13.0 NOISE AND VIBRATION

13.1 Introduction

This section of the EIAR has been prepared by AWN Consulting to assess the noise and vibration impact of the proposed development in the context of current relevant standards and guidance.

This assessment has been prepared by Leo Williams BAI MAI PgDip AMIOA, Acoustic Consultant at AWN Consulting who has over 9 years' experience as an environmental consultant specialising in Acoustics and Environmental Impact Assessment. He has authored numerous EIAR chapters for various developments including residential schemes, mixed-use developments, greenways and wind farms.

This chapter includes a description of the receiving ambient noise climate in the vicinity of the subject site and an assessment of the potential noise and vibration impact associated with the proposed development during both the short-term construction phase and the long-term operational phase on its surrounding environment. The assessment of cumulative noise and vibration impacts on the surrounding environment have been considered as part of the assessment.

Mitigation measures are included, where relevant, to control the noise and vibration emissions associated with both the construction and operational phases of the proposed development

13.2 Proposed Development

A full description of the development is available in Chapter 3 - Description of Development.

Elements relevant to noise and vibration during the construction phase include the demolition of existing structures, site clearance, excavation over the development site, the formation of the basement levels, construction of the new buildings and landscaping.

The proposed development primarily comprises apartments for residential purposes. Also included is a community space, a creche and a café/restaurant. The primary sources of outward noise during the operational phase are mechanical plant items that will serve the development and traffic travelling to and from the development. Inward noise from public road sources will also contribute to noise at the facades of the development buildings.

Figure 13.1 illustrates the site layout in context of its location.

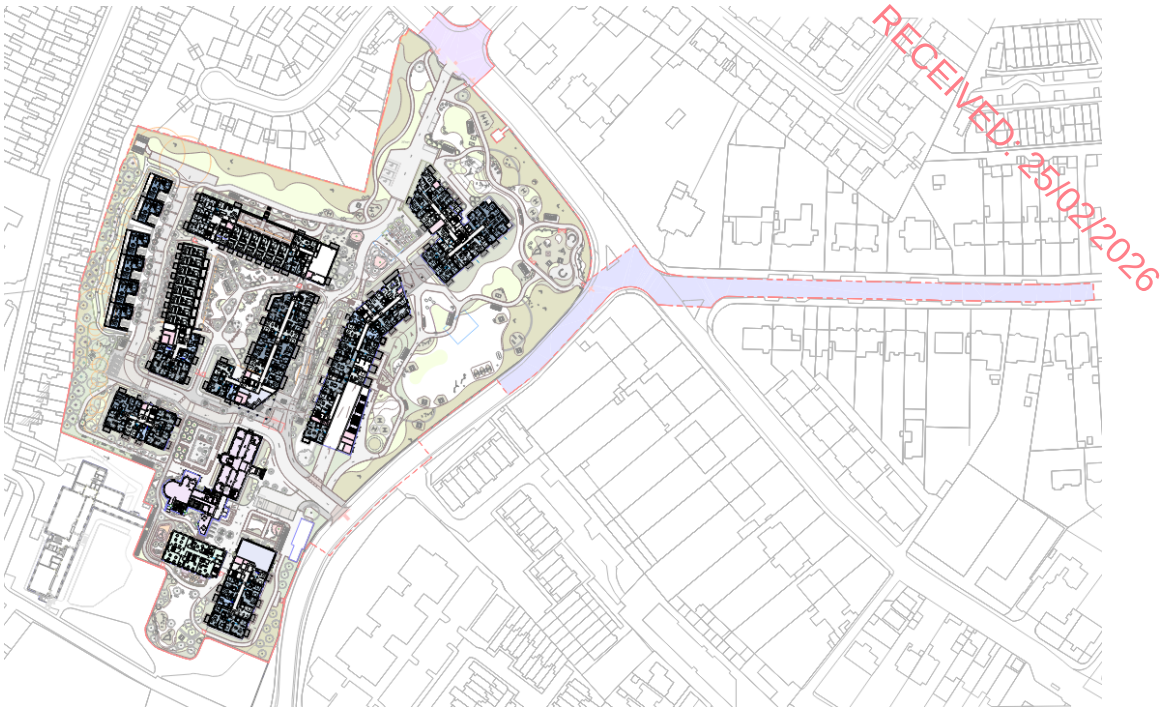


Figure 13.1: Proposed Site Layout (Source: OMP Architects)

13.3 Study Methodology

The assessment has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out in the following sections. In addition to specific noise and vibration guidance documents, the following Environmental Protection Agency (EPA) guidelines were considered and consulted in the preparation of this Chapter:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA 2022);
- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017)
- Directive 2011/92/EU of the European Parliament and of the Council of 13 phaseprojects on the environment;
- Directive 2014/52/EU of the European Parliament and of the Council of 16th April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment; and
- European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018).

This Chapter contains separate assessments for various aspects of the proposed development. The relevant criteria to each aspect are presented in Section 13.2.1 and referenced in each assessment section. In summary these include:

- British Standard Institute (BSI) British Standard (BS) 4142: 2014+A1:2019: Methods for Rating and Assessing Industrial and Commercial Sound (hereafter referred to as BS4142) (BSI 2019);
- BS 5228-1:2009 +A1 2014 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise (hereafter referred to as BS 5228–1) (BSI 2014a);
- BS 5228-2:2009+A1:2014 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration (hereafter referred to as BS 5228 – 2) (BSI 2014b);
- BS 8233:2014 Guidance on sound insulation and noise reduction for buildings (hereafter referred to as BS 8233–2) (BSI 2014c);
- BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings, Part 1 Vibration sources other than blasting (hereafter referred to as BS 6472–1) (BSI 2008);
- BS 7385: 1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration (hereafter referred to as BS 7385–2). (BSI 1993);
- Institute of Acoustics (IoA) ProPG: Planning and Noise. Professional Practice Guidance on Planning and Noise. New Residential Development. 2017. (hereafter referred to as ProPG) (IoA 2017).
- IoA Good Practice Guide on the Control of Noise from Pubs and Clubs (IoA 2003);
- IoA Code of Practice Guide on the Control of Noise from Pubs and Clubs (Draft) (IoA 1999);
- ISO 1996-2:2017 - Description, measurement and assessment of environmental noise - Part 2: Determination of sound pressure levels (hereafter referred to as ISO 1996 – 2) (ISO 2017);
- The UK Department of Transport Calculation of Road Traffic Noise (hereafter referred to as the CRTN) (UK Department of Transport 1998);
- ISO 1996-1:2016 Acoustics - Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures (hereafter referred to as ISO 1996 – 1) (ISO 2016);
- UK Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) LA 111 Sustainability & Environmental Appraisal LA 111 Noise and Vibration Revision 2 (hereafter referred to as DMRB Noise and Vibration) (UKHA 2020);

The study has been undertaken using the following methodology:

- Baseline noise monitoring has been undertaken across the development site to determine the range of noise levels at varying locations across the site;
- 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 to estimate the likely noise emissions during the construction phase of the project at the nearest sensitive locations (NSLs) to the site;
- Predictive calculations have been performed to assess the potential impacts associated with the operation of the development at the most sensitive locations surrounding the development site;

- An inward noise impact assessment has been undertaken considering the existing road noise sources impact on the proposed development; and,
- A schedule of mitigation measures has been proposed, where relevant, to control the noise and vibration emissions associated with both the construction and operational phases of the proposed development.

13.3.1 Criteria - Construction Phase

13.3.1.1 Noise

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.*

BS5228-1 gives several examples of acceptable limits for construction or demolition noise, the most simplistic being based upon the exceedance of fixed noise limits. For example, paragraph E.2 states:

> *"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut."*

Paragraph E.2 goes on to state:

> *"Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:*
> *70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;*
> *75 decibels (dBA) in urban areas near main roads in heavy industrial areas".*

Note that a typical planning condition in relation to construction noise issued by Local Authorities in Dublin refer also to compliance with BS 5228 Part 1 as a means of controlling impacts to the surrounding environment.

BS 5228-1, has therefore been used to inform the assessment approach for construction noise in line with normal practice.

For residential properties close to the proposed development, it is deemed appropriate to adopt a construction noise threshold of **70 dB(A)** during the daytime period. Construction noise levels above this will generate a potentially significant impact at adjacent residential properties. It is understood that no construction work will take place at night-time.

In order to assist with interpretation of significance, the UK Highways Agency (UKHA) Design Manual for Roads and Bridges includes guidance as to the likely magnitude of noise impact associated with Construction Noise Levels (CNL), relative to the CNT. This guidance is derived from the DMRB Noise and Vibration (2020) document and adapted to include the relevant significance effects from the EPA EIAR Guidelines (2022), using professional expertise and judgment.

In accordance with the DMRB Noise and Vibration (2020) document, construction noise and construction traffic noise impacts shall constitute a significant effect where it is determined that a DMRB major or moderate magnitude of impact will occur for a duration exceeding:

- Ten or more days or night in any 15 consecutive day or nights; and
- A total number of days exceeding 40 in any six consecutive months.

Table 13-1: Construction Noise Significance Rating

CNL per period	Classification of Impact		
	DMRB Classification of Impact	**EPA EIAR Guidelines**	**Determination**
Below or equal to baseline noise level	Negligible	Not Significant	Depending on range of CNT and baseline noise level
Above baseline and below or equal to CNT	Minor	Slight to Moderate Note 1	
Above CNT and Below or equal to CNT +5 dB	Moderate	Moderate to Significant	
Above CNT +5 dB and below or equal to CNT +15dB Note 2	Major	Significant to Very Significant	

Note 1: CNLs at the upper end of this range will result in higher potential impacts, therefore this range is `categorised as slight to moderate, acknowledging that values approaching the CNT are greater than slight. In accordance with DMRB, noise levels below the CNT are deemed 'Not Significant'.

Note 2: The DMRB does not distinguish beyond a 'Major' impact. For the purposes of distinguishing a Very Significant and Profound Impact, CNLs exceeding the CNT by +20dB are categorised as Profound.

13.3.1.2 Vibration

Vibration standards address two aspects: those dealing with cosmetic or structural damage to buildings and those dealing with human comfort. For the purpose of this assessment, the range of relevant criteria used for surface construction works for both building protection and human comfort are expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Reference to the following documents has been made for the purposes of this assessment in order to discuss appropriate PPV limit values.

- British Standard BS7385: 1993: *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*; and,
- British Standard BS5228-2: 2009 + A1: 2014: *Code of practice for noise and vibration control on construction and open sites – Vibration*.

- British Standard BS6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting.*

BS5228-2 and BS7385 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 BS7385 and BS5228-2, are reproduced in Table 13-2. The documents note that minor structural damage can occur at vibration magnitudes which are greater than twice those presented in Table 13-2. 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.

Table 13-2: Transient Vibration Guide Values for Cosmetic Damage

Building Category	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
Structurally sound and non-protected buildings	15 mm/s	20 mm/s	50 mm/s
Protected and /or potentially vulnerable buildings	6 mm/s	10 mm/s	25 mm/s

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 13.2 can lead to concern. BS5228-2 also provides a useful guide relating to the assessment of human response to vibration in terms of PPV. Whilst the guide values are commonly used to compare typical human response to construction works, they tend to relate closely to general levels of vibration perception from other general sources. Table 13-3 summarises the range of vibration values and the associated potential effects on humans.

Table 13-3: Guidance on effects of human response to PPV magnitudes

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.

The standards notes 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 is more appropriate to

determine whether time varying exposure is likely to give rise to any degree of adverse comment.

13.3.2 Criteria – Operational Phase

13.3.2.1 Noise

Mechanical Plant Noise

Planning conditions set by Local Authorities relating to noise emissions from mechanical plant items typically makes reference to the British Standard BS 4142: 2014+A1:2019 *Methods for Rating and Assessing Industrial and Commercial Sound*. This document is the industry standard method for analysing building services plant noise emissions to residential receptors and is the document typically used by Local Authorities in their standard planning conditions and also in complaint investigations.

BS 4142 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 2 dB penalty for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB 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, i.e. the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound, 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 +10 dB or more above the pre-existing background noise level, this indicates that complaints are likely to occur and that there will be a significant adverse impact at nearby noise sensitive locations, such as annoyance or sleep disturbance. A difference of around +5 dB 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 noise impact to nearby noise sensitive locations. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low noise impact.

Some items of mechanical plant serving the development will operate 24/7 and therefore the mechanical plant noise emissions must be designed to achieve the BS4142 requirements during the more sensitive night-time period when background noise levels are lower.

Therefore, in order to limit the noise impact of mechanical plant serving the proposed development, during the detailed design of the development the specific plant noise levels will be designed to be equal or lower to the prevailing background noise level at the nearest off-site NSLs.

Appropriate assessment periods are 1hr for daytime (07:00 to 23:00 hours) and 15 minutes for night-time (23:00 to 07:00 hours) as set out in BS4142.

Additional Vehicular Traffic

Given that traffic to and from the proposed development will make use of existing surrounding roads already carrying traffic volumes, i.e. Sandford Road and Milltown Road, it is appropriate to consider the increase in traffic noise level that arises as a result of vehicular movements associated with the operation of development.

In order to assist with the interpretation of the noise associated with vehicular traffic on public roads,

Table 13-4 offers guidance as to the likely impact associated with any particular change in traffic noise level based on the Design Manual for Roads and Bridges (Source UKHA, 2020). It shows that small changes in noise levels are not normally noticeable, whereas an increase of 10 dB would be described as a doubling of loudness. In summary the assessment looks at the impact with and without development at the nearest NSLs.

