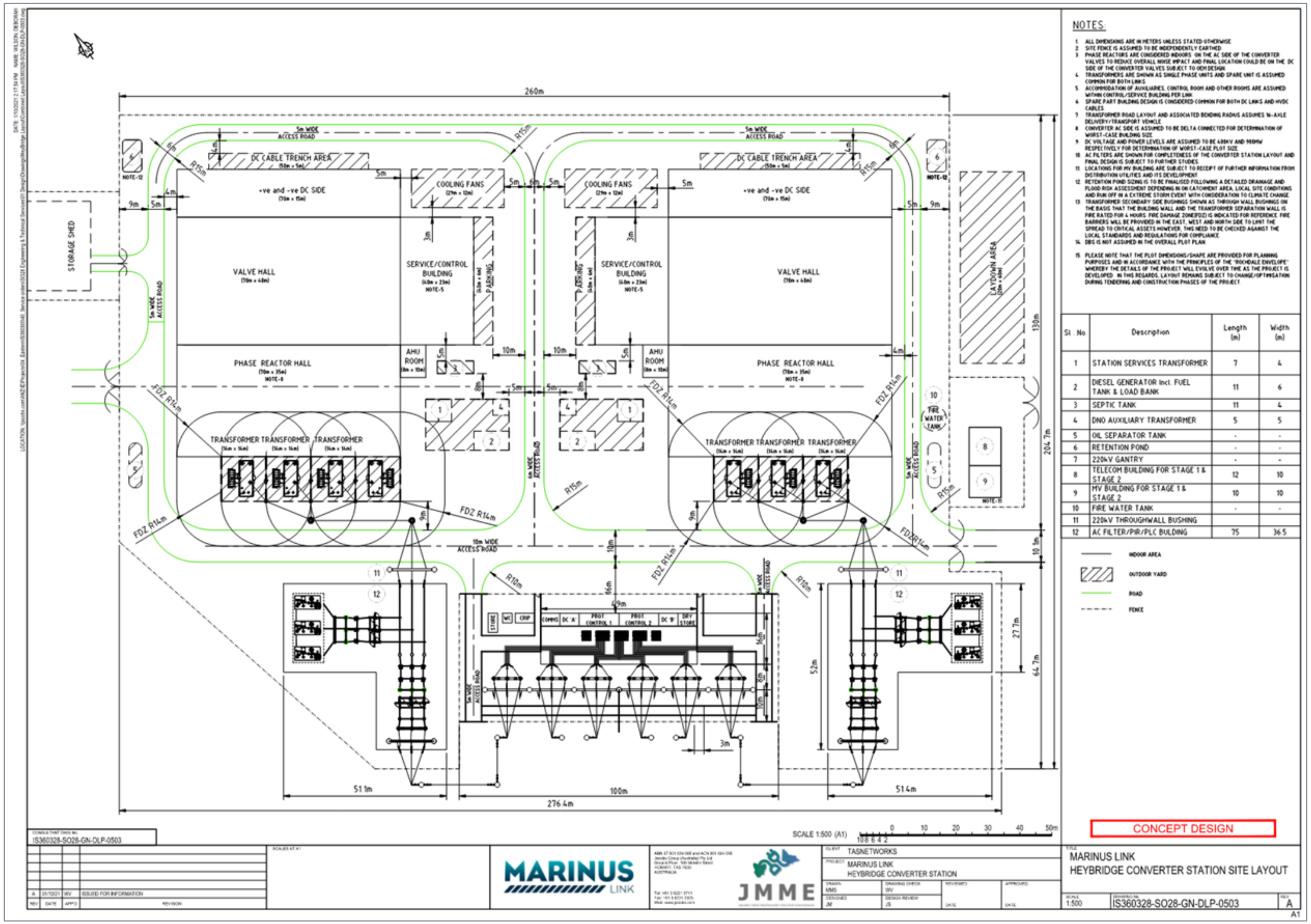


Figure 14: Converter station site plan

(Image courtesy of MLPL)

7.2.2 Predicted noise levels

Operational noise levels associated with the converter station were calculated for:

- typical operations: representative of normal full-power operation during the day, evening and night, accounting for temperatures up to 40 °C during the day and evening and up to 35 °C at night; and
- emergency standby generator operation: normal full-power typical operations of the converter station with simultaneous maintenance testing of the two emergency standby generators.

The predicted noise levels are based on simultaneous operation of all plant items scheduled in Section 7.2.1 (excluding standby generators during typical operations), using the ISO 9613-2 prediction method described in Section 5.3.3.

Adjustments for characteristics such as tonality or low frequency have not been applied to the predicted noise levels. These types of adjustments are addressed in the discussion of the results.

The results for typical operations during the day/evening and night are also presented as predicted noise contours in Figure 15 and Figure 16 respectively.

Table 27: Predicted noise levels – typical operations (no standby generators), dB L_{Aeq}

Receiver	Description	Day/Evening	Night
B1539	Existing dwelling	22	19
B1540	Existing dwelling	23	22
B1544	Existing dwelling	24	23
B1550	Existing dwelling	24	23
B1551	Existing dwelling	24	22
B1557	Existing dwelling	22	21
B6195	Existing dwelling	23	21
B7585	Existing dwelling	22	20
B7591	Existing dwelling	21	18
B7606	Existing dwelling	18	14
B7610	Existing dwelling	20	15
B7636	Existing dwelling	23	16
B7641	Existing dwelling	25	18
B7647	Existing dwelling	28	20
B7716	Existing dwelling	22	20
B7722	Existing dwelling	20	17
B7734	Existing dwelling	20	15
B7740	Existing dwelling	23	17
B7744	Existing dwelling	24	23
B4853*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	37	35
B4854*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	34	31

Receiver	Description	Day/Evening	Night
B4855*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	33	30
B4856*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	29	25
B4857*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	27	22
B4858*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	22	17
B4859	George Street residential development	18	12

The predicted noise levels with the emergency standby generators operating are presented in Table 28. These are the predicted noise levels for brief periods of testing with both generators operating simultaneously (or in an emergency situation when the generators are required as a result of a network power cut).

The results for atypical operations are also presented as predicted noise contours in Figure 17.

Table 28: Predicted noise levels – atypical operations (with standby generators), dB L_{Aeq}

Receiver	Description	Day (1 hour every 3 months)
B1539	Existing dwelling	31
B1540	Existing dwelling	35
B1544	Existing dwelling	34
B1550	Existing dwelling	32
B1551	Existing dwelling	35
B1557	Existing dwelling	32
B6195	Existing dwelling	34
B7585	Existing dwelling	33
B7591	Existing dwelling	32
B7606	Existing dwelling	29
B7610	Existing dwelling	28
B7636	Existing dwelling	25
B7641	Existing dwelling	29
B7647	Existing dwelling	31
B7716	Existing dwelling	34
B7722	Existing dwelling	29
B7734	Existing dwelling	26
B7740	Existing dwelling	29
B7744	Existing dwelling	35
B4853*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	51
B4854*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	45
B4855*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	45
B4856*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	38
B4857*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	35
B4858*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	31
B4859	George Street residential development	24

Figure 15: Heybridge converter station site – predicted noise contours for typical day operation, dB L_{Aeq}

Figure 16: Heybridge converter station site – predicted noise contours for typical night operation, dB L_{Aeq}

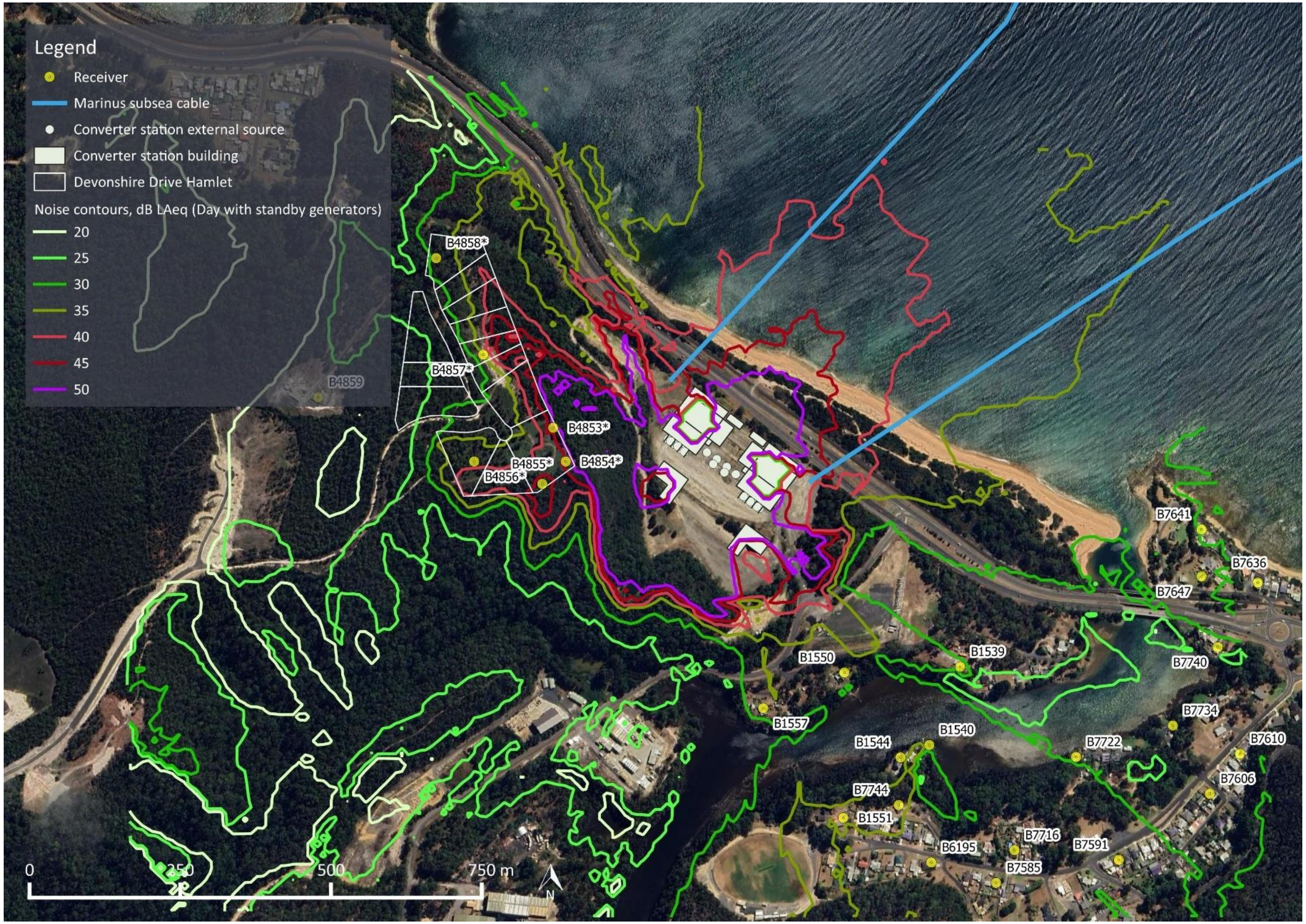


Figure 17: Heybridge converter station site – predicted noise contours for atypical day operation (normal operations plus emergency standby generator testing), dB L_{Aeq}

7.2.3 Discussion

The results for full-power typical operations presented in Table 27 indicate:

- the highest predicted noise levels at an existing dwelling location are 28 and 23 dB L_{Aeq} for the day/evening and night periods respectively – these represent relatively low noise levels which would be comparable to or below the background noise levels in most instances;
- the highest predicted noise levels at the boundary of a proposed future residential area are 37 and 35 dB L_{Aeq} for the day/evening and night periods respectively (Heybridge Residential Nature Reserve, Devonshire Drive Hamlet) – these levels are within the range of background noise levels, but would likely be audible during quiet periods (particularly at night);
- the predicted noise levels are lower than the Noise EPP acoustic environment indicator levels for the day and night periods;
- the predicted noise levels are below the EMPC Noise Regulations for fixed plant items; and
- the predicted noise levels meet the Victorian Noise Protocol design targets that are proposed for the design and assessment of the plant at all locations.

