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YANNATHAN QUARRY

870-910 WESTERNPORT ROAD YANNATHAN

PROPOSED EXTENSION OF EXTRACTION AREA

Noise Emission Assessment

A report
prepared on behalf of:

Hanson Construction Materials Pty Ltd
601 Doncaster Road,
Doncaster, VIC 3108

Ref: 12919-3ng.docx
28 February 2023

EXECUTIVE SUMMARY

This report sets out the findings of a noise emission assessment of the proposal to extend the presently approved extraction area of the Yannathan Sand Quarry, 870-910 Westernport Road Yannathan, operated by Hanson Construction Materials Pty Ltd.

The purpose of the assessment has been to identify potential constraints associated with off-site noise emission from the quarry on the proposed extension of the extraction area and depth and develop appropriate noise mitigation strategies as required.

The noise assessment has been conducted in terms of the Environment Protection Act 2017 (the Act) and subordinate legislation.

This report covers the following aspects:

- Determination of noise limits in accordance with the Noise Protocol EPA Publication 1826.4
- Modelling of noise levels at potentially affected residential locations resulting from the quarry including the proposed extraction area extension, using a three-dimensional noise modelling software package.
- Consideration of modelled noise levels in terms of noise limits and other guidance under the Act.
- Determination of required noise control measures, if necessary, to achieve compliance with relevant noise criteria at noise sensitive locations.

It has been concluded that implementation of appropriate strategies and noise controls will allow operation of the quarry with the proposed new extraction area to proceed in compliance with the Noise Protocol noise limits.

Consideration has also been given to additional measures that could reduce noise emission so far as reasonably practicable, consistent with the General Environmental Duty under the Act.

At the time when the previous version of this noise emission assessment report, WMG Ref 12919-1.1ng, was prepared in September 2022, it was understood that the existing building located on 815 Westernport Rd was being used as an office for the market garden at the site, no longer being used for residential purposes.

It has since been learned that the building at 815 Westernport Rd is occupied by a caretaker at times, so the noise emission assessment has been updated to include this location.

The noise emission assessment has also been updated to include a second house at 35 Milners Rd.

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1 INTRODUCTION

This report sets out the findings of a noise emission assessment of the proposal to extend the presently approved extraction area and depth of the Yannathan Sand Quarry, 870-910 Westernport Road Yannathan, operated by Hanson Construction Materials Pty Ltd.

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2 SUBJECT SITE AND SURROUNDING ENVIRONMENT

The subject site is located at 870-910 Westernport Road Yannathan.

An aerial photo of the quarry site appears in Appendix One. The annotated aerial photo includes the locations of relevant off-site independently owned residential receiver locations for the noise emission assessment.

The two noise sensitive areas located closest to the quarry site are 35 Milners Rd to the west and 950 Westernport Rd to the east.

At the time when the previous version of this noise emission assessment report, WMG Ref 12919-1.1ng, was prepared in September 2022, it was understood that a building formerly used as a dwelling at 815 Westernport Rd was being used as an office for the market garden at the site, no longer being used for residential purposes.

It has since been learned that the building at 815 Westernport Rd is occupied by a caretaker for residential purposes at times, so the noise emission assessment has been updated to include this location.

The noise emission assessment has also been updated to include a second house at 35 Milners Rd.

The illustration below shows the subject site in more detail, including the proposed extension area outlined in black.

