NOISE & VIBRATION IMPACT ASSESSMENT FOR PLANNING

PROPOSED GLEBE RESIDENTIAL DEVELOPMENT

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EXECUTIVE SUMMARY

AWN Consulting has been commissioned to carry out a study in relation to the potential noise impacts from the proposed residential development at the lands at Glebe House, Crumlin, Dublin 12. The proposed development will comprise 150 no. apartments consisting of 74 one beds, 72 two beds and 4 three bed residential units, a creche and café.

A baseline noise survey has been undertaken at the development site to determine the existing environment at the site.

Outward noise impact assessments have been undertaken for both construction and operational phases of the proposed development.

Construction noise thresholds have been selected and noise predictions have been undertaken. The predictions indicate that at the nearest noise sensitive receivers, noise from construction activities is predicted to be above the threshold at which a likely significant impact will occur. Appropriate construction mitigation measures have been presented within this report in order to reduce the impact of construction activities on nearby sensitive receptors.

Once operational, it is expected that noise emissions will be limited to noise associated with traffic coming to and from the development and plant items serving the development. With reference to data provided by the Traffic Consultant, traffic associated with the development is negligible and associated noise levels are expected to be imperceptible. Regarding plant noise, suitable noise thresholds have been assigned based on the measured noise levels on the site. It is understood that plant items serving the development will be located internally and therefore it is expected that noise emissions to atmosphere will be minimal. Plant items serving the proposed development will be designed such that he cumulative noise emissions will achieve the noise criteria set out in this report.

CONTENTS

1.0 INTRODUCTION

AWN Consulting has been commissioned to carry out an assessment in relation to the potential outward noise impact of the proposed residential development at lands at Glebe House, Crumlin, Dublin 12.

Included within this report is an assessment of the outward noise impact of the construction and operational phases of the development.

The development site is located on the lands at Glebe House, between Crumlin Village and Somerville Drive. To the north, south, east and west are residential houses. To the northeast are commercial premises.

Figure 1 presents the outline of the proposed development site and the surrounding area.

Figure 1 Location of proposed development

Appendix A presents a glossary of acoustic terminology that is used throughout this report.

2.0 DESIGN CRITERIA

2.1 Outward Noise Assessment – Construction Phase

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. Dublin City Council (DCC) typically controls construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

2.1.1 DCC - Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition

Dublin City Council's ***"Air Quality Monitoring and Noise Control Unit's Good Practice Guide for Construction and Demolition"*** (hereinafter referred to as DCC GPG) outlines a risk assessment methodology directly applicable to the specific construction activities on the proposed site.

The Proposed Development has been classed as a high risk category site based on the DCC GPG risk assessment factors as detailed below: -

- Duration of the works;
- Distance to NSLs;
- Ambient noise levels;
- Site operating hours;
- Location of works;
- Duration of demolition; and
- Intrusive noise activities, including vibration generating activities.

As the Proposed Development is in the high risk category, the monitoring section (S.6) of the DCC GPG document identifies that: -

> ***"The ABC Method detailed in Paragraph E.3.2 of BS 5228****-1:2009 shall be used* ***to determine acceptable noise levels for day, evening and night time work."***

Please note that construction works in relation to this development are proposed during normal working hours only as set out below: -

- Monday to Friday: 07:00 to 19:30hrs
- Saturdays: 08:00 to 14:00hrs
- Sundays and Bank Holidays: No construction works.

2.1.2 British Standard BS 5228 – 1: 2009+A1:2014

DCC GPG refers to British Standard BS 5228 – 1: 2009+A1:2014: Code of practice for noise and vibration control on construction and open sites – Noise (hereinafter referred to as BS 5228-1:2009+A1:2014) as appropriate criteria relating to permissible construction noise threshold levels for a development of this scale may be found in BS 5228-1:2009+A1:2014.