The results therefore indicate compliance with the reference levels and design targets. As a further point of context, the predicted noise levels are below criteria defined by the WHO for the protection of sleep at night at all locations (existing and future dwellings).

However, in the case of the design targets (and the EMPC Noise Regulations reference levels), compliance is based on the premise that the converter station does not attract a penalty for annoying characteristics such as tonality or low frequency.

The application of a penalty would be inconsequential to the assessment outcome at all locations other than the Devonshire Drive Hamlet within the Residential Nature Reserve to the west i.e. even with a penalty, the adjusted predicted noise levels would remain below the design targets at most locations. However, at the Devonshire Drive Hamlet, a penalty adjustment would result in noise levels above the design target.

Plant, such as transformers, are typically characterised by tonal noise emissions which can result in audible tones at receivers. Under the Tasmanian noise measurement manual, the presence of audible tones at a receiver can attract a penalty of up to 5 dB. Similarly, transformers have the potential to be characterised by low frequencies and, under the Tasmanian noise measurement manual, a penalty of 5 dB can also apply for this characteristic. The following contextual factors are noted for the predicted noise levels at the Devonshire Drive Hamlet:

- The predicted noise contribution of the converter transformers is 31 dB L_{Aeq}, compared to a total predicted noise level of 32 dB L_{Aeq} for all of the remaining plant at the site during the night (31 dB and 32 dB summing to the total predicted noise level of 35 dB L_{Aeq} presented in Table 27). This indicates that, while the converter transformers are the highest contributor, the converter transformers do not control/dominate the total predicted noise level.
- The 31 dB L_{Aeq} predicted noise contribution of the converter transformers is below the night-time background noise level of 32 dB L_{A90} determined in accordance with the Tasmania measurement manual (see median value of the data presented in Section 6.0, noting however the potential for lower background noise levels on some nights).
- Achieving the low converter transformer noise emissions accounted for in this assessment is expected to involve the use of acoustic enclosures which are designed to reduce the prominence of tones in the noise emission characteristics of the transformers.
- A risk assessment of low-frequency noise levels indicates a C-weighted predicted noise level of 49 dB L_{Ceq} at night at the Devonshire Drive Hamlet, which is below the criterion for the

application of low frequency penalties under the Tasmanian noise measurement manual (i.e. the difference between the A-weighted and C-weighted noise level is less than 15 dB).

For the above reasons, penalties have not been assumed in this assessment. However, there is a risk that tones could be audible or characterised as a low frequency. If this were to occur in practice, the predictions indicate that the noise levels would be above the design targets at the Devonshire Drive Hamlet. This aspect of the converter station therefore warrants further scrutiny and review during the design and procurement of the plant to verify that:

- the noise of the converter station will not contain audible tones or be characterised as a low frequency noise at the receivers; or
- there will be sufficient margin between the predicted noise levels and the final applicable noise limit to accommodate the potential for tone and/or low frequency related penalty adjustments.

In terms of the emergency standby generator plant, the predicted noise levels are less than 40 dB L_{Aeq} at most locations. The only exceptions are the southeast section of the Devonshire Drive Hamlet where the predicted noise levels are up to 51 dB L_{Aeq}. This noise level is still within the design target reference level of 55 dB L_{Aeq} and below the Noise EPP acoustic environment indictor noise level. Further, during routine testing of the plant for one (1) hour every three (3) months, the diesel generators may not be operated simultaneously, and predicted noise levels would be approximately 3 dB lower.

In terms of noise character, practical noise mitigation options are available to mitigate potential low-frequency and tonal characteristics associated with standby generator plant. Penalties have therefore not been applied to the predictions. However, consistent with the plant associated with normal operations, the frequency characteristics of the selected plant will require review as part of the detailed design process to identify and assess any mitigation measures required for the control of these characteristics.

The noise modelling accounts for full-power operation during typical worst-case conditions, including emergency standby generator plant, and demonstrates predicted noise levels within the assessment criteria proposed for the project, corresponding to stringent noise limits derived from the Victorian Noise Protocol.

The plant would be designed to enable continued operation and power supply during atypical conditions, including:

- peak network demand occurring simultaneously with ambient temperatures above 40 °C during the day/evening and 35 °C at night (the design temperatures for the project); and
- peak network demand occurring simultaneously during an emergency outage in the network that requires an overload of one of the project's circuits (for example, diversion of power transmission via one stage of the project only, involving the use of reserve capacity which temporarily increases the rating of the link from 750 MW to 900 MW until alternative power sources are dispatched across the network to return the grid to a stable state).

These atypical operating scenarios would result in slightly higher noise emissions than the typical worst-case conditions represented in the noise modelling. However, these are infrequent conditions which would typically only result in brief periods of slightly higher noise levels. The effect of these atypical operating conditions primarily relates to the cooling plant operating at increased duty. The cooling plant is not a dominant noise source for the converter station, and increases in their noise emissions would not equate to equivalent changes in the total noise levels of the project. Noise data to for these conditions is not available, but the potential increase in noise levels is expected to be less than 5 dB. This represents a minor increase in noise level for brief and atypical conditions which are not representative of normal operation of the plant. The risks of noise related impacts during these atypical conditions are therefore considered low.

7.2.4 Risk assessment

Based on the findings discussed above, an assessment of the risk associated with converter station operational noise levels is presented in Table 29.

Table 29: Converter station operational noise levels – risk assessment

Item	Rating	Comments
Risk consequence	Minor to moderate	The predicted noise levels are below the reference levels of the Noise EPP and the EMPC Noise Regulations, and below the design targets determined from the Victorian Noise Protocol. However, compliance is dependent on penalty adjustments for tonality and low frequency not being applicable, and this risk will need to be addressed during the detailed design of the project.
Likelihood	Possible	The assessment is based on the selection of low noise emission plant and site-specific noise attenuation. While the predicted noise levels are well below the reference levels and the design targets in most instances, the night-time predicted noise level at one of the future residential development sites is equal to the design target. Attention to noise emissions would be essential during subsequent design and equipment procurement to achieve outcomes that are consistent with the assessment findings.
Overall risk	Medium	The applicable EPA Victoria Publication 1695.1 guidance for this rating is that the risk can be acceptable if controls are in place, and attempts should be made to reduce the risk to low.

The risk rating determined in Table 29 supports that measures should be established to reduce the risk, and dedicated controls is warranted to provide assurance that operational noise would be appropriately addressed during the design and commissioning of the project.

7.2.5 Management and mitigation measures

Management and mitigation measures are recommended to control the risks of operational noise. The applicable measures are described below.

- **NV01: Conduct additional background noise monitoring**

  The purpose of this recommendation is to establish the requirement to obtain additional background noise data which will inform the design noise assessment report (NV04) and operational noise management plan (NV05) for the converter station.

- **NV04: Prepare a design noise assessment report for the final converter station design**

  The purpose of this recommendation is to establish the requirement to prepare a detailed assessment and report, based on the final converter station design and equipment selections, demonstrating that the impact of operational noise would be minimised to the extent reasonably practical.

- **NV05: Prepare an operational noise management plan for the converter station site**

  The purpose of this recommendation is to establish the requirement to document all controls to be implemented and maintained to control operational noise, including noise monitoring requirements and procedures for investigating noise complaints and potential compliance issues.

- **NV06: Prepare an operational noise compliance assessment report**

  The purpose of this recommendation is to establish a requirement to prepare a report verifying that the measures documented in the operational noise management plan have been fully implemented and that operational noise levels comply with the applicable noise limits.

Each of the above measures are specified in detail in Section 7.5.

7.2.6 Residual impacts

Adhering to the management and mitigation measures would limit the risk consequence to minor, however the overall risk rating of the residual impacts of operational noise would remain medium. The inherent and residual risks for operational noise are summarised in section 7.6.

7.3 Cumulative impacts

Development and operation of multiple projects at the same time and in proximity to each other can lead to cumulative environmental impacts. The EIS therefore includes an assessment of the potential cumulative impacts associated with other proposed and foreseeable projects near the study area.

Other projects were identified for inclusion in the EIS cumulative impact assessment where they:

- are under construction;
- have received approval but the project has not yet commenced construction;
- have officially commenced the approvals process and are in the process of developing applications; or
- have submitted approval application(s) that have not yet been determined.

The projects being considered in the EIS are listed in Table 30 along with a brief summary of relevant available information.

Table 30: Projects being considered in the EIS cumulative impact assessment

Project	Description	Location	Status and timing
Guilford Wind Farm / Epuron Pty Ltd	Wind farm in Guildford with up to 80 wind turbines Generation of up to 450 megawatts (MW) of wind energy Estimated capital: $50 million	7 km northeast of Waratah and 15 km south of Hampshire	Current status: Notice of intent submitted September 2020 Deemed a controlled action by DAWE in September 2021 Construction to commence: 2024
Robbins Island Renewable Energy Park / UPC Robbins Island Pty Ltd	Wind farm on Robbins Island with up to 122 wind turbines Generation of up to 900 MW of wind energy Estimated construction value: $1.2 billion Construction workforce: 250 personnel	Robbins Island, northwest coast of Tasmania	Current status: Approved by the Commonwealth Government and assessment by the EPA underway Construction to commence: 2023-2025
Jim's Plain Renewable Energy Park / UPC Robbins Island Pty Ltd	Wind farm in Jim's Plain with up to 31 wind turbines and possible solar generation Generation of up to 200 MW of wind energy and up to 40 MW of solar energy Capital investment: $350 million Construction workforce: over 150 personnel Operations workforce: 15 personnel	23 km west of Smithton	Current status: Approved by the Council and State and Commonwealth governments in 2020 Construction to commence: 2023
Robbins Island Road to Hampshire Transmission Line / UPC Robbins Island Pty Ltd	A new 220 kV overhead transmission line (OHTL) spanning 115 km, estimated to have 245 towers Connects Jim's Plain and Robbins Island Renewable Energy Parks transmission infrastructure to Tasmanian transmission network Construction workforce: up to 100 personnel over 24 months	Between Robbins Island Rd at West Montagu and Hampshire	Current status: Detailed planning/environmental approvals phase underway Commonwealth Government determined the project to be a controlled action under the EPBC Act in September 2020 Construction to commence: 2023

