Attachment 12: Noise and Vibration Technical Report (Arup, 2023)

ARUP

Cleanaway Operations Pty Ltd

Melbourne Energy and Resource Centre

Noise and Vibration Technical Report

Reference: MERC-ARU-MEL-ENNV-RPT-0001

Revision 0 Final | 22 March 2023

Job number 287710-01

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Document Verification

Project title	Melbourne Energy and Resource Centre
Document title	Noise and Vibration Technical Report
Job number	287710-01
Document ref	MERC-ARU-MEL-ENNV-RPT-0001
File reference	Rev 0 Final

Revision	**Date**	**Filename**	MERC-ARU-MEL-ENNV-RPT-0001		
Revision 0 Final	22/03/2023	**Description**	Final issue		
			Prepared by	**Checked by**	**Approved by**
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		Filename			
		Description			
			Prepared by	**Checked by**	**Approved by**
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Issue Document Verification with Document ☑

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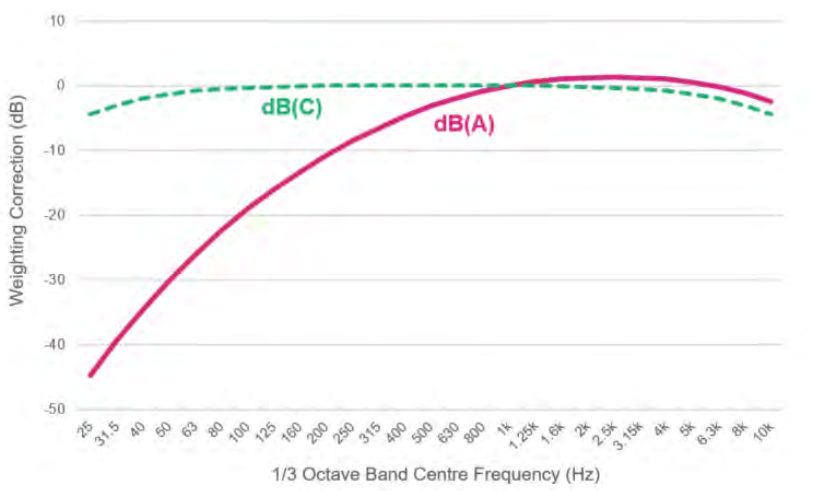
Abbreviations and glossary

Abbreviations	Definition
CIT	Commercial, Industrial and Trade
EP Act	Environmental Protection *Environment Protection Act 2017*
EP Legislation	Environmental Protection Legislation
ERS S245	Environmental Reference Standard S245, 26 May 2021
GED	General Environmental Duty
MERC	Melbourne Energy Resource Centre
Noise Protocol	EPA Publication 1826 Noise Protocol for Commercial, Industrial and Trade premises and entertainment venues
SEPP N-1	State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1
The Proposal	The proposed activity – definition of activities to be assessed as part of the DLA, specifically related to the WtE facility
The Regulations	The Environment Protection Regulations 2021
WSERRC	Western Sydney Energy and Resource Recovery Centre
WtE	Waste-to-energy facility
Noise and Vibration specific Terms	
Ambient noise level	The ambient noise level is the overall noise level measured at a location from multiple noise sources. When assessing noise from a particular development, the ambient noise level is defined as the remaining noise level in the absence of the specific noise source being investigated. For example, if a fan located on a building is being investigated, the ambient noise level is the noise level from all other sources without the fan operating, such as traffic, birds, people talking and other noise from other buildings.
Background noise level	The background noise level is the noise level that is generally present at a location at all or most times. Although the background noise may change over the course of a day, over shorter time periods (e.g. 15 minutes) the background noise is almost-constant. Examples of background noise sources include steady traffic (e.g. motorways or arterial roads), constant mechanical or electrical plant and some natural noise sources such as wind, foliage, water and insects. **Assessment Background Level (ABL)** A single-number figure used to characterise the background noise levels from a single day of a noise survey. ABL is derived from the measured noise levels for the day, evening or night time period of a single day of background measurements. The ABL is calculated to be the tenth percentile of the background L_{A90} noise levels – i.e. the measured background noise is above the ABL 90% of the time. **Rating Background Level (RBL / min$L_{A90,1hour}$)** A single-number figure used to characterise the background noise levels from a complete noise survey. The RBL for a day, evening or night time period for the overall survey is calculated from the individual Assessment Background Levels (ABL) for each day of the measurement period, and is numerically equal to the median (middle value) of the ABL values for the days in the noise survey.
Decibel (dB)	The logarithmic scale used to measure sound and vibration levels. Human hearing is not linear and involves hearing over a large range of sound pressures, which would be cumbersome if presented on a linear scale. Use of a logarithmic scale allows all sound levels to be expressed based on how loud they are

Abbreviations	Definition
	relative to a reference sound (typically 20 µPa, which is the approximate human threshold of hearing). For sound in other media (e.g. underwater noise) a different reference level is used. An increase of approximately 10 dB corresponds to a subjective doubling of the loudness of a noise. The minimum increase or decrease in noise level that can be noticed is typically 2 to 3 dB.
dB weighting curves	The frequency of a sound affects its perceived loudness and human hearing is less sensitive at low and very high frequencies. When seeking to represent the summation of sound pressure levels across the frequency range of human hearing into a single number, weighting is typically applied. Most commonly, A-weighting, denoted as dB(A), is used for environmental noise assessment. This is often supplemented by the linear or C-weighting curves, where there is the potential for excess low-frequency sound at higher sound pressure levels. 
dB(A)	dB(A) denotes a single-number sound pressure level that includes a frequency weighting ('A-weighting') to reflect the subjective loudness of the sound level. The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dB(A). Some typical dB(A) levels are shown below.

Sound Pressure Level dB(A)	Example
130	Human threshold of pain
120	Jet aircraft take-off at 100 m
110	Chain saw at 1 m
100	Inside nightclub
90	Heavy trucks at 5 m
80	Kerbside of busy street
70	Loud stereo in living room
60	Office or restaurant with people present
50	Domestic fan heater at 1m
40	Living room (without TV, stereo, etc)
30	Background noise in a theatre
20	Remote rural area on still night
10	Acoustic laboratory test chamber
0	Threshold of hearing

$L_{90(period)}$	The sound level exceeded for 90% of the measurement period.

Abbreviations	Definition
	The L_{90} is often defined as the 'average minimum' or 'background' noise level for a period of measurement. For example, 45 $dBL_{A90,15min}$ indicates that the sound level is higher than 45 dB(A) for 90% of the 15-minute measurement period.
$L_{eq(period)}$	The equivalent ('eq') continuous sound level, used to describe the level of a time-varying sound or vibration measurement. The L_{eq} is often defined as the 'average' level, and mathematically, is the energy-average level over a measurement period – i.e. the level of a constant sound that contains the same sound energy as the measured sound.
L_{max}	The L_{max} is the 'absolute maximum' level of a sound or vibration recorded over the measurement period. As the L_{max} is often caused by an instantaneous event, it can vary significantly between measurements.
Peak Particle Velocity (PPV)	The highest velocity of a particle (such as part of a building structure) as it vibrates. PPV is commonly used as a vibration criterion for the assessment of cosmetic and structural damage.
Sound Power and Sound Pressure	The sound power level (L_w) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level (L_p) varies as a function of the environment and distance from a source. The sound power level is an intrinsic characteristic of a source (analogous to its mass), which is not affected by the environment within which the source is located.
Vibration	Waves in a solid material are called 'vibration', as opposed to similar waves in air, which are called 'sound' or 'noise'. If vibration levels are high enough, they can be felt; usually vibration levels must be much higher to cause structural damage. A vibrating structure (e.g. a wall) can cause airborne noise to be radiated, even if the vibration itself is too low to be felt. Structure borne vibration limits are sometimes set to control the noise level in a space. Vibration levels can be described using measurements of displacement, velocity and acceleration. Velocity and acceleration are commonly used for structure borne noise and human comfort. Vibration is described using either metric units (such as mm, mm/s and mm/s^2) or else using a decibel scale.

1. Executive Summary

A noise and vibration assessment has been undertaken for the proposed Melbourne Energy and Resource Centre (MERC) which will be owned and operated by Cleanaway Operations Pty Ltd (Cleanaway). The purpose of the noise and vibration assessment is to highlight the risks of harm to human health from the proposed MERC WtE facility to the nearest noise and vibration sensitive receivers and provide mitigation options to minimise these risks as far as reasonably practicable to address the General Environmental Duty (GED) in Victoria. The information in this document is provided to support the MERC Proposal including the DLA application process and providing inputs into the Human Health Risk Assessment report.

Victorian Environmental Protection legislation and guidelines have been used to outline appropriate noise criteria for construction, operation, and maintenance of the MERC facility. Guidelines from New South Wales have also been adopted for establishing and assessing vibration criteria on the project.

The facility will operate 24 hours a day and have truck deliveries between 6 am and 6 pm from Monday – Saturday. Noise modelling of the MERC facility includes noise emissions from the facility during day, evening and night periods, with dominant noise contribution from movements of heavy vehicles within the facility boundaries. Cumulative noise contributions from nearby existing industrial facilities have been included in the noise assessment. Future industrial developments that may be constructed nearby to the MERC facility and/or nearby to the nearest noise sensitive receivers relevant to the MERC Proposal are not part of this assessment.

This report does not include vibration emissions from operational equipment at the MERC WtE facility due to the current level of project development, however preliminary mitigation measures are included to address potential risks that may arise in detailed design.

The key outcomes of the noise and vibration assessment are as follows:

- There is a risk of noise exceedances to noise sensitive residents during the construction stage of the project. A construction noise and vibration management plan (CNVMP) must be prepared to manage noise and vibration mitigation strategies and monitoring during the construction stage.
- Minimum safe working distances from construction equipment suggest that there is low risk of vibration criteria exceedance to nearby sensitive receivers.
- There is a risk of exceedance against the Victorian Noise Protocol to resident at 475 Summerhill Road during the day and night-time operations of the MERC facility.
    - The dominant noise contribution during day and night-time operations are from heavy vehicle (i.e. trucks) movement on-site.
    - Practical mitigation measures have been proposed but have not yet been finalised and include:
        - The implementation of noise barriers or earth bunds to shield noise to affected residents
        - Further detailed design of equipment and further refinement of traffic data, and/or
        - Upgraded treatment to glazing to affected properties which will require community engagement and consultation with residents
    - Unresolved mitigation measures (noise exceedance risk) at this stage will be communicated through planning and environmental approvals documentation.
- There is a risk of exceedance against the Victorian Noise Protocol to resident at 570 Summerhill Road during day-time testing of the emergency diesel generator. Noise mitigation measures that include noise attenuation to in-take and or exhaust of the generator will address this exceedance risk.
- There is a risk that increased traffic noise (especially of heavy vehicles) relating to the MERC site may potentially impact residents along the route. There are no clear guidelines or criteria in Victoria around controlling/monitoring increased operational traffic noise on public roads for a project such as MERC,

however future opportunities to reduce noise to residents along the route such as upgrade of roads should be considered.

The noise and vibration assessment undertaken has highlighted the risks of harm to human health and mitigation measures required to address these risks.

2. Introduction

2.1 Proposal overview

Cleanaway Operations Pty Ltd (Cleanaway) is an Australian waste management, recycling, and industrial services company. Cleanaway is developing a waste-to-energy (WtE) facility in Victoria known as the Melbourne Energy and Resource Centre (MERC) (the Proposal).

The Proposal will be designed to thermally treat 380,000 tonnes per annum (tpa) of waste feedstock that would otherwise be sent to landfill, primarily consisting of residual Municipal Solid Waste (MSW) and residual Commercial and Industrial (C&I) waste. The Proposal will also incorporate maturation and processing of bottom ash to recover recyclable metals, with the intent to utilise the remaining ash as an aggregate in construction.

Residual waste is waste that is left over from recycling and resource recovery operations and waste from source separated collections. Source separation involves separating waste into common material streams or categories for separate collection. Waste processed at the site will be subject to a Waste Acceptance Protocol to ensure only appropriate waste is used as feedstock.

The WtE process would generate approximately 46.3MW gross of electricity, 4.7MW of which would be used to power the facility itself and the associated on-site by-product and residue handling processes, with 41.6MW (328,700 MWh/year) exported to the grid as base load electricity. In addition to supplying electricity to the grid, there is also potential to supply energy in the form of heat and/or process steam to local industrial users.

Some residual materials are produced because of the WtE process, including Incinerator Bottom Ash (IBA), boiler ash and flue gas treatment residue. The boiler ash and flue gas treatment residue are typically combined and together are referred to as Air Pollution Control residue (APCr). Overall, the WtE process typically leads to about 90% reduction in the volume, or 80% reduction in mass (tonnes), of waste that would otherwise go to landfill. If IBA is reused as an alternative construction product to virgin materials, this percentage increases further to approximately 95% reduction in volume and mass of waste that would otherwise go to landfill. The final volume of waste diverted from landfill is dependent on the classification and market for the residues and by-products generated by the WtE facility.

The Proposal includes the construction and operation of an IBA maturation and processing facility on site. The purpose of this facility is to store the IBA to mature (stabilise) it, before mechanically processing IBA from the WtE facility into an aggregate for reuse. As part of this process, both ferrous and non-ferrous metals will be recovered from the IBA for recycling and sale to market.

The Proposal also includes a stabilisation facility for APCr, a necessary treatment step to immobilise leachable components of the APCr prior to removal from site by vehicle and disposal at an appropriately licenced landfill.

The Proposal will use best available techniques and technologies in the engineering design, operation, maintenance and monitoring activities associated with the MERC. Moving grate technology has been chosen as the means to thermally treat incoming waste to recover energy and other resources. Current international best-practice techniques, including automated combustion controls and advanced flue gas treatment technology will be applied so that air emissions meet stringent emission standards. The moving grate combustion system is a common form of thermal WtE technology in which the waste is fed through the combustion chamber on a travelling grate. This enables efficient and complete combustion of the waste, with primary combustion air introduced from below the grate and secondary combustion air introduced directly into the combustion zone above the grate. Moving grate technology has been used globally for over 100 years, and in that time the technology has been subject to continual improvement responding to regulatory, industry and public demands. There are approximately 500 similar operational examples across Europe alone, the majority of which use the moving grate-type technology being proposed for the MERC.

The Proposal involves the building of all onsite infrastructure required to support the WtE facility, including site utilities, internal roads, weighbridges, parking and hardstand areas, stormwater infrastructure, fencing and landscaping. The Proposal will also include a visitor and education centre to help educate and inform the

community on the circular economy, recycling, resource recovery, the benefits of landfill diversion and the WtE process. The intent behind this education is to drive a shift in community thinking and actions around waste management.

The Victorian Waste to Energy Framework (2021) recognises the role of WtE to divert waste from landfills, helping Victoria transition to a circular economy. *Recycling Victoria* recognises a role for WtE investment and supports WtE facilities where they meet best-practice environment protection requirements. This includes reducing waste to landfill, supporting waste avoidance, reusing and recycling, and demonstrating social license with affected communities. The Victorian Environment Protection Authority (EPA) Energy from Waste Guideline (Publication 1559, 1 July 2017) also notes that efficient recovery of energy from the thermal processing of waste is considered a resource recovery as opposed to a waste disposal option.

The EPA VIC Guideline: Energy from Waste stipulates that *'Proponents of EfW proposals…will be expected to demonstrate that the siting, design, construction and operation of EfW facilities will incorporate best practice measures for the protection of the land, water and air environments as well as for energy efficiency and greenhouse gas emissions management. Facilities should be able to provide evidence of how they minimise and manage emissions (including pollutants, odour, dust, litter, noise and residual waste) in accordance with relevant statutory requirements.*'

The WtE facility has been designed to meet the European Industrial Emissions Directive (IED) (2010) and the associated Best Available Techniques Reference (BREF) Document for Waste Incineration published December 2019, which sets the European Union environmental standards for waste incineration. The facility will also comply with the technical criteria set out in the EPA Victoria Guideline: Energy from Waste publication 1559.1.

The purpose of this specialist assessment is to demonstrate compliance with the various authority requirements, develop community support and social license.

2.2 Purpose of assessment

The purpose of this noise and vibration assessment is to demonstrate compliance with the various authority requirements, develop community support and social license.

The cornerstone of the new environmental protection legislation (*Environment Protection Act 2017*) is the General Environmental Duty (GED). The GED requires that anyone conducting an activity that poses risks of harm to human health and the environment from pollution or waste must minimise those risks, so far as reasonably practicable. This report provides assessment of potential risks of noise and vibration, and mitigation measures to address these risks.

This report will also provide inputs into the Human Health Risk Assessment report as part of the MERC Proposal.

This noise and vibration report will include:

- Noise and vibration criteria based on Victorian Environmental Protection (EP) legislation and guidelines. In the absence of Victoria specific guidance, NSW guidance will be adopted.
- Assessment of airborne noise emissions for construction and operation of the MERC WtE facility to the nearest sensitive receivers outside the Proposal area boundary.
- Assessment of vibration emissions for construction of the MERC WtE facility to the nearest sensitive receivers outside the Proposal area boundary. This is in the form of expected safe working distances of vibration generating construction plant and equipment

This report does not include:

- Vibration emissions from operational equipment at the MERC WtE facility due to the current level of project development, however possible risks and mitigation measures are included
- Noise and vibration assessment to receivers within the Proposal area boundary
    - The operator of the MERC facility is responsible for managing (assessing and controlling) noise levels within the Proposal area in accordance with the *Occupational Health and Safety Act 2004*

and the Occupational Health and Safety Regulations 2017 in Victoria. Refer to the Hazard and Risk report (Arup 2022) for these details.

- Internal noise and vibration design to *non-factory* spaces such as administration/office buildings and visitor centre
    - Consideration of the *Australian Standard AS2107:2016 Acoustics – recommended design sound levels and reverberation times for building interiors* should be referenced for these cases and appropriate partitions/floors/ceilings chosen to address sound reduction of airborne noise, structure-borne noise and vibration especially between *non-factory* and main factory spaces
- Future industrial developments that may be constructed nearby to the MERC facility and/or nearby to the nearest noise sensitive receivers relevant to the MERC Proposal are not part of this assessment. Future industrial developments may contribute to future noise exceedances at noise sensitive receivers and must be managed collaboratively between duty holders of each facility contributing to the exceedance.

2.3 Level of development

This section briefly states the information available to undertake noise and vibration assessments based on the current level of development of the MERC project.

- Information known:
    - Maximum internal noise levels of factory spaces during normal operation (supplied by Ramboll)
    - Emergency and maintenance modes of the factory (supplied by Ramboll)
    - Peak daily peak numbers of heavy and light vehicles based on capacity of factory operations (supplied by Ramboll)
    - Expected location of stationary noise sources, building locations and building envelope materiality
    - Expected location of truck entrances to the WtE site.
- Information based on Arup database
    - Noise of external Incinerator Bottom Ash (IBA) conveyor belt system
    - Noise levels of mobile plant and outdoor truck loading events.
- Information based on construction and operation of reference WtE facilities but needs confirmation as the MERC project develops:
    - Construction noise and vibration source level data, activities, locations on site and expected usage
    - Possible risks of operational equipment vibration
    - Expected noise levels of outdoor operational stationary plant (Air Cooled Condenser (ACC) fans, Radiator Cooler (RC) or Component Cooler fans, stack flue, substation)
    - Noise levels and expected operational vehicular movements of heavy and light traffic on-site
    - Daily traffic volumes.

2.4 Site description

The Proposal area is located at 510 Summerhill Road, Wollert, Victoria within the Whittlesea local government area. The Subject Site boundaries are located within Farming Zone (FZ) and Rural Conservation Zone – Schedule 1 (RCZ1).

The south boundary of the Proposal area runs along Summerhill Road (local rural road). Summerhill Road is managed/owned by Whittlesea Council between Merri Creek and Epping Road, and managed/owned by Hume Council further west between Amaroo Road and Merri Creek. The existing Summerhill Road immediately south of the WtE facility is generally flat gravel road with grass verges.

2.4.1 Surrounding land uses

See Appendix A for the planning property report of the Proposal area.

The site is immediately surrounded by the following planning zones:

- Farming Zone (FZ)[1] to the west followed by Rural Conservation Zone – Schedule 1 (RCZ1)
- Rural Conservation Zone – Schedule 1 (RCZ1) to the north
- Special Use Zone 4 (SUZ4)[2] Earth and Energy Resources Industry Type 3 to the east
- Summerhill Road to the south of the Proposal area followed by
  - Special Use Zone 4 (SUZ4) Earth and Energy Resources Industry Type 3 to the south-west
  - Farming Zone (FZ) to the south-east

Along with the surrounding land uses stated above, the Proposal area is surrounded by noise emitting transport infrastructure and industrial facilities including:

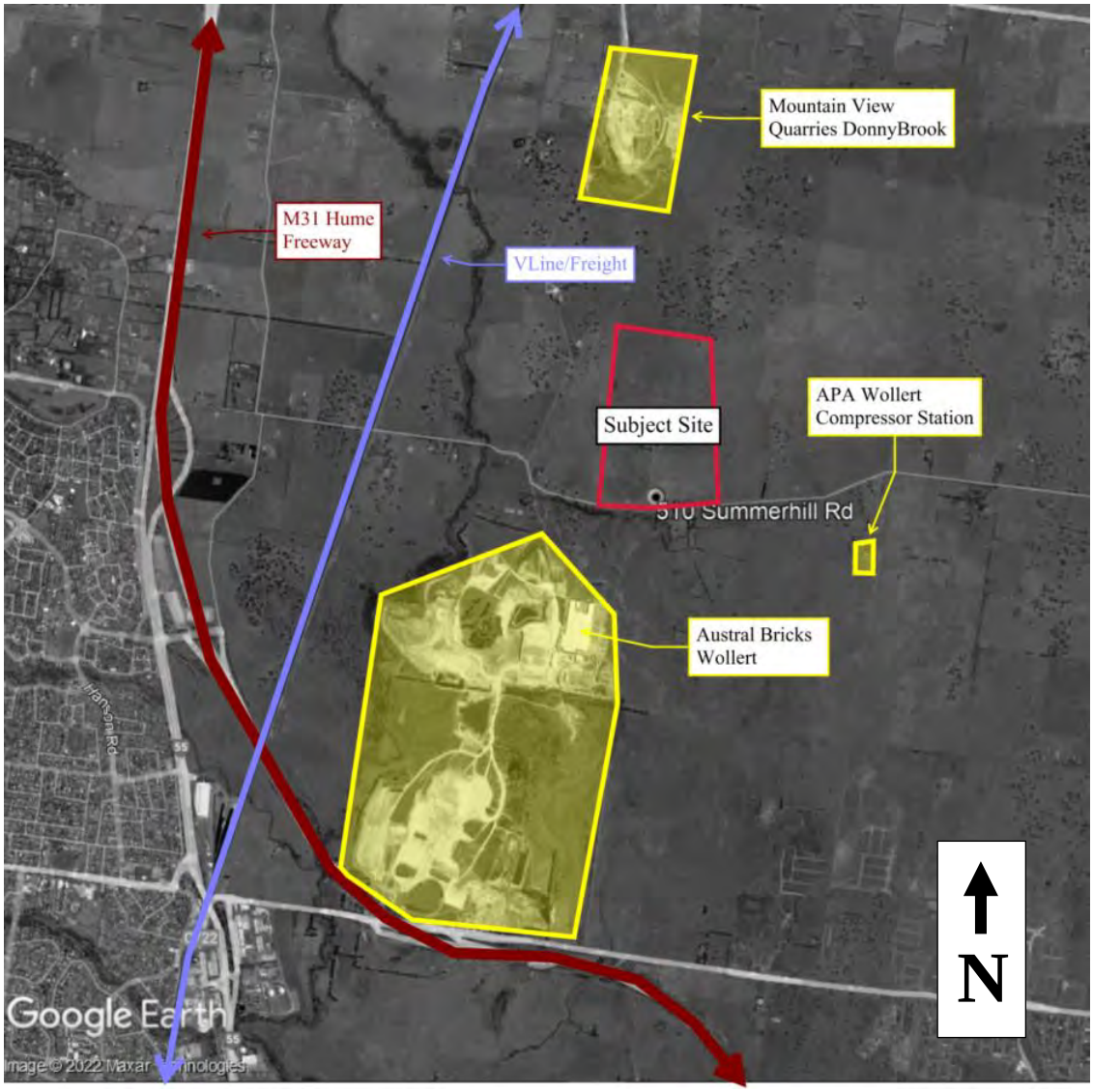
- Mountain View Quarries Donnybrook approximately 800 m to the north of the Proposal area boundary
- Dual carriageway for V/Line passenger and freight trains approximately 1.35 km to the west with a level crossing boom gate control at Summerhill Road
- M31 Hume Freeway approximately 3 km to the west, southwest and south
- Industrial facility complex with the closest factory building approximately 630 m to the south of the Proposal area containing Brickworks Design Centre Wollert and Austral Bricks Wollert
- APA Western Outer Ring Main Wollert Compressor Station approximately 1 km east of Proposal area on the south side of Summerhill Road.

Locations of these noise emitting sources are provided in Figure 1 below.

[1] Designated as Type 2

[2] Within the Whittlesea local government area as listed in Publication 1826.4 Noise Protocol for Victoria (1 July 2021)

Figure 1: Existing noise sources surrounding the Proposal area



3. Regulatory context and state of knowledge

This section sets out the noise and vibration legislation, policy and guidelines applicable to Victoria. Together, these documents form the current 'state of knowledge' for noise and vibration in relation to the Proposal.

3.1 State legislation overview

On July 1, 2021 the new environmental protection (EP) legislation, the *Environment Protection Act 2017* (the EP Act) as amended by the *Environment Protection Amendment Act 2018,* was enacted. This new Act has superseded the previous *Environment Protect Act 1970.*

The centrepiece of the new EP legislation is the general environmental duty (GED). The GED requires Victorians to understand and minimise their risks of harm to human health and the environment from pollution and waste (including noise). Duty holders (in this instance, the Proponent) need to comply with the GED under Section 25 of the EP Act.

The EP Act introduces an 'unreasonable noise' section, *Section 166 – Unreasonable noise*, to provide a legislative control for any noise emitted from a place or premises.

Part 5.3 – Noise of the *Environment Protection Regulations 2021* (the EP Regulations) prescribes situations which constitute 'unreasonable noise' from residential, commercial, industrial and trade premises, entertainment venues and outdoor entertainment events. The EP Regulations also define 'noise sensitive areas'[3] and 'noise limit', which means the maximum effective noise level allowed in a noise sensitive area, as determined in accordance with the Noise Protocol; *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*. The objective of the EP Regulations is to further the purpose of, and give effect to, the EP Act.

Noise from the MERC facility will be assessed with respect to the EP Act including:

- The Environment Protection Regulations 2021
- EPA Publication 1834 Civil construction, building and demolition guide
- EPA Publication 1820.1 Construction – guide to preventing harm to people and the environment
- EPA Publication 1826 Noise Protocol for Commercial, Industrial and Trade premises and entertainment venues
- EPA Publication 1996 Noise Guideline: Assessing low frequency noise

The methodology in the following document will also be drawn upon to consider corrections to predicted broadband noise levels that have low frequency characteristics:

- NSW EPA Noise Policy for Industry, October 2017

There are no legislative requirements for assessment of vibration in Victoria. The following additional documents have been referenced, and together with the above documentation forms the *state of knowledge*:

- NSW EPA *Draft Construction Noise Guideline*, 2020
- NSW Department of Environment and Climate Change *Interim Construction Noise Guideline,* 2009 (ICNG)
- NSW Department of Environment and Construction *Assessing Vibration: a technical guideline,* 2006.

[3] For example, in context of residential receivers in the study area of this project, a noise sensitive areas means within 10 metres of the outside of the external walls of a dwelling, residential building or a noise sensitive residential use within the boundary of that parcel of land.

3.2 Civil, construction and demolition guide

Chapter 4 of the *Civil construction, building and demolition guide* (Publication 1834) provides guidance to reduce noise and vibration impacts during the construction of the facility. The guideline acknowledges the links between noise and vibration and health impacts, including:

- Reduced quality of sleep
- Discomfort
- Reduced cognitive performance
- Stress, anxiety, or increase of existing problems
- Changes to behaviour of animals.

Factors that are known to influence the risk of harm include:

- Proximity of noise or vibration source
- Timing of works (e.g. day or night)
- Duration of exposure
- Background noise levels
- Duration of the works (e.g. if the project is a multi-year project).

EPA documentation acknowledges that the earlier that noise and vibration impacts are considered in the proposed works, the greater the opportunity to identify and implement relevant controls, such as (but not limited to):

- Control of operating hours is highlighted as the most effective way of reducing harm from noise due to construction activities. On occasions whereby works need to take place outside of normal working hours, documentation justifying out of hours works should be maintained and community consultation undertaken to notify affected residents
- Noise from vehicles and equipment should not exceed the manufacturer's specifications and vehicles should be regularly serviced, including noise management equipment, such as mufflers. Traffic management is also a tool in managing and reducing noise impacts
- Noise abatement measures, such as noise screens or earthen embankments are highlighted as an important tool to mitigate noise impact.

The guideline defines major construction works as follows:

- Development of road, rail, tunnels, bridges, power facilities, residential estates and public facilities such as schools and hospitals
- Sewer replacement works
- Underground power cable laying
- Other public works requiring major excavation.

Given the extent of these works they are likely to be considered major construction works.

The *Civil construction, building and demolition guide* provides recommendations for protecting nearby residential premises from unreasonable noise from commercial and industrial construction sites through the implementation of community consultation and work scheduling to manage noise impacts. These recommendations are summarised in Figure 2 below.

Figure 2: EPA Publication 1834: Construction, Building and Demolition Schedule/Noise Limits

Normal Working Hours

7:00 – 18:00 hrs Monday to Friday

7:00 – 13:00 hrs Saturdays

Weekend/evening work hours

Noise level at any residential premises is not to exceed background noise by:

- 10 dB(A) or more for up to 18 months after commencement of the works (i.e. significant construction commencing in a particular area)
- 5 dB(A) or more after 18 months

During the hours of:

18:00 – 22:00 hrs	Monday to Friday
13:00 – 22:00 hrs	Saturdays
07:00 – 22:00 hrs	Sundays and public holidays

Night period

Noise inaudible within a habitable room of any residential premises during the hours of:

22:00 – 7:00 hrs	Monday to Sunday

The guideline provides additional recommendations to control the potential noise impact on nearby noise sensitive receivers, summarised in Section 3.2.1 below.

3.2.1 Community consultation and work scheduling

Community consultation is essential for large-scale or high-impact works. Where the community will be significantly impacted, consult on the benefits and drawbacks of different scheduling, planning and remediation options. The following recommendations apply to large Projects with nearby sensitive uses:

- Inform potentially noise-affected neighbours about the nature of construction stages and noise reduction measures
- Give notice as early as possible for periods of noisier works such as piling. Describe the activities and how long they are expected to take. Keep affected neighbours informed of progress
- Appoint a principal contact person for community queries
- Within normal working hours, where it is reasonable to do so:
    - Schedule noisy activities for less sensitive times, (for example, delay a rock-breaking task to the later morning or afternoon)
    - Provide periods of respite from noisier works (for example, periodic breaks from jackhammer noise)
- The weekend/evening work hours in the schedule (including Saturday afternoon or Sunday) are more sensitive times and have noise requirements consistent with quieter work
- The weekend/evening periods are important for community rest and recreation and provide respite when noisy work has been conducted throughout the week. Accordingly, work should not usually be scheduled during these times.

3.2.2 Works outside normal working hours

Works should be constrained to normal working hours where possible. However, works outside normal working hours may at times be necessary and should be done in accordance with local laws or an approval, where relevant. The guideline details specific management for works or activities that may occur outside normal working hours as follows:

Unavoidable works are works which pose an unacceptable risk to life or property or a major traffic hazard and can be justified. Includes an activity which has commenced but cannot be stopped. The duty holder (or the works proponent) will need to demonstrate that planned unavoidable works cannot be reasonably moved to normal work hours. This requires additional consideration of potential noise and vibration generating activities and controls to noise and vibration. These can be recorded within the noise and vibration management plan (may be part of a broader environmental management plan). The relevant authority must be contacted to seek any necessary approvals for unavoidable works. Affected sensitive receivers should be notified for the intended work, its duration and times of occurrence.

Low-noise or managed-impact works are works approved by the relevant authority that are:

- Inherently quiet or unobtrusive (for example, manual painting, internal fit-outs, cabling) or
- Where the noise impacts are mitigated (for example, no impulsive noise and average noise levels over any half hour do not exceed the background) through actions specified in a Construction Noise and Vibration Management Plan (CNVMP) and supported by expert acoustic assessment.

Low-noise or managed-impact works do not have intrusive characteristics such as impulsive noise or tonal movement alarms.

It is noted that for the night period, the guideline specifies noise is to be "inaudible within a habitable room of any residential premises". It is often impractical to conduct attended listening within residences to assess this criterion, therefore construction noise will be considered to be inaudible inside the residence if it is:

- More than 10 dB below outdoor background (L_{A90}) noise level, or
- Less than 30 $dBL_{Aeq,T}$ outside the residence (based on AS/NZS2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors*).

3.2.3 NSW EPA

The NSW EPA Draft Construction Noise Guidelines provide construction noise management levels for airborne noise at residences. NSW guidance is typically adopted in Victoria as the state of knowledge in the absence of Victoria specific guidance.

The daytime construction noise management levels are reproduced in Table 1.

Table 1: Management levels for airborne noise to residences.