Table 13-4: Significance in Change in Noise Level

Change in Sound Level (dB L_{A10})	Subjective Reaction	DMRB magnitude of Impact	EPA Classification Magnitude of Impact
0	Inaudible	No Change	Neutral
0.1 – 2.9	Barely Perceptible	Negligible	Imperceptible
3 – 4.9	Perceptible	Minor	Slight
5 – 9.9	Up to a doubling of loudness	Moderate	Moderate

Entertainment Noise

There is potential for noise to be associated with amenity and cultural spaces. For the purposes of assessment this is categorised as 'entertainment' noise.

There is no Irish Standard or legislative guidance regarding the assessment of noise nuisance from entertainment source, e.g. music. However, it is good practice to specify a noise criterion relative to the existing noise levels and ensure that the proposed development has no significant impact on the nearest sensitive locations.

In the case of the proposed development there are several potential sources of entertainment noise located internally within the development across the proposed buildings. Section 13.5.3 discusses this in more detail.

The UK Institute of Acoustics (IOA) document *Good Practice Guide on the Control of Noise from Pubs and Clubs* (March 2003) contains recommendations for acoustic design criteria. This document however does not contain any objective assessment methods for music noise but defines what is considered to be inaudible music breakout as follows:

> *'Noise is considered to be inaudible when it is at low enough level such that it is not recognisable as emanating from the source in question and it does not alter the perception of the ambient noise environment that would prevail in the absence of the source in question.'*

Whilst a subjective assessment of audibility will identify the likelihood of a noise nuisance, it is considered prudent to assess any noise complaint on an objective basis with respect to noise.

In order to apply an objective criterion to permit a structured analysis, we propose that the following criterion is adopted for the assessment of the entertainment noise from the proposed development:

> *The $L_{Aeq,5min}$ level measured at the nearest noise sensitive location, with entertainment taking place, shall show no increase when compared with the representative $L_{Aeq,5min}$ level measured from the same position, under the same conditions and during a comparable period with no entertainment taking place; and*

The $L_{eq,5min}$ level in the 63 Hz and 125 Hz octave bands at the nearest noise sensitive location, with entertainment taking place, should show no increase when compared with the representative $L_{eq,5min}$ level in the 63 Hz and 125 Hz octave bands measured from the same position, under the same conditions and during a comparable period with no entertainment taking place.

This criterion is based on the guidance contained within the Draft IOA *Code of Practice Guide on the Control of Noise from Pubs and Clubs* (November 1999), which is guidance for the control of music noise breakout.

Creche Play Area

For other non-traffic related sources, e.g. the creche, appropriate guidance on internal noise levels for dwellings is contained within BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings. This British Standard sets out recommended noise limits for indoor ambient noise levels in dwellings as summarised in Table 13-5.

Table 13-5: Recommended Indoor Ambient Noise Levels

Typical situations	Design Range, $L_{Aeq,T}$ dB	
	Daytime $L_{Aeq,16hr}$ (07:00 to 23:00hrs)	Night-time $L_{Aeq,8hr}$ (23:00 to 07:00hrs)
Living / Dining Rooms	35 / 40	n/a
Bedrooms	35	30

In relation to assessment of noise levels associated with the creche, it is appropriate to derive external limits based on the internal criteria. These are set out in Table 13-5. This is done by factoring in the degree of noise reduction afforded by a partially open window and typical 15 dB attenuation is noted in this British Standard. Using this correction value across an open window, the following external noise levels would achieve the internal noise levels noted in Table 13-5 above. The creche will not operate during the night-time, i.e. 23:00 to 07:00 hours.

- Daytime / Evening (07:00 to 23:00 hours) 50 - 55dB $L_{Aeq,1hr}$

Noise emissions from creche activity will be controlled to ensure that the resultant noise level outside the façade of any nearby dwelling, both on and offsite, will not exceed the noise level above.

Inward Noise Impact

This section considers the potential for noise impacts inwards on the proposed development, due to existing and future noise sources such as noise from roads in proximity to the site.

The Professional Practice Guidance on Planning & Noise (ProPG) document was published in May 2017. The document was 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 government document, since its adoption, it is considered 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.

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 13.2 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.

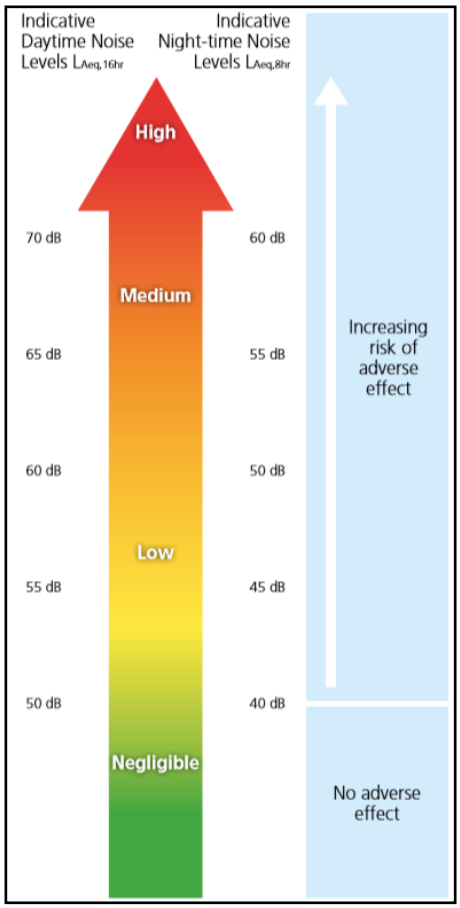


Figure 13.2: ProPG Stage 1 - Initial Noise Risk Assessment

Further, if more than 20 No. L_{AFmax} events exceed 80 dB during the night period, the site should be considered a high noise risk.

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 (2014). The recommended indoor ambient noise levels are set out in **Table 13-6** and are based on annual average data, that is to say they omit occasional events where higher intermittent noisy events may occur.

Table 13-6: ProPG Internal Noise Levels

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 dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,T}$*

***Note The document comments that the internal $L_{AFmax,T}$ noise level may be exceeded no more than 10 times per night without a significant impact occurring.**

In addition to these absolute internal noise levels, ProPG provides guidance on flexibility of these internal noise level targets. For instance, in cases where the development is considered necessary or desirable, and noise levels exceed the external noise guidelines, then a relaxation of the internal L_{Aeq} values by up to 5 dB can still provide reasonable internal conditions.

ProPG provides the following advice with regards to external noise levels for amenity areas in the development:

"The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$."

13.3.2.2 Vibration

Taking into account the expected activities associated with the operational phase of the proposed development, it is not anticipated that there will be any outward vibration impact associated. No further assessment of operational vibration is presented.

13.4 Receiving Environment

This section will describe the baseline situation of the site at present. Survey locations are selected in order to obtain baseline noise levels at nearby noise sensitive receivers in order to set appropriate noise criteria for the construction and operational phases of the development.

Noise surveys undertaken on site are described below and the monitoring locations illustrated on the site plan in Figure 13.3. The indicative redline boundary is illustrated in a dashed line.

13.4.1 Survey Periods

Noise surveys were carried out at the five locations by AWN over the following periods:

Table 13-7: Survey Periods

Survey	Date	Start Time	End Time
Attended Measurements	27 February 2020	11:20	15:20
	17 November 2025	13:18	18:05
Unattended Measurements	27 February to 3 March 2020	11:00	12:30
	17 to 18 November 2025	13:00	13:30

The attended surveys were carried out during weekdays to obtain typical prevailing noise levels.

13.4.2 Survey Locations

To account for the varying noise environment across the proposed site and at the nearest noise sensitive receivers, 5 No. survey locations were chosen in order to capture representative prevailing noise levels.

Descriptions of the measurement locations are as follows:

NM1 Located in the south west of the site close to houses at Upper and Lower Cherryfield Avenue.
NM2 Located in the north of the site, inside the gate onto Sandford Road.
NM2 (2025) Located to the north of the site, outside the gate onto Sandford Road.
NM3 Located in front of apartments at Mound Sanford, off the Milltown Road.
NM4 Located close to houses at Garrynure, to the south of the site.
UN1 Unattended monitoring location positioned at a location representative of the proposed building façade.

13.4.3 Survey Procedure

Attended measurement periods were 15 minutes long. The results were saved to the instrument memory for later analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up. The unattended monitor was configured to log noise levels continuously in 5 minute samples.

13.4.4 Instrumentation

The surveys were performed using the equipment listed below.

Attended survey: Bruel & Kjaer 2250 (serial number: 3008402).
Rion NL-52 (serial number: 586940).

Unattended survey: Rion NL-52 (serial number: 1076328).
Rion NL-52 (serial number: 00251904).

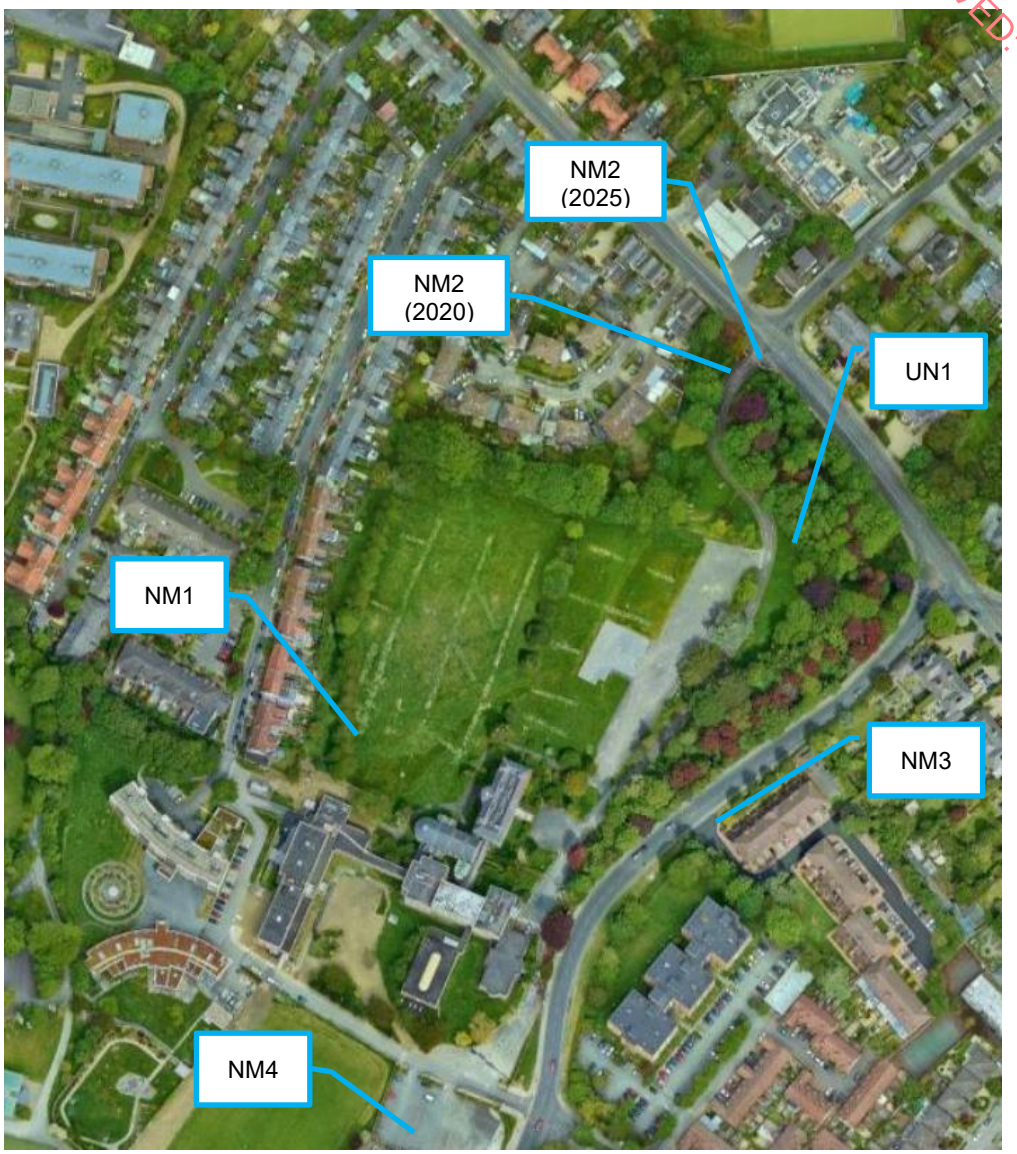


Figure 13.3: Site Layout and Survey Locations

13.4.5 Measurement Parameters

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

Table 13-8: Acoustic Parameters

Parameter	Description
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_{Amax}	is the maximum sound pressure level recorded during the sample period.

Parameter	Description
L_{Amin}	is the minimum sound pressure level recorded during the sample period.
L_{A10}	is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for background noise.
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.

The "A" suffix 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.

13.4.6 Survey Results

Location NM1

Table 13-9: Summary of Attended Measured Noise Levels – NM1

Date	Time	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AFmin} (dB)	L_{A10} (dB)	L_{A90} (dB)
27 February 2020	11:40	48	57	44	49	45
	12:20	47	58	43	50	45
	13:00	54	67	45	58	48
17 November 2025	13:48	46	55	37	45	44
	15:12	49	68	41	50	44
	17:05	43	55	37	44	40

2020 Survey

It was noted during the noise survey that the primary source of noise was distant road traffic on the Milltown Road and Sandford Road. Birdsong, intermittent construction noise and plant noise from existing site buildings also provided a contribution to the overall noise environment. Ambient noise levels were in the range 48 – 54 dB L_{Aeq}. Background noise levels were in the range 45 – 48 dB L_{A90}.

