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NOISE ASSESSMENT FOR A PROPOSED RESIDENTIAL DEVELOPMENT AT LEHAUNSTOWN, CHERRYWOOD

Technical Report Prepared For

ABK Architects

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EXECUTIVE SUMMARY

Permission is being sought for a Residential Development at a site in Lehaunstown, Cherrywood. The proposed development consists 109 residential units with a total gross floor area (GFA) of 12,679 sqm over 6 blocks in a mixture of apartments, duplexes and houses on a development site of approx. 1.565 hectares.

This report, prepared by AWN Consulting Limited (AWN), discusses the potential noise and vibration impacts of the proposed development works in the context of current relevant standards and guidance.

The existing noise climate of the site has been surveyed during both daytime and night-time periods. The site is noted as having a relatively low noise level considering the suburban area.

The potential noise impact during the construction phase has been assessed at the nearest residential noise sensitive locations with reference to BS 5228 (2009 +A1 2014) - Part 1: Noise. The report has set out a range of predicted indicative construction noise levels associated with the varying construction phases in addition to best practice noise and vibration control measures to minimise the impact from this phase.

During the operational phase, potential sources of noise are considered to be limited to building services plant and additional traffic on surrounding roads. In respect of building services, plant selection at detailed design stage will ensure that the noise criteria set out in this report are met. Additional road traffic along Lehaunstown Lane is predicted to be of negligible or minor impact and mitigation measures are not predicted to be required.

An initial inward impact risk assessment has been undertaken with the resultant risks identified as negligible, hence no further mitigation is required in terms of inward noise impacts.

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1.0 INTRODUCTION

This document has been prepared by AWN Consulting Ltd. (AWN) to assess the potential noise and vibration impacts of the proposed development in the context of current relevant standards and guidance.

This assessment has been prepared by Alistair Maclaurin BSc, PgDip, MIOA, Senior Acoustic Consultant at AWN, who has worked in the field of acoustics since 2012. He has been the lead noise consultant across various sites on major infrastructure projects such as Crossrail and Thames Tideway Tunnel, specialising in construction noise assessment and control. Additionally, he has undertaken various environmental noise assessments for infrastructure developments and planning reports.

This report presents information on the assessment of noise and vibration impacts on the surrounding environment during both the construction and operational phases. The principal objectives of the Noise and Vibration assessment will be to specify appropriate limit values and mitigation measures to ensure that the impact on the environment is minimised and complied with acceptable standards and guidelines.

Appendix A presents a glossary of the acoustic terminology used in this report.

2.0 PROPOSED DEVELOPMENT

This application relates to development with the Cherrywood Strategic Development Zone (SDZ) and is subject to the Cherrywood Planning Scheme 2014 (as amended). The application relates to lands within 'Development Area 1 – Lehaunstown' of the SDZ Planning Scheme (as amended) and includes part of the Res 2 plot identified in this application known as 'Plot L8'. The proposed development consists 109 residential units with a total gross floor area (GFA) of 12,679 sqm over 6 blocks in a mixture of apartments, duplexes and houses on a development site of approx. 1.565 hectares.

Figure 1 Site Location & Layout

3.0 METHODOLOGY AND CRITERIA

When considering a development of this nature, the potential noise and vibration impact on the surroundings is considered for each of two distinct stages:

- Construction Phase and
- Operational Phase.

The construction phase will involve site clearing, demolition and excavations, services installations, construction of building frame and envelope and landscaping. This phase will generate the highest potential noise impact due to the works involved, however, the phase is temporary to short-term.

The primary potential sources of outward noise in the operational context are long term and will comprise traffic movements to the site using the existing road network, potential outward noise from building services plant noise. These issues are discussed in detailed in this report.

The assessment of impacts has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out within the relevant sections of this report. In addition to specific guidance documents for the assessment of noise and vibration impacts which are discussed further in the relevant sections.

The study has been undertaken using the following methodology:

- An environmental noise survey has been undertaken in the vicinity of the subject site in order to characterise the existing baseline noise environment;
- A review of the most applicable standards and guidelines has been conducted in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- Predictive calculations have been performed during the construction phase of the project at the nearest sensitive locations to the development site;
- Predictive calculations have been performed to assess the potential impacts associated with the operational of the development at the most sensitive locations surrounding the development site;
- A noise risk assessment has been undertaken for the site in accordance with Professional Practice Guidance on Planning & Noise (ProPG) (2017) to determine the potential inward noise impacts to residential dwellings within the development ; and
- A schedule of mitigation measures will be proposed to reduce, where necessary, the identified potential outward impacts relating to noise and vibration from the proposed development.

3.1 Cherrywood Planning Scheme (2014 – Updated in 2018)

The following extract from the Cherrywood Planning Scheme (2014 – Updated in 2018) is of relevance here:

> *"2.13 Noise Sensitivity*
>
> *The Environmental Noise Regulations (2006) transpose into Irish law the EU Directive 2002/49/EC relating to the assessment and management of environmental noise, which is commonly referred to as the Environmental Noise Directive or END. The END defines a common approach intended to*

avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise.

In this context, Dún Laoghaire-Rathdown County Council in conjunction with Dublin City Council, South Dublin County Council and Fingal County Council, produced the Dublin Area Noise Action Plan and Noise Model. The findings of this model highlight that transportation related noise sources are the primary contributors to the existing noise environment in Cherrywood. AWN Consulting were commissioned by the Council to strategically assess the impact of the existing noise environment on the SDZ lands. These studies have influenced the development of the landuse strategy in the Planning Scheme. This influence, and the changes that it brought to the scheme are addressed fully through the strategic environmental assessment of the Planning Scheme, and are detailed in the Environmental Report that accompanies this scheme. Having regard to the studies undertaken, and the relationship of the SDZ lands to the M50, N11 and Wyattville Link Road, the noise sensitivity of proposed landuses must be considered in the location, design and form of development proposed.