Potential noise impacts during the construction stage of a project are often assessed in accordance with BS 5228-1:2009+A1:2014. Various mechanisms are presented as examples of determining if an impact is occurring, these are discussed in the following paragraphs.

ABC Method

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

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 1 sets out the values which, when exceeded, signify a significant effect at the facades of residential receptors.

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

Table 1 Example Threshold of Significant Effect at Dwellings

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

For the appropriate assessment period (i.e. daytime in this instance) the ambient noise level is determined and rounded to the nearest 5 dB. If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur. It should be noted that this assessment method is only valid for residential properties.

The closest neighbouring noise sensitive properties to the proposed development are houses on Somerville Green adjacent to the western site boundary and houses at Somerville Drive set back to the south and east of the site. Other residential receptors include houses located across St Anges' Road to the north of site. These noise sensitive receivers are located approximately 10 – 45m from areas of major works.

Fixed Limits

When considering non-residential receptors, reference is made to BS 5228-1:2009+A1:2014, which gives several examples of acceptable limits for construction 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".

Proposed Threshold Noise Levels

Taking into account the proposed documents outlined above and making reference to the baseline noise environment monitored around the development site (see Section 13.3), BS 5228-1:2009+A1:2014 has been used to inform the assessment approach for construction noise in line with the DCC GPG.

The following Construction Noise Threshold (CNT) levels are proposed for the construction stage of this development: -

- For residential NSLs it is considered appropriate to adopt 65 dB(A) CNT. Given the baseline monitoring carried out, it would indicate that Category A values are appropriate using the ABC method.
- For commercial NSLs along the main road it is considered appropriate to adopt the 75 dB(A) CNT, given the urban environment in which the closest commercial properties reside, in line with BS 5228-1:2009+A1:2014 and DCC GPG.
- For the Community Hall it is considered appropriate to adopt 70 dB(A) CNT.

Interpretation of the CNT

In order to assist with interpretation of CNTs, Table 2 includes guidance as to the likely magnitude of impact associated with construction activities, relative to the CNT. This guidance is derived from Table 3.16 of *DMRB: Noise and Vibration*.

Guidelines for Noise Impact Assessment Significance (DMRB)	CNT per Period	Determination
Negligible	Below or equal to baseline noise level	Depending on CNT, duration & baseline noise level
Minor	Above baseline noise level and below or equal to CNT	
Moderate	Above CNT and below or equal to CNT +5 dB	
Major	Above CNT +5 to +15 dB	
	Above CNT +15 dB	

Table 2 Construction Noise Significance Ratings

The adapted DMRB guidance outlined will be used to assess the predicted construction noise levels at NSLs and comment on the likely impacts during the construction stages.

2.1.3 Construction Phase – Traffic Noise

In order to assist with the interpretation of construction traffic noise, Table 3 includes guidance as to the likely magnitude of impact associated with changes in traffic noise levels along an existing road. This is taken from Table 3.17 of the *DMRB Noise and Vibration* (UKHA 2020).

Magnitude of Impact	Increase in Traffic Noise Level (dB)
Negligible	Less than 1.0
Minor	Greater than or equal to 1.0 and less than 3.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Major	Greater than or equal to 5.0

Table 3 Likely Effect Associated with Change in Traffic Noise Level **–** Construction Phase

In accordance with the *DMRB Noise and Vibration*, construction noise and construction traffic noise impacts shall constitute a significant effect where it is determined that a 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;
- A total number of days exceeding 40 in any six consecutive months.

2.2 Outward Vibration Assessment – Construction Phase

2.2.1 Building Damage

With respect to vibration, British Standard BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites **–** Vibration recommends 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. It is therefore common, on a cautious basis to use this lower value. Taking the above into consideration the vibration criteria in Table 4 are recommended.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:		
Less than 15Hz	**15 to 40Hz**	**40Hz and above**
12 mm/s	20 mm/s	50 mm/s

Table 4 Recommended Vibration Criteria During Construction Phase

Expected vibration levels from the construction works will be discussed further in Section 4.4.

