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CHAPTER 11

NOISE AND VIBRATION

QUARRY CONSULTING

Table of Contents

INTRODUCTION

11.1 This report has been prepared by Brenda O'Reilly of Noise and Vibration Consultants Ltd.

11.2 The proposed development involves the deepening of an existing permitted quarry area in Cregaree, Cong, Co. Mayo.

11.3 The report assesses the potential noise and vibrations impacts associated with the proposal to deepen the quarry. The proposal keeps the existing quarry infrastructure in place operating at a similar extraction rate. It is not planned to increase productivity but to extend the life of the quarry.

Statement of Authority

11.4 This Chapter has been prepared by Brendan O'Reilly of Noise and Vibration Consultants Ltd. Brendan has a Master's degree in noise and vibration from Liverpool University and has over 40 years' experience in noise and vibration control (and many years' experience in preparation of noise impact statements) and has been a member of a number of professional organisations including ISEE, SFA and IMQS. Brendan was a co-author and project partner (as a senior noise consultant) in 'Environmental Quality Objectives Noise in Quiet Areas' administered by the Environmental Protection Agency on behalf of the Department of the Environment, Heritage and Local Government. Brendan has considerable experience in the assessment of noise and vibration impacts and has compiled EIA/EIAR studies ranging from quarries, mines, retail development, wastewater treatment plants, tailing dams, housing developments and wind farms.

Acoustic Terminology

11.5 Sound is simply the pressure oscillations that reach our ears. These are characterised by their amplitude, measured in decibels (dB), and their frequency, measured in Hertz (Hz). Noise is unwanted or undesirable sound, it does not accumulate in the environment, is transitory, fluctuates, and is normally localised. Environmental noise is normally assessed in terms of A-weighted decibels, dB (A), when the 'A weighted' filter in the measuring device elicits a response which provides a good correlation with the human ear. The criteria for environmental noise control are of annoyance or nuisance rather than damage. In general, a noise level is liable to provoke a complaint whenever it's level exceeds by a certain margin, the pre-existing noise level or when it attains an absolute level. A change in noise level of 3 dB (A) is 'barely perceptible', while an increase in noise level of 10 dB (A) is perceived as a twofold increase in loudness. A noise level in excess of 85 dB (A) gives a significant risk of hearing damage. Construction and industrial noise sources are normally assessed and expressed using equivalent continuous levels, LAeq[1].

Assessment Methodology and Significant Criteria

11.6 The assessment involved the following elements, further details of which are provided in the following sections:

- Legislation and guidance review;
- Desk study, including review of available maps and published information;

[1] L_{Aeq} is defined as being the A-weighted equivalent continuous steady sound level that has the same sound energy as the real fluctuating sound during the sample period and effectively represents a type of average value.

- Evaluation of potential effects;
- Evaluation of the significance of these effects; and
- Identification of measures to avoid and mitigate potential effects.

11.7 The noise levels are predicted using noise data from the existing operations, other similar quarry operations, and by calculation.

Relevant Legislation and Guidance

11.8 The following relevant guidance and legislation was consulted:

- EPA, May 2022. Guidelines on information to be contained in the Environmental Impact Assessment Reports.
- Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (Jan 2016).
- Environmental Noise Surveys-Guidance Document, (EPA, 2003)
- ISO 1996-1-2016: Acoustics: Description and Measurement of Environmental Noise-Basic Quantities and Assessment Procedures.
- Integrated Pollution Control Licensing – Guidance Note for Noise in Relation to Scheduled Activities, EPA 1995.
- ISO 9613-2, First Edition 1996-12-15. Acoustics-Attenuation of sound during propagation outdoors-Part 2: General method of calculations.
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA).
- BS 5228, 2009 Code of Practice for Noise Control on Construction and Open Sites: Part 1: Noise.
- EPA, 2006, Environmental Management Guidelines-Environmental Management in Extractive Industry (Non-Scheduled Minerals).
- EPA, 2003, Environmental Quality Objectives-Noise in Quiet Areas.

Description of Proposed Activity

11.9 The proposed development area consisting of c. 19 Hectares is a deepening of the existing permitted extraction areas. The planned extraction rate is in the same order as current. The total application area covers 19.0 Hectares (refer to Plate 1).

11.10 The activity includes, drilling, rock extraction by blasting and trucking for processing on site. There are no construction works associated with the development.

Existing Permitted Activity Quarry

11.11 The existing quarry extracts rock by blasting which is trucked to the processing area where primary crushing occurs. Following primary crushing the material is screened into different sized material where secondary crushing (hammer mill /cone crushing) and additional screening to reduce material size. A series of screening / conveyor systems transfers material of different size. Frontend loaders feed stockpiles which feed fixed plants which produce a variety of products for facilities such as a lime plant, asphalt plant and a concrete plant for blocks and ready-mix. Following processing, material is sold off site.

11.12 The frequency of the blasting operation on the entire quarry is limited to not more than four production blasts per month, as per Condition 5 of Reference QD 16.QD0009 and Condition 6 of Plan Ref. File No. 20/77/ ABP Ref: ABP-308748-20.

11.13 The plan is to continue blasting at the same number of events as is current with the blast size being determined by location and distance to nearest receptors.

Quarry Layout

11.14 The main noise sources in the active quarry operation, including the proposed development can be divided into six zones as shown in **Plate 1** (Map by Quarry Consulting). **Plate 1** also shows the nearest NSL'S in different directions around the proposed extraction area (marked in red). The active Zones in the quarry are a level below surface.

- **Zone Z-1 denotes the Blocking Plant**
- **Zone Z-2 denotes the Asphalt Plant**
- **Zone Z-3 denotes the Drying Shed**
- **Zone Z-4 denotes the Processing Plant**
- **Zone Z-5 denotes the Lime Plant**
- **Zone Z-6 denotes the Quarry Face**

Extraction Proposal

11.15 The extraction of rock includes drilling, blasting, loading and trucking for processing in Zone 4 located on the quarry floor. The main noise sources and associated noise levels with this activity is listed in **Table 1**.

Table 1: Main Noise Sources and Associated Noise Levels due to Proposal

Noise Source	Noise level @ 20m Leq dBA	Comments
Tracked drill rig for drilling blast holes.	74	Operating on surface bench. For any one blast this drill would not operate for more than 2.5 days to complete task
Hitachi-850 Excavator	72	Operating at quarry face loading dumper.
Hitachi 455 excavator rock breaking.	79	On quarry floor beside bench face breaking rock
Cat 775E Dump Truck	76	Levels from dumper being filled while idling
Dump Truck on haulage+	48.6+	Travelling along haulage route in quarry floor

+ Calculations based on number of trucks and maximum sound power level, L_{WA}. See calculations in Appendix.

Relevant Guidance and Current Noise Limits of Existing Operations

11.16 The EPA has produced Environmental Management Guidelines- 'Environmental Management in the Extractive Industry (Non-Scheduled Minerals) [2]', 2006. This document references 'A Guidance Note for Noise in Relation to Scheduled Activities (EPA, 1996[1])'. It deals with the approach to be taken in the measurement and control of noise, and provided advice in relation to the setting of emission limits values and compliance monitoring.

