

Resonate

Syncline Community Cable

Preliminary Noise and Vibration Impact Assessment

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Glossary

A-weighting	A spectrum adaption that is applied to measured noise levels to represent human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies.
Aggravated noise	Noise defined by the Victorian <i>Environment Protection Regulations</i> to exceed the noise limits established under the Noise Protocol by more than 15 dB or to exceed a noise level of 75 dB during the day period, 70 dB during the evening period or 65 dB during the night period.
Ambient noise	The overall environmental noise level at a given location caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, insects, animals and the like. It is typically described by the L_{Aeq} metric.
Attended noise monitoring	Noise monitoring conducted with a suitably qualified and experienced acoustic consultant present to observe the noise sources contributing to the measured noise levels. Attended noise monitoring is typically conducted for 10 – 30 minutes per measurement depending on the nature of the noise being measured.
Background Level	The arithmetic average of the hourly L_{A90} levels that represents the background sounds in a noise sensitive area.
Background noise	The underlying noise level at a given location, measured in the absence of a noise source under investigation and any other short-term noise sources such as intermittent traffic, industry, lawnmowers, insect, animals and the like. It is typically described using the L_{A90} metric.
C-weighting	A spectrum adaption that is applied to measured noise levels to represent human hearing at high levels of noise. Because, unlike the A-weighting, the C-weighting does not apply large negative weightings to low frequency noise levels, it is commonly used for the assessment of low frequency noise.
CNVMP	Construction Noise and Vibration Management Plan
Day period	Monday to Saturday (except public holidays), from 7 am to 6 pm as defined in the <i>Environment Protection Regulations</i> .
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. People typically perceive a 10 dB increase in sound as a doubling of loudness.
EES	Environment Effects Statement
Effective noise level	The level of noise emitted from the commercial, industrial or trade premises and adjusted if appropriate for duration, character and position as defined in Part I, Section B2 of the Noise Protocol.
Environment Effects Act	<i>Environment Effects Act 1978</i>
Environment Protection Act	<i>Environment Protection Act 2017</i>
Environment Protection Regulations	The Victorian <i>Environment Protection Regulations</i> are subordinate legislation to the <i>Environment Protection Act 2017</i> . They give force to noise limits for commercial, industrial and trade premises.
EPA Victoria	Environment Protection Authority Victoria.

EPR	Environmental Performance Requirement
ERS	Environment Reference Standard
Evening period	Monday to Saturday, from 6 pm to 10 pm; and Sunday and public holidays, from 7 am to 10 pm, as defined in the Environment Protection Regulations.
Frequency (Hz)	The number of times a sound pressure wave oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low. 1 Hz is equal to 1 cycle per second.
General Environmental Duty (GED)	As defined by Section 25(1) of the <i>Environment Protection Act 2017</i> , it requires that any person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must minimise those risks, so far as reasonably practicable.
Impulse adjustment A_{imp}	When noise is impulsive in character then an adjustment is applied of +2 dB for just detectable impulse character of the noise or +5 dB for prominent impulse character of the noise, as defined in Part I, Section B3 of the Noise Protocol.
L_{A90}	A-weighted sound pressure level that is exceeded for 90% of the time interval considered. The L_{A90} metric is used to quantify the background noise level in an environment.
L_{Aeq}	The equivalent continuous A-weighted sound pressure level. It is the value of the A-weighted sound pressure level of a continuous steady sound that has the same acoustic energy as a given time-varying A-weighted sound pressure level when determined over the same measurement time interval. The L_{Aeq} metric is used to quantify the Effective Noise Level from a premises.
L_{Ceq}	The equivalent continuous C-weighted sound pressure level.
Night period	Between 10 pm and 7 am of the following day as defined in the Environment Protection Regulations.
Noise Catchment Area	Areas within the overall study area that are considered to have similar existing ambient sound environments based on the existing environment and the noise monitoring results.
Noise Limit	The maximum effective noise level allowed in a noise sensitive area, as determined in accordance with the Noise Protocol.
Noise Protocol	Environmental Protection Authority 1826 <i>Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues</i> .
Noise sensitive receiver	Refers to a land use that may be sensitive to noise from a construction or operational source. The precise type of sensitive receivers can vary depending on the type of noise source and the legislation or guidelines that apply, but noise sensitive receivers generally include residential land uses (including aged care), educational land uses and hospitals.
Noise source	Premises or a place at which an activity is undertaken, or a machine or device is operated, resulting in the emission of noise.
Normal Working Hours	Defined by EPA Victoria Publication 1834 as 7 am to 6 pm weekdays and 7 am to 1 pm on Saturdays.
Peak Particle Velocity (PPV)	Vibration velocity can be measured in a number of ways. For some projects vibration levels can be given in terms of Peak Particle Velocity (PPV) which represents the maximum level of vibration velocity arising at a given point.

Publication 1834	EPA Victoria Publication 1834 <i>Civil construction, building and demolition guide</i>
Tonal adjustment A_{tone}	When noise is tonal in nature then an adjustment is applied of +2 dB for just detectable tonal character of the noise or +5 dB for prominent tonal character of the noise, as defined in Part I, Section B3 of the Noise Protocol. In cases where the adjustment is unclear, the objective method defined by the Noise Protocol should be used.
Unattended noise monitoring	Noise monitoring conducted using an unattended noise monitor (logger) typically over a period of a few days or weeks. Unattended noise monitoring provides more information on changes in noise levels with time than attended monitoring, although the source of the noise levels being measured may not be as apparent as are for attended monitoring.
Unavoidable Works	Construction works that must be conducted outside of Normal Working Hours as they pose an unacceptable risk to life or property or a major traffic hazard and can be justified to occur out of hours. Includes an activity which has commenced but cannot be stopped.
Unreasonable noise	Noise defined by the <i>Environment Protection Regulations</i> to exceed the noise limits established under the Noise Protocol.
Vibration	Movement in solid materials. Can be felt at higher levels but can also disturb the operation of sensitive equipment at levels below that which would be felt by building occupants.
Vibration sensitive receiver	Refers to a land use that may be sensitive to vibration from a construction or operational source. The precise type of sensitive receivers can vary depending on the type of vibration source and the legislation or guidelines that apply, but vibration sensitive receivers generally include residential land uses (including aged care), educational land uses and hospitals. Building structures, including heritage-listed structures, are also typically considered sensitive to vibration due to the risk of potential damage.
Vibration Dose Value (VDV)	A metric that combines the magnitude and duration of vibration, typically across a defined day or night period. It is measured in units of $\text{m/s}^{1.75}$.
WRL	Western Renewables Link
Zone Level	The Zone Level determined on the basis of land zoning around a noise sensitive area in accordance with to Part I, Section A2 of the Noise Protocol.
Zoning Level	The Zoning Level determined on the basis of land zoning around a noise sensitive area in accordance with to Part I, Section A1 of the Noise Protocol.

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1 Introduction

Syncline Energy (the Client) is in the process of preparing an Environmental Effects Statement (EES) referral (the Referral) for the Syncline Community Cable (the Project). To inform the Referral, the Client has engaged Resonate to prepare a preliminary noise and vibration impact assessment.

The Project involves an approximately 265 km, 525 kV HVDC (high-voltage direct current) underground transmission line from Melbourne to Jeffcott. The Project corridor runs along the median strip of Calder Freeway and private lands.

To inform the first stage of planning and approvals, this report details:

- environmental noise limits at noise sensitive receivers around the converter stations in accordance with the *Environment Protection Regulations* and Noise Protocol¹.
- construction noise targets and vibration targets / limits according to relevant guidelines and standards.
- a preliminary desktop assessment based on available project information against the relevant referral criteria based on:
 - typical construction noise and vibration levels at converter stations and a section of the proposed project route.
 - typical operational noise levels for converter stations based on available information.
- recommendations on conceptual mitigation measures to ensure that impacts are minimised.
- high level mapping based on assessment.

This preliminary assessment will inform the Referral and what additional noise and vibration assessments may be necessary during future planning stages.

¹ EPA Victoria Publication 1826: *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Noise Protocol)

2 Project description

The Project involves an approximately 265 km, 525 kV HVDC (high-voltage direct current) underground transmission line from the existing Melbourne Renewable Energy Hub (MREH) at 77 – 347 Holden Road, Plumpton to the proposed Jeffcott Renewable Energy Hub (JREH) at Whykes Road, Wooroonook. The project route plan is shown in Figure 1.

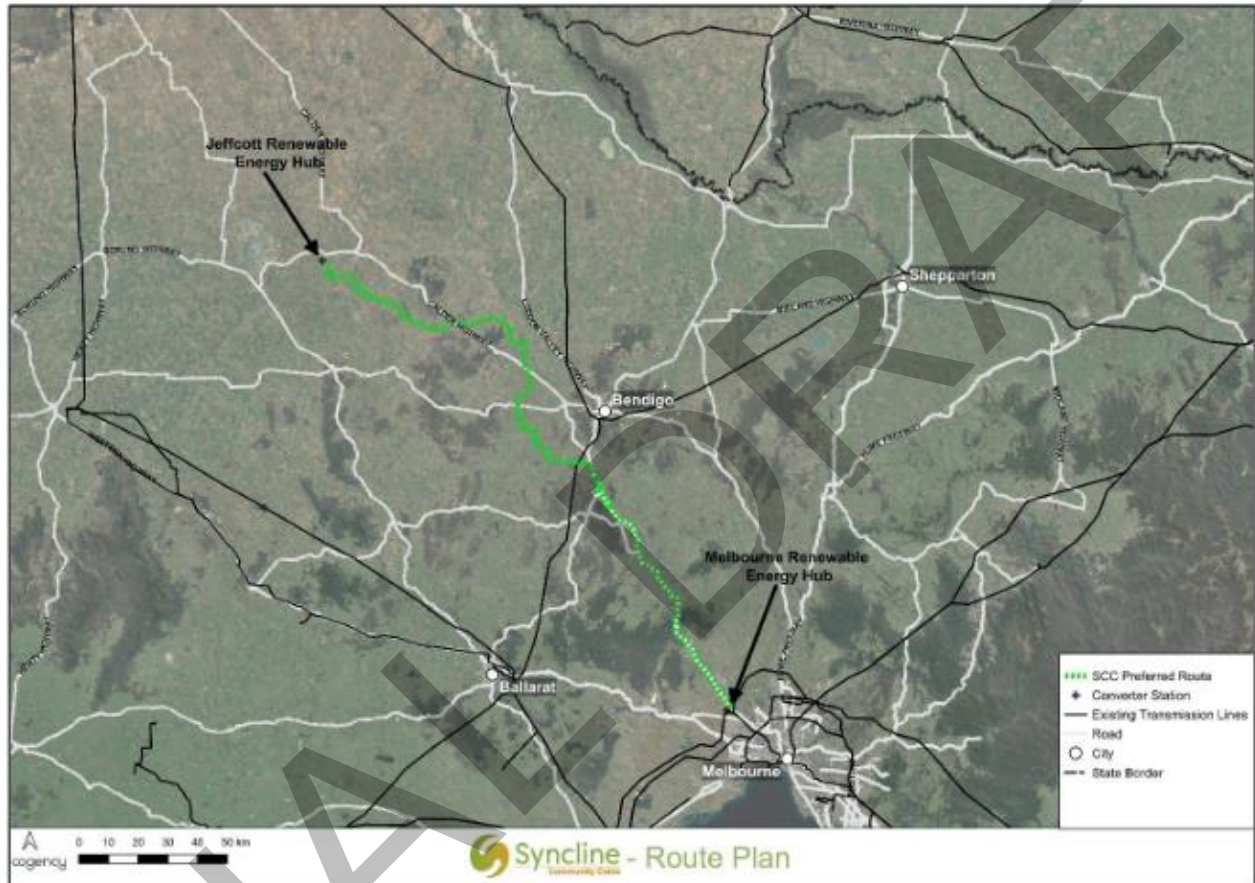


Figure 1 Project route plan

Along the corridor, at approximately 1.2 km intervals, joint bays will be constructed to allow access to the line for construction and maintenance. A 12 m wide easement will be applied over the transmission line corridor to protect the line and provide access as required.