Specific Objective:

PD 33 It is an objective to require all development proposals to undertake a detailed noise impact assessment, including noise survey, prior to the lodgement of any planning application. The noise survey shall be carried out in general accordance with International Standards Organization (ISO) 1996: 2007: Acoustics – Assessment, Description and Measurement of Environmental Noise. In residential proposals, this survey shall be undertaken for a period of not less than two weeks, and in non-residential areas it shall be undertaken for a period of not less than 1 day. The noise impact assessment shall include an assessment of the survey findings, and recommendations on mitigation and control measures to protect amenity. The noise impact assessment shall be lodged with the relevant planning application."

Section 2.13 of the Cherrywood Planning Scheme (2014 – Updated in 2018) references the Dún Laoghaire Rathdown County Council Noise Action Plan 2018 – 2023 (NAP). Consideration has been given to guidance contained within this document. Based on the content of this document, included within this report is an assessment of the impact of inward noise across the development site as per the guidance provided in the ProPG: Planning & Noise document.

3.2 ProPG: Planning & Noise

The Professional Guidance on Planning & Noise (ProPG 2017) document prepared by a working group comprising members of the Association of Noise Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH). Although not a UK or Irish government document, since its publication it has been generally considered as a best practice guidance and has been widely adopted in the absence of equivalent Irish guidance.

The ProPG outlines a systematic risk-based 2-stage approach for evaluating noise exposure on prospective sites for residential development. The two primary stages of the approach can be summarised as follows:

- Stage 1 – Comprises a high-level initial noise risk assessment of the proposed site considering either measured and or predicted noise levels; and,
- Stage 2 – Involves a full detailed appraisal of the proposed development covering four “key elements” that include:

- Element 1 - Good Acoustic Design Process;
- Element 2 - Noise Level Guidelines;
- Element 3 - External Amenity Area Noise Assessment, and;
- Element 4 - Other Relevant Issues.

A key component of the evaluation process is the preparation and delivery of an Acoustic Design Statement (ADS) which is intended for submission to the planning authority. This document is intended to clearly outline the methodology and findings of the Stage 1 and Stage 2 assessments, so as the planning authority can make an informed decision on the permission. ProPG outlines the following possible recommendations in relation to the findings of the ADS:

A. Planning consent may be granted without any need for noise conditions;
B. Planning consent may be granted subject to the inclusion of suitable noise conditions;
C. Planning consent should be refused on noise grounds in order to avoid significant adverse effects (“avoid”); or,
D. Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects (“prevent”).

Section 3.0 of the ProPG provides a more detailed guide on decision making to aid local authority planners on how to interpret the findings of an accompanying Acoustic Design Statement (ADS).

A summary of the ProPG approach is illustrated in Figure 2.