2.2.2 Human Perception

People are sensitive to vibration stimuli at levels orders of magnitude below those which have the potential to cause any cosmetic damage to buildings. There are no current standards which provide guidance on typical ranges of human response to vibration in terms of PPV for continuous or intermittent vibration sources.

BS5228-2:2009+A1:2014, provides a useful guide relating to the assessment of human response to vibration in terms of the PPV. Whilst the guide values are 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 5 summarises the range of vibration values and the associated potential effects on humans.

Vibration Level, PPV	Effect
0.140mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies. At lower frequencies people are less sensitive to vibration.
0.3mm/s	Vibration might be just perceptible in residential environments.
1mm/s	It is likely that a vibration level of this magnitude in residential environments will cause complaint.

Table 5 Guidance on Effects of Human Response to PPV Magnitudes

Vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short-term duration, particularly during construction projects and when the origin and or the duration of vibration is known. For example, ground breaking can typically be tolerated at vibration levels up to 2.5 mm/s if adequate public relations are in place and timeframes are known. These values refer to the day-time periods only.

During surface construction works (demolition and ground breaking etc.) the vibration limits set within would be perceptible to building occupants and have the potential to cause subjective effects. The level of effect is, however, greatly reduced when the origin and time frame of the works are known and limit values relating to structural integrity are adequately communicated. In this regard, the use of clear communication and information circulars relating to planned works, their duration and vibration monitoring can significantly reduce vibration effects to the neighbouring properties.

Interpretation of the Human Response to Vibration

In order to assist with interpretation of vibration thresholds, Table 6 presents the significance table relating to potential impacts to building occupants during construction based on guidance from BS5228-2:2009+A1:2014.

Criteria	Impact Magnitude	Significance Rating
≥10 mm/s PPV	Very High	Very Significant
≥1 mm/s PPV	High	Moderate to Significant
≥0.3 mm/s PPV	Medium	Slight to Moderate
≥0.14 mm/s PPV	Low	Not significant to Slight
Less than 0.14 mm/s PPV	Very Low	Imperceptible to Not significant

Table 6 Human Response Vibration Significance Ratings

2.3 Outward Noise Assessment – Operational Phase

During the operational phase of the proposed development the primary sources of noise are expected to be mechanical plant items serving the apartments, café and creche buildings.

2.3.1 Mechanical Services Plant

Reference is made to the typical conditions that would be applied by DCC to the development of this nature:

> *"Noise levels from the proposed development should not be so loud, so continuous, so repeated, of such duration or pitch or occurring at such times as to give reasonable cause for annoyance to a person in any premises in the neighbourhood or to a person lawfully using any public space. In particular the*

rated noise levels from the proposed development shall not constitute reasonable grounds for complaint as provided for in B.S. 4142. Method for rating industrial noise affecting mixed residential and industrial area.

Reason: In order to ensure a satisfactory standard of development, in the interests of residential amenity."

Guidance from DCC on noise emissions from mechanical plant items makes reference to the British Standard BS 4142: 2014: *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 used by DCC in their standard planning conditions and 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 are summarised below:

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

"background noise level, $L_{A90,T}$" is the sound pressure level of the residual noise that is exceeded for 90% of the time period T.

If the rated plant noise level is +10 dB or more above the pre-existing background noise level then this indicates that complaints are likely to occur and that there will be a significant adverse impact. A difference of around +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 impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

2.3.2 Noise due to Additional Traffic Serving the Development

There are no specific guidelines or limits relating to traffic related sources along the local or surrounding roads. Given that traffic from the development will make use of existing roads already carrying traffic volumes, it is appropriate to assess the calculated increase in traffic noise levels that will arise because of vehicular movements associated with the development. In order to assist with the interpretation of the noise associated with additional vehicular traffic on public roads, Table 7 is taken from DMRB Design Manual for Roads and Bridges (DMRB), Highways England Company Limited, Transport Scotland, The Welsh Government and The Department for Regional Development Northern Ireland, (2020).