Two converter stations located at MREH and JREH, both with an area of approximately 290 m x 220 m and a maximum height of 18 m. They will comprise a large shed like structure. These comprise a variety of electrical and power equipment, switchgear, associated sheds and buildings, car parking and fencing.

Figure 2 and Figure 3 show converter stations and surroundings.

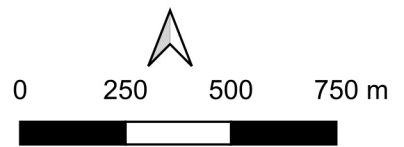
A cable-cable intermediate transition station is located in the median strip of the Calder Freeway at Ravenswood where the underground cable turns west into private properties. It is expected that this station will be located on a bench 30 m x 50 m in size and will include three shipping containers (1 x 20 ft and 2 x 40 ft).



FIGURE 2:
Syncline Community
Cable
JREH Site Layout

Legend

- Noise sensitive receivers
- Indicative noise sources
- Site Boundary
- Syncline Community Cable path



Projection: Map Grid of Australia Zone 54

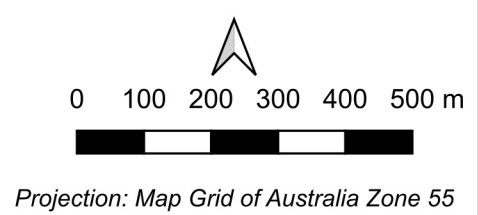
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FIGURE 3:
Syncline Community
Cable
MREH Site Layout

- Legend**
- Measurement Locations
 - Noise sensitive receivers
 - Indicative noise sources
 - Site boundary
 - Syncline Community Cable path



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3 Legislation, policy and guidelines

3.1 State legislation

3.1.1 Environment Protection Act 2017

On 1 July 2021, the new *Environment Protection Act 2017* (the Act) came into effect. The Environment Protection Authority (EPA) Victoria has released a range of subordinate legislation to support the new Act. The Act and subordinate legislation have replaced existing noise legislation in Victoria.

The cornerstone of the Act is the General Environmental Duty (GED), which states:

A person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must minimise those risks, so far as reasonably practicable.

In the context of the Act, 'reasonably practicable' measures mean putting in controls to eliminate the risk of harm to human health and the environment so far as reasonably practicable. If eliminating the risk of harm is not reasonably practicable, then the risk of harm must be reduced so far as reasonably practicable. A number of matters must be considered in deciding what is reasonably practicable in the circumstances:

- The likelihood of those risks eventuating
- The degree of harm that would result if those risks eventuated
- What the person concerned knows, or ought reasonably to know, about the harm or risks of harm and any ways of eliminating or reducing those risks
- The availability and suitability of ways to eliminate or reduce those risks
- The cost of eliminating or reducing those risks.

EPA Victoria Publication 1856: *Reasonably practicable* explains that, when dealing with a common risk or harm, it is possible to demonstrate that the risk has been reduced so far as reasonably practicable if well-established effective practices or controls have been adopted to eliminate or manage risk. Where well-established practices or controls do not exist, then it is necessary to show that effective controls have been assessed and adopted.

In addition to the GED, duties imposed by the Act that relate to noise and vibration are the:

- Duty to notify of certain (notifiable) pollution incidents to the EPA Victoria as soon as practicable after the person becomes or should have become aware of the incident
- Duty to respond to harm (restore the environment) after a pollution incident, which imposes a duty to take reasonably practicable steps to restore the land affected by a pollution incident that causes or is likely to cause harm to human health or the environment.

The Act also prohibits the emission of unreasonable noise and aggravated noise. The Act provides a definition for 'Unreasonable noise' in two parts. Section 3(1)(a) states that noise that is unreasonable having regard to the following:

- Its volume, intensity or duration
- Its character
- The time, place and other circumstances in which it is emitted
- How often it is emitted
- Any prescribed factor.

Section 3(1)(b) states that noise is unreasonable noise if it is prescribed to be so. Under the *Environment Protection Regulations*, noise that exceeds the noise limits established in accordance with EPA Victoria Publication 1826.4 *Noise*

limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (Noise Protocol) is prescribed to be unreasonable noise.

Unreasonable noise occurs if noise meets the requirements of Section 3(1)(a) and/or Section 3(1)(b) of the Act.

3.1.2 Environment Reference Standard

The *Environment Reference Standard* exists under the Act and specifies environment reference standards (ERS) that reflect the environmental values that the Victorian community wants to achieve and maintain. An ERS is not a compliance standard which a duty holder must achieve, but is intended to inform planning decisions. An ERS may be taken into account by any decision maker, where it is helpful, to assist with making an environment protection decision.

Part 3 of the *Environment Reference Standard* documents environmental values of the ambient sound environment and indicators and objectives for the ambient sound environment that are intended to support these values. Table 1 presents the environmental values of the ambient sound environment and Table 2 presents the supporting indicators and objectives.

Table 1 Environmental values of the ambient sound environment

Environmental value	Description of environmental value
Sleep during the night	An ambient sound environment that supports minimal sleep disruption at night
Domestic or recreational activities	An ambient sound environment that supports recreational and domestic activities in a residential setting
Normal conversation	An ambient sound environment that allows for a normal conversation indoors without the need to raise voices
Child learning and development	An ambient sound environment that supports cognitive development and learning in children
Human tranquillity and enjoyment outdoors in natural areas	An ambient sound environment that allows for the appreciation and enjoyment of the environment for its natural condition and the restorative benefits of tranquil soundscapes in natural areas
Musical entertainment	An ambient sound environment that recognises the community's demand for a wide range of musical entertainment

Table 2 Indicators and objectives of the ambient sound environment

Land use category	Indicator	Objective
Category 1: An urban form with distinctive features or characteristics of taller buildings, high commercial and residential intensity and high site coverage. For example, Industrial Zone 1, Industrial Zone 2, Port Zone, Road 1 Zone, Capital City Zone and Docklands Zone.	Outdoor $L_{Aeq,8h}(10 \text{ pm}-6 \text{ am})$	55 dB
	Outdoor $L_{Aeq,16h}(6 \text{ am}-10 \text{ pm})$	60 dB
Category 2: Medium rise building form with a strong urban or commercial character. For example, Industrial Zone 3, Commercial Zones, Activity Centre Zone, Mixed Use Zone and Road Zone 2.	Outdoor $L_{Aeq,8h}(10 \text{ pm}-6 \text{ am})$	50 dB
	Outdoor $L_{Aeq,16h}(6 \text{ am}-10 \text{ pm})$	55 dB
Category 3: Lower rise building form including lower density residential development and detached housing, typical or	Outdoor $L_{Aeq,8h}(10 \text{ pm}-6 \text{ am})$	40 dB
	Outdoor $L_{Aeq,16h}(6 \text{ am}-10 \text{ pm})$	50 dB

Land use category	Indicator	Objective
suburban residential settings or in towns of district or regional significance. For example, Residential Growth Zone, General Residential Zone, Neighbourhood Residential Zone, Urban Floodway Zone, Public Park and Recreation Zone and Urban Growth Zone.		
Category 4: Lower density or sparse populations with settlements that include smaller hamlets, villages and small towns that are generally unsuited for further expansion. Land uses include primary industry and farming. For example, Low Density Residential Zone, Township Zone, Rural Living Zone, Green Wedge A Zone, Rural Conservation Zone, Public Conservation and Resource Zone, Green Wedge Zone, Farming Zone and Rural Activity Zone.	Outdoor $L_{Aeq,8h}(10\text{ pm}-6\text{ am})$	35 dB
	Outdoor $L_{Aeq,16h}(6\text{ am}-10\text{ pm})$	40 dB
Category 5: Unique combinations of landscape, biodiversity and geodiversity. These natural areas typically provide undisturbed species habitat.	Qualitative	A sound quality that is conducive to human tranquillity and enjoyment having regard to the ambient natural soundscape.

The majority of the Proposed Route passes through, or near to, areas that would be considered Category 3 or Category 4, as defined in Table 2, in accordance with the relevant planning scheme.

3.1.3 Environment Protection Regulations

The EPA Victoria *Environment Protection Regulations 2021* (the Regulations) are subordinate legislation that support the Act. Under the *Environment Protection Regulations 2021*, the assessment of noise from commercial, industrial and trade premises at noise sensitive areas must be carried out in accordance with the Noise Protocol, both in terms of establishing noise limits as noise sensitive areas and in terms of the measurement of noise from the subject premises.

Noise sensitive areas are defined in the *Environment Protection Regulations 2021* as:

- The area within 10m of the external walls of dwellings (including residential care facilities but excluding caretaker's houses), residential buildings and noise sensitive residential uses.
- The area within 10m outside the external walls of any dormitories, wards, bedrooms and living rooms of caretaker's houses, hospitals, hotels, motels, residential hotels specialist disability accommodation, corrective institutions, tourist establishments, retirement villages and residential villages.
- The area within 10m outside the external walls of classrooms or other rooms in which learning occurs at childcare centres, kindergartens, primary schools and secondary schools.
- Within the boundary of tourist establishments, campgrounds and caravan parks that are located in rural areas.

Note that, in this report, the term noise sensitive receiver has been used to describe the above uses and, where considering noise that is subject to the *Environment Protection Regulations 2021* is consistent with the term noise sensitive area.

The *Environment Protection Regulations 2021* also define Day, Evening and Night time periods for the assessment of noise, reproduced in Table 3.

Table 3 Time periods for operational noise assessment

Time period	Details
Day	Weekdays and Saturdays, 7 am to 6 pm
Evening	Weekdays and Saturdays, 6 pm to 10 pm Sundays and public holidays, 7 am to 10 pm
Night	10 pm to 7 am any day

Under the *Environment Protection Regulations 2021*, noise that exceeds the noise limits is prescribed to be unreasonable noise. While the *Environment Protection Regulations 2021* state that noise limits must be established in accordance with the Noise Protocol, Regulation 118(2) sets base noise limits that are the lowest decibel value that may be set as a noise limit for urban and rural areas across different times of day. Regulation 118(3) also states that the night period noise limit must not exceed 55 dB $L_{Aeq,30min}$.

The *Environment Protection Regulations 2021* also define frequency spectrum as a prescribed factor for the purposes of establishing unreasonable noise under Section 3(1)(a) of the Act. EPA Victoria Publication 1996 *Noise guidelines: Assessing low frequency noise* (EPA Victoria Publication 1996) that provides detailed guidance on the assessment of low frequency noise for the purposes of establishing whether unreasonable noise is being produced. EPA Victoria Publication 1996 is discussed further in Section 3.2.3.

3.2 Policy, guidelines and standards

3.2.1 EPA Victoria Publication 1834

EPA Victoria has prepared the *Civil construction, building and demolition guide* (EPA Victoria Publication 1834) that provides guidance on construction noise management to the construction industry. The current version of EPA Victoria Publication 1834 (1834.1) was issued in September 2023.

EPA Victoria Publication 1834 is not a compliance document but is intended to assist in contributing to the state of knowledge that duty holders should take into account in meeting the GED. As such, it provides a framework for assessing construction noise from works associated with the Project.

Under EPA Victoria Publication 1834, land uses sensitive to airborne construction noise (noise sensitive receivers) are defined to include sensitive areas or species from a human or environmental context, including, but not limited to:

- Social surroundings (houses, hospitals, schools, playgrounds, public amenities)
- Waterways, streams, sources of drinking water for people or livestock
- Parks and recreational areas
- Areas of public interest and cultural significant
- Land or water with identified flora, fauna, vegetation, ecosystem or environmental value.

EPA Victoria Publication 1834 recommends different construction noise management techniques for different working hours as summarised in Table 4 for major construction works, such as those required for the Project.

Table 4 EPA Victoria Publication 1834 construction noise provisions

Working hours	Construction noise provisions
Normal Working Hours Monday to Friday, 7 am to 6 pm Saturday, 7 am to 1 pm	Minimise noise as far as possible in any situation.