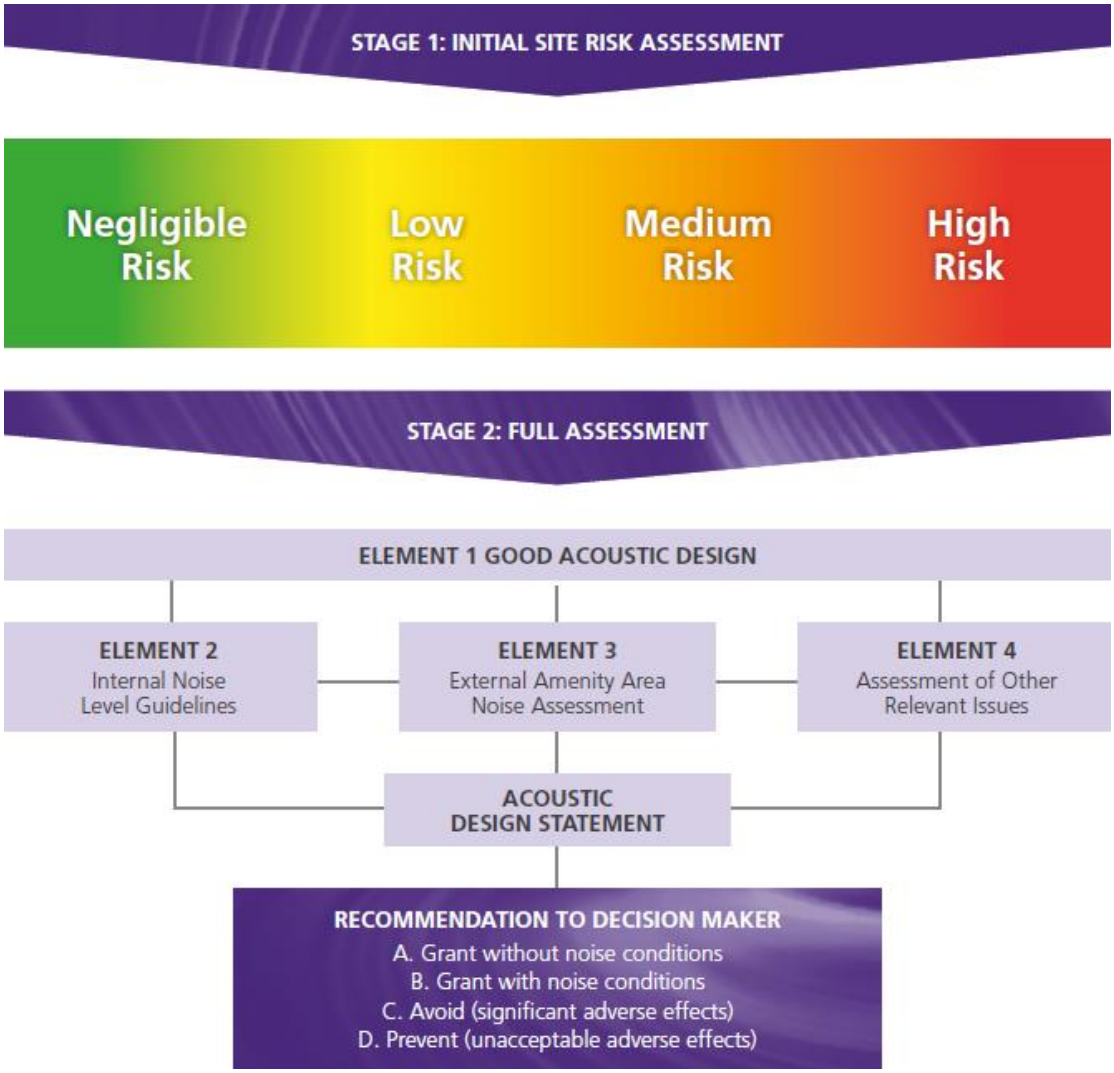

Figure 2 ***ProPG Approach (Source: ProPG)***

3.3 Internal Noise (BS 8233)

There are no statutory guidelines or specific local guidelines relating to appropriate internal noise levels in dwellings. In this instance, reference is made to BS 8233: 2014: *Guidance on sound insulation and noise reduction for buildings.*

BS 8233 sets out recommended internal noise levels for several different building types from external noise sources such as traffic. The guidance is primarily for use by designers and hence BS 8233 may be used as the basis for an appropriate schedule of noise control measures. The recommended indoor ambient noise levels for residential dwellings are set out in Table 1.

Activity	Location	Day (07:00 to 23:00hrs) dB $L_{Aeq,16hr}$	Night (23:00 to 07:00hrs) dB $L_{Aeq,8hr}$
Resting	Living room	35	-
Dining	Dining room/area	40	-
Sleeping (daytime resting)	Bedroom	35	30

Table 1 Indoor Ambient Noise Levels for Dwellings from BS8233: 2014

BS 8233 also provides some guidance on individual noise events, it states:

> *"Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or L_{AFmax}, depending on the character and number of events per night. Sporadic noise events could require separate values."*

3.4 Additional Traffic on Public Roads

In order to consider the potential noise impact associated with the proposed development introducing additional traffic onto the existing road networks and given that vehicle movements on public roads are assessed using a different parameter (the ten-percentile noise level; L_{A10}), it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the development in terms of the L_{A10} parameter.

In order to assist with the interpretation of the noise associated with vehicular traffic on public roads, Table 2 offers guidance as to the likely impact associated with any change in traffic noise level (Source DMRB).

Change in Sound Level (dB L_{A10})	Subjective Reaction	DMRB Magnitude of Impact
Less than 3.0	Inaudible	Negligible
3.0 – 4.9	Barely Perceptible	Minor
5.0 – 9.9	Perceptible	Moderate
5 – 9.9	Up to a doubling of loudness	Major

Table 2 Likely Impact Associated with Change in Traffic Noise Level

3.5 Offsite Noise Impacts

Once a development of this nature becomes fully operational, a variety of electrical and mechanical plant will be required to service the development. Most of this plant will be capable of generating noise to some degree. Some of this plant may operate 24 hours a day, and hence would be most noticeable during quiet periods (i.e. overnight).

BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

For an appropriate BS 4142 assessment it is necessary to compare the measured external background noise level (i.e. the $L_{A90,T}$ level measured in the absence of plant items) to the rating level ($L_{Ar,T}$) of the various plant items, when operational. Where noise emissions are found to be tonal, impulsive in nature or irregular enough to attract attention, BS 4142 also advises that a penalty be applied to the specific level to arrive at the rating level.

The subjective method for applying a penalty for tonal noise characteristics outlined in BS 4142 recommends the application of a 2dB penalty for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible.

The following definitions as discussed in BS 4142 as summarised below:

"ambient noise level, $L_{Aeq,T}$"	is the noise level produced by all sources including the sources of concern, i.e. the residual noise level plus the specific noise of mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"residual noise level, $L_{Aeq,T}$"	is the noise level produced by all sources excluding the sources of concern, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"specific noise level, $L_{Aeq,T}$"	is the sound level associated with the sources of concern, i.e. noise emissions solely from the mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"rating level, $L_{Ar,T}$"	is the specific sound level plus any adjustments for the characteristic features of the sound (e.g. tonal, impulsive or irregular components);
"background noise level, $L_{A90,T}$"	is the sound pressure level of the residual noise that is exceeded for 90% of the time period T.

If the rated plant noise level is +10dB or more above the pre-existing background noise level then this indicates that complaints are likely to occur and that there will be a significant adverse impact. A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is, relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

3.6 Construction Noise Impacts (BS 5228)

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the *British Standard BS 5228 – 1: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Noise*.

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities.

This document sets out guidance on permissible noise levels relative to the existing noise environment. Table 3 sets out the values which, when exceeded, signify a significant effect at the facades of residential receptors as recommended by BS 5228 – 1.

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends Note D	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

Table 3 Example Threshold of Significant Effect at Dwellings

Note A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
Note B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
Note C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
Note D) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

It should be noted that this assessment method is only valid for residential properties. Review of the measured noise levels in Section 4 indicates that all surrounding receptors will be categorised as Category A with a resultant 65 dB $L_{Aeq,T}$ threshold.