2025 Survey

During this survey distant road traffic was also noted as the primary noise source, originating from the direction of the Milltown Road and Sandford Road. Intermittent birdsong and distant construction noise were also noted as contributing noise sources. Ambient noise levels were in the range 43 – 49 dB L_{Aeq}. Background noise levels were in the range 40 – 44 dB L_{A90}.

Location NM2

Table 13-10: Summary of Attended Measured Noise Levels – NM2

Date	Time	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AFmin} (dB)	L_{A10} (dB)	L_{A90} (dB)
27 February 2020	11:20	64	75	51	68	55
	12:00	65	76	49	68	55
	12:40	65	75	49	68	55
17 November 2025	13:18	72	81	54	75	60
	14:48	76	81	50	73	58
	16:45	67	77	46	71	57

2020 Survey

It was noted during the noise survey that the primary source of noise was road traffic on the Sandford Road. Birdsong, passing sirens and helicopter movements also provided a contribution to the overall noise environment. Ambient noise levels were in the range 64 – 65 dB L_{Aeq}. Background noise levels were of the order of 55 dB L_{A90}.

2025 Survey

During this survey, the survey location was located around half the distance to the main road in comparison to the 2020 survey.

It was noted during the noise survey that the primary source of noise was road traffic on the Sandford Road. Other noise sources included passing pedestrian activity, birdsong and intermittent sirens. Ambient noise levels were in the range 67 – 76 dB L_{Aeq}. Background noise levels were in the range 57 – 60 dB L_{A90}.

Location NM3

Table 13-11: Summary of Attended Measured Noise Levels – NM3

Date	Time	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AFmin} (dB)	L_{A10} (dB)	L_{A90} (dB)
27 February 2020	13:25	73	83	52	76	63
	14:05	73	82	52	76	61
	14:43	73	82	50	77	63
17 November 2025	14:24	74	82	50	77	64
	16:21	70	82	44	74	58
	17:50	72	81	45	75	60

2020 Survey

It was noted during the noise survey that the primary source of noise was road traffic on the Milltown Road. Birdsong and passing pedestrian activity also provided a contribution to the

overall noise environment. Ambient noise levels were of the order of 73 dB L_{Aeq}. Background noise levels were in the range 61 – 63 dB L_{A90}.

2025 Survey

It was noted during the noise survey that the primary source of noise was road traffic on the Milltown Road. Other noise sources included passing pedestrian activity, birdsong and intermittent sirens. Ambient noise levels were in the range 70 – 74 dB L_{Aeq}. Background noise levels were in the range 58 – 64 dB L_{A90}.

Location NM4

Table 13-12: Summary of Attended Measured Noise Levels – NM4

Date	Time	L_{Aeq} (dB)	L_{AFmax} (dB)	L_{AFmin} (dB)	L_{A10} (dB)	L_{A90} (dB)
27 February 2020	13:46	55	70	45	57	50
	14:25	54	62	45	56	50
	15:01	54	67	44	57	49
17 November 2025	14:06	55	66	41	58	48
	15:35	53	73	42	57	47
	17:29	52	65	40	55	46

2020 Survey

It was noted during the noise survey that the primary source of noise was road traffic on the Milltown Road. Birdsong and passing pedestrian activity also provided a contribution to the overall noise environment. Ambient noise levels were in the range 54 – 55 dB L_{Aeq}. Background noise levels were in the range 49 – 50 dB L_{A90}.

2025 Survey

It was noted during the noise survey that the primary source of noise was road traffic on the Milltown Road. Other contributing noise sources included vehicle movements elsewhere in the car park, voices of pedestrians, activity on a nearby sports pitch and intermittent noises such as car horns and doors closing. Ambient noise levels were in the range 52 – 55 dB L_{Aeq}. Background noise levels were in the range 46 – 48 dB L_{A90}.

Location UN1 – 2020 Survey

The unattended measurements collected over the 2020 survey period are summarised below.

Table 13-13: Summary of Measured Noise Levels at UN1 (dB re. 2x10-5 Pa)

Date		Period	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
			L_{Aeq}	L_{Amax}	L_{A90}
2020	27 Feb	Day	56	64	52
		Night	53	61	45
	28 Feb	Day	57	66	54
		Night	54	62	50

Date		Period	Measured Noise Levels (dB re. 2×10^{-5} Pa)		
			L_{Aeq}	L_{Amax}	L_{A90}
	29 Feb	Day	62	71	57
		Night	60	69	54
	1 Mar	Day	56	64	52
		Night	51	62	40
	2 Mar	Day	56	65	53
		Night	52	61	46
	3 Mar	Day	57	66	55
	Average	Day	58	66	54
		Night	55	63	47

Daytime ambient noise levels were in the range of 56 to 62 dB L_{Aeq}. Daytime average maximum levels ranged from 64 to 71 dB L_{Amax}. Background noise levels were in the range of 52 to 57 dB L_{A90}.

Night-time ambient noise levels were in the range of 52 to 60 dB L_{Aeq}. Night-time average maximum levels ranged from 61 to 69 dB L_{Amax}. Background noise levels were in the range of 40 to 54 dB L_{A90}.

In addition, the L_{AFmax} values were measured over 15-minute intervals over the duration of the unattended monitoring survey. Figure 13.4 presents the number of measured L_{AFmax} events for each decibel level during the night period measured at Location UN1. On review of the maximum noise levels the value of 68 dB L_{AFmax} is not regularly exceeded on a given night (less than 10 events).

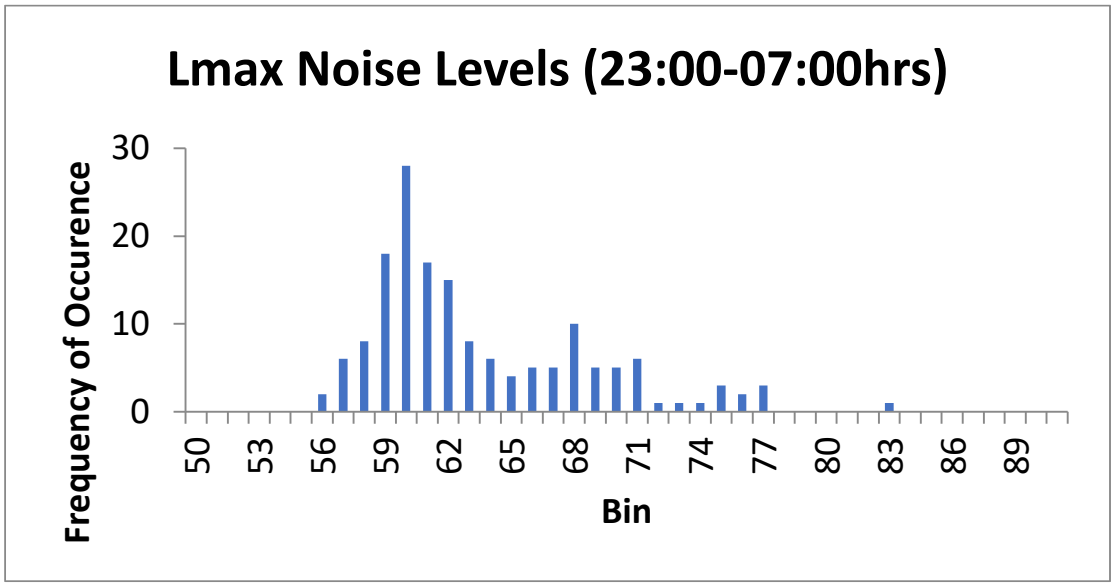


Figure 13.4: Distribution of L_{Amax} events – Night-time (2020)

Location UN1 – 2025 Survey

The unattended measurements collected over the 2025 survey period are summarised below.

Table 13-14: Summary of Measured Noise Levels at UN1 (dB re. 2x10-5 Pa)

Date		Period	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)		
			L_{Aeq}	L_{Amax}	L_{A90}
2025	17 Nov	Day	54	83	49
		Night	48	72	38
	18 Nov	Day	55	82	52

Daytime ambient noise levels were in the range of 54 to 55 dB L_{Aeq}. Daytime maximum levels peaked at 83 dB L_{Amax}. Background noise levels were in the range of 49 to 52 dB L_{A90}.

Night-time ambient noise levels were of the order of 48 dB L_{Aeq}. Night-time maximum levels peaked at 72 dB L_{Amax}. Background noise levels were of the order of 38 dB L_{A90}.
In addition, the L_{AFmax} values were measured over 15-minute intervals over the duration of the unattended monitoring survey. Figure 13.5 presents the number of measured L_{AFmax} events for each decibel level during the night period measured at Location UN1. On review of the maximum noise levels the value of 68 dB L_{AFmax} is not regularly exceeded on a given night (less than 10 events).

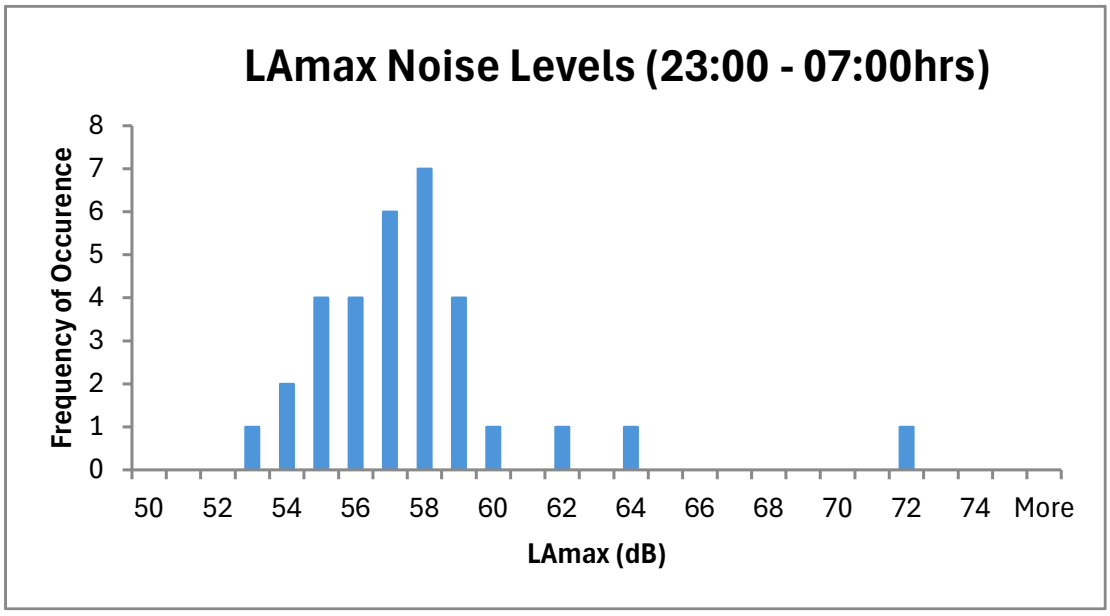


Figure 13.5: Distribution of L_{Amax} events – Night-time (2025)

Generally, noise levels measured during the 2025 baseline noise survey were lower than those measured in 2020. It is noted that the sample duration was shorter and potentially does not capture any variability in conditions over a longer time period.

During the attended surveys which were undertaken later in the afternoon, heavy, slow moving traffic was noted on the Sandford and Milltown roads. Typically, lower noise levels are observed from slow moving traffic when compared to free-flowing traffic.

Review of the unattended noise monitoring data shows lower levels than the 2020 survey, particularly at night-time. It is possible that a noise source near to the monitoring position present in 2020 was not present in 2025. Differing weather conditions are also a possible factor.

Based on the above, the assessment of inward noise impact on proposed development buildings has been undertaken using the data measured during the 2020 noise survey as a worst case scenario.

13.5 Predicted Likely Impacts

Taking into account the characteristics of the proposed development, there is the potential for noise and vibration impacts during the short-term construction phase associated with construction activities and mobile plant, etc. During the long-term operational phase of the development there is a potential impact associated with noise emissions from mechanical plant items and from an increase in traffic coming to and from the proposed site. Noise from amenity spaces such as gym areas and the creche has also been assessed under the operational phase.

13.5.1 Construction Phase – Noise

The proposed general construction hours are 07:00 to 19:00hrs, Monday to Friday and 09:00 to 13:00 on Saturdays. Due to the type of daytime activities undertaken on a construction site of this nature, there is potential for generation of significant levels of noise.

Reference has been made to reference noise levels set out in BS5228-1 in order to predict typical noise levels associated with the construction activities anticipated. Table 13-15 outlines typical plant items and associated noise levels that are anticipated for various phases of the construction programme at a standard reference distance of 10 metres from the various plant items.

Various construction methods of basement levels are currently under consideration. Each option is described below based on information provided by DBFL Consulting Engineers and have been presented in the table below for comparison and impact assessment.

Basement/Foundation Construction

The construction methods being considered for construction of foundation level are as follows:

- **Option A** – Standard pad and strip foundations to all blocks.
- **Option B** – Bored piles for Blocks D and F. Standard pad and strip to all other blocks.
- **Option C** – Ground improvement technique at Block E. Standard pad and strip to all other blocks.

Options B and C will utilise either bored piles or continuous flight auguring. The reference sound pressure levels set out in BS5228 are 80 dB L_{Aeq} and 83 dB L_{Aeq} for continuous flight auguring and bored piles respectively.

In addition to the above, sheet piles may be required for the erection of temporary retaining walls around tree roots and protected structures. This activity has been assumed as a part of each option listed above.