Working hours	Construction noise provisions
Weekend / Evening Period Monday to Friday, 6 pm to 10 pm Saturday, 1 pm to 10 pm Sundays and public holidays, 7 am to 10 pm	Unless works are classed as Unavoidable Works, then noise levels at residential premises should not exceed the background noise ⁽¹⁾ level by: • 10 dB or more for up to 18 months after project commencement • 5 dB or more after 18 months.
Night Period Any day, 10 pm to 7 am	Unless works are classed as Unavoidable Works, then construction noise levels should be inaudible ⁽²⁾ within a habitable room of any residential premises.

- (1) EPA Victoria Publication 1834 sets out that the background noise level for assessing out of hours construction activities is to be the background noise level at the time of impact. This may differ from the Background Level established in accordance with the Noise Protocol.
- (2) EPA Victoria Publication 1834 advises that inaudibility is not meant to be a measurable criterion in terms of decibels. It advises that, for planning purposes, a reference level set at the background noise level at the time of impact + 0 dB could be used as a suitable reference level to assess the risk of audible noise with due consideration of the potential character of the noise. However, for assessing compliance during construction activities, an assessment of audibility itself would be necessary.

No specific noise limits are established for works during Normal Working Hours, but construction noise should be minimised as far as possible. If works are required outside of Normal Working Hours, then these would need to be classified as:

- **Unavoidable Works:** Works that must be conducted outside of Normal Working Hours as they pose an unacceptable risk to life or property or a major traffic hazard and can be justified. Unavoidable Works also include an activity which has commenced during Normal Working Hours but cannot be stopped.
- **Managed-Impact Works:** Works where noise emissions are managed through actions specified in a noise and vibration management plan, to minimise impacts on noise sensitive receivers. These works do not include intrusive characteristics such as impulsive noise or tonal movement alarms.
- **Low-Noise Impact Works:** Inherently quiet or unobtrusive works, such as manual painting, internal fitouts and cabling. These works do not include intrusive characteristics such as impulsive noise or tonal movement alarms.

3.2.2 Noise Protocol

EPA Victoria has prepared the Noise Protocol to specify methodologies for establishing noise limits for operational noise sources and for assessing noise levels against the noise limits. Compliance with the noise limits defined by the Noise Protocol is required by the *Environment Protection Regulations* and is expected to assist with meeting the GED during the operational phase of the Project.

The Noise Protocol defines different procedures for establishing noise limits depending on whether the noise sensitive receiver is located within a major urban area or rural areas. Major urban areas are defined as those locations within Melbourne's urban growth boundary or within defined areas around major regional centres, such as Ballarat. The majority of the Project will be located outside of the defined major urban areas, but the nearest residential areas to the MREH Converter Station are located within Melbourne's urban growth boundary. Therefore, both the urban and rural area methodologies require consideration.

Urban areas

For urban areas, the Noise Protocol defines noise limits dependent on the following:

- Time of day. Different noise limits apply for the different time periods of Day, Evening and Night.
- Land zoning used to determine the Zoning Level.
- The measured background noise levels in the area in the absence of noise due to commercial, industrial or trade premises used to determine the Background Level.

To determine the applicable noise limits under the Noise Protocol:

- The Zoning Level is determined for each time period through review of the planning scheme and application of Part I, Clause 1.1 of the Noise Protocol.
- The Background Level is determined for each time period through measurement and application of Part 4 of the Noise Protocol. The Background Level is classified as:
 - **Low:** where it is more than 12 dB below the Day Zoning Level or more than 9 dB below the Evening or Night Zoning Level.
 - **High:** where it is less than 6 dB below the Day Zoning Level or less than 3 dB below the Evening or Night Zoning Level, including if it is at or above the Zoning Level for any time period.
 - **Neutral:** for all other cases.
- The noise limit is determined as follows:
 - Where the Background Level is Low, the noise limit is set at a fixed level above the average of the Background Level and Zone Level, being 4.5 dB above during the Day and 3 dB above during the Evening and Night.
 - Where the Background Level is Neutral, the noise limit is set at the Zoning Level.
 - Where the Background Level is High, the noise limit is set at a fixed level above the Background Level being 6 dB above during the Day and 3 dB above during the Evening and Night.

The noise limit at Night is not permitted to exceed 55 dB $L_{Aeq,30min}$ regardless of the Background Level.

The relevant noise limits are defined for the MREH Converter Station, located adjacent to a defined urban area, in Section 5.1.

Rural areas

For rural areas, the Noise Protocol primarily defines noise limits dependent on the following:

- Time of day. The same time periods are applied as for urban areas (Table 3).
- Land zoning of both the noise source and noise sensitive receiver used to determine the Zone Level.
- A distance adjustment applied to the Zone Level where a noise sensitive receiver is in a different zone to a noise source:
 - if the noise generator and receiver are covered by the same contiguous zone, the distance adjustment is 0 dB;
 - if the noise generator and receiver are not located in land use zones with the same zone code subtract 1 dB for every 100 metres of receiver distance;
 - if the noise generator and receiver are located in land use zones that have the same zone code and there is an intervening zone that is not for a road or railway line, subtract 1 dB for every 100 metres of receiver distance;
 - if there is a zone for a road or a railway line that divides a noise-emitting zone, ignore the road or railway zone (that is, the zone should be treated as one contiguous zone for the receiver-distance adjustment);
 - if a distance adjustment is required, the maximum subtraction is 9 dB;
 - the distance adjustment must be applied to the zone level for the day, evening and night periods.
- Type of noise source. Specific limits are set for certain noise sources, such as utilities and earth resources.

For the Project, the noise limits will generally be established in accordance with Section 2.6 of the Noise Protocol, which applies to utilities in rural areas. The determination of the noise limits throughout the Project area will vary depending on the factors above.

Background noise levels may be taken into account in establishing noise limits in rural areas where the noise sensitive receiver is located within a 'background relevant area.' Background relevant areas are those rural areas where background levels may be higher than usual and include areas where road traffic is a significant audible source. If a

noise sensitive receiver is located in a background relevant rural area, then the noise limits are set at the higher of the noise limit determined using the land zoning methodology above or:

- The background noise level plus 8 dB for the Day period
- The background noise level plus 5 dB for the Evening period
- The background noise level plus 5 dB for the Night period.²

3.2.3 EPA Victoria Publication 1996

EPA Victoria Publication 1996 provides guidance on the assessment of low frequency noise from commercial, industrial and trade premises. As frequency spectrum is a separate prescribed factor under the Act, operational sources with the potential to produce a higher relative level of low frequency noise should be separately assessed against this guidance in addition to the noise limits applicable under the *Environment Protection Regulations*.

EPA Victoria Publication 1996 defines low frequency noise as that occurring between the frequency range of 10 Hz and 160 Hz. It provides noise thresholds, in one-third octave bands, with levels above the threshold indicating a potential risk of problematic low frequency noise that would require further consideration, investigation and potentially mitigation.

Table 5 presents the low frequency noise thresholds for predictions and measurements conducted outdoors. The outdoor threshold levels are based on indoor thresholds with an assumed façade noise reduction, as specified by EPA Victoria Publication 1996. For the purposes of this assessment, the outdoor thresholds have been adopted but, should a risk of exceedance be identified, further investigation of the specific building façade could be undertaken to assess whether it offers a greater attenuation of low frequency noise than assumed by EPA Victoria Publication 1996.

Table 5 Outdoor low frequency noise thresholds

Outdoor noise level in dB L _{eq} at one-third octave band centre frequency in Hz												
10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
92	89	86	77	69	61	54	50	50	48	48	46	44

3.2.4 Vibration

Vibration from the Project requires assessment during the construction phase. No sources of operational vibration are proposed that would be expected to be perceptible beyond the site boundary of both converter stations and therefore, this assessment considers guidelines appropriate for the assessment of construction vibration.

Ground vibration from construction works from the Project could arise from activities such as heavy vehicle movements, excavation or compaction. Depending on their magnitude, these vibrations can have the following effects:

- Human disturbance – disturbance to building occupants: vibration which inconveniences or interferes with the activities of the occupants or users of a building.
- Effects on building structures and underground assets (i.e., pipework) – vibration which may compromise the condition of the building structure itself or damage pipework.

In general, vibration criteria for maintaining human comfort are more stringent than vibration criteria aimed at lowering the potential risk of building or infrastructure asset damage due to vibration. Building occupants will normally feel vibration at levels well below those which may cause a risk of cosmetic or structural damage to a building or a pipeline. However, while vibration criteria for human disturbance are lower, the potential risks associated with building or pipeline damage are greater than those associated with disturbance, which, as long as the disturbance is

² As per Regulation 118(3), the night period noise limit is not to exceed 55 dB L_{Aeq,30min}, even in cases where the background noise level exceeds 50 dB L_{A90}.

temporary, can often be managed through the provision of appropriate respite periods. Given this, it is common for assessments of vibration to take the following approach:

- Vibration targets are adopted for construction that are based on human comfort standards. Where these are predicted or measured to be exceeded during construction, then reasonably practicable management measures would be put in place.
- Vibration limits are adopted that are based on standards set to prevent damage to buildings.

There are no Victorian-specific standards or guidelines for the control of vibration from construction or operation of industry, and reference is generally made to guidance from international references appropriate to the source of the vibration and the potential effect being considered.

Human comfort targets for vibration

British Standard BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings* sets forth criteria for the assessment of potential impacts on human comfort from vibration and is commonly used for the assessment of human comfort from construction vibration in Victoria. It provides ranges of vibration levels at which adverse comment may be received from occupants based on when specified Vibration Dose Values (VDVs) are exceeded as shown in Table 6. Note that, in BS 6472-1, the night time period is defined as 10 pm to 6 am but has been modified to 10 pm to 7 am here to maintain consistency with the Night period typically used for noise and vibration assessments in Victoria. This represents a conservative approach as it extends the Night period by an additional hour.

Table 6 BS 6472-1 construction vibration targets for human comfort

Location	Low probability of adverse comment ⁽¹⁾	Adverse comment possible	Adverse comment probable ⁽²⁾
	VDV m/s ^{1.75}	VDV m/s ^{1.75}	VDV m/s ^{1.75}
Residential (Night – 10 pm to 7 am)	0.1 – 0.2	0.2 – 0.4	0.4 – 0.8
Residential (Day – 7 am to 10 pm)	0.2 – 0.4	0.4 – 0.8	0.8 – 1.6
Commercial offices (7 am to 10 pm)	0.4 – 0.8	0.8 – 1.6	1.6 – 3.2
Workshops (7 am to 10 pm)	0.8 – 1.6	1.6 – 3.2	3.3 – 6.4

(1) Below these ranges, adverse comment is not expected.

(2) Above these ranges, adverse comment is very likely.

BS 6472-1 defines adverse comment as the first overt sign of an unfavourable reaction to building vibration, whereby occupants express negative responses to the vibration. The values are provided as ranges due to the widely differing susceptibility to vibration evident among populations, as well as their differing expectations on the vibration environment.

The use of VDVs require the assessment of vibration levels over an extended period, considering the number of hours within a day during which the vibration source may be operating, which is not always practical at the planning stage of a project. Therefore, it is often easier for the vibration targets to be converted to a Peak Particle Velocity (PPV) level, which allows for the assessment of vibration where the duration of the exposure is not yet known.

Table 7 presents PPV construction vibration targets based on the BS 6472-1 targets at the lower values of the range of 'adverse comment being possible' presented in Table 6. The PPV targets in Table 7 are relatively conservative as they are based on continuous (rather than impulsive) vibration and therefore assume that the vibration is occurring continuously over the day or night period. They are also based on conservative assumptions with regard to crest factor and orientation of the occupant with respect to the vibration.

Table 7 Human comfort construction vibration targets as PPV based on BS 6472-1

Location	PPV target
	mm/s
Residential (Night – 10 pm to 7 am)	0.4
Residential (Day – 7 am to 10 pm)	0.56
Commercial offices (7 am to 10 pm)	1.1
Workshops (7 am to 10 pm)	2.2

Vibration limits for the prevention of building damage

In Australia, it is common to assess the potential for construction vibration to pose a risk of damage to buildings in accordance with the vibration limits set forth in German Standard DIN 4150-3:2016 *Structural Vibration – Part 3: Effects of vibration on structure* (DIN 4150-3).