3.7 Review of Vibration Guidance

Peak particle velocity (PPV) is commonly used to assess the structural response of buildings to vibration. Reference to the following documents has been made for the purposes of this assessment in order to discuss appropriate PPV limit values.

- British Standard BS 7385: 1993: *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*, and;
- British Standard BS 5228-2: 2009 + A1: 2014: *Code of practice for noise and vibration control on construction and open sites – Vibration*.

BS 5228-2 and BS 7385 advise that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5 mm/s PPV the risk of damage tends to zero.

The recommended vibration limits in order to avoid cosmetic damage to buildings, as set out in both documents referred to above, are reproduced in Table 4. The documents note that minor structural damage can occur at vibration magnitudes which are greater than twice those presented in Table 4. Major damage to a building structure is possible at vibration magnitudes greater than four times the values set out in the Table. It should be noted that these values refer to the base of the building.

Vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
4 to 15 Hz	15 to 40Hz	40Hz and above
15 mm/s	20 mm/s	50 mm/s

Table 4 Transient Vibration Guide Values for Buildings

Human response to vibration stimuli occurs at orders of magnitudes below those associated with any form of building damage, hence vibration levels lower than those indicated in Table 4 can lead to concern. BS 5228-2 also provides a useful guide relating to the assessment of human response to vibration in terms of PPV. Table 5 below summarises the range of vibration values and the associated potential effects on humans.

Vibration Level, PPV	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies. At lower frequencies people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1 mm/s	It is likely that a vibration level of this magnitude in residential environments will cause complaint.

Table 5 Guidance on Effects of Human Response to PPV Magnitudes

The standards note that single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. Where these values are routinely measured or expected then an assessment in accordance with BS 6472-1 might be more appropriate to determine whether time varying exposure is likely to give rise to any degree of adverse comment.

4.0 EXISTING RECEIVING ENVIRONMENT

4.1 Noise Survey Locations

An environmental noise survey has been conducted at the site in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 2017: Acoustics – *Description, measurement and assessment of environmental noise.*

The noise measurement location was selected to represent the noise environment at the proposed development. This location, labelled UN1, is indicated in Figure 3 below.

Figure 3 Noise Survey Locations

4.2 Survey Periods

Unattended noise measurements at UN1 were conducted between 17 and 18 June 2024.

The weather during the survey period was dry with varying cloud cover. Wind speeds were moderate; however, they were not considered to have had a detrimental effect on the noise measurements. At the time of the install and collection, it was noted that the noise environment comprised of birdsong, light wind related foliage noise, and distant road traffic and construction noise.

4.3 Instrumentation

AWN installed and collected the noise monitoring equipment. The following instrumentation was used in conducting the noise and surveys:

Instrumentation	Type	Serial Number
Sound Level Meter	Rion NL-52	164426
Calibrator	Bruel & Kjaer 4231	2263026

Table 6 Instrumentation Details

4.4 Noise Measurement Parameters

The noise survey results are presented in terms of the following parameters.

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period.

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

L_{AFmax} is the instantaneous maximum sound level measured during the sample period using the 'F' time weighting.

The "A" suffix for the noise parameters denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

4.5 Survey Results

The results of the unattended monitoring survey at Location UN1 are summarised in Table 7, and a graph of the full dataset is observed in Figure 4.

Date	Period	Average Measured Noise Levels (dB re. $2x10^{-5}$ Pa)	
		$L_{Aeq,T}$	$L_{A90,T}$
17/6/2024 – 18/6/2024	Day (07:00 – 23:00)	47	43
	Night (23:00 – 07:00)	39	34

Table 7 Summary of Unattended Noise Measurements at UN1.

Table Note: L_{Aeq} Averages refer to logarithmic averages and L_{A90} averages refer to arithmetic averages.