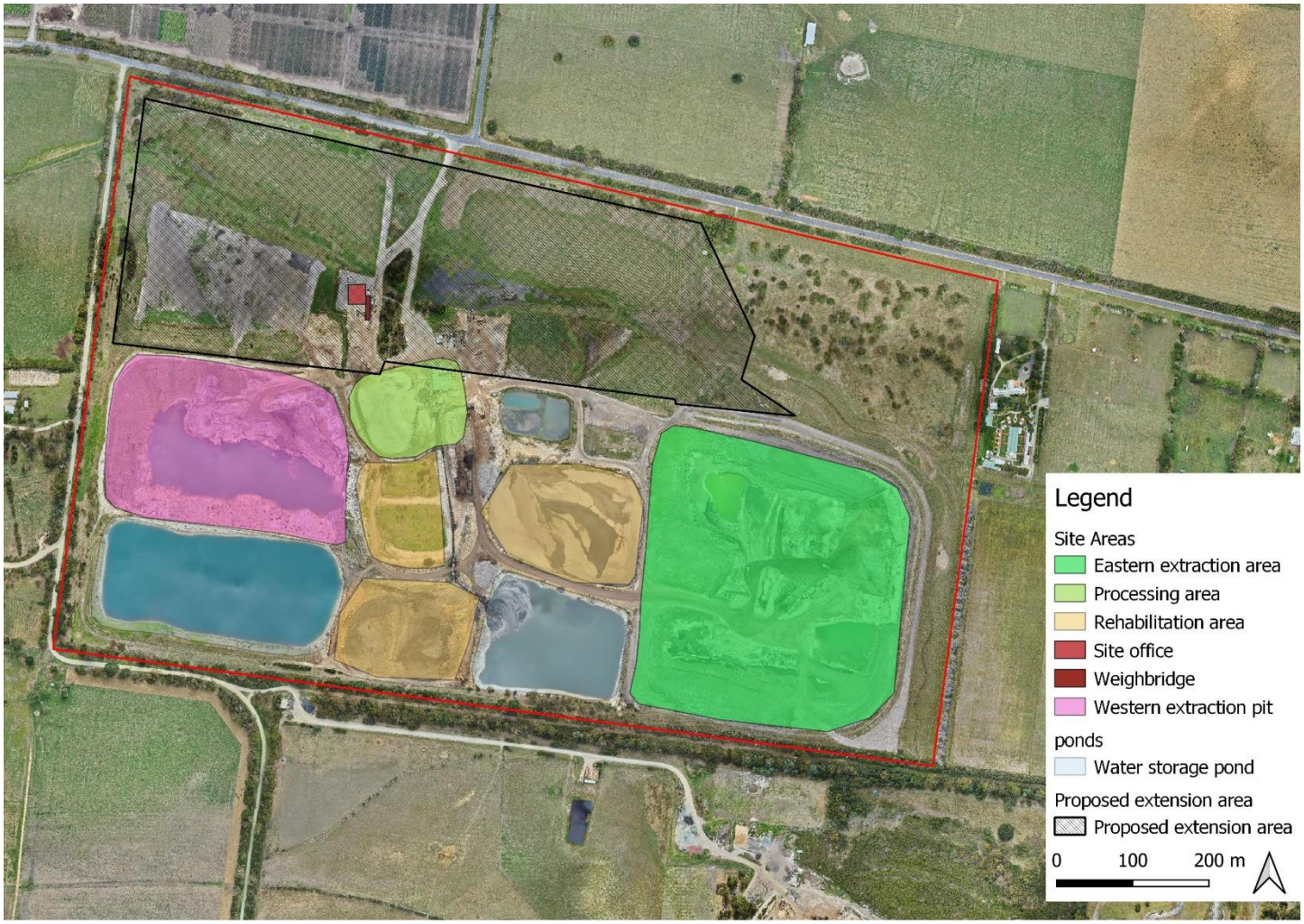


Figure 1: Subject site indicating proposed extension area

As can be seen from Figure 1 viewed in conjunction with Appendix One, the proposed new extraction area is further from the noise sensitive areas than the extraction areas that have been successfully worked under the pre-existing approvals.

A Planning Scheme zoning map is included in Appendix Two. The Planning Scheme zonings are relevant to the determination of the noise constraints. The subject site and all relevant noise receiver locations are zoned GWZ1.

3 PROJECT HISTORY IN RELATION TO NOISE EMISSION

The currently approved extraction area that is reaching the end of its life was the subject of a noise emission assessment as part of the approvals process in 2013.

The 2013 noise emission assessment was conducted in accordance with the then-applicable *NOISE FROM INDUSTRY IN REGIONAL VICTORIA Recommended Maximum Noise Levels from Commerce, Industry and Trade Premises in Regional Victoria* (NIRV).

The extraction area for which approval is being sought now is located further from noise sensitive areas than the previously approved and successfully extracted resource area, and the other components of the quarry being the processing, stockpiling and sales areas are not changing as part of the current approvals that are being sought.

Overall, the quarry extraction area noise contribution has the prospect of reducing at most existing noise sensitive areas compared with the pre-existing extraction areas.

The quarry extraction area will move closer to the building at 815 Westernport Rd that is occupied by a caretaker for residential purposes at times, which was not included in the previous noise assessment report in September 2022.

Changes in noise assessment introduced as part of the Environment Protection Act 2017 that came into operation on 1 July 2021 will place additional constraints on noise emission, even though the quarry extraction area noise contribution at most of the existing noise sensitive areas will, if anything, reduce as extraction moves to the proposed new areas.

The 2013 noise assessment concluded that noise emission with the recommended noise controls would meet the NIRV Recommended Maximum Noise Levels during the day period, but not during the evening and night periods at times. This had been found to be the case with the previously approved extraction area, but without causing concern to nearby residents.

On the basis of the prior experience in operation of the quarry and the modelling findings that resultant noise levels at residential premises would not increase as part of the new extraction areas proposed in 2013, the proposed extension was approved and has operated successfully since then.

The proposed extraction area that is the subject of the current noise assessment is being considered in terms of the noise assessment procedures under the now-applicable Environment Protection Act 2017.

4 NOISE ASSESSMENT TERMINOLOGY

Noise assessment terminology used as part of the assessment within the report is described below in Table 1.

Table 1: Description of noise terminology

Reference	Description
dB(A)	Decibels recorded on a sound level meter, which has had its frequency response modified electronically to an international standard, to quantify the average human loudness response to sounds of different character.
L_{eq}	The equivalent continuous level that would have the same total acoustic energy over the measurement period as the actual varying noise level under consideration. It is the noise measure defined by the EPA as the measure of the noise to use in assessing compliance with noise limits.
L_{90}	The level exceeded for 90% of the measurement period, which is representative of the typical lower levels in a varying noise environment. It is the noise measure defined by the EPA as the measure of the background noise level to use in determining noise limits.
Sound power level	The amount of energy in the form of sound emitted by a source, which is an inherent characteristic of a machine independent of the surroundings. This is the quantity input into the noise model as the starting point for calculating resultant noise levels at off-site locations.