Project	Description	Location	Status and timing
Bass Highway, targeted upgrades between Deloraine and Devonport / Department of State Growth	Targeted highway upgrades between Deloraine and Devonport Roads of strategic importance Estimated project cost: $50 million	Targeted areas along Bass Highway between Deloraine and Devonport	Current status: In planning Construction expected to commence: late 2023 Expected completion: 2027
Remaining North West Transmission Developments (Remaining NWTD) Transmission Line / TasNetworks	Remaining NWTD is a component of the North West Transmission Developments, comprising of a new double-circuit 220 kV (OHTLs in North West Tasmania, upgrades to the existing Palmerston, Sheffield and Burnie substations, and a new switching station at Hampshire Hills Remaining NWTD will connect to the project at the Heybridge converter station Supports new and existing renewable energy developments in North West Tasmania, including Marinus Link Estimated project cost: $220 million	Between Palmerston, Sheffield, Burnie and Hampshire Hills	Current status: Planning and approvals phase in progress Construction expected to commence: 2025
Hellyer Wind Farm / Epuron Pty Ltd	Wind farm with up to 48 wind turbines Generation of up to 300 MW of wind energy	8.5km southwest of Hampshire	Current status: Design phase Notice of intent issued Tasmanian EPA -EIS Guidelines issued in November 2022
Western Plains / Epuron Pty Ltd	Wind farm with up to 12 wind turbines Generation of up to 50.4 MW of wind energy	4 to 5 km northwest of Stanley	Current status: Work on the Development Proposal and Environmental Management Plan (DPEMP) is continuing. The DPEMP has been drafted in accordance with the Project Specific Guidelines issued for the project by the Environment Protection Authority (EPA Tasmania). The EPA Tasmania recently extended the timeframe for submission to enable completion of the required documentation

Project	Description	Location	Status and timing
Table Cape Luxury Resort / Table Cape Enterprises	Proposed accommodation	Table Cape, 4.5 km north of Wynyard, Ransleys Road	Current status: Approved by Waratah-Wynyard Council
Lake Cethana Pumped Hydro / Hydro Tasmania	Storage and underground pumped hydro power station with associated infrastructure, with up to 600 MW capacity Estimated construction cost: $900 million	19 km southwest of Sheffield	Current status: Hydro Tasmania will progress with the final feasibility stage Construction likely to commence: 2027
Youngmans Road Quarry / Railton Agricultural Lime Pty Ltd	Limestone quarry development on old quarry site Average annual production of 72,000 tonnes of limestone	2.5km northwest of Railton	Current status: EPA approved the development in February 2021 Kentish Council is reviewing the land permit for the proposed development
Port Latta Wind Farm / Nekon Pty Ltd	Wind farm with up to 7 wind turbines Generation of up to 25 MW of wind energy Construction workforce: 15 people over six months Estimated capital: $50 million	Mawbanna Plain, 2 km southwest of Cowrie Point	Current status: Environmental Assessment Report and EPA decision issued October 2018 Website states intent to start construction late 2020, no further updates available
Port of Burnie Shiploader Upgrade / TasRail	Minerals shiploader and storage expansion at TasRail's existing Bulk Minerals Export Facility Estimated cost: $64 million Design and construction workforce: 140 personnel	Port of Burnie	Current status: onsite works and detailed design (commenced in April 2022) Commissioning expected to commence: 2023
Bass Highway – Cooee to Wynyard / Department of State Growth	Priority works upgrade along the Bass Highway between Cooee and Wynyard to realign and upgrade approximately 3.2 km of road Estimated cost: $50 million	Bass Highway from the intersection of Brickport Road in Cooee, across the Cam River Bridge, to the intersection of the Old Bass Highway at Doctors Rocks near Wynyard	Current status: Construction (commenced late 2021) Expected completion:2025

Project	Description	Location	Status and timing
QuayLink - Devonport East Redevelopment / TasPorts	Port terminal upgrade project to support TasPorts in increasing capacity of both freight and passenger ferry services across Bass Strait Estimated cost: $240 million Design and construction workforce: 1060 direct and indirect jobs in North West Tasmania, and a further 655 broader Tasmanian jobs during construction	Port of Devonport	Current status: Early works/construction (commenced 2022); approvals phase ongoing Expected completion: 2027

Out of the projects above, only the Remaining North West Transmission Developments (Remaining NWTD) is in close proximity to the project. All other projects are located over 5 km away and are therefore not considered relevant for the study.

The primary cumulative consideration that is relevant to the technical noise and vibration study is the potential for cumulative operational noise. However, the operational noise sources associated with the Remaining NWTD are limited, and are not expected to represent a noise compliance consideration for the project (in isolation or cumulatively with other neighbouring developments). All of the other proposed and foreseeable projects being considered in the EIS, and which may produce noise during operation, are distant from the project and would not result in cumulative operational noise.

While there is potential for cumulative construction noise to arise from other projects, the risk of cumulative noise is low on account of the transient nature of construction and due to the separation of the projects in most instances. Heavy vehicle traffic is one aspect of construction where the development of multiple projects at the same time can potentially result in cumulative increases in traffic movements on the surrounding road network, with corresponding increases in road traffic noise levels. However, for this to occur, the projects must use the same construction traffic routes, and the construction phases of the projects must overlap. Further, as construction traffic volumes typically vary throughout the construction of a project, the potential for cumulative construction traffic noise is also likely to depend on the peak phases of construction traffic for each project overlapping. These factors reduce the likelihood of cumulative construction traffic noise being a material consideration in practice. Irrespective, the high-level assessment of construction traffic associated with the project (Section 7.1.7) indicated construction traffic is unlikely to warrant dedicated noise mitigation measures; on account of the relatively low estimated levels when compared with benchmarks that are typically used for the assessment of permanent/long-term noise sources. Based on these considerations, the risk of cumulative construction traffic noise impacts is also low.

In terms of other existing sources of operational noise in the area around the project, there are existing commercial premises to the south of the project. However, at the receivers to the south of the project, the predicted operational noise levels associated with the converter station are low (e.g. less than 25 dB L_{Aeq} at B1550 and B1557) and do not indicate a risk of cumulative noise considerations (i.e. on account of the predicted noise levels being well below any of the reference levels considered for the assessment of operational noise from commercial premises).

7.4 Inspection, monitoring and review

Monitoring and review requirements are established as part of the management and mitigation measures for construction and operational noise detailed in Section 7.1.8 and Section 7.2.5 respectively, and summarised in Section 7.5.

7.5 Management and mitigation measures

The recommended management and mitigation measures for the control of noise and vibration associated with the project are summarised in Table 31.

The following key items are noted:

- The converter station EIS proposes the development of a decommissioning management plan, and this plan would need to address environmental noise and vibration impacts. It is envisaged that a decommissioning plan would also be required for the shore crossing for the project, and similarly would need to address environmental noise and vibration impacts. Dedicated controls for noise and vibration associated with decommissioning activities have therefore not been documented in the mitigation and management measures presented subsequently in this section.
- The following recommendations identify activities to occur prior to commencement of construction. In all cases, this refers to commencement of construction activities which may result in environmental noise in the surrounding areas, such as earthworks.

Table 31: Noise and vibration management and mitigation measures

ID	Management and mitigation measures	Project stage
NV01	**Conduct additional background noise monitoring** Prior to commencement of construction, conduct additional background noise monitoring for receivers in the areas around the project. The background noise monitoring data must: • Inform the assessment of construction noise (NV02 and NV03) and operational noise (NV04, NV05 and NV06). • Be conducted at a selection of locations which are representative of the receivers that could be impacted by construction and operation of the project. The background noise monitoring and results analysis must be conducted in accordance with procedural guidance detailed in: • *Noise Measurement and Procedures Manual 2008* (Tas) • Australian Standard 1055:2018 *Acoustics - Description and measurement of environmental noise* where relevant. The results must be documented in a background noise report and made available to EPA Tasmania on request.	Construction
NV02	**Develop and implement a construction noise and vibration management plan** Prior to commencement of construction, develop a construction noise and vibration management plan in consultation with EPA Tasmania for onshore construction including the shore crossing. The construction noise and vibration management plan must document: • A description of all noise generating construction activities and their locations. This must include a schedule of equipment types and numbers for each activity and location. • A description of the proposed construction program including timing and duration of construction activities. This must include confirmation that the works will adhere to standard working hours, other than unavoidable works that must occur outside standard working hours. • The results of additional background monitoring conducted under NV01. • Details of the location, duration and type of unavoidable works which may need to occur outside of standard working hours and the protocols that will apply for the management of unavoidable works outside standard working hours. • Details of all reasonable and practicable measures that are proposed to minimise the impact of noise and vibration associated with both on-site and off-site sources of construction activities (including heavy vehicle movements on local roads), including: – requirements for the selection of major plant items with low noise emissions, characterised by sound power levels that are equivalent to, or lower than, the values/ranges indicated in AS 2436 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites (Reconfirmed 2016)*, unless it can be demonstrated that adhering to these values would not be reasonably practicable.	Construction

ID	Management and mitigation measures	Project stage
	– Measures for the control of potentially annoying characteristics such as tonality, impulsive and low-frequency. – Scheduling protocols for minimising the potential disruption caused by high noise levels as a result of transient construction activities which occur near to receivers for brief periods. – Details of any locations where temporary screens or enclosures are identified as a reasonably practicable control measure, informed by updated construction noise modelling. • Requirements for monitoring noise of construction works, including: – unavoidable works – verification noise testing (if warranted) to assess the effectiveness of the noise controls before commencing continuous night works. • Communication protocols for notifying landowners and land managers in advance of the works occurring. • Protocols for providing respite in circumstances where residents are affected by prolonged exposure to elevated noise levels as a result of unavoidable works out of hours. • Complaint handling and response protocols, in accordance with the MLPL complaints management system. The construction noise and vibration management plan must address the requirements of: • *Environmental Management and Pollution Control (Noise) Regulations 2016* (Tas). • *Environment Protection Policy (Noise) 2009* (Tas). • Australian Standard AS 2436. The construction noise and vibration management plan must be made available to EPA Tasmania on request. The construction noise and vibration management plan must be a sub plan to the Construction Environmental Management Plan and implemented during construction.	
NV03	**Conduct construction noise monitoring** Conduct construction noise monitoring in accordance with the requirements of the construction noise and vibration management plan prepared in accordance with NV02. This shall include, at minimum, construction noise monitoring for the shore crossing. The results of the construction noise monitoring must be documented in accordance with the timeframe and reporting requirements established in the construction noise and vibration management plan. The report must identify if changes to the construction noise mitigation and management measures are warranted to minimise the impact of noise as far as reasonably practicable.	Construction