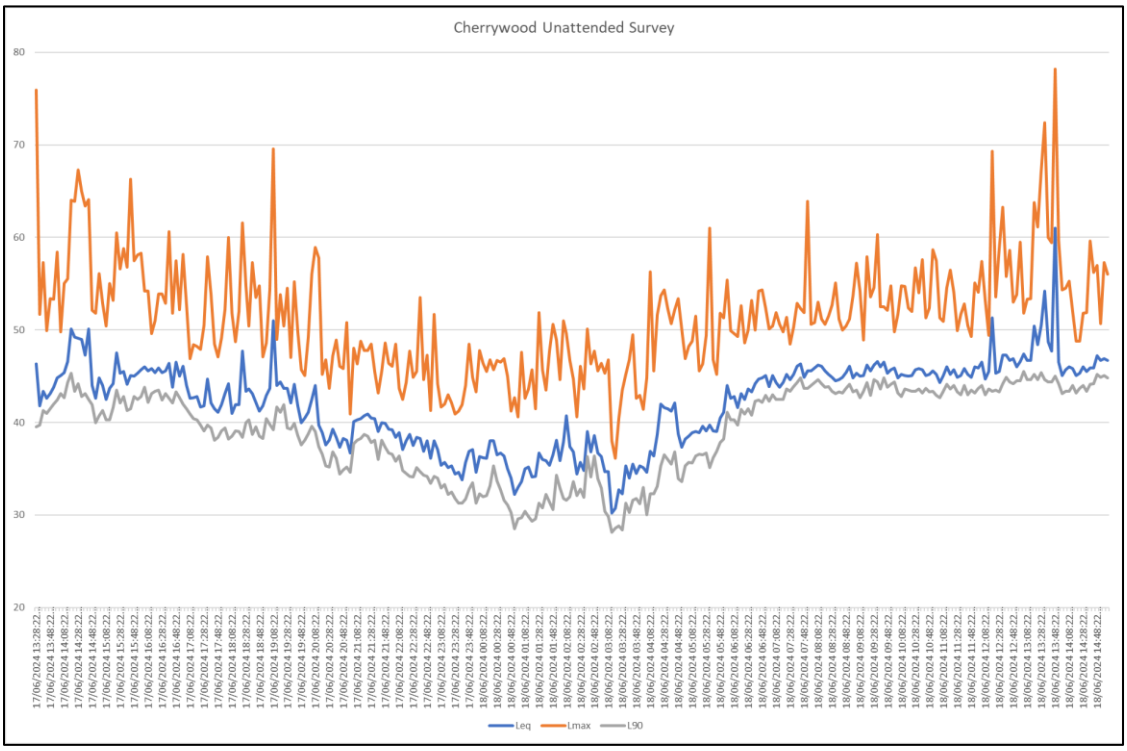

Figure 4 Noise Survey Results

During daytime periods, average noise levels were 47 dB $L_{Aeq,16hr}$ and 43 dB $L_{A90,16hr}$. During night-time periods, average noise levels were 39 dB $L_{Aeq,8hr}$ and 34 dB $L_{A90,8hr}$. Maximum levels range from 47 to 76 dB L_{AFmax} during the day and 36 to 61 dB L_{AFmax} during the night. The site location is noted as being a relative low noise environment considering the suburban location.

5.0 POTENTIAL IMPACTS

5.1 Construction Stage

Construction Noise

The construction stage will be undertaken over a number of phases from site preparation through to building construction and internal fit out. In terms of the potential noise and vibration impacts, the key stages and activities are expected to involve:

- Site clearance and demolition of existing structures;
- Ground works (excavation and piling);
- Superstructure Construction; and
- Internal fit out.

The construction programme will create typical construction activity related noise onsite. Indicative ranges of noise levels associated with construction may be calculated in accordance with the methodology set out in *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise*. This standard sets out sound power / sound pressure levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels.

The following section discusses typical noise levels associated with the proposed development construction phase and comments on potential noise impacts at distances to the nearest Noise Sensitive Locations (NSLs) during the key stages and types of activities that will occur on site.

Excavation and Rock Breaking

For construction works associated with activities such as excavation, there will be periods when breakers will be required to break out rocks within the ground. For this specific activity a total construction noise level of 92 dB L_{Aeq} at 10m has been used for the purposes of indicative calculations, however it should be noted that noise levels will be significantly lower for a large portion of the activity.

Piling

Piling will be undertaken for blocks A1, A2 and B. Reference to BS 5228 indicates that continuous flight augured piling etc. noise levels are typically in the range 82 dB L_{Aeq} at 10m. This value has been used for normal excavation works when rock breaking is not taking place.

Construction of Proposed Structures

For construction work areas with lower noise levels such as those associated with superstructure works including site compounds (for storage, offices and material handling, generators etc.), smaller items of mobile plant (excavators, cranes, dozers), landscaping and concreting works with lower noise emissions, a total construction noise level of 80 dB L_{Aeq} at 10m has been used for the purposes of indicative calculations. This would include, for example two items of plant at 75 dB L_{Aeq} and three items of plant at 70 dB L_{Aeq} operating simultaneously within a work area.

Indicative Construction Noise Levels

Indictive noise calculations have been undertaken which assume that plant items are operating for 66% of the time. Screening from a standard site hoarding of 2.4m is assumed around all site boundaries. It must be stated that for most of the time, plant and equipment will be a greater distance from the nearest NSLs than those used within the calculations and the "on-time" of plant and equipment will be less than those assumed over a normal working day (i.e. the use of piling rigs or breakers for ground excavations will be in use for shorter periods than those assumed over a normal working day) and consequently will have lower noise levels. The assessment presented is therefore representative of a best estimate conservative scenario representing construction activities. Table 8 presents the calculated noise levels at varying distances.

Activity	Predicted Construction Noise Level $L_{Aeq(1hour)}$ (dB)					
	10m	20m	30m	40m	50m	100m
Rock Breaking	85	79	75	73	71	65
Excavations and Piling Works	75	69	65	63	61	56
General Site Work including Superstructure and Fit out	73	67	63	61	59	53

Table 8 Calculated Construction Noise Levels at Varying Distances

Reference to the construction noise levels in Table 8 indicate that the daytime Construction Noise Threshold (CNT) of 65 dB $L_{Aeq,T}$ will be exceeded at the closest NSLs when activities are occurring along the closest site boundaries during all site activities. However, a range of noise levels will be experienced at the closest noise sensitive locations as works take place across the site at further distances.

During rock breaking, the CNT is likely to be exceeded at the closest NSLs when breakers are operating within 100m. This will be the shortest phase of works and the use of breakers will only occur for a portion of this phase at the site.

During piling works, there is potential for the CNT to be exceeded at distances of 30m and closer indicating that piling works for Block A1 will exceed the threshold at the two closest residential receptors north of the site - however the duration of this works is limited in the overall period of the construction phase of the project. Construction noise levels reaching 70 dB for temporary periods of time can be tolerated once advance notice is given to NSLs of the extent, timing and duration of the works.

Piling for Blocks A2 and B are predicted to be below the threshold of 65 dB $L_{Aeq,T}$ at the closest NSLs.

During the general site construction works involving construction of the site buildings, lower noise levels will be generated on site. There is potential for the CNT to be exceeded by a small margin at 20m and closer if working along the immediate boundaries. When works are occurring at 25m or greater distances from NSLs the works are likely to be within the CNT.