5 NOISE EMISSION ASSESSMENT CRITERIA

Noise emissions within the State of Victoria are governed by the legislative framework contained within the Environment Protection Act 2017 (the Act), which commenced on 1 July 2021.

The approach within the Act focuses on prevention of pollution impacts rather than managing the impacts after they have occurred and is based on a person or entity's *General Environmental Duty* (GED) for the protection of human health and the environment from pollution and waste.

The GED is explained within Part 3.2 of the Act and stipulates that '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'.

Determining what is deemed 'reasonably practicable' is explained within EPA Publication 1856 and relates to the implementation of controls that are proportionate to the potential risk. It relates to the potential for harm to occur, the potential impacts on the environment, and considers what controls are available to reduce the risk, and their associated costs.

Under the Act it is the responsibility of the operator to understand and assess the risks which their operations may pose on human health or the environment, and once understood, implement proportionate controls to mitigate or minimise the risk of harm.

The definition of harm within the Act introduces the concept of what is deemed 'unreasonable' generally, and in particular 'unreasonable noise'. The Regulations under the Act essentially define unreasonable noise as noise that exceeds the noise limit that applies under the Noise Protocol (EPA Publication 1826.4) at the time the noise is emitted.

Methodologies, specific criteria, and guidance regarding unreasonable noise emissions are included within the following Regulations and guideline documentation referred to within the Act and provided by the Environment Protection Authority (EPA):

- Environment Protection Regulations 2021 (The Regulations).
- EPA Publication 1826.4 '*Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*' (Noise Protocol).
- Environmental Reference Standard (ERS).
- EPA Publication 1996 *Noise Guideline – assessing low frequency noise*.
- EPA Publication 1856 *Reasonably practicable*.

With the above considered, whilst evaluating risks and implementing reasonably practicable measures are considered as a necessity to comply with the GED, the basis for any noise emission assessment will be ensuring that noise emissions are not deemed 'unreasonable', discussed further below.

5.1 Environment Protection Regulations And Noise Protocol

Implementation of the general concepts within the Act rely on the Regulations. The objectives of the Regulations are to further the purposes of and give effect to the Act by imposing obligations in relation to environmental protection through providing a basis for addressing potential emissions.

The Regulations further define the concepts of 'unreasonable' and 'aggravated' noise and introduce the Noise Protocol as a tool for quantitatively addressing noise emissions from commercial premises within 'noise sensitive areas' including residential and accommodation type premises as well as childcare, kindergarten, primary school and secondary school facilities.

Within the Regulations, a person who conducts a prediction, measurement, assessment, or analysis of noise within a noise sensitive area for the purpose of the Act or the Regulations must conduct the relevant works in accordance with the Noise Protocol.

The main focus of the noise assessment has therefore been consideration of noise emission in terms of noise limits determined in accordance with the Noise Protocol.

5.1.1 General Methodologies

The subject site land and the sensitive receptors surrounding the subject site are not located within a 'major urban area' and will therefore be defined as a 'rural area'.

In accordance with the Noise Protocol, noise limits for site operations are determined as set out in Part I, A:2.7 of the Noise Protocol document 'noise limits in rural areas for earth resources'. Using the rural area method, relevant 'earth resources levels' for noise emission from the subject site are determined based on the noise sensitive area zonings and the methodologies described in Clauses 33-36 of the Noise Protocol 'noise limits in rural areas for earth resources'.

The earth resources levels vary depending on the time of the day, evening, or night with the highest during the day period and the lowest during the night periods.

The relevant day, evening, and night assessment periods are shown in Table 2 below.

Table 2: Details of EPA Assessment Periods

EPA Assessment Period	Relevant Days	Relevant Time Periods
Day	Monday to Saturday	7:00am to 6:00pm
Evening	Monday to Saturday	6:00pm to 10:00pm
	Sunday, Public Holidays	7:00am to 10:00pm
Night	All Days	10:00pm to 7:00am

Where the site is located within a background relevant area, typically near a major highway or the coast where there are non-typical sources of background noise, further derivation of noise limits applicable for commercial, industrial and trade noise emissions are based on measurement of the existing ambient background noise level at nearby relevant sensitive receptors in accordance with Clauses 21-23 of the Noise Protocol.

If the background noise level plus 8 during the day or 5 during the evening or night exceeds the zone level, then noise limits for site operations are based on the following:

- The day background noise level plus 8dB.
- The evening background noise level plus 5dB
- The night background noise level plus 5dB.

For the night period, the noise criterion is limited to 55 dB(A) as a maximum applicable value.

The subject site and surrounds are not in a background relevant area.

5.1.2 Derivation of Noise Protocol Noise Limits

The Planning Scheme zoning map indicates that the subject site and all relevant receivers are zoned GWZ1.

For this noise sensitive area zoning, the Noise Protocol earth resources levels are 46, 41 and 36 dB(A) for the day, evening and night periods respectively.

