12.0 NOISE AND VIBRATION

12.1 Introduction

AWN Consulting Ltd. has been appointed to prepare the noise and vibration chapter of the EIAR supporting the proposed Sandyford Central residential development off Carmanhall Road, Sandyford Business District, Dublin 18.

This section of the EIAR has been prepared by AWN in the context of current relevant standards and guidance. This assessment has been prepared by Alistair Maclaurin BSc PgDip MIOA, Senior Consultant at AWN Consulting who has prepared multiple EIS and EIAR documents throughout his 7 years' experience as an environmental consultant.

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

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 impacts associated with the proposed development during both the short-term construction phase and the long-term operational phase on its surrounding environment and on the development itself. The assessment of direct, indirect and cumulative noise and vibration impacts on the surrounding environment have been considered as part of the assessment. Unplanned events have also been considered throughout this chapter.

Mitigation measures are included, where relevant, to ensure the proposed development is constructed and operated within the adopted criteria.

The assessment has been undertaken with reference to the most appropriate guidance documents relating to environmental noise and vibration which are set out within the relevant sections of this chapter and included in the references section. In addition to specific noise guidance documents, the following guidelines were considered and consulted for the purposes of this chapter:

- 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), and;
- EPA Advice Notes for Preparing Environmental Impact Statements, (Draft, September 2015).

12.2 Methodology

The following methodology has been prepared based on the requirements of the EPA document Guidelines on the information to be contained in Environmental Impact Assessment Reports Draft August 2017 and on our experience of preparing the noise &

vibration chapters for similar developments. The assessment will be undertaken using the following methodology:

- Baseline noise monitoring has been undertaken in the vicinity of the proposed development site in order to characterise the existing noise environment;
- A review of the most applicable standards and guidelines has been reviewed in order to set a range of acceptable noise and vibration criteria for the construction and operational phases of the proposed development;
- Predictive calculations relating to construction phase impacts have been undertaken at the nearest sensitive locations to the development 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 proposed development;
- A schedule of mitigation measures has been incorporated where required, to reduce, where necessary, the identified potential outward impacts relating to noise and vibration from the proposed development, and;
- The inward impact of noise and vibration in the surrounding environment into the proposed buildings has also been assessed to determine the requirements, for additional noise mitigation, where required, to provide suitable residential amenity.

12.3 Baseline Study

The site is bounded to the north by Blackthorn Avenue and to the south by Carmanhall Road. Existing industrial and commercial premises are located to the east. The site boundary and nearest noise sensitive locations have been indicated in Figure 12.1.

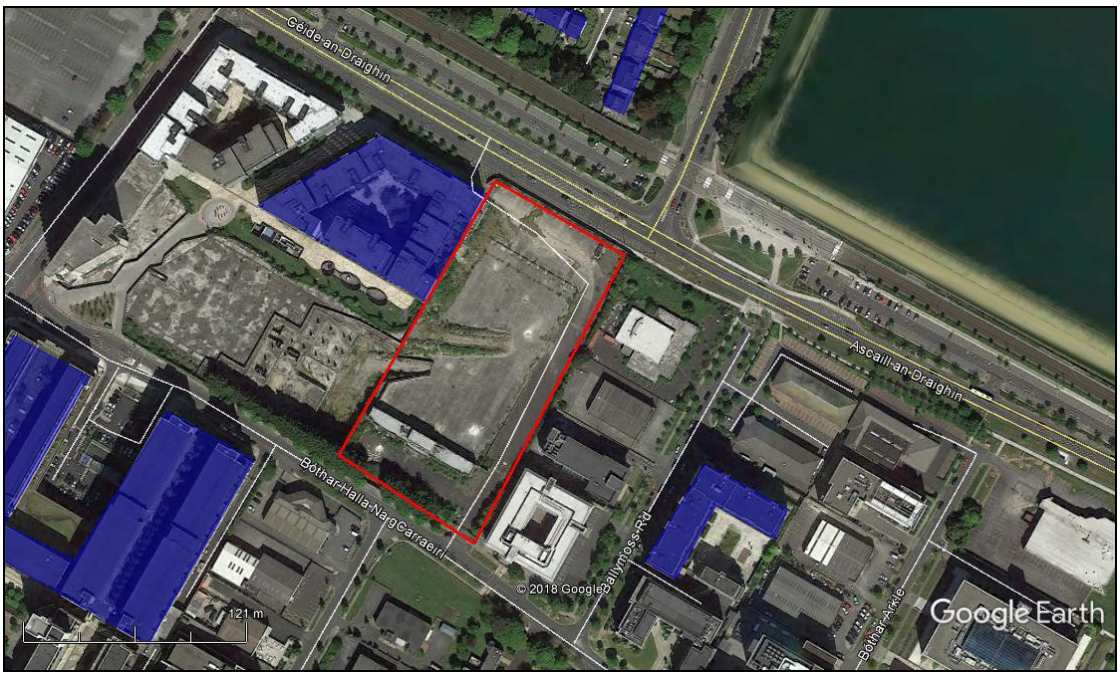

Figure 12.1: Site Location and Noise Sensitive Locations.