11.17 In relation to quarry developments and ancillary activities, it is recommended that noise from the activities; it recommended that noise from the activities on site shall not exceed the following noise limits at the nearest noise-sensitive receptor:

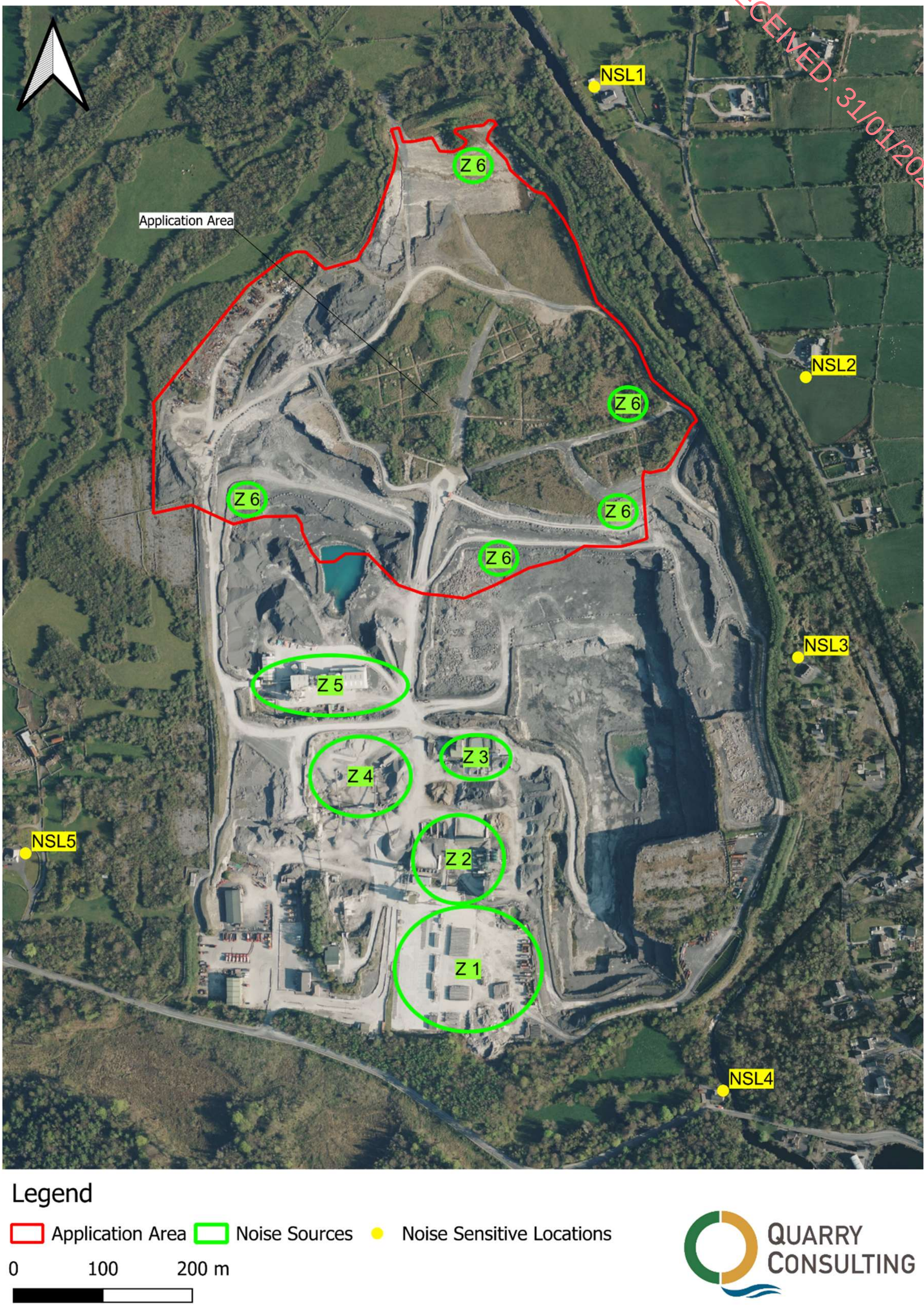
Daytime	08.00-20.00 hrs	LAeq (1h) = 55dBA
Night-time	20.00-08.00 hrs	LAeq (1h) = 45dBA

11.18 95% of all noise levels shall comply with the specified limits values(s). No noise level shall exceed the limit value by more than 2dBA.

[2] Quarries and Ancillary Activities, Guidelines for Planning Authorities, Dept of the Environment, Heritage and Local Government April 2004.

[1] Ref. EPA's Guidance Note for Noise in Relation to Scheduled Activities, 1996.

Plate 1:Noise prediction locations & main noise sources denoted by zone 1 to zone 6 (Z-1 to Z-6)



Baseline Conditions

11.19 The existing quarry operates under a number of planning conditions including An Bord Pleanála (Ref. No. QD16.QD0009) P2077 & ABP30874820 condition 7 from a section 37L application.

11.20 During the operational phase of the proposed development, the noise level from within the boundaries of the site measured at noise sensitive locations in the vicinity shall not exceed-

(a) An LArT value of 55dBA during 0700 to 1800 hours, The T value should be one hour

(b) An LArT value of 45dBA at any other time. The T value should be 15 minutes.

11.21 Noise monitoring is carried out during the year at a number of locations inside the site perimeter at locations closer to quarrying activity than to receptors. Noise levels have been shown to be at a level that would be well within noise limits at all receptors surrounding the site (refer to Noise Monitoring Report in Appendix 3).

Noise Impacts

11.22 The operational activity (extraction of rock) includes drilling, blasting and rock being loaded on to a dump truck by excavator prior to being transferred to the processing area in zone 4. Occasional rock breaking occurs to break larger stones. To make the assessment more robust an assumption is made that rock breaking occurs simultaneously with the excavator loading dump trucks while drilling is being carried out. **Table 2** gives noise sources levels resulting from quarry extraction.

Table 2: Noise Sources and Levels due to Quarry Extraction

Noise Source	Noise level @ 20m Leq dBA	Comments
Tracked drill rig for drilling blast holes.	74	Operating on surface bench. For any one blast this drill would not operate for more than 2.5 days to complete task
Hitachi-850 Excavator	72	Operating at quarry face loading dumper. Also operates removing overburden when required
Hitachi 455 excavator rock breaking.	79	On quarry floor beside bench face breaking rock
Cat 775E Dump Truck	76	Levels from dumper being filled while idling Also operates removing overburden when required
Dump Truck on haulage	48.6	Travelling along haulage route in quarry floor

11.23 The combined activity of excavator, rock breaking and dump truck on quarry floor gives (72 + 79 +76) dBA which equates to a noise level of <u>81.3 dBA at 20m</u>. The plant operating on the quarry floor has an effective barrier height of over 15m resulting in a minimum attenuation of 20 dBA (the acoustic barrier effect measured in a number of quarries with similar barrier height resulted in additional attenuation range of between 29-38 dBA).

11.24 All drilling for quarry blasting will be at a location approximately 15m below surface (excluding berms) so a minimum of 20 dBA barrier attenuation for drilling is allowed for in all calculations.

11.25 Trucking on the haul route is calculated as 48.6 dBA Leq 1hr (see appendix for calculations). The barrier attenuation provided on the trucking route to the processing area on the quarry floor is given as 20 dBA.

11.26 **Table 3** gives the predicted maximum noise levels for zone 6 operational effects. The distances to receptors given for Z-6 (zone 6) is when extraction is carried out in the deepened quarry boundary at location closest to receptors (NSL1 to NSL6).

Table 3: Predicted Noise Levels from Quarry Extraction (zone 6)

Receptor id	Source in dBA at 20m and distance to receptor	Geometric spreading	Barrier / attenuation/air attenuation	Total attenuation	Predicted Leq 1hr dBA
NSL1	81.3 74.0 At 105m	14.4 14.4	20 20	34.4 34.4	46.9 40.6 <u>= 47.6</u>
NSL2	81.3 74.0 At 144m	17.1 17.1	20 20	37.1 37.1	43.2 36.9 <u>= 44.1</u>
NSL3	81.3 74.0 At 186m	19.4 19.4	20 20	39.4 39.4	41.9 34.6 <u>= 42.6</u>
NSL4	81.3 74.0 At 513m	28.2 28.2	20 20	48.2 48.2	33.1 25.8 <u>= 33.8</u>
NSL5	81.3 74.0 At 480m	27.6 27.6	20 20	47.6 47.6	33.7 26.4 <u>= 34.4</u>

Assessment of Quarry Extraction Impacts

11.27 The predicted maximum noise levels are based on all plant working together which in practice is very unlikely to occur, one example being the same excavator driver normally operates both the loading shovel and rock breaking activity. The predicted noise levels are well with the existing planning guidelines at all nearest receptors (NSL's). Noise levels monitored inside the quarry boundary over the years (including all quarry sources) demonstrates compliance. When there is compliance within the quarry boundary, then it can be said that compliance will definitely be met at the receptors further away as noise levels decrease with distance from a source.