The operating hours of the quarry are within the defined night period (the hour from 0600 to 0700), the day period (0700-1800), plus the evening period (1800-2200) for processing only.

The noise sensitive areas relevant to consideration of noise emission from the subject site are not located in a background relevant area, therefore the zoning-based earth resources levels apply as the Noise Protocol noise limits.

Table 3: Noise Protocol noise limits

EPA Assessment Period	Relevant Days	Relevant Time Periods	Noise Protocol Noise Limit, dB(A) L_{eq}
Day	Monday to Saturday	7:00am to 6:00pm	46
Evening	Monday to Saturday	6:00pm to 10:00pm	41
	Sunday, Public Holidays	7:00am to 10:00pm	
Night	All Days	10:00pm to 7:00am	36

The noise limits are to be met within a 'noise sensitive area', which for this site will be within the boundary of any of the nearby houses, and within 10 metres of the outside of the external walls of the dwelling.

5.1.3 Noise Protocol Assessment Adjustments

When considering noise impacts on residential receptors, the Noise Protocol methodology includes relevant adjustment factors which account for the potential for the noise source to impact on the acoustic amenity of the noise sensitive receptor. The relevant adjustments include:

- Tonal Adjustment
- Impulsive adjustment.
- Intermittency adjustment.
- Reflection Adjustment.
- Duration Adjustment.

Clarification regarding each of the adjustments is shown below in Table 4.

Table 4: Noise Protocol Assessment Adjustments

Relevant Adjustment	Description
Tonal Adjustment	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 + 2 dB(A). ▪ When the tonal character of the noise is prominent then + 5 dB(A).
Impulsive Adjustment	When the noise is impulsive in character then an adjustment shall be made as follows: ▪ When the impulsive character of the noise is just detectable then + 2 dB(A). ▪ When the impulsive character of the noise is prominent then + 5 dB(A).

Relevant Adjustment	Description
Intermittency Adjustment	An intermittency adjustment applies when the noise increases in level rapidly by at least 5 dB, on at least two occasions during a 30-minute period and maintains the higher level for at least one minute duration. The relevant intermittency adjustments applicable include: ▪ When the level increase is >10 dB during the day period, then apply an adjustment of +3 dB(A). ▪ When the level increase is 5-10 dB during the night period, then apply an adjustment of +3 dB(A). ▪ When the level increase is >10 dB during the night period, then apply an adjustment of +5 dB(A).
Reflection Adjustment	When the measurement point is located outdoors and the microphone is located from 1 to 2 metres from an acoustically reflecting surface, an adjustment of -2.5 dB shall be made.
Duration Adjustment	If noise emissions from the commercial, industrial or trade premises investigated do not occur over the whole continuous 30-minute period, the duration adjustment applies. This adjustment is negative, reducing the effective level compared with the 'raw' measured level.

The above adjustments are applied to the measured/predicted values at residential receptors to determine the 'effective' noise level impacting on the residential receptor.

Observations at quarries indicate that the offsite noise emissions are typically dominated by the processing plant, diesel engine noise associated with mobile plant, and conventional tonal reversing beepers if they are in use at the site.

One of the recommendations is to continue the practice of using broadband reverse alarms at the site, to avoid the tonal adjustment that would apply to the use of tonal reversing beepers.

5.2 Environment Reference Standard

The ERS provides environmental values which have been developed to reflect the ambient soundscape associated with different land use settings, from highly urbanised areas to natural environments.

Through consideration of land zoning types, and varying assessment periods for the day and night, it is understood that the ERS intends to provide consideration of noise levels which may impact on:

- Sleep during the night.
- Domestic and recreational activities.
- Normal conversation.
- Child learning and development.
- Human tranquillity and enjoyment outdoors in natural areas.
- Musical entertainment.

Whilst being included within the Act, the ERS is not a compliance standard and clearly states that 'the objectives for each land use category are typical ambient sound level values and are neither noise limits nor noise design criteria'.

It's understood that the primary function of the ERS is to provide an environmental assessment benchmark to assist 'decision makers' with evaluating noise emissions within areas not captured within The Regulations and Noise Protocol.

The assessment has considered noise emissions from the site at existing residential receptors as well as within currently vacant farm zone land which may be developed for residential use at a later stage.

Given the proximity of the noise sensitive residential receptors to the site, and the fact that the focus of the noise emission assessment is based on the Noise Protocol, it is understood that consideration of the ERS will not impact on the findings of the assessment and has therefore not been considered further.

5.3 EPA Noise Guideline – Assessing Low Frequency Noise

As defined within the Act, a person must not, from a place or premises that are not residential premises emit an unreasonable noise or permit an unreasonable noise to be emitted.

Within the Regulations, consideration of unreasonable noise is based on exceedances determined in accordance with the Noise Protocol, however, the Regulations also include consideration of the sound frequency spectrum associated with a noise emission.

To provide some basis for addressing low frequency noise emissions and determining whether the noise emission is deemed 'unreasonable', the EPA released Publication 1996 *Noise Guideline – assessing low frequency noise*.

The guideline document provides 'threshold levels for assessing low frequency noise' which are not set limits, but levels that indicate a potential risk of problematic low frequency noise. The threshold levels for indoor and outdoor measurements are included within Table 5 below.