Time of Day	Management Level $L_{Aeq,15min}$	How to apply
Normal working hours	Noise Affected Background Level + 10dB	The Noise Affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected management level, the proponent shall apply all feasible and reasonable work practices to meet this level. As a matter of good practice, noise should be reduced as far as reasonably practicable. The proponent should notify all potentially impacted residents.
	Highly Noise Affected 75 dB(A)	The Highly Noise Affected level represents the point above which there may be strong community reaction to noise. Where noise is above the highly noise affected management level, all feasible and reasonable mitigation shall be applied as well as engagement with the consent authority or regulator to identify other measures to manage noise impacts. Where appropriate, engagement with the community is encouraged to determine the preferred mitigation approach, such as: • Negotiated agreements and/or respite periods to restrict work activity • Identification of times when the community is less sensitive to noise, including options for longer periods of construction in exchange for restrictions on construction times.

Time of Day	Management Level $L_{Aeq,15min}$	How to apply
Outside normal working hours	Background Level + 5dB	Strong justification is required for works outside the recommended standard hours. The proponent shall apply all feasible and reasonable work practices to meet the noise affected management level. Where this cannot be met, residual impacts should be quantified, and potentially impacted residents notified.
	Highly Noise Affected 65 dB(A)	The highly noise affected management level represents the point above which the supplementary mitigation must be considered. The proponent must justify the selection of feasible and reasonable mitigation, including the supplementary mitigation, with emphasis on consultation with the community and the consent authority or regulator, and community views on work scheduling and respite periods.

3.3 Commerce, Industry and Trade Noise Legislation

Within the Melbourne metropolitan area, noise emissions from commercial, industrial and trade (CIT) premises is governed by the Environmental Protection Regulations (EP Regulations). The EP Regulations supersede the previous *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1).

The EP Regulations refer to an incorporated document titled *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (EPA Publication 1826) (the Noise Protocol) to set noise limits, assess existing noise emissions and evaluate the anticipated noise emissions from development proposals.

Noise limits must be set at an assessment location within a *noise sensitive area* as defined by the EP Regulations.

The calculation of noise limits requires the calculation of a zoning level that is based on land use in the surrounding area. The zoning level is then adjusted appropriately, depending on the measured background noise level[4].

3.3.1 Time periods

The EP Regulations separate the day into three different operating time periods; day, evening and night, as shown in Table 2.

Table 2: Operating time periods

Period	Day of week	Time period
Day	Monday – Saturday	0700 – 1800hrs
Evening	Monday – Saturday	1800 – 2200hrs
	Sunday, Public Holidays	0700 – 2200hrs
Night	Monday – Sunday	2200 – 0700hrs

3.3.2 Noise limits for emergency operations

The Noise Protocol sets noise limits for testing and maintenance of emergency equipment.

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.

[4] The process to determine an appropriate noise limit adopted in Publication 1826 is largely identical to that adopted previously in SEPP N-1.

In accordance with the Noise Protocol, a standby generator is only classified as such in the case of emergencies or in planned maintenance if the operating period is less than or equal to 4 hours a month. For the purposes of this assessment, it is assumed that this maintenance programme would be feasible for the WtE facility, however Cleanaway must notify the project team if prolonged testing is planned.

3.3.3 Cumulative noise levels

The Noise Limits established for a WtE facility apply to all combined industrial noise at the receiver, that is, it is not a single site's emission limit, but is the cumulative noise limit for *all* industrial, commercial and trade noise at the receiver.

Clause 3.3.1 in the *Technical Guide: Measuring and Analysing Industry Noise and Music (EPA Publication 1997)* outlines guidance on *Noise Sharing*, where the cumulative noise contribution from multiple noise emitters must be taken into consideration and shared equally. In effect this means that when there are multiple significant noise sources, that the emission limits for each site are reduced, so that when combined they do not exceed the Noise Protocol limit. As mentioned in Section 2.2, noise emissions from future developments nearby to the proposed MERC facility and/or noise sensitive receivers applicable to the MERC facility have not been included in this assessment but must be managed by the duty holders of the facilities.

Site investigation has been conducted to understand the noise levels in vicinity of the Proposal area and nearest noise sensitive receivers. Noise data collected includes ambient noise from other nearby industrial sites including Mountain View Quarries Donnybrook, Austral Bricks Wollert and APA Western Outer Ring Main Wollert Compressor Station. We understand that is it likely that at least one of the adjacent sites will operate during the night-time hours where the cumulative noise contribution is most critical for the site noise criteria.

3.3.4 Effective noise level assessment

To verify compliance, the noise level at the noise sensitive receiver is measured and compared against the limits.

The Noise Protocol provides requirements for the location of the noise measurements (outdoor, indoor) based on the noise transmission path and the WtE facility constraints.

In general, the Noise Protocol requires that noise measurements are undertaken directly outside the residence potentially affected by noise from commerce or industry.

The effective noise level used for assessment must account for:

- Measured noise level
- Noise adjustments to account for noise duration, measurement position and noise character, including tonality, impulsivity and intermittency
- Cumulative contribution from existing and approved premises affecting noise sensitive areas.

3.3.5 Assessing low frequency

Regulation 120 of the EP Regulations 2021 makes frequency spectrum a prescribed factor when assessing noise from commercial, industrial and trade premises. The frequency spectrum from 10 – 160 Hz must be used to assess whether the low frequency noise is unreasonable. The EPA Publication 1996 *Noise Guideline: Assessing low frequency noise* (June 2021) provides information for predicting and assessing low frequency noise impact on noise sensitive receivers.

Common sources of low frequency noise that are highlighted in Table 1 of Publication 1996 that are relevant to the MERC project include:

- Boilers
- Cooling fans
- Compressors

- Diesel engines
- Electrical installations, power stations, transformers
- Extraction fans and ventilation plant
- Heavy machinery, large generators
- Loading and unloading activities
- Metal thudding
- Pumps and motors.

Suppliers of equipment and noise control solutions do not generally provide low frequency noise data extending down to the 10 Hz one-third octave band. It is therefore necessary to extrapolate published data following the trend of source noise levels and material transmission losses as the frequency decreases. Where the trend shows a reduction in noise as the frequency decreases, a flat spectrum will be extrapolated as a conservative estimate.

Low frequency predictions will be assessed against low frequency threshold levels. These threshold levels are not set limits, rather they are levels that indicate a potential risk of problematic low frequency noise. This report also adopts the NSW EPA Noise Policy for Industry methodology of exceedances of the low frequency noise threshold levels by adding a correction factor to the overall dB(A) broadband noise predictions.

See Section 7.1 for the specified low frequency noise threshold levels and how correction factors will be applied to predictive modelling.

3.4 Vibration Specific Guidelines

Victoria has no statutory vibration limits for construction. It is proposed to adopt criteria from relevant standards as used on other similar Projects, as well as reference to NSW EPA documentation. The standards and guidelines referenced in this section forms the *state of knowledge* with respect to vibration impact for construction and operation of the MERC facility.

The effects of vibration, and hence the criteria, can typically be split into three categories:

- **Effects of vibration on structures:** a level of vibration where the integrity of the building or the structure itself may be affected, ranging from cosmetic to major structural damage. The relevant criteria are typically well above the level of vibration which people may consider intrusive. Guidance on relevant vibration criteria are commonly found in AS 2187:2006 Part 2[5], BS 7385:1993 Part 2[6] and DIN 4150-3:2016[7] which also has criteria of particular reference for heritage structures and buried pipework
- **Human perception of vibration**: when the occupants or users of the building are potentially disturbed by vibration**.** Relevant guidance is provided in NSW *Assessing Vibration: a technical guideline*[8]. This document is based on BS 6472:1992[9]. Note that although a new version of BS 6472 has been published (BS 6472:2008[10]) which contains some considerable differences to the 1992 version of the Standard. The criteria from the 2008 version of the standard will be adopted

[5] Australian Standards, "*AS2187:2006 Explosives - Storage and Use - Part 2: Use of Explosives*,"

[6] British Standards Institute, "*BS7385:1993 Evaluation and Measurement for Vibration in Buildings Part 2*"

[7] Deutsche Norm *DIN 4150-3:2016 Vibrations in buildings- part 3: Effects on structures.* DIN, Germany

[8] Environment Protection Authority, *Assessing Vibration: A Technical Guideline*, EPA, Sydney, 2006.

[9] British Standards, *BS 6472-1992 Evaluation of human exposure to vibration in buildings (1-80Hz)*, British Standards

[10] British Standards, *BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*. British Standards

- **Effects on building contents**: people can perceive floor vibration at levels well below those likely to cause damage to typical building contents. However, some scientific equipment (e.g. electron microscopes and microelectronics manufacturing equipment) can require more stringent objectives than those applicable to human comfort. Where appropriate, objectives for the satisfactory operation of critical instruments or manufacturing processes should be sourced from manufacturer's data and/or other published objectives. There are no clinics or hospitals nearby requiring a vibration assessment, and therefore this has not been discussed further in this report.

3.4.1 Building Structures

DIN 4150-3 provides vibration targets to protect nearby buildings from structural damage, due to short-term and long-term vibration exposure. These guideline targets, in terms of peak particle velocity (PPV), are presented in Table 3 and Table 4. Long term vibration is defined as vibration likely to induce a resonant structural response.

These vibration targets have also been prescribed on large scale infrastructure Projects such as Melbourne Metro Tunnel and the West Gate Tunnel.

Table 3: Short-term vibration targets for building structures

Structural type	Vibration Velocity, PPV in mm/s				
	Foundation			Plane of floor of uppermost full storey	Floor slabs, vertical direction
	less than 10Hz	10–50Hz	50–100Hz	Frequency mixture	Frequency mixture
Commercial, Industrial or Similar	20	20 to 40	40 to 50	40	20
Dwellings or Similar	5	5 to 15	15 to 20	15	20
Particularly Sensitive	3	3 to 8	8 to 10	8	20

Table 4: Long-term vibration targets for building structures

Type of structure	Vibration velocity, mm/s PPV in horizontal plane at all frequencies	Vibration velocity, mm/s PPV in vertical plane at all frequencies
Buildings used for commercial purposes, industrial buildings and similar design	10	10
Dwellings and buildings of similar design and/or occupancy	5	10
Structures that have a particular sensitivity to vibration e.g. heritage buildings	2.5	10

A maximum vibration velocity, PPV of 10 mm/s for commercial buildings, and 5 mm/s for residential dwellings are nominated as targets for structural damage for this assessment. Due to the distance of > 100 metres between the Proposal area boundary and the nearest residential dwelling at 475 Summerhill Road, it is unlikely that structural damage to buildings due to construction work within the Proposal area will be an issue.

3.4.2 Underground utilities

DIN4150-3:2016 provides vibration targets to avoid damage to buried pipework. These targets are shown in Table 5. These are general guideline values, and the asset owner should be consulted to establish limits for below-ground infrastructure.

Table 5: Vibration targets for buried pipework

Pipe material	Vibration velocity, mm/s PPV
Steel	100
Clay, concrete, reinforced concrete, pre-stressed concrete, metal	80
Masonry, plastic	50

A Before You Dig Australia (BYDA) enquiry along Summerhill Road either side of the Proposal area identified no pipes or underground utilities and therefore it is not expected that the associated vibration limits apply to the WtE facility.

3.4.3 Human Comfort

Sources of vibration are defined in NSW *Assessing Vibration: a technical guideline* (the Guideline) as either 'Continuous', 'Impulsive' or 'Intermittent' as described in Table 6 below.

Table 6: Types of vibration – definitions

Type of vibration	Definition	Examples
Continuous vibration	Continues uninterrupted for a defined period (usually throughout the daytime and/or night-time).	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).
Impulsive vibration	A rapid build-up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds.	Infrequent: activities that create up to three distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Can be defined as interrupted periods of continuous or repeated periods of impulsive vibration that varies significantly in magnitude.	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer, this would be assessed against impulsive vibration criteria.

Table 7 reproduces the 'Preferred' and 'Maximum' values for continuous and impulsive vibration from Table 2.2 of the Guideline.

Table 7: Preferred and maximum vibration acceleration levels for human comfort, m/s^2

Location	Assessment period[1]	Preferred values		Maximum values	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night-time	0.020	0.014	0.040	0.028
Workshops	Day- or night-time	0.04	0.029	0.080	0.058
Impulsive vibration (weighted RMS acceleration, m/s^2, 1-80Hz)					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night-time	0.64	0.46	1.28	0.92
1 – Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am					

Table 8 reproduces the 'Preferred' and 'Maximum' values for intermittent vibration from Table 2.4 of the Guideline. The vibration does value (VDV) is dependent upon the level and duration of the vibration episode and the number of vibration episodes occurring during the assessment period; a higher vibration level is permitted if the total duration of the vibration event(s) is small.

Table 8: Acceptable vibration dose values (VDV) for intermittent vibration (m/s$^{1.75}$)

Location	Daytime[1]		Night-time	
	Preferred value	Maximum value	Preferred value	Maximum value
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60
1- Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am				

Due to the distance from the Proposal area boundary (where construction works may occur) to the nearest residential receivers as illustrated later in Figure 3 of Section 4.1, it is not expected that construction vibration will be a significant issue. Safe working distances from typical construction equipment with vibration emissions will be provided in Section 6.5 to address structural damage avoidance and human comfort criteria.

3.4.4 Ground-borne noise

Vibration has the potential to re-generate noise in building elements (e.g. floors, walls, etc.). Guidance for appropriate target levels has been sought from Section 5.6 of the NSW EPA *Draft Construction Noise Guidelines*, in the absence of local guidelines.

Target ground-borne noise levels are provided for residences, sleeping areas in hospital wards, student accommodation and hotel rooms during construction activities as outlined in Table 9.

Table 9: Ground-borne noise targets

Time period	Internal dB $L_{Aeq(15\ min)}$
Evening (6pm to 10pm)	40
Night (10pm to 7am)	35

The above targets apply to evening and night periods. In the event where the proposed activities are conducted primarily during Normal Working Hours, these levels generally do not apply.

Note that these targets apply only when ground-borne noise levels are higher than airborne noise levels.

As the targets only apply outside of normal working hours and when ground-borne noise is higher than airborne noise levels, ground-borne noise impact is not expected to be significant and therefore the associated limits are unlikely to be applicable.

3.4.5 Assessing construction vibration criteria

The assessment against construction vibration criteria to avoid damage to structures and remain under human response is provided in Section 6.5.3 as safe working distance for key construction equipment expected to sources of vibration.

4. Existing conditions

This section provides information relevant to the existing noise environment broadly across the study area of the MERC facility. The study area of interest is within one kilometre of the boundaries of the Proposal area and includes the nearest noise sensitive receivers which are considered worst case assessment points. Baseline noise site measurements conducted by Arup were located within the study area.

It is important to note that baseline noise monitoring within the study area will still measure noise contributions from rail, road and industrial noise outside the study area.

4.1 Baseline noise monitoring

The definition of noise sensitive areas are defined in the EP Regulations.

The nearest noise sensitive receivers have been identified graphically in Figure 3 below, along with unattended and attended noise monitoring locations.

Baseline attended and unattended noise monitoring was conducted in general accordance with EPA Publication 1826.4 *Noise Protocol for Commercial, Industrial and Trade premises and entertainment venues* between September – October 2022 to understand the existing noise environment in the area and establish construction noise management levels and operational Noise Protocol limits at noise sensitive receivers. Details of the noise monitoring methodology is provided in Appendix B.

Figure 3: Site and receiver locations

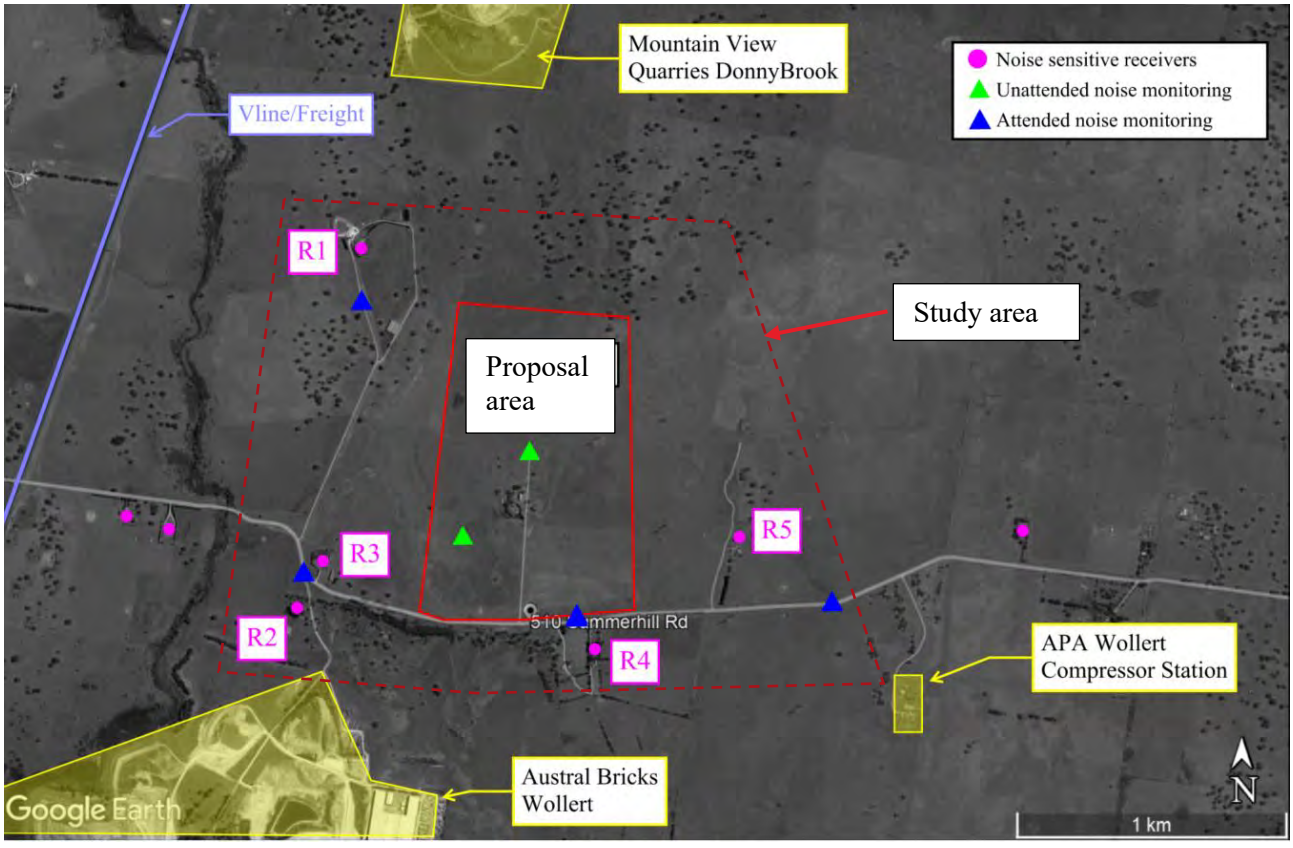


Table 10 summarises the nearest residential receivers, their distances from the nearest Proposal area boundary and their measured background levels determined from both attended and unattended noise measurements.

Table 10: Identification of nearest noise sensitive receivers and background noise levels

ID	Noise sensitive Receiver Address	Nearest distance to Proposal area boundary (m)	Background Noise Level, dBL_{A90}		
			Day	Evening	Night
R1	620 Summerhill Rd	400	37	37	38
R2	585 Summerhill Rd	430	37	37	38
R3	570 Summerhill Rd	350	37	37	38
R4	475 Summerhill Rd	110	37	37	37
R5	430 Summerhill Rd	350	37	37	41

The resulting background noise limits used to establish the Noise Protocol limits at each sensitive receiver are provided in Appendix C.

Based on the existing environment and the proposal description, the potential environmental risks that are assessed in this document are:

- Noise and vibration impacts of nearest noise sensitive residential receivers.

The next chapters detail the noise and vibration risk assessment in relation to both construction and operational impacts.

5. Assessment methodology

The construction and operational airborne noise impact assessments have been undertaken using a 3D computer acoustic modelling software SoundPLAN 8.1. Further details of airborne noise modelling methodology including modelling parameter assumptions and inputs are provided in Appendix D.

Construction vibration assessment against criteria set out in Section 3.4 has been conducted as a desktop assessment.

Typical construction equipment and plant expected during the construction phase of a WtE facility such as MERC are listed in Section 6.2. Typical safe working distances for construction equipment that are expected to be the most onerous sources of vibration are supplied in Section 6.5.3. These safe working distances are expected to meet vibration criteria for surrounding building structures and human comfort within residential building locations outside the Proposal area.

Based on the current level of development of the project, vibration emissions from operational equipment at the MERC WtE facility are unknown and specific predictions have not been assessed, however Section 8 includes details of potential risks and mitigation measures to consider during the equipment selection process.

6. Construction noise and vibration assessment

A detailed construction program is not yet known. A preliminary noise and vibration assessment has been undertaken based on the construction phases provided below. Construction works have been broadly broken down into five phases:

- Phase 1: Demolition (including initial mobilisation works then demolition and removal of the existing structures and facilities on the site)
- Phase 2: Site establishment and enabling works
- Phase 3: Main construction works
- Phase 4: Testing and commissioning
- Phase 5: Finishing and landscaping

6.1 Construction Noise Management Levels

Background noise levels were measured by Arup in September to October 2022 with further information provided in Appendix B. The construction noise management levels in this report have been based on these background noise level measurements.

Construction noise management levels for day, evening and night period are determined by the process in Table 1. Noise affected receivers are defined during the day-period when construction noise exceeds 10 dB above measured background level during normal work hours (day), 5 dB above measured background level outside normal working hours (evening), and when construction noise is considered audible during night period (see Section 3.2.2 for determination of inaudibility).

Based on guidelines discussed in Section 3.2, measured background noise levels at residential receivers and construction noise management levels are presented in Table 11.

Table 11: Construction noise management levels, dB re 20 µPa.

Time of Day	Background Noise Level, dBL_{A90}	Construction Noise Management Levels $dBL_{Aeq,15min}$
Normal working hours – Day (R1 – R5)	37	47 dB(A)
		Highly Noise Affected 75 dB(A)
Outside normal working hours – Evening (R1 – R5)	37	42 dB(A)
		Highly Noise Affected 65 dB(A)
Night (R1 – R3)[1]	38	30 dB(A) (inaudibility)
Night (R4)[1]	37	
Night (R5)[1]	41	
1. See Figure 3 and Table 10 for address and location of receivers R1 – R5		

6.2 Construction Source noise levels and usage

Details of the construction phases on the MERC project have not yet been detailed. The following details of construction plant and equipment used on the MERC project require refinement as the project progresses to ensure the noise management levels outlined in Table 11 are met:

- Sound power levels of all equipment
- Number of equipment/plant type
- Duration of equipment use during each phase
- Location of equipment on the site.

Expected construction stages and corresponding plant and equipment are provided in Table 12 below. This information is based on conservative assumptions for the MERC project and are indicative only.

Table 12: Construction stages and corresponding plant and equipment

Plant description	Main Works (Number of each equipment)		
	Phase 1 Demolition	Phase 2 Earthworks & Piling	Phase 3 to Phase 5 Construction (including roads & landscaping)
Backhoe loader	2	2	1
Backhoe with auger			1
Bulldozer (CATD8 to CATD10 or similar)	1	2	
Chain saw	2	2	
Compactor (CAT835 or similar)		2	2
Concrete Boom Pump		1	2
Concrete saw	2		1
Concrete truck		2	2
Concrete vibrator		2	4
Crawler Crane >200t			1
Delivery Truck		2	
Delivery Truck (incl low loader)			2
Diesel generator	2	2	4
Dump truck	2	2	2
Excavator (>25t)	1	2	1
Excavator (<25t)	1		
Excavator hammer	2		
Forklift			2

Plant description	Main Works (Number of each equipment)		
	Phase 1 Demolition	Phase 2 Earthworks & Piling	Phase 3 to Phase 5 Construction (including roads & landscaping)
Front end loader (FEL)		2	2
Grader (CAT14G to CAT16G or similar)		2	1
Hand tools	2	2	4
Manitou			2
Mobile crane (<50t)	1		1
Mobile crane (50t to 200t)			2
Padfoot roller		2	2
Piling rig (bored pile)		2	
Pump	4	2	4
Road profiler			2
Roller		2	3
Scraper		2	
Semi-trailer		2	
Truck and dog (trailer)	2		2
Trucks (water cart)	1	2	1
Vibration roller		2	2

Equipment sound power levels (L_w) have been sourced from AS2436 – 2010 (R2016), BS 5228-1:2009+A1:2014 and Transport for New South Wales 'Construction Noise and Vibration Strategy' (CNVS). It should be noted that during the different construction stages, it is unlikely that all machinery would be operating at the same time (like the modelling assumes). However, assuming a 'worst-case' scenario approach helps to identify where noise impacts could be a concern and assists in the design of mitigation measures.

Table 13: Construction scenarios and equipment

Equipment	Assumed percentage of use per 15 minutes	$L_{Aeq(15\ min)}$ Sound power level (per unit), dB(A)[2]
Asphalt paver	100%	112
Backhoe loader	100%	108
Backhoe with auger	100%	111
Bulldozer (CATD8 to CATD10 or similar)	100%	114
Chain saw	25%	119[1]

Equipment	Assumed percentage of use per 15 minutes	$L_{Aeq(15\ min)}$ Sound power level (per unit), dB(A)[2]
Compactor (CAT835 or similar)	100%	120[1]
Concrete Boom Pump	100%	106
Concrete saw	50%	127[1]
Concrete truck	100%	113
Concrete vibrator	100%	110[1]
Crawler Crane >200t	100%	113
Delivery Truck	100%	107
Delivery Truck (incl low loader)	100%	108
Diesel generator	100%	113
Dump truck	100%	117
Excavator (>25t)	100%	106
Excavator (<25t)	100%	95
Excavator hammer	25%	129[1]
Forklift	100%	106
Front end loader (FEL)	100%	115
Grader (CAT14G to CAT16G or similar)	100%	115
Hand tools (pneumatic)	100%	117
Manitou	100%	106
Mobile crane (<50t)	100%	113
Mobile crane (50t to 200t)	100%	113
Padfoot roller	100%	109
Piling rig (bored pile)	100%	111
Pump (water)	100%	100
Road profiler	100%	117
Roller	100%	99
Scraper	100%	116
Semi-trailer	100%	108
Truck and dog (trailer)	100%	108
Trucks (water cart)	100%	108
Vibration roller[1]	100%	117[1]

Equipment	Assumed percentage of use per 15 minutes	$L_{Aeq(15\ min)}$ Sound power level (per unit), dB(A)[2]
Notes: 1. Includes 5 dB penalty in accordance with the ICNG 2. Sound power level not adjusted for duration		

6.3 Construction noise and vibration methodology

Construction airborne noise predictive modelling has been undertaken using a 3D computer acoustic modelling software SoundPLAN 8.1. See Appendix D for further information on the modelling assumptions.

Construction vibration safe working distances for various construction equipment and plant are provided in Section 6.5.3.

6.4 Construction airborne noise impact

The predicted noise levels for different phases of construction are provided in Table 14. Red text indicates where predicted noise levels exceed the construction noise management levels at each receiver during normal working hours.

Table 14: Predicted noise to noise sensitive receivers for different phases of construction

ID	Receiver Type	Distance	Noise Management Levels				Predicted Noise Level, $L_{Aeq,15min}$		
							Construction Phases		
			Noise Affected – Normal Working Hours, $L_{Aeq,15min}$	Highly Noise Affected – Normal Working Hours, $L_{Aeq,15min}$	Noise Affected – Outside Normal Working Hours, $L_{Aeq,15min}$	Highly Noise Affected – Outside Normal Working Hours, $L_{Aeq,15min}$	Phase 1 Demolition	Phase 2 Earthworks & Piling	Phase 3 to 5 Construction (including roads & landscaping)
R1	Residential	400	47	75	42	65	51	50	51
R2	Residential	430	47	75	42	65	58	57	59
R3	Residential	350	47	75	42	65	55	54	55
R4	Residential	110	47	75	42	65	65	64	65
R5	Residential	350	47	75	42	65	58	57	59

Notes:
Results in red exceed the construction noise management levels and show residences as *noise affected* both within and outside normal working hours

Based on the equipment type and usage as listed in Section 6.2 and the predicted noise levels at each receiver, the risk of noise exceedance is likely to occur and noise mitigation measures must be considered. A Construction Noise and Vibration Management Plan (CNVMP) will be required, and construction activities and scheduling will need to be revised (compared to the assessment conducted above) to minimize risk of exceeding noise management levels at sensitive receivers.

6.5 Construction risk mitigations proposed

Noise mitigation measures for each major construction activity are discussed in the following section. These mitigation measures are considered to represent all 'feasible and reasonable' mitigation measures suitable for implementation during construction of the project. As noted previously, this is a preliminary study, therefore selection of equipment and preparation of a noise management plan should be implemented by the successful contractor once further information is available.

6.5.1 Construction noise management plan

For all construction works, the contractor would be expected to prepare a detailed Construction Noise and Vibration Management Plan (CNVMP). A detailed CNVMP should include all works associated with the construction of the WtE facility including works required for site access.

A CNVMP should include, but not be limited to the following:

- Roles and responsibilities
- Noise sensitive receiver locations
- Areas of potential impact
- Mitigation strategy
- Monitoring methodology
- Community engagement strategy.

General guidance on the control of construction noise and vibration impacts relevant to this study are discussed in the following sections.

In general, practices to reduce construction noise impacts will be required, and may include;

- Adherence to the standard approved working hours as outlined in the Project Approval
- Manage noise from construction work that might be undertaken outside the recommended standard hours
- The location of stationary plant (concrete pumps, air-compressors, generators, etc.) as far away as possible from sensitive receivers
- Using site sheds and other temporary structures or screens to limit noise exposure where possible
- The appropriate choice of low-noise construction equipment and/or methods
- Modifications to construction equipment or the construction methodology or programme. This may entail programming activities to occur concurrently where a noisy activity will mask a less noisy activity, or, at different times where more than one noisy activity will significantly increase the noise. The programming should also consider the location of the activities due to occur concurrently
- Carry out consultation with the community and surrounding building owners/occupants during construction including, but not limited to; advance notification of planned activities and expected disruption/effects, as well as construction noise complaints handling procedures.

6.5.2 Universal work practices

The following noise mitigation work practices are recommended to be adopted at all times on site:

- Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways to minimise noise
- Site managers to periodically check the site and nearby residences for noise problems so that solutions can be quickly applied
- Avoid the use of radios or stereos outdoors

- Avoid the overuse of public address systems
- Avoid shouting and minimise talking loudly and slamming vehicle doors
- Avoid the use of tonal reverse beepers where possible, a possible alternative being broadband squawkers
- Turn off all plant and equipment when not in use.

6.5.3 Vibration – minimum working distances

Recommended minimum working distances for vibration intensive plant, which are based on international standards and guidance, and reproduced in Table 15 for reference.

Table 15: Recommended minimum working distances for vibration intensive plant

Plant item	Rating / description	Minimum working distance (metres)			
		Cosmetic damage – screening criteria			Human response
		Industrial and heavy commercial buildings BS 7385 Line 1 -25 mm/s (See note 1)	Residential and light commercial buildings BS 7385 Line 2 – 7.5 mm/s (See note 1)	Structures unsound DIN 4150 Line 3 – 3 mm/s	
Vibratory roller	< 50 kN (~ 1 to 2t)	2	5	11	15 to 20
	< 100 kN (~ 2 to 4t)	2	6	13	20
	< 200 kN (~ 4 to 6t)	5	12	26	40
	< 300 kN (~ 7 to 13t)	6	15	31	100
	> 300 kN (~ 13 to 18t)	8	20	40	100
	> 300 kN (> 18t)	10	25	50	100
Hydraulic hammer – Small	300 kg / 5 to 12t excavator	1	2	5	7
Hydraulic hammer – Medium	900 kg / 12 to 18t excavator	3	7	15	23
Hydraulic hammer – Large	1600 kg / 18 to 34t excavator	9	22	44	73
Piling – Vibratory	Sheet piles	9	22	44	73
Piling – Bored (small auger)	≤ 800 mm	1 (nominal)	2	5	10
Piling – Hammer	12t down force	6	15	30	50
Jackhammer	Hand-held	1 (nominal)	1 (nominal)	3	5
Mechanised bored tunnelling works[1]	-	1 to 5	2 to 12	4 to 24	6 to 35
Note: 1_Where vibration might give rise to resonant responses in structures					

The minimum working distances are indicative only and will vary depending on the item of plant and local geotechnical conditions.

Given that the nearest residential receiver property building is approximately 120 m south of the Proposal area (construction site) boundary, it is not expected that construction vibration will be a critical issue to building structures and human comfort to residents within the study area.

6.6 Summary of construction risk mitigation

Mitigation measures required to achieve construction noise management levels and construction vibration criteria are provided in

Table 16: Construction mitigation measures for noise and vibration

ID	Risk	Mitigation measure	Timing
Construction Noise and Vibration			
NV01	Construction noise may exceed at noise sensitive receivers based on typical construction equipment, activities and usage.	A detailed Construction Noise and Vibration Management Plan (CNVMP) will be prepared. This plan will include: - Roles and responsibilities - Noise sensitive receiver locations - Noise mitigation strategy - Monitoring methods - Community engagement strategy. Safe working distances to be planned and monitored as part of the CNVMP.	Construction
NV11	Commissioning noise and vibration emissions	Noise and vibration emissions as part of Commissioning Plan requires approval from EPA including alarm systems and start-up of facility equipment	Commissioning
TT01	Construction transport management plan	A Construction Traffic Management Plan (CTMP) will be prepared to include measures to reduce construction traffic such as adjusting shift patterns and encouraging car sharing. The CTMP will form part of the CEMP and will be updated once a contractor is appointed. Construction transport routes / access to the site will be directed away from residential areas and sensitive receptors. Optimal construction access routes will be identified with City of Whittlesea, City of Hume and DoT. Timing of deliveries will also be considered to avoid impacts, and where possible, the number of construction vehicles will be limited.	Construction

7. Operational noise assessment

This chapter details the noise assessment in relation to operational noise impacts.