Table 13-15: Assumed Plant Items Reference Noise Levels

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	Construction Noise Level at 10m Distance (dB L_{Aeq})
Site Preparation	Wheeled Loader Lorry (D3 1)	75
	Tracked Excavator (C2 22)	72
	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
Demolition	Pulveriser on Tracked Excavator (C1.5)	72
	Tracked Crusher (C1.14)	82
	Breaker Mounted on Backhoe (C1.2)	92
	Dump Truck (C4.2)	78
Foundation Works	Option A	
	Tracked Excavator (C2 22)	72
	Dozer (C2.13)	78
	Concrete Pump (C3.25)	78
	Compressor (D7 6)	77
	Poker Vibrator (C4 33)	78
	Dump Truck (C4.2)	78
	Sheet Steel Piles – Hydraulic Hammer (D3.13)	78
	Option B	
	Tracked Excavator (C2.22)	72
	Dozer (C2.13)	78
	Concrete Pump (C3.25)	78
	Compressor (D7 6)	77
	Poker Vibrator (C4 33)	78
	Dump Truck (C4.2)	78
	Sheet Steel Piles – Hydraulic Hammer (D3.13)	78
	Piling Rig	80-83
	Option C	
	Tracked Excavator (C2 22)	72
	Dozer (C2.13)	78
	Concrete Pump (C3.25)	78
	Compressor (D7 6)	77
	Poker Vibrator (C4 33)	78
	Dump Truck (C4.2)	78
	Sheet Steel Piles – Hydraulic Hammer (D3.13)	78

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	Construction Noise Level at 10m Distance (dB L_{Aeq})
	Piling Rig	80-83
	Batching Plant (Lime preparation) (D6.10)	78
	Road Roller (D3.114)	80
General Construction	Hand tools	81
	Tower Crane (C4.48)	76
	Pneumatic Circular Saw (D7.79)	75
	Internal fit – out	70
Landscaping	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
	Surfacing (D8.25)	68

The predicted daytime noise levels from an indicative construction period on site at the nearest off-site receptor have been calculated. Note construction noise sources for site are assumed to be running 66% of the time over soft ground. Piling operations are assumed to be running 50% of the time. The predictions have been prepared at various representative noise sensitive at various locations across the site. The nearest NSLs to the development have been identified and are illustrated in Figure 13.6.

NSL 1 Houses to the west and north of site at Norwood Park and Upper and Lower Cherryfield Avenue, some 10 – 15m from areas of major works.

NSL 2 Accommodation at the Jesuit Community Buildings, some 25m from areas of major works.

NSL 3 Apartments to the east of site on Milltown Road, some 40m from areas of major works.

NSL 4 Houses north of site on Sandford Road, some 50m from areas of major works

Figure 13.6: Identified Sensitive Locations – Residential

The predicted construction noise associated with each of the expected construction activities is presented below for various distances from areas of major works. Not all work types are anticipated to take place across the site, distances between activities and sensitive receivers are taken into account.

Table 13-16: Predicted Construction Noise Emission Levels

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	Construction Noise Level at Distance (dB L_{Aeq})			
		NSL1 (15m)	NSL2 (25m)	NSL3 (40m)	NSL4 (50m)
Site Preparation	Wheeled Loader Lorry (D3 1)	65	60	56	54
	Tracked Excavator (C2 22)	62	57	53	51
	Dozer (C2.13)	68	63	59	57

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	Construction Noise Level at Distance (dB L_{Aeq})			
		NSL1 (15m)	NSL2 (25m)	NSL3 (40m)	NSL4 (50m)
	Dump Truck (C4.2)	68	63	59	57
	Cumulative	**72**	**68**	**64**	**62**
Demolition*	Pulveriser on Tracked Excavator (C1.5)	48	56	48	44
	Tracked Crusher (C1.14)	58	66	58	54
	Breaker Mounted on Backhoe (C1.2)	68	76	68	64
	Dump Truck (C4.2)	54	62	54	50
	Cumulative	**69**	**76**	**69**	**64**
Foundations	Option A				
	Tracked Excavator (C2 22)	62	57	53	51
	Dozer (C2.13)	68	63	59	57
	Concrete Pump (C3.25)	68	63	59	57
	Compressor (D7 6)	67	62	58	56
	Poker Vibrator (C4 33)	68	63	59	57
	Dump Truck (C4.2)	68	63	59	57
	Sheet Steel Piles – Hydraulic Hammer (D3.13)	64	62	58	58
	Cumulative	**75**	**71**	**67**	**65**
	Option B				
	Tracked Excavator (C2 22)	62	57	53	51
	Dozer (C2.13)	68	63	59	57
	Concrete Pump (C3.25)	68	63	59	57
	Compressor (D7 6)	67	62	58	56
	Poker Vibrator (C4 33)	68	63	59	57
	Dump Truck (C4.2)	68	63	59	57
	Sheet Steel Piles – Hydraulic Hammer (D3.13)	65	62	59	58
	Piling Rig	66-69	62-65	59-62	50-53
	Cumulative	**76**	**72**	**68**	**65**
	Option C				
	Tracked Excavator (C2 22)	62	57	53	51
	Dozer (C2.13)	68	63	59	57
	Concrete Pump (C3.25)	68	63	59	57
	Compressor (D7 6)	67	62	58	56
	Poker Vibrator (C4 33)	68	63	59	57
	Dump Truck (C4.2)	68	63	59	57
	Sheet Steel Piles – Hydraulic Hammer (D3.13)	64	62	58	58
	Piling Rig	66-69	62-65	59-62	50-53
	Batching Plant (Lime preparation) (D6.10)	65	65	51	48
	Road Roller (D3.114)	67	67	53	50
	Cumulative	**77**	**73**	**68**	**66**

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	Construction Noise Level at Distance (dB L_{Aeq})			
		NSL1 (15m)	NSL2 (25m)	NSL3 (40m)	NSL4 (50m)
General Construction	Hand tools	71	66	62	60
	Tower Crane (C4.48)	66	61	57	55
	Pneumatic Circular Saw (D7.79)	65	60	56	54
	Internal fit – out	60	55	51	49
	Cumulative	**73**	**68**	**64**	**62**
Landscaping	Dozer (C2.13)	65	60	56	54
	Dump Truck (C4.2)	58	53	49	47
	Surfacing (D8.25)	65	60	56	54
	Cumulative	**68**	**64**	**60**	**58**

* Demolition limited to area around the Chapel, not required site-wide.

It is important to note that the calculations set out above are based on assumed site activity and a combination of plant items operating simultaneously, as such they are typically worst-case scenarios. The use of construction noise and vibration mitigation measures will be employed during the construction phase with a view to minimising noise impacts.

Site Preparation

The cumulative predicted noise level associated with site preparation activities listed in Table 13-16 are predicted to exceed the threshold of 70 dB $L_{Aeq,1hr}$ at 15m distance from works, i.e. the level above which a significant noise impact is predicted to occur. This worst case assumes several plant items in operation at the closest point to a nearby noise sensitive receiver. Note that this impact will be short-term in nature and will only occur when works take place in close proximity to the site boundary.

At distances of 25m and more from works, the predicted cumulative noise levels are below the threshold and therefore a significant impact is not predicted.

Demolition

The cumulative predicted noise level associated with demolition activities listed in Table 13-16 are predicted to be just below the threshold of 70 dB $L_{Aeq,1hr}$, above which a significant noise impact is predicted to occur. Demolition is anticipated only in the area of the Chapel, therefore predicted noise levels are highest at NSL2, where there is a short-term significant impact predicted in the absence of mitigation.

Foundations

At distances of 15-40m from works, the cumulative predicted noise levels associated with foundation construction, listed in Table 13-16, range from 66 – 80 dB for the options listed and therefore a short-term significant noise impact is predicted.

Options A, B and C are comparable in terms of predicted noise levels, with a variance of 1-2 dB predicted depending on the method.

As works move around the site and move further from noise sensitive receivers, the predicted noise levels associated with the works decrease. The associated construction traffic associated with the foundation construction options is discussed in the Construction Traffic section below.

General Construction

With reference to Table 13-16, the cumulative predicted noise level associated with general construction activities listed in Table 13-16 are predicted to exceed the threshold of 70 dB $L_{Aeq,1hr}$ at 15m distance from works, i.e. the level above which a short-term significant impact is predicted to occur. This worst case assumes several plant items in operation at the closest point to a nearby noise sensitive receiver.

At distances of 25m and more from works, the predicted cumulative noise levels are below the threshold and therefore a significant impact is not predicted.

Landscaping

The cumulative predicted noise level at 15m distance associated with landscaping activities are predicted to be just below the threshold of 70 dB $L_{Aeq,1hr}$ all distances from works, i.e. the level above which a short-term significant noise impact is predicted to occur. This worst case assumes several plant items in operation at the closest point to a nearby noise sensitive receiver.

Construction Traffic

The noise levels associated with mobile plant items such as concrete mixer trucks, loaders etc. operational on site have been included as part of the construction noise assessment and calculated noise levels in Table 13-16. Consideration has also been given to the addition of construction traffic along the site access routes. Access to the development site for construction traffic will predominantly be via Milltown Road with some vehicles using the existing entrance on Sandford Road.

It is possible to calculate the noise levels associated with the passing vehicle using the following formula.

$$L_{Aeq,T} = L_{AX} + 10\log_{10}(N) - 10\log_{10}(T) + 20\log_{10}(r_1/r_2)dB$$

where:

Table 13-17: Equation Variables

Parameter	Description
$L_{Aeq,T}$	is the equivalent continuous sound level over the time period T in seconds
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
r_1	is the distance at which L_{AX} is expressed
r_2	is the distance to the assessment location

A calculation distance of 5m from the road has been used to assess noise levels at the closest buildings along the construction routes. The mean value of Sound Exposure Level for truck moving at low to moderate speeds (i.e. 15 to 45km/hr) is of the order of 82dB L_{AX} at a distance of 5 metres from the vehicle. This figure is based on a series of measurements conducted under controlled conditions.

The construction vehicle numbers for the various construction phases are summarised below:

Table 13-18: Construction Traffic Volumes

Phase		Traffic Flow (Daily Movements)
Site Preparation		140
Demolition		140
Foundations	Option A	128
	Option B	128
	Option C	128
General Construction		140
Landscaping		140

Construction vehicle numbers are anticipated to reach a maximum of 140 No. per day for site preparation, demolition, general construction and landscaping. Assuming trips are spread throughout the workday, the calculated noise level associated with 12 No. construction vehicles per hour is 61 dB $L_{Aeq,1hr}$.

For periods that may require more frequent trips, it is assumed that 20% of the daily vehicle numbers arrived in a one-hour period. The predicted noise level associated with 30 No. construction vehicles in a "peak" hour is 65 dB $L_{Aeq,1hr}$. This level is below the construction noise threshold and the prevailing noise levels along Milltown Road and Sandford Road.

During the foundations construction, slightly fewer HGV trips are anticipated over a shorter time period. The calculated noise level associated with 16 No. construction vehicles per hour is 63 dB $L_{Aeq,1hr}$. Options B and C require HGV trips over approximately 62 days, while for Options A and D these movements will occur over approximately 68 days. Therefore, for these options, the impact will prevail over a marginally larger number of days, but not to the point that a significantly different impact is associated.

Therefore, a negative, slight to moderate and short-term impact is predicted in the absence of mitigation.

13.5.2 Construction Phase – Vibration

Piling

The main potential source of vibration during the construction programme is associated with piling activities, depending on the methodologies used.

Review of the foundation construction methodology indicates that Option A does not require piling, aside from discreet sections of retaining wall. Therefore, this option is predicted to generate less vibration.

The other options include piling of foundations by either bored piles or continuous flight auguring (Options B and C).

For the purposes of this assessment the expected vibration levels during piling 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 600 mm 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.

Considering the low vibration levels at very close distances to augured piling rigs, vibration levels at the adjoining buildings are not expected to pose any significance in terms of cosmetic or structural damage to any of the protected structures in proximity to the development works or any of the other adjacent buildings. Continuous flight auguring follows a similar mechanism, i.e. no rapid acceleration of the tools in contact with the ground and rely on steady motion and therefore the vibration levels presented are representative of this method.

The range of vibration magnitudes indicate vibration levels at the closest neighbouring buildings noted in Figure 13.6 are likely to be below the limits set out in Table 13-2 to avoid any cosmetic damage to buildings.

Regarding disturbance to building occupants, works undertaken within close proximity to the residential receptors on the site perimeter have the potential to emit perceptible vibration levels.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 13-2 during all activities. Further discussion on mitigation measures during this phase are discussed in Section 13.7.

13.5.3 Operational Phase – Noise

Mechanical Plant Noise

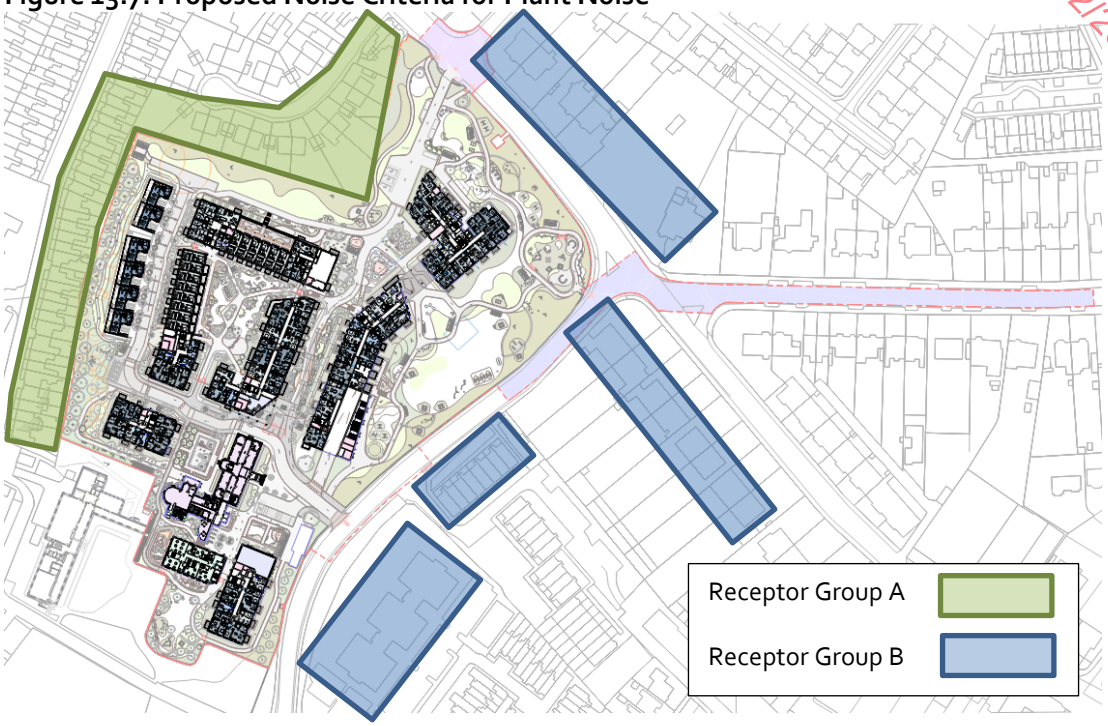
Once operational, building services plant items will be required to serve the development. The cumulative operational noise level at the nearest noise sensitive location external to the development will be designed/attenuated to meet the relevant BS 4142 noise criteria for day and night-time periods.