Table 5: Indoor and outdoor measurement one-third octave band noise level thresholds

Measurement Location	One-third octave band noise levels Hz												
	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
Indoor noise dB L_{eq}	92	87	83	74	64	56	49	43	42	40	38	36	34
Outdoor noise dB L_{eq}	92	89	86	77	69	61	54	50	50	48	48	46	44

EPA Publication 1996 *Noise Guideline – assessing low frequency noise* notes the following:
Predicting expected noise levels at noise sensitive receivers may be compared against the

relevant low frequency threshold levels (Table 2 for indoor or Table 3 for outdoor measurements).

However, noise level calculations in the low frequency range can be problematic and of limited accuracy.

The use of noise calculations should be restricted to indicative estimations only. Due to this, calculations should only be used as a screening tool to assess the risk of low frequency noise from the proposed development and/or extension of existing commercial, industrial and trade premises.

Therefore, modelling results can be used with some caution in considering low frequency noise levels.

6 OPERATIONAL PARAMETERS RELEVANT TO CONSIDERATION OF NOISE EMISSION

Extraction of raw material and removal of overburden occurs from 0600 to 1800 hrs Monday to Saturday.

The processing plant operates from 0600 to 2200 hrs and sales occur between 0600 and 1800 hrs. Sales involves typically 6 to 8 trucks per hour entering the site, being loaded by a loader and exiting the site.

During the day period haul trucks are loaded by an excavator operating at the quarry working face and deliver raw material directly to the feed hopper for the processing plant. The haul trucks also build up a stockpile of raw material that is then fed into the processing plant hopper by a loader during the evening period, 1800-2200 hrs.

It has been indicated that a small diesel-powered cutter suction dredge may be added to the equipment list at the Yannathan quarry. The cutter suction dredge would be used to extract sand in locations where the sand is immersed in water.

This would occur at the bottom of the pit once the water table has been intersected. The combination of a source noise level typically lower than conventional earthmoving equipment and operation at the base of the pit means that this source does not require detailed consideration. Using a dredge also means that haul trucks are not required, further reducing noise generation at the site.

7 RELEVANT NOISE SOURCES

The noise level that is to be assessed in terms of the noise limits at off-site residential premises is the L_{eq} over a 30-minute period, adjusted as discussed in section 4.1 above.

Therefore, the objective of noise modelling to predict resultant off-site noise levels is to capture the mix of noise sources operating during a 30-minute period.

Source noise measurements were conducted at the quarry and drawn from WMG file records to obtain the data to input into the noise modelling to allow calculation of resultant effective levels at the residential receivers.

The sound power levels derived from these noise measurements and used in the noise modelling have been tabulated below.

Sound power levels in one-third octave frequency bands have been modelled, but octave band figures are tabulated below for convenience.

Table 6: Source Noise Sound Power Levels

Noise Source	Sound Power Level (dB Re. 1pW) In Octave Frequency Bands (Hz)								
	31.5	63	125	250	500	1000	2000	4000	dB(A)
Processing plant	132	122	111	103	101	102	100	96	107
Excavator Komatsu PC450L	108	106	112	105	99	100	96	90	105
Excavator Hitachi ZX490	107	113	109	100	101	97	96	91	104
Loader Volvo L180H	121	117	108	102	99	101	100	92	107
Loader Komatsu WA470/WA480	104	112	107	98	97	101	101	96	106
Volvo A35/A30/A25 haul truck	110	108	106	106	108	105	103	97	110
Typical Road Truck	107	113	107	102	100	99	98	91	104

8 MODELLED NOISE LEVELS DUE TO NOISE EMISSIONS FROM OPERATIONS AT THE QUARRY SITE

8.1 NOISE MODELLING METHODOLOGY

Modeling of operational noise emissions has been conducted using the CadnaA software package, implementing the ISO 9613-2 sound propagation algorithms. The ISO 9613-2 method aims to determine the average sound level under meteorological conditions favourable to propagation, that is, moderately downwind propagation, or propagation under a well-developed, but moderate, ground-based temperature inversion, such as can occur at night.

Environment Protection Authority assessment methodology indicates that residual noise levels at noise sensitive receivers should be considered when weather conditions assist propagation of noise emissions in the direction of the receivers. This condition is implemented by the noise modelling software.

The noise modelling has allowed for the effects of light breezes from the noise sources to the residential locations enhancing sound propagation. For much of the time, the resultant noise levels would be lower than predicted on this basis.

Apart from the reduction of sound due to distance, ground attenuation and atmospheric effects, noise attenuation results from acoustic shielding.

Topographical files were obtained for the quarry site from the project team based on an aerial survey conducted in April 2022. These files include all the bunding presently on the site.

Topographical data for the surrounding area was obtained from *Elvis - Elevation and Depth - Foundation Spatial Data* (https://elevation.fsdf.org.au/).

Noise modelling has been used iteratively in conjunction with discussions with the quarry operations personnel to develop modifications to the site operations to reduce noise emission.

8.2 Noise Prediction Results and Noise Control Considerations

Modelling scenarios have been run in relation to eight extraction locations representing easterly, midline and westerly locations in the northern and southern parts of the proposed new extraction area as indicated below.