11.28 The noise impact from extraction at deeper levels inside the quarry will not increase the noise levels and will have a neutral impact.

Impacts of Existing Plant

11.29 The noise impacts include all plant given in **Table 2** operating together with all plant listed in **Table 4**. The main noise sources in **Table 4** are blocking plant, batching plant, asphalt plant, processing plant and lime plant. The main noise sources within the fixed plant structures including crushers /screeners/ conveyors are driven by motors which are located within 3.5m of quarry floor. In the prediction an attenuation of 20 dBA is assumed for berm /barrier effect of the deepening elevation and surface.

11.30 **Table 4** gives the list of plant with main noise sources within the zones 1 to zone 5 inc. In the prediction it is assumed that all plant listed is operating at the same time continuously.

Table 4: List of Main Noise Sources within Zones of Activity

Noise Source	Noise level @ 20m Leq dBA*	Comments
Zone 1-Blocking plant		
Block making machine	77	Operating when demand requires
Mixer	72	
Batching Plant	75	Filling truck -inside a housing envelope
Mitsubishi 7t forklift	71	Filling block machine
Mitsubishi 13t forklift	78	Grab to stack and load lorries
Zone 1 equivalent to	82.4	
Zone 2		Operating inside a housing envelope
Asphalt Plant	75	
Zone 3-Drying Shed	68.5	Operating inside a housing envelope
Zone 4-Processing plant		
Primary crusher with screeners Max cap. @ 300tonnes/hr	81	Operating at full capacity including being filled by front end loader
# 1 secondary crusher and screeners/conveyors	68	System in housing envelope
# 2 Mansfield secondary crusher and screeners/conveyors	78	Operating at full capacity
# 3 Mansfield secondary crusher and screeners/conveyors	78	Operating at full capacity
Trucking +Front end loader	79.5	Filling plant and trucks
Zone 4 equivalent to	85.9 (81+68+78+78+79.5)	

Zone 5-Lime Plant Secondary crusher and screeners/conveyor	69	System in housing envelope

11.31 **Table 5** gives the distance of activity in zones 1 to 5 to the nearest receptors and predicted noise levels at NSL's. The locations of zones 1 to 5 will not change during the life of quarry.

Table 5: Distance of Zone Activity to the Nearest NSL with Predicted Noise Levels

Location id	Distance to zones (m)	Source: 1hr Leq dBA	Berm/barrier attenuation	Geometric spreading	Predicted 1hr Leq dBA	Zones 1 to 5 incl Leq 1hr dBA
NSL1	Zone 1 - 948	82.4	20	33.5	28.9	
	Zone 2 - 866	75.0	20	32.7	22.3	
	Zone 3 - 740	68.5	20	31.4	17.1	35.4
	Zone 4 - 810	85.1	20	32.1	33.8	
	Zone 5 - 729	69.0	20	31.2	17.8	
NSL2	Zone 1 - 741	82.4	20	31.4	31.0	
	Zone 2 - 690	75.0	20	30.8	24.2	
	Zone 3 - 581	68.5	20	29.2	19.3	36.9
	Zone 4 - 693	85.1	20	30.8	35.1	
	Zone 5 - 662	69.0	20	30.4	18.6	
NSL3	Zone 1 - 479	82.4	20	27.6	34.8	
	Zone 2 - 445	75.0	20	26.9	28.1	
	Zone 3 - 375	68.5	20	25.5	23.0	40.1
	Zone 4 - 492	85.1	20	27.8	38.1	
	Zone 5 - 549	69.0	20	28.8	20.2	
NSL4	Zone 1 - 304	82.4	20	23.6	38.8	
	Zone 2 - 414	75.0	20	26.3	28.7	
	Zone 3 - 449	68.5	20	27.0	21.5	41.7

	Zone 4 - 500	85.1	20	28.0	37.9	
	Zone 5 - 646	69.0	20	30.2	18.8	
NSL5	Zone 1 - 502	82.4	20	28.0	34.4	
	Zone 2 - 471	75.0	20	27.4	27.6	
	Zone 3 - 514	68.5	20	28.2	20.3	41.5
	Zone 4 - 386	85.1	20	25.7	40.2	
	Zone 5 - 366	69.0	20	25.2	23.8	

Cumulative Impacts

11.32 The cumulative effects include all zones operating together (zones 1 – 6 inclusive).

11.33 Table 6 gives the cumulative impact of all activity inside the quarry including all zones (1 to 6).

Table 6: Predicted Cumulative Noise Levels from all Activity (zones 1 to 6)

Receptor id	Zone 6 + (Zones 1-5)	Predicted Leq 1hr dBA
NSL1	47.7 + 35.4	47.9
NSL2	44.1 + 36.9	44.9
NSL3	42.6 + 40.1	44.5
NSL4	33.8 + 41.7	42.4
NSL5	34.4 + 41.5	42.3

Assessment

11.34 The noise levels have been predicted for decommissioning aspects of the proposed development and for the extraction of rock. In all cases the predicted are within the existing noise limits and within EPA, 2006, Environmental Management Guidelines for Extractive Industries.

11.35 The cumulative noise levels have been predicted and are well within the existing planning noise limits and within the EPA 2006 Guidelines.

Ameliorative Measures Already Place

- A barrier of minimum height of 5 to 6m has been constructed around the development area and proposed quarry activity
- All main noise sources crushing systems, screening, conveyors washing, concrete batching plant, blocking plant, asphalt plant, lime plant, trucking and extraction are located on the quarry floor which provides very significant acoustic barrier attenuation effect (over 20dBA measured at a number of points). Asphalt plant Is housed.
- Rubber lining is installed on all transfer points on the crusher / screener systems with a number of crushers and conveyors housed.

- All motors and pulleys are maintained to a high standard with regular maintenance to avoid any tonal or impulsive components in the emission.
- All mobile plant on site have well maintained silencers.
- Machinery is throttled down or turned off when not in use.
- There are a number of crushers/conveyors housed inside Kingspan sheeting

Blast Vibration

Ground Vibration

11.36 Ground vibration is caused by the imperfect utilisation of the explosive energy released from the fragmentation of rock during blasting operations. The energy that is unused in the fragmentation of rock propagates as an elastic disturbance away from the shot area as seismic waves. These waves, which radiate in a complex manner, diminish in strength with distance from the source. The theory relative to this motion is based on an idealised (sinusoidal) vibratory motion. When these waves come into contact with a free face, physical motion results as the energy induces oscillation in the ground surface. Blasting vibration is a surface wave type, which incorporates components of both body and surface motion.

11.37 Ground vibration itself is in-audible, however air vibrations (air overpressure) both audible and sub-audible usually accompany it. The resulting impacts of blasting vibration are often characterised as being impulsive and of short duration, usually less than 2 seconds. It is difficult for the average lay person to differentiate between the various types of vibrations (ground vibration and air overpressure), humans commonly associate the level of vibration with the 'loudness' of a blast.

Ground Vibration Control

11.38 Ground vibration from blasting at any receptor point is influenced in the main by:

- the maximum instantaneous charge of explosives usually referred to as MIC.
- the medium between blast source and receptor point and.
- the distance between the receptor point and the blast source.