Noise mitigation measures will therefore be required on site to reduce construction noise levels along these boundaries to reduce any potential significant effects. Recommended mitigation measures are presented in Section 6.0 of this report.

Construction Vibration

Expected vibration levels during piling assuming augured or bored piles have been determined through reference to published empirical data. The British Standard BS 5228 – Part 2: Vibration, publishes the measured magnitude of vibration of rotary bored piling using a 600mm pile diameter for bored piling into soft ground over rock, (Table D.6, Ref. No. 106):

- 0.54mm/s at a distance of 5m, for auguring;
- 0.22mm/s at a distance of 5m, for twisting in casing;
- 0.42mm/s at a distance of 5m, for spinning off, and;
- 0.43mm/s at a distance of 5m, for boring with rock auger.

Taking into account the distance to the closest off site sensitive buildings on all perimeters, vibration emissions from this activity will be significantly reduced. Vibration levels at the closest neighbouring buildings **(20m)** will be orders of magnitude below the limits set out in Table 4 to avoid any cosmetic damage to buildings, and will be below the thresholds for human perception. The impacts are predicted to be short-term, negative and not significant.

During rock breaking, there is potential for vibration to be generated through the ground. Empirical data for this activity is not provided in the BS 5228-2:2009+A1:2014 (BSI 2014b) standard, however the likely level of vibration from this activity is expected to be significantly below the vibration criteria for building damage on experience from other sites. AWN Consulting Ltd have previously conducted vibration measurements under controlled conditions, during trial construction works, where breaking was carried out. The trial construction works consisted of the use of the following plant and equipment when measured at various distances:

- 3 tonne hydraulic breaker on small CAT tracked excavator; and
- 6 tonne hydraulic breaker on large Liebherr tracked excavator.

Vibration measurements were conducted during various staged activities and at various distances. Peak vibration levels during staged activities using the 3 Tonne Breaker ranged from 0.48 PPV (mm/s) to 0.25 PPV (mm/s) at distances of 10m to 50m respectively from the breaking activities. Using a 6 Tonne Breaker, measured vibration levels ranged between 1.4 PPV (mm/s) to 0.24 PPV (mm/s) at distances of 10m to 50m respectively.

Whilst these measurements relate to a breaking of concrete, the range of values recorded provides some context in relation typical ranges of vibration generated by construction breaking activity. The vibration levels experienced at surrounding receptors will be well below the criteria of cosmetic building damage, however, it will likely be perceptible when work is taking place at the closest locations to the receptors at distances of approximately 10m.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 4 during all activities. Mitigation and management of these works are discussed in Section 6.

5.2 Operational Stage - ProPG Stage 1 Noise Risk Assessment

The initial noise risk assessment is intended to provide an early indication of any acoustic issues that may be encountered. It calls for the categorisation of the site as a negligible, low, medium or high risk based on the pre-existing noise environment. Figure 5 presents the basis of the initial noise risk assessment, it provides appropriate

risk categories for a range of continuous noise levels either measured and/or predicted on site.

It should be noted that a site should not be considered a negligible risk if more than 10 L_{AFmax} events exceed 60 dB during the night period and the site should be considered a high risk if the L_{AFmax} events exceed 80 dB more than 20 times a night.

Paragraph 2.9 of ProPG states that,

> *"The noise risk assessment may be based on measurements or prediction (or a combination of both) as appropriate and should aim to describe noise levels over a "typical worst case" 24 hour day either now or in the foreseeable future."*

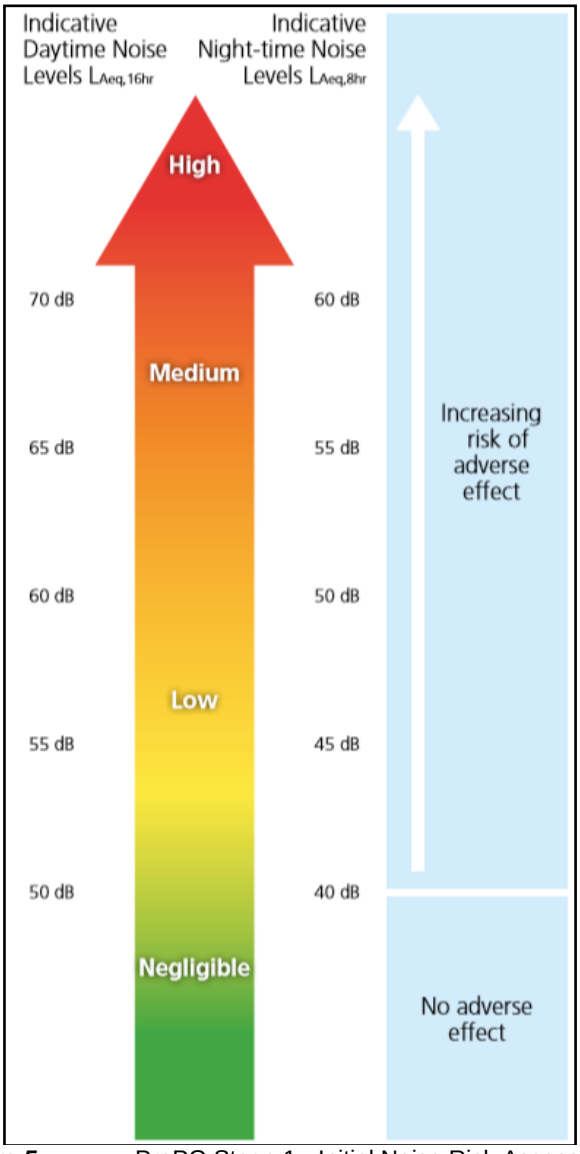

Figure 5 ProPG Stage 1 - Initial Noise Risk Assessment

Note that noise levels measured on site discussed in Section 4.5 are representative of the noise levels expected at the façade of the proposed residential units. Giving consideration to these noise levels, the assessment has concluded that the level of risk across the site is considered to be negligible. ProPG states the following with respect to negligible risks:

Negligible Risk *These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds*

Given the level of risk noted above, an Acoustic Design Statement (ADS) will not be required. It should be noted that the typical level of sound reduction offered by a partially open window falls in the region of 15 dB[1]. Considering the design goals outlined in Table 1, and a sound reduction across an open window of 15 dB, calculations indicate that occupants will be able to achieve the internal noise criteria with windows open, and hence no further mitigation is required.