ID	Management and mitigation measures	Project stage
NV04	**Prepare a design noise assessment report for the final converter station design** Prior to installing the converter station plant and any enclosing structures, prepare a design noise assessment report for the final converter station design. The report must: • Include predicted noise levels based on the final design of the converter station and representative noise emission data for the final equipment selections for the project. • Provide a schedule of the measures that have been incorporated into the design for the control of environmental noise levels, demonstrating that all reasonable and practical measures would be implemented to minimise the impact of operational noise. • Present the results of updated background noise monitoring conducted for the nearest receivers to the converter station (NV01). • Provide details of the noise frequency characteristics of key items of plant such as the transformers and valve coolers, and assessment of whether character adjustments are warranted. • Demonstrate that noise levels for the final design and equipment selections during typical operations (normal full-power operation during elevated temperatures, excluding emergency standby generators and overload conditions), when assessed in accordance with the procedures of the *Tasmanian Noise Measurements Procedures Manual*, Second Edition dated 2008, are predicted to comply with: - Day (Monday to Saturday 0700 – 1800 hrs) 45 dB $L_{Aeq,30\text{-}min}$ - Evening (Monday to Saturday 1800 – 2200 hrs, and 0700 – 2200 hrs on Sundays and public holidays) 40 dB $L_{Aeq,30\text{-}min}$ - Night (Monday to Sunday 2200 – 0700 hrs) 35 dB $L_{Aeq,30\text{-}min}$ • Demonstrate that noise levels for the final design and equipment selections during testing of the emergency standby generators, when assessed in accordance with the procedures of the Tasmanian Noise Measurements Procedures Manual, Second Edition dated 2008, are predicted to comply with a level of 55 dB $L_{Aeq,30\text{-}min}$ (testing to occur during the day on weekdays for a period of not more than one hour every three months). The design noise assessment report must be made available to EPA Tasmania on request.	Construction
NV05	**Prepare an operational noise management plan** As part of the Operation Environmental Management Plan, develop an operational noise management plan for the converter station in consultation with EPA Tasmania. The operational noise management plan must: • Document the noise mitigation and management measures developed in design (NV04) that apply to the operation and maintenance of the converter station. • Procedures for, and timing of, noise monitoring to be carried out to assess compliance with the applicable noise limits when the converter station commences operation.	Operation

ID	Management and mitigation measures	Project stage
	• Details and timing of noise compliance reporting to be submitted to EPA Tasmania. • Details of any maintenance and monitoring measures that are required to maintain ongoing compliance. • Procedures for routine operational testing of plant that is used solely for emergencies (e.g. regularity, days and times of testing). • Procedures to investigate noise complaints or suspected noise compliance issues. The operational noise management plan must be made available to EPA Tasmania on request. The operational noise management plan must be a sub plan to the Operation Environmental Management Plan and implemented during operation.	
NV06	**Prepare an operational noise compliance assessment report** Prepare an operational noise compliance assessment report based on: • An inspection of the converter station to confirm that the noise mitigation and management measures documented in the operational noise management plan (NV05) have been fully implemented. • The results of noise monitoring conducted in accordance with the operational noise management plan (NV05), to assess compliance with the applicable noise limits. The report must be submitted to EPA Tasmania within six months of each stage of the converter station becoming fully operational.	Operation

7.6 Summary of risks

The inherent and residual risks for construction and operational noise are summarised in Table 32.

Table 32: Risk assessment summary

Affected value	Potential risk of harm	Project phase	Initial risk assessment			Management and mitigation measures	Residual risk assessment		
			Consequence	Likelihood	Risk		Consequence	Likelihood	Risk
Ambient noise environment	Airborne noise generated by construction activities associated with the converter station during standard working hours impacting noise sensitive areas.	Construction	Moderate	Possible	Medium	NV02 - requirement for a CNVMP	Minor	Unlikely	Low
Ambient noise environment	Airborne noise generated by construction of the shore crossing involving night works over an extended period, affecting noise sensitive areas (including disturbance of sleep).	Construction	Moderate to major	Likely	High	NV02 - requirement for a CNVMP	Moderate	Possible	Medium
Ambient noise environment	Airborne noise generated by heavy construction vehicles using the public road network during standard working hours affecting noise sensitive areas.	Construction	Low	Possible	Low	NV02 - requirement for a CNVMP	Low	Possible	Low
Ambient vibration environment	Ground borne vibration generated by construction activities resulting in perceptible vibration in sensitive (habited) areas or building damage.	Construction	Low	Unlikely	Low	NV02 - requirement for a CNVMP	Low	Unlikely	Low

Affected value	Potential risk of harm	Project phase	Initial risk assessment			Management and mitigation measures	Residual risk assessment		
			Consequence	Likelihood	Risk		Consequence	Likelihood	Risk
Ambient noise environment	Airborne noise generated by operation of the converter station affecting noise sensitive areas	Operation	Minor to moderate	Possible	Medium	NV04 – requirement for a pre-construction noise assessment NV05 – requirement for an operational noise management plan NV06 – requirement for a post-construction operational noise compliance assessment	Minor	Possible	Medium

8.0 CONCLUSION

A technical noise and vibration assessment of the Tasmanian terrestrial component of the project has been completed for submission with the environmental impact statement for the project.

A risk-based assessment was used to evaluate noise and vibration impacts associated with construction and operation of the project. Risks are assessed by accounting for both their consequence and likelihood. The objective of the risk assessment was to determine appropriate risk controls in the form of management and mitigation measures for the project.

Construction of the project would broadly involve transitory noise and vibration generating activities. Off-site truck movements on public roads are also a relevant environmental noise consideration.

The primary source of operational noise associated with the project is the proposed converter station which would comprise indoor and outdoor plant including transformers and cooling systems.

Construction noise and vibration

In relation to the noise of construction activities during the proposed standard working hours, the assessment demonstrates that the risk rating is medium.

The main noise consideration for construction is work that needs to be conducted outside of the proposed standard working hours. In particular, the need for continuous horizontal directional drilling (HDD) works for the shore crossing to ensure the stability of the boreholes. HDD works are expected to occur continuously for a total period of up to 6 months. The assessment demonstrates that the risk of noise impacts from HDD works during the night is high.

Management and mitigation measures have been recommended to minimise the risk of construction noise and vibration as far as reasonably practical. The measures comprise:

- **NV01: Conduct additional background noise monitoring**

  A requirement to obtain additional background noise data which will then inform the development of controls under NV02.

- **NV02: Develop and implement a construction noise and vibration management plan**

  A requirement for a comprehensive plan which describes all measures that would be used to minimise the impact of construction noise and vibration as far as reasonably practical, based on updated information for the planned construction works and equipment selections.

- **NV03: Conduct construction noise monitoring**

  A requirement to conduct construction noise monitoring at locations specified in the construction noise and vibration management plan, and requirements concerning construction noise monitoring reports.

Provided that the management and mitigation measures are adhered to, and the CNVMP is fully implemented, the residual risk of noise impacts from construction during the proposed standard working hours and HDD shore crossing works conducted at night would be reduced to low and medium respectively.

In relation to construction vibration, the assessment considers potential effects in terms of both the potential for cosmetic building damage and disturbance of human comfort. Based on the separating distances to construction activities, vibration from construction activities is not a material consideration for the project.

In relation to off-site traffic movements associated with construction of the project, there are no specific criteria or policy requirements. However, a high level of assessment of potential noise level increases, considered in the context of criteria normally applied to long-term or permanent noise levels, supports that dedicated mitigation measures are not expected to be warranted for the control of off-site vehicle noise.

Operational noise

Operational noise levels from the converter station have been assessed on the basis of a concept design incorporating a range of noise controls to address site-specific constraints.

The assessment addresses all relevant Tasmanian legislative and policy requirements, including the *Environment Protection Policy (Noise) 2009* as referenced in the Tasmanian EIS Guidelines. Assessment criteria that the project would ultimately be designed and assessed against have been proposed. The proposed criteria are based on guidance sourced from the Victorian Noise Protocol and are more stringent than the reference levels sourced from Tasmanian legislation and guidelines. Separate criteria are proposed for typical operations and the testing periods for the emergency standby generator plant.

The predicted operational noise levels are well below the reference levels from Tasmanian policy and achieve the proposed assessment criteria at all receivers. However, in recognition of the extent of noise control measures required to achieve the design targets, and the requirement for measures to prevent noise characteristics which could attract penalties, the risk of operational noise impacts has been assessed as medium. Accordingly, management and mitigation measures to minimise the risk have been recommended and comprise:

- **NV01: Conduct additional background noise monitoring**

  A requirement to obtain additional background noise data which will inform the design noise assessment report (NV04) and operational noise management plan (NV05) for the converter station.

- **NV04: Prepare a design noise assessment report for the final converter station design**

  A requirement to prepare a detailed assessment and report, based on the final converter station design and equipment selections, demonstrating that the impact of operational noise would be minimised to the extent reasonably practical.

- **NV05: Prepare an operational noise management plan for the converter station site**

  A requirement to document all measures to be implemented and maintained to control operational noise, including noise monitoring requirements and procedures for investigating noise complaints and potential compliance issues.

- **NV06: Prepare an operational noise compliance assessment report**

  A requirement to prepare a report verifying that the measures documented in the operational noise management plan have been fully implemented and that operational noise levels comply with the applicable noise limits.

Adhering to the recommended management and mitigation measures reduces the consequence of the risk to minor. However, in recognition of the stringency of the design requirements, and the need for verification measures at the design and commissioning stages of the project, the residual impacts of operational noise remain medium.

The assessment findings indicate that environmental noise will be an important consideration to address for the construction and operational stages of the project. However, the risks of noise impacts can be reduced to acceptable levels by implementing suitable controls in accordance with the recommended management and mitigation measures.

APPENDIX A REFERENCES

Australian Standard AS 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*

British Standard BS 5228-1:2009+A12014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*

British Standard BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings*

British Standard BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings* Part 2

Deutsche Institut fur Normung (German Institute for Standards) DIN 4150-3:2016-12 *Vibrations in buildings – Part 3: Effects on structures*

EPA Victoria Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* published May 2021 (Victoria) (Noise Protocol)

Environmental Management and Pollution Control Act 1994 (Tas)

Environmental Management and Pollution Control (Noise) Regulations 2016 (Tas)

Environment Protection Policy (Noise) 2009 (Tas)

Noise Measurement Procedures Manual 2008 (Tas)

NSW government publication *Interim Construction Noise Guideline* dated July 2009

NSW Roads and Maritime Services publication *Construction Noise and Vibration Guideline* dated August 2016

World Health Organization (WHO) publication *Guidelines for Community Noise* dated 1999

APPENDIX B DESCRIPTION OF SOUND

Sound is an important feature of the environment in which we live; it provides information about our surroundings and influences our overall perception of amenity and environmental quality.

While sound is a familiar concept, its description can be complex. A glossary of terms and abbreviations is provided at the front of this report. This appendix provides general information about the definition of sound and the ways that different sound characteristics are described.

B1 Definition of sound

Sound is a term used to describe very small and rapid changes in the pressure of the atmosphere. Importantly, for pressure fluctuations to be considered sound, the rise and fall in pressure needs to be repeated at rates ranging from tens to thousands of times per second.

These small and repetitive fluctuations in pressure can be caused by many things such as a vibrating surface in contact with the air (e.g. the cone of a speaker) or turbulent air movement patterns. The common feature is a surface or region of disturbance that displaces the adjacent air, causing a very small and localised compression of the air, followed by a small expansion of the air.

These repeated compressions and expansions then spread into the surrounding air as waves of pressure changes. Upon reaching the ear of an observer, these waves of changing pressure cause structures within the ear to vibrate; these vibrations then generate signals which can be perceived as sounds.

The waves of pressure changes usually occur as complex patterns, comprising varied rates and magnitudes of pressure changes. The pattern of these changes will determine how a sound spreads through the air and how the sound is ultimately perceived when it reaches the ear of an observer.