7.1 Operational noise criteria

Table 17 summarises the nearest noise sensitive residential receivers, background noise levels measured, and their associated operational noise limits calculated in accordance with the Noise Protocol are provided for each residential receiver in Appendix C.

Table 17: Operational noise limits for nearest noise sensitive receivers

Noise sensitive Receiver Address	Time period	Background Noise levels, L_{90}, dB(A)	Zoning Level, L_{eq} dB(A)	Noise limit, $L_{eq,30min}$ dB(A)	
				Normal Operation	Emergency Mode
R1 620 Summerhill Rd	Day	37	50	48	58
	Evening	37	44	44	49
	Night	38	39	41	46
R2 585 Summerhill Rd	Day	37	67	57	67
	Evening	37	60	52	57
	Night	38	55	50	55
R3 570 Summerhill Rd	Day	37	60	53	63
	Evening	37	54	49	54
	Night	38	49	47	52
R4 475 Summerhill Rd	Day	37	59	53	63
	Evening	37	53	48	53
	Night	37	48	46	51
R5 430 Summerhill Rd	Day	37	68	57	67
	Evening	37	61	52	57
	Night	41	56	52	57

To comply with the Regulations, relevant noise emissions due to commercial, industry and/ or trade operations within the WtE facility must not exceed noise limits in Table 17 at each noise sensitive receiver.

It is our current understanding that, for control of noise from commercial, industrial and trade premise compliance with the Regulations and Noise Protocol does not guarantee compliance with the GED. Noise management measures will be included as part of the Operational Environmental Management Plan (OEMP) for the MERC facility to ensure adverse noise impacts to sensitive receivers are minimised as far as reasonably practicable.

As introduced in Section 3.3.5, the outdoor low frequency threshold levels, as stated in Table 3 of Publication 1996 *Noise Guideline: Assessing low frequency noise*, will be used at the assessment criteria for low frequency at noise sensitive receivers and is provided in Table 18 below[11]. Note that these low frequency threshold levels are identical to those provided in Table C2 of the NSW EPA Noise Policy for Industry.

[11] Source of threshold levels: Table 1 from Downey, G and Parnell, J 2017, Assessing low frequency noise from industry – a practical approach, 12th ICBEN Congress on Noise as a Public health Problem, Zurich, Switzerland, June 2017.

Table 18: Outdoor one-third octave low frequency noise threshold levels (10 Hz – 160 Hz)

Outdoor one-third octave low frequency noise threshold levels													
One-third Octave (Hz)	**10**	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
L_{eq} (dB)	92	89	86	77	69	61	54	50	50	48	48	48	44

Relevant noise emissions due to commercial, industry and/ or trade operations within the WtE facility must consider these threshold levels stated in Table 18 at each noise sensitive receiver. The threshold levels are not set limits, rather they are levels that indicate a potential risk of problematic low frequency noise.

The Victorian EPA Publication 1996 does not address exceedances of thresholds any further than highlighting a potential risk of problematic low frequency noise. Therefore where the C-weighted[12] minus the A-weighted noise level is 15 dB or more, and there is an exceedance of the threshold level in any one-third octave band, a correction factor (penalty) is applied to the overall dB(A) broadband noise prediction as outlined in Table C1 of the NSW EPA Noise Policy for Industry. This is outlined in Table 19.

Table 19: Modifying factor corrections (excerpt from NSW EPA Noise Policy for Industry)

Factor	Assessment/measurement	When to apply	Correction (addition to A-weighted values)	Comments
Low-frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz	Measure/assess source contribution C- and A-weighted Leq,T levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: • Where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2- dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period • Where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2-dB(A) positive adjustment applies for the daytime period.	2 or 5 dB	A difference of 15 dB or more between C and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

A noise emission risk assessment and consideration of practicable mitigation and operational controls have been addressed in this report in Section 7.10.

7.2 Site layout

The overall proposed site layout is shown in Figure 4 and identification of the noise emitting buildings and stationary (non-vehicular) noise sources are shown in Figure 5.

No bunds or earth mounds have been assumed around the boundary of the site.

Stationary and moving vehicular noise sources are further discussed in Section 7.4.

[12] See Glossary and Abbreviations at the start of this report for definitions of C-weighted and A-weighted broadband values

Figure 4: Overall site layout

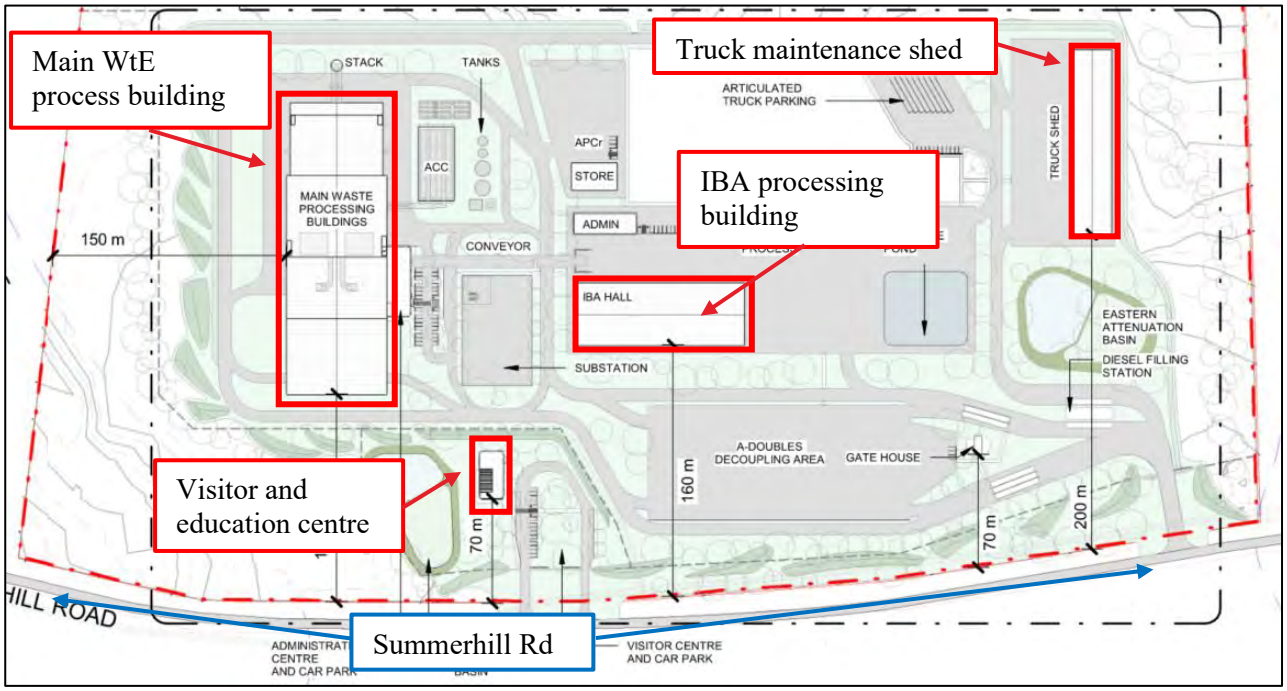
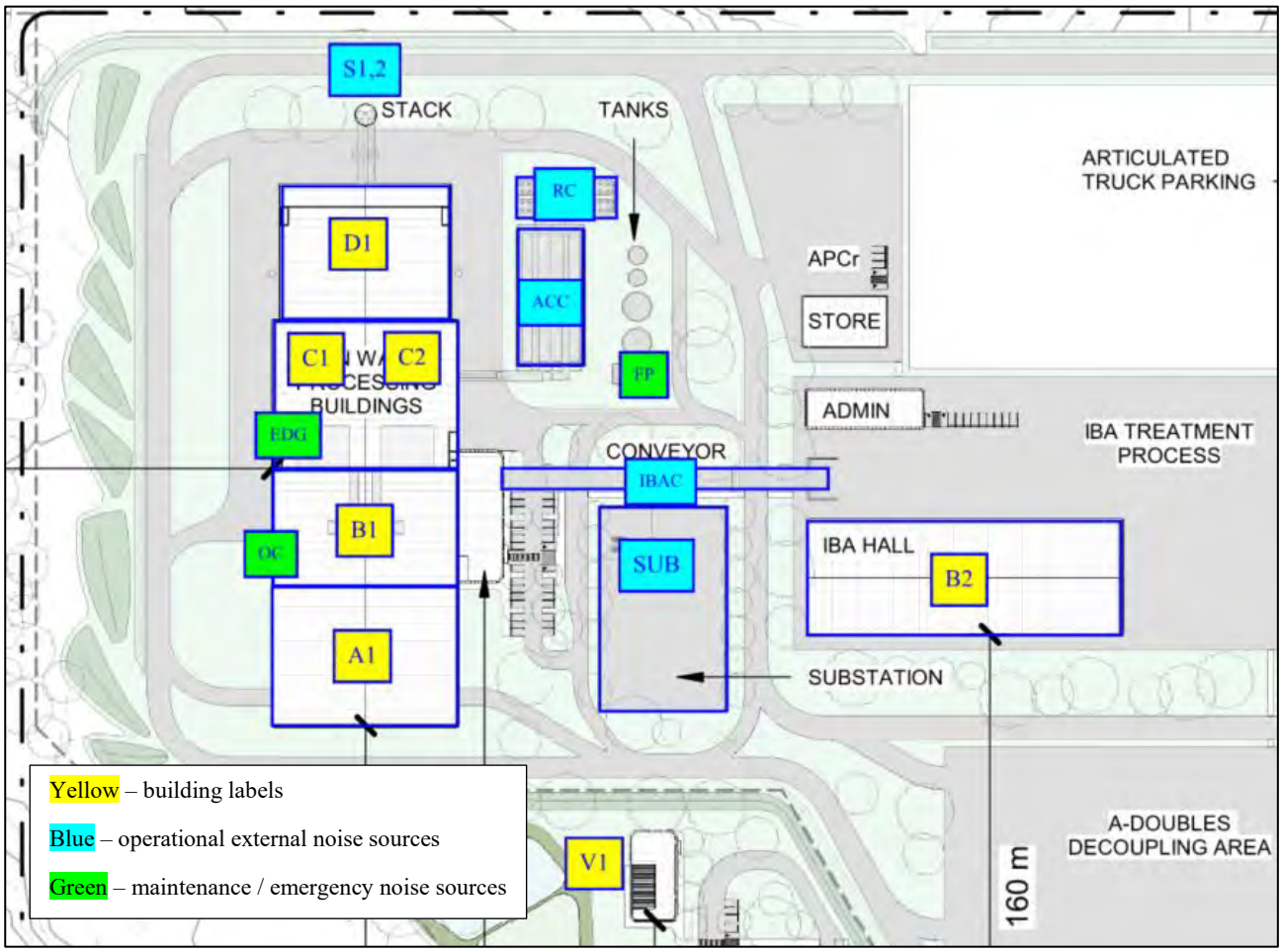


Figure 5: Identification of key buildings and stationary (non-vehicular) outdoor noise sources



7.3 Primary noise sources

The primary operational noise sources associated with the proposed development are listed below and identified in Section 7.2:

- **Buildings**
  - A1 – Waste Reception Hall (Tipping Hall)
  - B1 – Waste Bunker including an annexed east building for Control Room / Offices/ Staff / Visitors
  - B2 – IBA sorting process building
  - C1, C2 – Boiler Halls
  - D1 – Flue Gas Treatment Halls
  - Various internal processes and equipment operating within the buildings such as generators, turbine, shredder, ID fans, pumps and emergency diesel generator
  - Truck maintenance shed located on the east boundary of the site
  - V1 - Visitor and education centre located on the south boundary of the site
- **Outdoor plant and equipment:**
  - ACC - Air Cooled Condensers (pumps contained within C2 boiler building)
  - SUB – Substation with transformer
  - IBAC – IBA conveyor to transport ash from the waste bunker to the IBA sorting building
  - S1,2 - Exhaust stack
  - RC - Radiator Cooler (Banks of fans placed outside, east of the Flue Gas Treatment hall)
- **Emergency and maintenance equipment:**
  - EDG – emergency diesel generator, testing done once a month
  - OC – Odour Control system, for maintaining air pressure and controlling odour during boiler maintenance
  - FP – fire pump
- **Vehicular traffic:**
  - Heavy vehicles (trucks) travelling within the site (Refer to Section 7.4 for a description of the truck movements):
    - To deliver waste to the waste reception hall (tipping hall)
    - To deliver/pick up consumables/residues
  - Light vehicles travelling to/from the staff/visitor entrance via the staff/visitor entrance
- Buses travelling to/from the staff/visitor entrance via the staff/visitor entrance

7.4 Vehicular movement

Anticipated daily truck volumes and light vehicles are provided by Ramboll. This information has been summarised in Appendix F.1.

Cleanaway have previously provided Arup with typical 12-hour daily traffic profiles of operational vehicles for Erskine Park Transfer Facility as a guide for the noise impact assessment. The Erskine Park facility documented truck visits typically between 4 am – 4 pm. Arup have used this daily traffic profile assumption for the noise impact assessment of the MERC project. The profile has been shifted back 2 hours to satisfy the proposed MERC delivery periods of 6 am – 6 pm on weekdays. This daily volume percentage profile along with the weighted daily delivery numbers is provided in Appendix F.2.

The peak hour used as part of the day-time assessment as highlighted in Table F- 3 is estimated to occur at 14:00 hrs (2:00 pm). The peak hour for truck deliveries during the night-time period is assumed to occur between 06:00 hrs – 07:00 hrs as this is the only hour where truck deliveries overlap with the Noise protocol night period. There are no proposed deliveries in the evening period 18:00 hrs – 22:00 hrs. It is assumed that half of the peak hour truck and light vehicle volumes occur in the first 15 minutes of the hour as a conservative scenario. These volumes are provided in Table 20.

Table 20: Number of moving vehicles modelled

Trucks	Number of vehicles		
	Worst-case 15 minutes		
	Night (06:00 hrs)	Day / EDG testing (14:00 hrs)	Evening (18:00 hrs)
Residual waste 9t – Type 1 and Type 2	1	4	0
Residual waste 42t – Type 3 A-double	1	1	0
IBA (73t A-double)	1	1	0
APCr (36.5t semi-trailer)	0	1	0
Quicklime/PAC/Urea (7.2t - 36.5t semi-trailer)	0	1	0
Staff/visitors (light vehicles)	0	2	2
Visitor bus	0	1	0
Notes: 1 – There are no trucks accessing site during evening time. Hours of deliveries are 6 am to 6 pm. 2 – Assumed that half of the trucks would be entering/leaving the site during the first 15 minutes of the hour.			

The expected traffic movements throughout the WtE facility is provided in Appendix F.3. The expected location of idling heavy and light vehicles including front load mobile plant for loading/unloading residual materials in outdoor areas are also provided in Appendix F.3.

7.5 Noise source data and building materiality

A summary of the noise levels data used in the model is given in Table 21. Noise levels used in this assessment were sourced from:

- Ramboll (the Technical Advisor)
- Dublin Waste to Energy Project, Environmental Impact Statement report, Chapter 9 Noise and vibration, dated June 2006
- Noise Database from *Department for Environment, Food and Rural Affairs* (DEFRA) 2009

Note that information regarding plant and equipment and building design will be reviewed at detailed design to ensure that criteria are met. Detailed inputs used in the SoundPLAN model for this assessment are provided in Appendix G.

Table 21: Noise modelling source level data

Equipment	Metric	Sound Power Levels, dBA, re 1 pW
Moving sources		
Truck (9t waste/compactor or APCr light transport truck) 10 km/h – L_w	$L_{eq(15minute)}$/m	64
Truck (36.5 - 73t semi-trailer trucks, B-doubles, A-doubles) – 10 km/h – L_w	$L_{eq(15minute)}$/m	70
Truck braking – L_w	$L_{eq(15\ minute)}$	71
	L_{max}	106
Truck idling (constant) – L_w	$L_{eq(15\ minute)}$	95
With an 8 min time correction (loading A-double, i.e. two semi-trailers)	$L_{eq(15\ minute)}$	*93*
With a 4 min time correction (decouple A-double, loading single semi-trailer)	$L_{eq(15\ minute)}$	*90*
With a 2 min time correction (weighbridges)	$L_{eq(15\ minute)}$	*87*
Truck reversing with beeper 5 km/h (30 second event) – L_w	$L_{eq(15\ minute)}$/m	54
Light vehicle 10 km/h – L_w	$L_{eq(15minute)}$/m	45
Visitor Bus 10 km/h – L_w	$L_{eq(15minute)}$/m	64
Stationary sources		
ACC – L_w	$L_{eq(15minute)}$	95 (per fan)[1]
Substation – L_w	$L_{eq(15minute)}$ /sq. m	88
Exhaust stack[6] (2 flux) – L_w	$L_{eq(15minute)}$	83 (80 per flux)
Radiator coolers (bank of 8 fans) – L_w	$L_{eq(15minute)}$	89 (per bank) – 80 (per fan)
IBA conveyor[2] - L_w	$L_{eq(15minute)}$ /m	83
Front loader mobile plant[3] (IBA sorting/loading events, ACPr loading events) – 5x loading events per 15 min period	$L_{eq(15\ minute)}$	87
Emergency Diesel Generator Exhaust (mitigation installed to achieve 75 dBA at 1 m)	$L_{eq(15minute)}$	83
Buildings[4]		
A1 - Reception hall – Internal L_p	$L_{eq(15minute)}$	85[4]
Waste Bunker – Internal L_p		
B1 – Waste Bunker (including shredder)	$L_{eq(15minute)}$	80[4]
B2 – IBA sorting building	$L_{eq(15minute)}$	80[5]
Boiler hall – Internal L_p		
C1 – Boiler hall	$L_{eq(15minute)}$	80[4]
- Emergency Diesel Generator room on C1 building west façade	$L_{eq(15minute)}$	85[4]
C2 – Boiler hall (includes turbine, condensation pump for ACC fans,	$L_{eq(15minute)}$	85[4]
D1 - FGT hall – Internal L_p	$L_{eq(15minute)}$	85[4]
Truck maintenance shed (Mechanical workshop[4]) – Internal L_p	$L_{eq(15minute)}$	50

Equipment	Metric	Sound Power Levels, dBA, re 1 pW

Notes:

1. Based on discussions with Ramboll on previous projects where the ACC fans were adjusted to a quieter option resulting in a sound pressure level of 80 dBA at 1 metre per fan. Assumed the same approach will be taken on MERC project. There are 8x ACC fans proposed on the MERC project.
2. Noise data from Arup database. The conveyor belt motor is assumed to be located on one end, inside and contributes to the specific internal noise level of the waste bunker. The penetration in the east waste bunker façade is assumed fully enclosed by the outer metal casing of the IBA conveyor. Resilient connections between the metal enclose and conveyor system are recommended to minimise radiated noise. Arup recommends that measurements are conducted of existing enclosed conveyors to understand if mitigation is required.
3. Based on DEFRA database for Item C33 Front End Loader 190 kW 25 t (loading lorry event).
4. Max sound levels (dBA) of each space provided by Ramboll.
5. Internal noise level based on IBA treatment plant (East Rockingham WtE Project, WA) including two front end loaders and four trucks.
6. Silencer applied to the ID fan to ensure sound power levels achieved at stack termination

Facades of the buildings will be constructed from either concrete or metal cladding. The assumed sound transmission loss for each of these materials used in this assessment are given in Table 22 and one-third octave transmission loss spectra used in noise modelling is provided in Appendix G.1.

Table 22: Transmission loss of building envelope

Material	Weighted Sound Reduction, R_w
Insulated metal roof panel[1], eg. Kingspan KS1000 RW30 or similar	24
Metal wall cladding - 0.8 mm thick steel[2]	25
Concrete 200 mm thick (1700 kg/m^3)[2]	54
70 mm thick polycarbonate (semi-transparent cladding)[2]	35
Louvres[1] (mitigated), eg. Soundbar Louvres SBL1 or similar	13

Notes:

1. Based on manufacturer data.
2. Thickness is indicative. Based on Strutt transmission loss prediction software.

Openings due to louvres and truck entrances/exits (all assumed to be fully open) are conservatively assumed to have no transmission loss. The buildings also comprise several doors and louvres which have currently been modelled as openings.

See Appendix G.2 for further details of location and extents of openings on the building façade used in noise modelling.

7.6 Operational scenarios

Operational noise levels have been predicted for the following scenarios. Compliance with the night-time criteria will result in compliance with evening criteria.

It is understood from Ramboll that an emergency situation may occur if there is a trip of electricity from the grid and the Power Island mode is unsuccessful. In this case the Emergency Diesel Generator is used to safely shut down the boiler(s) and will provide support for equipment such as feed water pumps, component cooling pumps but not radiator cooler fans, boiler roof extraction fans, turbine generator and other noise generating equipment. It is expected that the operation of these equipment will generally not be running at

full capacity and therefore the maintenance scenario listed below in Table 24 will be considered as a worst-case noise scenario for the beginning of a factory shutdown scenario.

Similarly for boiler maintenance where both boilers are being repaired/serviced, odour control unit fans may be utilised to provide odour control in the Tipping Hall and Waste Bunker areas. In this case it is expected that noise emissions from the main factory building boiler halls and turbine room will be at a minimum, however it is not expected that the outlet of the odour fans (located on the west side near the EDG exhaust) will be noisier than the EDG exhaust during EDG maintenance testing scenario. The EDG maintenance scenario in Table 23 is considered a more onerous noise emission scenario than noise emissions during boiler maintenance.

Table 23: Modelling scenarios

Noise Sources	Number of sources/equipment for worst-case 15-min period			
	Operational			Maintenance / Emergency
	Night (06:00 hrs)	Day (14:00 hrs)	Evening (18:00 hrs)	EDG testing[1] Day (14:00 hrs)
Operational vehicle movements (total two way)				
Residual waste 9t – Type 1 and Type 2	1	4	0	4
Residual waste 42t – Type 3 A-double	1	1	0	1
IBA (73t A-double)	1	1	0	1
APCr (36.5t semi-trailer)	0	1	0	1
APCr transport truck (between FGT hall and APCr area)	0	1	0	1
Quicklime/PAC/Urea (7.2t - 36.5t semi-trailer)	0	1	0	1
Light vehicle movements (total two way)				
Staff/visitors (light vehicles)	0	2	2	2
Visitor bus	0	1	0	1
Stationary vehicle noise sources				
Trucks idling near truck maintenance shed	0	4	0	4
Front loader mobile plant - outdoor in IBA conveyor sorting	1	1	1	1
Front loader mobile plant - outdoor in IBA truck loading area	1	1	0	1
Front loader mobile plant - outdoor in APCr truck loading area	0	1	0	1
Plant, equipment and internal activities				
ACC unit (1 fan per unit)	8	8	8	8
Substation	1	1	1	1

Noise Sources	Number of sources/equipment for worst-case 15-min period			
	Operational			Maintenance / Emergency
	Night (06:00 hrs)	Day (14:00 hrs)	Evening (18:00 hrs)	EDG testing[1] Day (14:00 hrs)
Exhaust stack (2 flues	1	1	1	1
Fan banks (on top of Waste Bunker) – 1 x Bank has 8 fans	6	6	6	6
Ash Bunker Extraction Fans	2	2	2	2
Reception hall	1	1	1	1
Waste Bunker	1	1	1	1
IBA sorting and processing building[2]	1	1	1	1
Boiler halls	1	1	1	1
FGT hall	1	1	1	1
Truck maintenance building	0	1	0	1
EDG running	0	0	0	1

Notes:

1. Emergency diesel generator expected to be tested once a month as per Ramboll documentation.
2. Ash from the IBA conveyor will continue to be dumped outside the IBA sorting building and a mound will build-up throughout the night-time period of 10 pm – 7 am. It has been assumed that the IBA sorting and processing building and its associated machinery/mobile plant will not be operating and producing noise during the night-time period, with the exception of a single front-end loader moving IBA mound build-up between IBA conveyor and IBA sorting building.

7.7 Operational noise modelling methodology

Operational airborne noise predictive modelling has been undertaken using a 3D computer acoustic modelling software SoundPLAN 8.1. See Appendix D for further information on the modelling assumptions.

7.8 Operational noise impact

Predicted noise levels for day, evening and night periods are shown in Table 24 below. Noise prediction spectra are provided in Appendix H to show further details of where low frequency noise exceeds the threshold limits. Exceedance of threshold limits indicates a potential risk of problematic low frequency noise.

Cumulative noise levels have been considered for 430 Summerhill Road and 475 Summerhill Road based on attended measurement observations from APA Western Outer Ring Main Wollert Compressor Station. Mitigation measures stated in Table 24 below are required before the consideration of cumulative noise levels were included.

Note that Option 1 IBA truck route as illustrated in Figure F- 2 showed approximately the same noise predictions at the nearest residential receivers as Option 2 IBA route and therefore Option 1 IBA truck route will be used for noise prediction modelling.

The noise predictions for day, evening and night periods are provided in Table 24 below. Note that these noise predictions have mitigation measures implemented where required. Mitigation measures are stated as EPR identification codes and the description of these mitigation measures is provided in Table 25.

Scenarios where noise predictions exceeded the Noise Protocol limits are as follows:

- Day period
  - 475 Summerhill Road – noise exceedance mostly due to truck movement volumes
- Day period with EDG testing–
  - 475 Summerhill Road - noise exceedance mostly due to truck movement volumes
  - 570 Summerhill Road - EDG noise emissions
- Night period
  - 475 Summerhill Road – noise exceedance mostly due to truck movement volumes

To see all noise predictions for non-mitigated and mitigated cases in one-third octave bands, please see Appendix H.

Table 24: Predicted noise levels during worst case 15-minute day, evening and night periods

Receiver ID	Noise protocol noise limit – L_{Aeq}, dB(A)	Predicted Levels, L_{Aeq}(15min)			Mitigation in noise modelling[1] (EPR)	Compliance	Further mitigation options required
		A-weight broadband spectrum dBA (dBC)	Low frequency penalty, dB	**Noise Protocol**		**Noise Protocol**	
	Day period – predicted worst case 15 minutes with low frequency corrections						
R1	48	40 (60)	0	**40**	NV03, NV05, NV07	YES	NV04A
R2	57	41 (63)	0	**41**		YES	
R3	53	45 (66)	0	**45**		YES	
R4	53	55 (69)	0	**55**[2,3]		NO	
R5	57	47 (64)	0	**47**[2]		YES	
	Day period (with EDG maintenance testing) – predicted worst case 15 minutes with low frequency corrections						
R1	48	40 (60)	0	**40**	NV03, NV05, NV07, NV08	YES	NV04A
R2	57	41 (63)	0	**41**		YES	
R3	53	45 (66)	0	**45**		YES	
R4	53	55 (69)	0	**55**[2,3]		NO	
R5	57	47 (64)	0	**47**[2]		YES	
	Evening period – predicted worst case 15 minutes with low frequency corrections						
R1	44	38 (59)	0	**38**	N/A	YES	N/A
R2	52	37 (62)	0	**37**		YES	
R3	49	42 (65)	2	**44**		YES	
R4	48	44 (66)	2	**47**[2,3]		YES	
R5	52	41 (61)	2	**47**[2]		YES	
	Night period – predicted worst case 15 minutes with low frequency corrections						
R1	41	37 (59)	0	**37**		YES	

Receiver ID	Noise protocol noise limit – L_{Aeq}, dB(A)	Predicted Levels, L_{Aeq}(15min)			Mitigation in noise modelling[1] (EPR)	Compliance	Further mitigation options required
		A-weight broadband spectrum dBA (dBC)	Low frequency penalty, dB	**Noise Protocol**		**Noise Protocol**	
R2	50	38 (62)	0	**38**	NV03, NV05, NV06, NV07	YES	NV04B
R3	47	42 (65)	2	**44**		YES	
R4	46	51 (66)	2	**53**[2,3]		NO	
R5	52	45 (62)	2	**47**[2]		YES	

Notes:

1. See Table 25 for definition of noise mitigation measures.
2. Includes correction for cumulative ambient noise from APA Western Outer Ring Main Wollert Compressor Station.
3. The mitigation required in this situation is due to an exceedance at R4 (475 Summerhill Road) where truck noise is the dominating noise contribution. See text below this table for further information.

The worst case 15-minute daytime scenario as stated in Table 23 exceeds the noise limit at receiver R4 (475 Summerhill Road) as shown in all results tables of Appendix H apart from the evening period Table H- 5. It is important to note that the noise modelling for this scenario includes conservatism with the following items:

- Worst cast 15-min period assumes 50% of the peak hour truck volume based on the traffic volumes provided in Appendix F.1
- Transmission loss spectra of factory building façades and roof as listed in Appendix G.1, and noise source spectra as listed in Appendix G.3 have a conservative extrapolation approach for low frequency one-third octave bands where data is typically not available
- A +2 to 5 dB penalty correction to predicted dBA levels (where applicable) due to potential problematic noise frequency
- All noise sources as listed for the worst case 15-minute day-time period in Table 23 are running concurrently
- Cumulative noise adjustment due to neighbouring compressor station included in the final noise prediction result to R4 (475 Summerhill Rd) and R5 (430 Summerhill Rd).

The results in Table 24 shows that further noise mitigation measures are required to be developed to achieve Noise Protocol limits at 475 Summerhill Road. Consultation and approval with the resident owner of 475 Summerhill Road will be required if mitigation options include proposed upgrades to the resident's house.

7.9 Operational traffic noise

As part of the noise assessment of the proposed MERC facility, Arup considered the risk of increased traffic noise events directly related to delivery and collection of materials from the MERC site along Summerhill Road.

There are no clear guidelines or criteria in Victoria around controlling/monitoring increased operational traffic noise on public roads for a project such as MERC. The increase in traffic (especially of heavy vehicles) relating to the MERC site may potentially impact residents along the route.

It is understood from Section 8.3 of Traffic Engineering Assessment (Traffic report G30331R-02A, October 2022) that sections of Summerhill Road are recommended to be upgraded from a gravel road to a sealed standard. Upgrades to the route may provide an opportunity to improve potential short-term noise events from trucks based on the current state of Summerhill Road.

7.10 Summary of operational risk mitigation

Environmental Protection Requirements (EPR) and operational noise mitigations measures are summarised in Table 25.

Table 25: Operational mitigation measures for noise and vibration

EPR ID	Risk	Mitigation measure	Timing
Operational Noise and Vibration			
NV02 Operating Licence - noise conditions	Noise conditions for operating licence are not met before the operation of the WtE facility	An Operating License will be obtained from the EPA which will outline conditions around noise compliance.	Operation
NV03 Operational Environmental Management Plan - noise measures	Noise from the WtE facility exceeds noise criteria and operations are suspended.	Noise emissions from the WtE facility must be managed so that the ongoing operation adheres to noise criteria and mitigates noise impacts to sensitive receivers. Prepare an Operational Environmental Management Plan and monitor noise emissions from MERC after a 6-month period	Operation
NV04A Operational traffic noise - on-site during day	Noise due to worst case day-time truck volumes is the main contributor to predicted exceedances at 475 Summerhill Road during the day-time period.	Operational vehicle noise of stationary (idling) and moving vehicles circulating the WtE facility must not to exceed day, evening and night-time Noise Protocol limits (in accordance with the EP Regulations) at noise sensitive receivers. Mitigation measures that may be required in isolation or in combination include: - acoustic shielding provided by earth bunds or noise barriers, - mitigation to receiver location such as upgraded glazing - where operationally possible, reduce the number trucks (heavy vehicles) from the volumes stated in Table 23 during any 15-minute period of the daytime.	Operation
NV04B Operational traffic noise - on-site during night	Truck noise night-time operation contributing to predicted exceedance for night-time limits at 475 Summerhill Road.	Mitigation measures that may be required in isolation or in combination include: - acoustic shielding provided by earth bunds or noise barriers, - mitigation to receiver location such as upgraded glazing - where operationally possible, reduce the number trucks (heavy vehicles) between 06:00 hrs and 07:00 hrs (night-time period) to meet noise limits.	Operation
NV05 Operational mobile plant noise	Noise from operational mobile plant noise	Control of operational noise related to outdoor loading and unloading (tipping) events must not exceed day, evening and night-time Noise Protocol limits (in accordance with the EP Regulations) at noise sensitive receivers. Control of noise of loading/tipping events may include carrying out activities within or behind building enclosures where possible, and controlling the tipping action for gradual release of material.	Operation

EPR ID	Risk	Mitigation measure	Timing
NV06 Acoustic enclosure of buildings	Noise transmission from A1 reception hall south louvres contributing to predicted exceedance for day-timea nd night-time noise limits at 475 Summerhill Road. Noise transmission from C2 boiler east façade (concrete and metal cladding areas) contributing to predicted exceedance for day-time and night-time noise limits at 475 Summerhill Road. Noise transmission from C1/C2 Boiler hall roof louvres contributing to predicted exceedance for day-time and night-time noise limits at 475 Summerhill Road. Noise transmission from D1 boiler east façade (concrete and metal cladding areas) contributing to predicted exceedance for day-time and night-time noise limits at 475 Summerhill Road.	Apply acoustically rated louvres to A1 reception hall south façade. Apply acoustically rated louvres to C2 boiler east façade. Apply acoustically rated louvres to C1/C2 boiler hall exhaust louvre on roof. Apply acoustically rated louvres to D1 flue gas treatment east facade. Ensure that roller door motors for truck entrance and exiting to the building are located on the inside of the building enclosure.	Operation
NV07 Operational noise - stationary plant	IBA conveyor noise contributing to predicted exceedance for night-time limits at 475 Summerhill Road. It has been assumed that the only IBA conveyor motor/s are located inside the waste bunker and so only noise associated with the conveyor belt has been modelled.	Limit noise level of IBA conveyor to 73 $dBL_{Aeq(15minute)}$ /m. The following interventions may be required to achieve this noise level: – Dampen idlers (conveyor rollers) – Install motor of the IBA conveyor within the main factory building – Reduce structure-borne noise of the metal enclosure by isolating the conveyor from the enclosure with rubber pads or similar – Providing a solid barrier on the south side and underneath the IBA conveyor enclosure An alternative solution is to relocate the IBA conveyor to a location that is provided more shielding to 475 Summerhill Road. It is recommended that measurement of an enclosed conveyor system with similar context/application is conducted to improve noise data used in predictive modelling. Silencer applied to ID fan to achieve a combined sound pressure level of 72 dBA at 1 metre from the termination of the two exhaust stacks.	Operation

EPR ID	Risk	Mitigation measure	Timing
NV08 Emergency Diesel Generator testing	Emergency diesel generator exhaust is predicted to exceed noise limits at 570 Summerhill Road noise sensitive receivers during testing/maintenance.	Apply a silencer to air-intakes and generator exhaust to achieve 75 dBA at 1 m.	Commissioning and Operation
NV10 Operational noise and vibration to administration buildings	Internal noise and vibration levels transferred from the main factory building to the administration building may cause risk to health and safety of personnel and structural integrity of the administration building	Consideration of the Australian Standard AS2107:2016 *Acoustics – recommended design sound levels and reverberation times for building interiors* should be referenced for internal noise design to non-factory spaces such as administration buildings. Consideration of DIN 4150-3 vibration targets should be referenced to protect nearby non-factory spaces from structural damage, and *NSW Assessing Vibration: a technical guildeine* referenced for vibration design for human comfort Appropriate partitions/floors/ceilings are to be chosen to address sound reduction of airborne noise, structure-borne noise and vibration especially between non-factory and main factory spaces.	Commissioning and Operation

8. Operational vibration risk mitigation

Several vibration generating items such as the turbine, EDG and the ACCs are likely to be installed at the end of the construction phase. Vibration impact can occur during the startup/shutdown sequence of these types of equipment and during typical operating speed. Appropriate vibration isolation measures (such as isolated rubber/spring floor mounts or concrete inertia bases) will need to be carefully selected based on equipment selection and location.