The DIN 4150-3 limits for short-term vibration, such as that typically generated by construction activities, are shown in Table 8 and are specified as PPV levels measured directly at the building foundations in any direction.

Table 8 Short-term building damage vibration limits based on DIN 4150-3

Type of structure	PPV limit in mm/s at building foundations in all directions within frequency range			PPV limit in mm/s for topmost floor in horizontal direction	PPV limit in mm/s for floor slabs in vertical direction
	1 to 10 Hz	10 to 50 Hz	> 50 Hz	All frequencies	All frequencies
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40	20
Residential buildings, and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15	20
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g., heritage listed buildings)	3	3 to 8	8 to 10	8	20

DIN 4150-3 states that exposing buildings to vibration levels higher than that recommended above would not necessarily result in damage. Rather it recommends these values as maximum levels of short-term construction vibration at which experience has shown that damage that reduces the serviceability of structures will not occur due to vibration effects.

DIN 4150-3 establishes vibration limits that are suitable for the assessment of both structural and cosmetic damage as the standard considers a reduction in serviceability of the structure is deemed to have occurred if even relatively minor effects occur such as:

- Cracks form in plastered surfaces of walls
- Existing cracks in the building are enlarged

- Partitions become detached from loadbearing walls or floors.

Vibration limits for the prevention of damage to buried pipework

High levels of vibration can present a risk of damage to assets such as buried pipework. In some cases, the asset owner may specify a vibration limit, in which case the owner-specified limit should be adopted in preference to the generic limits set forth by DIN 4150-3.

For buried pipework, DIN 4150-3 also provides recommended levels for vibration, dependent on the pipe material. The following DIN 4150-3 limits in Table 9 are specified as PPV levels measured on the surface of the pipework.

Table 9 Underground pipework vibration limits based on DIN 4150-3

Pipe material	Peak Particle Velocity limit, mm/s
Steel (including welded pipes)	100
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
Masonry, plaster	50

These limits are based on pipework built to modern construction standards. Where the integrity of the pipework is uncertain, it may be appropriate to adopt a lower limit in consultation with the asset owner.

4 Preliminary construction noise assessment

4.1 Assumptions

No detailed site layouts including work areas for construction works are available at this early stage. This preliminary assessment for construction noise and vibration has therefore been conducted based on following assumptions:

- Representative work areas:
 - Cable installation: considers an approximate 4.5 km stretch along preliminary project corridor in the south of Kyneton, considered typical of the nearest residential areas to the corridor.
 - Converter station establishment: earthworks/civil.
- Construction equipment including sound power levels for the relevant construction activities have been adopted as presented in *Volume 4 Chapter 10 Noise and Vibration of Environmental Impact Statement/Environment Effect Statement*, MARINUS LINK.

4.2 Construction noise impact

4.2.1 Noise source

Converter station

Table 10 presents the typical construction activities and major corresponding equipment for earthworks for converter station establishment. A typical worst-case overall sound power level is also shown, assuming that the plant item is operating continuously over a typical 15-minute assessment period.

Table 10 Typical construction equipment and sound power levels for converter station establishment

Construction zone	Tasks	Equipment	Worst sound power level, dB L _{WA}
Converter station at JREH and MREH	Earthworks / civil	2 x excavators 1 x dozer 1 x wheeled loader 2 x dump trucks 1 x roller 2 x tippers 5 x light vehicles 1 x concrete agitator 1 x concrete saw	120

Cable installation

Table 11 presents the typical construction activities and relevant equipment for trenching. A typical worst-case overall sound power level is also shown, assuming that the plant item is operating continuously over a typical 15-minute assessment period.

Table 11 Typical construction equipment and sound power levels for trenching

Construction zone	Tasks	Equipment	Worst sound power level, dB L _{WA}
Along project alignment	Trenching	1 x trencher (or excavator) 1 x dozer 1 x dump truck	120

4.2.2 Environmental noise model

A noise model of the project site was developed in SoundPLAN Version 9.0 environmental noise prediction software incorporating:

- Topography for surrounding the project site: sourced from Spatial Datamart Victoria on 19 November 2024.
- ISO 9613-2³ noise prediction algorithm, which predicts noise levels during conditions typical of light downwind conditions or a moderate temperature inversion.
- Ground absorption:
 - 50% corresponding to typical residential areas, with the majority of areas being covered by grass and agricultural areas.
 - 0% for work areas on the assumption of a hard work surface.
- Noise sensitive receiver:
 - location: noise sensitive receivers were determined from aerial photography
 - height: 1.5 m above ground.
- Noise source input:
 - sound power levels in Table 10 and Table 11.
 - height: HVAC at 2 m, assuming wall mounted and 3 m from transformers.

4.2.3 Typical noise levels at receivers

Converter station establishment

Construction noise levels for the establishment of converter stations have been predicted and the results are presented graphically in Appendix B. The predictions were carried out by assuming the typical worst-case construction activities occurring at the time so the predictions may be considered conservative as construction noise levels will generally be lower at other times when less intensive activities are occurring.

From the prediction results, the following can be seen:

- At JREH Converter Station: predicted noise levels at the nearest noise sensitive receivers are in a range of 35 – 40 dB L_{Aeq} . This range of noise levels is within the ERS daytime objective level of 40 dB $L_{Aeq,16h}$ for Category 4 land uses as shown in Table 2, particularly as it is unlikely to persist over an entire 16 hour period.
- MREH Converter Station:
 - Highest predicted noise level of 52 dB L_{Aeq} at 1 Holden Rd. This noise level is marginally higher than the ERS daytime objective level of 50 dB $L_{Aeq,16h}$ for Category 3 land uses as shown in Table 2 and would only occur at a single sensitive receiver.
 - Predicted noise levels at noise sensitive receivers in the Hillside area are below 40 dB L_{Aeq} . This level of noise is likely to be below the general daytime ambient noise levels observed based on Resonate's recent experience of noise surveys in the Hillside area for the Western Renewables Link project.

Consequently, the predicted construction noise levels for converter station establishment at surrounding noise sensitive receivers were in the range of corresponding ERS objective levels for day period. The predicted noise levels for even the typical worst-case construction scenarios are considered.

Cable installation

As a representative section of the Project, construction noise levels for cable installation within an approx. 4.5 km long work area in the south of Kyneton presented in Table 14 have been predicted and results are presented graphically in Appendix B. The predictions were carried out assuming the typical worst-case construction activities occurring at the

³ International Standard ISO 9613-2 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

time so the predictions may be considered conservative as construction noise levels will generally be lower at other times when less intensive activities are occurring.

From the prediction results the following can be seen:

- A number of receivers were in a range of noise levels 65 – 70 dB L_{Aeq}. These receivers were at a minimum distance of 65 m from the centre line of construction areas.
- No receivers were predicted to experience noise levels above 75 dB L_{Aeq}.

These noise levels would be readily audible above the existing noise environment but are typical of construction noise levels that occur next to major projects. In the case of the Syncline projects, the noise levels would only be expected to persist for short durations of time for individual sensitive receivers, likely to be no more than a period of a few days to a few weeks.

4.3 Construction vibration impact

4.3.1 Converter stations

As there is a large separation distance between construction areas for the converter stations and vibration sensitive receivers, being greater than 400 m at MREH and 2.5 km at JREH vibration impact from construction activities at sensitive receivers is expected to be negligible. Consequently, no further vibration impact assessment for converter station establishment was conducted for this preliminary study.

4.3.2 Cable installation

Typical construction vibration levels

Table 12 presents typical vibration levels for general trenching activities at various distances. The predictions are based on both in-house and other external measurement data, and typical propagation loss with distance for the Melbourne metropolitan area. Note that these levels are subject to change with different geology and source characteristics.

Table 12 Typical vibration levels from general trenching activities

Vibration source	Typical PPV at stated distance, mm/s			
	5 m	10 m	20 m	50 m
35T excavator with grab / cutter	3.3	2.0	1.1	0.3
45T – 60T excavator (digging)	3.0	1.9	1.0	0.3
13T static roller	2.7	1.4	0.5	<0.2
13T vibratory roller	15.2	8.8	2.5	0.5
DPU / plate compactor (hand held)	2.0	1.0	0.4	<0.2
Trench roller	2.8	1.5	0.6	<0.2
Truck (Loaded, rough road)	2.5	1.5	0.8	0.2
Posi track / skid steer loader	1.3	0.8	0.4	<0.2

Safe working distances

Based on the data presented in Table 12, Table 13 presents typical safe working distances (SWDs) for different activities against both the human disturbance vibration targets and the damage limits.

Table 13 Typical safe working distances for different construction activities

Vibration source	Typical safe working distance, m				
	Vibration targets		Damage limits		
	Residence ⁽¹⁾	Commercial / Industrial	Residence ⁽²⁾	Commercial /Industrial ⁽²⁾	Underground infrastructure ⁽³⁾
35T Excavator with grab/cutter	45	20	3	-	< 1
45T – 60T excavator (digging)	40	20	3	-	< 1
13T Static roller	22	12	3	-	< 1
13T vibratory roller	110	70	15	8	8
DPU/plate compactor	20	10	2	-	< 1
Trench roller	25	13	3	-	< 1
Truck (Loaded, rough road)	35	15	2	-	< 1
Posi track/skid steer loader	20	8	1	-	< 1

(1) Disturbance to residences during night in Table 7 is implemented.

(2) Most stringent limits in Table 8 are implemented.

(3) Conservative limit of 20 mm/s is implemented.

Table 13 indicates that some risk of human disturbance from vibration exists during the cable installation, but the risk of damage to structures is low.

It is expected that the risk of human perception and disturbance of vibration could be managed through:

- Appropriate selection of equipment to minimise vibration.
- Scheduling of vibration-intensive activities to less sensitive times of day.
- Consultation with and prior notification to sensitive receivers.

4.4 Construction noise and vibration management plan

To manage construction noise and vibration impact on the amenity of residents, a construction noise and vibration management plan (CNVMP) for the Project should be prepared. The CNVMP should include:

- identification of construction noise and vibration reference levels consistent with Section 3
- identification of noise and vibration sensitive receivers
- predictions of noise and vibration for different construction stages suitable for construction noise and vibration impact assessments
- a risk assessment for construction noise and vibration
- identification of measures to reduce the risk of harm to human health and the environment from construction noise so far as reasonably practicable, including work scheduling site and equipment management measures, community consultation and notification
- a noise and vibration monitoring program commensurate to the residual risk.

5 Preliminary operational assessment

Sources of operational noise expected to be generated by the Project are only those fixed sources within the converter stations at MREH and JREH because transmission cables are buried underground and therefore would not present a risk of audible noise.

In this section preliminary assessments for operational noise at converter stations were detailed based on information provided by the Client.

As there is a large separation distance between the converter stations and vibration sensitive receivers, being greater than 400 m at MREH and 2.5 km at JREH operational vibration impact from converter stations at sensitive receivers is expected to be negligible. Consequently, no further vibration impact assessment was conducted for this preliminary study.

5.1 Noise limits and design target

5.1.1 Cumulative noise assessment

Regulation 119 in EPA Victoria Environmental Protection Regulations (2021) describes the following for cumulative compliance:

- (1) If 2 or more commercial, industrial and trade premises (where existing or proposed) emit, or are likely to emit, noise that contributes to the effective noise level, a person in management or control of noise or more of those premises must take all reasonable steps to ensure that the contribution from each of the premises, when combined, does not exceed the noise limit for the noise sensitive area.
- (2) For the purposes of subregulation (1), what constitutes a reasonable step must be determined in accordance with the Noise Protocol.