11.39 Ground vibration control is based on reducing and controlling the weight of explosives detonated per delay. In any given situation large amounts of explosives can be detonated using time delay intervals (greater than 8millie-second) between specific charges within the overall blast. The level of ground vibration is directly related to the maximum charge weight per delay and numerous studies have shown that peak particle velocity (PPV) is directly related to the maximum charge weight per delay. In terms of predicting ground vibration each quarry location is 'site specific'. Typically a 'scaled distance' regression line can be established using monitored vibration data, MIC and distance. Continuous vibration monitoring ensures that blast vibration limits are being complied with and it also allows the development and adjustments to the 'scale distance' regression line for the proposed site. As this is an established blasting site a significant amount of data is available to ensure compliance with ground vibration levels. In practice the distance and MIC to a blast receptor will determine the MIC used for blasting. As blasting operations move in a north to north-east direction blast vibration levels can be reduced if required by lowering the MIC. Lowering the MIC can be obtained by a number of means including a combination of the following:

- reducing the shot hole diameter
- reducing the bench height, thereby reducing the length of shot hole

- decking charges-dividing the charge with the shot hole by using a minimum of 1.5m of stemming

11.40 The most up to date technology in blasting operation is used and will continue to be used in the quarry. To this end face profiling is carried for each blast so that the accurate geometry of the free face is established, thereby enabling the optimum burden and spacing to be applied for each blast. Monitoring demonstrates compliance with blast vibration limits is being met.

Historical Blast Measurements

11.41 There have been a number of blasts carried out in the excavation area during the past 3 years. **Table 7** gives the maximum blast vibration levels from 2021 to March 2024. The locations where maximum vibration measurements where recorded is given in **Plate 2**. Locations where historical blast vibration measurements were taken over a number of years is given in **Appendix 2**. Table 7 demonstrates compliance with the vibration limits over the past 3 years of blasting. The PPV is denoted by the maximum vector, or the maximum of three orthogonal directions: the horizontal longitudinal (H), horizontal transverse (T) and vertical (V).

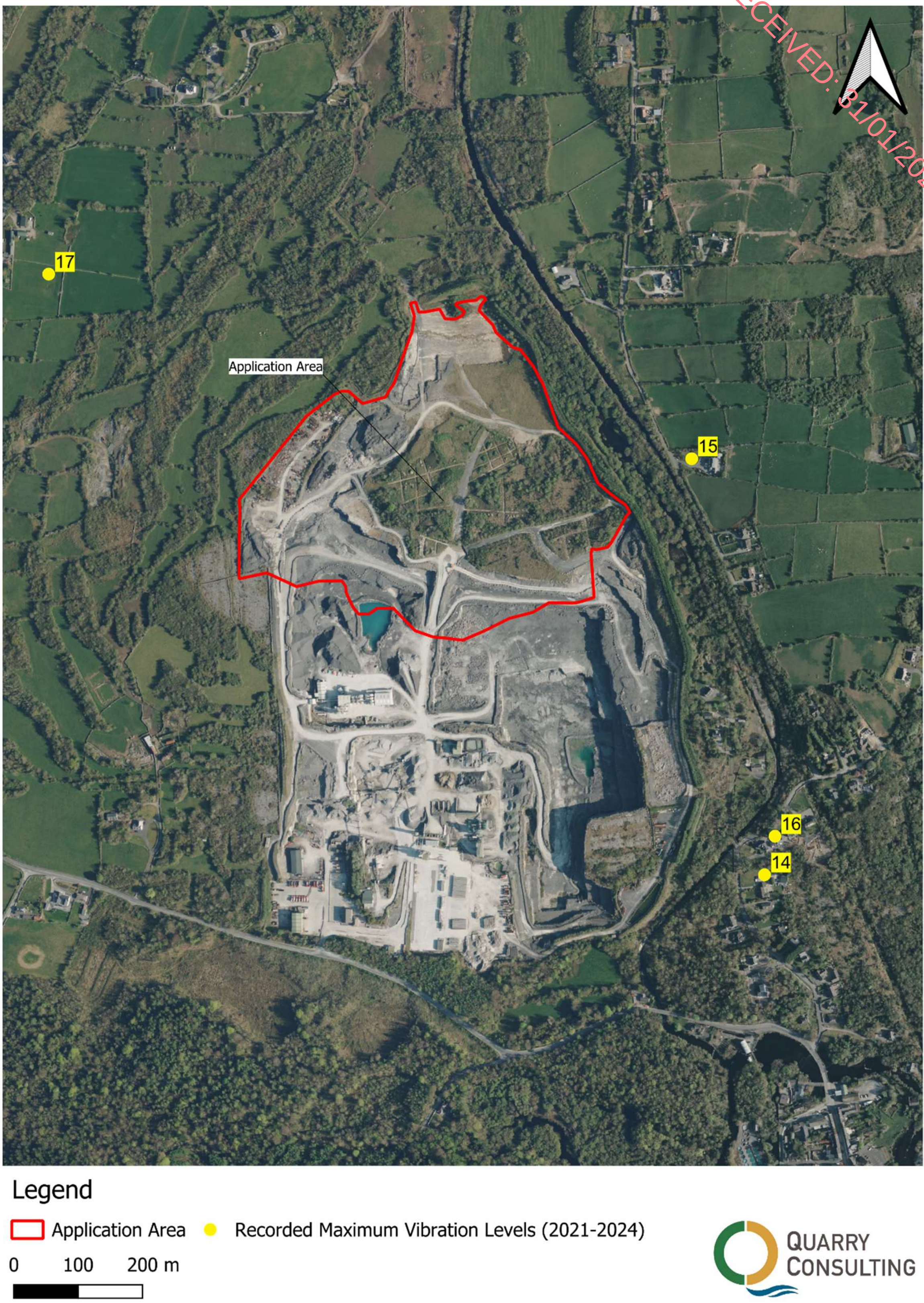
Table 7: Maximum Blast Vibration for 2021, 2022, 2023 and up to March 2024

	2021 BLASTING DETAILS-MAXIMUM LEVELS				
		Peak Particle Velocity			Air
Location 16	Date	H	V	T	Overpressure
		mm/s	mm/s	mm/s	dB (L)
	17th February'21	1.5	2.2	1.1	111
	2022 BLASTING DETAILS-MAXIMUM LEVELS				
		Peak Particle Velocity			Air
Location 14	Date	H	V	T	Overpressure
		mm/s	mm/s	mm/s	dB (L)
	26th May'22	2.2	2.1	1.1	123
	2023 BLASTING DETAILS-MAXIMUM LEVELS				
		Peak Particle Velocity			Air
Location 15	Date	H	V	T	Overpressure
		mm/s	mm/s	mm/s	dB (L)
	31st October'23	2.5	1.7	5.0	111
	2024 BLASTING DETAILS-MAXIMUM LEVELS				
		Peak Particle Velocity			Air

Location 17	Date	H	V	T	Overpressure
		mm/s	mm/s	mm/s	dB (L)
	21st March'24	2.3	1.7	3.7	109

Plate 2 shows locations where the maximum vibration levels were recorded over a 3 year period between 2021 and March 2024.

Plate 2: Locations where maximum vibration levels were recorded between 2021 and March 2024



11.42 Variations in the maximum instantaneous charge weights (MIC) and distance to a receptor at any specific site are closely related to variations in vibration magnitude. The distance from a blast to receiver and MIC determines the basis of vibration prediction.

11.43 Ground vibration monitoring is carried out for every blast at the subject quarry to ensure that blast vibration limits are being complied with and it allows the development and adjustments to their 'scale distance' regression line for the site so that the MIC charge can be lowered as a blasting goes closer to a receptor, or structure.

Ground Vibration Criteria, Guidelines/Recommendations/Standards

11.44 The measurement of peak particle velocity (PPV) is internationally recognised as the best single descriptor to use when assessing potential ground vibration damage to structures/buildings. More recently velocity-frequency control bounds are used as damage control criteria. There are no Irish standards for ground vibration control, however there are limits recommended in the EPA's Guidance Note on Noise in Relation to Scheduled Activities. These limits are also recommended in the Guidelines for Planning Authorities for *Quarries and Ancillary Activities* issues in April 2004 by the Department of the Environment, Heritage and Local Government. The EPA has also published a document "Environmental Management Guidelines" Environmental Management in the Extractive Industry (Non-Schedule Minerals)-2006. There are many different standards and recommendations being used internationally, some like the German DIN 4150[1] that lacks data for its foundation. However, most of these standards and recommendations are derived from the considerable work carried by the U.S Bureau of Mines (USBM). The USBM Report of Investigation 8507[2] gives practical safe criteria for blasts that generate low frequency ground vibrations (<40Hz). These are 19 mm/sec for modern houses and 12.7 mm/sec for older houses. Since 1993 British Standards Institute have adopted BS 7385 Part 2: 1993[3], which is based predominately on a literature review of the previous studies already alluded to in this report.