While details regarding the exact equipment selections are not yet known, vibration mitigation measures must be implemented to limit vibration transmission through the ground and building structures to meet project vibration criteria. This is to protect surrounding building structures on the WtE facility site, human comfort levels within the main building and nearby administration buildings, and personnel working near the equipment.

These mitigation measures must be put in place before commissioning phase and should be tested as part of the Commissioning Plan.

The mitigation measures for potential operational vibration are summarised in Table 26.

Table 26: Operational mitigation measures for noise and vibration

ID	Risk	Mitigation measure	Timing
Operational Vibration			
NV09	Vibration from operational stationary plant located outdoors to potentially damage surrounding building structures on the WtE facility site, human comfort levels within the nearby administration buildings and personnel working near the equipment.	Mitigation measures will include assessment of natural frequencies of footings to ensure resonant response does not occur during ramp up, operation and ramp down of the generator turbines and ACC fans. The turbine will be founded on a piled raft which may incorporate a spring damper system to reduce the vibration effect of the equipment.	Operation

ID	Risk	Mitigation measure	Timing
NV10 Operational noise and vibration to administration buildings	Internal noise and vibration levels transferred from the main factory building to the administration building may cause risk to health and safety of personnel and structural integrity of the administration building	Consideration of the Australian Standard AS2107:2016 *Acoustics – recommended design sound levels and reverberation times for building interiors* should be referenced for internal noise design to non-factory spaces such as administration buildings. Consideration of DIN 4150-3 vibration targets should be referenced to protect nearby non-factory spaces from structural damage, and *NSW Assessing Vibration: a technical guildeine* referenced for vibration design for human comfort Appropriate partitions/floors/ceilings are to be chosen to address sound reduction of airborne noise, structure-borne noise and vibration especially between non-factory and main factory spaces.	Operation

It is unlikely that structural damage to surrounding residential buildings, and affects to human health will occur from operational vibration for the following reasons:

- The distance between the current location of vibration generating equipment within the WtE facility and the surrounding sensitive receivers in the study area
- Appropriate mitigation measures provided to protect on-site personnel and on-site structures will likely result in low vibration levels outside the Proposal area.

9. Conclusions and proposed controls

Arup has undertaken a noise and vibration impact assessment for the Melbourne Energy and Resource Centre that is proposed to be located in Wollert, Victoria. The purpose of this noise and vibration assessment is to demonstrate compliance with the various authority requirements, develop community support and social license.

Noise and vibration criteria based on Victorian Environmental Protection (EP) legislation and guidelines has been established. In the absence of Victoria specific guidelines, NSW guidance has been adopted and combine to form the *state of knowledge*. The key assessment criteria include:

- Construction noise management levels – which will be further developed in the CNVMP.
- Operational noise criteria considering Noise Protocol limits and low frequency noise penalties
- Construction and operational vibration criteria for building structures and human comfort.

The following assessments have been conducted:

- Assessment of airborne noise emissions for construction and operation of the MERC WtE facility to the nearest sensitive receivers outside the Proposal area boundary.
- Assessment of vibration emissions for construction of the MERC WtE facility to the nearest sensitive receivers outside the Proposal area boundary. This is in the form of expected safe working distances of particular vibration generating construction plant and equipment.

A summary of the results and applicable mitigation measures are provided in Table 27 below. The EPR mitigation IDs listed (for eg. NV1) are defined in Section 6.6 for construction noise and vibration, Section 7.10 for operational noise and Section 8 for operational vibration.

Table 27: Construction and operational mitigation measures for noise and vibration

Assessment	Brief description of assessment	Results	Mitigation measures
Construction			
Airborne Noise	Section 6 provides a conservative assessment of typical construction equipment types and usages running simultaneously in different construction phases.	Section 6.4 shows a risk of exceeding construction noise management levels at residential receivers based on the conservative scenarios assessed for each construction phase. Construction scenarios need to be planned and managed to minimise affect to human health	NV1 – Construction Noise and Vibration Management Plan to be formed before construction to ensure scheduling of activities and equipment usage are controlled during construction activities
Vibration	Based on the level of development, exact locations vibration generating equipment during construction is not known, however typical safe working distances to achieve vibration criteria are used	The distance between the expected construction site boundary and the nearest residential building are greater than typical minimum safe working distances of expected vibration generating sources. Based on this assessment, vibration issues to building structure and human comfort are unlikely to be an issue, but	
Operational			
Day period – airborne noise	Predictive noise modelling has been conducted based on the worst-case 15 minutes of the day (14:00 hrs) regarding heavy and light vehicle movement, stationary vehicle and plant noise and noise breakout from factory buildings.	The assessment shows that, with the exception of one receptor (475 Summerhill Road), there would not be exceedances of the Noise Protocol day-time limits during operation. The assessment shows a risk of exceeding Noise Protocol day-time limits at the nearest residential receiver (475 Summerhill Road). Mitigation measures must be put in place to minimise risk of harm to human health.	Mitigation measures include: - (NV04A)[1] mitigation measures would need to be considered including earth bunds/noise barriers, and or upgraded glazing treatment to affected residents. - (NV05) ensuring truck unloading/loading events occur within areas enclosed or shielded by building where practical. - (NV06) including acoustically treated louvres on the south and east side of the main factory building - (NV07) mitigating potential IBA conveyor noise emissions
Evening period – airborne noise	Predictive noise modelling has been conducted based on the worst-case 15 minutes of the day regarding light vehicle movement and plant noise and noise breakout from factory buildings.	The assessment shows that, there would not be exceedances of the Noise Protocol evening-time limits during operation. Due to the expectation of no heavy vehicles (trucks, mobile plant) operating between 18:00 hrs and 20:00 hrs, noise levels from the MERC facility are predicted to not exceed Noise Protocol limits at the nearest residential receivers. No mitigation measures have been noted.	N/A

Assessment	Brief description of assessment	Results	Mitigation measures
Night period – airborne noise	Predictive noise modelling has been conducted based on the worst-case 15 minutes of the night (06:00 hrs) regarding heavy and light vehicle movement, stationary vehicle and plant noise and noise breakout from factory buildings.	The assessment shows that, with the exception of one receptor (475 Summerhill Road), there would not be exceedances of the Noise Protocol night-time limits during operation. The assessment shows a risk of exceeding Noise Protocol night-time limits at the nearest residential receiver (475 Summerhill Road). Mitigation measures must be put in place to minimise risk of harm to human health. Consideration of increased operational traffic noise on public roads has been included but is not assessed against Victorian Noise Protocol criteria.	Mitigation measures include: - (NV04B)[1] mitigation measures would need to be considered including earth bunds/noise barriers, and or upgraded glazing treatment to affected - (NV05) ensuring truck unloading/loading events occur within areas enclosed or shielded by building where practical. - (NV06) including acoustically treated louvres on the south and east side of the main factory building - (NV07) mitigating potential IBA conveyor noise emissions
Maintenance / Emergency shutdown scenario			
Day-time with EDG testing	Predictive noise modelling has been conducted based on the worst-case 15 minutes of the day (14:00 hrs) regarding heavy and light vehicle movement, stationary vehicle and plant noise, noise breakout from factory buildings and noise emission from the Emergency Diesel Generator	The assessment shows that, with the exception of one receptor (475 Summerhill Road), there would not be exceedances of the Noise Protocol day-time limits during maintenance / emergency shutdown scenarios. For monthly EDG maintenance testing, the assessment shows a risk of exceeding Noise Protocol day-time limits (non-emergency) at the nearest residential receiver (475 Summerhill Road). Mitigation measures must be put in place to minimise risk of harm to human health.	Mitigation measures include: - (NV04A)[1] mitigation measures would need to be considered including earth bunds/noise barriers, and or upgraded glazing treatment to affected residents. - (NV05) ensuring truck unloading/loading events occur within areas enclosed or shielded by building where practical. - (NV08) apply noise attenuation to air-intakes and EDG exhaust to achieve 75 dBA at 1 metre It is noted that mitigation measures applied for EDG maintenance will likely be representative for cases of emergency shutdown when factory is running at lower load capacity and increased Noise Protocol limits for emergency mode apply (See Table 17 of Section 7.1)

Notes:

1. The details of mitigation options NV04A and NV04B are yet to be finalised at this stage. These mitigation measures are specific to the compliance of Noise Protocol limits at 475 Summerhill Road. These will likely require consultation with and approval from the resident at 475 Summerhill Road.

In general, there is no expected exceedances of the Noise Protocol limits for surrounding residential receptors, apart from 475 Summerhill Road during day-time and night-time periods, and 570 Summerhill Road during EDG testing.

Noise and vibration from the MERC facility that poses risks of harm to human health and the environment have been identified, and mitigation measures have been stated to minimise those risks in worst case scenarios. This information provides inputs in the Human Health Risk Assessment report as part of the MERC project.

Appendix A

510 Summerhill Road Planning Report

PLANNING PROPERTY REPORT

Environment, Land, Water and Planning

From www.planning.vic.gov.au at 13 October 2022 09:49 AM

PROPERTY DETAILS

Address:	**510 SUMMERHILL ROAD WOLLERT 3750**
Crown Description:	**Allot. 10B PARISH OF KALKALLO**
Standard Parcel Identifier (SPI):	**10B\PP2819**
Local Government Area (Council):	**WHITTLESEA** www.whittlesea.vic.gov.au
Council Property Number:	**523084**
Planning Scheme:	**Whittlesea** Planning Scheme - Whittlesea
Directory Reference:	**Melway 388 A3**

UTILITIES

Rural Water Corporation:	**Southern Rural Water**
Melbourne Water Retailer:	**Yarra Valley Water**
Melbourne Water:	**Inside drainage boundary**
Power Distributor:	**JEMENA**

STATE ELECTORATES

Legislative Council:	**NORTHERN METROPOLITAN**
Legislative Assembly:	**THOMASTOWN**

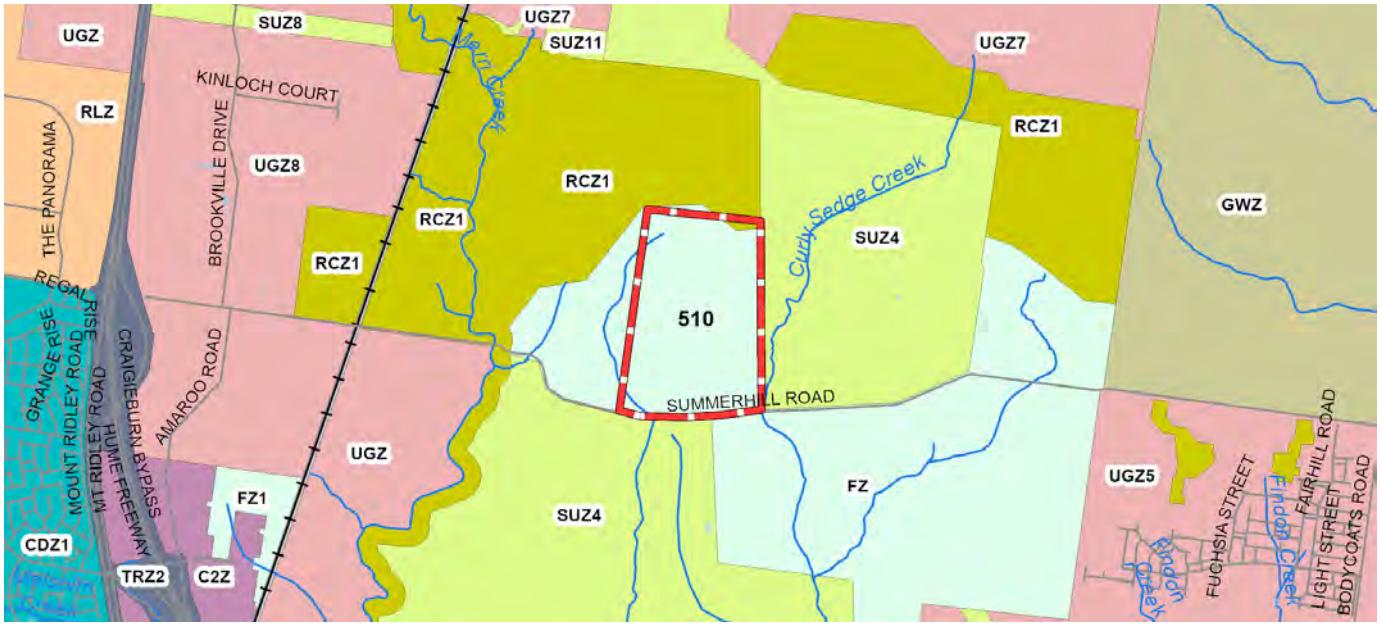
OTHER

Registered Aboriginal Party: **Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation**

View location in VicPlan

Planning Zones

FARMING ZONE (FZ) (WHITTLESEA)
SCHEDULE TO THE FARMING ZONE (FZ) (WHITTLESEA)
RURAL CONSERVATION ZONE (RCZ) (WHITTLESEA)
RURAL CONSERVATION ZONE - SCHEDULE 1 (RCZ1) (WHITTLESEA)



C2Z - Commercial 2	CDZ - Comprehensive Development	FZ - Farming
GWZ - Green Wedge	RCZ - Rural Conservation	RLZ - Rural Living
SUZ - Special Use	TRZ1 - State Transport Infrastructure	TRZ2 - Principal Road Network
UGZ - Urban Growth	Railway line	Water area
Water course		

Note: labels for zones may appear outside the actual zone - please compare the labels with the legend.

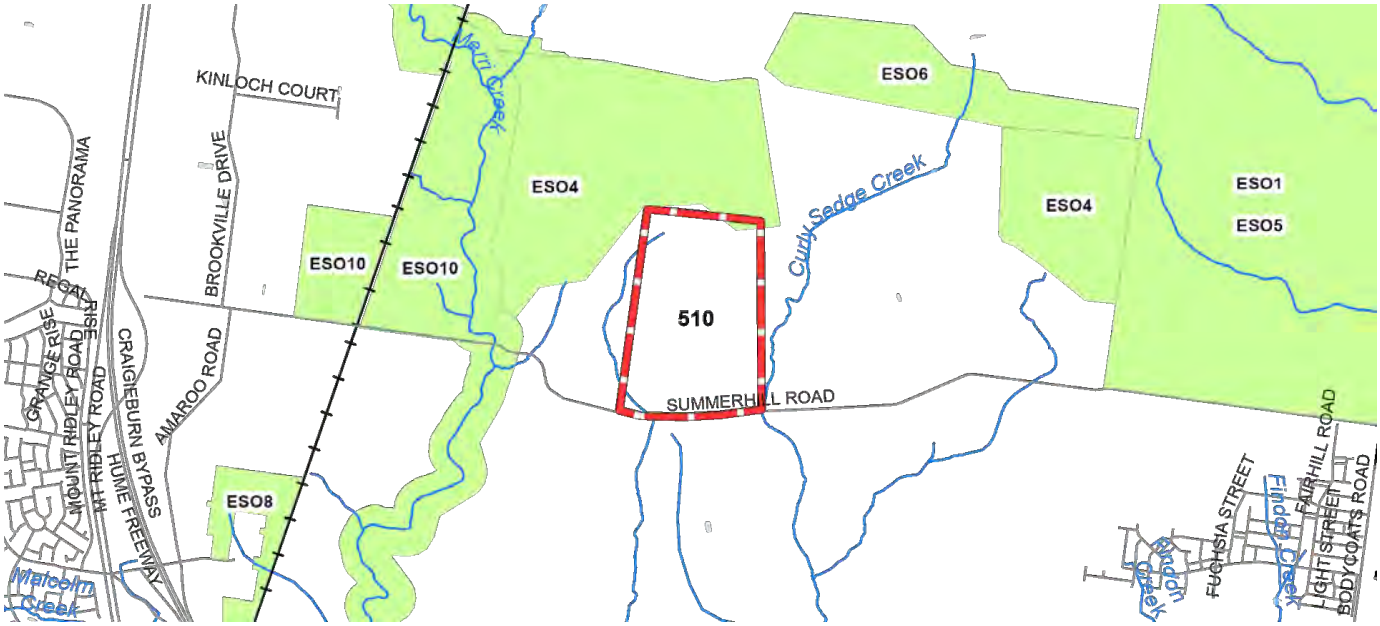
PLANNING PROPERTY REPORT

Environment, Land, Water and Planning

Planning Overlays

ENVIRONMENTAL SIGNIFICANCE OVERLAY (ESO) (WHITTLESEA)

ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 4 (ESO4) (WHITTLESEA)



Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend

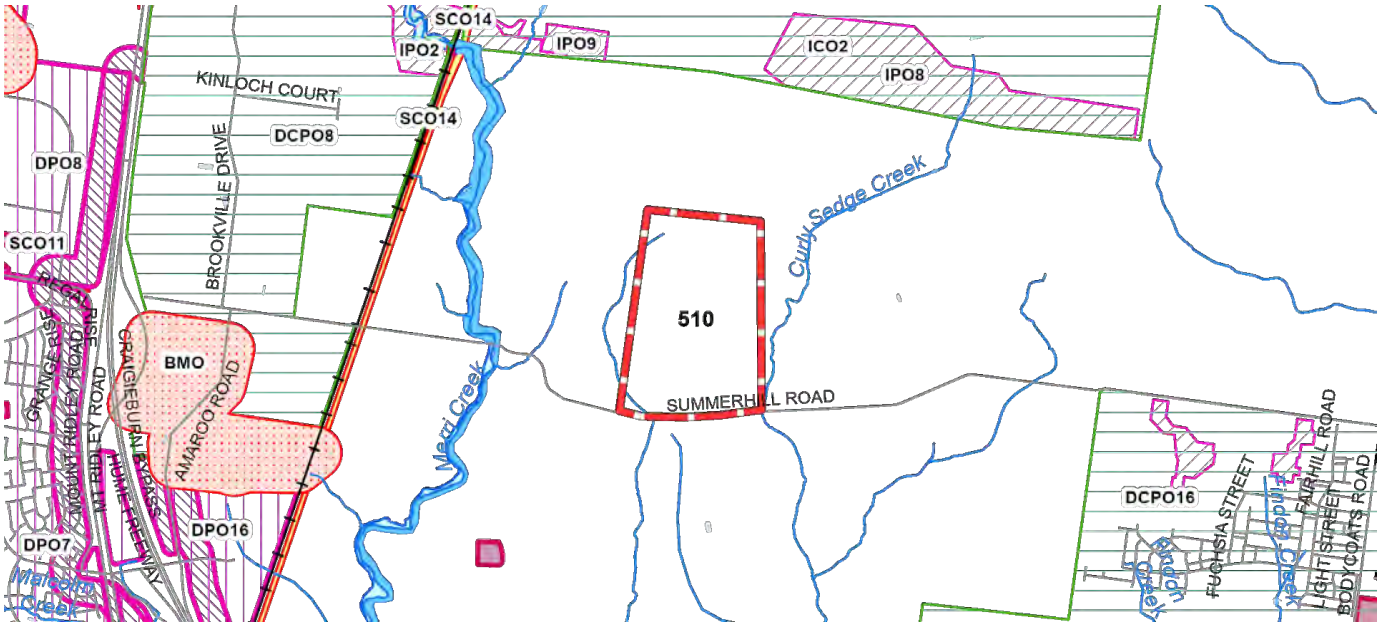
PLANNING PROPERTY REPORT

Environment, Land, Water and Planning

OTHER OVERLAYS

Other overlays in the vicinity not directly affecting this land

BUSHFIRE MANAGEMENT OVERLAY (BMO) (HUME)
DEVELOPMENT CONTRIBUTIONS PLAN OVERLAY (DCPO) (WHITTLESEA)
DEVELOPMENT CONTRIBUTIONS PLAN OVERLAY (DCPO) (HUME)
DESIGN AND DEVELOPMENT OVERLAY (DDO) (HUME)
DEVELOPMENT PLAN OVERLAY (DPO) (HUME)
HERITAGE OVERLAY (HO) (WHITTLESEA)
HERITAGE OVERLAY (HO) (HUME)
INFRASTRUCTURE CONTRIBUTIONS OVERLAY (ICO) (WHITTLESEA)
INCORPORATED PLAN OVERLAY (IPO) (WHITTLESEA)
INCORPORATED PLAN OVERLAY (IPO) (HUME)
LAND SUBJECT TO INUNDATION OVERLAY (LSIO) (HUME)
LAND SUBJECT TO INUNDATION OVERLAY (LSIO) (WHITTLESEA)
PUBLIC ACQUISITION OVERLAY (PAO) (HUME)
PUBLIC ACQUISITION OVERLAY (PAO) (WHITTLESEA)
RURAL FLOODWAY OVERLAY (RFO) (WHITTLESEA)
RURAL FLOODWAY OVERLAY (RFO) (HUME)
SPECIFIC CONTROLS OVERLAY (SCO) (HUME)
SPECIFIC CONTROLS OVERLAY (SCO) (WHITTLESEA)



BMO - Bushfire Management Overlay
DCPO - Development Contributions Plan Overlay
DDO - Design and Development Overlay
DPO - Development Plan Overlay
FO - Floodway Overlay
HO - Heritage Overlay
ICO - Infrastructure Contributions Overlay
IPO - Incorporated Plan Overlay
LSIO - Land Subject to Inundation Overlay
PAO - Public Acquisition Overlay
SCO - Specific Controls Overlay
Railway line
Water area
Water course

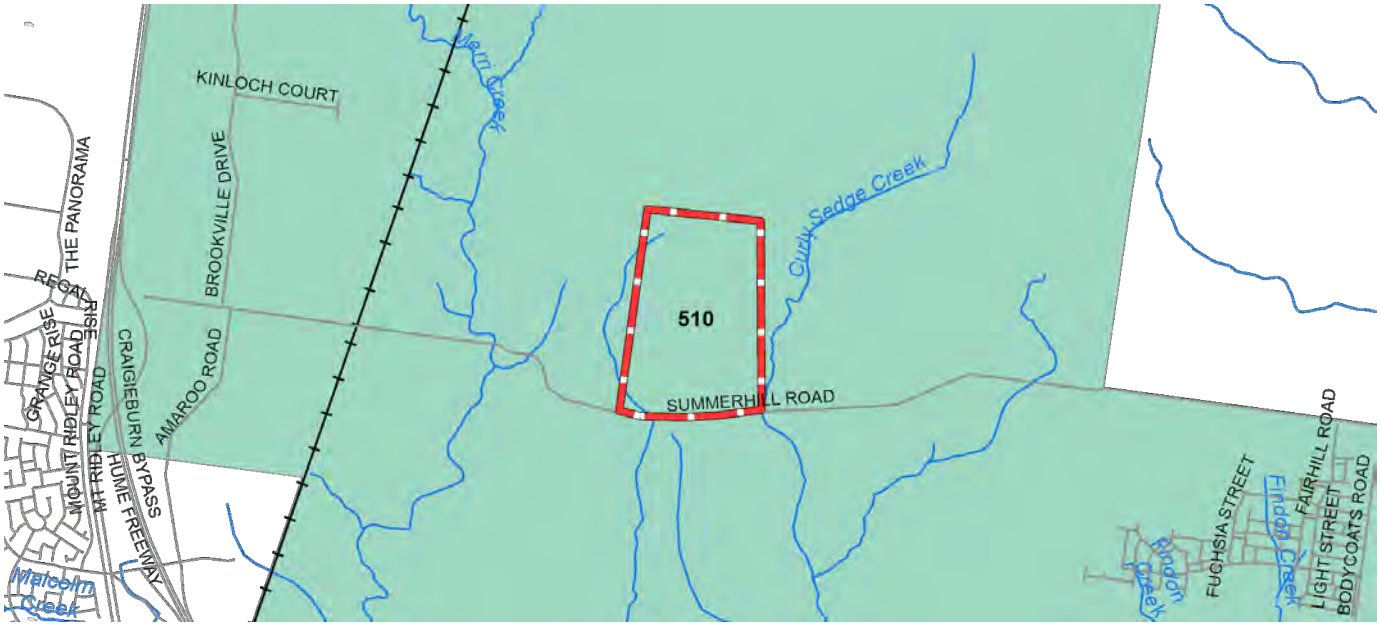
Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend

PLANNING PROPERTY REPORT

Environment, Land, Water and Planning

Melbourne Strategic Assessment

This property may be located within the Melbourne Strategic Assessment program area. Actions associated with urban development are subject to requirements of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Follow the link for more details: https://nvim.delwp.vic.gov.au/BCS



PLANNING PROPERTY REPORT

Environment, Land, Water and Planning

Areas of Aboriginal Cultural Heritage Sensitivity

All or part of this property is an 'area of cultural heritage sensitivity'.

'Areas of cultural heritage sensitivity' are defined under the Aboriginal Heritage Regulations 2018, and include registered Aboriginal cultural heritage places and land form types that are generally regarded as more likely to contain Aboriginal cultural heritage.

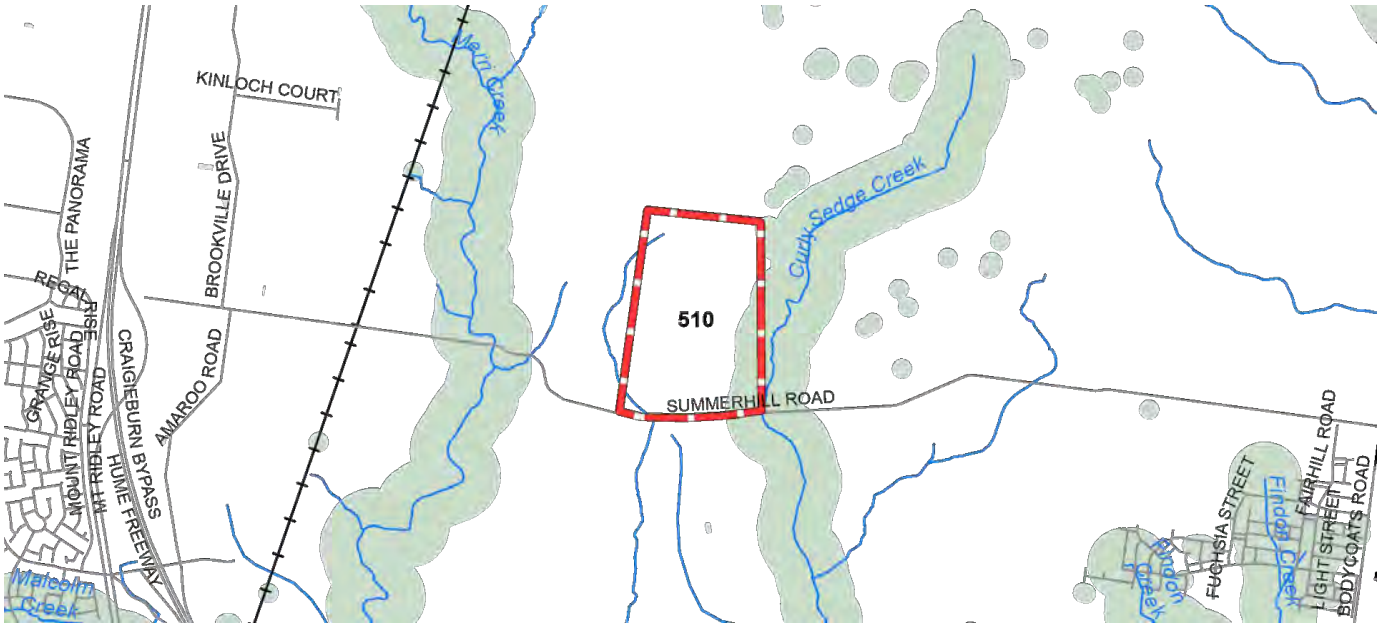
Under the Aboriginal Heritage Regulations 2018, 'areas of cultural heritage sensitivity' are one part of a two part trigger which require a 'cultural heritage management plan' be prepared where a listed 'high impact activity' is proposed.

If a significant land use change is proposed (for example, a subdivision into 3 or more lots), a cultural heritage management plan may be triggered. One or two dwellings, works ancillary to a dwelling, services to a dwelling, alteration of buildings and minor works are examples of works exempt from this requirement.

Under the Aboriginal Heritage Act 2006, where a cultural heritage management plan is required, planning permits, licences and work authorities cannot be issued unless the cultural heritage management plan has been approved for the activity.

For further information about whether a Cultural Heritage Management Plan is required go to http://www.aav.nrms.net.au/aavQuestion1.aspx

More information, including links to both the Aboriginal Heritage Act 2006 and the Aboriginal Heritage Regulations 2018, can also be found here - https://www.aboriginalvictoria.vic.gov.au/aboriginal-heritage-legislation



PLANNING PROPERTY REPORT

Environment, Land, Water and Planning

Further Planning Information

Planning scheme data last updated on 5 October 2022.

A **planning scheme** sets out policies and requirements for the use, development and protection of land.
This report provides information about the zone and overlay provisions that apply to the selected land.
Information about the State and local policy, particular, general and operational provisions of the local planning scheme that may affect the use of this land can be obtained by contacting the local council or by visiting https://www.planning.vic.gov.au

This report is NOT a **Planning Certificate** issued pursuant to Section 199 of the ***Planning and Environment Act 1987.***
It does not include information about exhibited planning scheme amendments, or zonings that may abut the land.
To obtain a Planning Certificate go to Titles and Property Certificates at Landata - https://www.landata.vic.gov.au

For details of surrounding properties, use this service to get the Reports for properties of interest.

To view planning zones, overlay and heritage information in an interactive format visit https://mapshare.maps.vic.gov.au/vicplan

For other information about planning in Victoria visit https://www.planning.vic.gov.au

PLANNING PROPERTY REPORT

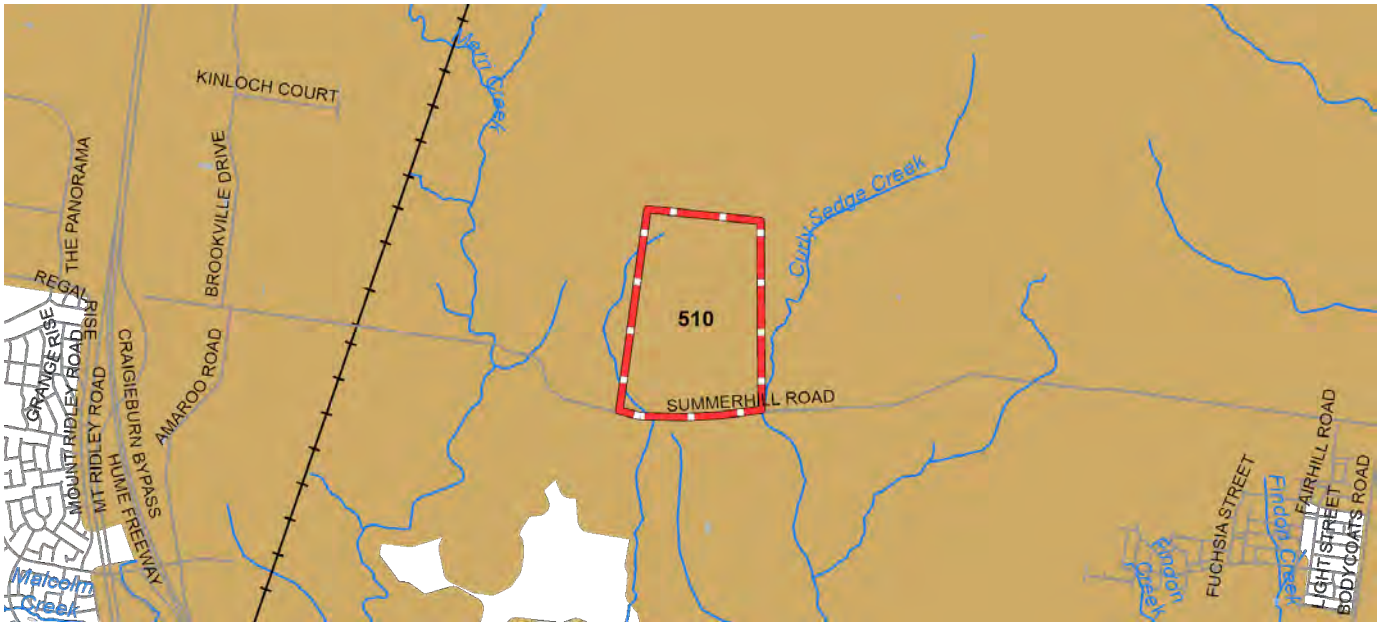
Environment, Land, Water and Planning

Designated Bushfire Prone Areas

This property is in a designated bushfire prone area. Special bushfire construction requirements apply to the part of the property mapped as a designated bushfire prone area (BPA). Planning provisions may apply.