5.3 Building Services Plant

Once operational, there may be building services plant items required to serve the proposed development. In this instance, it is best practice to set appropriate noise limits that will inform the detailed design during the selection of building services plant for the development. The cumulative operational noise level from building services plant at noise sensitive locations will be designed / attenuated to meet the relevant noise criteria for day and night-time periods as set out below.

Based on the baseline noise data the following criteria is proposed for plant noise:

- Dwellings within the development itself: 45 dB $L_{Aeq,15min}$
- Existing dwellings external to the development during the day: 43 dB $L_{Aeq,1hr}$
- Existing dwellings external to the development during the night: 34 dB $L_{Aeq,15min}$

Criteria has been set taking account of guidance from BS 4142 and BS 8233. For dwellings internal to the development where a change in noise level will not occur the criteria has been set to achieve the internal guidance night time noise levels in BS 8233 so that the guidance levels will be met when occupants have their windows open. For existing dwellings located off site the criteria has been set so that at most a low impact will occur as per the BS 4142 guidance.

5.4 Additional Traffic on Surrounding Roads

The proposed development site will generate traffic on the existing Lehaunstown Road once operational. The traffic has the potential to increase noise levels at existing residential receptors, consequently a traffic noise assessment has been undertaken to determine whether the increase in traffic will have an impact on receptors in this location.

The noise level associated with an event of short duration, such as a passing vehicle movement, may be expressed in terms of its Sound Exposure Level (L_{AX}). The Sound Exposure Level can be used to calculate the contribution of an event or series of events to the overall noise level in a given period.

The appropriate formula is given below:

$$L_{Aeq,T} = L_{AX} + 10\log10(N) - 10\log10(T) + 10\log10(r1/r2) \quad dB$$

where:

$L_{Aeq,T}$ is the equivalent continuous sound level over the time period T (in seconds);

[1] British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings

L_{AX} is the "A-weighted" Sound Exposure Level of the event considered(dB);
N is the number of events over the course of time period T;
r1 is the distance at which L_{AX} is expressed;
r2 is the distance to the assessment location.

The assumed mean value of Sound Exposure Level for cars and HGVs is in the order of 73 dB L_{AX} and 88 dB L_{AX} respectively at a distance of 5 metres. These values have been used to calculate the noise levels as a result of site traffic in isolation which results in a worst case peak hour value of 55 dB $L_{Aeq,1hr}$ at 5m from the road edge. Given that this is a peak hour value it can be concluded that noise levels from additional traffic will be lower outside of the peaks hours, and particularly during the night period. Hence, lower noise levels are expected outside of the peak hours.

Review of the Dublin agglomeration noise maps indicates that the existing noise levels on Lehaunstown Lane ranges between 55 – 60 dB L_{den}, which are reproduced in Figure 6. Based on a review of Brink *et al*.[2], to convert the L_{den} parameter used in the EPA noise mapping to the daytime $L_{Aeq,16hr}$ parameter of interest here, 2 dB should be subtracted from the mapped L_{den}. This correction has been adopted to give a mapped daytime traffic noise level range of between 53 and 58 dB $L_{Aeq,16hr}$ along Lehaunstown Lane.

Figure 6 EPA Round 4 Road Traffic Noise Mapping (L_{den})

Given the peak hour calculated noise levels for the development are 55 dB $L_{Aeq,1hr}$ and that noise levels are expected to be lower outside of the peak hours, it can be determined that, at worst, the generated noise levels are likely to be similar to the existing noise levels in the area and may increase noise levels by up to 3 dB. Hence, with reference to the guidance criteria set out in Table 2 it can be concluded that the increase will be negligible to minor.

6.0 MITGATION MEASURES

In order to ameliorate the likely noise impacts, a schedule of noise control measures has been formulated for both construction and operational phases.

[2] Title: *Conversion between noise exposure indicators L_{eq24h}, L_{Day}, $L_{Evening}$, L_{Night}, L_{dn} and L_{den}: Principles and practical guidance*. Authors: Mark Brink, Beat Schaeffer, Reto Pieren, Jean Marc Wunderli

6.1 Construction Phase

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) *Parts 1 and 2*. Whist construction noise and vibration impacts are expected to vary during the construction phase depending on the distance between the activities and noise sensitive buildings, the contractor will ensure that all best practice noise and vibration control methods will be used, as necessary in order to ensure impacts at off-site noise sensitive locations are minimised.

The best practice measures set out in BS 5228 (2009 +A1 2014) Parts 1 and 2 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- selection of quiet plant;
- noise control at source;
- screening,
- hours of work; and;
- liaison with the public.

Detailed comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures and screens around noise sources, limiting the hours of work and noise and vibration monitoring, where required.

Selection of Quiet Plant

The potential for any item of plant to generate noise should be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control “at source”. This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

Referring to the potential noise generating sources for the works under consideration, the following best practice migration measures should be considered:

- The lifting of bulky items, dropping and loading of materials will be restricted to normal working hours.
- Mobile plant should be switched off when not in use and not left idling.
- For piling plant, noise reduction can be achieved by enclosing the driving system in an acoustic shroud.
- For concrete mixers, control measures will be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.