Change in Sound Level (dB)	Subjective Reaction	Magnitude of Impact
10+	Over a doubling of loudness	Major
5–9.9	Up to a doubling of loudness	Moderate
3–4.9	Perceptible	Minor
0.1 – 2.9	Imperceptible	Negligible
0	None	No Change

Table 7 Significance in Change of Noise Level

The guidance outlined in Table 7 will be used to assess the predicted increases in traffic levels on public roads associated with the proposed development and comment on the likely long-term impacts during the operational phase.

2.3.4 Noise from Creche

For the most part children attending the creche will be indoors. Part of the creche facilities include a secure outdoor play area. Reference has been made to British Standards in order to assess a potential noise impact associated with the creche play area.

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 presented in Table 8.

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

Table 8 Recommended Indoor Ambient Noise Levels from BS 8233: 2014

For the purposes of this assessment, it is appropriate to derive external limits based on the internal criteria noted in the paragraph above. This is done by factoring in the degree of noise reduction afforded by a partially open window. This is nominally deemed to equate to 15 dB for a partially open window.

Appropriate periods are 1 hour for daytime (07:00 to 23:00 hours). It is assumed the play area will not be in use between the hours of 23:00 to 07:00hrs.

Taking account of the attenuation afforded by an open window, an external noise level of 50 **–** 55 dB $L_{Aeq,1hr}$ would apply in order to achieve the internal noise levels within Table 10.8.

2.4 Outward Vibration Assessment – Operational Phase

The proposed development is residential in nature, therefore it is not anticipated that there will be any generation of vibration associated with operational phase.

3.0 BASELINE NOISE SURVEY

Environmental noise surveys have been conducted in order to quantify noise emissions across the existing site. The external survey was conducted in general accordance with ISO1996-2:2017 *Acoustics - Description, Measurement and Assessment of Environmental Noise -- Determination of Environmental Noise Levels*. Specific details are set out in the following sections.

3.1 Methodology

An attended environmental noise survey was conducted at the site 17 November 2021 by AWN Consulting in order to quantify the existing noise environment. The approximate noise measurement locations were selected at the proposed site as shown in Figure 2.

Figure 2 Noise Monitoring Locations

NM1 Attended noise monitor, to front of site set back from main road.

NM2 Attended measurement, located to the west of the site.

NM3 Attended measurement, located to the south east of site.

3.2 Measurement Parameters

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

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

L_{AFMax} is the maximum sound pressure level recorded during the sample period.

L_{AFMin} 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 traffic 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.

3.3 Instrumentation

A Brüel & Kjær 2250 Light sound level meter (SLM) was used in the attended noise survey. Before and after the survey the SLM was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

3.4 Survey Results

Location NM1

Time	L_{Aeq} dB	L_{AFmax} dB	L_{AFmin} dB	L_{A10} dB	L_{A90} dB
11:30	63	83	43	68	47
12:45	64	77	42	69	47
14:05	66	80	43	70	48

Table 8 Summary of Attended Measured Noise Levels **–** NM1

The noise environment at this location comprised road traffic noise and passing pedestrians. Ambient noise levels were in the range 63 **–** 66 dB L_{Aeq}. Background noise levels were in the range 47 **–** 48 dB L_{A90}.

Location NM2

Time	L_{Aeq} dB	L_{AFmax} dB	L_{AFmin} dB	L_{A10} dB	L_{A90} dB
11:55	49	57	46	50	48
13:05	49	69	44	51	46
14:30	51	70	45	64	46

Table 9 Summary of Attended Measured Noise Levels **–** NM2

The noise environment at this location local road traffic noise on Somerville Green. A house alarm and vegetation noise was also noted. Ambient noise levels were in the range 49 **–** 51 dB L_{Aeq}. Background noise levels were in the range 46 **–** 48 dB L_{A90}.