Where part of the property is mapped as BPA, if no part of the building envelope or footprint falls within the BPA area, the BPA construction requirements do not apply.

Note: the relevant building surveyor determines the need for compliance with the bushfire construction requirements.



Designated BPA are determined by the Minister for Planning following a detailed review process. The Building Regulations 2018, through adoption of the Building Code of Australia, apply bushfire protection standards for building works in designated BPA.

Designated BPA maps can be viewed on VicPlan at https://mapshare.vic.gov.au/vicplan/ or at the relevant local council.

Create a BPA definition plan in VicPlan to measure the BPA.

Information for lot owners building in the BPA is available at https://www.planning.vic.gov.au.

Further information about the building control system and building in bushfire prone areas can be found on the Victorian Building Authority website https://www.vba.vic.gov.au. Copies of the Building Act and Building Regulations are available from http://www.legislation.vic.gov.au. For Planning Scheme Provisions in bushfire areas visit https://www.planning.vic.gov.au.

PLANNING PROPERTY REPORT

Extractive Industry Work Authorities (WA)

All or parts of this property are within 500 metres of Extractive Industry Work Authorities (current).

On 22 March 2022, Amendment VC219 introduced changes to all planning schemes in Victoria to support the ongoing operation of extractive industry across Victoria and increase amenity protection for nearby accommodation in rural zones.

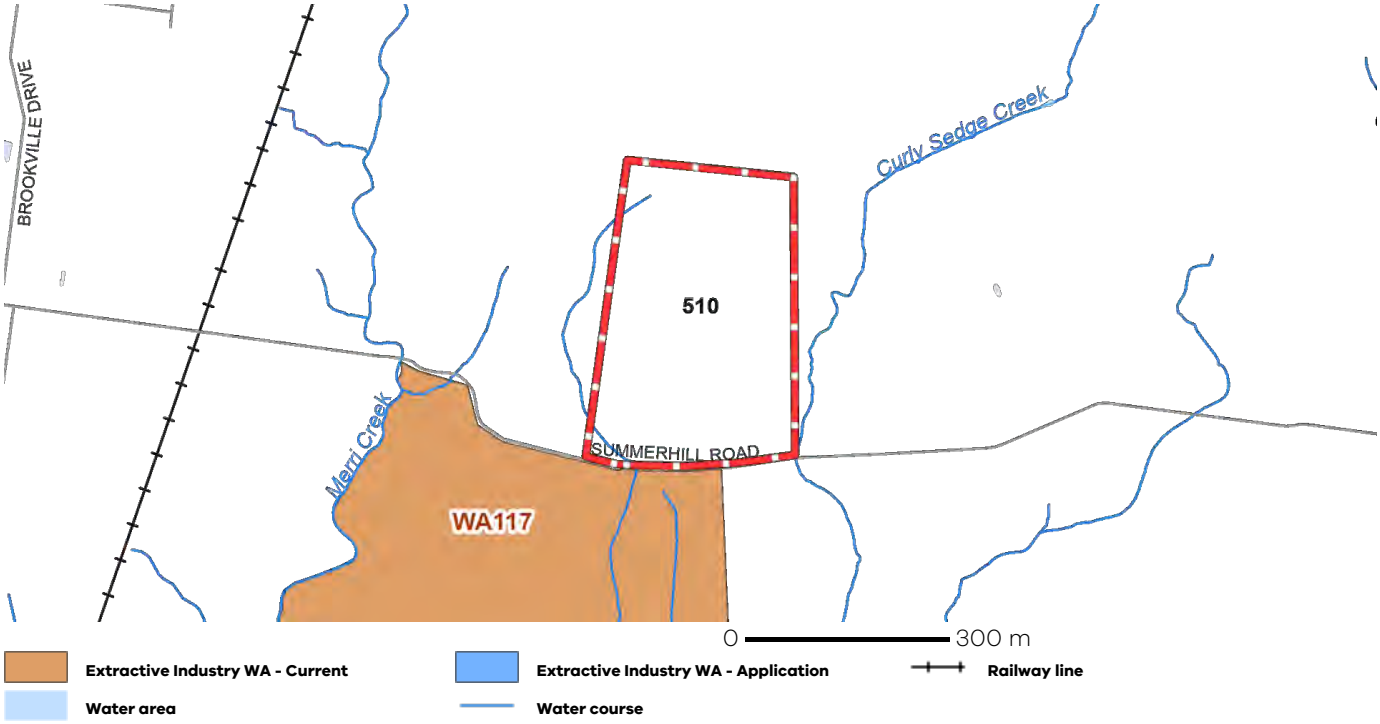
The amendment made changes to the Rural Living Zone, Green Wedge Zone, Green Wedge Zone A, Rural Activity Zone, Farming Zone and Rural Conservation Zone, introducing a permit requirement for accommodation and building and works associated with accommodation that is located within 500 metres from the nearest title boundary of land on which a work authority has been applied for or granted under the Mineral Resources (Sustainable Development) Act 1990 (MRSD Act).

The Amendment also introduced new referral and notice requirements, and decision guidelines.

VicPlan mapping shows property information, including whether a work authority application has been made or approved under the MRSD Act.

Guidance on accessing work authority maps is detailed at the DELWP Extractive Resources (planning.vic.gov.au) webpage.

Further information on extractive and mining activities in Victoria can be found on the (GeoVic - Earth Resources) website which is maintained by the Resources Branch within the Department of Jobs, Precincts and Regions. Limited information is available for unregistered users (anonymous user).



Appendix B

Noise monitoring methodology

B.1 Baseline Noise Monitoring

B.1.1 Unattended noise monitoring

On-site unattended noise monitoring was undertaken by Arup between Tuesday 6 September 2022 and Tuesday 13 September 2022.

Unattended noise measuring instruments measured continuous sound pressure levels to accumulate dBL_{A90}, dBL_{Aeq} and dBL_{A10} noise descriptors over 15-minute sampling interval throughout the monitoring duration. Table B- 1 outlines the equipment used.

Table B- 1: Noise logging equipment

Measurement Location	Equipment/Model	Serial No.	SLM Type
Logger 1 Subject Site – Centre[1]	ARL Ngara	878012	Type 1
Logger 2 Subject Site – West[1]	ARL Ngara	87807B	Type 1
1. See Figure 3 for unattended noise monitoring locations			

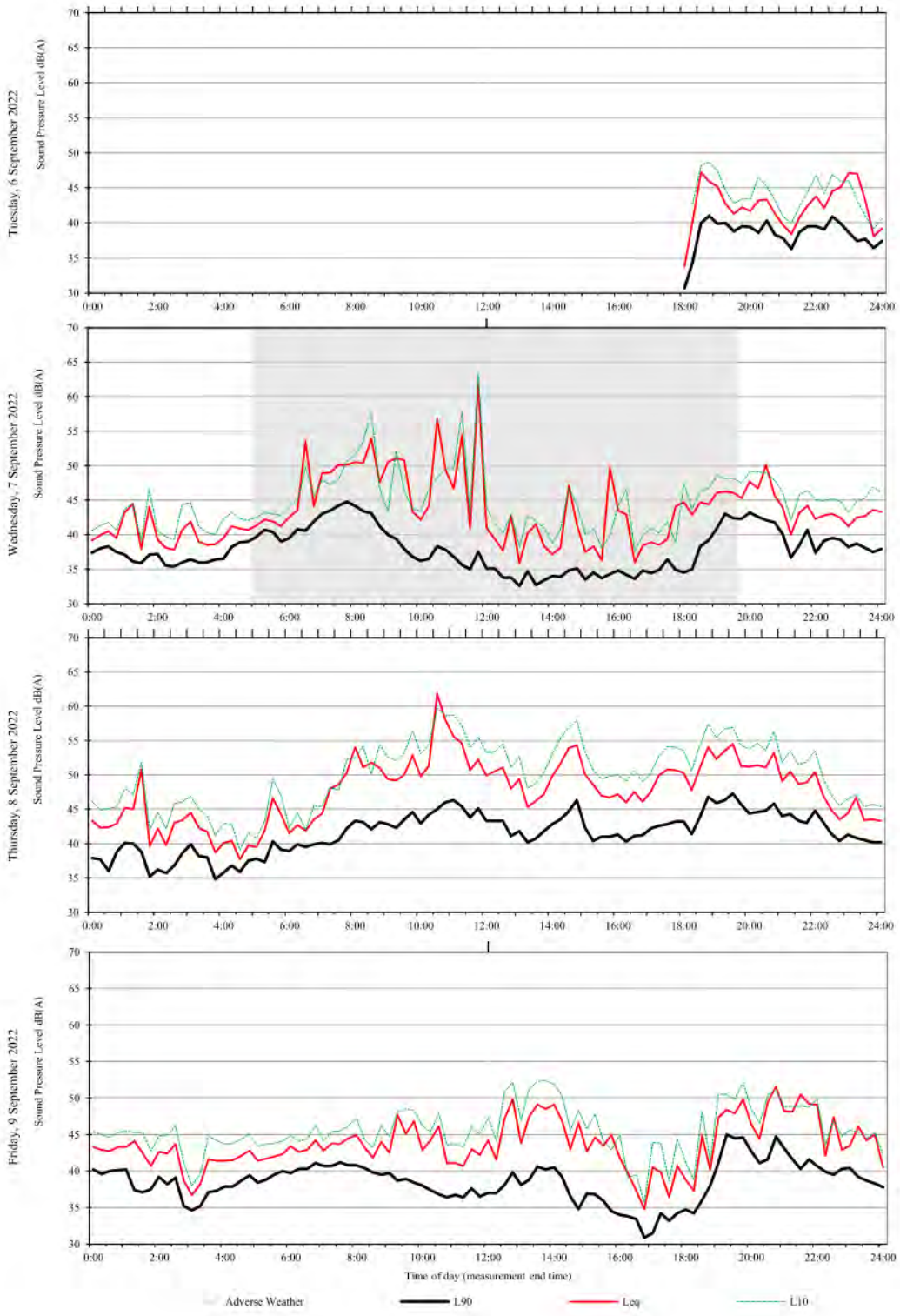
The equipment was calibrated prior and after the measurement period using a Brüel & Kjær 4231 calibrator. No significant drift in the calibration was observed.

Data collected using the unattended noise monitors was downloaded and analysed. The measurements for Logger 1 near the centre of the site were generally observed to be quieter than measurements at Logger 2 at the west of the site. The measured data for Logger 1 is used to determine the background noise levels of nearby residents.

The following pages below show the unattended noise monitoring measurements for ARL Ngara logger 878012 over 6 full days. Invalid data was removed as shown in greyed-out areas on the plots. Invalid data generally refers to periods of time where average wind speeds were greater than 10 m/s for extended periods of time, or when significant rainfall occurred. The nearest BOM weather station was identified as Melbourne Airport.

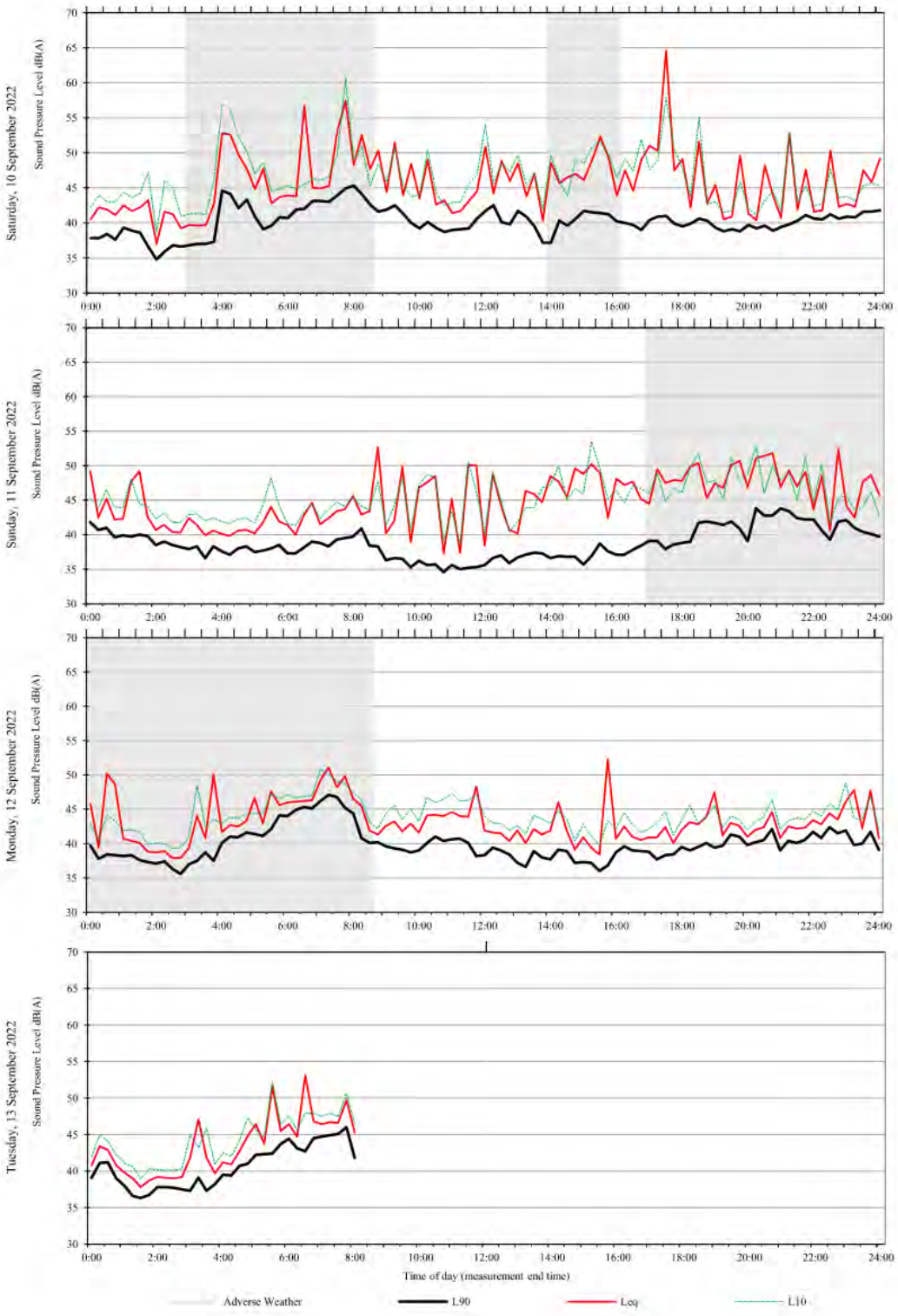
Unattended monitoring (Logger 878012): 510 Summerhill Rd, Wollert (Free Field)

ARUP



Unattended monitoring (Logger 878012): 510 Summerhill Rd, Wollert (Free Field)

ARUP



B.1.2 Attended noise monitoring

Attended night-time noise monitoring was undertaken on Tuesday 11 October 2022 between 02:00 hrs – 04:30 hrs. Attended measurements consist of 2 x 10-minute measurements at each location. There were no adverse weather conditions during the time of measurements. Plane and train pass-bys did not significantly affect the 10-minute L_{A90} measurements. Table B- 2 outlines the equipment used.

Table B- 2: Noise monitoring equipment

Measurement Location	Equipment/Model	Serial No.	SLM Type
In the vicinity of residential receivers R1-R5	Brüel & Kjær 2250 Sound Level Meter	2630367	Type 1

The sound level meter was calibrated prior and subsequent to the measurement period using a Brüel & Kjær 4231 calibrator. No significant drift in the calibration was observed.

Attended background noise levels and ambient noise levels measured in the vicinity of each location as illustrated in Figure 3 of Section 4.1 are provided in Table B- 3.

Table B- 3: Short-term noise monitoring results, dB(A)

Location	Start time	Background noise levels, dB $L_{A90\ (10min)}$	Ambient noise levels, dB $L_{Aeq\ (10min)}$	Noise Sources Contributions
R1 620 Summerhill Rd	02:10 am	38	49	M31 Traffic hum (controlling background) Freight pass-by
	02:20 am	39	41	M31 Traffic hum (controlling background) Wildlife (Insects, crickets, frogs)
R2-3 570-585 Summerhill Rd	02:40 am 02:50 am	38 38	40 41	M31 Traffic hum (controlling background) Wildlife (Insects, Cicadas, birds)
R4 475 Summerhill Rd	02:40 am 02:50 am	38 38	38 46	M31 Traffic hum (controlling background) Wildlife (Insects, Cicadas, birds) Plane pass-by
R5 430 Summerhill Rd (representative location)	03:50 am 04:00 am	41 42	46 45	Steady state factory noise dominant source Wildlife (Insects, Cicadas, birds)

The dominant source at each location was generally traffic noise and wildlife sounds. However, attended night-time noise monitoring in the vicinity of 430 Summerhill Road and 475 Summerhill Road, Wollert found clearly audible noise emissions from the APA Western Outer Ring Main Wollert Compressor Station. In this case the compressor station noise was the main contribution to the background noise levels measured.

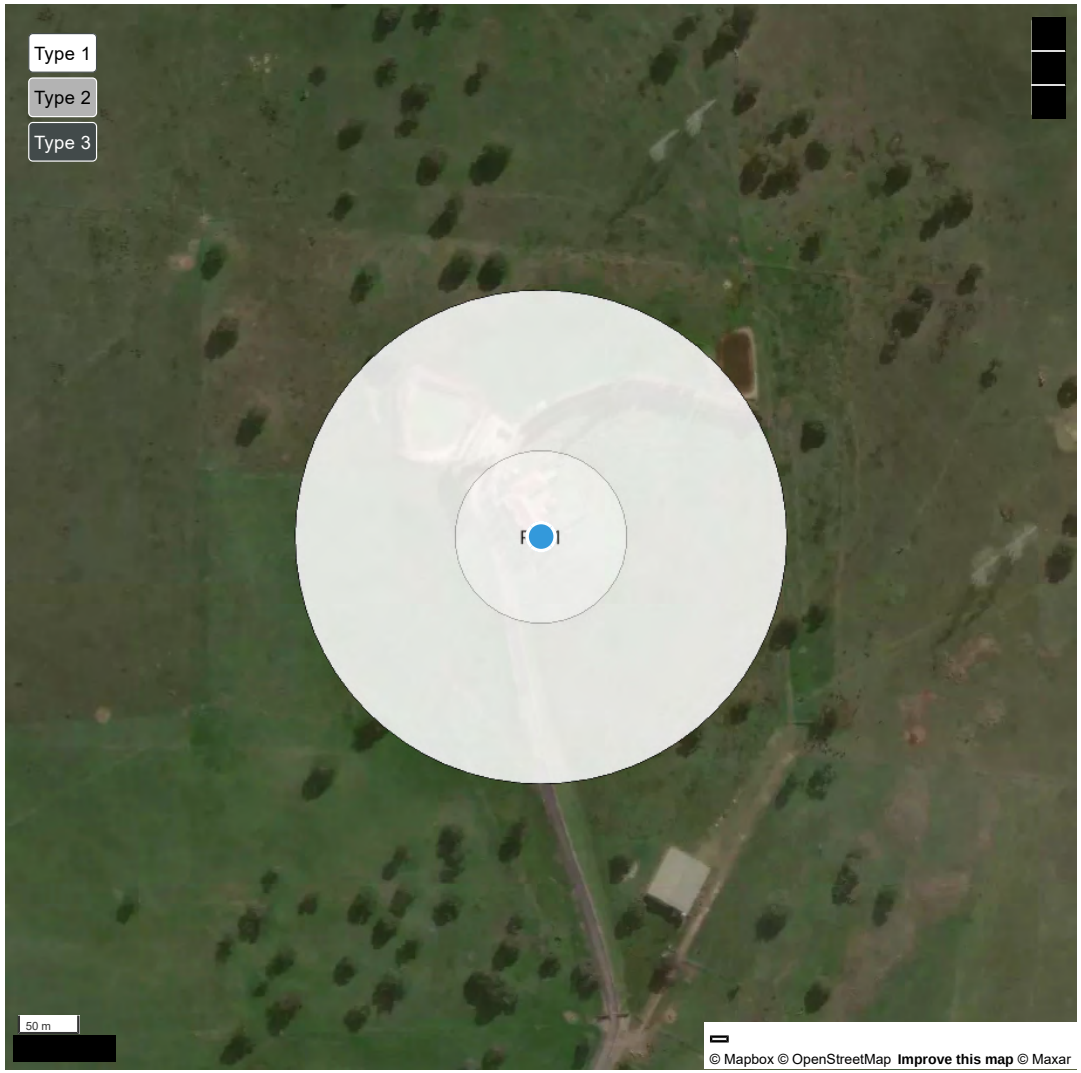
Appendix C

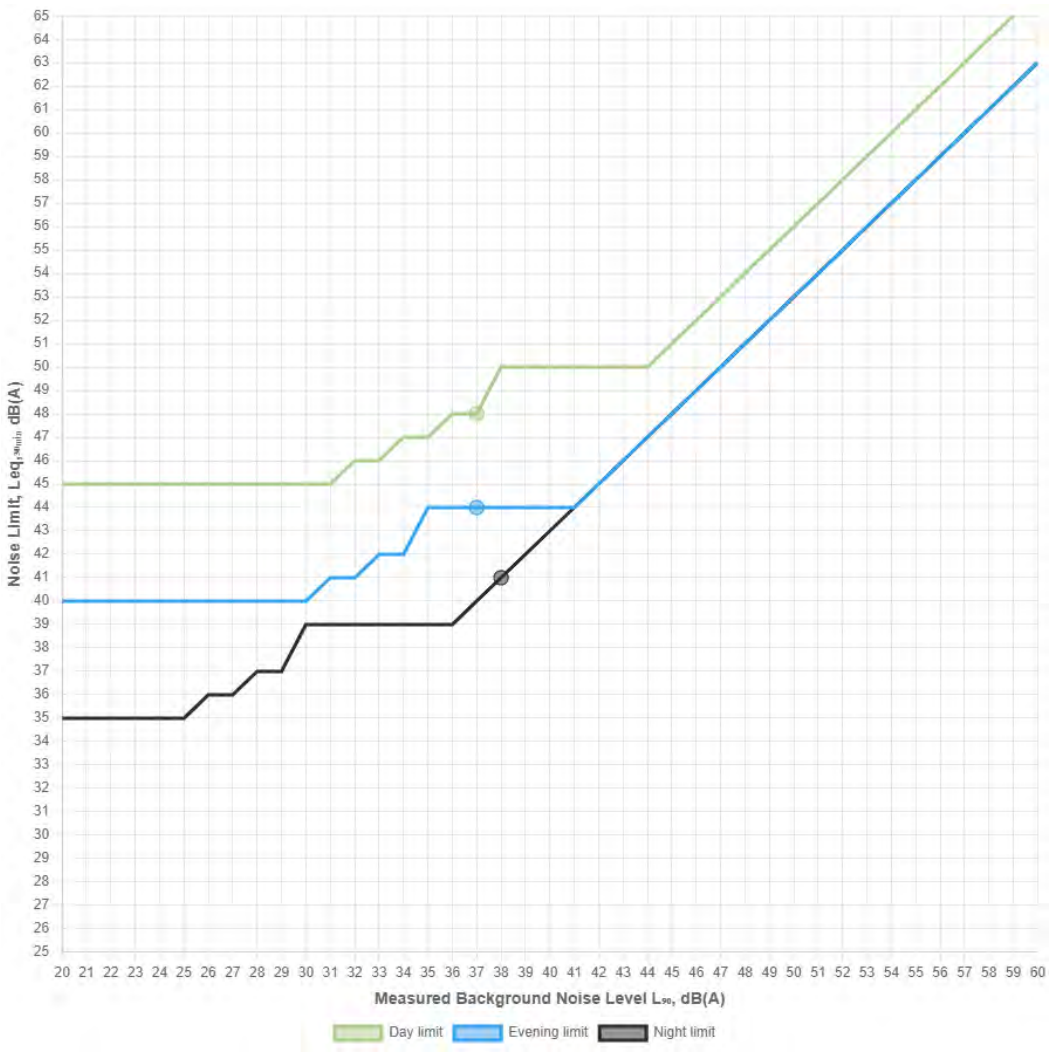
Noise protocol noise limits

C.1 R1 - 620 Summerhill Road

Ben.Dumas@arup.com
Mon 21 November 2022

ARUP | arcadian





		Day	Evening	Night
Zoning Level		50	44	39
Background Noise	L_{90},dB(A)	37	37	38
Background Condition		low	neutral	high
Noise Limit	$L_{eq.30min}$,dB(A)	48	44	41

Type	Zone	Description	140m			400m		
1	RCZ1	RURAL CONSERVATION ZONE - SCHEDULE 1	15394	15394	100%	125661	125661	100%
2				0	0%		0	0%
3				0	0%		0	0%
Influencing Factor				0.000				

C.2 R2 - 585 Summerhill Road

Ben.Dumas@arup.com
Mon 21 November 2022

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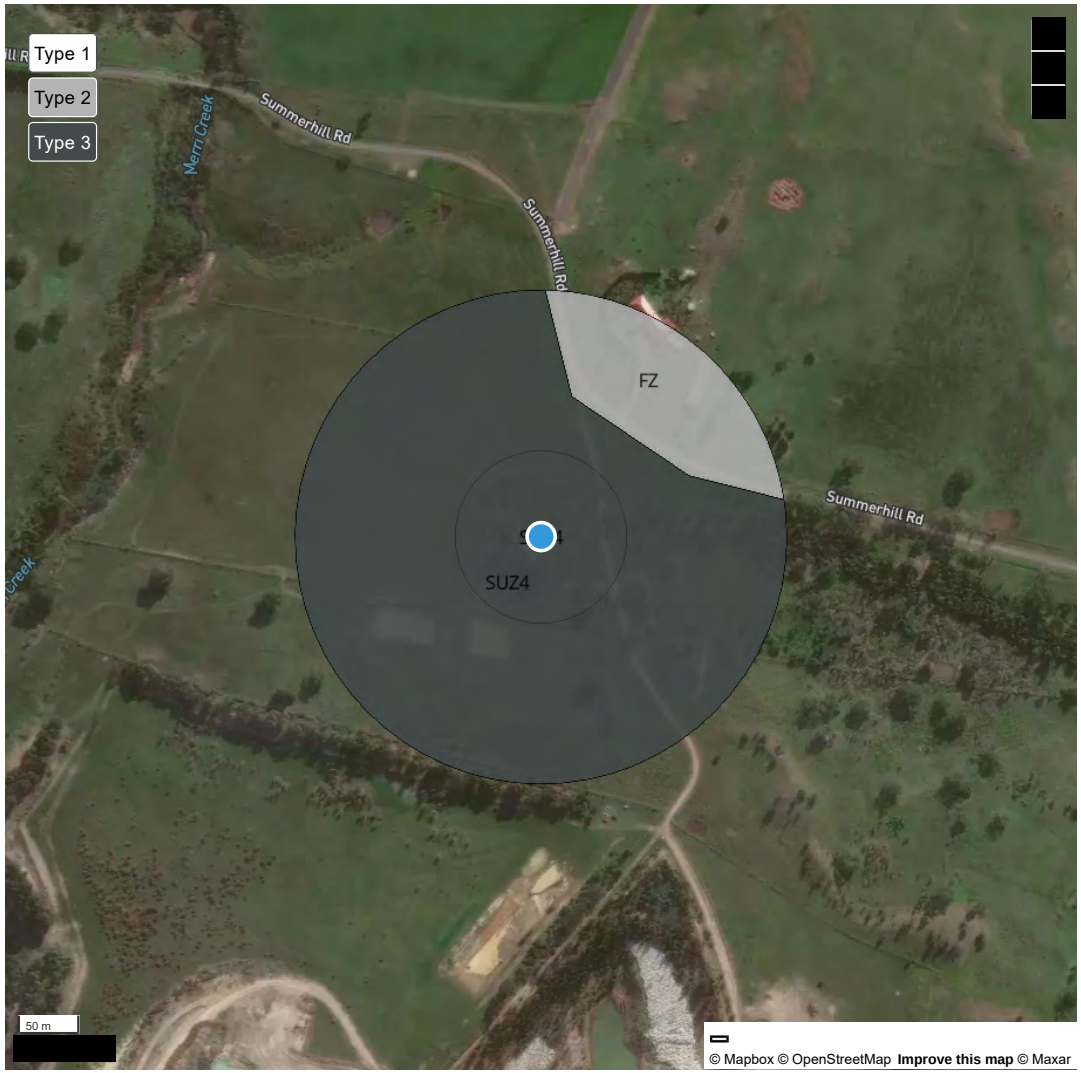

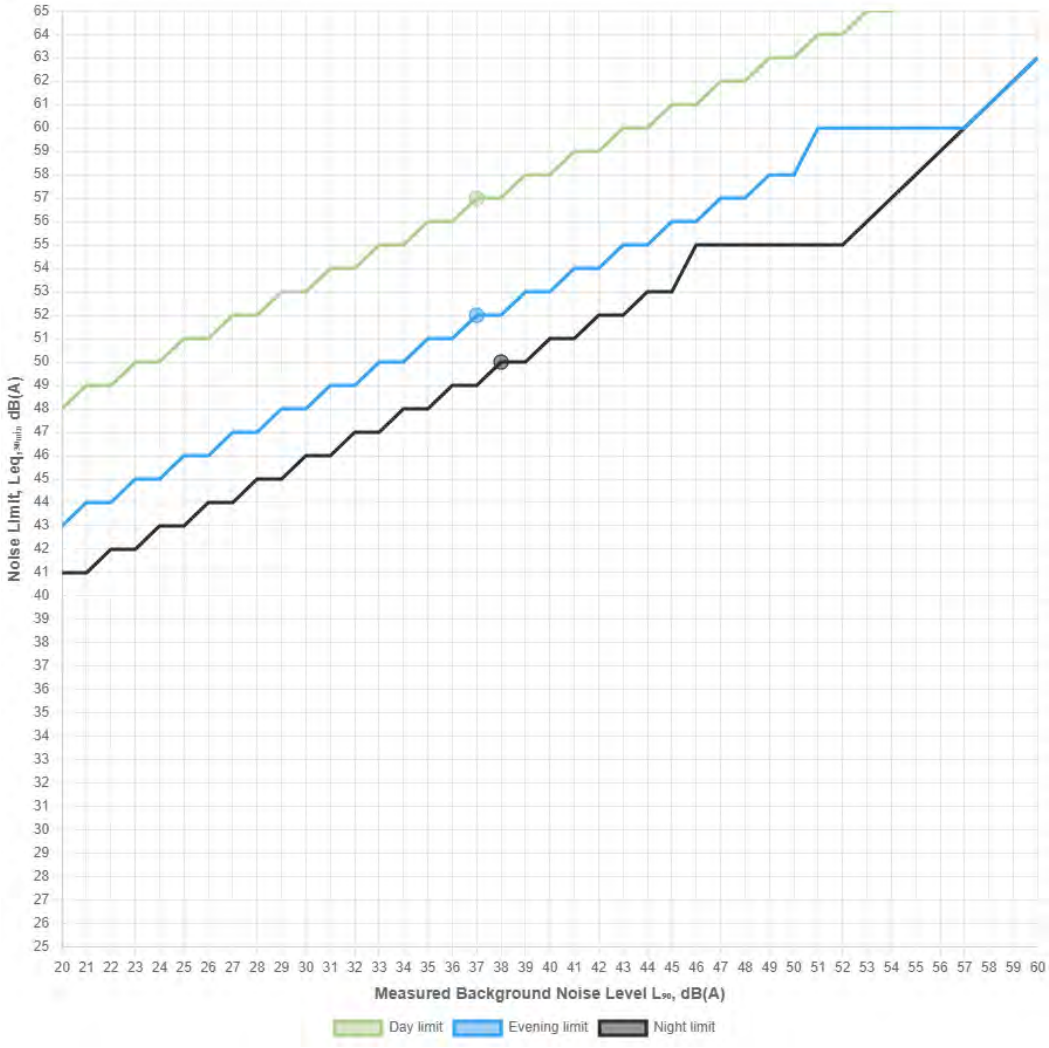

		Day	Evening	Night
Zoning Level		67	60	55
Background Noise	L_{90},dB(A)	37	37	38
Background Condition		low	low	low
Noise Limit	$L_{eq.30min}$,dB(A)	56.5	51.5	49.5

Type	Zone	Description	140m			400m		
1				0	0%		0	0%
2	FZ	FARMING ZONE	0	0	0%	16422	16422	13%
3	SUZ4	SPECIAL USE ZONE - SCHEDULE 4	15394	15394	100%	109240	109240	87%
Influencing Factor				**0.967**				