B2 Physical description of sound

There are many situations where it can be useful to objectively describe sound, such as the writing or recording of music, hearing testing, measuring the sound environment in an area, or evaluating new man-made sources of sound.

Sound is usually composed of complex and varied patterns of pressure changes. As a result, several attributes are used to describe sound. Two of the most fundamental sound attributes are:

- sound pressure; and
- sound frequency.

Each of these attributes is explained in the following sections, followed by a discussion about how each of these attributes varies.

B2.1 Sound pressure

The compression and expansion of the air that is associated with the passage of a sound wave results in changes in atmospheric pressure. The pressure changes associated with sound represent very small and repetitive variations that occur amidst much greater pressures associated with the atmosphere.

The magnitude of these pressure changes influences how quiet or loud a sound will be; the smaller the pressure change, the quieter the sound, and vice versa. The perception of loudness is complex though, and different sounds can seem quieter or louder for reasons other than differences in pressure changes.

To provide some context, Table 33 lists example values of pressure associated with the atmosphere and different sounds. The key point from these example values is that even an extremely loud sound equates to a change in pressure that is thousands of times smaller than the typical pressure of the atmosphere.

Table 33: Atmospheric pressure versus sound pressure – example values of pressure

Example	Pascals (Pa)	Bars	Pounds per Square Inch (PSI)
Atmospheric pressure	100,000	1	14.5
Pressure change due to weather front	10,000	0.1	1.5
Pressure change associated with sound at the threshold of pain	20	0.0002	0.003
Pressure change associated with sound at the threshold of hearing	0.00002	0.0000000002	0.000000003

The pressure values in Table 33 also show that the range of pressure changes associated with quiet and loud sounds span over a very large range, albeit still very small changes compared to atmospheric pressure. To make the description of pressure changes more practical, sound pressure is expressed in decibels or dB.

To illustrate the pressure variation associated with sound, Figure 18 shows the repetitive rise and fall in pressure of a very simple and steady sound. This figure illustrates the peaks and troughs of pressure changes relative to the underlying pressure of the atmosphere in the absence of sound. The magnitude of the change in pressure caused by the sound is then described as the sound pressure level. Since the magnitude of the change is constantly varying, the sound pressure may be defined in terms of:

- Peak sound pressure levels: the maximum change in pressure relative to atmospheric pressure i.e. the amplitude as defined by the maximum depth or height of the peaks and troughs respectively; or
- Root Mean Square (RMS) sound pressure levels: the average of the amplitude of pressure changes, accounting for positive changes above atmospheric pressure, and negative pressure changes below atmospheric pressure.

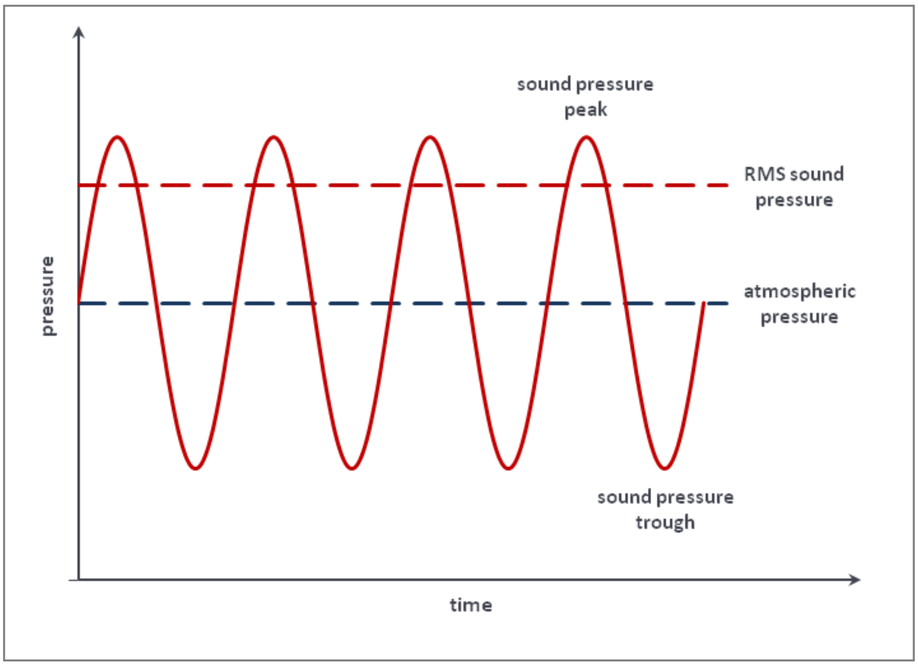


Figure 18: Pressure changes relative to atmospheric pressure associated with sound

B2.2 Frequency

Frequency is a term used to describe the number of times a sound causes the pressure to rise and fall in a given period. The rate of change in pressure is an important feature that determines whether it can be perceived as a sound by the human ear.

Repetitive changes in pressure can occur as a result of a range of factors with widely varying rates of fluctuation. However, only a portion of these fluctuations can be perceived as sound. In many cases, the rate of fluctuation will either be too slow or too fast for the human ear to detect the pressure change as a sound. For example, local fluctuations in atmospheric pressure can be created by someone waving their hands back and forth through the air; the reason this cannot be perceived as a sound is the rate of fluctuation is too slow.

At the rates of fluctuation that can be detected as sound, the rate will influence the character of the sound that is perceived. For example, slow rates of pressure change correspond to rumbling sounds, while fast rates correspond to whistling sounds.

The rate of fluctuation is numerically described in terms of the number of pressure fluctuations that occur in a single second. Specifically, it is the number of cycles per second of the pressure rising above, falling below, and then returning to atmospheric pressure. The number of these cycles per second is expressed in Hertz (Hz). This concept of cycles per second is illustrated in Figure 19 which illustrates a 1 Hz pressure fluctuation. The figure provides a simple illustration of a single cycle of pressure rise and fall occurring in a period of a single second.

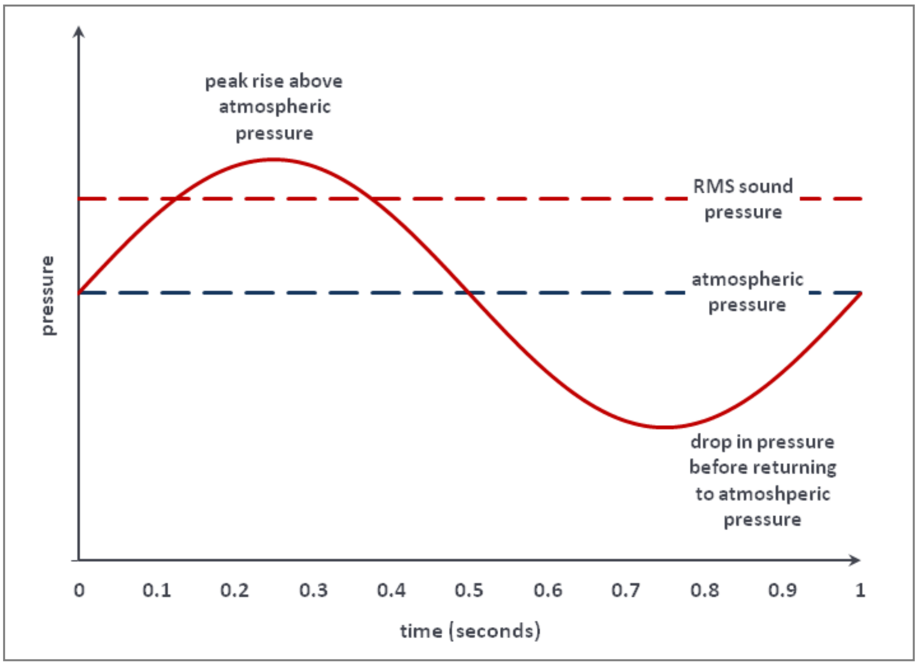
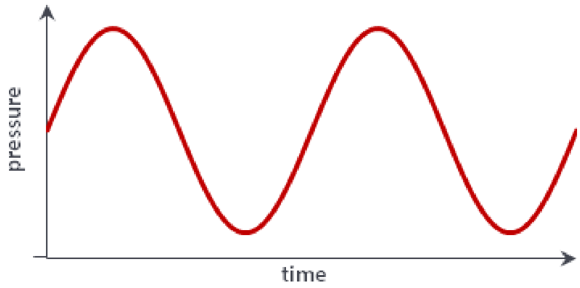


Figure 19: Illustration of a pressure fluctuation with a frequency of 1Hz

The rate that sound pressure rises and falls will vary depending on the source of the sound. For example, the surface of a tuning fork vibrates at a specific rate, in turn causing the pressure of the adjacent air to fluctuate at the same rate. Recalling the idea of pressure fluctuations from someone waving their hands, the pressure would fluctuate at the same rate as the hands move back and forth; a few times a second translating to a very low frequency below our hearing range (termed an infrasonic frequency). Examples of low and high frequency sound are easily recognisable, such as the low frequency sound of thunder, and the high frequency sound of crashing cymbals. To demonstrate the differences in the patterns of different frequencies of sound, Figure 20 illustrates the relative rates of pressure change for low, mid and high frequency sounds. Note that in each case the amplitude of the pressure changes remains the same; the only change is the number of fluctuations in pressure that occur over time.

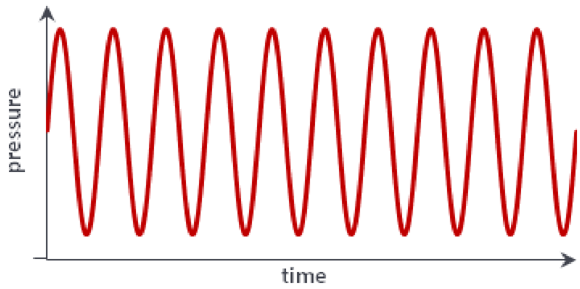
Low frequency sounds:

20 to 200 Hz



Mid-frequency sounds:

200 to 800 Hz



High frequency sounds:

greater than 800 Hz

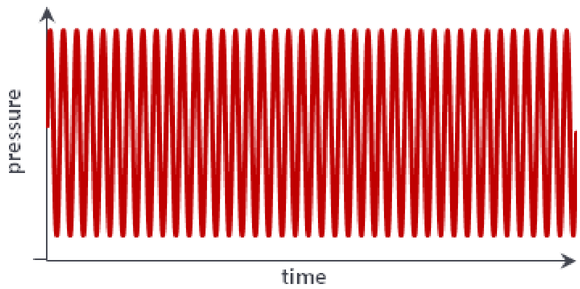


Figure 20: Examples of the rate of change in pressure fluctuations for low, mid and high frequencies

B2.3 Sound pressure and frequency variations

The preceding sections describe important aspects of the nature of sound, the changes in pressure and the changes in the rate of pressure fluctuations.

The simplest type of sound comprises a single constant sound pressure level and a single constant frequency. However, most sounds are made up of many frequencies, and may include low, mid and high frequencies. Sounds that are made up of a relatively even mix of frequencies across a broad range of frequencies are referred to as being 'broad band'. Common examples of broad band sounds include flowing water, the rustling of leaves, ventilation fans and traffic noise.