11.45 For the quarry development the vibration limits will be similar to those already in place by Mayo County Co. Co. An Bord Pleanala and within the EPA's Guidance Note.

Air Blast (Air-Overpressure) Noise

11.46 A blast causes a diverging shock-wave front that quickly reduces to the speed of sound, and an air blast is then propagated through the atmosphere as sound waves. Air blast or air overpressure is the term used to describe the low frequency high energy air vibrations generated by blasting detonation. Air blasts are characterised by containing a larger proportion of its energy in the sub-audible spectrum, below 20 Hz. Because the waves associated with air blasts are essentially outside the audible spectrum (below 20 Hz), a separate unit of measure, pressure is reported.

11.47 The pressure is recorded using an air-blast transducer and the linear device must measure accurately in the structurally critical range of 2 to 20 Hz. Air blast (sound waves) can be reported in two distinct units of measurements, pressure (psi) or decibels (dB), normally as dB(Lin), or dB(L).

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[1] German Standard, DIN 4150; Part 3: 1986, Vibration in buildings; effects on structures

[2] Siskind, D. E, Stagg, M. S., Kopp, and Dowding, C. H. (1980) '*Structure Response and Damage Produced by Ground Vibration From Surface Mine Blasting*' U .S Bureau of Mines RI 8507

11.48 Sound waves in the form of the sub-audible sound waves (air overpressure/air blast waves), and noise (the audible waves) are sometimes linked inextricable. It is difficult sometimes for humans to differentiate between the characteristics of air blasts and noise.

11.49 A wind speed of 9 m/s produces a pressure equal to 133.7 dB (0.014 psi). Although such wind is comparable in amplitude to a strong air-blast, its effects are not as noticeable because of the relatively slow rate of wind change and the corresponding minor or non-existent rattling, compared with the rapid rise time (impulsive) of an air blast transient.

11.50 Air blast waves are attenuated over distance in much the same way as sound waves; however there are some differences due to the lower frequency of the sub-audible air blast waves. Lower frequency waves are attenuated at a lower rate by air absorption over distance than the higher frequency audible waves. Air blasts, being very high pulses of energy in the form of low frequency waves can travel great distances. The effects of temperature inversions are negligible close to a blast. The effects of ambient temperature and relative humidity are considered negligible, at less than 1 dB at 1Km[5]. Prediction and control of air blasts can be more difficult than that of ground vibration due to the influences of weather conditions on the air blast propagation.

Control of Air Blasts

11.51 The principal factors governing air blasts are:

(a) the type and quantity of explosives

(b) the degree and type of confinement (stemming)

(c) the method of initiation (not-use of exposed detonating Cord etc.)

(d) local geology, topography and distance

(e) atmospheric conditions

11.52 Factors (a), (b) and (c) are variables within the control of the quarry operator whereas (d) and (e) are essentially uncontrollable at any particular site. However, by varying the timing of a blast (avoid early morning or late evening), by controlling the degree of confinement and by using non-electric or electronic detonators as the method of initiation (non –use of detonating Cord on surface) the quarry operator, in effect, achieves control over the influence of atmospheric conditions and hence over the blast emissions. It is important to note that atmospheric conditions (including temperature inversions) will have little effects at distances within 300m. Air over pressure for the site can be lowered by keeping the active blast face perpendicular (or close to perpendicular) to the nearest receptors north and east of the site. The air overpressure limit is applied to a level of 125 dB (Lin peak) with a 95% confidence when measured with instrumentation that has a linear response down to 2 Hz. as is given in the existing permission. This proposed limit is well below the safe level of 133 dB for air blasts given by Siskind *et al.*, 1980[6] and is also within the limit recommended by the EPA.

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[5] Aimone-Martin, C., and Martin, R. S. (2000). *Effects of Temperature and Humidity on Airblast Sound Pressure Levels*. Journal of the International Society of Explosive Engineers

[6] Siskind, D. E., Stachura, V.J., Stagg, M. S., and Kopp, J. W. (1980). *Structural Response and Damage Produced by Air Blast from Surface Mining*, USBM, RI 8485

Flyrock

11.53 Flyrock can occur due to incorrect design and poor management of blasting rounds where there is inadequate stemming or inadequate burden (overcharging the holes with explosives). Overcharging can be avoided by existing management procedures. Considerations for the bench height, bench face profile, face condition, local geology, rock properties, burden and spacing of the drilling pattern and in particular to the first row of boreholes when calculating charge weight per hole will ultimately define the optimum powder and energy factors for a safe and productive blast. The measures taken to control ground vibration and air-overpressure will also control and counteract the possibility of flyrock.

Mitigating Measures for Ground Vibration, Air-Overpressure Noise and Flyrock

11.54 The following controls are already in place so that ground vibration, air overpressure, noise and flyrock is minimised and kept well within the regulatory limits. Specific mitigations measures are listed that is followed by the experienced Contractors who carry out these duties and are as follows;

- Pre-blasting management procedures, loading Management procedures and blasting management procedures) are in place at all times.
- Considerable care is taken to conduct the blast only between 11:00 hrs and 16:00 hrs, Monday to Friday. No blast are conducted on weekends or bank holidays.
- Prior drilling of any blast a face profiling or a trigonometric bench height measurement is carried out for all blasts.
- Prior to drilling the blasting pattern the quarry foreman marks the position of boreholes and the blast number on the ground as per the agreed blasting plan approved and signed by the Drilling and Blasting Manager.
- A blasting plan is issue by the blaster in charge for agreement with the Driller and Blasting Manager prior to the drilling of any blast.
- Only personnel with appropriated Certification in drilling and blasting operate the blasting programs.
- A driller’s log is in place at all times.
- A site-specific scale distance regression for the proposed development site is continuously developed as blasting continues over the life of the quarry.
- Monitoring locations for ground vibration and air overpressure is agreed prior to blasting. Monitoring data is used to allow for future adjustments to the maximum instantaneous charge of the blast if required.
- All seismographs used have a certificate of calibration from the manufacturer and all certificates and serial numbers of each seismograph being used for the monitoring of a blast is kept on file.
- Advance warning notice of all blasts is given to residents in the near environs of the quarry at least 24hrs prior to blasting.
- Optimum blast ratio is maintained and this ensures that the maximum amount of explosive on any one delay, the maximum instantaneous charge (MIC) is optimised so that the ground vibration levels are kept within regulatory limits.

- Explosive charges are properly and adequately confined with sufficient quantity of stemming using angular chippings and/or a combination of angular chippings and plug.
- The adequate confinement of all charges by means of accurate face survey and the subsequent judicious placement of explosives by certified personnel is carried out.
- Overcharging is avoided by considering depth, burden and spacing when calculating charge weight per hole.
- There is no exposed detonating cord used on surface.
- The initiation sequence in the blast is set in a way that it progresses away from the nearest sensitive locations or structure to be protected, where practical.
- An adequate powder factor and energy factor is chosen for each blast by considering safety, confinement and productivity.
- Borehole deviation studies is conducted in order to have a better control in potential borehole deviation.
- Only the necessary sub drilling to achieve good breakage is used (normally 1 to 1.5 m), excessive sub-drilling is avoided at all times.
- Use of decked charges if required in order to reduce the Maximum Instantaneous Charge (MIC).