C.3 R3 - 570 Summerhill Road

Ben.Dumas@arup.com
Mon 21 November 2022

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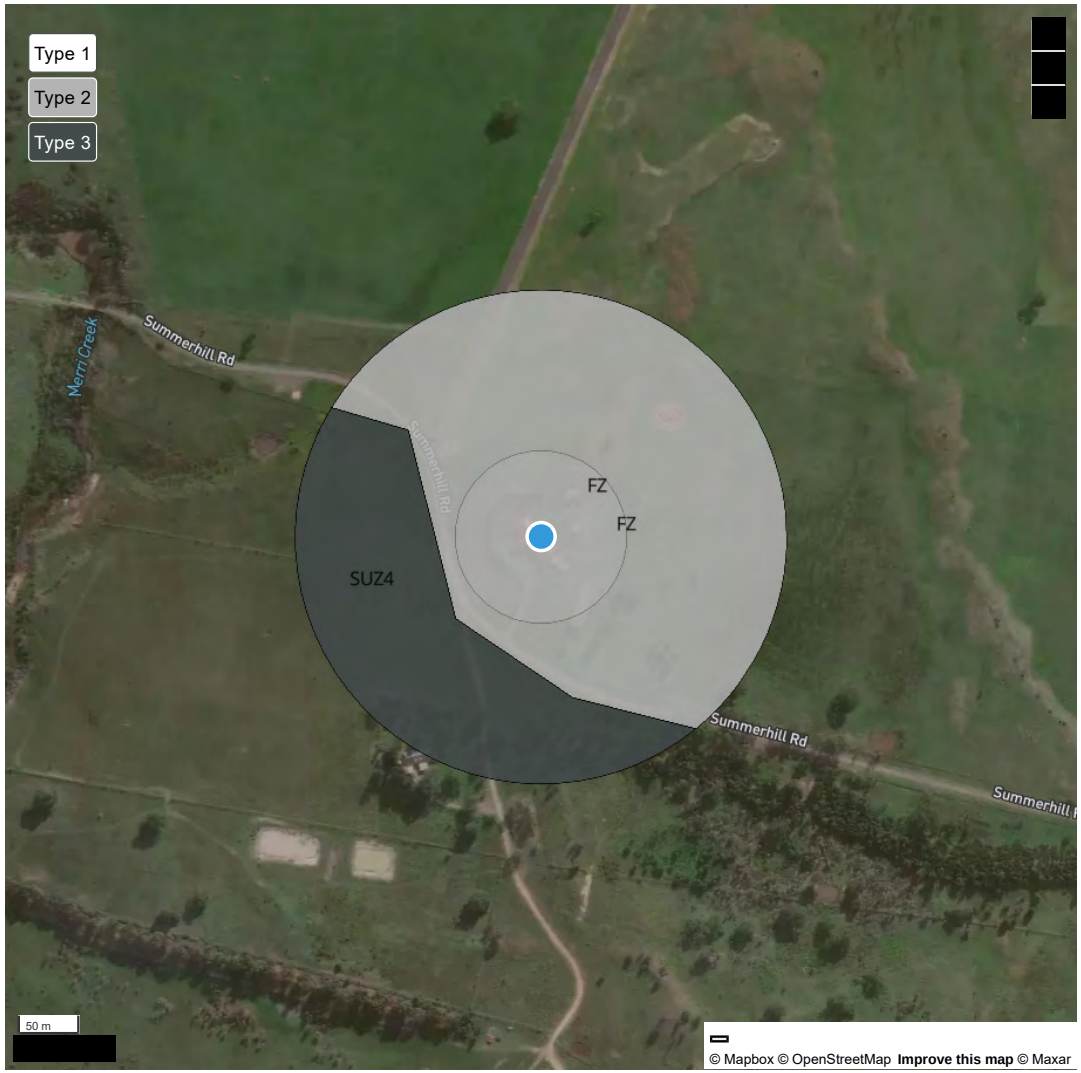
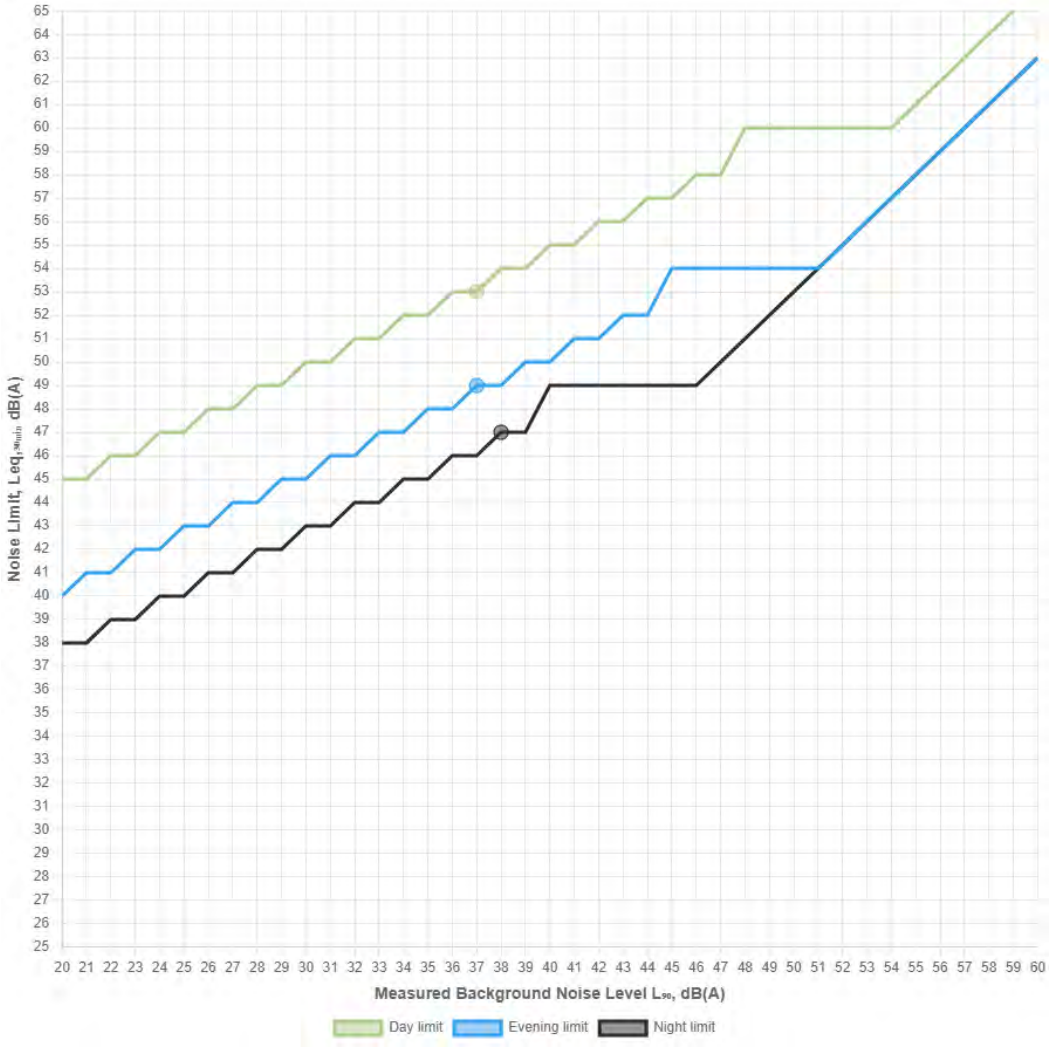




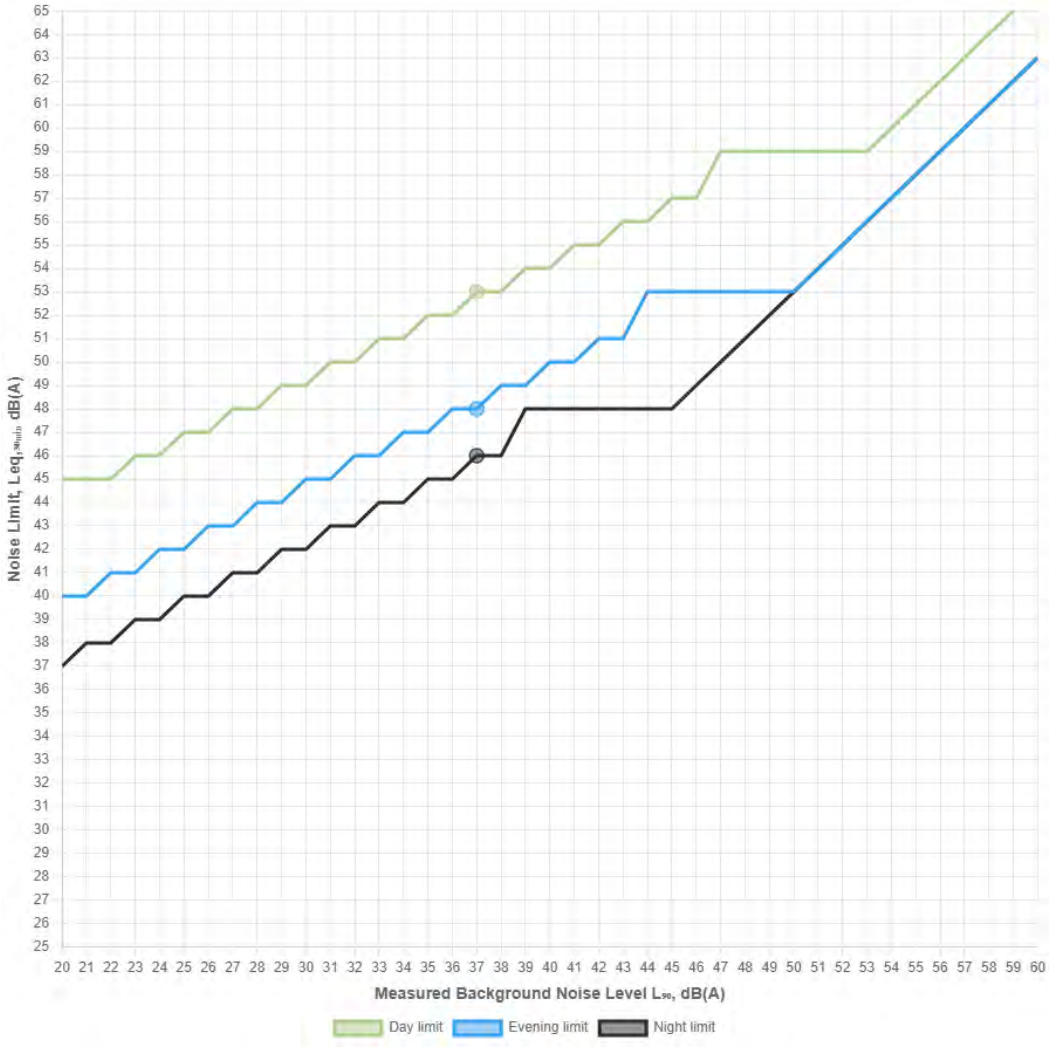
		Day	Evening	Night
Zoning Level		60	54	49
Background Noise	L_{90},dB(A)	37	37	38
Background Condition		low	low	low
Noise Limit	$L_{eq.30min}$,dB(A)	53	48.5	46.5

Type	Zone	Description	140m			400m		
1				0	0%		0	0%
2	FZ	FARMING ZONE	15394	15394	100%	85991	85991	68%
3	SUZ4	SPECIAL USE ZONE - SCHEDULE 4	0	0	0%	39670	39670	32%
Influencing Factor				**0.579**				

C.4 R4 - 475 Summerhill Road

Ben.Dumas@arup.com
Mon 21 November 2022

ARUP | arcadian



		Day	Evening	Night
Zoning Level		59	53	48
Background Noise	L_{90},dB(A)	37	37	37
Background Condition		low	low	low
Noise Limit	$L_{eq.30min}$,dB(A)	52.5	48	45.5

Type	Zone	Description	140m			400m		
1				0	0%		0	0%
2	FZ	FARMING ZONE	15394	15394	100%	113936	113936	91%
3	SUZ4	SPECIAL USE ZONE - SCHEDULE 4	0	0	0%	11725	11725	9%
Influencing Factor				**0.523**				

C.5 R5 - 430 Summerhill Road

Noise Protocol Limits Assessment

430 Summerhill Rd

Ben.Dumas@arup.com

Tue 11 October 2022

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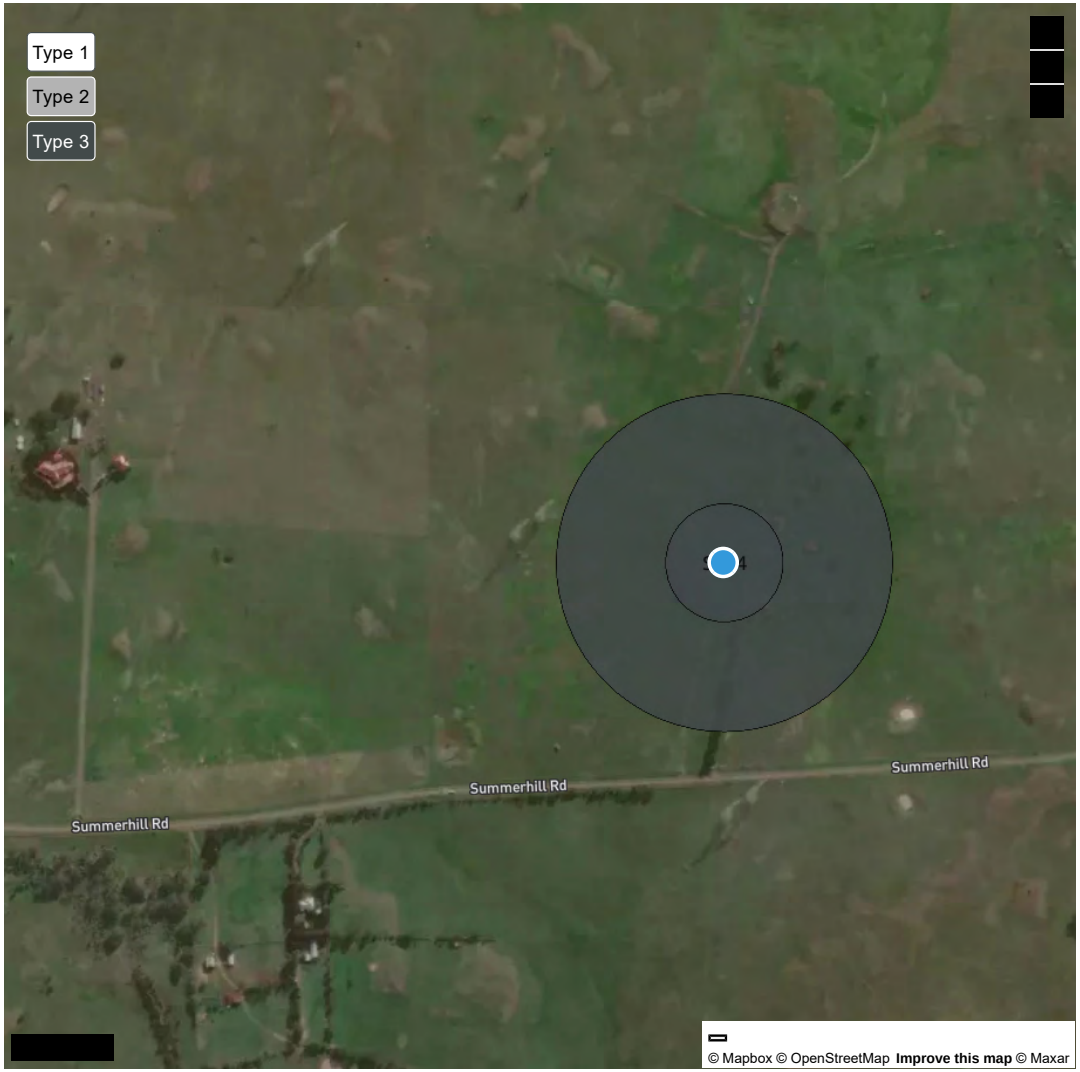
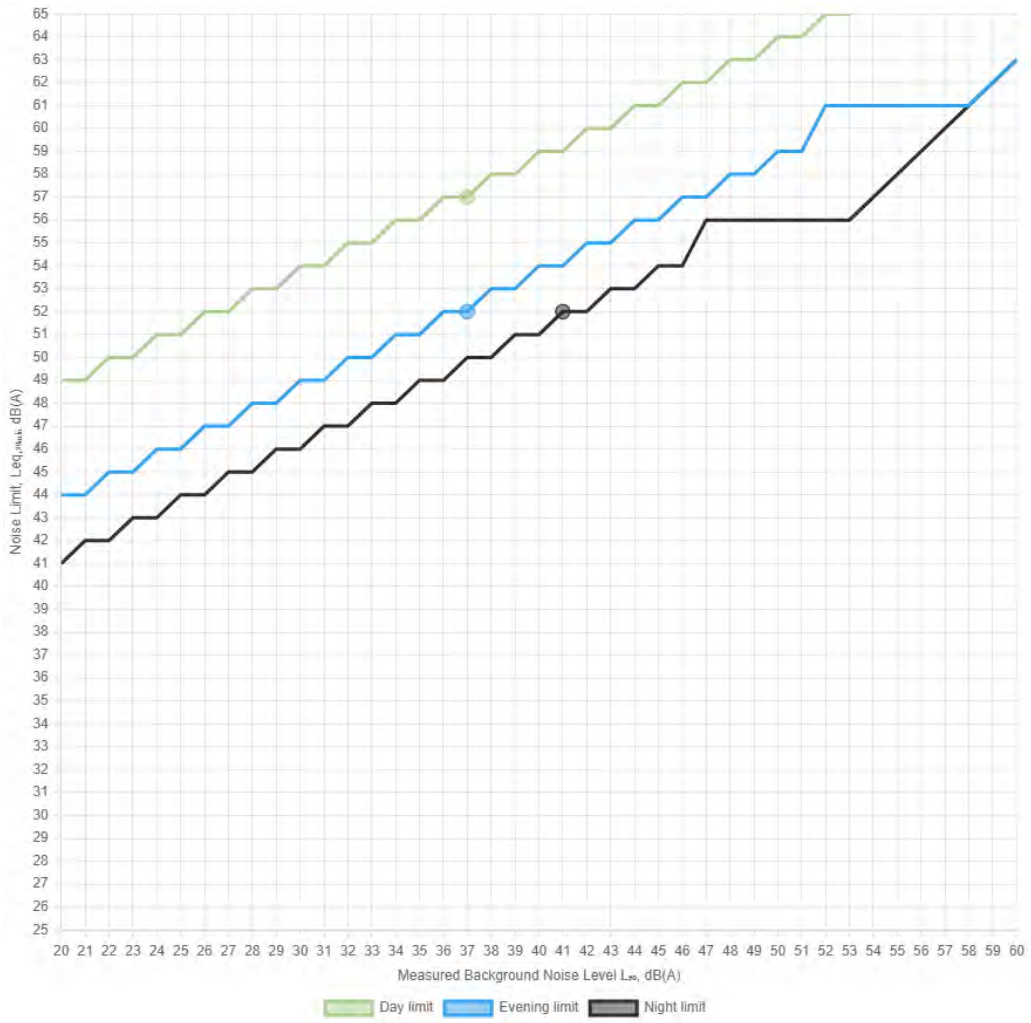




		Day	Evening	Night
Zoning Level		68	61	56
Background Noise	L_{90},dB(A)	37	37	41
Background Condition		low	low	low
Noise Limit	$L_{eq.30min}$,dB(A)	57	52	51.5

Type	Zone	Description	140m			400m		
1				0	0%		0	0%
2				0	0%		0	0%
3	SUZ4	SPECIAL USE ZONE - SCHEDULE 4	15394	15394	100%	125661	125661	100%
		Influencing Factor	**1.000**					

Appendix D

Airborne Noise Modelling Methodology

D.1 Airborne Noise modelling

The airborne noise impact assessments have been undertaken using a 3D computer acoustic modelling software SoundPLAN 8.1. The model was prepared to match the geometry of the site and the nearby sensitive receivers with the noise sources based on the construction and operational activities assessed. Noise levels were predicted at the nearest noise sensitive receivers.

Acoustic models have been built using the environmental noise modelling software package SoundPLAN including the following inputs:

- Topography
- Building structures (operational)
- Noise sources
- Noise sensitive receivers
- Ground and air absorption
- ISO 9613-2:1996[13] has been used to predict noise levels at the receivers for typical scenarios of operational and construction activity.

D.2 Assumptions and inputs

The following assumptions and input conditions have been used in the construction and operational assessment:

- Buildings and the Digital Ground Model are based on Arup's internal project reference library. All building facades are treated as including a 1 dB reflection loss
- Hard ground effect (G = 0) has been assumed for the factory site ground
- Normal uncompacted ground (G = 0.6) has been assumed for the grassland surrounding the Proposal area
- All noise maps are shown at a height of 1.5 m relative to the ground level
- **Operational specific:**
  - Operational stationary activities, stationary sources and mobile sources operating in small areas have been modelled as fixed-point noise sources including:
    - Idling trucks during unloading/loading, trailer decoupling and weighbridge events
    - Front loader mobile plant loading activity
  - Transformer area in the substation yard north-west corner is modelled as an equivalent area source
  - Heavy, medium and light vehicles that move around the site have been modelled as line noise sources
  - Reversing events of trucks with beeper alarms
  - The IBA conveyor has been modelled as a line noise source
  - All plant for each scenario is operating concurrently throughout the modelling period

[13]ISO ISO9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.*

- **Construction specific:**
    - Typical construction scenarios and the locations of expected noise related activities are yet to be determined. In lieu of this information for the MERC project, a preliminary assessment has been completed based on the construction phases and expected noise emitting plant and equipment from a reference WtE facility. See Section 6.2 for more details.

Appendix E

Construction equipment

E.1 Construction noise source levels and usage

Details of the construction phases on the MERC project have not yet been detailed. The following details of construction plant and equipment used on the MERC project require refinement as the project progresses to ensure the noise management levels are met:

- Sound power levels of all equipment
- Number of equipment/plant type
- Duration of equipment use during each phase
- Location of equipment on the site.

Expected construction stages and corresponding plant and equipment are provided in Table E- **1** below. This information is based on conservative assumptions for the MERC project and are indicative only.

Table E- 1: Construction stages and corresponding plant and equipment

Plant description	Main Works (Number of each equipment)		
	Phase 1 Demolition	Phase 2 Earthworks & Piling	Phase 3 to Phase 5 Construction (including roads & landscaping)
Backhoe loader	2	2	1
Backhoe with auger			1
Bulldozer (CATD8 to CATD10 or similar)	1	2	
Chain saw	2	2	
Compactor (CAT835 or similar)		2	2
Concrete Boom Pump		1	2
Concrete saw	2		1
Concrete truck		2	2
Concrete vibrator		2	4
Crawler Crane >200t			1
Delivery Truck		2	
Delivery Truck (incl low loader)			2
Diesel generator	2	2	4
Dump truck	2	2	2
Excavator (>25t)	1	2	1
Excavator (<25t)	1		
Excavator hammer	2		

Plant description	Main Works (Number of each equipment)		
	Phase 1 Demolition	Phase 2 Earthworks & Piling	Phase 3 to Phase 5 Construction (including roads & landscaping)
Forklift			2
Front end loader (FEL)		2	2
Grader (CAT14G to CAT16G or similar)		2	1
Hand tools	2	2	4
Manitou			2
Mobile crane (<50t)	1		1
Mobile crane (50t to 200t)			2
Padfoot roller		2	2
Piling rig (bored pile)		2	
Pump	4	2	4
Road profiler			2
Roller		2	3
Scraper		2	
Semi-trailer		2	
Truck and dog (trailer)	2		2
Trucks (water cart)	1	2	1
Vibration roller		2	2

Equipment sound power levels (L_w) have been sourced from AS2436 – 2010 (R2016), BS 5228-1:2009+A1:2014 and Transport for New South Wales 'Construction Noise and Vibration Strategy' (CNVS). It should be noted that during the different construction stages, it is unlikely that all machinery would be operating at the same time (like the modelling assumes). However, assuming a 'worst-case' scenario approach helps to identify where noise impacts could be a concern and assists in the design of mitigation measures.

Table E- 2: Construction scenario and equipment

Equipment	Assumed percentage of use per 15 minutes	$L_{Aeq(15\ min)}$ Sound power level (per unit), dB(A)[2]
Asphalt paver	100%	112
Backhoe loader	100%	108
Backhoe with auger	100%	111
Bulldozer (CATD8 to CATD10 or similar)	100%	114

Equipment	Assumed percentage of use per 15 minutes	$L_{Aeq(15\ min)}$ Sound power level (per unit), dB(A)[2]
Chain saw	25%	119[1]
Compactor (CAT835 or similar)	100%	120[1]
Concrete Boom Pump	100%	106
Concrete saw	50%	127[1]
Concrete truck	100%	113
Concrete vibrator	100%	110[1]
Crawler Crane >200t	100%	113
Delivery Truck	100%	107
Delivery Truck (incl low loader)	100%	108
Diesel generator	100%	113
Dump truck	100%	117
Excavator (>25t)	100%	106
Excavator (<25t)	100%	95
Excavator hammer	25%	129[1]
Forklift	100%	106
Front end loader (FEL)	100%	115
Grader (CAT14G to CAT16G or similar)	100%	115
Hand tools (pneumatic)	100%	117
Manitou	100%	106
Mobile crane (<50t)	100%	113
Mobile crane (50t to 200t)	100%	113
Padfoot roller	100%	109
Piling rig (bored pile)	100%	111
Pump (water)	100%	100
Road profiler	100%	117
Roller	100%	99
Scraper	100%	116
Semi-trailer	100%	108
Truck and dog (trailer)	100%	108
Trucks (water cart)	100%	108
Vibration roller[1]	100%	117[1]

Equipment	Assumed percentage of use per 15 minutes	$L_{Aeq(15\ min)}$ Sound power level (per unit), dB(A)[2]
Notes: 1. Includes 5 dB penalty in accordance with the ICNG 2. Sound power level not adjusted for duration		

Appendix F

Operational Traffic Information

F.1 Vehicular numbers

Anticipated daily truck volumes and light vehicles were provided by Ramboll. These daily truck numbers are provided in the final column of Table F-1 below. These volumes are based on nominal capacities (380,000 tonnes per year). Future expansion scenarios are not considered in the scope of this document. Light vehicle daily volumes are provided in Table F-2 below.

Cleanaway have previously provided Arup with typical 12-hour daily traffic profiles of operational vehicles for Erskine Park Transfer Facility as a guide for the noise impact assessment. The Erskine Park facility documented truck visits typically between 4 am – 4 pm. Arup have used this daily traffic profile assumption for the noise impact assessment of the MERC project. The profile has been shifted back 2 hours to satisfy the proposed MERC delivery periods of 6 am – 6 pm on weekdays. This daily profile along with the daily delivery numbers shown in Table F-3 below allow for a weighted estimate volume of each truck type and is provided in Appendix D.

Table F- 1: Truck volumes

Type	Assumption	Yearly Volume (tonnes per year)	Truck Payload (tonnes)	Daily vehicles (peak)[1]
Residual waste	Type 1 – Council Compactor Truck	380,000	9	25
	Type 2 – Front load direct delivery		9	24
	Type 3 – A-double type[1]		42	21
Quicklime	Single trailer semi-trailer	5,700	20	3
Powdered Activated Carbon	Tanker truck	201	7.2	1
Urea (40%)	Single trailer semi-trailer	2,280	36.5	2
Cement (delivery for APCr stabilisation)	Bulk tanker truck	3,420	36.5	2
IBA	A-double type	109,250 (wet)	73	21
Stabilised APCr (concrete pickup)	Single trailer semi-trailer	17,100	36.5	4
Recycled materials	Single trailer semi-trailer	9,500	36.5	1
Sodium Hydroxide		Unknown		~ 1
Diesel		Unknown		~ 1
Total				**106**

Notes:

1. Assuming trucks coming in and out within the hour
2. Terberg Dolly (tug truck) acts as a second prime mover following the daily delivery of the A-double truck beginning and ending route at decoupling area.

Table F- 2: Light vehicle volumes

Type	Daily vehicles (peak)[1]
Maintenance Vehicles - Light Trucks	2
WtE Facility Cars	40
APCr Stabilisation Area - cars	2
IBA treatment area cars	2
Total	**46**

Type	Daily vehicles (peak)[1]
Notes: 1. Assuming employees coming in in the morning and out during the late afternoon	

Light vehicle daily volume profile is based on a reference WtE facility where peak numbers occur during opening business hours (08:00 hrs) and closing business hours (18:00 hrs) with a ramp up and ramp down either side of these peak hours. This daily volume profile has been adjusted for the total number of light vehicles per day.

F.2 Operational traffic data – based on Erskine Park Transfer Facility

Table F- 3: Indicative breakdown of heavy and light vehicles throughout the day

Hour starting	Erskine daily operational vehicle profile in % (shifted back by two hours)	Total number of trucks for MERC project (two-ways trips)[1]	Light vehicle daily traffic profile in % based on reference facility (shifted back by two hours)	Total number of light vehicles movements for MERC project (one-way trip)[2]	Estimated breakdown of heavy trucks for assessment purpose – per hour						
					Waste (residual)			IBA trucks (residuals)	APCr trucks (residuals)	Quicklime/ PAC/ Urea/Diesel /Sodium Hydroxide (consumables)	Recycled materials
					Type 1	Type 2	Type 3				
0:00	0%	0	0%	0	0	0	0	0	0	0	0
1:00	0%	0	0%	0	0	0	0	0	0	0	0
2:00	0%	0	0%	0	0	0	0	0	0	0	0
3:00	0%	0	0%	0	0	0	0	0	0	0	0
4:00	0%	0	0%	0	0	0	0	0	0	0	0
5:00	0%	0	0%	0	0	0	0	0	0	0	0
6:00	**4%**	**5**	**0%**	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**1**
7:00	10%	10	10%	4	2	2	2	2	1	1	0
8:00	7%	8	19%	10	2	2	2	2	0	0	0
9:00	4%	5	12%	6	1	1	1	1	0	1	0
10:00	1%	0	3%	1	0	0	0	0	0	0	0
11:00	12%	13	3%	1	3	3	3	3	1	0	0
12:00	10%	11	3%	1	3	3	1	2	1	1	0
13:00	7%	7	3%	1	1	1	2	2	0	1	0
14:00	15%	**16**	3%	**1**	**4**	**4**	**3**	**3**	**1**	**1**	**0**
15:00	11%	11	3%	1	3	3	2	2	0	1	0
16:00	10%	10	12%	6	3	2	2	2	0	1	0
17:00	7%	8	22%	10	2	2	2	1	0	1	0
18:00	0%	0	10%	4	0	0	0	0	0	0	0

Hour starting	Erskine daily operational vehicle profile in % (shifted back by two hours)	Total number of trucks for MERC project (two-ways trips)[1]	Light vehicle daily traffic profile in % based on reference facility (shifted back by two hours)	Total number of light vehicles movements for MERC project (one-way trip)[2]	Estimated breakdown of heavy trucks for assessment purpose – per hour						
					Waste (residual)			IBA trucks (residuals)	APCr trucks (residuals)	Quicklime/ PAC/ Urea/Diesel /Sodium Hydroxide (consumables)	Recycled materials
					Type 1	Type 2	Type 3				
19:00	0%	0	0%	0	0	0	0	0	0	0	0
20:00	0%	0	0%	0	0	0	0	0	0	0	0
21:00	0%	0	0%	0	0	0	0	0	0	0	0
22:00	0%	0	0%	0	0	0	0	0	0	0	0
23:00	0%	0	0%	0	0	0	0	0	0	0	0
Total	100%	106[3]	100%	46	25	24	21	21	4	10	1

Notes:

Blue – night-time, Orange – daytime, Green – evening

In bold, red text – peak night-time and daytime

1. Assuming trucks coming in and out within the hour.
2. Assuming employees coming in in the morning and out during the late afternoon.
3. 104 operational trucks stated in Table 11 of Ramboll's Traffic Analysis and Management Plan (Memo no. REN2022N00102-RAM-ME-00006). Additional two trucks, sodium hydroxide and diesel truck, have been included as part of this assessment.

F.3 Vehicular movements

Figure F- 1 and Figure F- 2 below show the travel path of vehicles within the site along with an estimated time spent at key locations such as weighbridges and within buildings (either dumping or collecting) provides a description of the travel paths. Table F- 4 provides a description of the travel paths of trucks.