Location NM3

Time	L_{Aeq} dB	L_{AFmax} dB	L_{AFmin} dB	L_{A10} dB	L_{A90} dB
12:17	48	59	44	49	46
13:25	47	69	43	47	44
14:50	53	80	42	51	45

Table 10 Summary of Attended Measured Noise Levels **–** NM3

The noise environment at this location comprised road traffic noise on Somerville Drive. Vegetation noise was also noted, with children playing and shouting nearby during the last measurement. Ambient noise levels were in the range 47 **–** 53 dB L_{Aeq}. Background noise levels were in the range 44 **–** 46 dB L_{A90}.

3.5 Noise Survey Summary

The baseline noise levels measured across the proposed development site are typical of a suburban noise landscape. Noise levels measured to the front of site adjacent to Crumlin Village were dictated by passing vehicles on the main road and by pedestrian activity.

Based on measured noise levels, predicted noise levels at facades of development buildings are below a level whereby acoustic mitigation will be necessary.

To the southwest and southeast of site, away from the main road, noise levels were relatively low and influenced by local vehicle movements, vegetation noise and children playing **–** noise sources typical of a residential setting.

4.0 OUTWARD NOISE ASSESSMENT – CONSTRUCTION PHASE

4.1 Construction Phase Overview

A variety of items of plant will be in use for the purposes of demolition, site clearance/groundworks, and construction. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, there is potential for the generation of elevated levels of noise.

During the construction phase, it is anticipated that there will be a number of HGV's moving to/from site. Excavators will be employed to excavate and piling rigs may be used for foundation work, and breakers will be used in demolition and removal of existing structures and paved areas. Following this standard construction tools and methods will be employed for general construction and landscaping.

Review of aerial imagery and baseline noise surveys have identified the closest noise sensitive locations (NSLs), i.e. residential properties. The nearest NSLs are houses at Somerville Green and Somerville Drive adjacent to the western and eastern site boundary respectively. Several commercial premises with residential units above, are located fronting on to St Agnes Road to the east of the site.

4.2 Construction Criteria

4.2.1 Noise

The closest sensitive residential receptor locations have been assigned the value 65 dB $L_{Aeq,1hr,}$ while commercial receptors have been assigned the value 70dB $L_{Aeq,1hr}$. This is the value for construction noise at a sensitive receiver that, above which, a significant impact is likely to occur.

4.2.2 Vibration

As set out in Section 2.2 recommended vibration limits have been set in order to avoid damage to existing buildings in proximity to areas of major construction works within the proposed development.

4.3 Predicted Construction Noise

BS 5228-1 contains noise level data for various construction machinery. The noise levels relating to site clearance, ground excavation and loading lorries (dozers, tracked excavators and wheeled loaders) reach a maximum of 81 dB $L_{Aeq,T}$ at a distance of 10 m. For this assessment, a worst-case scenario is assumed of 3 no. such items with a sound pressure level (SPL) of 81 dB at 10 m operating simultaneously along the closest works boundary. This would result in a total noise level of 86 dB at 10 m and an equivalent combined sound power level of 114 dB L_{WA}. This worst-case scenario is the typical assumption made for developments of this size, on the basis that it is unlikely that more than 3 no. items of such plant/equipment would be operating simultaneously in such close proximity to each other.

The calculations also assume that the equipment will operate for 66% of the 12-hour working day (i.e. 8 hours) and that a standard site hoarding, typically 2.4m height, will be erected around the perimeter of the construction site for the duration of works.

Comparison of the proposed plans with the surrounding area indicates that the closest area where significant works are to take place is approximately 10m from the nearest sensitive locations.

NSL1 Houses at Somerville Green and fronting onto the main road, adjacent to the western site boundary, some 10m from areas of major works.

NSL2 Houses at Somerville Drive some 40m from areas of major works, to the south of the site.

NSL3 Houses at Somerville Drive some 25m from areas of major works, to the to the east of site.