Do-nothing Scenario

11.55 If the proposed development were not to proceed, the operator would continue to operate until planning permission has expired and life of quarry would be reduced significantly.

Unplanned Events

11.56 In the event of an emergency such as a fire to plant or equipment, the emergency response plan will be implemented, and the relative emergency services will be contacted. An assessment in relation to the cause of the emissions will be undertaken and the activity will not recommence until the problem has been rectified.

Decommissioning

11.57 There is no published national guidance relating to the maximum permissible noise level that may be generated during the construction or decommissioning phase of a project. However, the National Roads Authority (“NRA”) give limit values which are deemed acceptable (“the NRA Guidelines”)[2]. Guidance to predict and control noise is also given in BS 5228:2009, *Code of Practice for Noise and Vibration Control on Construction and Open Sites* (two parts) where Part 1 deal with Noise. The NRA guidelines for construction noise which are considered acceptable are given in **Table 8**. Decommission noise levels follows similar guidelines.

Table 8: Noise Levels Considered Acceptable

Day / Times	**Guideline Limits**
Monday to Friday	

[2] National Roads Authority, *Guidelines for Noise and Vibration in National Road Schemes.*

07:00 – 19:00hrs	70dB LAeq, (1h) and LAmax 80dB
19:00 – 22:00hrs	*60dB LAeq, (1h) and LAmax 65dB*
Saturday	
08:00 – 16:30hrs	65dB LAeq,1h and LAmax75dB
Sunday and Bank Holidays	
08:00 – 16:00hrs	*60dB LAeq,1h and LAmax 65dB*

*Construction at these times, other than required by an emergency works, will normally require explicit permission from the relevant local authority

11.58 Part 1 of BS 5228 provides several example criteria for the assessment of the significance of noise effects from construction activities. Noise levels generated by construction activities are considered significant if:

The LAeq, period level of construction noise exceeds lower threshold values of 65dB during daytime, 55dB during evenings and weekends or 45dB at night, and;

The total noise level (pre-construction ambient noise plus construction noise) exceeds the pre-construction noise level by 5dB or more for a period of one month or more.

Decommissioning Impacts

11.59 There is no construction associated with the development so there will be no construction impacts however, decommissioning will involve activity which is similar to low intensity construction.

11.60 It is planned that a significant amount of decommissioning will occur during the working life of the quarry when equipment otherwise used for production will be utilised to carry out decommissioning tasks in phases.

11.61 The maximum noise impacts are associated with decommissioning could involve minor works being carried out close to the perimeter of the site. It is envisaged that all existing berms on the perimeter of the site will remain in place.

11.62 The predicted noise levels are based on the activity being carried out on the boundary of the extraction site at locations nearest to receptors listed NSL1 to NSL5.

Predicted Noise Levels

11.63 The noise levels generated by decommissioning can be modelled as follows:

11.64 The difference between noise levels at two far-field locations can be calculated as:

$$L_{p2} - L_{p1} = 10 \log (R_2 / R_1)^2 - (A_{atm} + A_{gr} + A_{br} + A_{mis})$$
$$= 20 \log (R_2 / R_1) - (A_{atm} + A_{gr} + A_{br} + A_{mis})$$

Where,

L_{p1} = sound pressure level at location 1
L_{p2} = sound pressure level at location 2
R_1 = distance from source to location 1
R_2 = distance from source to location 2

and where,

A_{atm} = Attenuation due to air absorption
A_{gr} = Attenuation due to ground absorption
A_{br} = Attenuation provided by a berm/barrier
A_{mis} = Attenuation provided by miscellaneous other effects

Attenuation by ground absorption and miscellaneous effects is assumed as zero.

11.65 The combined activity on surface, excavator, and dump truck gives (72+76) dBA which equates to a noise level of 77.5dBA at 20m. An assumption is made that both plant is operating continuously for 50% in any hour which equates to 74.4dBA at 20m. No attenuation is assumed for ground absorption, or miscellaneous effects.

11.66 There is a 5-6m height barrier / mound effect between activity and nearest receptors. An attenuation effect of 15dBA is assumed along boundaries at the nearest receptors. **Table 9** gives maximum predicted noise levels for decommissioning related activity which is based on activity being at nearest boundary location to a receptor. The predicted maximum noise levels are likely to pertain for no less than 2 weeks at any location.

Table 9: Predicted Maximum Noise Levels from Decommissioning

Receptor id	Distance to Receptor (m) at source 74.5 dBA	Geometric spreading	Barrier / attenuation/air attenuation	Total attenuation	Predicted Leq 1hr dBA
NSL1	85	14.8	15	29.8	44.7
NSL2	144	17.2	15	32.2	42.0
NSL3	45	7.0	15	22.0	52.5
NSL4	111	14.9	15	29.9	44.6
NSL5	200	20	15	35	39.5

11.10.3 Assessment of Decommissioning Activity

11.67 The maximum predicted noise levels are well within the NRA guidelines for decommissioning activity which is akin to low intensity construction works. It is likely that the duration of decommissioning will be short term considering that a significant percentage of works involved will be carried out when equipment otherwise used for production will be utilised to carry out these tasks in phases.

11.68 Any legislation, guidance or best practice relevant at the time of decommissioning would be complied with.

Noise and Vibration Monitoring

11.69 To ensure compliance with regulatory limits, monitoring of all blasting events is carried out at a selection of nearest sensitive dwellings, the location which may vary as the quarry develops. Keeping within the statutory limits of blast vibration or air overpressure will ensure that the likelihood of damage (or superficial damage) to property approaches zero.

11.70 Noise monitoring was carried out at three locations within the site boundary where details of weather conditions (wind speed/direction) are included (Appendix 4). It is preferable that the annual monitoring is carried out within a single day when the quarry is operating at, or close to full capacity. When compliance is met at the nearest noise receptors within the site boundary, then it will be met at distance further away as noise levels decreases with distance from a source.

11.71 Blast vibration monitoring is carried out for each blast and will continue to be carried out. Attached in **Appendix 2** are the locations where historical blast vibration monitoring has been carried out over a number of years.

Residual Impacts

11.72 It is not anticipated that there will be an adverse impact on noise or vibration quality in the vicinity of the application site provided mitigation measures and best practice already in place is applied.

Technical Difficulties

11.73 There were no technical difficulties encountered during the study / assessment.

Summary of Significant Effects

Table 10: Summary the Significant effects

	Quality	Significance	Duration
Decommissioning	Negative	Not significant	Temporary
Operational Noise	Neutral	Not significant	Long Term
Blast Vibration	Negative	Not significant	Momentary

Statement of Significance

11.74 This chapter has assessed the significance of the potential effects of the development during operation, construction and decommissioning.

11.75 There are no construction works planned for this development. The operation of the development means deepening the extraction works in a way that the noise effects will be neutral (within existing levels) and well within the noise limits. Blast vibration will be controlled and monitored using best practice with levels kept well within ground vibration limits as is current practice.

11.76 It is planned that a significant component of decommissioning will be carried out during the working life of the quarry when equipment otherwise used for production will be utilised to carry out decommissioning tasks in phases.

Glossary of Technical Terms

Peak Particle Velocity (PPV) – the maximum rate of change of particle displacement, measured in millimetres per second (mm/sec).

Frequency (Hz) – the number of cycles per second of vibration usually expressed in Hertz (Hz).

dB – Decibel, a unit of measure on a logarithmic scale used to quantify pressure fluctuations such as those associated with air overpressure (concussion wave).

dB(A) – Decibel measured within an A weighted frequency curve that differentiates between sounds of different frequency in a similar way to the human ear

Maximum Instantaneous Charge Weight – The maximum amount of explosives detonated at any one precise instance in time.

Scaled Distance – The blast/receiver separation distance divided by the square root of the maximum instantaneous charge weight.

Blast Ratio – The amount of work per unit of explosive measured in tonnes of rock per kilogram of explosives detonated.

Delay Interval – The time between successive detonations of detonators.