Given the baseline noise levels measured and presented in Section 13.3, appropriate criteria for plant noise levels at the nearest sensitive noise receptors have been derived. Based on the varying baseline noise levels across the site the following apply:

Table 13-19: Proposed Noise Criteria for Plant Noise

Receptor Group	Day, dB $L_{Aeq,1hr}$	Night, dB $L_{Aeq,15min}$
A	45 – 48	45
B	55	47

Figure 13.7: Proposed Noise Criteria for Plant Noise



Additional Traffic on Local Roads

The proposed development has provision of 319 No. car parking spaces and set-down areas. Residents and visitors will journey to and from the development making use of local roads.

Figure 13.8 below illustrates the road links in the vicinity of the proposed site. The traffic flows on these road links have been provided by DBFL Engineers in the form of Annual Average Daily Traffic (AADT).

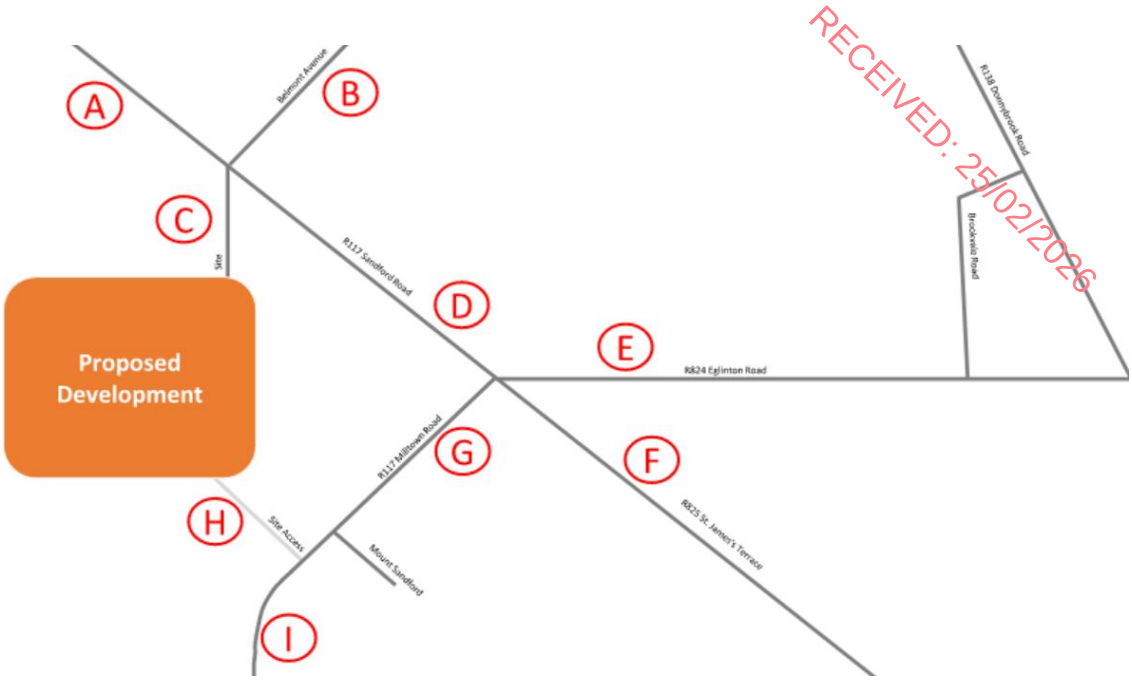


Figure 13.8: Traffic Noise Assessment – Road Links (Source: DBFL)

The predicted changes in noise level on the local road network have been calculated based on the change in traffic flows that have been provided for the various scenarios considered, i.e. Do-Nothing and Do-Something. These are presented in the tables below. This assessment considers the impact of combined traffic flows associated with the proposed development as well as nearby permitted developments.

Road links C and H are located within the proposed development. Link C will replace the existing northern entrance road and serve as a secondary entrance that connects to Sandford Road while Link H is a proposed new entrance road that will connect to the Milltown Road.

Table 13-20: Predicted Change in Traffic Noise Levels - Opening Year

Road Link	Traffic Flows – AADT		
	Do Nothing – 2022	Do Something – 2022 (With Development)	Predicted Change in Noise Level (dB)
A	15,371	16,061	0.2
B	2,716	2,765	+0.1
D	16,950	17,690	+0.2
E	7,749	8,020	+0.1
F	8,224	8,224	0.0
G	15,098	16,109	+0.3
I	14,796	15,770	+0.3

Table 13-21: Predicted Change in Traffic Noise Levels - Design Year

Road Link	Traffic Flows – AADT		
	Do Nothing – 2037	Do Something – 2037 (With Development)	Predicted Change in Noise Level (dB)
A	16,867	17,557	+0.2
B	2,990	3,040	+0.1
D	18,512	19,253	+0.2
E	8,529	8,800	+0.1
F	9,022	9,022	0.0
G	16,506	17,518	+0.3
I	16,290	17,264	+0.3

At all external road links under consideration, the predicted changes in noise levels are in the range of 0.0 to 0.3 dB. With reference to

Table 13-4 the corresponding impact is negligible. The overall impact is determined to be neutral, imperceptible and permanent.

Entertainment Noise

The following are examples of areas within the development which may generate noise levels internally having the potential to generate an external impact on the proposed development:

- Communal areas
- Co-working areas
- Cultural/community spaces

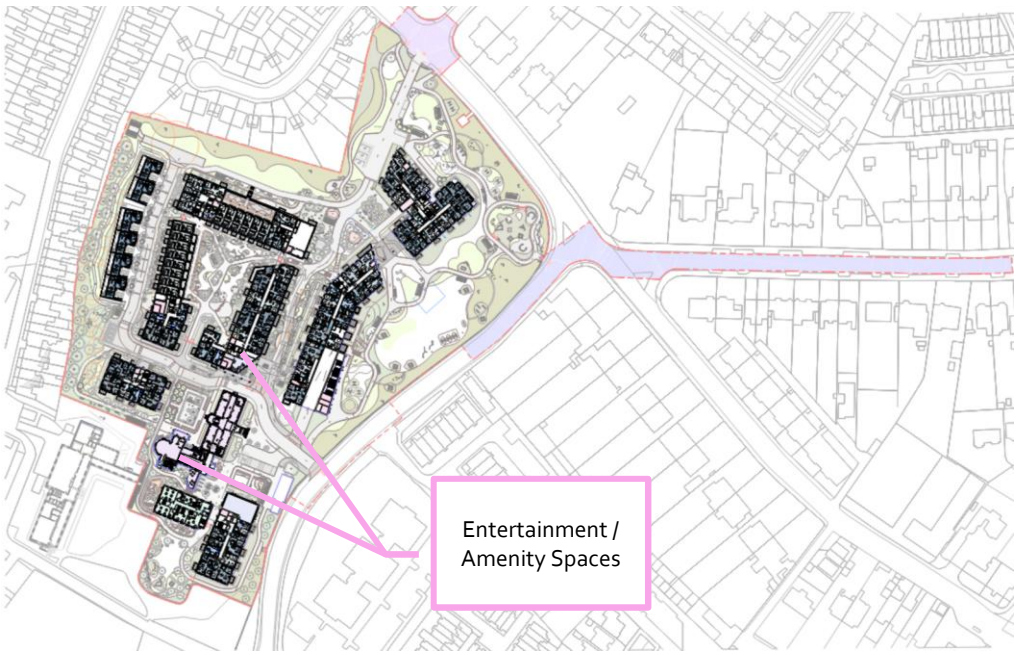


Figure 13.9: Entertainment/Amenity Spaces

The building envelope construction is a combination of precast concrete with brickwork and glazed windows. The solid wall elements will offer high levels of sound insulation, however, the windows will be weakest element.

To ensure that noise emissions are appropriately controlled, the relevant mitigation measures outlined in Section 13.6.2 will be incorporated at the detailed design stage. Where existing buildings are being refurbished and used as amenity space, management of the space and control of noise levels are more relevant.

Creche Play Area

Measurement of noise levels generated by children playing outdoors at several crèches and kindergartens indicate typical noise levels in the order of 56 dB $L_{Aeq,1hr}$ at distance of 5 metres. The nearest noise sensitive receptors are located at the Jesuit community building at ground and first floor levels, approximately 34 and 38m from the creche, respectively. Considering the usage of the creche area (e.g. external areas are only expected to be in use for a portion of the 16 hour daytime period) and the standard noise insulation of the façade, it is predicted that the internal criteria in Table 13-5 will be met in these closest sensitive rooms and also receptors further away, and therefore the resultant noise impact due to the creche is not significant.

13.5.4 Operational Phase – Vibration

There are no significant sources of vibration associated with the operational phase of the proposed development.

13.5.5 Operational Phase – Inward Noise Impact

The development lands in question are bound to the north by Sandford Road and Milltown Road to the east, which dominate noise levels along these boundaries. In order to establish noise levels across the development site an acoustic noise model was developed and calibrated against noise levels measured during the baseline study on site.

13.5.5.1 Noise Model of Study Area

Proprietary noise calculation software was used for the purposes of establishing the prevailing noise levels on the proposed site. The selected software, Brüel & Kjær Type 7810 Predictor, calculates noise levels in accordance with the Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3) issued by the UK Department of Transport in 1988. This is the standard recognised for the prediction of road traffic noise by Transport Infrastructure Ireland (TII) and the Environmental Noise Regulations 2006 SI/140 2006.

13.5.5.2 Noise Model Validation

Noise levels recorded during the unattended survey were used to calibrate the noise model to within 1 dB of the calculated values. The resultant daytime levels output from the model calibration are slightly higher that the average measured levels (UN1) but are representative

of periods of higher noise levels measured on site. This is regarded as very strong correlation in respect of predicted noise levels. Noise levels are calculated over daytime periods, i.e. 07:00 to 23:00hrs and night-time periods, 23:00 to 07:00 hrs.

Table 13-22: Calculated and Measured Noise Levels at Development Site

Location	Time Period	Measured Noise Level (dB)	Calculated Noise Level (dB)
UN1	Daytime, $L_{Aeq,16hr}$	58*	62
	Night-time, $L_{Aeq,8hr}$	55	55
NM2	Daytime, $L_{Aeq,T}$	65	66
NM3	Daytime, $L_{Aeq,T}$	73	73

* Measured levels for certain daytime periods reached 62 dB $L_{Aeq,16hr}$. Higher noise level used in assessment.

Figures 13.10 and 13.11 display the calculated noise contours across the site for day and night-time periods at a height of 4m above ground, i.e. the typical height of a first floor window. The results of the modelling exercise demonstrate that highest noise levels are experienced along the north and east of the site in proximity to the road edges and reduce considerably by more than 10 dB towards the central part of the site, in the absence of any development buildings.