Further, sound quite often changes from moment to moment, in terms of both pressure levels and frequencies. The time varying characteristics of sound are important to how we perceive sound. For example, rapid changes in sound level produced by voices provide the component of sound that we interpret as intelligible speech. Variations in sound pressure levels and frequencies are also features which can draw our attention to a new source of sound in the environment.

To demonstrate this, Figure 21 illustrates an example time-trace of total sound pressure levels which varies with time. This variation presents challenges when attempting to describe sound pressure levels. As a result, multiple metrics are generally needed to describe sound pressure, such as the average, minimum or maximum noise levels. Other ways of describing sound include statistics for describing how often a defined sound pressure level is exceeded; for example, typical upper sound levels are often described as an L_{10} which refers to the sound pressure exceeded for 10% of the time, or typical lower levels or lulls which are often described as an L_{90} which refers to the sound exceeded for 90% of the time.

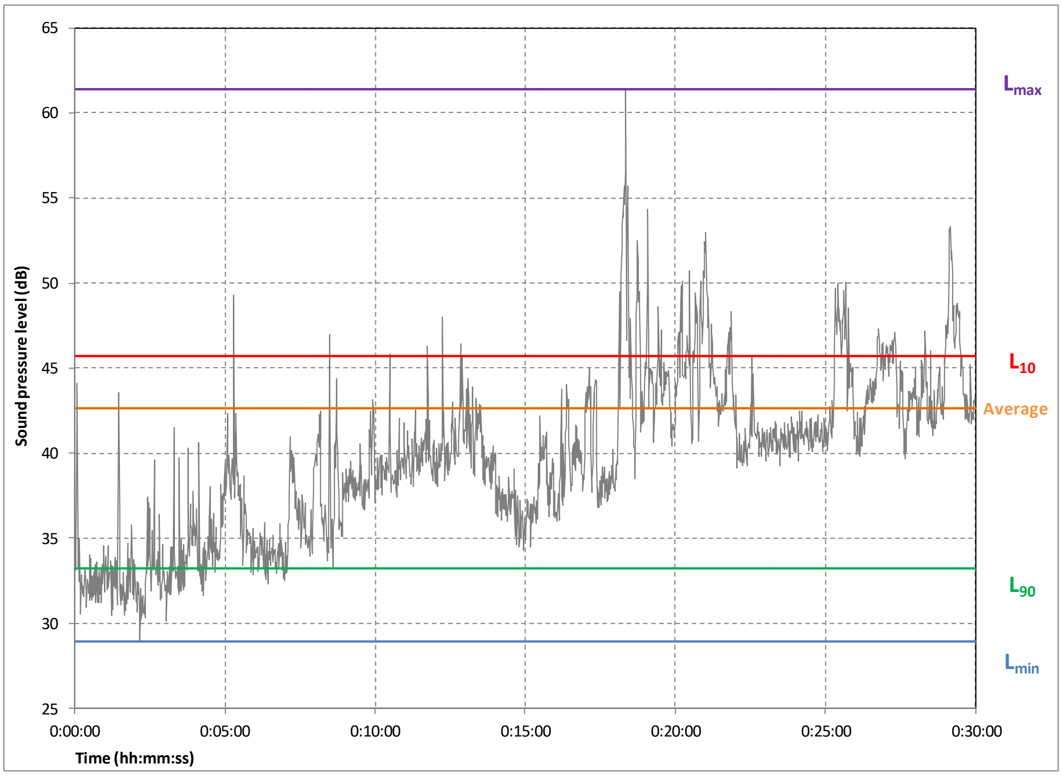


Figure 21: Example of noise metrics that may be used to measure a time-varying sound level

This example illustrates variations in terms of just total sound pressure levels, but the variations can also relate to the frequency of the sound, and frequently the number of sources affecting the sound.

These types of variations are an inherent feature of most sound fields and are an important point of context in any attempt to describe sound.

B3 Hearing and perception of sound

This section provides a discussion of:

- the use of the decibel to practically describe sound levels in a way that corresponds to the pressure levels the human ear can detect as sounds
- the relationship between sound frequency and human hearing.

The section concludes with a discussion of some of the complicating non-acoustic factors that influence our perception of sound.

B3.1 Sound pressure and the decibel

Previous sections discussed the wide range of small pressure fluctuations that the ear can detect as sound. Owing to the wide range of these fluctuations, the way we hear sound is more practically described using the decibel (dB). The decibel system serves two key purposes:

- Compressing the numerical range of the quietest and loudest sounds commonly experienced.

  As an indication of this benefit, the pressure of the loudest sound that might be encountered is around a million times greater than the quietest sound that can be detected. In contrast, the decibel system reduces this to a range of approximately 0-120 dB.

- Consistently representing sound pressure level changes in a way that correlate more closely with how we perceive sound pressure level changes.

  For example, a 10 dB change from 20-30 dB will generally be subjectively like a 10 dB change from 40-50 dB. However, expressed in units of pressure as Pascals, the 40-50 dB change is ten times greater than the 20-30 dB change. For this reason, sound pressure changes cannot be meaningfully communicated in terms of units of pressure such as Pascals.

Sound pressure levels in most environments are highly variable, so it can be misleading to describe what different ranges of sound pressure levels correspond to. However, as a broad indication, Table 34 provides some example ranges of sound pressure levels, expressed in both dB and units of pressure.

Table 34: Example sound pressure levels that might be experienced in different environments

Environment	Example Sound Pressure Level	
Outside in an urban area with traffic noise	50-70 dB	0.006-0.06 Pa
Outside in a rural area with distant sounds or moderate wind rustling leaves	30-50 dB	0.0006-0.006 Pa
Outside in a quiet rural environment in calm conditions	20-30 dB	0.0002-0.0006 Pa
Inside a quiet bedroom at night	<20 dB	0.0002 Pa

The impression of how much louder or quieter a sound is will be influenced by the magnitude of the change in sound pressure. Other important factors will also influence this, such as the frequency of the sound which is discussed in the following section. However, to provide a broad indication, Table 35 provides some examples of how changes in sound pressure levels, for a sound with the same character, can be perceived.

Table 35: Perceived changes in sound pressure levels

Sound pressure level change	Indicative change in perceived sound
1 dB	Unlikely to be noticeable
2-3 dB	Likely to be just noticeable
4-5 dB	Clearly noticeable change
10 dB	Distinct change – often subjectively described as halving or doubling the loudness

The example sound pressure level changes in Table 35 are based on a side-by-side comparison of a steady sample of sound heard at different levels. In practice, changes in sound pressure levels may be more difficult to perceive for a range of reasons, including the presence of other sources of sound, or gradual changes which occur over a longer period.

B3.2 Sound frequency and loudness

Although sound pressure level and the sensation of loudness are related, the sound pressure level is not a direct measure of how loud a sound appears to humans. Human perception of sound varies and depends on a number of physical attributes, including frequency, level and duration.

An example of the relationship between the sensation of loudness and frequency is demonstrated in Figure 22. The chart presents equal loudness curves for sounds of different frequencies expressed in 'phons'. Each point on the phon curve represents a sound of equal loudness. For example, the 40 phon curve shows that a sound level of 100 dB at 20 Hz (a very low frequency sound) would be of equal loudness to a level of 40 dB at 1,000 Hz (a whistling sound) or approximately 50 dB at just under 8,000 Hz (a very high pitch sound). The information presented is based on an international standard[6] that defines equal loudness levels for sounds comprising individual frequencies. In practice, sound is usually composed of many different frequencies, so this type of data can only be used as an indication of how different frequencies of sound may be perceived. An individual's perceptions of sound can also vary significantly. For example, the lower dashed line in Figure 22 shows the threshold of hearing, which represents the sounds an average listener could correctly identify at least 50% of the time. However, these thresholds represent the average of the population. In practice, an individual's hearing threshold can vary significantly from these values, particularly at the low frequencies.

[6] ISO 226:2003 *Acoustics - Normal equal-loudness-level contours*, 2003

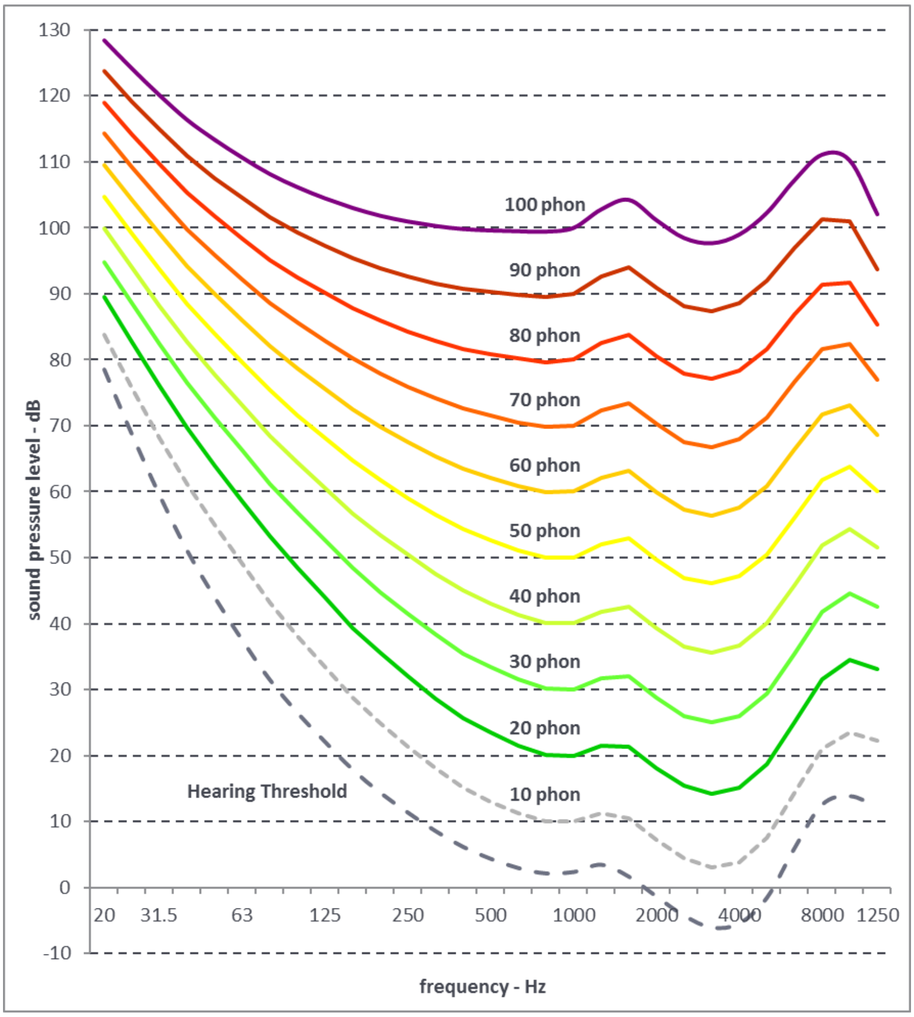


Figure 22: Equal loudness contours for pure tone sounds

The noise curves in Figure 22 demonstrate that human hearing is most sensitive at frequencies from 500 to 4000 Hz, which usefully corresponds to the main frequencies of human speech. The contours also demonstrate that sounds at low frequencies must be at much higher sound pressure levels to be judged equally loud as sounds at mid to high frequencies.