- Demountable enclosures can also be used to screen operatives using hand tools (e.g. breakers) and will be moved around site as necessary.
- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

Screening

Screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. For demolition works it is recommended that, where practicable, localised screening is utilised around the works areas if breaking is undertaken. Propriety mobile screens are available that can provide up to 10 dB or more of noise attenuation when used as per the directions of the manufacturer.
In addition, careful planning of the site layout will also be considered. The placement of site buildings such as offices and stores will be used, where feasible, to provide noise screening when placed between the source and the receiver.

Liaison with the Public

A designated environmental liaison officer should be appointed to site during construction works. Any noise complaints should be logged and followed up in a prompt fashion by the liaison officer. In addition, where a particularly noisy construction activity is planned or other works with the potential to generate high levels of noise, or where noisy works are expected to operate outside of normal working hours etc., the liaison officer will inform the nearest noise sensitive locations of the time and expected duration of the noisy works.

Project Programme

The phasing programme will be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. While high noise generating works are in progress on a site at the same time as other works of construction that themselves may generate significant noise and vibration, the working programme will be phased so as to prevent unacceptable disturbance at any time.

Hours of Works

Construction works will be undertaken within the times below:

Monday to Friday	07:00 to 19:00hrs
Saturday	08:00 to 13:00hrs
Sunday and Public Holidays	No noisy work on site.

However, it may be necessary for some construction operations to be undertaken outside these times, for example, to facilitate connections to public service systems or utilities. Such works will be agreed in advance with Dun Laoghaire Rathdown County Council.

Monitoring

Where required, construction noise monitoring will be undertaken at periodic sample periods at the nearest noise sensitive locations to the development works to check compliance with the construction noise criterion.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2017: Acoustics – *Description, measurement and assessment of environmental noise.*

Where rock breaking and piling works are undertaken directly adjacent to receptor locations vibration monitoring will be undertaken to ensure that vibration levels remain within the defined criteria.

Vibration monitoring stations should continually log vibration levels using the Peak Particle Velocity parameter (PPV, mm/s) in the X, Y and Z directions, in accordance with BS ISO 4866: 2010: *Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures.*

6.2 Operational Phase

In order to ensure that acceptable operational noise levels at the nearest noise sensitive locations are achieved, the following mitigation measures should be considered during the detailed design stage.

6.2.1 Building Services Plant

Noise emissions from the plant areas will be designed to ensure that noise levels at the façade of the noise-sensitive locations both within the development and in the surrounding area do not exceed the criteria discussed at Section 5.3.

During the detailed design of the development, the selection and location of mechanical and electrical plant will be undertaken in order to ensure the noise emission limits set out above are not exceeded. In addition to selecting plant with suitable noise levels, the following best practice measures are recommended for all plant items in order to minimise potential noise disturbance for adjacent buildings:

- where ventilation is required for plant rooms, consideration will be given to acoustic louvers or attenuated acoustic vents, where required to reduce noise breakout;
- ventilation plant serving plant rooms and car parks will be fitted with effective acoustic attenuators to reduce noise emissions to the external environment;
- the use of perimeter plant screens will be used, where required, for roof top plant areas to screen noise sources;
- the use of attenuators or silencers will be installed on external air handling plant;
- all mechanical plant items e.g. fans, pumps etc. shall be regularly maintained to ensure that excessive noise generated any worn or rattling components is minimised;
- any new or replacement mechanical plant items, including plant located inside new or existing buildings, shall be designed so that all noise emissions from site do not exceed the noise limits outlined in this document, and;
- Installed plant will have no tonal or impulsive characteristics when in operation.

6.2.2 Additional Traffic on Surrounding Roads

Given the negligible or minor increase in traffic noise there are no mitigation measures in respect of additional traffic on surrounding roads.

7.0 CONCLUSION

An assessment of noise and vibration impacts associated with the proposed Lehaunstown Lane residential development has been undertaken.

The existing noise climate of the site has been surveyed during both daytime and night-time periods. The site is noted as having a relatively low noise level considering the suburban area.

The potential noise impact during the construction phase has been assessed at the nearest residential noise sensitive locations with reference to BS 5228 (2009 +A1 2014) - Part 1. The report has set out a range of predicted indicative construction noise levels associated with the varying construction phases in addition to best practice noise and vibration control measures to minimise the impact from this phase.

During the operational phase, potential sources of noise are considered to be limited to building services plant and additional traffic on surrounding roads. In respect of building services, plant selection at detailed design stage will ensure that the noise criteria set out in this report are met. Additional road traffic along Lehaunstown Lane is predicted to be of negligible or minor impact and mitigation measures are not predicted to be required.

An initial inward impact risk assessment has been undertaken with the resultant risks identified as negligible, hence no further mitigation is required in terms of inward noise impacts.

APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

ambient noise — The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.

background noise — The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ($L_{AF90,T}$).

broadband — Sounds that contain energy distributed across a wide range of frequencies.

dB — Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).

dB L_{pA} — An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

$L_{Aeq,T}$ — This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background. As standard it is measured using the fast time weighting constant of 125ms.

L_{AFN} — The A-weighted noise level exceeded for N% of the sampling interval. Measured using the "Fast" time weighting.

L_{AF90} — Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.

noise — Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.

noise sensitive location — NSL – Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

sound pressure level The sound pressure level at a point is defined as:

$$L_P = 20 \log \frac{P}{P_0} \text{ dB}$$

tonal Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.