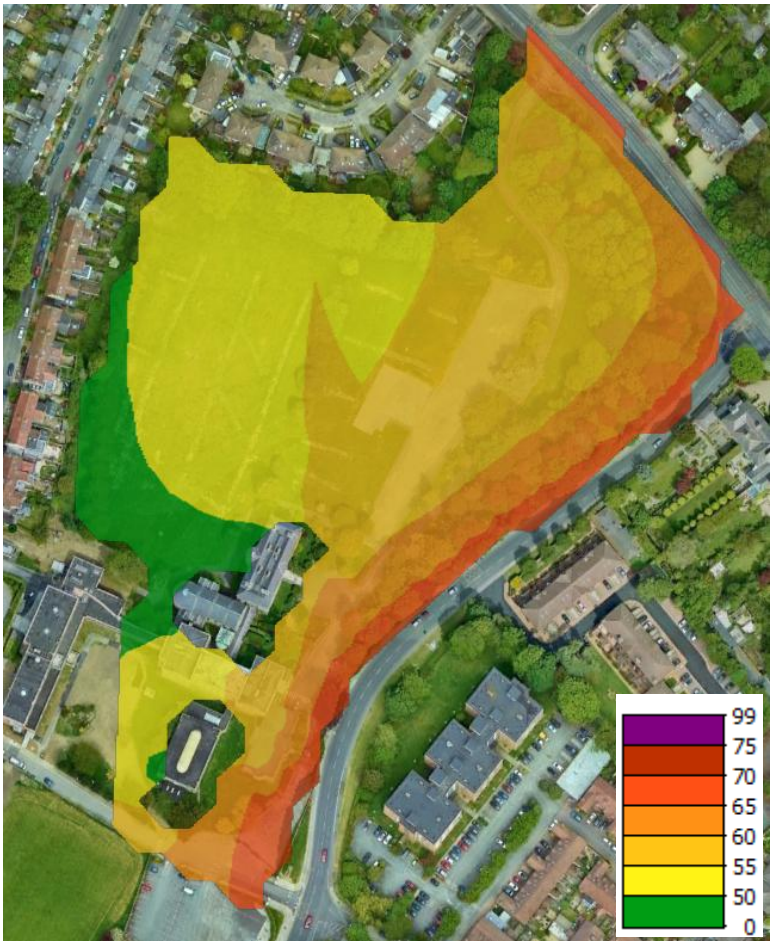


Figure 13.10: ProPg Stage 1 – Initial Noise Risk Assessment – Daytime

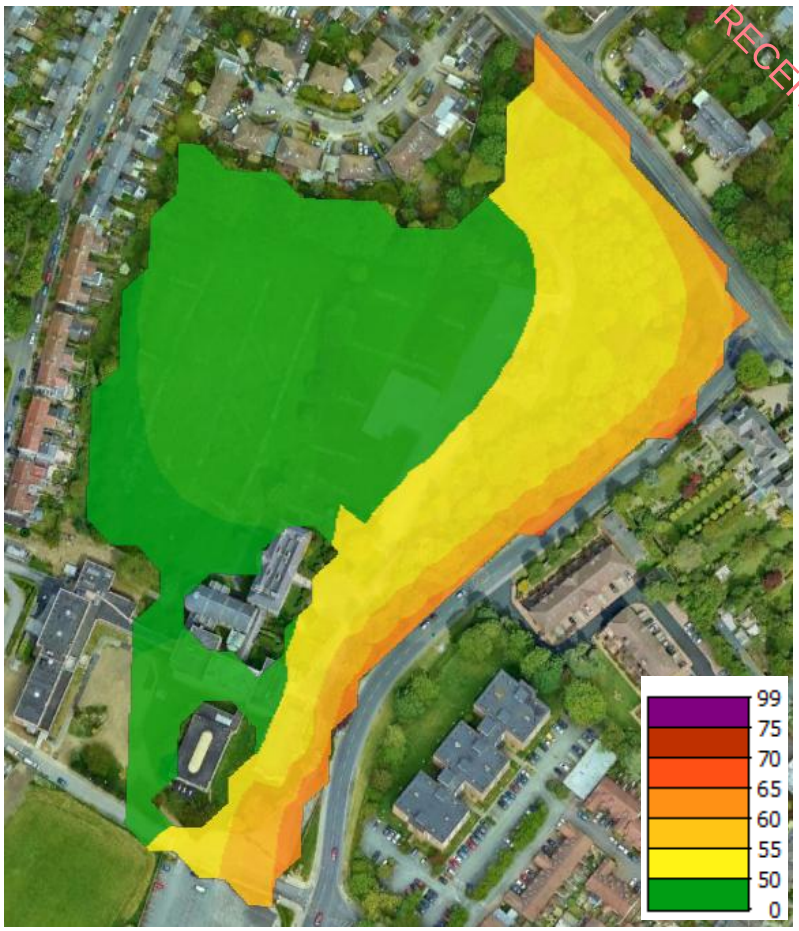


Figure 13.11: ProPg Stage 1 – Initial Noise Risk Assessment – Night-time

Giving consideration to the noise levels presented in the previous sections, the initial site noise risk assessment has concluded that the level of risk across the site lies within the *Medium* to *High* noise risk categories.

ProPG states the following with respect to medium and high risks areas:

Table 13-23: ProPG Noise Risk Categories

Category	Comment
Medium Risk	As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.
High Risk	High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.

Given the above, it can be concluded that the development site may be categorised as *Medium* to *High* Noise Risk and as such the Acoustic Design Statement (following here and also in Section 13.6.2) is required to demonstrate that suitable care and attention has been applied in mitigating and minimising noise impact to such an extent that an adverse noise impacts will be avoided in the final development.

It should be noted that ProPG states the following with regard to how the initial site noise risk is to be used:

> "2.12 *It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner, and the decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced. Thus, a site considered to be high risk will be recognised as presenting more acoustic challenges than a site considered as low risk. A site considered as negligible risk is likely to be acceptable from a noise perspective and need not normally be delayed on noise grounds. A potentially problematical site will be flagged at the earliest possible stage, with an increasing risk indicating the increasing importance of good acoustic design."*

Following the guidance contained in ProPG, therefore, it does not preclude residential development on sites that are identified as having medium or high noise levels. It merely identifies the fact that a more considered approach will be required to ensure the developments on the higher risk sites are suitably designed to mitigate the noise levels. The primary goal of the approach outlined in ProPG is to ensure that the best possible acoustic outcome is achieved for a particular site.

13.5.5.3 Acoustic Design Statement – Part 1

Façade Noise Levels

Noise levels have been predicted across the proposed development site during day and night-time periods using the noise model developed to include the development buildings. Figures 13.12 and 13.13 illustrate the predicted traffic noise levels for daytime and night-time.

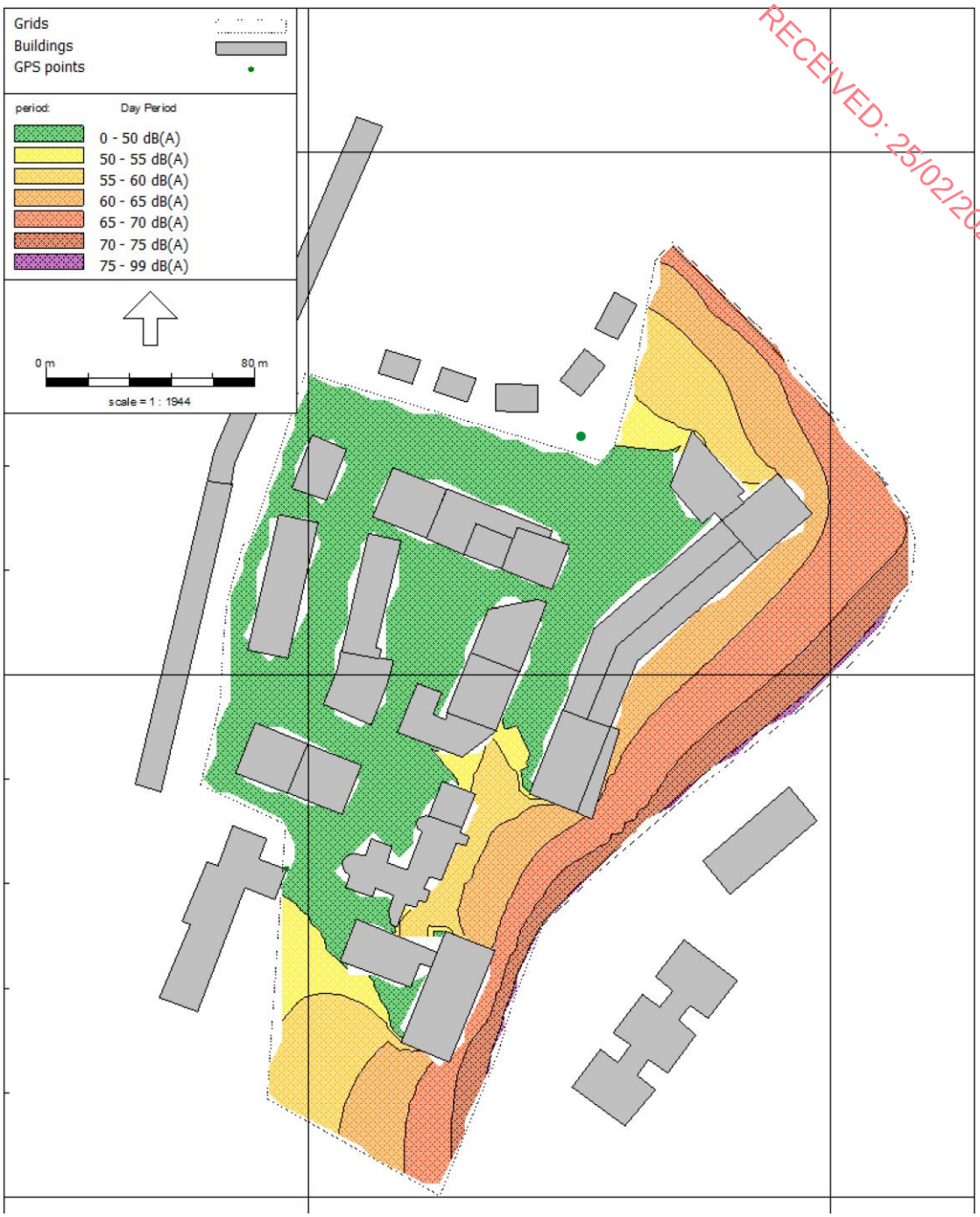


Figure 13.12: ProPg Stage 2 – Predicted Noise Levels – Daytime

Predicted daytime noise levels across the site range from 37 dB in sheltered areas, screened from road traffic, to 74 dB along the eastern boundary which faces on to Milltown Road.

Predicted night-time noise levels are in the range 30 dB to 66 dB, respective of the location across the development site, with the highest noise levels along the eastern boundary which faces on to Milltown Road.

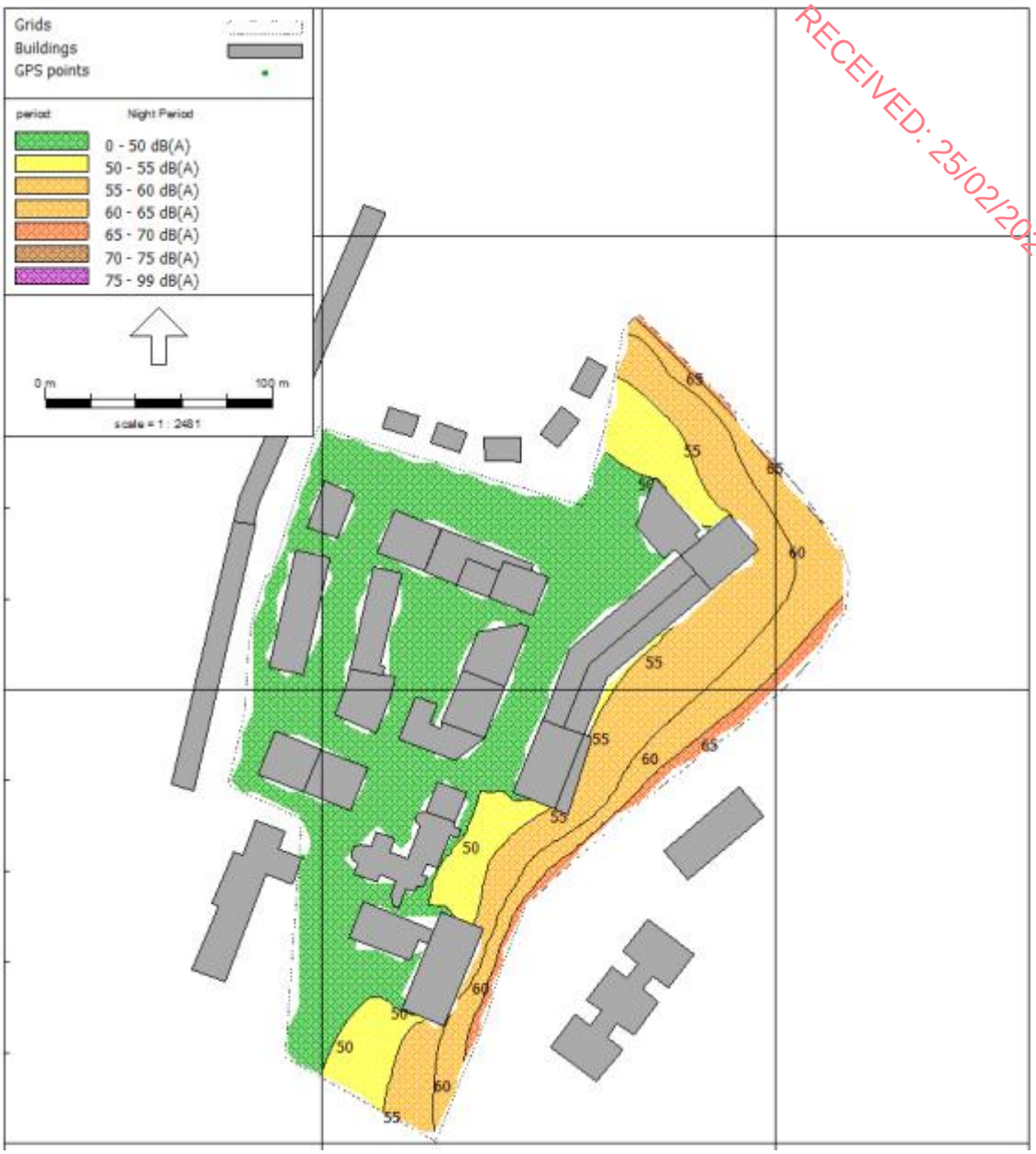


Figure 13.13: ProPg Stage 2 – Predicted Noise Levels – Night-time

Where façade noise levels are less than 55 dB $L_{Aeq,16hr}$ during the day and 50 dB $L_{Aeq,8hr}$ at night it is possible to achieve reasonable internal noise levels while also allowing for supplementary ventilation of dwellings with open windows. Therefore, for those properties where the façade noise levels are less than 55 dB $L_{Aeq,16hr}$ during the day and 50 dB $L_{Aeq,8hr}$ at night no further mitigation is required, e.g. Blocks B, C, D, E and the western facades of Block A and F.