Sequential Detonation – The method of control of time intervals between explosions of individual charges.

Stemming – The term given to the inert material, typically stone chippings that is placed into the top of a borehole which has already been filled with explosives. The length of stemming should equal the distance between the hole and its associated free face.

Burden – The distance measured at right angles between a row of holes and the free face, or between rows of holes.

Shot – is a borehole complete with primed charge and stemming.

Bench blasting - method of blasting in quarries and opencast sites by means of steps or benches with holes positioned parallel to the bench face.

Flyrock - The projection of material from the blast site to any area beyond the designated danger zone.

Free face - A rock surface bounded by air.

Ground Vibration Terminology

Particle Velocity (V) - the particle velocity is defined as the rate of change of amplitude or, for sinusoidal motion this may be mathematically expressed as;

$V=2\pi fa$

Where, 'V' represents PPV (mm/sec.), 'f' is the frequency (Hz) and 'a' is the peak particle displacement or amplitude (mm). Particle velocity as the term suggests is the movement of particles within a body or medium.

Vibration is usually measured in three orthogonal directions: the vertical, horizontal transverse and the horizontal longitudinal (often termed the x, y, z vector components). Vibration waves can be divided into P (primary) waves which are compression wave, S (secondary) waves which are shear waves, Rayleigh waves, Love waves, Stonely waves etc. However, in practice it is very difficult (and not very important) to distinguish between these waves. In most cases the vertical component is the *body wave* while the *surface waves* are the longitudinal and transverse waves.

Peak Vector Sum (PVS) - the peak vector sum is often referred to as the RPPV (resultant peak particle velocity) and can be mathematically expressed as;

$$PVS = \sqrt{X^2 + Y^2 + Z^2}$$

and this is equal to the real time resultant (not the pseudo resultant). You will usually find that in practice the average difference in the peak vector-particle and the PVS is less than 10% at distances in excess of 200 metres[5].

Zero cross frequency (zc) - zero crossing frequency is the frequency at the peak particle velocity of the recorded wave.

References

[1] Siskind, D.E., Stagg, M.S., Kopp, J.W. and Dowding C.H., *Structural response and damage produced by ground vibration from surface mine blasting,* United States Bureau of Mines (USBM), Report of Investigations No. RI 8507, 1980. OSMRE –The U.S. Office of Surface Mining (OSM) regulation given by the solid line is a modification of USBM

[2] DIN 4150: Part 3: 1986, *Vibrations in buildings; effects on structures.*

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

Part 2. Guide to damage levels from ground borne vibration.

[4] Dowding, Charles, H. (1996). *Construction Vibrations*, 610 pages, Prentice Hall.

[5] O'Reilly, B., (2000), Noise and Vibration Monitoring Around an Active Base Metal Mine, M.Phil Thesis, Liverpool University, U.K.

[6] BS 5228-1:2009: Code of Practice for noise and vibration and open sites- Part 1: Noise

Appendix 1: Calculation for trucking

The likely heavy goods vehicle (HGV) noise impact due to the expected traffic flows has been calculated using the Haul Road Method detailed in BS5228 'Noise and control on construction and open sites', (2009).

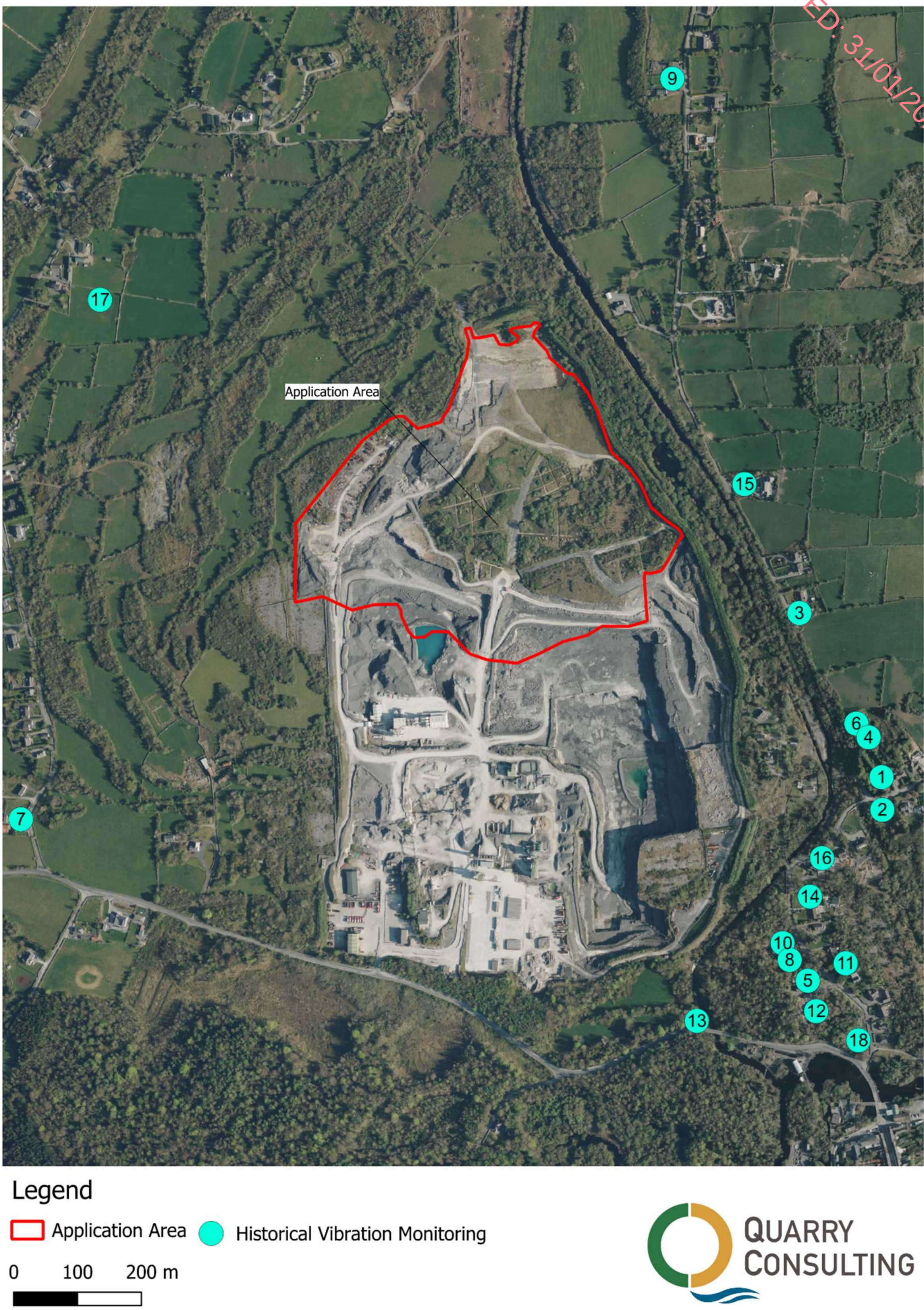
Method For mobile items of plant that pass at intervals (such as earth-moving machinery passing along a haul road), it is possible to predict an equivalent continuous sound level using the following method. a) Stage 1. The general expression for predicting the LAeq alongside a haul road used by single engine items of mobile plant is:

$L_{Aeq} = L_{WA} - 33 + 10\log10Q - 10\log10V - 10\log10d$ where: L_{WA} is the sound power level of the plant, in decibels (dB); Q is the number of vehicles per hour; V is the average vehicle speed, in kilometres per hour (km/h); d is the distance of receiving position from the centre of haul road, in metres (m).