For the MREH Converter Station there are three (3) existing industrial noise sources:

- MREH-A (under construction)
- Calder Park Stabling Yard
- Sydenham Terminal Station (fixed infrastructure)

For the current preliminary assessment in this report, and as a conservative approach in the absence of the knowledge of noise emissions from those existing noise sources, a design target for noise emission from the Project has been adopted to be 10 dB below Noise Protocol night limits to ensure that Project does not contribute to cumulative noise exceedance of Noise Protocol limits at receivers.

There are no other significant commercial, industrial and trade premises in the region around the JREH Converter Station so no risk of cumulative noise has been identified at that site, and the noise limits have been adopted for the JREH Converter Station.

5.1.2 Noise Protocol limits

Noise Protocol limits around the converter stations were determined in accordance with the Regulation and Noise Protocol. The derivation of the limits are detailed in Appendix A.

Table 14 and Table 15 summarise the Noise Protocol limits and design targets around the MREH Converter Station.

Table 14 Noise Protocol noise limits and design targets around MREH Converter Station, in major urban area

Noise sensitive receiver	Noise Protocol noise limit, dB L _{Aeq}			Design target, dB L _{Aeq}
	Day	Evening	Night	
Noise sensitive receivers near Glenview Court, Hillside VIC	47	44	36	26
Noise sensitive receivers near Galli Court, Hillside VIC	48	44	37	27

Table 15 Noise Protocol noise limits and design target around MREH Converter Station, in rural area

Noise sensitive receiver	Noise Protocol noise limit, dB L _{Aeq}			Design target, dB L _{Aeq}
	Day	Evening	Night	
1 Holden Road, Plumpton VIC	47	44	40	30
2 Holden Road, Plumpton VIC	47	44	40	30
62 Holden Road, Plumpton VIC	47	44	40	30

Table 16 summarises the Noise Protocol limits around the JREH Converter Station.

Table 16 Noise Protocol noise limits for JREH Converter Station, in rural area

Noise sensitive receiver	Noise Protocol noise limit, dB L _{Aeq}		
	Day	Evening	Night
936 Borung Hwy, Jeffcott VIC	45	39	34
1202 Borung Hwy, Jeffcott VIC	45	39	34
1264 Borung Hwy, Jeffcott VIC	45	37	32

5.2 Environmental noise prediction methodology

The assessments were conducted using a proprietary noise modelling software package, SoundPLAN (version 9.0). The relative noise source contributions from the site can be quantified based on the prediction model and assist to determine noise mitigation requirements, if applicable.

The environmental noise prediction methodology provided in the international standard ISO 9613-2 was adopted for the prediction model. The methodology takes into following considerations:

- geometrical divergence
- atmospheric absorption
- ground effect
- reflection from surfaces
- screening by obstacles.

The ISO 9613-2 methodology provides a prediction representative of conditions where the receiver is downwind of the source in a light breeze or under a moderate ground-based temperature inversion.

5.3 Noise sources

5.3.1 Sound power level

The main noise sources expected at the converter station site and their sound power levels were provided by the Client for this preliminary noise study, as shown in Table 17. It should be noted that the sound power levels are indicative, with the final sound power levels subject to the procurement process with the suppliers.

Table 17 Overall sound power levels for main noise sources within converter stations

Source	Overall sound power level, dB L _{WA}
Control Building HVAC	85 - 95
DC-Reactor Hall HVAC	85 - 95
Converter Hall 1 HVAC	85 - 95
Converter Cooler	90 - 100
Transformers (in all for three transformer incl. cooler)	90 - 110
PLC Filter, in all	80 - 95
AC Filter, in all	80 - 95
GIS Building HVAC	80 - 95

As a number of noise sources will be located inside buildings, for the preliminary assessment in this report it was assumed that these buildings will be acoustically designed to attenuate noise from sources during detail design so no detailed assessment for these internal noise sources was conducted in this report. The HVAC sources for ventilations on buildings have been assessed as external noise sources as presented in Table 17.

No specific manufacturers or models of equipment have been selected at this early stage so no detailed acoustic specifications for equipment, e.g. sound power spectrum were available. For assessment in this report the sound power spectrum distribution was calculated based on typical sound spectrum for relevant equipment from previous projects.

Table 18 and Table 19 present sound power spectra for transformer and HVAC (cooler and filters) at upper levels of the sound power ranges shown in Table 17.

Table 18 Sound power level for a single transformer at upper range in Table 17

Sound power level in dB L _w at octave band centre frequency (Hz)								Overall, dB L _{WA}
63	125	250	500	1000	2000	4000	8000	
108	120	104	97	90	80	81	88	105

Table 19 Sound power level for HVAC at upper range in Table 17

Sound power level in dB L _w at octave band centre frequency (Hz)								Overall, dB L _{WA}
63	125	250	500	1000	2000	4000	8000	
100	96	97	88	91	87	82	75	95

5.3.2 Source location

For the assessment in this report external noise sources presented in Table 17 were evenly distributed within the converter stations as shown in Figure 2 and Figure 3 due to the lack of a detailed site layout at this early stage.

5.4 Prediction model

The following inputs were used in the environmental noise model:

- Representative nearest noise sensitive receivers surrounding the converter stations were provided by the Client as summarised below:
 - MREH Converter Station:
 - 1 Holden Road, Plumpton VIC
 - 2 Holden Road, Plumpton VIC
 - 62 Holden Road, Plumpton VIC
 - 22 Galli Court, Hillside VIC
 - JREH Converter Station
 - 936 Borung Hwy, Jeffcott VIC
 - 1202 Borung Hwy, Jeffcott VIC
 - 1264 Borung Hwy, Jeffcott VIC
- The noise sensitive receivers were positioned 1.5 m above floor level within 10 metres of the outside of the external walls of dwelling in accordance with the Regulations.
- General ground absorption factor:
 - 50% for residential area and farmland
 - 0% for site and road (fully reflective surface such as concrete).
- Topography: surrounding the project site: sourced from Spatial Datamart Victoria on 19 November 2024.

5.5 Noise character adjustments

According to the Noise Protocol, a measured or predicted noise level needs to be adjusted for noise characteristics to derive the Effective Noise Level for the assessment. The Effective Noise Level, with noise character adjustment, is then assessed against the noise limit.

Potential duration and noise character adjustments are discussed below:

- **Duration adjustment (potential reduction):** When the noise emission is not audible over the whole of a continuous 30-minute period, then a duration adjustment based upon the total amount of time for which the noise is audible over that continuous 30-minute period shall be determined in accordance with Item 3.3 of Noise Protocol.
- **Impulsive adjustment (potential increase):** When the noise emission is impulsive in character, then any impulse noise emission event shall be considered to be audible for 10 seconds after the occurrence of the event for the purposes of determining the duration adjustment. Then, an adjustment shall be made as follows:
 - When the impulsive character of the noise is just detectable then the adjustment of +2 dB.
 - When the impulsive character of the noise is prominent then the adjustment of +5 dB.
- **Intermittency adjustment (potential increase):** When the noise emission is intermittent or variable and the noise emission, when measured by a sound level meter set to F time-weighting and A frequency weighting, increases in level rapidly on at least two occasions during a 30-minute period and maintains the level for at least a one-minute duration, then an adjustment determined shall be made in accordance with Item 3.4 of Noise Protocol.
- **Tonal adjustment (potential increase):** When the noise is tonal in character then an adjustment shall be made as follows:
 - When the tonal character of the noise is just detectable then a tonal adjustment of +2 dB applies.

- When the tonal character of the noise is prominent then a tonal adjustment of +5 dB applies.

In accordance with Schedule 2 of Noise Protocol, the Effective Noise Level is then derived by applying any determined character adjustments to the measured or predicted L_{Aeq} noise level for assessment against the noise limits.

For the current assessment we note that:

- Duration: It has been assumed that the proposed converter stations would operate continuously over a 30-minute period. Therefore, no duration adjustment has been applied.
- Impulse: The noise from the converter stations is expected to be steady in nature. Therefore, no adjustment has been applied for impulsive noise.
- Intermittency: The noise from the converter stations is expected to be steady in nature and not intermittent over a 30-minute assessment period. Therefore, no adjustment has been applied for intermittency.
- Tonality: In general, transformers are considered potential tonal noise sources. As no noise spectrum for selected transformer is available for tonality study, +5 dB adjustment has been applied for tonality as a conservative approach.

5.6 Assessment

Noise emissions from the convert stations were assessed for the following source level scenarios:

- Scenario 1: adopt upper level of sound power range in Table 17.
- Scenario 2: adopt lower level of sound power range in Table 17.

5.6.1 JREH Converter Station

Scenario 1

Table 20 presents predicted noise levels from the JREH Converter Station at the noise sensitive receivers for Scenario 1.

Table 20 Predicted noise level from JREH Converter Station at noise sensitive receiver, Scenario 1

Receiver	Predicted noise level, dB L_{Aeq}	Tonality adjustment, dB	Effective noise level, dB L_{Aeq}	Night limit, dB L_{Aeq}	Compliance
936 Borung Hwy, Jeffcott VIC	< 20	+5	< 25	34	✓
1202 Borung Hwy, Jeffcott VIC	< 20	+5	< 25	34	✓
1264 Borung Hwy, Jeffcott VIC	< 20	+5	< 25	32	✓

The predicted noise levels in the table above demonstrate that predicted noise levels from the JREH Converter Station at noise sensitive receivers for Scenario 1 are comfortably below Night limits so no assessment for Scenario 2 is required.

A preliminary predicted noise contour map is presented in Appendix C.

5.6.2 MREH Converter Station

Scenario 1

Table 21 presents predicted noise levels from the MREH Converter Station at the noise sensitive receivers for Scenario 1.

Table 21 Predicted noise level from MREH Converter Station at noise sensitive receiver, Scenario 1

Receiver	Predicted noise level, dB L _{Aeq}	Tonality adjustment, dB	Effective noise level, dB L _{Aeq}	Night limit/target level, dB L _{Aeq}	Compliance
22 Galli Ct, Hillside VIC	34	+5	39	37 / 27	x / x
1 Holden Rd, Plumpton VIC	42	+5	47	40 / 30	x / x
2 Holden Rd, Plumpton VIC	40	+5	45	40 / 30	x / x
62 Holden Rd, Plumpton VIC	39	+5	44	40 / 30	x / x

The predicted noise levels in the table above demonstrate that the noise emissions from the site exceeded Noise Protocol night limits and design targets at all receivers. The highest predicted noise level at 1 Holden Rd exceeded the night limit and design target by 7 dB and 17 dB, respectively.

To reduce noise emission from the site the effect of a 4 m high noise wall along four sides of site boundary was assessed. Table 22 presents the predicted noise level from MREH Converter Station at noise sensitive receivers with a 4 m high noise wall around four sides of boundary based on Scenario 1.

Table 22 Predicted noise level from MREH Converter Station at noise sensitive receiver with 4 m high noise wall at side boundary, Scenario 1

Receiver	Predicted noise level, dB L _{Aeq}	Tonality adjustment, dB	Effective noise level, dB L _{Aeq}	Night limit/target level, dB L _{Aeq}	Compliance
22 Galli Ct, Hillside VIC	34	+5	39	37 / 27	x / x
1 Holden Rd, Plumpton VIC	38	+5	43	40 / 30	x / x
2 Holden Rd, Plumpton VIC	37	+5	42	40 / 30	x / x
62 Holden Rd, Plumpton VIC	36	+5	41	40 / 30	x / x

The predicted noise levels in the table above demonstrate that the noise emissions from the site still exceeded Noise Protocol night limits and design targets at all NSAs even 4 m high noise wall at site boundary was installed. From the table it can be seen that the exceedance of night limits at receivers was caused by tonality adjustment of +5 dB.

Scenario 2

Table 23 presents the predicted noise level from MREH Converter Station at noise sensitive receivers based on Scenario 2, with equipment selected at the lower end of the sound power ranges.