Where façade levels are above the levels detailed above, the sound insulation performance of the building façade becomes important and a minimum sound insulation performance specification is required for windows and vents to ensure that when windows are closed the internal noise criteria are achieved.

Predicted noise levels on several facades are above a level whereby internal noise levels are achieved with standard double glazing and therefore mitigation in the form of enhanced glazing and ventilators will be required. These facades include:

- Block A – north, east and south façade.
- Block B – south east façade.
- Block F - north, east and south façade.

The specification of this enhanced façade is discussed in Section 13.6.2.

An external assessment maximum level of 71 dB L_{AFmax} has been assumed in the noise intrusion calculations, correcting the measured value for distance. Further assessment in this regard is recommended during the detail design stage of the Proposed Project.

External Noise Levels

Figure 13.11 presents the calculated day time noise levels across the site with the development buildings in place. The existing boundary wall will be retained along sections of the eastern and northern site boundary. The contours are calculated for a height of 1.5m.

External noise levels within the majority of communal open spaces, communal terraces and private balconies across the development site are within the recommended range of noise levels from ProPG of between 50 – 55 dB $L_{Aeq,16hr}$ as illustrated in Figure 13.14.

Outdoor space along the northern and eastern boundaries experience higher noise levels due to proximity to local roads however this is offset somewhat by the desirability of developed urban surroundings and proximity and accessibility of public transport and local amenities. There is also provision of internal communal amenity space in close proximity.

It is considered that the objectives of achieving suitable external noise levels is achieved within the overall site, therefore no further mitigation is required to control external noise levels across amenity areas.

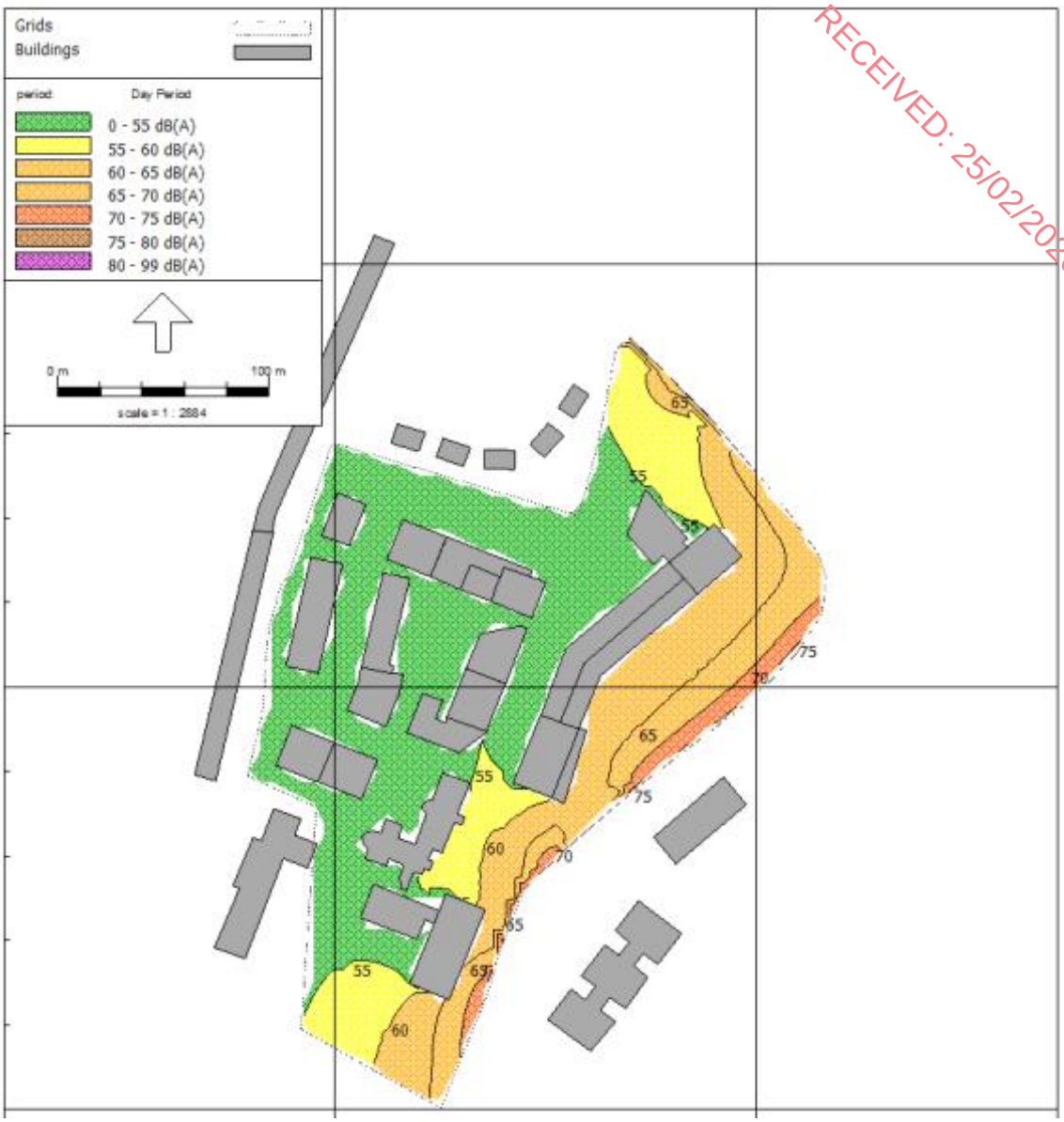


Figure 13.14: Predicted Noise Levels across External Areas (1.5m above ground)

13.6 Mitigation Measures

13.6.1 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) *Code of Practice for Noise and Vibration Control on Construction and Open Sites 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 NSLs are minimised.

The best practice measures set out in BS 5228-1 and BS 5228-2 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

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

Construction activities will vary depending on the phase of construction. The following matrix identifies which mitigation measures are applicable to the various phases.

Table 13-24: Mitigation Measures

Construction Phase		Mitigation Measure			
		Selection of quiet plant	**Noise control at source**	**Piling**	**Screening**
Site Preparation		X	X		X
Demolition		X	X		X
Foundations	Option A	X	X		X
	Option B	X	X	X	X
	Option C	X	X		X
General Construction		X	X		X
Landscaping		X	X		X
		Liaison with Public	**Project Programme**	**Monitoring**	**General Measures**
Site Preparation		X	X	X	X
Demolition		X	X	X	X
Foundations	Option A	X	X	X	X
	Option B	X	X	X	X
	Option C	X	X	X	X
General Construction		X	X	X	X
Landscaping		X	X		X

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 will 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 will 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 will 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 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.

Piling

Piling is the construction activity which is most likely to cause disturbance. General guidance in relation to piling is outlined in the following paragraphs.

Piling programmes 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. If piling works are in progress on a site at the same time as other works of construction or demolition that themselves may generate significant noise and vibration, the working programme will be phased so as to prevent unacceptable disturbance at any time.

Prior to construction the planner, developer, architect and engineer, as well as the local authority, will be made aware of the proposed method of working of the piling contractor. The piling contractor will in turn have evaluated any practicable and more acceptable alternatives that would economically achieve, in the given ground conditions, equivalent structural results.

On typical piling sites the major sources of noise are essentially mobile and the noise received at any control points will therefore vary from day to day as work proceeds. The duration of piling works is typically relatively short in relation to the length of construction work as a whole, and the amount of time spent working near to noise sensitive areas can represent only a part of the piling period.

Noise reduction can be achieved by enclosing the driving system in an acoustic shroud. For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover. Impact noise when piling is being driven can be reduced by introducing a non-metallic dolly between the hammer and the driving helmet.

Screening by barriers and hoardings is less effective than total enclosure but can be a useful adjunct to other noise control measures. For maximum benefit, screens should be close either to the source of noise (as with stationary plant) or to the listener. Removal of a direct line of sight between source and listener can be advantageous both physically and psychologically. In certain types of piling works there will be ancillary mechanical plant and equipment that may be stationary, in which case, care should be taken in location, having due regard also for access routes. When appropriate, screens or enclosures should be provided for such equipment.

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. It is understood that the existing concrete perimeter wall will remain during the construction process and provide a degree of screening.

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 will be appointed to site during construction works. Any noise complaints will 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. During excavation/ piling or other 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.

Monitoring

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.*

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.*

General Good Practice

General good practice measures include:

- The contractor will appoint a site representative responsible for matters relating to noise.
- A noise and vibration monitoring specialist will be appointed to periodically carry out independent monitoring of noise and vibration during random intervals and at sensitive locations for comparison with limits and background levels.
- All ancillary pneumatic percussive tools shall be fitted with mufflers or silences of the type recommended by the manufacturers, and where commercially available, dampened tools and accessories shall be used.

13.6.2 Operational Phase

Mechanical Plant Noise

As part of the detailed design of the development, plant items with appropriate noise ratings and, where necessary, appropriately selected remedial measures (e.g. enclosures, silencers etc.) will be specified in order that the adopted plant noise criteria is achieved at the façades of noise sensitive properties, including those within the development itself.

The assessment outlined earlier in this Chapter has specified cumulative plant noise limits at the nearest noise sensitive properties that must be achieved in order to ensure the impact is acceptable. To achieve these noise limits consideration will be given, at the detailed design stage, to a variety of mitigation measures and forms of noise control techniques. Some examples of these measures are as follows:

- Reduced/quiet modes
- duct mounted attenuators on the atmosphere side of air moving plant;
- splitter attenuators or acoustic louvres providing free ventilation to internal plant areas;
- solid barriers screening any external plant;
- anti-vibration mounts on reciprocating plant.

In addition to the above, it is proposed that the following practices are adopted to minimise potential noise disturbance for neighbours.

- All mechanical plant items e.g. motors, 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.

Entertainment Noise

The amenity spaces that have entertainment noise associated will be designed at a later stage however to ensure no negative impact associated with these spaces, the following acoustic measures may be incorporated.

Table 13-25: Acoustic Design Measures – Entertainment Noise

Measure	Description
Appropriate Linings	Proposed constructions (e.g. external walls) should be reviewed in order to determine whether additional measures are required in order to control noise emissions from the highlighted areas. These measures would typically consist of independent wall linings where appropriate.
Glazing	Where glazing is proposed in the design the installed elements should offer an appropriate sound insulation performance in order to minimise noise break out.
Doors	Access to noisy internal areas from external locations may require acoustic lobbies with double doors separated by an appropriate distance.
Ventilation	Ventilation should be supplied by suitably attenuated mechanical means. Once details of the proposed building services installation are known, consideration should be given to the potential for entertainment noise breakout to atmosphere via ductwork; the potential for services noise transfer to both external and internal areas.
Audio System	The audio systems should feature a distributed array of loudspeakers arranged such that the coverage zones are tightly controlled and all patrons are within the "near field" of one or more loudspeakers. This will limit the amount of sound energy incident upon the external walls and in turn help to control the amount of noise transfer and break-out.
Noise Level	Once the measures outlined above are implemented it would be recommended that a maximum permissible noise level be set for each venue (i.e. a noise level that should not be exceeded in order to ensure that noise emissions are kept to an acceptable level).

Inward Noise Impact – Acoustic Design Statement Part 2

As is the case in most buildings, the glazed elements and ventilation paths of the building envelope are typically the weakest element from a sound insulation perspective. In general, all wall constructions (i.e. block work or concrete and spandrel elements) offer a high degree of sound insulation, much greater than that offered by the glazing systems. Therefore, noise intrusion via the wall construction will be minimal.

In this instance, the facades highlighted in Figure 13.15 will be provided with glazing and ventilation that achieves the minimum sound insulation performances as set out in Table

13-26 and Table 13-27. Other facades in the development have no minimum requirement for sound insulation.

Table 13-26: Sound Insulation Performance Requirements for Glazing, SRI (dB)

Façade	Mark-up	Octave Band Centre Frequency (Hz)						R_w
		125	250	500	1000	2000	4000	
Block A (South)	RED	27	29	36	41	42	52	**39**
Block F	RED	27	29	36	41	42	52	**39**
Block A (North)	ORANGE	19	27	36	41	37	42	**37**

The overall R_w and $D_{ne,w}$ outlined in this section are provided for information purposes only. The over-riding requirement is the octave band sound insulation performance values which may also be achieved using alternative glazing and ventilation configurations. Any selected system will be required to provide the same level of sound insulation performance set out in Table 13-26 and Table 13-27 or greater.

The following performance requirements apply to all ventilation paths from outside the building. This can be achieved by passive acoustic wall or window vents or via mechanical ventilation systems.