To account for the sensitivity of the ear to different frequencies, a set of adjustments were developed to enable sound levels to be measured in a way that more closely aligns with human hearing. Sound levels adjusted in this way are referred to as A-weighted sound levels.

B3.3 Interpretation of sound and noise

Human interpretation of sound is influenced by many factors other than its physical characteristics, such as how often the sound occurs, the time of day it occurs and a person's attitude towards the source of the sound.

For example, the sound of music can cause very different reactions, from relaxation and pleasure through to annoyance and stress, depending on individual preferences, the type of music and the circumstances in which the music is heard. This example illustrates how sound can sometimes be considered noise – a term broadly used to describe unwanted sounds or sounds that have the potential to cause negative reactions.

The effects of excess environmental sound are varied and complicated, and may be perceived in various ways including sensations of loudness, interference with speech communication, interference with working concentration or studying, disruption of resting/leisure periods, and disturbance of sleep. These effects can give rise to behavioural changes such as avoiding the use of exposed external spaces, keeping windows closed, or timing restful activities to avoid the most intense periods of disruption. Prolonged annoyance or interference with normal patterns can lead to possible effects on mental and physical health. In this respect, the World Health Organization (preamble to the *Constitution of the World Health Organization*, 1946) defines health in the following broad terms:

> *A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*

The World Health Organization Guidelines for Community Noise (Berglund, Lindvall and Schwela, 1999) documents a relationship between the definition of health and the effects of community noise exposure by noting that:

> *This broad definition of health embraces the concept of well-being, and thereby, renders noise impacts such as population annoyance, interference with communication, and impaired task performance as 'health' issues.*

The reaction that a community has to sound is highly subjective and depends on a range of factors including:

- The hearing threshold of individuals across the audible frequency range. These thresholds vary widely across the population, particularly at the lower and upper ends of the audible frequency range. For example, at low frequencies the distribution of hearing thresholds varies above and below the mean threshold by more than 10 dB.
- The attitudes and sensitivities of individuals to sound, and their expectations of what is considered an acceptable level of sound or intrusion. This in turn depends on a range of factors such as general health and the perceived importance of sound amongst other factors relevant to overall amenity perception.
- The absolute sound pressure level of the sound in question. The threshold for the onset of community annoyance varies according to the type of sound; above such thresholds, the percentage of the population annoyed generally increases with increasing sound pressure level.
- The sound pressure level of the noise relative to background noise conditions in the area, and the extent to which general background noise may offer beneficial masking effects.
- The characteristics of the sound in question such as whether the sound is constant, continually varies, or contains distinctive audible features such as tones, low frequency components or impulsive sound which may draw attention to the noise.
- The site location and the compatibility of the source in question with other surrounding land uses. For example, whether the source is in an industrial or residential area.

- The attitudes of the community to the source of the sound. This may be influenced by factors such as the extent to which those responsible for the sound are perceived to be adopting reasonable and practicable measures to reduce their emissions, whether the activity is of local or national significance and whether the noise producer actively consults and/or liaises with the community.
- The times when the sound is present, the duration of exposure to increased sound levels, and the extent of respite periods when the sound is reduced or absent (for example, whether the sound ceases at weekends).

The combined influence of the above considerations means that physical sound levels are only one factor influencing community reaction to sound. Importantly, this means that individual reactions and attitudes to the same type and level of sound will vary within a community.

APPENDIX C BACKGROUND NOISE SURVEY

This appendix presents details of the background noise monitoring conducted between Friday, 6 May and Wednesday, 25 May 2022, at a selection of sites in the vicinity of the project, including:

- monitoring equipment locations and installation photos
- tabular measured background noise levels for each location
- a time history of the measured background and ambient noise levels for each location.

All noise monitoring was undertaken using Class 1 sound level meters (highest class rating for environmental noise surveys). Instrument calibration conformed with the requirements of AS 1055:2018 *Acoustics – Description and measurement of environmental noise* (independent laboratory calibration and reference level checks during deployment and retrieval of the instrumentation).

The measured background noise levels for each location were analysed in accordance with the Tasmanian Noise Measurements Procedures Manual, Second Edition dated 2008 (the Tasmanian noise measurement manual). This involved collating noise and weather measurement data for each 10-minute period of the survey and producing:

1. A derived background noise level for each period (i.e. day, evening and night) of each day

   This process involves screening the data to exclude any 10-minute periods in which rainfall was measured or average wind speeds greater than 5 m/s were recorded, and determining the 10th percentile of the screened $L_{A90,10min}$ values for each period i.e. the quietest 10% of the 10-minute background values, which in turn represent the quietest 10% of each 10-minute sample.

2. An aggregated single figure value to represent each period

   This process involved aggregating the period values for each day to determine the minimum, mean and median values; the median being the value specified by the Tasmanian noise measurement manual to derive a representative single value for each period.

In deriving the aggregated median background noise level value of all periods, a sensitivity analysis was conducted to gauge the potential effect of weather related data exclusions. Specifically, the median background noise level was calculated with and without certain periods included, according to the amount of 10-minute measurement samples excluded on account of weather (i.e. calculation of the median background noise level value for periods containing different minimum percentages of retained data). The review indicated the derived median was relatively insensitive to the exclusion of periods in which a greater portion of 10-minute data was screened; the variation was typically 1 dB or less and there was no clear pattern of higher median noise levels with or without the removal of periods where part of the period was affected by weather. Accordingly, the median background noise values were derived from the available periods for all days (i.e. including those periods when a portion of the 10-minute background noise levels needed to be removed). However, for reference, the periods in which more than 20% of the 10-minute periods were excluded as a result of rain and/or wind are designated by grey shading.

The above processes relate to the background noise levels, dB L_{A90}, used to quantify the quietest periods at a location; this is commonly used to gauge the potential for new noise sources to be intrusive on the existing noise environment. The total ambient noise environment, often measured by the average (equivalent) noise over the same period, is typically around 5 dB higher (note that this equivalent noise level includes all sounds present at the locations, and is distinct from the mean or median background noise values). The ambient noise levels are illustrated on the measurement time history charts for each location.

C1 Background noise monitoring locations

Table 36: Monitoring equipment and locations

Site	Location	Equipment	Easting	Northing	Weather station
1	Proposed Heybridge converter station site	Cube 11276	413958	5452418	No
2	Heybridge Residential Nature Reserve development site	Cube 10521	413273	5452373	No

Wind and rainfall were assessed based on a combination of data from publicly available data from the Bureau of Meteorology monitoring station at Burnie and weather stations deployed in the area as part of a separate survey being undertaken for the Remaining NWTD project.

Figure 23: Equipment set-up – Site 1 – proposed Heybridge converter station site

Figure 24: Equipment set-up – Site 2 – Heybridge residential development site

C2 Measured background noise levels – Site 1 – converter station site

The measured background noise levels at site 1, analysed in accordance with the Tasmanian noise measurement manual, are summarised in Table 37. Periods in which more than 20% of the 10-minute periods were excluded as a result of rain and/or wind are designated by grey shading.

As a result of an interruption of the power supply to the monitoring equipment at this location, the equipment ceased monitoring from 20 May onwards.

The time history of noise levels and periods of inclement weather (i.e. excluded periods) for site 4a is shown on the following page in Figure 25, and also presents the ambient (L_{Aeq}) and maximum (L_{Amax}) noise levels.

Table 37: Site 1 – proposed Heybridge converter station site – background noise levels , dB L_{A90}

Date	Day	Evening	Night
05/05/2022 - Thursday	-	-	26
06/05/2022 - Friday	43	34	32
07/05/2022 - Saturday	42	37	32
08/05/2022 - Sunday	35	-	28
09/05/2022 - Monday	42	29	26
10/05/2022 - Tuesday	42	36	34
11/05/2022 - Wednesday	44	-	-
12/05/2022 - Thursday	44	34	32
13/05/2022 - Friday	42	35	-
14/05/2022 - Saturday	-	38	36
15/05/2022 - Sunday	38	42	39
16/05/2022 - Monday	44	38	37
17/05/2022 - Tuesday	46	38	37
18/05/2022 - Wednesday	46	37	32
19/05/2022 - Thursday	42	35	27
20/05/2022 - Friday	-	-	-
21/05/2022 - Saturday	-	-	-
22/05/2022 - Sunday	-	-	-
23/05/2022 - Monday	-	-	-
24/05/2022 - Tuesday	-	-	-
Minimum	**35**	**29**	**26**
Average	**42**	**36**	**32**
Median	**42**	**36**	**32**

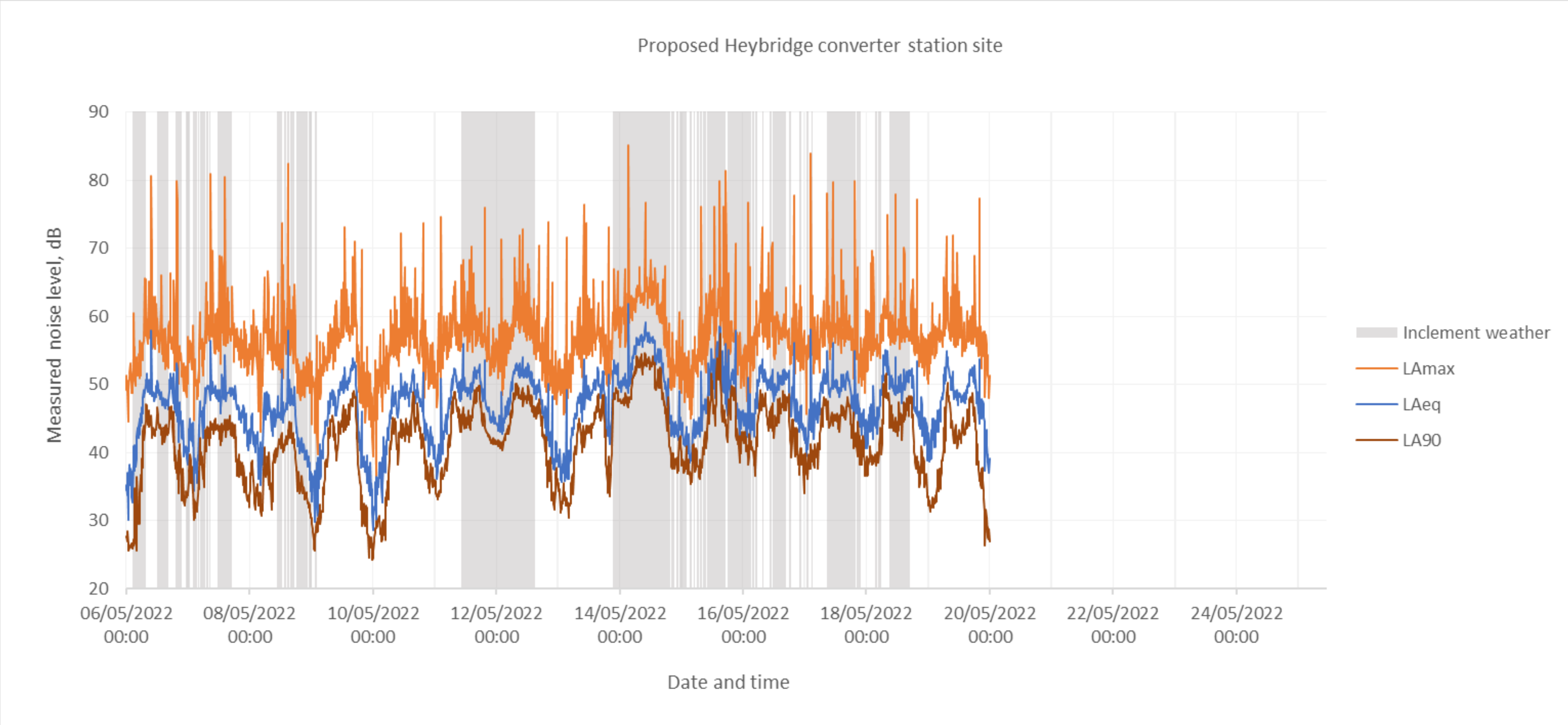


Figure 25: Site 1 – proposed Heybridge converter station site

C3 Measured noise levels – Site 2 – Heybridge Residential Reserve development site

The measured background noise levels at site 2, analysed in accordance with the Tasmanian noise measurement manual, are summarised in Table 38. Periods in which more than 20% of the 10-minute periods were excluded as a result of rain and/or wind are designated by grey shading.