Figure F- 1: Origins and destinations of trucks within the site – Arriving loaded

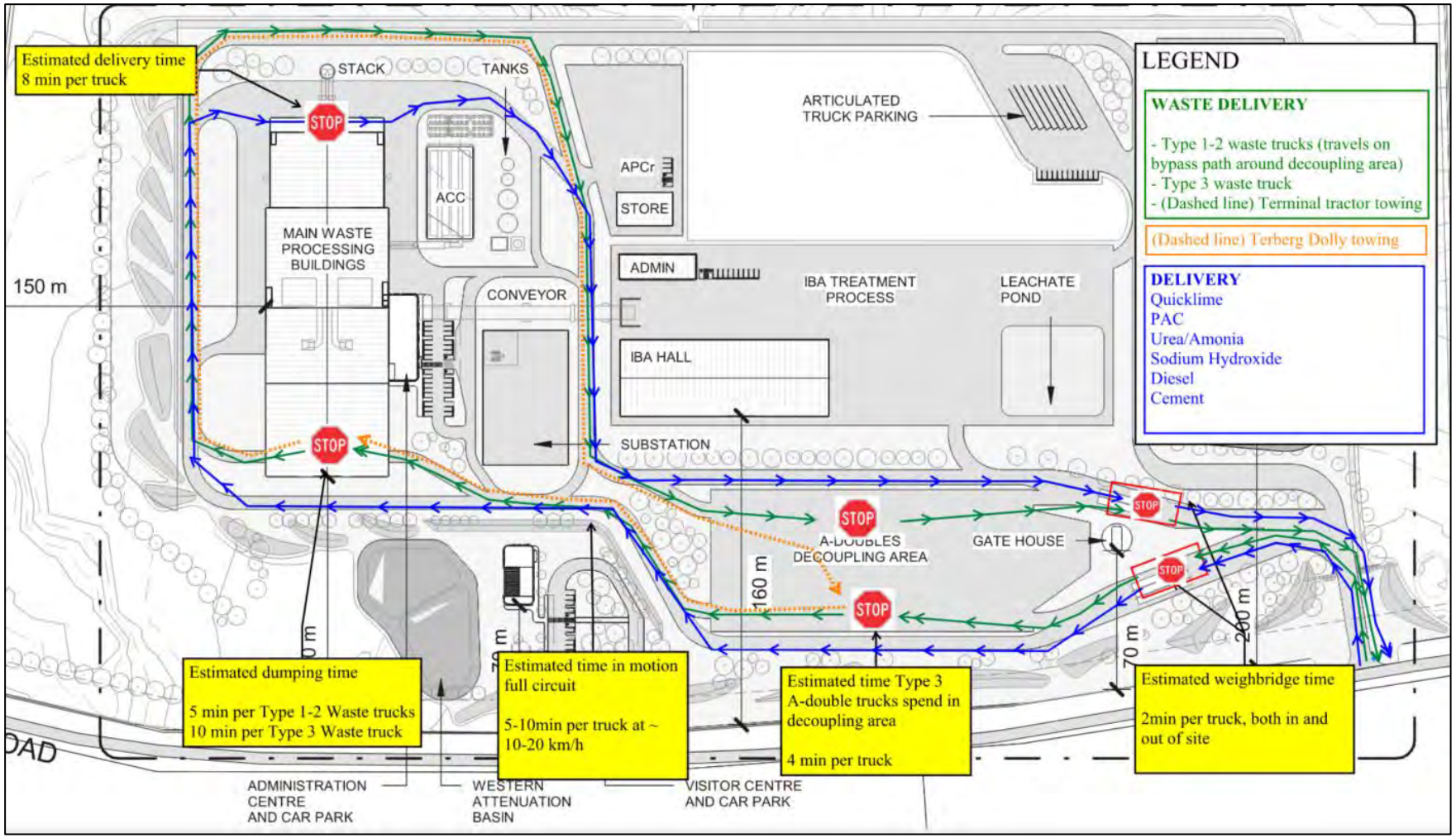


Figure F- 2: Origins and destinations of trucks within the site – Arriving empty

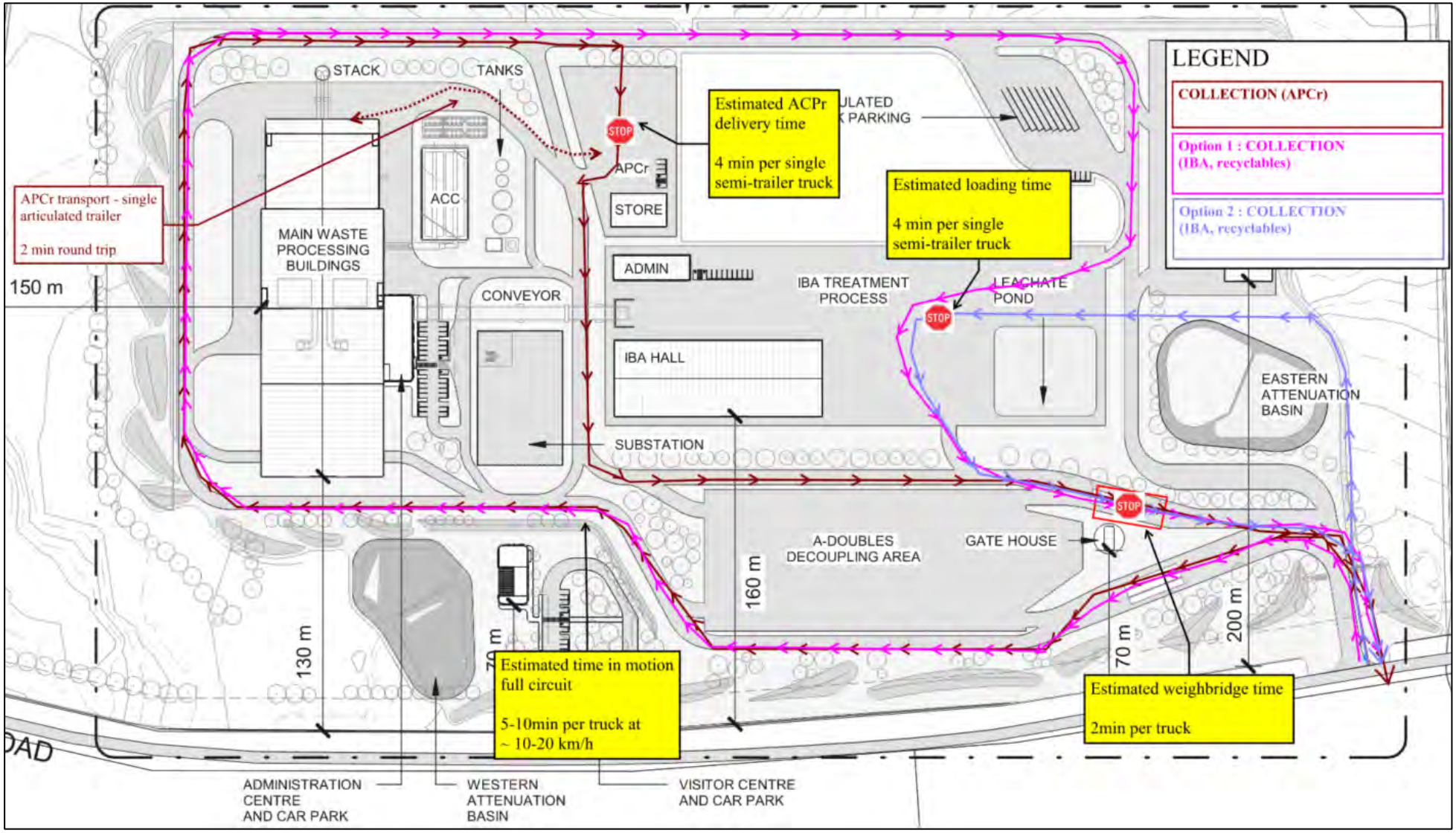


Table F- 4: Origins and destinations of trucks within the site

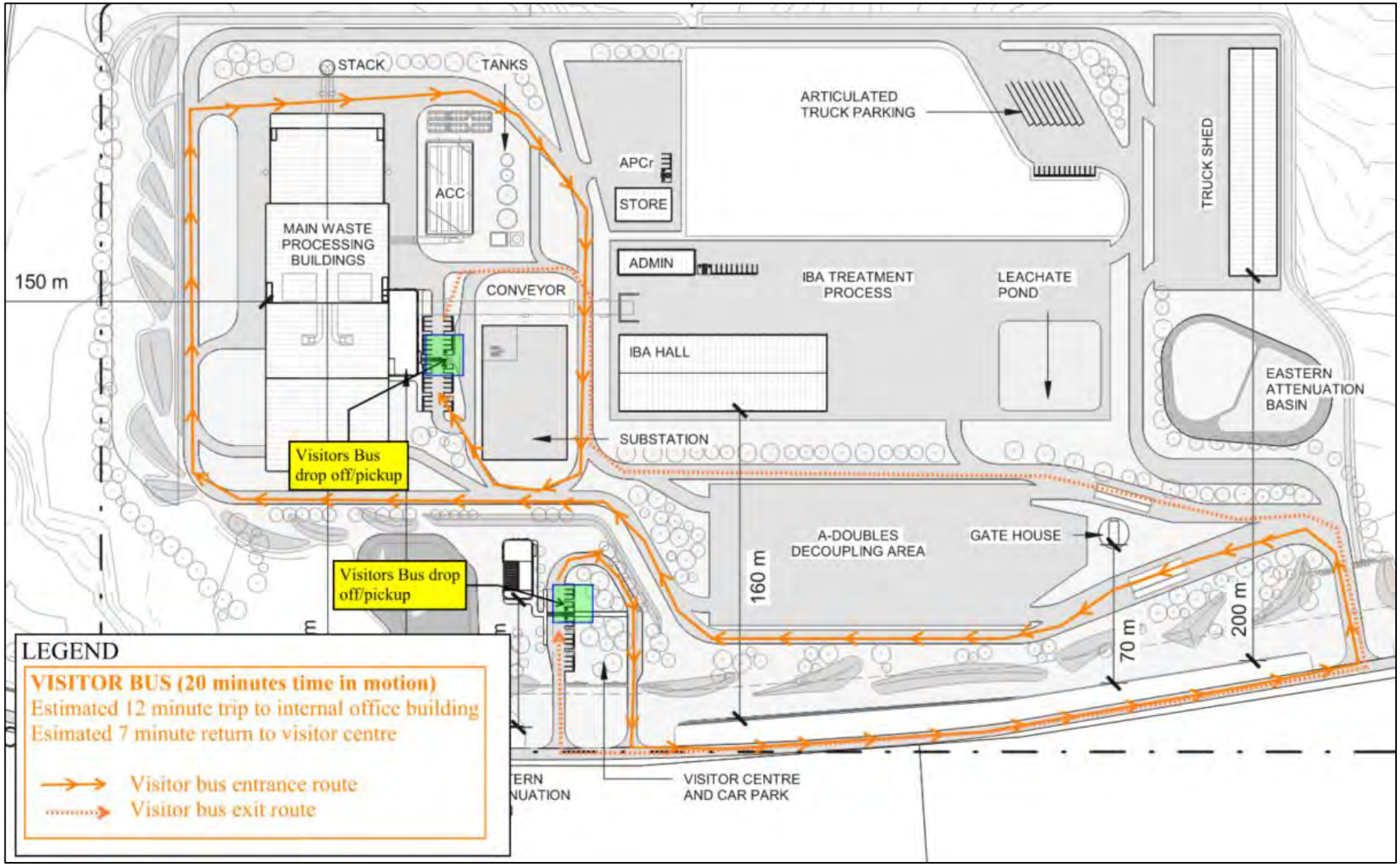
Trucks	Travel path (indicative)
Type 1-2 Waste trucks[1]	Step 1: Truck loaded – travel from site entrance to weighbridge Step 2: Bypass decoupling area and travel to reception hall to dump waste Step 3: Truck empty – travel from reception hall around site to weighbridge and exit
Type 3 Waste trucks[1] Terberg Dolly[2]	Step 1: Truck loaded – Travel from site entrance to weighbridge Step 2a: Travel to A-double decoupling area, detach trailer B then prime mover travels with trailer 'A' to reception hall to dump waste. Step 2b: Terberg Dolly attaches to trailer 'B' Travel to reception hall to dump waste Step 3: Truck empty – both prime mover (empty trailer 'A') and terberg dolly (empty trailer 'B') travel from reception hall to A-double decoupling area. Step 4: Reattach empty trailer 'B' to empty trailer 'A', A-double truck exits
Quicklime/Activated Carbon/Ammonia / Diesel / Sodium Hydroxide [3]	Step 1: Truck loaded – Travel from site entrance to weighbridge Step 2: Travel from weighbridge to FGT hall for delivery of consumables Step 3: Travel from FGT hall all the way around the site again to the exit
IBA/ recycled material[4]	**Option 1** Step 1: Truck empty – Travel from site entrance to weighbridge, circulating around complete site to IBA sorting area for collection of ash Step 2: Truck loaded – travel from IBA sorting area to weighbridge Step 3: Truck loaded – Travel from weighbridge to site exit **Option 2** Step 1: Truck empty – Travel from site entrance to IBA sorting area via east road extension and dedicated weighbridge to collect ash Step 2: Truck loaded – travel from IBA sorting area to weighbridge Step 3: Truck loaded – Travel from weighbridge to site exit
Air Pollution Control residue (APCr)[5]	Step 1: Truck empty – Travel from site entrance to weighbridge then to APCr outdoor area for collection of residues Step 2: Truck loaded – Travel from APCr outdoor area to the weighbridge Step 3: Truck loaded – Travel from weighbridge to site exit

Trucks	Travel path (indicative)
APCr light transport truck[6]	Step 1: Pick up residuals from FGT hall ~ 5 minutes Step 2: Drive to APCr outdoor area ~ 2 minutes Step 3: Unload residuals ~ 5 minutes Step 3: Drive back to FGT hall ~ 2 minutes

1. Waste Type 1 and 2 truck route shown in green in Figure F- 1.
2. Waste Type 3 A-double truck route and Terberg Dolly prime mover route shown in orange in Figure F- 1.
3. Consumables truck route shown in blue in Figure F- 1.
4. IBA and recycled materials truck route shown as pink (route Option 1) and blue (route Option 2) in Figure F- 2.
5. APCr semi-trailer path shown in brown in shown in Figure F- 2. Dashed brown line shows the transport truck between the FGT Hall and the APCr outdoor area.
6. For modelling purposes it is assumed that the APCr light transport truck will make a return trip between the FGT hall and APCr outdoor area once in the worst case 15 minutes.

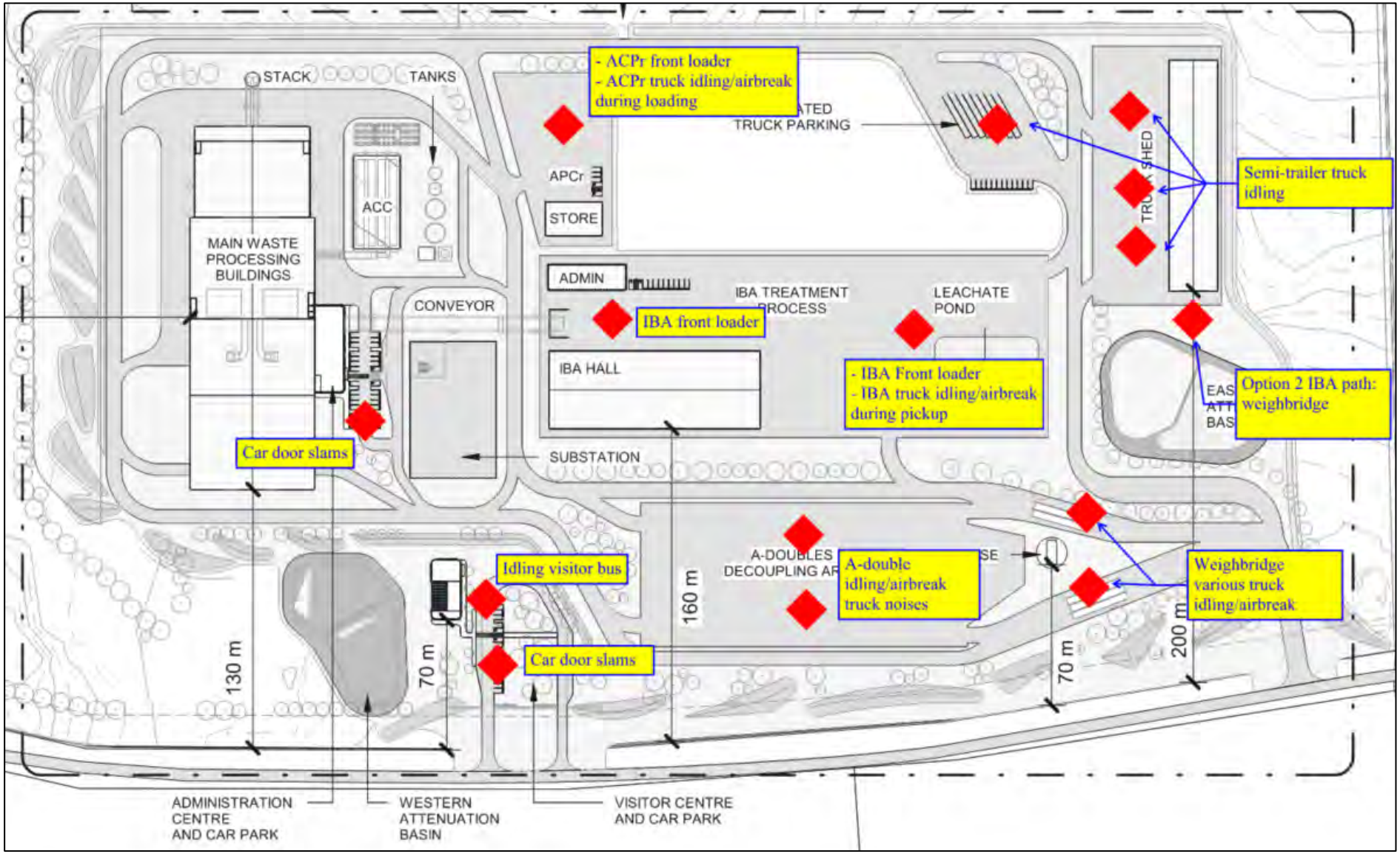
The expected travel routes for the visitor bus travelling between the visitor centre and admin building is provided in Figure F- 3.

Figure F- 3: Travel route of visitor bus transporting between Visitor Centre and Administration Building



An overview of assumed locations of stationary vehicular noise sources/events are illustrated in Figure F- 4 below.

Figure F- 4: Identification of key stationary vehicular outdoor noise sources/events



Appendix G

Sound Power Levels and transmission losses

G.1 Sound transmission losses used in noise modelling

The transmission loss data shown below in Table G- 1 and is supplementary data to Table 22 of this report. Transmission loss data has been converted from one octave transmission loss values to one-third octave values by estimation of interpolation. Values in grey cells at low frequencies have been extrapolated based on the trend of values as the frequency decreases as a conservative approach.

Table G- 1: Transmission loss spectrum estimated for noise modelling

Item	Weighted sound reduction index (R_w)	Octave Band Centre Frequency Hz (dB)																													
		10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
Insulated metal roof panel[1], e.g. Kingspan KS1000 RW30 or similar	24	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	23	23	23	23	22	22	28	38	44	44	41	41	41
Metal wall cladding - 0.8 mm thick steel[2]	25	4	4	4	4	4	5	6	7	8	9	11	12	14	15	17	18	20	21	23	24	26	27	29	30	31	33	34	35	35	36	36
Concrete 200 mm thick (1700 kg/m^3)[2]	54	38	38	38	38	39	39	40	41	42	44	44	42	39	39	41	45	48	51	53	56	59	61	64	66	68	70	72	74	76	78	79
70 mm thick polycarbonate (semi-transparent cladding)[2]	35	17	18	19	20	22	23	25	26	27	29	30	32	33	35	36	37	38	37	26	28	32	36	39	41	44	46	48	51	52	54	56
Louvres[1] (mitigated), e.g. Soundbar Louvres SBL1 or similar	13	0	0	0	0	0	1	2	3	4	5	6	7	8	8	9	10	12	13	14	14	14	14	12	12	12	12	12	11	9	8	7

Notes:

1. Interpolated to one-third octave bands based on manufacturer data and extrapolated down to 10 Hz.
2. Interpolated based on Strutt transmission loss prediction and extrapolated down to 10 Hz.

G.2 Façade openings in noise modelling

The following openings (truck access and louvres) have been identified based on the architectural drawings listed above:

- A1 Reception hall:
  - 2x doors for truck arrival and departure (1x located on east façade and 1x located on west façade)
  - Long acoustically rated louvre above the 6 m concrete datum
- B1 Waste bunker:
  - No openings modelled
- C1/C2 Boiler Halls:
  - Acoustically rated roof exhaust louvre
  - 1x door for truck access on the C1 west façade
  - 2x doors for truck access on the C2 east façade
  - Multiple small louvres approximately 10% of the C1 west concrete façade

- Multiple small louvres approximately 10% of the C1 west boiler hall metal cladding façade
- Multiple small louvres (acoustically rated) approximately 10% of the C2 east turbine hall concrete façade
- Multiple small louvres (acoustically rated) approximately 10% of the C2 east boiler hall metal cladding façade

- D1 FGT Hall:
  - Roof exhaust louvre
  - Multiple small louvres approximately 10% of the metal cladding east façade
  - Multiple small louvres approximately 10% of the metal cladding west façade
  - 2x doors for truck access on east façade
  - 1x doors for truck access on west façade.

Note that the east façade penetration for the IBA conveyor to pass through is assumed sealed by the IBA metal enclosure than runs along the entire outdoor length before terminating near the IBA sorting building.

The following semi-transparent cladding have been identified based on the architectural drawings listed above:

- B1 Waste bunker:
  - Semi-transparent cladding wrapping around the south-east corner of the façade
- C1/C2 Boiler Halls:
  - Semi-transparent cladding on the C1 west façade
  - Semi-transparent cladding on the C2 east façade just above the ACC condensation pipe façade penetrations
- D1 FGT Hall:
  - Semi-transparent cladding wrapping on the west façade
  - Semi-transparent cladding wrapping on the east façade.

G.3 Sound levels used in operational noise modelling

Table G- 2: Sound power levels in one-third octaves from 10 Hz – 10 kHz for noise modelling, dB re 20µPa

Item	Metric	Broadband sound levels, dBA	Octave Band Centre Frequency Hz (dB)																														
			10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15 k	4k	5k	6.3k	8k	10k
Moving Sources[1]																																	
Truck (9t waste/compactor or APCr light transport truck) 10 km/h – L_w	$L_{eq(15minute)}$/m	64	84	82	80	77	75	73	70	68	66	63	59	56	56	58	59	58	56	55	55	55	54	54	54	54	52	49	47	45	43	41	39
Truck (36.5 - 73t semi-trailer trucks, B-doubles, A-doubles) 10 km/h – L_w	$L_{eq(15minute)}$/m	70	76	75	74	73	72	71	70	69	68	67	65	64	63	62	61	61	60	60	61	62	63	61	59	57	56	55	53	51	49	47	45
Truck braking event – L_w	$L_{eq(15\ minute)}$	71	63	63	63	63	63	64	65	68	69	68	66	64	63	61	59	58	56	55	55	55	56	58	61	63	62	59	58	58	58	58	58
Truck idling (constant) – L_w	$L_{eq(15\ minute)}$	95	85	85	85	85	85	87	89	92	94	93	92	92	89	85	82	83	85	85	86	86	86	86	86	86	83	79	76	73	70	68	65
Truck reversing with beeper 5 km/h (30 seconds) – L_w	$L_{eq(15minute)}$/m	54	53	53	53	53	53	53	54	55	56	55	55	55	52	47	44	44	44	43	43	42	42	43	45	46	42	36	32	35	33	30	27
Light vehicle 10 km/h – L_w	$L_{eq(15minute)}$/m	45	86	82	78	74	70	66	62	58	54	50	46	42	41	41	40	38	36	34	33	34	33	33	33	33	31	30	28	27	25	23	21
Visitor Bus 10 km/h – L_w	$L_{eq(15minute)}$/m	64	84	82	80	77	75	73	70	68	66	63	59	56	56	58	59	58	56	55	55	55	54	54	54	54	52	49	47	45	43	41	39
Stationary sources[1]																																	
ACC (per fan unit) – L_w	$L_{eq(15minute)}$	95	81	81	81	81	81	81	81	81	84	88	94	97	95	91	89	88	88	87	87	86	86	84	82	80	78	74	71	71	72	72	72
Substation – L_{wA}	$L_{eq(15minute)}$ /sq. m	88	68	68	68	68	68	68	68	68	72	76	84	88	81	68	62	59	58	55	53	51	49	48	48	47	45	35	33	44	55	66	77
Exhaust stack (2 flues) – L_w	$L_{eq(15minute)}$	83	93	92	91	91	90	89	89	88	87	87	86	86	83	79	76	76	76	75	74	73	72	71	71	71	68	64	62	60	59	57	55
Radiator coolers (per bank of 8x fans) – L_w	$L_{eq(15minute)}$	89	84	84	84	84	84	84	84	84	84	84	84	84	83	83	83	82	81	80	80	80	80	79	78	77	76	74	73	72	70	68	67
IBA conveyor[3] - L_w	$L_{eq(15minute)}$/m	83	88	87	86	86	85	84	84	83	82	82	83	84	83	81	80	79	77	76	75	74	73	71	69	67	66	64	62	59	56	53	50
IBA conveyor mitigated[4] - L_w	$L_{eq(15minute)}$/m	73	78	77	76	76	75	74	74	73	72	72	73	74	73	71	70	69	67	66	65	64	63	61	59	57	56	54	52	49	46	43	40

Item	Metric	Broadband sound levels, dBA	Octave Band Centre Frequency Hz (dB)																														
			10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15 k	4k	5k	6.3k	8k	10k
Front loader mobile plant (IBA sorting /loading events, ACPr loading events) – 5x loading events per 15 min period	$L_{eq(15minute)}$	87	113	111	108	105	103	100	97	95	92	89	86	84	83	84	84	82	79	77	77	77	77	76	75	75	74	73	72	69	65	62	59
EDG Exhaust (mitigated to meet 75 dBA at 1m)	$L_{eq(15minute)}$	83	46	46	46	46	46	49	53	58	62	62	62	62	65	69	71	71	70	70	70	70	70	70	70	71	70	67	67	69	73	75	78
Buildings[1,2]																																	
A1 - Reception hall	Internal Lp	85	105	103	101	98	96	93	91	89	86	84	81	79	78	79	78	77	76	75	76	77	77	76	74	72	70	68	66	64	62	60	58
B1 – Waste Bunker (including shredder)	Internal Lp	80	100	98	96	93	91	88	86	84	81	79	76	74	73	74	73	72	71	70	71	72	72	71	69	67	65	63	61	59	57	55	53
B2 – IBA sorting building	Internal Lp	80	90	89	88	87	86	85	84	83	82	81	81	80	77	72	68	69	70	70	71	71	71	71	70	70	66	61	57	55	53	50	47
C1 – Boiler hall	Internal Lp	80	87	86	85	84	83	82	81	80	79	78	76	75	75	76	76	75	74	73	71	70	69	68	67	66	65	65	64	62	60	58	57
EDG room	Internal Lp	85	78	77	77	76	75	75	74	73	73	72	71	71	71	70	71	73	78	81	80	78	77	74	71	69	66	65	62	58	52	48	44
C2 – Boiler hall (includes turbine, condensation pump for ACC fans)	Internal Lp	85	92	91	90	89	88	87	86	85	84	83	81	80	80	81	81	80	79	78	76	75	74	73	72	71	70	70	69	67	65	63	62
D1 - FGT hall	Internal Lp	85	88	87	86	85	84	83	82	81	79	78	77	76	76	76	76	75	74	73	74	77	78	77	73	72	71	72	71	68	64	61	58
Truck maintenance shed (Mechanical workshop)	Internal Lp	50	21	21	21	21	21	21	21	21	27	33	43	49	47	44	42	42	42	42	41	39	38	38	39	39	38	36	35	34	33	32	31

Notes:

1. Greyed out one-third octave bands identify values that have been extrapolated (as per guidelines in Publication 1996 Noise guidelines: assessing low frequency noise 2021) from proposed source noise spectrum.
2. Max sound levels (dBA) of each space provided by Ramboll. Noise spectrum shape was back calculated from one octave band sound power levels (63 Hz – 8 kHz) available from Figure 9.3, Chapter 9 of Dublin Waste to Energy Project 2006 for similar functioning spaces and adjusted to match Ramboll's advised maximum sound levels. These resulting one octave band spectra was then interpolated to obtain one-third octave data, and then extrapolated to obtain low frequency sound level estimates down to 10 Hz.
3. Based on Arup database for an enclosed conveyor system with unmitigated idlers (rollers).
4. Mitigation measures required to achieve IBA noise propagation is to be investigated. Potential interventions to investigate are included in Table 25.

Appendix H

Noise prediction results

H.1 Noise modelling predictions in one-third octave bands

The following tables show the detailed noise modelling predictions for worst case 15-minute scenarios for:

- day-time (Table H- 1) and day-time with mitigation measures (Table H- 2),
- day-time with EDG testing (Table H- 4) and day-time with EDG testing and mitigation measures (Table H- 4)
- evening-time (Table H- 5Table H- 2),
- night-time (Table H- 6) and night time with mitigations implemented (Table H- 7).

Red bold text indicates where predictions between the low frequency threshold levels for outdoor measurements and orange filled cells indicate where predicted levels exceed the threshold values by 5 dB. Penalties are applied to the A-weighted broadband (dB(A)) values based on NSW EPA Noise Policy for Industry guidelines outlined in Table 19.

Table H- 1: Day-time period – Predicted worst case 15 min noise levels with correction due to low frequency penalty

Receiver ID	Noise protocol noise limit – Daytime period L_{Aeq}, dB(A)	Predicted Levels, L_{Aeq}(15min)			Compliance	Octave Band Centre Frequency Hz (dB)[1,2]																																
		A-weight broadband spectrum dBA (dBC)	low frequency penalty, dB	dB(A) Adjusted based on low frequency penalty	Noise Protocol	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25 k	1.6k	2k	2.5k	3.15 k	4k	5k	6.3k	8k	10k
Low frequency threshold levels for outdoor measurement						92	89	86	77	69	61	54	50	50	48	48	46	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soundplan noise predictions																																						
R1	48	40 (60)	0	**40**	YES	65	63	60	58	56	53	51	49	47	46	42	44	39	35	33	32	32	32	31	34	33	30	27	22	15	5	-10	-34	-66	-112	0
R2	57	41 (63)	0	**41**	YES	69	66	64	61	59	56	54	**51**	49	46	40	39	37	36	35	33	32	31	31	34	34	32	29	26	21	15	6	2	-14	-35	-65
R3	53	45 (66)	0	**45**	YES	71	69	66	63	61	58	**56**	**54**	**51**	**49**	43	42	40	39	38	37	36	35	35	38	38	36	34	31	27	23	16	26	19	9	-3
R4	53	56 (69)	0	**56**[3]	NO	74	71	69	66	64	**62**	**60**	**58**	**57**	**55**	**52**	**52**	**49**	45	44	43	43	43	43	48	48	47	46	45	42	38	34	13	11	10	9
R5	57	48 (64)	0	**48**[3]	YES	68	65	63	61	59	57	**55**	**53**	**52**	**51**	48	**46**	43	40	38	37	37	37	37	41	40	38	36	36	30	27	20	16	14	13	12

Notes:

1. Red bold text indicates where the predicted low frequency third-octave noise levels exceed the recommended threshold levels in any one-third octave band between 10 Hz – 160 Hz. This indicates a potential risk of problematic low frequency noise. If dBC – dBA is equal or greater than 15 dB, then this triggers a penalty to the predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017 for evening and night-periods only.
2. Orange highlighted boxes indicate where dBC – dBA is equal or greater than 15 dB and any one-third octave band noise levels exceed threshold levels by more than 5 dB. This triggers a 2 dB penalty to day-time predicted dBA noise levels, and 5 dB penalty to the evening/night-time predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017.
3. Includes correction for cumulative ambient noise from APA Western Outer Ring Main Wollert Compressor Station.

Table H- 2: Day-time period (mitigation) - Predicted worst case 15-min noise levels with corrections due to low frequency penalty

Receiver ID	Noise protocol noise limit – Daytime period L_{Aeq}, dB(A)	Predicted Levels, L_{Aeq}(15min)			Compliance	Octave Band Centre Frequency Hz (dB)[1,2]																																
		A-weight broadband spectrum dBA (dBC)	low frequency penalty, dB	dB(A) Adjusted based on low frequency penalty	Noise Protocol	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25 k	1.6k	2k	2.5k	3.15 k	4k	5k	6.3k	8k	10k
Low frequency threshold levels for outdoor measurement						92	89	86	77	69	61	54	50	50	48	48	46	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soundplan noise predictions																																						
R1	48	40 (60)	0	**40**	YES	65	63	60	58	55	53	51	49	47	45	41	43	39	33	32	30	30	31	30	33	33	30	27	22	15	5	-10	-32	-64	-109	3
R2	57	41 (63)	0	**41**	YES	69	66	64	61	59	56	54	**51**	49	46	40	38	36	35	34	33	32	31	30	34	34	32	29	26	21	15	6	-7	-26	-52	-89
R3	53	45 (66)	0	**45**	YES	71	69	66	63	61	58	**56**	**54**	**51**	**49**	43	41	40	38	37	36	36	35	35	38	38	36	33	31	27	23	16	-1	-17	-40	-72
R4	53	55 (69)	0	**55**[3]	NO	74	71	69	66	64	**62**	**60**	**58**	**57**	**55**	**52**	**52**	**49**	44	43	42	43	42	43	48	48	47	46	45	42	38	34	13	11	10	9
R5	57	47 (64)	0	**47**[3]	YES	68	65	63	61	59	57	**55**	**53**	**52**	**51**	47	**46**	43	39	37	36	36	36	37	40	40	38	36	36	30	27	20	16	14	13	12

Notes:

1. Red bold text indicates where the predicted low frequency third-octave noise levels exceed the recommended threshold levels in any one-third octave band between 10 Hz – 160 Hz. This indicates a potential risk of problematic low frequency noise. If dBC – dBA is equal or greater than 15 dB, then this triggers a penalty to the predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017 for evening and night-periods only.
2. Orange highlighted boxes indicate where dBC – dBA is equal or greater than 15 dB and any one-third octave band noise levels exceed threshold levels by more than 5 dB. This triggers a 2 dB penalty to day-time predicted dBA noise levels, and 5 dB penalty to the evening/night-time predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017.
3. Includes correction for cumulative ambient noise from APA Western Outer Ring Main Wollert Compressor Station.

Table H- 3: Day-time period with EDG testing - Predicted worst case 15-min noise levels with corrections due to low frequency penalty

Receiver ID	Noise protocol noise limit – Daytime period L_{Aeq}, dB(A)	Predicted Levels, L_{Aeq}(15min)			Compliance	Octave Band Centre Frequency Hz (dB)[1,2]																																
		A-weight broadband spectrum dBA (dBC)	low frequency penalty, dB	dB(A) Adjusted based on low frequency penalty	Noise Protocol	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k		
Low frequency threshold levels for outdoor measurement						92	89	86	77	69	61	54	50	50	48	48	46	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soundplan noise predictions																																						
R1	**48**	47 (61)	0	**47**	YES	65	63	60	58	56	53	51	49	47	46	42	44	40	38	38	37	37	38	38	40	39	38	37	33	27	16	2	-16	-44	-88	3		
R2	**57**	48 (63)	0	**48**	YES	69	66	64	61	59	56	54	**51**	49	47	41	39	38	40	41	40	39	39	38	40	40	39	38	36	32	26	18	9	-4	-27	-60		
R3	**53**	54 (66)	0	**54**	NO	71	69	66	63	61	58	**56**	**54**	**52**	**49**	44	43	42	44	45	45	44	44	44	46	46	45	46	44	41	35	29	-1	-17	-40	-72		
R4	**53**	56 (69)	0	**56**[3]	NO	74	71	69	66	64	**62**	**60**	**58**	**57**	**55**	**52**	**52**	**49**	45	44	43	43	43	43	48	48	47	46	45	42	38	34	13	11	10	9		
R5	**57**	48 (64)	0	**48**[3]	YES	68	65	63	61	59	57	**55**	**53**	**52**	**51**	48	**46**	43	40	38	37	37	37	37	41	40	38	36	36	30	27	20	16	14	13	12		

Notes:

1. Red bold text indicates where the predicted low frequency third-octave noise levels exceed the recommended threshold levels in any one-third octave band between 10 Hz – 160 Hz. This indicates a potential risk of problematic low frequency noise. If dBC – dBA is equal or greater than 15 dB, then this triggers a penalty to the predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017 for evening and night-periods only.
2. Orange highlighted boxes indicate where dBC – dBA is equal or greater than 15 dB and any one-third octave band noise levels exceed threshold levels by more than 5 dB. This triggers a 2 dB penalty to day-time predicted dBA noise levels, and 5 dB penalty to the evening/night-time predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017.
3. Includes correction for cumulative ambient noise from APA Western Outer Ring Main Wollert Compressor Station.