Assuming a maximum frequency of 30 vehicle trips per hour (Q) and a minimum distance of at least 110 m (d) from the haul road to nearest receptor, a speed of 30 km/h (V) and a L_{WA} value of 102dB the calculated noise level is as follows:

LAeq = 102-33 + 10log 30 – 10log30 – 10log110 = 48.6dBA with no acoustic berm effects

Appendix 2: Locations Where Historical Vibration Measurements Were Carried Out



Appendix 3

Noise Monitoring Report

EXISTING QUARRY AT CREGAREE, CONG, CO. MAYO

CLIENT NAME: MCGRATHS LIMESTONE (CONG) LTD
REFERENCE: 65.01

SEPTEMBER 2024

Table of Contents

INTRODUCTION

Quarry Consulting were commissioned by McGraths Limestone Works Ltd. to undertake a noise survey at its existing quarry in Cregaree, Cong, Co. Mayo.

The purpose of the survey was to provide McGraths Limestone Works Ltd. with the noise data and analysis required as part of their regulatory requirements.

Noise Measurements Methodology

Environmental noise survey has been carried out by Quarry Consulting to assess the ambient noise levels in the vicinity of the quarry. The methodology of the surveys and the results are set out below. The weather conditions during the survey's periods were acceptable for noise monitoring.

The measurements were carried out using a Larson Davis SoundExpert LxT sound level meter (serial number 0007036). The sound level meter was calibrated before the measurements, and its calibration checked after, using a Larson Davis Cal200 field calibrator (serial number 20011). No calibration drifts were found to have occurred during surveys. All noise equipment had been calibrated to a traceable standard by UKAS (United Kingdom Accreditation Service) accredited laboratories within 12 months preceding the surveys.

At the measurement positions, the following noise level indices were recorded:

- $L_{Aeq,T}$ is the A-weighted equivalent continuous noise level over the measurement period, effectively represents an "average" value.
- $L_{A90,T}$ is the A-weighted noise level exceeded for 90% of the measurement period. This parameter is often used to describe the background noise.
- $L_{A10,T}$ is the A-weighted noise level exceeded for 10% of the measurement period. This parameter is often used to describe road traffic noise.

Environmental noise survey at the existing site (N1, N2, N3) was undertaken by Quarry Consulting on the 25th of September 2024; see **Table 3** and **Figure 1.**

Noise measurements were undertaken over one-hour periods during the daytime. The monitoring periods chosen are considered to give representative daytime noise levels at noise sensitive locations.

During the surveys, the sound level meter was located in free-field conditions (i.e. at least 3.5 m from the nearest vertical reflecting surface, with the microphone approximately 1.5 m above ground level).

A-weighting is the process by which noise levels are corrected to account for the non-linear frequency response of the human ear. All noise levels are quoted in dB(A) relative to a sound pressure of 20µPa.

The locations of the noise monitoring points are indicated on **Figure 1**.

Existing Noise Conditions at Cong

The noise monitoring locations used, shown in **Figure 1**, consist of the following:

- N1 to the west of the quarry;
- N2 to the north of the quarry;
- N3 to the east of the quarry;

The noise monitoring locations listed above are considered representative of the nearest noise sensitive locations (receptors) to the existing development site as described below[1]:

- Location N1 is representative of the residential properties located to the west of the development;
- Location N2 is representative of the residential properties located to the north of the development.
- Location N3 is representative of the residential properties located to the west and southwest of the development.

Noise monitoring results are provided in **Table 3**; noise monitoring notes and noise climate notes are provided in **Table 2.**

Table 1
Summary of Weather Conditions 25th of September 2024

Weather Conditions During Survey:	
25/09/24 **N1**	Dry; 100% cloud cover Temperature 13°C Wind Speed: 3.1 m/s Wind direction: From the northeast
25/09/24 **N2**	Dry; 100% cloud cover Temperature 13°C Wind Speed: 0m/s Wind direction: From the northeast
25/09/24 **N3**	Dry; 100% cloud cover Temperature 12°C Wind Speed: 4.3m/s Wind direction: From the northeast

[1] Note: Noise levels were not taken at the exact locations of the noise sensitive properties as access could not be gained to privately owned land.

Table 2
Summary of Measured Noise Levels, Free Field dB

Monitoring Location	Date	Time	$L_{Aeq,T}$	L_{A10}	L_{A90}	Notes
N1	25/09/24	13:03 – 14:03	53.8	56.2	49.8	Screening plant audible at 52 dB Reversing noise audible at 54 dB
N2	25/09/24	14:11 – 15:11	40.2	41.1	33.2	Quarry operations audible at 34 dB
N3	25/09/24	15:20 – 16:23	43.5	46.2	38.2	Quarry operations not audible Nearby machinery/construction work to the east audible at 44 dB Cars on a local road to the east audible at 45 dB

There was no evidence of a tonal or impulsive component to the noise attributable to the site operation.

Conclusions

As can be seen in Table 2, noise levels at the noise monitoring location are less than the daytime limit of 55dBA at locations N1 – N3.

Figure 1: Noise Monitoring Locations 2024

APPENDIX 1: GLOSSARY OF TERMINOLOGY

dB (decibel)

The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2x10^{-5}$ Pa).

B(A) A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

L_{Aeq}

L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

L_{10} & L_{90}

If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.

$L_{Amax}L_{Amax}$

is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

Noise Monitoring Report

EXISTING QUARRY AT CREGAREE, CONG, CO. MAYO

CLIENT NAME: MCGRATHS LIMESTONE WORKS LTD
REFERENCE: 65.01

JANUARY 2025

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- $L_{Aeq,T}$ is the A-weighted equivalent continuous noise level over the measurement period, effectively represents an "average" value.
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- $L_{A10,T}$ is the A-weighted noise level exceeded for 10% of the measurement period. This parameter is often used to describe road traffic noise.

Environmental noise survey at the existing site (N1, N2, N3) was undertaken by Quarry Consulting on the 14th of January 2025; see **Table 3** and **Figure 1.**

Noise measurements were undertaken over one-hour periods during the daytime. The monitoring periods chosen are considered to give representative daytime noise levels at noise sensitive locations.

During the surveys, the sound level meter was located in free-field conditions (i.e. at least 3.5 m from the nearest vertical reflecting surface, with the microphone approximately 1.5 m above ground level).

A-weighting is the process by which noise levels are corrected to account for the non-linear frequency response of the human ear. All noise levels are quoted in dB(A) relative to a sound pressure of 20µPa.

The locations of the noise monitoring points are indicated on **Figure 1**.

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The noise monitoring locations used, shown in **Figure 1**, consist of the following:

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- Location N1 is representative of the residential properties located to the west of the development;

- Location N2 is representative of the residential properties located to the north of the development.
- Location N3 is representative of the residential properties located to the west and southwest of the development.

Noise monitoring results are provided in **Table 3**; noise monitoring notes and noise climate notes are provided in **Table 2.**

Table 1
Summary of Weather Conditions 25th of September 2024

Weather Conditions During Survey:	
14/01/25 **N1**	Dry; 100% cloud cover Temperature 11°C Wind Speed: 1.9 m/s Wind direction: From the southwest
14/01/25 **N2**	Dry; 100% cloud cover Temperature 11°C Wind Speed: 1.2 m/s Wind direction: From the southwest
14/01/25 **N3**	Dry; 100% cloud cover Temperature 11°C Wind Speed: 2.6 m/s Wind direction: From the southwest

Table 2
Summary of Measured Noise Levels, Free Field dB

Monitoring Location	Date	Time	$L_{Aeq,T}$	L_{A10}	L_{A90}	Notes
N1	14/01/25	13:46 – 14:46	48.9	51.8	41.5	Dump truck audible at 50 dB Crushing and screening plant constantly running and audible at 44 dB
N2	14/01/25	14:52 – 15:52	47.7	50.3	42.7	Dump trucks with reverse warning system audible at 49dB
N3	14/01/25	15:56 – 16:56	44.3	46.4	41.5	Quarry audible at 43 dB

There was no evidence of a tonal or impulsive component to the noise attributable to the site operation.

Conclusions

As can be seen in Table 2, noise levels at the noise monitoring location are less than the daytime limit of 55dBA at locations N1 – N3.

Figure 1: Noise Monitoring Locations 2024

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If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.

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is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.