The nearest noise sensitive locations are illustrated in Figure 3.

Figure 3 Indication of Sensitive Receptor Location Compared to Site

The predicted construction noise associated with each of the expected construction activities is presented below for various distances from areas of major works.

Guidance on the approximate attenuation achieved by standard construction hoarding surrounding construction sites is also provided in BS 5228-1. It states that when the top of the plant is just visible to the receiver over the noise barrier, an approximate attenuation of 5 dB can be assumed, while a 10 dB attenuation can be assumed when the noise screen completely hides the sources from the receiver.

This scenario can be assumed in this case due to the proximity of the noise-sensitive locations, i.e. a hoarding height will be chosen so as to completely hide the source. Table 11 shows the potential noise levels calculated at various distances based on the assumed sound power level and attenuation provided by the barrier of 10 dB.

Description of Noise Source	Sound Power Level (dB $L_{w(A)}$)	Calculated noise levels at varying distances (dB $L_{Aeq,T}$)				
		10m	20m	30m	40m	50m
3 no. items each with SPL of 81 dB at 10 m operating simultaneously.	114	76	70	66	62	56

Table 11 Potential Construction Noise Levels at Varying Distances Assuming Attenuation of 10 dB from Site Hoarding

The calculated noise levels show that the criteria for residential receptors will be exceeded at locations that are up to approximately 35m from areas of construction works. In this instance the nearest houses are located some 10-25m from areas of major construction works and therefore the contribution of construction noise is predicter to be in the range of +11 to +3 dB above the recommended criteria. With reference to Table 2, a negative moderate to major and short-term impact is expected at these nearest residential locations.

The predicted construction noise levels at residential NSLs at 35m from works is predicted to be below the recommended noise criteria and therefore a negative, minor and short-term impact is predicted.

The predicted construction noise levels are within the recommended criteria for commercial receptors at distances greater than 10 m from construction works. Identified commercial receptors are set back at distances greater than 10m from the works. Therefore, it is expected that a minor impact is associated with construction works at these receptors.

In order to minimise the impact of construction activity, good practice mitigation measures are detailed in Section 4.5

4.4 Predicted Construction Vibration

The main potential source of vibration during the construction phase is associated with piling, demolition and ground-breaking activities.

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 adjacent buildings.

Estimated vibration levels may be perceptible to occupants of buildings adjacent to the site where piling works are taking place at 10m distance.

During demolition and ground breaking in the excavation phase, there is also potential for vibration to propagate through the ground. Empirical data for this activity is not provided in the BS 5228- 2:2009+A1:2014 standard, however the likely levels of vibration from this activity is expected to be significantly below the vibration criteria for building damage on experience from other sites. AWN Consulting have previously conducted vibration measurements under controlled conditions, during trial construction works, on a sample site where concrete slab breaking was carried out. The trial construction works consisted of the use of the following plant and equipment when measured at various distances:

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

Vibration measurements were conducted during various staged activities and at various distances. Peak vibration levels during staged activities using the 3 Tonne Breaker ranged from 0.48 to 0.25 PPV (mm/s) at distances of 10 to 50 m respectively from the breaking activities. Using a 6 Tonne Breaker, measured vibration levels ranged between 1.49 to 0.24 PPV (mm/s) at distances of 10 to 50 m respectively.

The range of values recorded provides some context in relation to typical ranges of vibration generated by construction breaking activity likely required on the proposed site. The range of vibration magnitudes indicate vibration levels at the closest neighbouring buildings noted in Figure 3 are likely to be below the limits set out in Table 2 to avoid any cosmetic damage to buildings.

Therefore, there is potential for vibration to be perceptible at the nearest houses adjacent to the site boundaries for the time that demolition and groundbreaking activity is taking place close to the boundaries. Depending on machinery used, with reference to Table 5 and Table 6, there is potential for vibration levels to be above the level whereby vibration could cause complaint during periods of demolition and groundbreaking activity.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 4 during all activities. Further discussion on mitigation measures during this phase are discussed in the next section.