Table H- 4: Day-time period with EDG testing (mitigation) - Predicted worst case 15-min noise levels with corrections due to low frequency penalty

Receiver ID	Noise protocol noise limit – Daytime period L_{Aeq}, dB(A)	Predicted Levels, L_{Aeq}(15min)			Compliance	Octave Band Centre Frequency Hz (dB)[1,2]																																
		A-weight broadband spectrum dBA (dBC)	low frequency penalty, dB	dB(A) Adjusted based on low frequency penalty	Noise Protocol	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k		
Low frequency threshold levels for outdoor measurement						92	89	86	77	69	61	54	50	50	48	48	46	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soundplan noise predictions																																						
R1	48	40 (60)	0	**40**	YES	65	63	60	58	55	53	51	49	47	45	41	43	39	33	32	30	30	31	30	33	33	30	27	22	15	5	-10	-32	-63	-109	3		
R2	57	41 (63)	0	**41**	YES	69	66	64	61	59	56	54	**51**	49	46	40	38	36	35	34	33	32	31	30	34	34	32	29	26	21	15	6	-7	-26	-52	-87		
R3	53	45 (66)	0	**45**	YES	71	69	66	63	61	58	**56**	**54**	**51**	**49**	43	41	40	38	37	36	36	35	35	38	38	36	34	31	27	23	16	-1	-17	-40	-72		
R4	53	55 (69)	0	**55**[3]	NO	74	71	69	66	64	**62**	**60**	**58**	**57**	**55**	**52**	**52**	**49**	44	43	42	43	42	43	48	48	47	46	45	42	38	34	13	11	10	9		
R5	57	47 (64)	0	**47**[3]	YES	68	65	63	61	59	57	**55**	**53**	**52**	**51**	47	**46**	43	39	37	36	36	36	37	40	40	38	36	36	30	27	20	16	14	13	12		

Notes:

1. Red bold text indicates where the predicted low frequency third-octave noise levels exceed the recommended threshold levels in any one-third octave band between 10 Hz – 160 Hz. This indicates a potential risk of problematic low frequency noise. If dBC – dBA is equal or greater than 15 dB, then this triggers a penalty to the predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017 for evening and night-periods only.
2. Orange highlighted boxes indicate where dBC – dBA is equal or greater than 15 dB and any one-third octave band noise levels exceed threshold levels by more than 5 dB. This triggers a 2 dB penalty to day-time predicted dBA noise levels, and 5 dB penalty to the evening/night-time predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017.
3. Includes correction for cumulative ambient noise from APA Western Outer Ring Main Wollert Compressor Station.

Table H- 5: Evening-time period - Predicted worst case 15-min noise levels with corrections due to low frequency penalty

Receiver ID	Noise protocol noise limit – Evening-time period L_{Aeq}, dB(A)	Predicted Levels, L_{Aeq}(15min)			Compliance	Octave Band Centre Frequency Hz (dB)																														
		A-weight broadband spectrum dBA (dBC)	low frequency penalty, dB	dB(A) Adjusted based on low frequency penalty	Noise Protocol	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25 k	1.6k	2k	2.5k	3.15 k	4k	5k	6.3k	8k	10k
Low frequency threshold levels for outdoor measurement						92	89	86	77	69	61	54	50	50	48	48	46	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soundplan noise predictions																																				
R1	44	38 (59)	0	**38**	YES	64	62	59	57	54	52	50	47	45	44	41	44	39	33	32	30	30	30	29	30	29	26	23	18	11	1	-13	-36	-68	-114	3
R2	52	37 (62)	0	**37**	YES	69	66	63	60	58	55	52	50	47	44	38	37	34	33	33	31	29	28	27	29	29	26	23	20	16	11	3	-11	-31	-58	-96
R3	49	42 (65)	2	**44**	YES	71	68	65	62	60	57	**55**	**52**	49	47	41	40	38	36	36	34	33	32	31	34	34	32	29	26	23	19	13	-19	-45	-75	-108
R4	48	44 (66)	2	**47**[3]	YES	71	69	66	64	62	59	**57**	**55**	**53**	**51**	**49**	**51**	**46**	40	39	37	36	36	35	36	36	33	32	33	26	24	17	13	11	10	9
R5	52	41 (61)	2	**47**[3]	YES	67	64	61	59	58	56	54	**51**	**50**	**49**	47	46	42	39	37	36	35	35	35	37	36	33	32	35	27	25	19	15	14	13	12

Notes:

1. Red bold text indicates where the predicted low frequency third-octave noise levels exceed the recommended threshold levels in any one-third octave band between 10 Hz – 160 Hz. This indicates a potential risk of problematic low frequency noise. If dBC – dBA is equal or greater than 15 dB, then this triggers a penalty to the predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017 for evening and night-periods only.
2. Orange highlighted boxes indicate where dBC – dBA is equal or greater than 15 dB and any one-third octave band noise levels exceed threshold levels by more than 5 dB. This triggers a 2 dB penalty to day-time predicted dBA noise levels, and 5 dB penalty to the evening/night-time predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017.
3. Includes correction for cumulative ambient noise from APA Western Outer Ring Main Wollert Compressor Station.

Table H- 6: Night-time period - Predicted worst case 15-min noise levels with corrections due to low frequency penalty

Receiver ID	Noise protocol noise limit – Night-time period L_{Aeq}, dB(A)	Predicted Levels, L_{Aeq}(15min)			Compliance	Octave Band Centre Frequency Hz (dB)																																
		A-weight broadband spectrum dBA (dBC)	low frequency penalty, dB	dB(A) Adjusted based on low frequency penalty	Noise Protocol	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k		
Low frequency threshold levels for outdoor measurement						92	89	86	77	69	61	54	50	50	48	48	46	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soundplan noise predictions																																						
R1	**41**	38 (59)	0	**38**	YES	64	62	59	56	54	52	49	47	45	44	41	44	39	34	32	31	30	30	29	31	30	28	24	20	12	2	-12	-34	-66	-112	3		
R2	**50**	38 (62)	0	**38**	YES	69	66	63	60	57	55	52	49	46	44	38	36	34	34	33	32	30	29	28	31	31	29	26	22	18	12	4	-10	-29	-56	-93		
R3	**47**	43 (65)	2	**45**	YES	71	68	65	62	60	57	**55**	**52**	50	47	41	40	38	37	37	35	34	33	33	36	36	34	31	28	25	20	14	-6	-22	-45	-77		
R4	**46**	51 (66)	5	**56**[3]	NO	72	69	66	64	62	59	**57**	**55**	**53**	**52**	**50**	**51**	**47**	42	41	40	40	39	39	43	43	42	41	40	37	33	29	13	11	10	9		
R5	**52**	43 (61)	2	**45**[3]	YES	67	64	61	59	57	55	53	**51**	**50**	**49**	47	46	42	39	37	36	36	36	36	38	38	35	34	35	28	26	19	15	14	13	12		

Notes:

1. Red bold text indicates where the predicted low frequency third-octave noise levels exceed the recommended threshold levels in any one-third octave band between 10 Hz – 160 Hz. This indicates a potential risk of problematic low frequency noise. If dBC – dBA is equal or greater than 15 dB, then this triggers a penalty to the predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017 for evening and night-periods only.
2. Orange highlighted boxes indicate where dBC – dBA is equal or greater than 15 dB and any one-third octave band noise levels exceed threshold levels by more than 5 dB. This triggers a 2 dB penalty to day-time predicted dBA noise levels, and 5 dB penalty to the evening/night-time predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017.
3. Includes correction for cumulative ambient noise from APA Western Outer Ring Main Wollert Compressor Station.

Table H- 7: Night-time period (with applied mitigation) - Predicted worst case 15-min noise levels with corrections due to low frequency penalty

Receiver ID	Noise protocol noise limit – Night-time period L_{Aeq}, dB(A)	Predicted Levels, L_{Aeq}(15min)			Compliance	Octave Band Centre Frequency Hz (dB)																																
		A-weight broadband spectrum dBA (dBC)	low frequency penalty, dB	dB(A) Adjusted based on low frequency penalty	Noise Protocol	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k		
Low frequency threshold levels for outdoor measurement						92	89	86	77	69	61	54	50	50	48	48	46	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soundplan noise predictions																																						
R1	41	37 (59)	0	**37**	YES	64	62	59	56	54	51	49	46	44	43	40	43	38	32	30	28	28	29	28	30	30	27	24	19	12	2	-13	-34	-67	-112	3		
R2	50	38 (62)	0	**38**	YES	69	66	63	60	57	55	52	49	46	43	37	36	34	33	32	31	29	28	27	30	30	28	25	22	17	12	3	-10	-29	-56	-93		
R3	47	42 (65)	2	**44**	YES	71	68	65	62	60	57	**55**	**52**	49	47	41	40	38	36	36	34	34	32	32	36	36	33	31	28	24	20	14	3	-14	-35	-65		
R4	46	51 (66)	2	**53**[3]	NO	72	69	66	64	61	59	**57**	**54**	**53**	**51**	**49**	**51**	**46**	41	40	39	38	38	38	43	43	42	41	40	37	33	29	24	18	12	9		
R5	52	45 (62)	2	**47**[3]	YES	67	64	61	59	57	55	53	**51**	50	**49**	47	46	42	38	36	35	35	35	35	38	37	34	33	35	28	26	19	16	14	13	12		

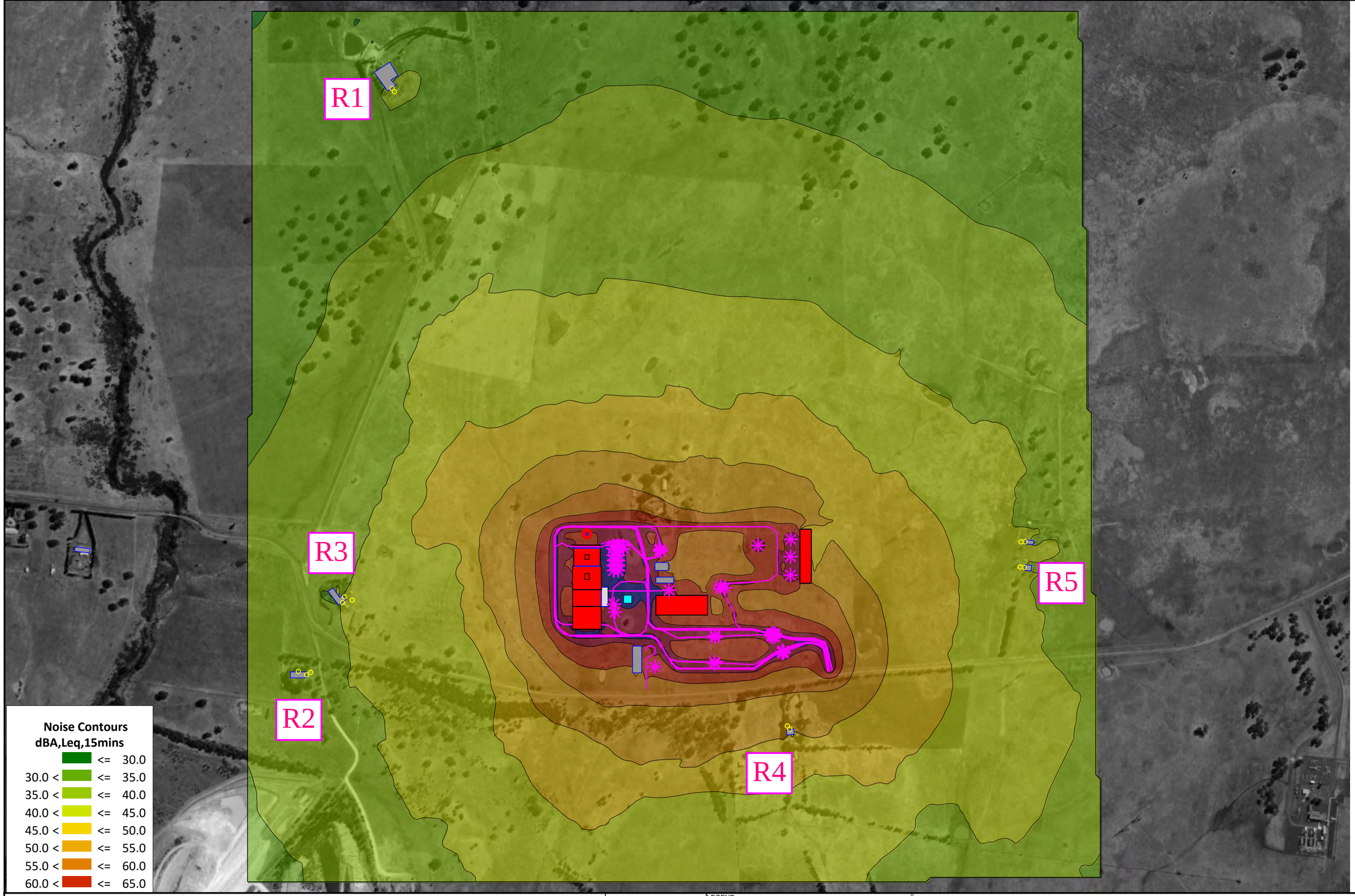
Notes:

1. Red bold text indicates where the predicted low frequency third-octave noise levels exceed the recommended threshold levels in any one-third octave band between 10 Hz – 160 Hz. This indicates a potential risk of problematic low frequency noise. If dBC – dBA is equal or greater than 15 dB, then this triggers a penalty to the predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017 for evening and night-periods only.
2. Orange highlighted boxes indicate where dBC – dBA is equal or greater than 15 dB and any one-third octave band noise levels exceed threshold levels by more than 5 dB. This triggers a 2 dB penalty to day-time predicted dBA noise levels, and 5 dB penalty to the evening/night-time predicted dBA noise level based on Table C1 on NSW EPA Noise Policy for Industry 2017.
3. Includes correction for cumulative ambient noise from APA Western Outer Ring Main Wollert Compressor Station.

Appendix I

Noise Contours

I.1 Day – Operational Noise Contours



Project Number: 287710-01

Noise levels are shown 1.5m above ground level

SCALE
0 50 100 200 300 400 m

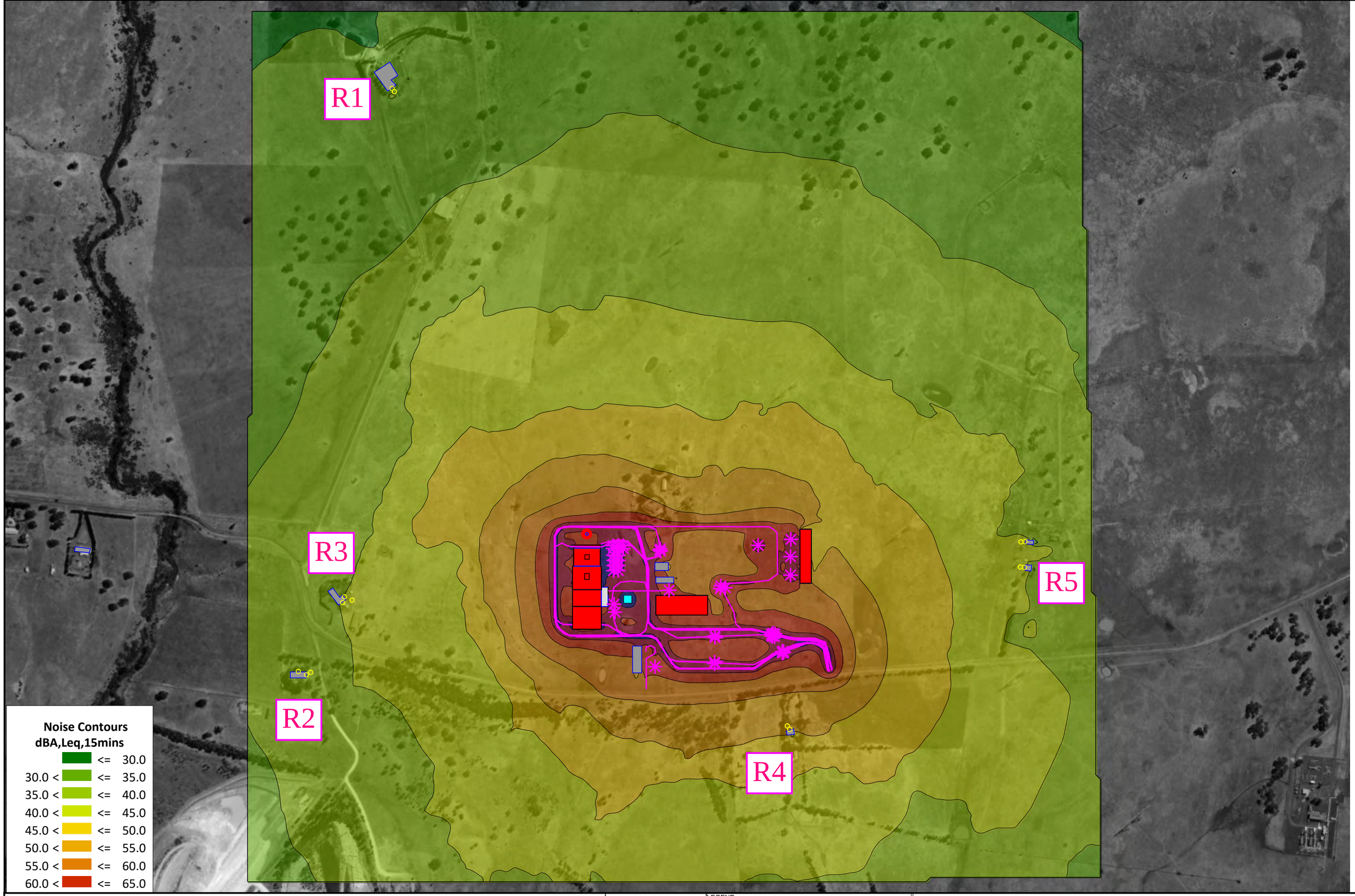
Author: BD

Date: 6/02/2023

Melbourne Energy and Resource Centre (MERC)
Industrial Noise Prediction - LAeq,15min day-time period

Day scenario

I.2 Day – Operational Noise Contours (with mitigation measures)



Project Number: 287710-01

Noise levels are shown 1.5m above ground level

SCALE
0 50 100 200 300 400 m

Author: BD

Date: 6/02/2023

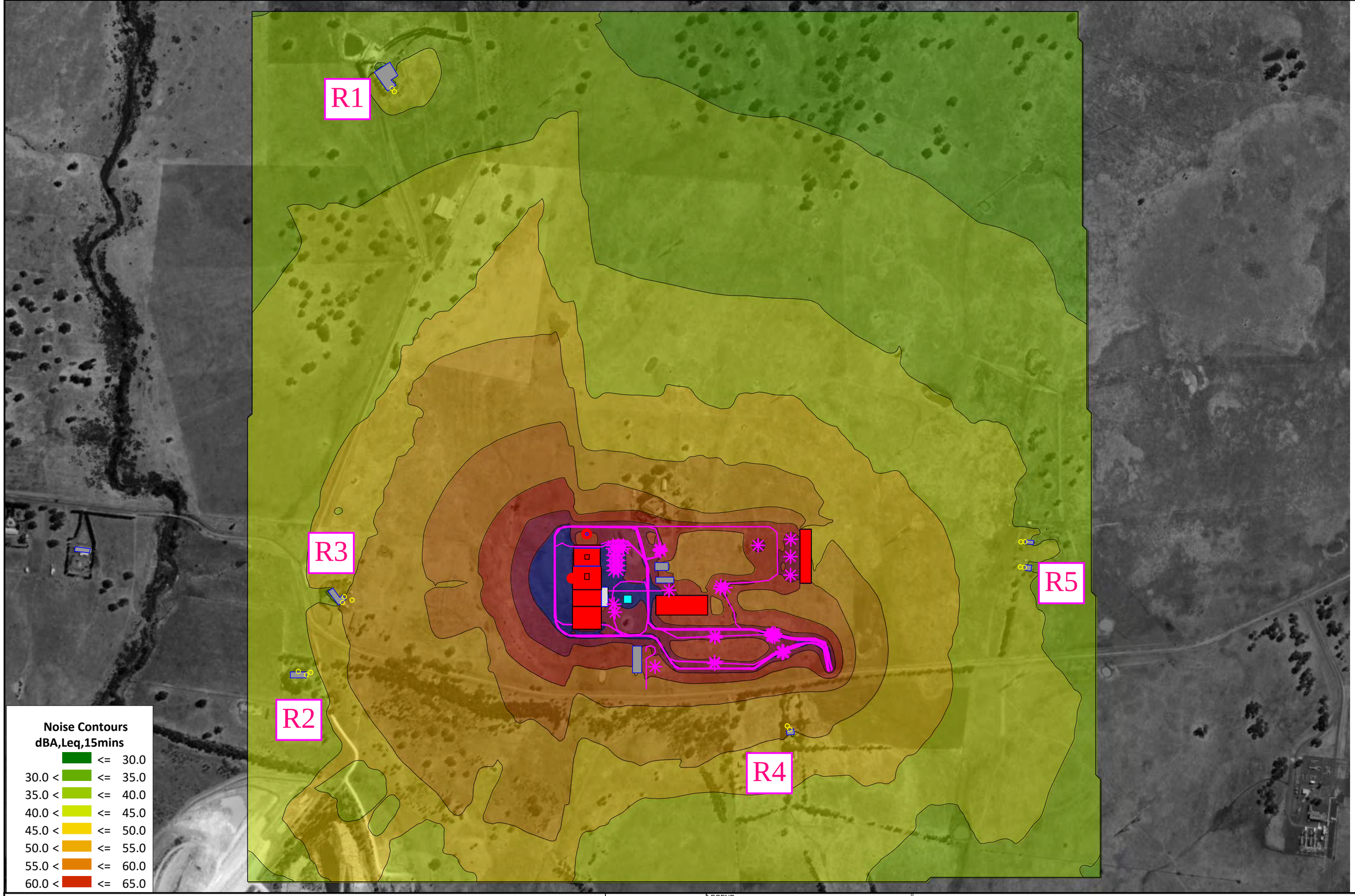
N

LEGEND
Building
Existing Noise Wall
Point source
Single Point Receiver
Line source
Outdoor area source
Industrial building/Room
Building area source
Properties as text

Melbourne Energy and Resource Centre (MERC)
Industrial Noise Prediction - LAeq,15min day-time period

Day scenario with mitigation

I.3 Day with EDG Testing – Operational Noise Contours



Project Number: 287710-01

Noise levels are shown 1.5m above ground level

Author: BD

Date: 6/02/2023

Melbourne Energy and Resource Centre (MERC)
Industrial Noise Prediction - LAeq,15min day-time period

Day scenario (EDG testing)

I.4 Day with EDG Testing – Operational Noise Contours (with mitigation measures)

R1

R2

R3

R4

R5

Noise Contours
dBA,Leq,15mins

	<=	30.0
30.0 <	<=	35.0
35.0 <	<=	40.0
40.0 <	<=	45.0
45.0 <	<=	50.0
50.0 <	<=	55.0
55.0 <	<=	60.0
60.0 <	<=	65.0

Project Number: 287710-01

Noise levels are shown 1.5m above ground level

SCALE
0 50 100 200 300 400 m

Author: BD

Date: 6/02/2023

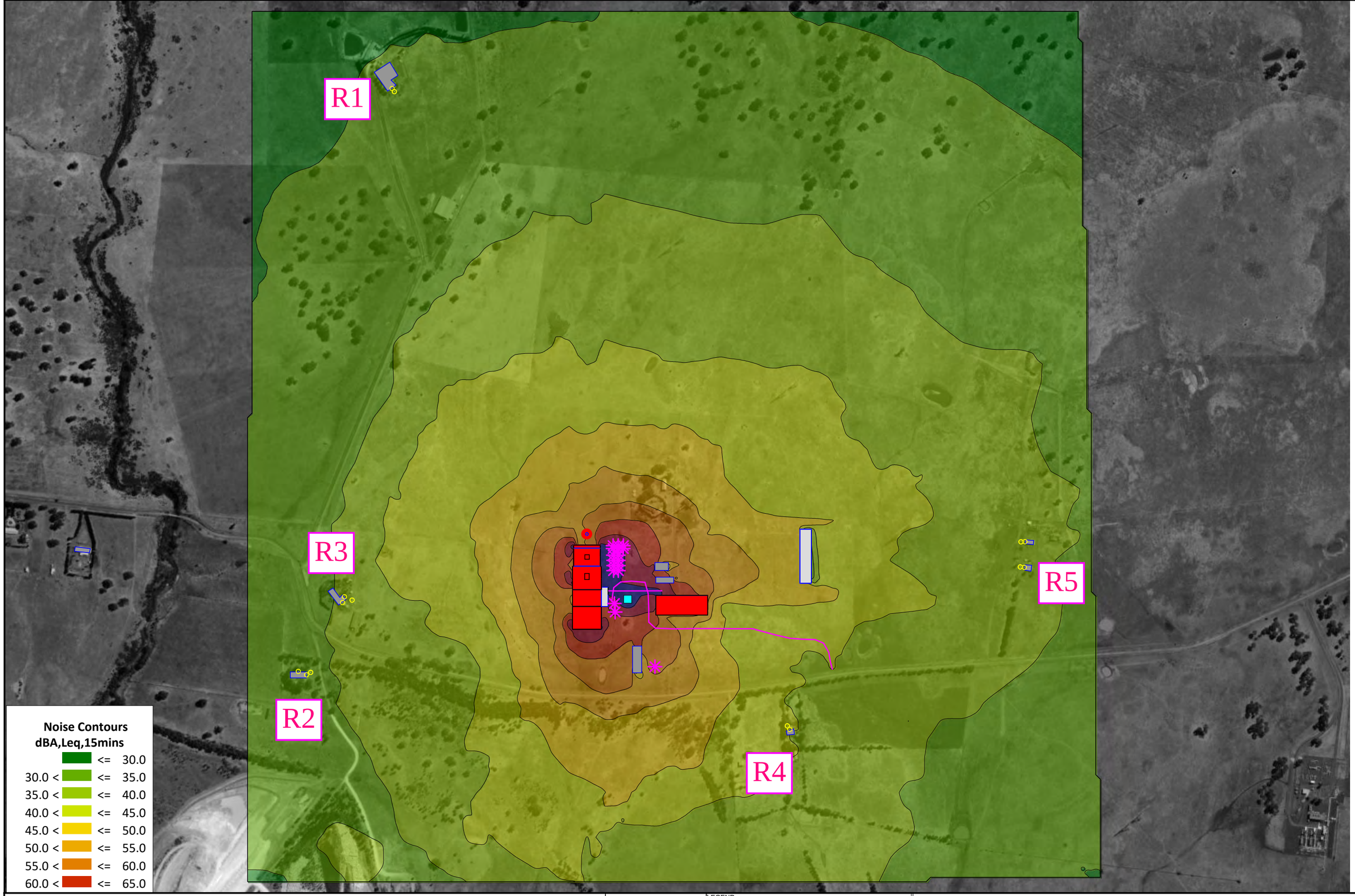
N

LEGEND
- Building
- Existing Noise Wall
- Point source
- Single Point Receiver
- Line source
- Outdoor area source
- Industrial building/Room
- Building area source
- Properties as text

Melbourne Energy and Resource Centre (MERC)
Industrial Noise Prediction - LAeq,15min day-time period

Day scenario (EDG testing)
with mitigation

I.5 Evening – Operational Noise Contours



Project Number: 287710-01

Noise levels are shown 1.5m above ground level

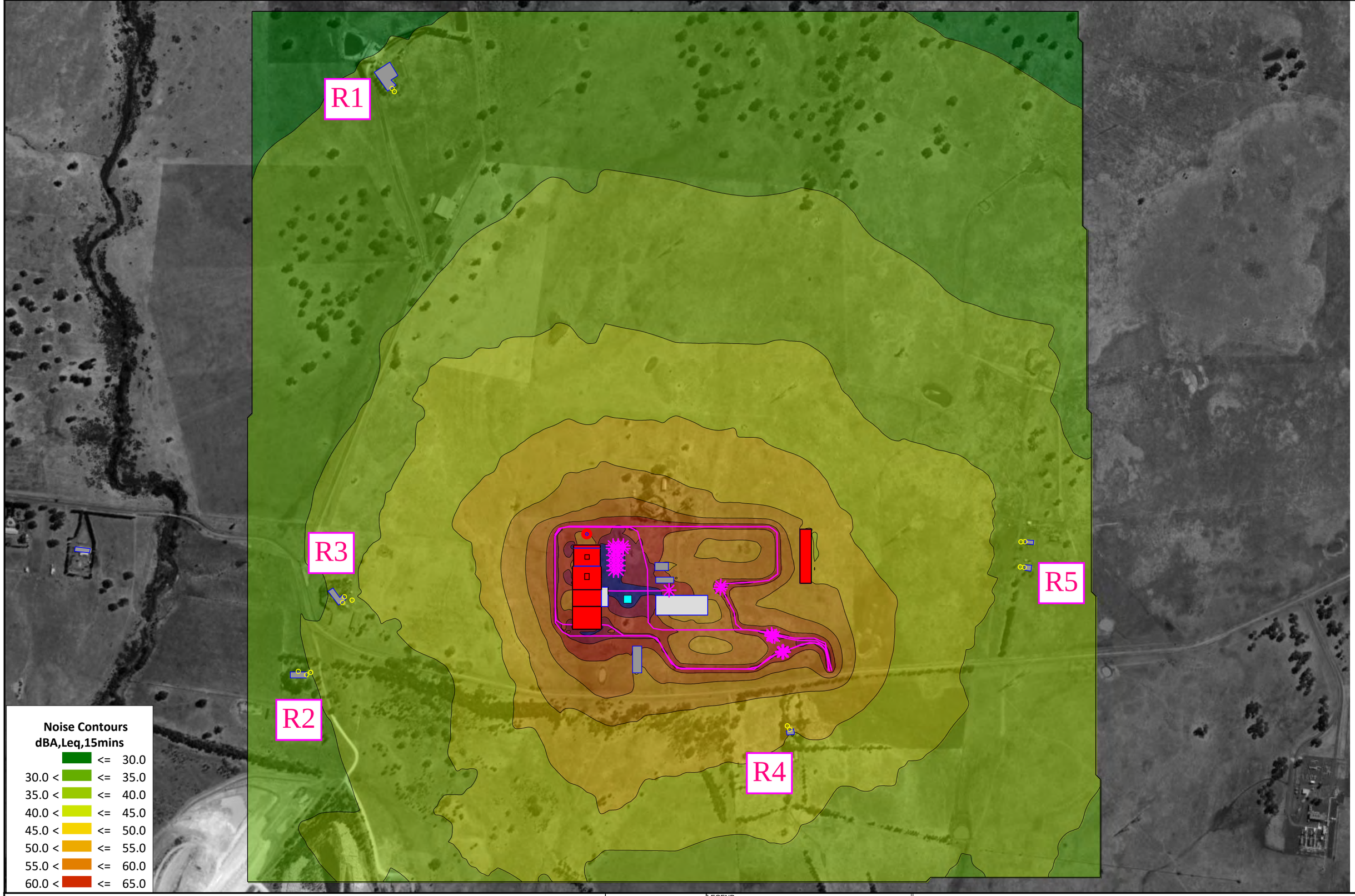
Author: BD

Date: 6/02/2023

Melbourne Energy and Resource Centre (MERC)
Industrial Noise Prediction - LAeq,15min evening-time period

Evening scenario

I.6 Night – Operational Noise Contours



Project Number: 287710-01

Noise levels are shown 1.5m above ground level

SCALE
0 50 100 200 300 400 m

Author: BD

Date: 6/02/2023

N

LEGEND
Building
Existing Noise Wall
Point source
Single Point Receiver
Line source
Outdoor area source
Industrial building/Room
Building area source
Properties as text

Melbourne Energy and Resource Centre (MERC)
Industrial Noise Prediction - LAeq,15min night-time period

Night scenario

I.7 Night – Operational Noise Contours (with mitigation measures)

R1

R2

R3

R4

R5

Noise Contours dBA,Leq,15mins

	<=	30.0
30.0 <	<=	35.0
35.0 <	<=	40.0
40.0 <	<=	45.0
45.0 <	<=	50.0
50.0 <	<=	55.0
55.0 <	<=	60.0
60.0 <	<=	65.0

Project Number: 287710-01

Noise levels are shown 1.5m above ground level

SCALE

0 50 100 200 300 400 m

Author: BD

Date: 6/02/2023

N

LEGEND

- Building
- Existing Noise Wall
- Point source
- Single Point Receiver
- Line source
- Outdoor area source
- Industrial building/Room
- Building area source
- Properties as text

Melbourne Energy and Resource Centre (MERC)
Industrial Noise Prediction - LAeq,15min night-time period

Night scenario with mitigation