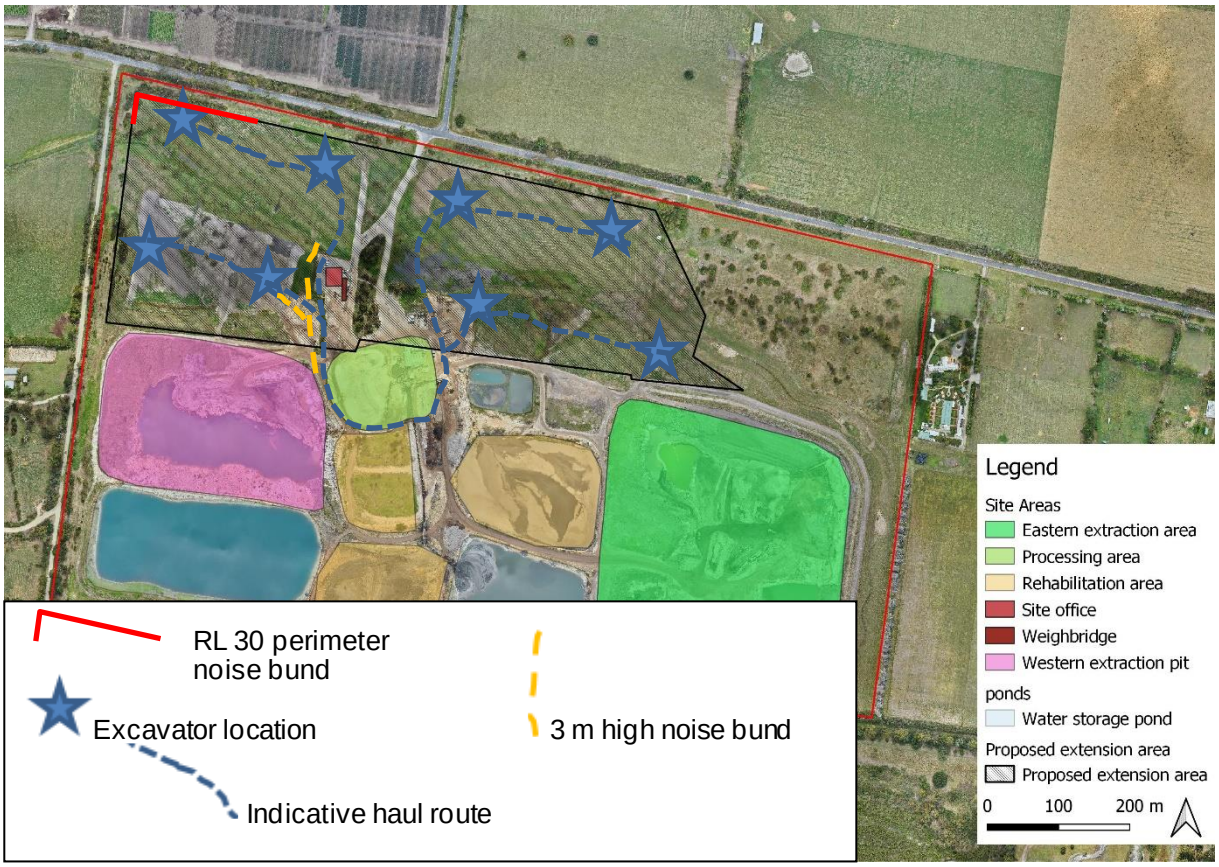


Figure 2: Noise modelling scenarios

The modelling reflects the operational parameters described in section 6 above.

The modelling results were found to meet the Noise Protocol noise limits for the day and evening periods at all noise sensitive areas, including for initial site works when operations are occurring at the natural surface level.

Initial modelling established that operation of an excavator loading haul trucks at the natural surface level would not be consistent with meeting the noise limit from 0600 to 0700 hrs.

Modelling was replicated for the locations shown above with progressively lower operation of an excavator loading haul trucks, and it has been established that the excavator will need to operate at a level nominally 6 m below the natural surface between 0600 and 0700 hrs to remain below the noise limit during that period, in conjunction with the other operating noise sources.

With haul trucks operating at the natural surface level, the noise modelling has established that a 3 m high noise bund will be required on the western side of the haul route as indicated in Figure 2, to achieve compliance with the 0600 to 0700 noise limit at 35 Milners Rd. The bund extent is from the point of access to the now depleted southwestern pit and stopping short of the ephemeral watercourse that crosses the site through the proposed new extraction area.

The bund can be progressively shortened as extraction proceeds and a pit established in the southwestern section of the proposed new extraction area.

Introducing a noise assessment location at 815 Westernport Rd has led to introduction of a perimeter noise bund to RL 30 at the north west corner of the site to reduce modelled noise levels to reduce the modelled noise level at that location to no more than 36 dB(A) between 0600 and 0700.

8.3 Low Frequency Noise

Resultant low frequency modelled noise levels at the nearest houses were found to be above the low frequency threshold levels by up to 4 dB in the 31.5 and 50 Hz one-third octave frequency bands respectively, due to noise emission from the wet screens at the processing plant under light breeze conditions assisting sound propagation from the source to noise sensitive areas.