Table 23 Predicted noise level from MREH Converter Station at noise sensitive receiver, Scenario 2

Receiver	Predicted noise level, dB L _{Aeq}	Tonality adjustment, dB	Effective noise level, dB L _{Aeq}	Night limit/target level, dB L _{Aeq}	Compliance
22 Galli Court, Hillside VIC	17	-(1)	17	37 / 27	✓ / ✓
1 Holden Rd, Plumpton VIC	27	+5	32	40 / 30	✓ / x
2 Holden Rd, Plumpton VIC	24	+5	29	40 / 30	✓ / ✓
62 Holden Rd, Plumpton VIC	23	+5	28	40 / 30	✓ / ✓

(1) The predicted noise level is significantly lower than the general ambient and background noise levels so the noise from the site is not expected to be a readily noticeable. Consequently, subjective tonality adjustment is not applied.

The predicted noise levels in the table above demonstrates that, with appropriate selection of noise sources, the site is expected to be able to comply with night noise limits and design target except for design target at 1 Holden Rd. The predicted noise level exceeded the design targets at 1 Holden Rd by 2 dB. It is noted that this does not necessarily result in a cumulative non-compliance with the noise limits at 1 Holden Road but would necessitate further investigation of cumulative noise sources at the MREH site.

Table 24 presents the predicted noise level from MREH Converter Station at noise sensitive receiver with a 4 m high noise wall at the eastern side of boundary, Scenario 2.

Table 24 Predicted noise level from MREH Converter Station at noise sensitive receiver, Scenario 2

Receiver	Predicted noise level, dB L _{Aeq}	Tonality adjustment, dB	Effective noise level, dB L _{Aeq}	Night limit/target level, dB L _{Aeq}	Compliance
22 Galli Court, Hillside VIC	17	-(1)	17	37 / 27	✓ / ✓
1 Holden Rd, Plumpton VIC	24	+5	29	40 / 30	✓ / ✓
2 Holden Rd, Plumpton VIC	24	+5	29	40 / 30	✓ / ✓
62 Holden Rd, Plumpton VIC	23	+5	28	40 / 30	✓ / ✓

(1) The predicted noise level is significantly lower than the general ambient and background noise levels so the noise from the site is not expected to be a readily noticeable. Consequently, subjective tonality adjustment is not applied.

The predicted noise levels in the table above demonstrate that the site is expected to be able to comply with night noise limits and, if necessary, design targets at all receivers with the incorporation of appropriate equipment selection and other mitigation measures. It is noted that the noise barrier is one example of such a measure but other options such as localised barriers around noisy items of plant would also be an option.

Predicted noise contour maps for above assessment scenarios are presented in Appendix C.

Based on the preliminary assessments with some assumptions above, the following conceptual design strategies are considered to achieve the Noise Protocol limits and design targets where relevant:

- Considering noise as part of the selection of equipment to procure equipment with lower sound power levels and to avoid tonality where possible.
- Consideration of acoustic enclosures around more significant noise sources.
- Consideration of noise walls particularly where fire walls are required.
- Locating on-site buildings as a sound barrier between sources and the nearest noise sensitive receivers.
- Orientation of noise source:
 - ventilation openings on buildings towards south
 - exhaust fans
- Further investigation on noise emissions from other industrial premises so the design target for cumulative assessment would be increased.

5.7 Low frequency noise assessment

The predicted noise level from the site at 1 Holden Rd for Scenario 1 with no noise wall has been assessed against the outdoor low frequency noise thresholds presented in Table 5.

As the ISO 9613-2 algorithm is an octave band prediction methodology, rather than a one-third octave band methodology, the assessment has been undertaken on the basis of the predicted octave band sound pressure levels and assuming that all of the acoustic energy in each octave band could be concentrated in any relevant one-third octave band. For example, the predicted noise level in the 31.5 Hz octave band has been assumed to apply in each of the 25 Hz, 31.5 Hz and 40 Hz one-third octave bands. This is a conservative approach as the octave band level will in reality be the logarithmic sum of the level in the three corresponding one-third octave bands.

Information on the noise emissions for the noise sources is only available in octave bands from 63 Hz and up but, based on prior experience, the proposed equipment is not expected to generate significant noise below the 50 Hz one-third octave band.

Table 25 presents the predicted noise level against the low frequency noise thresholds from 50 Hz to 160 Hz.

Table 25 Low frequency noise assessment at 1 Holden Rd, Scenario 1 with no noise mitigation

Outdoor noise level in dB L _{eq} at one-third octave band centre frequency in Hz						
One-third octave band centre frequency, Hz	50	63	80	100	125	160
Outdoor noise threshold	50	50	48	48	46	44
Predicted noise level	53	53	53	55	55	55

It can be seen that the thresholds are exceeded in all bands at 1 Holden Rd for Scenario 1. Investigation of sound source contribution indicates that high noise levels at low frequency from transformers, high tonal noise level at 125 Hz shown in Table 18 introduced the exceedance at 100 - 160 Hz. To avoid the impact of low frequency noise at the receiver requirements could be imposed on the suppliers of the transformer that low overall noise emission and low tonal noise component would be applicable to noise from the equipment at the nearest noise receiver 1 Holden Road.

6 Conclusion

This report provides a preliminary noise and vibration impact assessment to inform the EES referral for the Syncline Communication Cable project. The assessments have been conducted, based on preliminary information received from the Client, for:

- construction noise and vibration impact: at two converter stations and a 4.5 km long project corridor as a case study
- operational noise impact: at two converter stations.

6.1 Construction impact assessment

6.1.1 Converter stations

Predicted construction noise levels from converter stations are similar to the ambient noise levels expected in the environment as defined by the ERS. Predicted noise levels from the MREH Converter Station at noise sensitive receivers in the Hillside area are below general daytime ambient noise level.

6.1.2 Cable installation

Predicted construction noise levels from cable installation activities such as trenching are expected to be readily audible above the existing noise environment but are typical of construction noise levels that occur next to major projects. In the case of the Syncline project, the noise levels are only expected to persist for short durations of time for individual sensitive receivers, likely to be no more than a period of a few days to a few weeks.

Total avoidance of construction noise and vibration is not possible. However, based on the preliminary assessments in this report the risk of high impact from construction noise or vibration is considered to be low provided that works are properly scheduled and managed according to a proper CNVMP.

6.1.3 Recommendations

To manage construction noise and vibration impact on the amenity of residents, a construction noise and vibration management plan (CNVMP) for the Project should be prepared for converter station work and cable installation work. The CNVMP should include:

- identification of construction noise and vibration reference levels consistent with Section 3 of this report
- identification of noise and vibration sensitive receivers
- predictions of noise and vibration for different construction stages suitable for construction noise and vibration impact assessments
- a risk assessment for construction noise and vibration
- identification of measures to reduce the risk of harm to human health and the environment from construction noise so far as reasonably practicable, including work scheduling site and equipment management measures, community consultation and notification
- a noise and vibration monitoring program commensurate to the residual risk.

6.2 Operational impact assessment

Operational noise impacts from the converter stations were assessed in accordance with the Regulation and Noise Protocol.

No operational vibration impact was predicted as a result of the Project.

6.2.1 JREH Converter Station

The assessment results demonstrated that predicted operational noise levels from the JREH Converter Station at noise sensitive receivers are comfortably below the most stringent applicable night limits. No risk of cumulative noise was identified at the JREH Converter Station.

6.2.2 MREH Converter Station

Predicted operational noise levels for the MREH Converter Station are predicted to be able to comply with the applicable noise limits subject to the selection of equipment with due consideration of noise emissions.

To assess cumulative noise from other industrial premises around MREH Converter Station a design target of 10 dB below Noise Protocol night limits was established for this preliminary assessment to ensure that Project does not contribute to cumulative noise exceedance of Noise Protocol limits at receivers. To achieve compliance with the design targets, should it be required due to cumulative noise, additional noise mitigation may be necessary such as noise walls or equipment enclosures.

Based on the preliminary assessments in this report the risk of impact from operational noise or vibration is considered to be low provided that noise mitigation is incorporated into the design of the MREH Converter Station in particular.

6.2.3 Recommendations

Based on the preliminary assessments in this report, the following conceptual design strategies are recommended for consideration to achieve the Noise Protocol limits and design targets where relevant:

- Considering noise as part of the selection of equipment to procure equipment with lower sound power levels and to avoid tonality where possible.
- Consideration of acoustic enclosures around more significant noise sources.
- Consideration of noise walls particularly where fire walls are required.
- Locating on-site buildings as a sound barrier between sources and the nearest noise sensitive receivers.
- Orientation of noise source:
 - ventilation openings on buildings towards south
 - exhaust fans
- Further investigation on noise emissions from other industrial premises so the design target for cumulative assessment would be increased.

It is recommended that a noise assessment be carried out as the design progresses to ensure compliance with the applicable noise limits.

6.3 Summary

This preliminary noise and vibration impact concludes that there are no significant effects on the amenity of residents, or exposure to health or safety hazards, due to emissions of noise or vibration.

Appendix A Noise limit derivation

Noise Protocol limits at noise sensitive receivers around the converter stations were determined in accordance with the Regulation and Noise Protocol.

MREH Converter Station

The site and nearest noise sensitive receivers on Holden Road are in a rural area and a large number of receivers in Hillside area are within an urban area, as defined by the Noise Protocol. Figure A.1 shows the site location relative to Major Urban Area definitions.



Figure A.1 Site location relative to Major Urban Area definitions

The noise limits around MREH Converter Station are detailed in Table A.1 – Table A.2

Table A.1 Applicable Noise Protocol noise limits for MREH Converter Station, in major urban area

Noise sensitive area	Time period	Zoning Level, dB L _{Aeq}	Background noise level ⁽¹⁾ , dB L ₉₀	Background noise level classification	Noise Limit, dB L _{Aeq}
Noise sensitive receivers near Glenview Court, Hillside VIC	Day	50	35	Low	47
	Evening	44	35	Neutral	44
	Night	39	27	Low	36
Noise sensitive receivers near Galli Court, Hillside VIC	Day	50	36	Low	48
	Evening	44	36	Neutral	44
	Night	39	29	Low	37

(1) Background noise levels measured within the area by Resonate for preparing EES for Western Renewable Link. The measurement locations are at P1 and P2 as shown in Figure 3.

Table A.2 Applicable Noise Protocol noise limits for MREH Converter Station, in rural area

Noise sensitive area	Time period	Zone Level, dB L _{Aeq}	Background noise level ⁽¹⁾ , dB L ₉₀	Noise Limit, dB L _{Aeq}
1 Holden Road, Plumpton VIC	Day	46	39	47
	Evening	41	39	44
	Night	36	35	40
62 Holden Road, Plumpton VIC	Day	46	39	47
	Evening	41	39	44
	Night	36	35	40

(1) Background noise levels measured within the area by Resonate for preparing EES for Western Renewable Link. The measurement location is at P3 as shown in Figure 3.

JREH Converter Station

The site and surrounding noise sensitive receivers are within zone FZ (Farming Zone) and Zone level has been determined based utility specific Zone Level as defined by Section 2.6, Clause 31 of the Noise Protocol.

Table A.3 presents the Noise Protocol limits at noise sensitive receivers.

Table A.3 Applicable Noise Protocol noise limits for JREH Converter Station, in rural area

Noise sensitive area	Time period	Zone Level, dB L _{Aeq}	Distance adjustment, dB	Noise Limit, dB L _{Aeq}
936 Borung Hwy, Jeffcott VIC	Day	45	0	45
	Evening	39	0	39
	Night	34	0	34
	Day	45	0	45

Noise sensitive area	Time period	Zone Level, dB L _{Aeq}	Distance adjustment, dB	Noise Limit, dB L _{Aeq}
1202 Borung Hwy, Jeffcott	Evening	39	0	39
	Night	34	0	34
1264 Borung Hwy, Jeffcott	Day	45	-9 ⁽¹⁾	45 ⁽²⁾
	Evening	39	-9 ⁽¹⁾	37 ⁽²⁾
	Night	34	-9 ⁽¹⁾	32 ⁽²⁾

- (1) There is an intervening zone PCRZ (Public Conservation and Resource Zone) between the noise sensitive receiver and the source.
- (2) Base noise level (lowest) in rural area defined in the Regulation 118(2)(b): 45 dB(A) during day period, 37 dB(A) during evening period Evening and 32 dB(A) during night period.