Source: Google Earth.

The residents along the immediate perimeter boundaries are the closest noise sensitive locations to the development site.

12.3.1 Survey Methodology

An environmental noise survey has been conducted at the site in order to quantify the prevailing noise environment. The survey was conducted in general accordance with *ISO 1996-2:2017 Acoustics - Description, Measurement and Assessment of Environmental Noise - Determination of Environmental Noise Levels*. Specific details are set out below.

12.3.2 Survey Locations

Two survey locations were selected to determine noise levels within the development site. The locations were monitored along the north and south boundaries in order to establish noise levels along the most exposed development site boundaries. This information is used to calibrate the noise model developed for the site across the full extent of the site. The monitoring locations are illustrated in Figure 12.2.

12.3.3 Procedure

Survey equipment was installed at measurements Locations N1 and N2 between the following periods:

- N1: 16:52hrs on Thursday 14th February to 10:33hrs on Monday 18th February 2019
- N2: 16:14hrs on Thursday 14th February to 10:26hrs on Monday 18th February 2019

Sample periods for the noise measurements were 15 minutes.

There was an element of construction activities occurring to the south east of the site at an adjacent site. Noise data has been reviewed during daytime periods and outlier values associated with construction periods have been omitted from average results, where relevant.

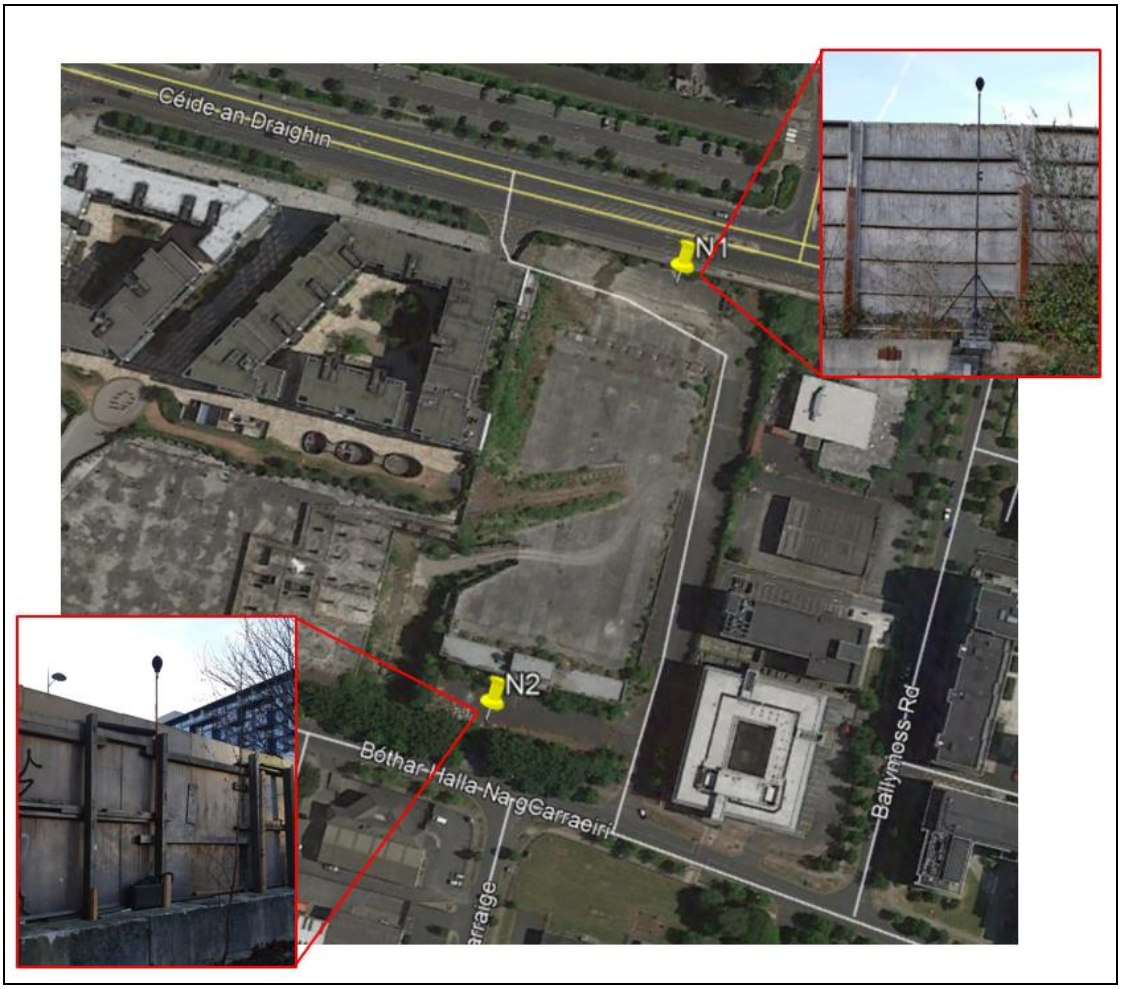

Figure 12.2: Survey Locations for Inward Noise Study.

12.3.4 Instrumentation

Noise measurements were conducted using a Rion Type NL-42 Sound Level Meter at both survey locations. The measurement apparatus was check calibrated both before and after each survey using a Brüel & Kjær Type 4231 Sound Level Meter Calibrator.

12.3.5 Measurement Parameters

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

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

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

L_{AFmax} is the instantaneous fast time weighted maximum sound level measured during the sample period.

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.

12.3.6 Measurement Results

Location N1

The results of the baseline noise survey at Survey Location N1 are presented in Figure 12.3 below.

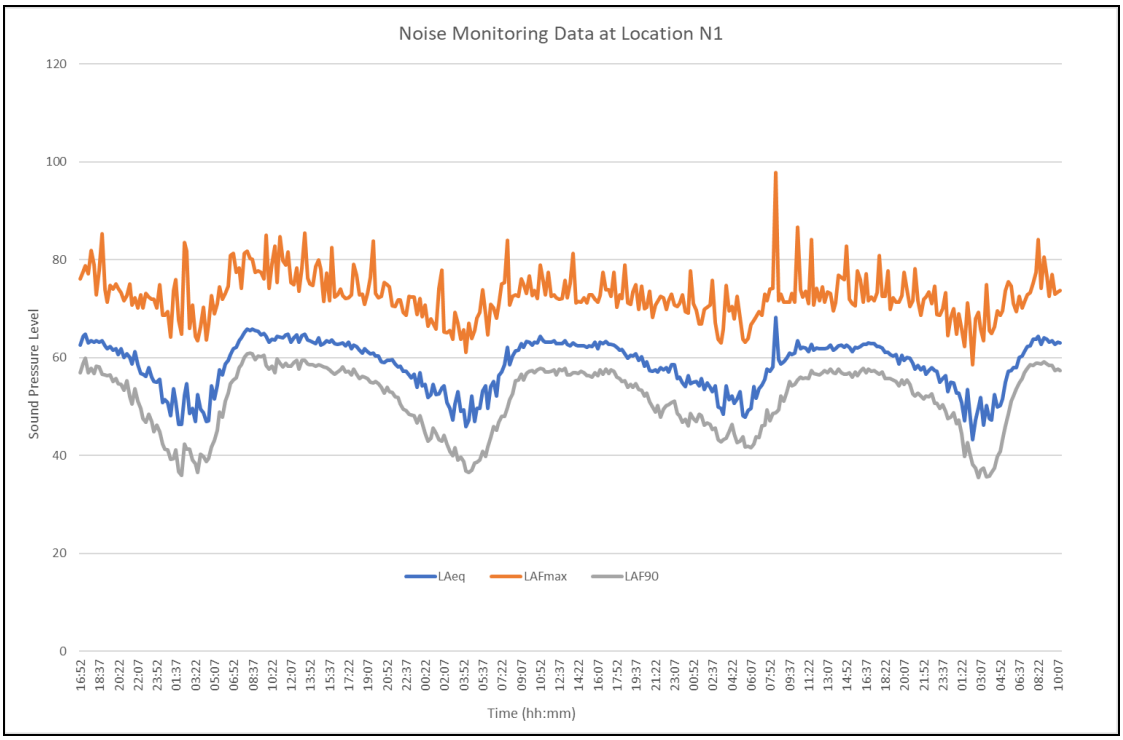

Figure 12.3: Noise Monitoring Data at Location N1.