Light breeze conditions are the most relevant to consideration of noise emission as even though stronger winds also assist sound propagation, they also generate elevated noise levels due to interactions with vegetation and other obstructions, elevating the masking background levels.

The processing plant is not changing, so these resultant levels will also not be changing and will have been a part of the quarry operation for many years.

The EPA Publication 1996 low frequency threshold levels are not set limits. Rather, they are levels that indicate a potential risk of problematic low frequency noise. The disturbance from low frequency noise depends on the noise level; characteristics that can increase annoyance with the noise, for example, tonality, frequency modulation; and the baseline noise levels in the absence of the low frequency noise.

The existing operation of this source for many years indicates that it has not caused disturbance in the context of the quarry locality and the operating hours, despite the finding of noise levels above the low frequency threshold in two one-third octave frequency bands.

The magnitude of these margins above the threshold, 4 dB, is not large and would be characterised as a 'just noticeable difference', which is a possible explanation for the long-term operation of the processing plant without adverse effects on the surrounding environment.

Consideration of noise mitigation at such low frequencies is hampered by a lack of sound transmission data and computational limitations.

Discussion regarding options for reducing low frequency noise emission appears in section 10 of this report.

9 SUMMARY OF NOISE CONTROL MEASURES TO ACHIEVE COMPLIANCE WITH NOISE PROTOCOL NOISE LIMITS

9.1 EXTRACTION BETWEEN 0600 AND 0700 HRS

It is recommended that extraction in the proposed new area between 0600 and 0700 hrs only occur when the pit has reached a stage where the excavator can operate at a level nominally 6 m below the natural surface level, or 3 m below the natural surface level in conjunction with bunds 3 m high relative to the natural surface between the excavator location and the houses to the east and west of the site.

9.2 NOISE BUNDS

A perimeter noise bund to nominally RL 30 is recommended extending along the western boundary from north of the ephemeral watercourse to the north western corner of the site, then extending along the northern boundary for nominally 200 m, as shown in Figure 2.

A noise bund nominally 3 m high is recommended along the western side of the haul route to the western extraction areas, extending from the entry point of the existing and now depleted southwestern pit to just south of the ephemeral watercourse that crosses the site through the proposed new extraction area.

This extent is indicated in Figure 2, and can be reduced as the pit develops and haul trucks are operating within the pit.

9.3 REVERSING BEEPERS

Conventional reversing beepers have the potential to cause annoyance to residents and contribute to exceedance of noise limits at the residential locations around the site by addition of a tonal adjustment, due to the highly distinctive tonal noise character and on-off nature of the noise.

All mobile equipment operating at the site should be fitted with broadband reverse alarms, which vary their noise output according to the ambient noise level. These reversing alarms should be selected for the lowest noise level consistent with safe operation.

Product stockpiles and travel routes within the site should be configured to minimise any need for sales trucks to reverse.

This is already the case and should be maintained.

10 CONSIDERATION OF OPTIONS FOR REDUCING LOW FREQUENCY NOISE EMISSION

EPA Publication 1996 recommends a hierarchy of controls for reduction of low frequency noise.

The first of these is elimination of the noise emission such as through plant design and siting. The processing plant is located approximately centrally on the site, which maximises distances to off-site receiver locations. The motion of the screens that is responsible for the low frequency noise generation is also the motion that is required for the screens to achieve the purpose of dewatering the sand.

Elimination is not an option as the screens are an essential part of processing plant.

The second in the hierarchy of control is substitution, which involves replacing a process or equipment that generates low frequency noise with a lower noise alternative. It may be possible to investigate an alternative dewatering technology, but as noted above, the motion of the screens that generates the low frequency noise is an inherent part of the processing plant achieving its function.

The third control strategy is engineering controls, and in this respect the characteristics of low frequency noise present challenges in achieving noise reduction. Simply bolting rigid panels to the framework of the processing plant would not be effective, as the panels themselves would become radiating sound sources.

If the current circumstances change, consideration could be given to options such as limp sound attenuation materials or a free-standing noise barrier, but sound attenuation properties of materials are not available at such low sound frequencies as acoustic test facilities are not large enough to conduct sound transmission testing with the large wavelengths of low frequency sound.

The final control in the hierarchy is administrative controls, such as avoiding operating of machinery in the most noise sensitive periods. The processing plant does not operate through the night period, with the exception of 0600-0700. It is likely that the existing processing plant has not been found to cause disturbance during this time period because the rural nature of the area is likely associated with significant other activity from 0600 as general activity increases for the day.

In view of the foregoing considerations, it would appear to be reasonable for the processing plant to continue as it has been operating, with the possibility of giving consideration to engineering and administrative controls should disturbance associated with low frequency noise arise in future.

11 ADDITIONAL NOISE CONTROL MEASURES TO MINIMISE NOISE EMISSION SO FAR AS REASONABLY PRACTICABLE

There are bunds located at the western and eastern boundaries of the subject site, but the updated topography files that have been generated to provide a basis for the noise emission modelling have indicated that the bunds are typically only in the range 2-3 m high.