4.5 Construction Mitigation Measures

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 noise sensitive locations are minimised.

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

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

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

4.5.1 Selection of Quiet Plant

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

4.5.2 Noise Control at Source

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

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

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

4.5.3 Piling

Piling is the construction activity which is likely to cause disturbance. Mitigation 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.

During consultation the planner, developer, architect and engineer, as well as the local authority, should 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.

Noise reduction will be achieved by enclosing the driving system in an acoustic shroud. 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 will be provided for such equipment.

Contributions to the total site noise can also be anticipated from mobile ancillary equipment, such as handling cranes, dumpers, front end loaders etc. These machines may only have to work intermittently, and when safety permits, their engines will be switched off (or during short breaks from duty reduced to idling speed) when not in use.

4.5.4 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.

4.5.5 Liaison with the Public

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

4.5.6 Project Programme

The phasing programme will be arranged so as to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. While excavation demolition 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.

4.5.7 Monitoring

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

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

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.

5.0 OUTWARD NOISE ASSESSMENT – OPERATIONAL PHASE

5.1 Plant Noise

The prevailing baseline noise levels have been reviewed so as to set an appropriate noise criteria.

Daytime measured noise levels in the residential areas at Somerville Drive & Somerville Green were in the range 46 – 48 dB L_{A90}. Therefore, with consideration of the criteria set out in Section 2.3.1, plant noise levels during the daytime should be designed so as not to exceed **46 dB L_{A90}** at nearby noise sensitive locations.

With respect to night-time plant noise levels, reference has been made to available EPA noise maps[1] in order to estimate an appropriate noise level for the contribution of proposed plant items.

Night-time noise levels for the area surrounding the site are limited and noise levels are estimated to be < 50 – 54 dB L_{night}. With reference to measured daytime noise levels it is considered appropriate that plant noise levels during the night-time should be designed so as not to exceed **40 dB L_{A90}** at nearby noise sensitive locations.

Taking into account the recommendation from BS 4142 that if the plant noise level does not exceed the background sound level it is an indication of a low impact, it is recommended in this instance that noise emissions from all plant installed on the development site (considered cumulatively) do not exceed the following background noise levels:

- Daytime (07:00 – 23:00hrs) – 46 dB $L_{A90,1hr}$
- Night-time (23:00 – 07:00hrs) – 40 dB $L_{A90,15min}$

[1] Source: https://gis.epa.ie/EPAMaps/

It is understood that plant items serving the development will be located internally. The technology has not been selected at this stage however, typically plant items are installed in enclosed plant rooms, basement areas, or within residential units themselves, therefore it is expected that noise emissions to atmosphere will be minimal. Plant items serving the proposed development will be designed such that he cumulative noise emissions will achieve the noise criteria set out above.

5.2 Additional Traffic on Surrounding Roads

The proposed development provides for 75 no. car parking spaces. Traffic data provided by the Traffic Consultant allows for assessment of any increase in traffic noise associated with vehicle movements to and from the proposed development.

The percentage increase in traffic for AM and PM peak hours has been calculated by NRB Consulting Engineers. The relevant table from the Transportation Assessment has been reproduced here.

Assessed Road Junction	Traffic Increase %	
	AM Pk Hr	PM Pk Hr
St Mary's Rd/Bunting Rd junction	3.2%	3.1%
Somerville Ave/St Agnes Rd Junction	4.1%	3.9%
Lisle Rd/St Agnes Rd Junction	2.3%	2.9%
Windmill Rd/St Agnes Rd Junction	2.0%	2.4%
St Agnes Pk/St Agnes Rd Junction	1.3%	1.7%

Table 12 Proposed Development Percentage Increase in Traffic 2024

In order to increase traffic noise levels by 1 dB, traffic volumes would need to increase by the order of 25%. With reference to the calculations above, the predicted increase in noise level associated with traffic going to and from the proposed development would be less than +1 dB. With reference to Table 7, this represents an imperceptible change and therefore a negligible impact.