Appendix B Construction noise contour maps

FINAL DRAFT



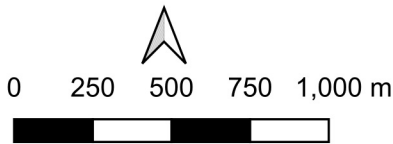
FIGURE B.1:
Syncline Community
Cable
Predicted noise levels -
JREH Converter Station
(Construction)

Legend

-  Construction
-  Houses

Predicted maximum
noise levels, dB(A)

-  35-45 dB(A)
-  45-55 dB(A)
-  55-65 dB(A)
-  65-75 dB(A)
-  >75 dB(A)



Projection: Map Grid of Australia Zone 54

PROJECT NUMBER M240722
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CHECKED BY XL
DATE ISSUED Dec 2024
CLIENT Syncline Energy
IMAGERY (c) Google Maps

Resonate

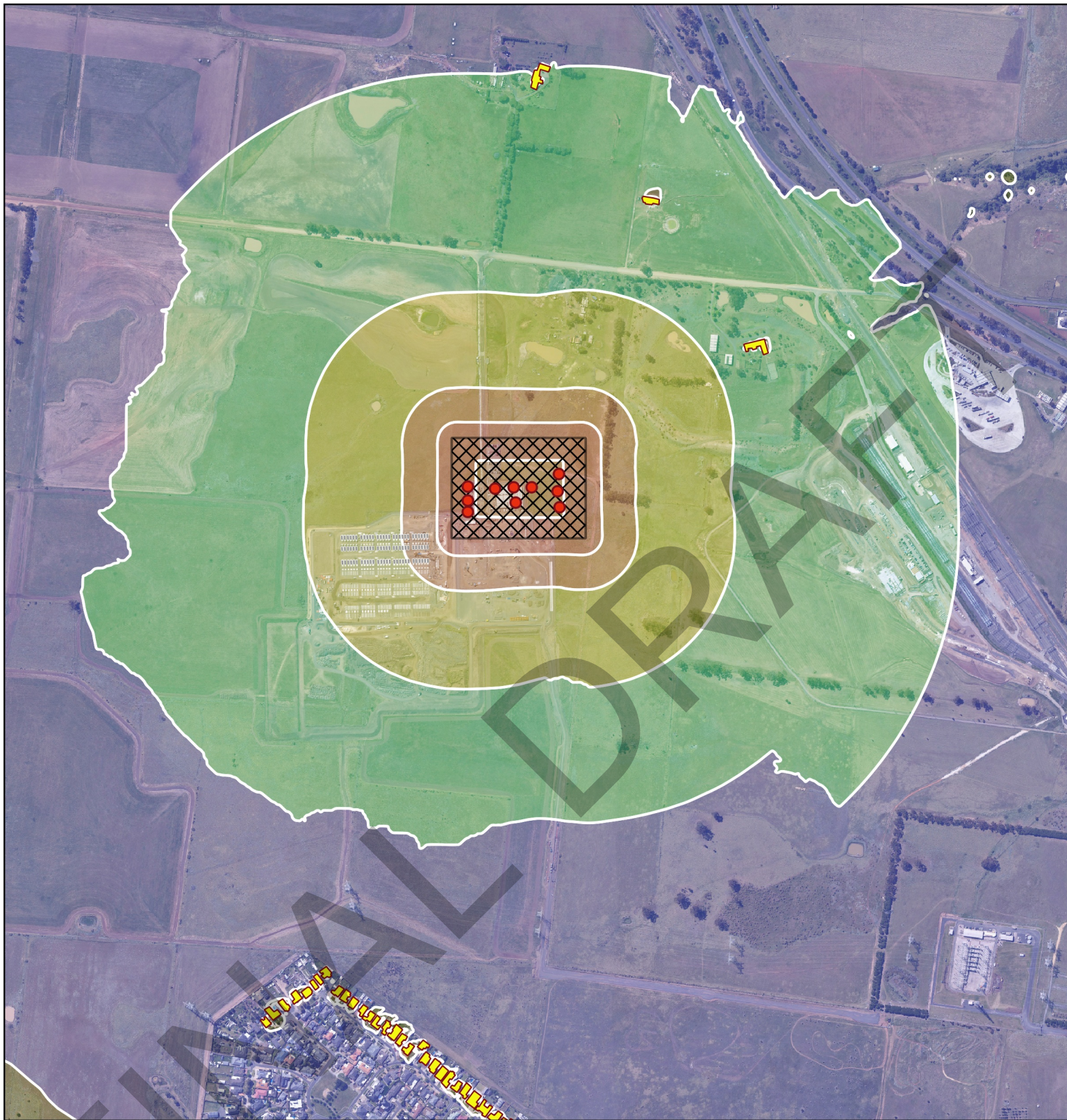


FIGURE B.2:
Syncline Community
Cable
Predicted noise levels -
MREH Converter Station
(Construction)

Legend

-  Construction
-  MREH BESS
-  Houses

Predicted maximum noise levels, dB(A)

-  35-45 dB(A)
-  45-55 dB(A)
-  55-65 dB(A)
-  65-75 dB(A)
-  >75 dB(A)



0 100 200 300 400 500 m



Projection: Map Grid of Australia Zone 55

PROJECT NUMBER M240722
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 CHECKED BY XL
 DATE ISSUED Dec 2024
 CLIENT Syncline Energy
 IMAGERY (c) Metro Maps

Resonate

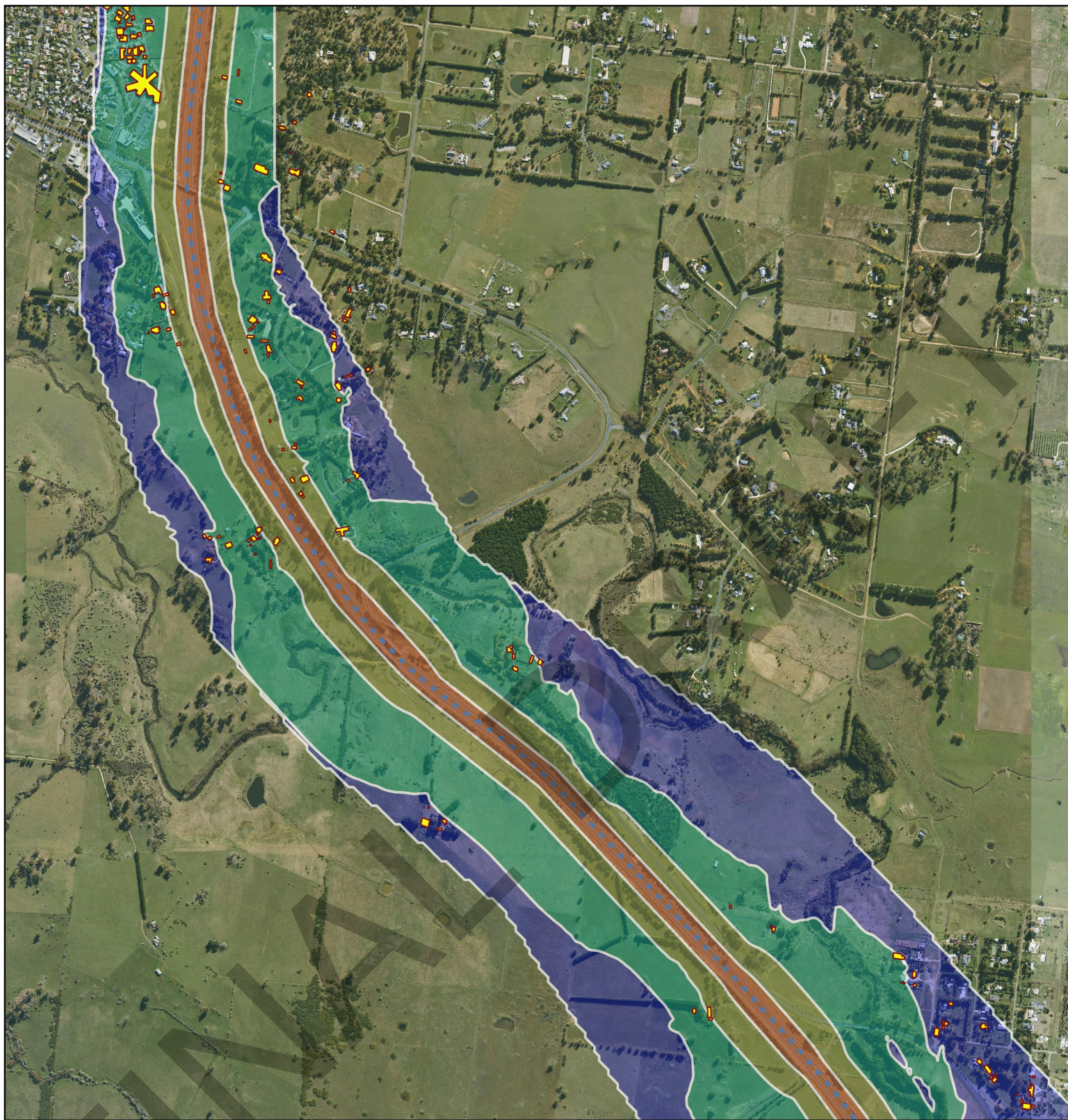


FIGURE B.3:
Syncline Community
Cable
Predicted noise levels -
Kyneton South
(Construction)

Legend

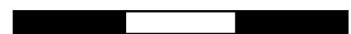
- Syncline Cable Construction Path
- Houses

Predicted maximum noise levels, dB(A)

- 45-55 dB(A)
- 55-65 dB(A)
- 65-75 dB(A)
- >75 dB(A)



0 250 500 750 m



Projection: Map Grid of Australia Zone 55

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Resonate

Appendix C Operational noise contour maps

FINAL DRAFT

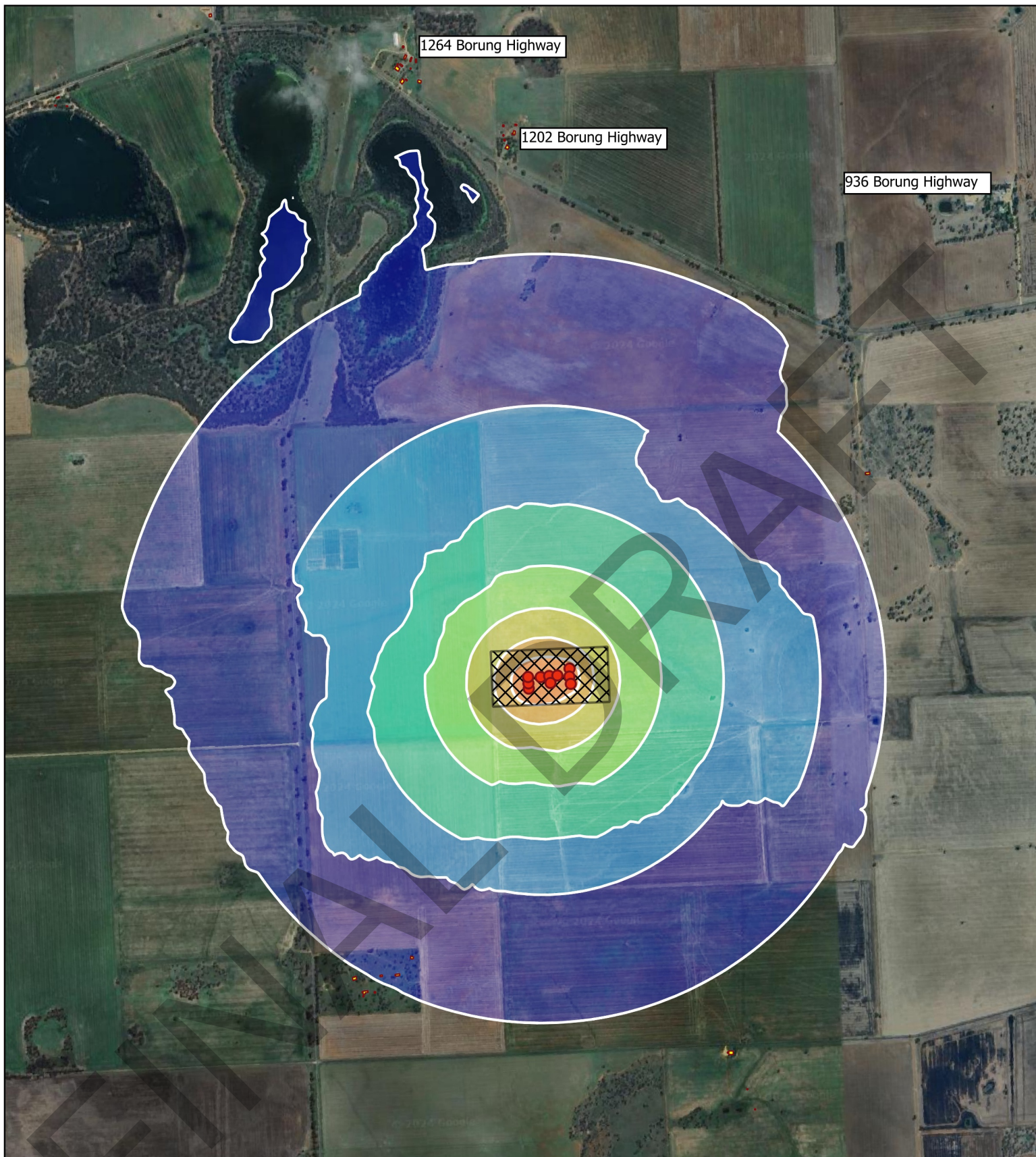


FIGURE C.1:
Syncline Community
Cable
Predicted noise levels -
JREH Converter Station