Table 13-27: Sound Insulation Performance Requirements for Ventilation, $D_{n,e,w}$ (dB)

Façade	Mark-up	Octave Band Centre Frequency (Hz)						$D_{n,e,w}$
		125	250	500	1000	2000	4000	
Block A (South)	RED	35	34	33	38	49	45	**39**
Block F	RED	35	34	33	38	49	45	**39**
Block A (North)	ORANGE	30	33	38	37	36	34	**38**

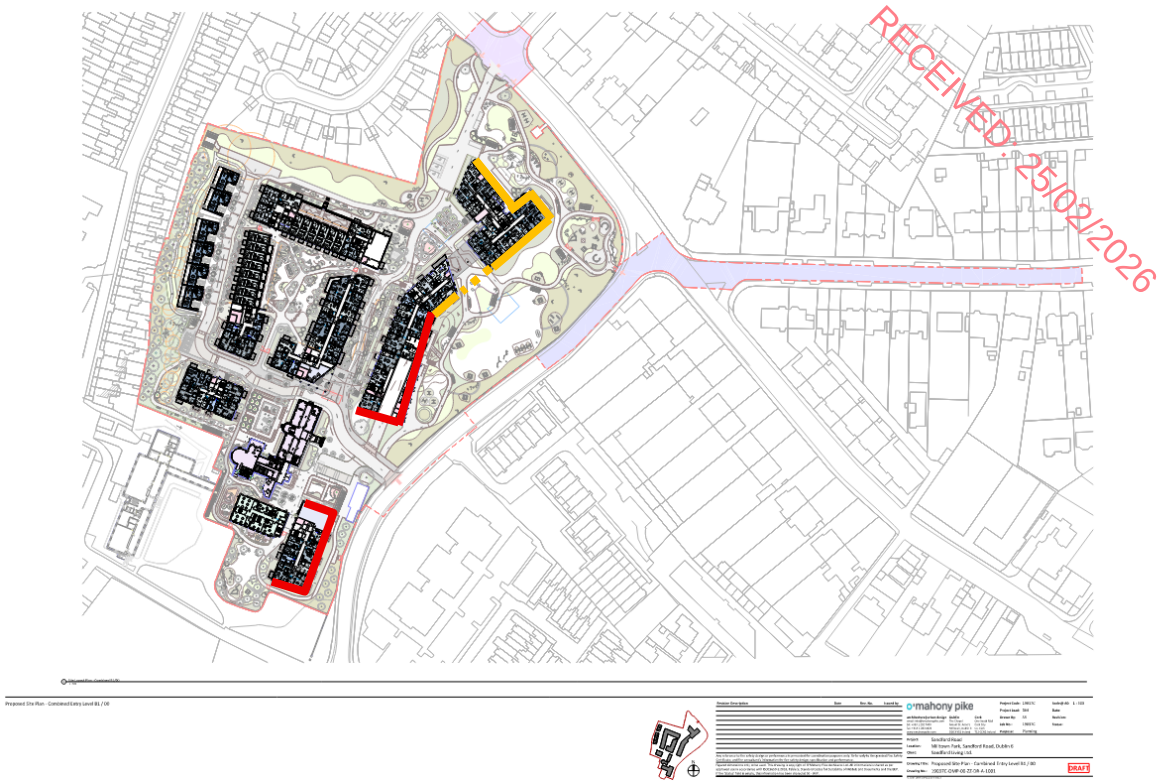


Figure 13.14: Façade Acoustic Requirements

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing and ventilation systems. In the context of the acoustic performance specification, the 'glazing system' is understood to include any and all of the component parts that form part of the glazing element of the façade, i.e. glass, frames, seals, openable elements etc.

The assessment has demonstrated that the recommended internal noise criteria will be achieved through consideration of the proposed façade elements at the design stage. The calculated glazing and ventilation specifications are preliminary and are intended to form the basis for noise mitigation at the detailed design stage. Consequently, these may be subject to change as the project progresses.

There is no acoustic requirement relating to the creche façade. Appropriate internal noise levels are predicted to be achieved with standard double glazing and ventilators.

13.7 Residual Impacts

13.7.1 Construction Phase

Noise

Demolition and piling activities are predicted to exceed the noise threshold of 70dB(A) as defined in Section 13.3.1.1 above which a significant noise impact can occur. However, this significant impact is only predicted to occur when works occur at the closest proximity to the dwellings located on the boundary of the site. In addition, it should be noted that the assessment considers all site equipment to be occurring simultaneously, however, it is

unlikely that all items of plant will be in operational simultaneously. Additionally, the predictions only indicate a potential significant noise effect (based on a worst-case scenario) when working at the closest location to the dwellings, with lesser impacts predicted at all other locations across site.

Residual impacts associated with construction activities undertaken adjacent to site boundaries are categorised as:

Quality	*Significance*	*Duration*
Negative	Significant	Short-term

Residual impacts associated with works taking place 40m from receptors are:

Quality	*Significance*	*Duration*
Negative	Moderate	Short-term

Residual impacts associated with construction traffic are:

Quality	*Significance*	*Duration*
Negative	Slight to Moderate	Short-term

Vibration

It is possible that vibration from construction activities will be perceptible at receptor locations, but not of the magnitude that would cause disturbance. The impacts are predicted to be as follows:

Quality	*Significance*	*Duration*
Negative	Not significant	Short-term

13.7.1.1 Operational Phase

Noise

Mechanical Plant and Services Noise

Once cumulative plant noise emissions from the development are designed to achieve the appropriate noise criteria the residual noise impact is as follows:

Quality	*Significance*	*Duration*
Neutral	Imperceptible	Permanent

Additional Traffic on Local Roads

Based on the traffic flows associated with the operation of the proposed development the impacts are predicted to be as follows for assessed local road Links A, B and D-G :

Quality	*Significance*	*Duration*
Neutral	Imperceptible	Permanent

Entertainment Noise

Once measures are implemented with respect to entertainment noise, the impact is predicted to be as follows:

Quality	*Significance*	*Duration*
Neutral	Imperceptible	Permanent

Creche Play Area

The impacts associated with noise from the creche area are categorised as follows:

Quality	*Significance*	*Duration*
Negative	Not significant	Permanent

13.8 Monitoring

13.8.1 Construction Phase

The contractor will be required to ensure construction activities operate within the noise and vibration limits set out within this assessment. The contractor will be required to undertake regular noise and vibration monitoring at locations representative of the closest sensitive locations to ensure the relevant criteria are not exceeded.

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

Vibration monitoring should be conducted in accordance with BS 6472:2008 *Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting* (human disturbance) and 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* (building damage).

13.8.2 Operational Phase

Noise or vibration monitoring is not required once the development is operational.

13.9 Reinstatement

Not applicable in the context of noise and vibration.

13.10 Interactions

13.10.1 General

In compiling this impact assessment, reference has been made to the project description provided by the project co-ordinators, project drawings provided by the project architects and information relating to mechanical plant provided by the mechanical engineers. Noise emission sources from the proposed development during the construction and operational phases will be from traffic. The noise impact assessment has been prepared in consultation with the design team and traffic engineers. Refer to the relevant chapters for additional information. Additional interactions include those relating to Chapter 9 - Lands and Soils, associated with noise impacts during the development of the lands.

13.10.2 Human Health

The potential impacts on human beings in relation to the generation of noise and vibration during the construction phases are that high levels of noise and vibration could cause nuisance to people in nearby sensitive locations. Implementation of the mitigation measures set out and adherence to good practice noise reducing measures will ensure that the residual impact on human health will be lessened and impacts will be short-term, slight to significant and negative in nature.

Similarly, during the operational phase, plant selections designed to achieve the relevant noise criteria will result in a residual impact that is long-term, imperceptible and neutral to people in nearby noise sensitive locations. External noise sources have been assessed and mitigation to ensure internal noise levels achieve the relevant noise criteria have been provided.

13.11 Cumulative Impacts

Any noise and vibration impacts resulting from existing developments located in proximity to the proposed development have been captured in the measurement of the baseline environment at and around the proposed site. In this way, cumulative effects, i.e. the proposed development combined with existing developments, has been considered in the assessments set out in this chapter.

In respect of construction noise and vibration, there is potential for cumulative impacts at sensitive locations equidistant to both the proposed development and another development site should significant construction works be occurring simultaneously.

Receivers at further distance would be less vulnerable to cumulative effects, since during the construction phase of the proposed development, construction noise on site will be localised and will therefore likely be the primary noise source at the nearest noise sensitive receivers.

A review has been carried out of permitted and proposed developments in proximity to the proposed development site. These sites will also have to adhere to an appropriate noise criteria and where necessary implement mitigation measures to reduce noise impacts. In this way, the risk of cumulative impacts is reduced.

Cumulative impacts will need to be considered and managed in the case that the construction phase of the proposed development occurs simultaneously to other permitted developments. It is recommended that liaison between construction sites is on-going throughout the duration of the construction phase. Contractors should schedule work in a co-operative effort to limit the duration and magnitude of potential cumulative impacts on nearby sensitive receptors. Cumulative construction noise impacts are expected to be negative, significant and short-term.

In respect of the operational phase, traffic flows associated with permitted developments are included in the provided traffic data used in the traffic noise impact assessment in Section 13.5.3, and therefore the potential for a cumulative impact has already been assessed. Future projects or any future currently unpermitted developments of large scale would need to conduct an EIA to ensure that no significant impacts resulting from noise and vibration will occur as a result of those developments.

Table 13-28: Summary of Construction Phase Likely Significant Effects with and without out Mitigation / Monitoring

		Impact Without Mitigation					Mitigation Measures	Monitoring	Impact With Mitigation / Monitoring				
Likely Significant Effect	**Extent**	**Quality**	**Significance**	**Duration**	**Type**	**Probability**			**Quality**	**Significance**	**Duration**	**Type**	**Probability**
Construction Noise & Vibration	Local	Negative	Significant	Short-Term	Direct	Likely	The Contractor will be required to fully implement the noise & vibration mitigation measures outlined	Noise & vibration levels will be monitored during construction	Negative	Slight to Significant	Short-Term	Direct	Likely

Table 13-29: Summary of Operational Phase Likely Significant Effects with and without out Mitigation / Monitoring

		Impact Without Mitigation					Mitigation Measures	Monitoring	Impact With Mitigation / Monitoring				
Likely Significant Effect	**Extent**	**Quality**	**Significance**	**Duration**	**Type**	**Probability**			**Quality**	**Significance**	**Duration**	**Type**	**Probability**
Mechanical Plant and Services Noise	Local	Neutral	Imperceptible	Permanent	Direct	Likely	plant items with appropriate noise ratings and, where necessary, appropriately selected	N/A	Neutral	Imperceptible	Permanent	Direct	Likely

		Impact Without Mitigation					Mitigation Measures	Monitoring	Impact With Mitigation / Monitoring				
							remedial measures (e.g. enclosures, silencers etc.) will be specified in order that the adopted plant noise criteria is achieved at the façades of noise sensitive properties, including those within the development itself						
Entertainment Noise	Local	Neutral	Imperceptible	Permanent	Direct	Unlikely	The proposed building construction will incorporate suitable sound insulation to control entertainment noise.	N/A	Neutral	Imperceptible	Permanent	Direct	Un-Likely
Additional Traffic on Local Roads	Local	Neutral	Imperceptible	Permanent	Direct	Likely	Not required	N/A	N/A	N/A	N/A	N/A	N/A

		Impact Without Mitigation					Mitigation Measures	Monitoring	Impact With Mitigation / Monitoring				
Creche Play Area	Local	Negative	Not Significant	Permanent	Direct	Likely	Not required	N/A	N/A	N/A	N/A	N/A	N/A
Inward Noise Impact	Local	Negative	Moderate	Permanent	Direct	Likely	Acoustic glazing and ventilation	N/A	Neutral	Not Significant	Permanent	Direct	Likely

13.12 Do-Nothing Impact

In the absence of the proposed development being constructed, the noise environment at the nearest noise sensitive locations and across the development site itself will remain largely unchanged. The noise levels measured and noted during the baseline studies are considered representative of the Do-Nothing scenario. The Do-Nothing scenario is therefore considered neutral impact.

13.13 Difficulties Encountered in Compiling the Chapter

No difficulties were encountered during the formation of this chapter.

13.14 Conclusion

When considering a development of this nature, the potential noise and vibration effects on the surroundings must be considered for two stages: the short-term construction phase and the permanent operational phase.

The assessment of construction noise and vibration and has been conducted in accordance best practice guidance contained in BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise and BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration. Subject to good working practice as recommended in the EIAR Chapter, noise associated with the construction phase is not expected to exceed the recommended limit values for noise-sensitive locations beyond 40m from the site boundary and therefore no significant effects are expected. At distances less than 40m from the boundary, construction noise has the potential to exceed the recommended limit values depending on the construction activity occurring. A variety of standard proven best practice noise & vibration mitigation is proposed together with noise & vibration monitoring to ensure that limit values are adhered to.

This chapter demonstrates that the predicted noise levels associated with the operational phase of the proposed development will be within best practice noise limits recommended in Irish guidance, therefore it is not considered that a significant effect is associated with the development.

No significant vibration effects are associated with the operation of the site.

13.15 References

- Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment.
- Directive 2014/52/EU of the European Parliament and of the Council of 16th April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.
- European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018).
- Dublin Agglomeration Noise Action Plan 2018 – 2023 (NAP).
- BS 8233: 2014: Guidance on sound insulation and noise reduction for buildings.

- British Standard BS 4142: 2014+A1 2019: Methods for Rating and Assessing Industrial and Commercial Sound.
- United Kingdom Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2. (UKHA 2020).
- British Standard BS 5228 (2009 +A1 2014): Code of Practice for Control of Noise and Vibration on Construction and Open Sites Part 1: Noise & Part 2: Vibration.
- British Standard BS 7385 (1993): Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration.
- British Standard BS6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting.
- The UK Department of Transport *Calculation of Road Traffic Noise* (hereafter referred to as the CRTN) (UK Department of Transport 1998);
- ISO 1996-1:2016 *Acoustics - Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures* (hereafter referred to as ISO 1996 – 1) (ISO 2016);
- ISO 1996-2:2017 - *Description, measurement and assessment of environmental noise - Part 2: Determination of sound pressure levels* (hereafter referred to as ISO 1996 – 2) (ISO 2017);
- ISO 9613 (1996): Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation.
- EPA Guidelines on the Information to be contained in Environmental Impact Statements, (EPA, 2002).
- EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), (EPA, 2003).
- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports, (Draft August 2017).
- EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015).
- Professional Practice Guidance on Planning & Noise (ProPG), (IoA, 2017).
- Institute of Acoustics (IOA) document *Good Practice Guide on the Control of Noise from Pubs and Clubs* (March 2003).
- Draft Institute of Acoustics IOA *Code of Practice Guide on the Control of Noise from Pubs and Clubs* (November 1999).