5.3 Noise from Creche

The nearest noise sensitive receivers to the creche play area, outside of the proposed development, are located some 25 **–** 35m to the west and east.

Measurement of noise levels generated by children playing outdoors at several creches and kindergartens indicate typical noise levels in the order of 56 dB $L_{Aeq,1hr}$ at distance of 5 metres.

At the larger distances to the nearest NSLs outside the site, noise levels from the creche are predicted to be below the criterion set out in Section 2.3.4 and therefore no significant impact is predicted in association with this noise source.

6.0 CONCLUSION

Planning Permission is being sought for a proposed residential development at the lands at Glebe House, Crumlin, Dublin 12. The proposed development will comprise 150 no. apartments consisting of 74 one beds, 72 two beds and 4 three bed residential units, a creche and café.

A baseline noise survey has been undertaken at the development site to determine the existing environment.

Construction noise thresholds have been selected and noise predictions have been undertaken. The predictions indicate that at the nearest noise sensitive receivers, noise from construction activities is predicted to be above the threshold at which a likely significant impact will occur. Appropriate construction mitigation measures have been presented within this report in order to reduce the impact of construction activities on nearby sensitive receptors.

Once operational, it is expected that noise emissions will be limited to noise associated with traffic coming to and from the development and plant items serving to the development. With reference to the Transportation Assessment prepared for the scheme, traffic associated with the development is negligible and associated noise levels are expected to be imperceptible. Regarding plant noise, suitable noise thresholds have been assigned based on the measured noise levels on the site. During detailed design stage plant and noise mitigation options should be selected so that the noise emissions at nearby sensitive receptors do not exceed the recommended thresholds. Noise from the creche has been assessed and determined that no significant impact at nearby houses outside the site will result as a result of this noise source.

APPENDIX A
GLOSSARY OF ACOUSTIC TERMINOLOGY

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

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

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

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

$D_{n,e,w}$ — Weighted element-normalized level difference. This is the value of sound insulation performance of a ventilator measured under laboratory conditions. It is a weighted single figure index that is derived from values of sound insulation across a defined frequency spectrum. Technical literature for acoustic ventilators typically presents sound insulation data in terms of the $D_{n,e,w}$ parameter.

Hertz (Hz) — The unit of sound frequency in cycles per second.

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

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

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

L_{AF10} — Refers to those A-weighted noise levels in the upper 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period. It is typically representative of traffic noise levels. Measured using the "Fast" time weighting.

L_{AFmax}	is the instantaneous fast time weighted maximum sound level measured during the sample period.
Octave band	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.
PPV	Peak Particle Velocity (PPV) is defined as the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position and is measured in mm/s.
R_w	Weighted Sound Reduction Index **–** This is the value of the sound insulation performance of a partition or element measured under laboratory conditions. It is a weighted single figure index that is derived from values of sound insulation across a defined frequency spectrum. Technical literature typically presents sound insulation data in terms of the R_w parameter.
R'_w	Weighted Apparent Sound Reduction Index **–** This is similar to R_w but is used to express *in-situ* sound insulation performance, where issues such as flanking issue noise transfer may affect the measured level. As stated previously, technical literature typically uses the R_w parameter. In order to reflect the likely *in-situ* performance of an element an appropriate correction should be applied for the expected reduction in performance. Note that in instances where significant flanking issues are present the *in-situ* performance may be further reduced.
VDV	Vibration Dose Value (VDV). This is an assessment of the effect of building vibration on the people within. The VDV is the fourth root of the integral of the fourth power of acceleration after it has been frequency-weighted (as defined in BS6472: 2008). The frequency-weighted acceleration is measured in m/s^2 and the time period over which the VDV is measured is in seconds. This yields VDVs in $m/s^{1.75}$.