PROJECT NUMBER M240722
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Legend

- Noise sources
- Site Boundary
- Houses

Predicted noise levels, dB(A)

- 15-20 dB(A)
- 20-25 dB(A)
- 25-30 dB(A)
- 30-35 dB(A)
- 35-40 dB(A)
- 40-45 dB(A)
- >45 dB(A)



0 250 500 750 1,000 m



Projection: Map Grid of Australia Zone 54

Resonate

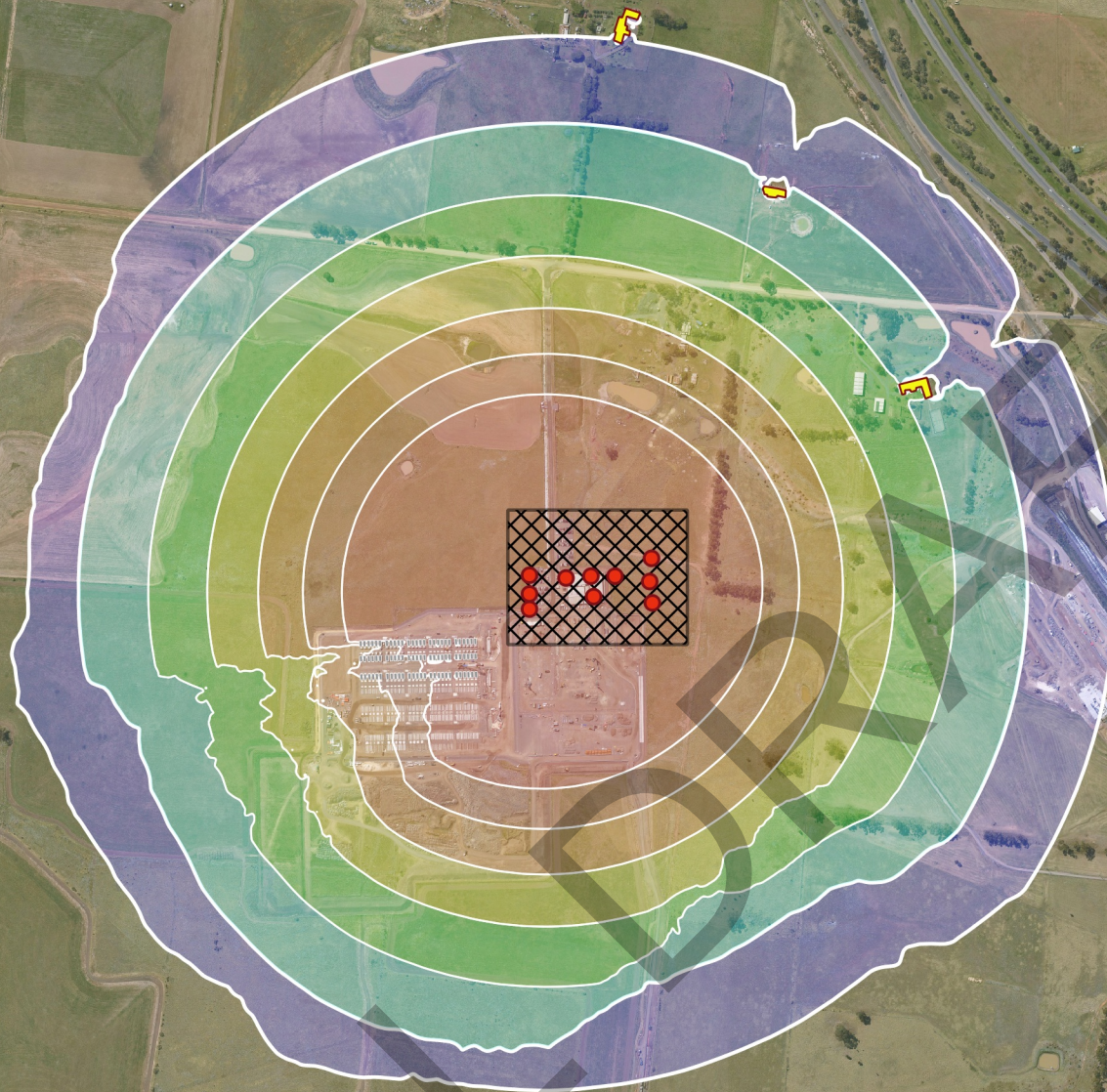


FIGURE C.2:
Syncline Community
Cable
Predicted noise levels -
MREH Converter Station
(Scenario 1)

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Legend

- Noise sources
- Site boundary
- Houses

Predicted noise levels, dB(A)

- 36 - 38 dB(A)
- 38 - 40 dB(A)
- 40 - 42 dB(A)
- 42 - 44 dB(A)
- 44 - 46 dB(A)
- 46 - 48 dB(A)
- > 48 dB(A)



0 100 200 300 400 500 m



Projection: Map Grid of Australia Zone 55

Resonate

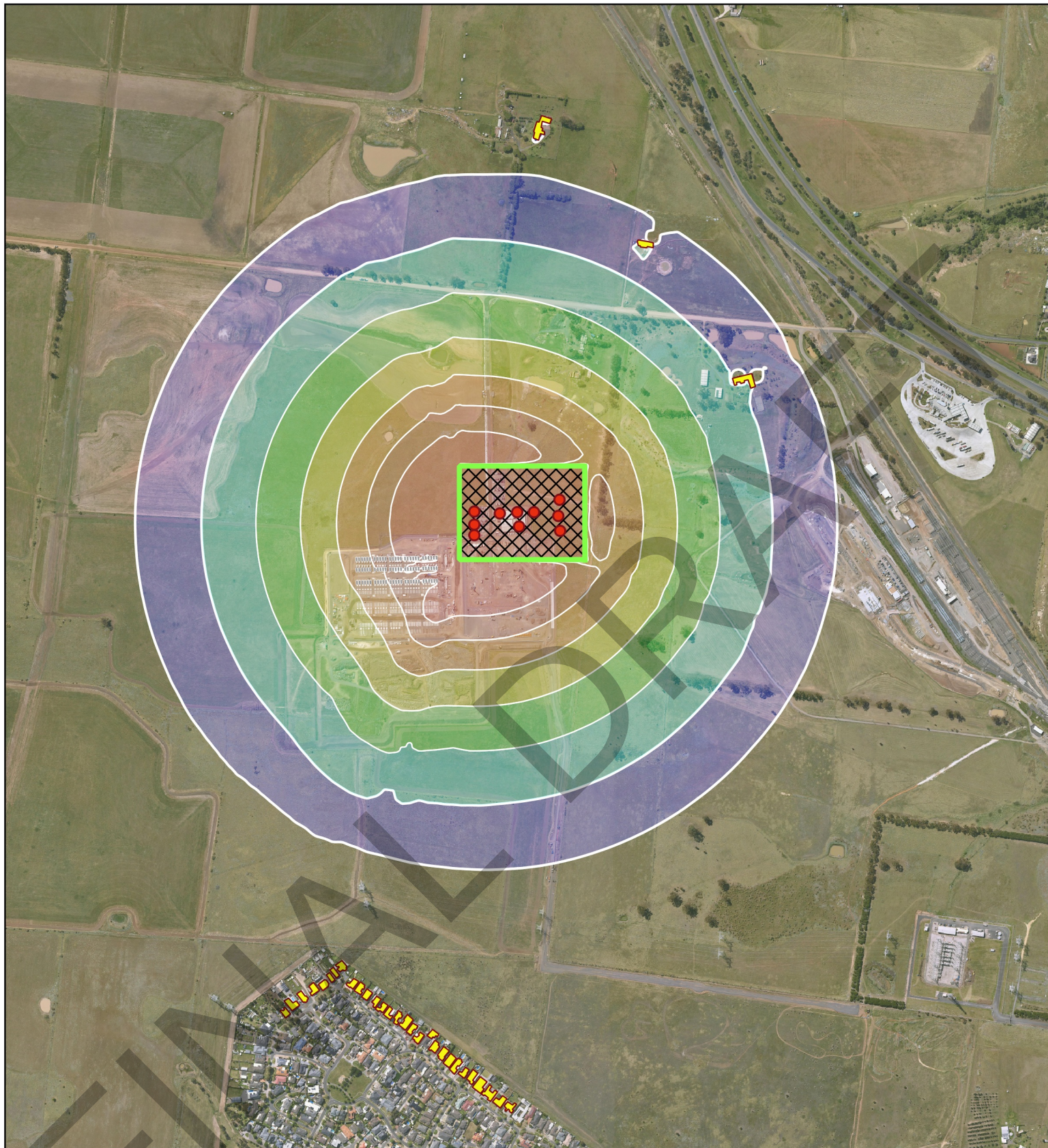


FIGURE C.3:
Syncline Community
Cable
Predicted noise levels -
MREH Converter Station
(Scenario 1 with wall)

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Legend

- Indicative noise sources
- Noise protection wall
- Site boundary
- Houses

Predicted noise levels, dB(A)

- 36 - 38 dB(A)
- 38 - 40 dB(A)
- 40 - 42 dB(A)
- 42 - 44 dB(A)
- 44 - 46 dB(A)
- 46 - 48 dB(A)
- > 48 dB(A)



0 100 200 300 400 500 m



Projection: Map Grid of Australia Zone 55

Resonate



FIGURE C.4:
Syncline Community
Cable
Predicted noise levels -
MREH Converter Station
(Scenario 2)

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Legend

- Noise sources
- Site boundary
- Houses

Predicted noise levels, dB(A)

- 36 - 38 dB(A)
- 38 - 40 dB(A)
- 40 - 42 dB(A)
- 42 - 44 dB(A)
- 44 - 46 dB(A)
- 46 - 48 dB(A)
- > 48 dB(A)



0 100 200 300 400 500 m



Projection: Map Grid of Australia Zone 55

Resonate



FIGURE C.5:
Syncline Community
Cable
Predicted noise levels -
MREH Converter Station
(Scenario 2 with wall)

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Legend

- Noise sources
- Noise protection wall
- Site boundary
- Houses

Predicted noise levels, dB(A)

- 36 - 38 dB(A)
- 38 - 40 dB(A)
- 40 - 42 dB(A)
- 42 - 44 dB(A)
- 44 - 46 dB(A)
- 46 - 48 dB(A)
- > 48 dB(A)



0 100 200 300 400 500 m



Projection: Map Grid of Australia Zone 55

Resonate