The time history of noise levels and periods of inclement weather (i.e. excluded periods) for site 4b is shown on the following page in Figure 26, and also presents the ambient (L_{Aeq}) and maximum (L_{Amax}) noise levels.

Table 38: Site 2 – Heybridge Residential Nature Reserve development site – background noise levels , dB L_{A90}

Date	Day	Evening	Night
05/05/2022 - Thursday	-	-	36
06/05/2022 - Friday	38	31	30
07/05/2022 - Saturday	36	31	26
08/05/2022 - Sunday	36	-	32
09/05/2022 - Monday	35	33	27
10/05/2022 - Tuesday	38	35	33
11/05/2022 - Wednesday	42	-	-
12/05/2022 - Thursday	42	38	36
13/05/2022 - Friday	38	37	-
14/05/2022 - Saturday	-	41	34
15/05/2022 - Sunday	36	42	40
16/05/2022 - Monday	42	36	37
17/05/2022 - Tuesday	42	39	38
18/05/2022 - Wednesday	39	31	32
19/05/2022 - Thursday	37	34	37
20/05/2022 - Friday	39	38	31
21/05/2022 - Saturday	36	32	24
22/05/2022 - Sunday	35	30	29
23/05/2022 - Monday	38	34	30
24/05/2022 - Tuesday	39	37	33
Minimum	**35**	**30**	**24**
Average	**38**	**35**	**32**
Median	**38**	**35**	**32**

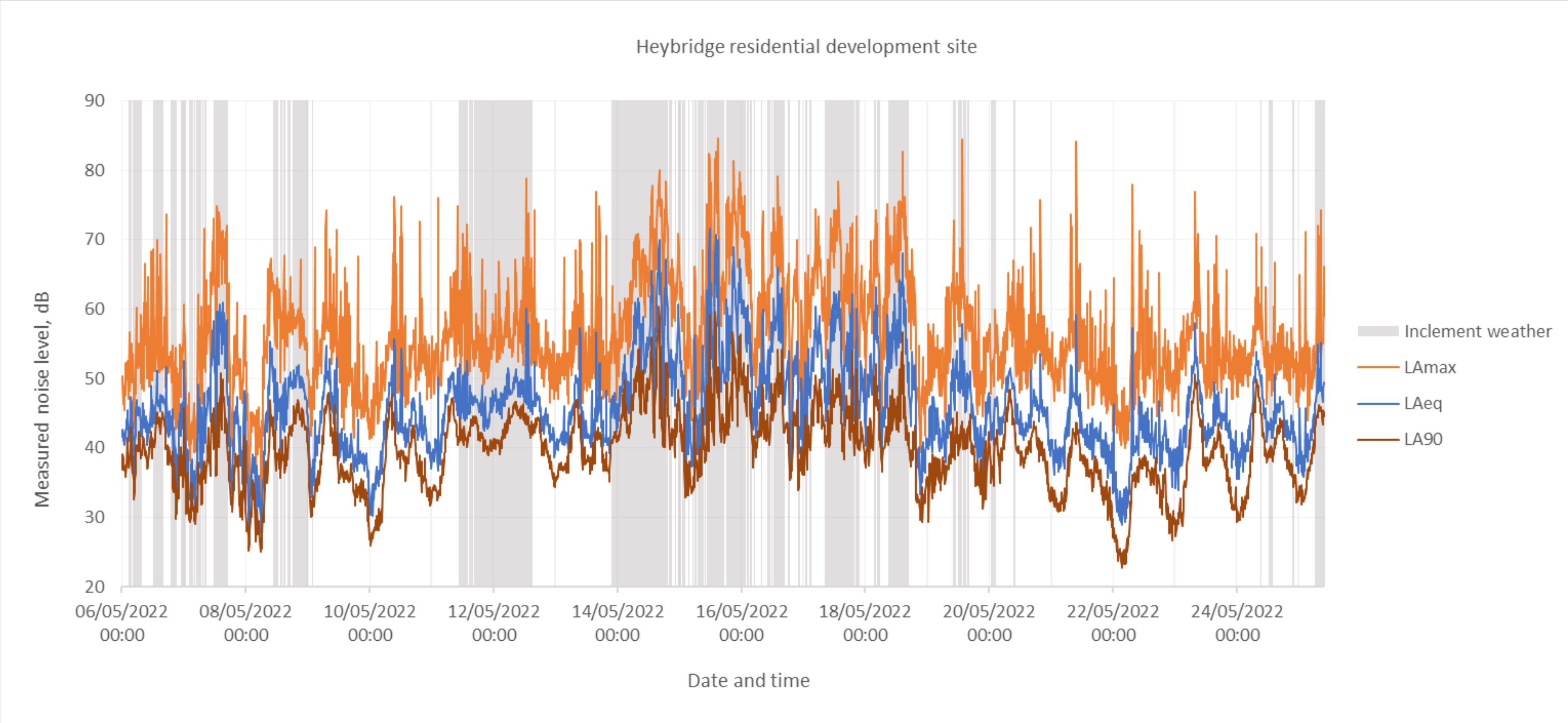


Figure 26: Site 2 – Heybridge Residential Nature Reserve development site

APPENDIX D CONVERTER STATION SOUND POWER LEVELS

The noise emission data provided by MLPL for the assessment are reproduced in Table 39.

Noise emission data was not available for the converter modules and valves that would be housed in the two valve halls. However, the converter modules and valves are understood to be low noise emission plant items that are not expected to materially contribute to environmental noise levels associated with the converter station.

Table 39: Sound power levels, dB L_{WA}
(note: all data including spectrum values are A-weighted)

Source name	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	Total
AHU – valve hall	67	74	76	80	80	77	73	85
AHU – AC/DC yard	68	75	77	80	81	78	74	86
Auxiliary Transformer 1	57	59	65	63	61	59	57	70
Auxiliary Transformer 2	57	59	65	63	61	59	57	70
Auxiliary Transformer 3	57	59	65	63	61	59	57	70
Converter Transformer 1	53	82	71	64	58	57	44	82
Converter Transformer 2	51	80	69	62	56	55	42	80
Converter Transformer 3	49	78	67	60	54	53	40	78
Converter Transformer 4	53	82	71	64	58	57	44	82
Converter Transformer 5	51	80	69	62	56	55	42	80
Converter Transformer 6	49	78	67	60	54	53	40	78
DC Reactor 1	-	59	71	77	55	37	21	78
DC Reactor 2	-	59	71	77	55	37	21	78
DC Reactor 3	-	59	71	77	55	37	21	78
DC Reactor 4	-	59	71	77	55	37	21	78
Transformer Cooler 1	64	66	73	76	66	64	63	80
Transformer Cooler 2	64	66	73	76	66	64	63	80
Transformer Cooler 3	64	66	73	76	66	64	63	80
Transformer Cooler 4	64	66	73	76	66	64	63	80
Transformer Cooler 5	64	66	73	76	66	64	63	80
Transformer Cooler 6	64	66	73	76	66	64	63	80
Valve Cooler 1 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 2 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 3 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 4 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 5 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 6 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 7 – day/evening	74	82	84	76	72	68	67	87

Source name	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	Total
Valve Cooler 8 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 9 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 10 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 11 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 12 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 13 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 14 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 1 – night	66	74	76	68	64	60	59	79
Valve Cooler 2 – night	66	74	76	68	64	60	59	79
Valve Cooler 3 – night	66	74	76	68	64	60	59	79
Valve Cooler 4 – night	66	74	76	68	64	60	59	79
Valve Cooler 5 – night	66	74	76	68	64	60	59	79
Valve Cooler 6 – night	66	74	76	68	64	60	59	79
Valve Cooler 7 – night	66	74	76	68	64	60	59	79
Valve Cooler 8 – night	66	74	76	68	64	60	59	79
Valve Cooler 9 – night	66	74	76	68	64	60	59	79
Valve Cooler 10 – night	66	74	76	68	64	60	59	79
Valve Cooler 11 – night	66	74	76	68	64	60	59	79
Valve Cooler 12 – night	66	74	76	68	64	60	59	79
Valve Cooler 13 – night	66	74	76	68	64	60	59	79
Valve Cooler 14 – night	66	74	76	68	64	60	59	79
Valve Reactor 1	n/a	66	78	84	62	44	28	85
Valve Reactor 2	n/a	66	78	84	62	44	28	85
Valve Reactor 3	n/a	66	78	84	62	44	28	85
Valve Reactor 4	n/a	66	78	84	62	44	28	85
Valve Reactor 5	n/a	66	78	84	62	44	28	85
Valve Reactor 6	n/a	66	78	84	62	44	28	85
Valve Reactor 7	n/a	66	78	84	62	44	28	85
Valve Reactor 8	n/a	66	78	84	62	44	28	85
Valve Reactor 9	n/a	66	78	84	62	44	28	85
Valve Reactor 10	n/a	66	78	84	62	44	28	85
Valve Reactor 11	n/a	66	78	84	62	44	28	85
Valve Reactor 12	n/a	66	78	84	62	44	28	85

APPENDIX E CONVERTER STATION BUILDING UPGRADES

E1 AC Phase Reactor Hall and AC Filter Building – wall and roof

The noise modelling for these elements of the converter station account for example building fabric upgrades comprising tilt-up concrete walls and a proprietary acoustically-rated roof system (comprising a metal deck upper, insulated void and solid ceiling system).

The sound transmission loss values for these elements are summarised in Table 40.

Table 40: Upgraded wall and roof – sound transmission loss values, dB

Element	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Wall – tilt-up concrete	39	42	40	43	51	58	63
Roof – proprietary system	17	23	39	49	57	62	72

E2 AC Phase Reactor Hall – acoustic louvre

The noise modelling of the ventilation openings for the AC Phase Reactor Hall includes 300 mm acoustic louvres providing the insertion loss values detailed in Table 41.

Table 41: Acoustic louvre insertion loss values, dB

Element	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Acoustic louvre	4	7	9	13	14	12	12