Increasing these to 4 m would provide an additional noise reduction and could be deemed to be reasonably practicable, subject to other considerations such as visual impact, cost and the availability of horizontal space to increase the height of the bunds.

12 CONCLUSIONS

A noise assessment has been conducted to quantify noise emission from the sand quarry at 870 Westernport Road Yannathan and identify noise control requirements to extend the currently approved quarry extraction area while remaining in compliance with relevant noise constraints.

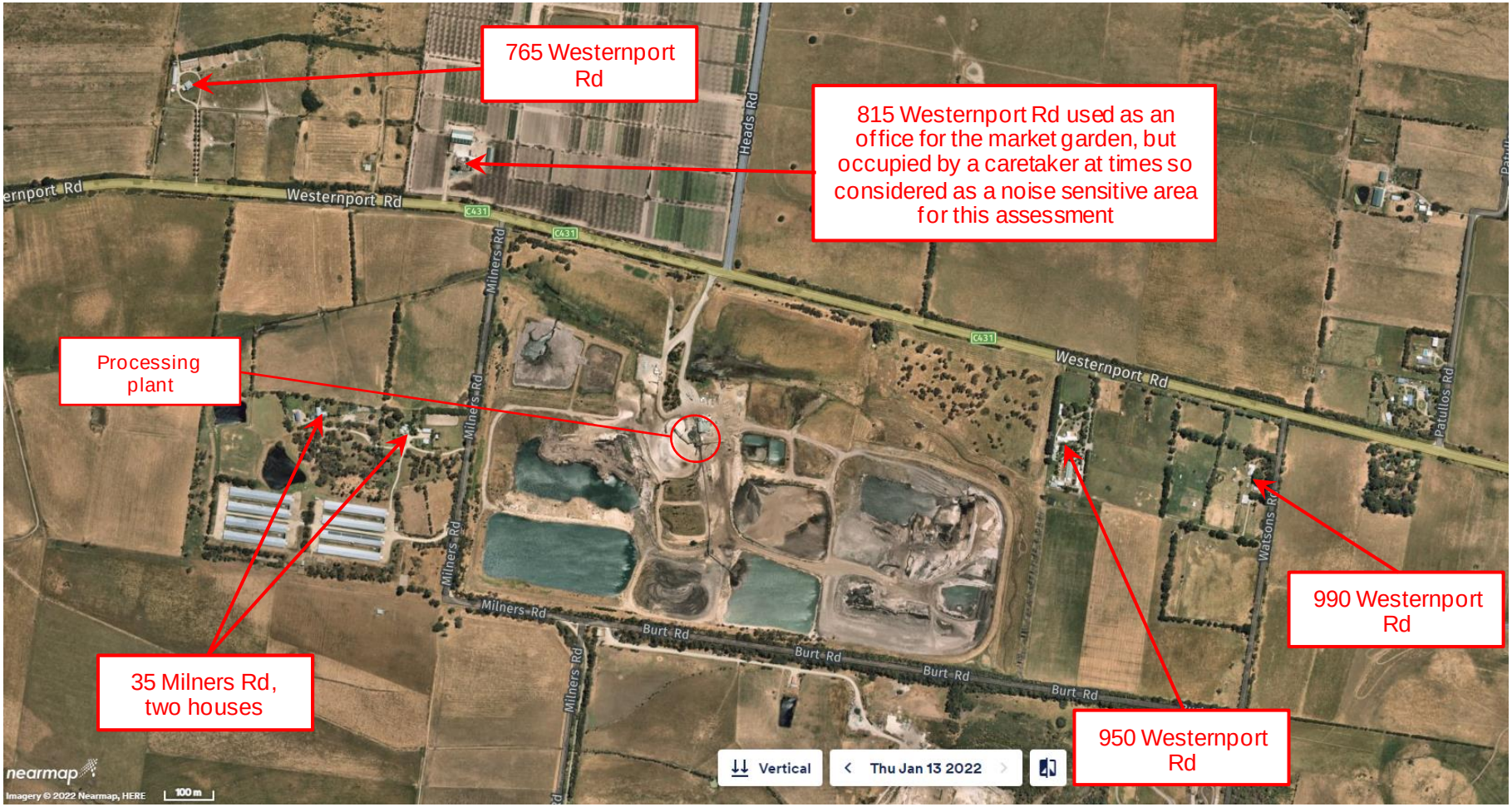
The noise assessment has been undertaken in accordance with the new Environment Act and subordinate legislation that have been in force since 1 July 2021.

It has been concluded that implementation of the strategies and noise controls set out in Section 9 can allow operation of the quarry with the proposed extended extraction area to proceed in compliance with the Noise Protocol noise limits.

Consideration has also been given to additional measures that could reduce noise emission so far as reasonably practicable, consistent with the General Environmental Duty under the Act.

NEVILLE GODDARD
WATSON MOSS GROWCOTT
acoustics pty ltd

APPENDIX ONE: AERIAL PHOTO OF SITE AND SURROUNDS INCLUDING LOCATION OF NOISE SENSITIVE AREAS



APPENDIX TWO: PLANNING SCHEME ZONING MAP