The results over the daytime 16hr period (07:00 – 23:00hrs) are summarised in Table 12.1 below.

Date	Measured Ambient Noise Levels, Daytime dB		
	$L_{Aeq,16hr}$	$L_{A90,16hr}$	L_{AFmax} Note 1
14/02/2019	62	55	70 – 85 (75)
15/02/2019	63	57	69 – 85 (76)
16/02/2019	62	55	68 – 84 (73)
17/02/2019	61	55	69 – 98 (74)
18/02/2019	63	58	71 – 84 (75)

Table 12.1: Survey Results N1 – Daytime.

Note 1: L_{AFmax} values are presented in terms of the measured range, with average values in parenthesis.

During the daytime period, the dominant noise source was noted to be road traffic noise from Blackthorn Avenue and Luas activities at low level in the background.

The measured noise levels recorded over the night-time 8hr period (23:00 – 07:00hrs) are summarised in Table 12.2.

Date	Measured Ambient Noise Levels, Daytime dB		
	$L_{Aeq,16hr}$	$L_{A90,16hr}$	L_{AFmax} Note 1
15/02/2019	55	43	63 – 84 (71)
16/02/2019	53	42	61 – 78 (68)
17/02/2019	54	45	63 – 78 (69)
18/02/2019	55	44	59 – 76 (69)

Table 12.2: Survey Results N1 – Night-time.

Night-time noise levels are expected to be governed by road traffic movements along the local road network.

Figure 12.4 presents the distribution of the magnitude of L_{AFmax} events during the night period at noise monitoring location N1.

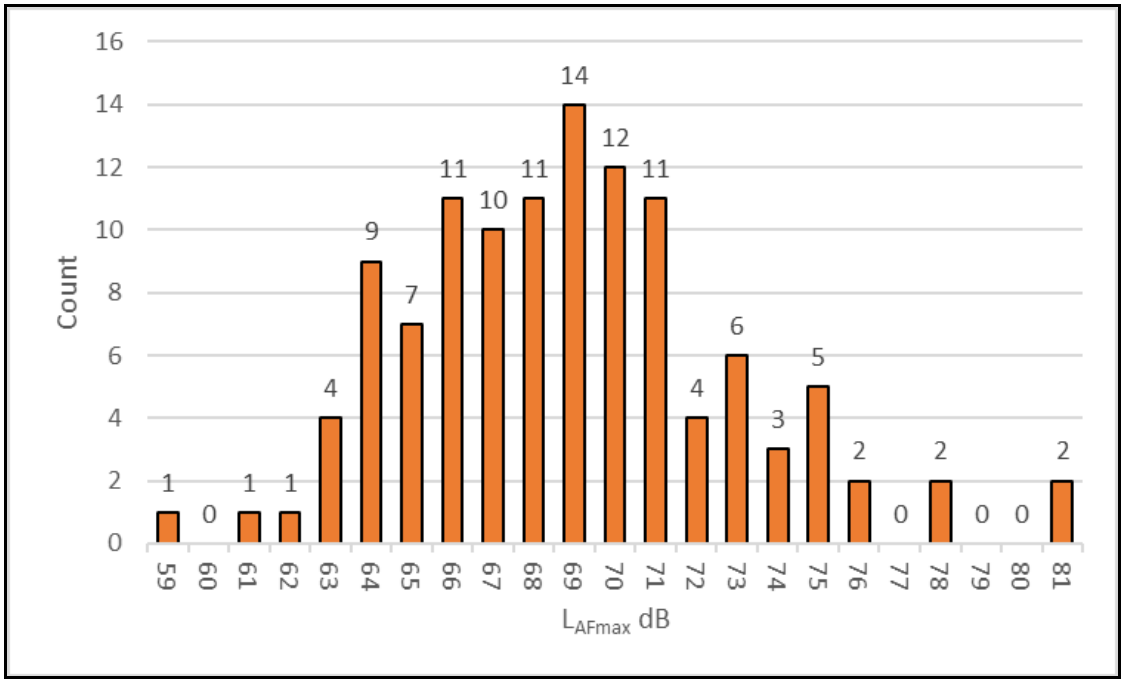

Figure 12.4: Distribution of the Magnitude of Night Time Noise Events at Location N1.

Location N2

The results of the baseline noise survey at Survey Location N2 are presented in Figure 12.5 below. Typical periods of construction activities are also highlighted in Figure 12.5.

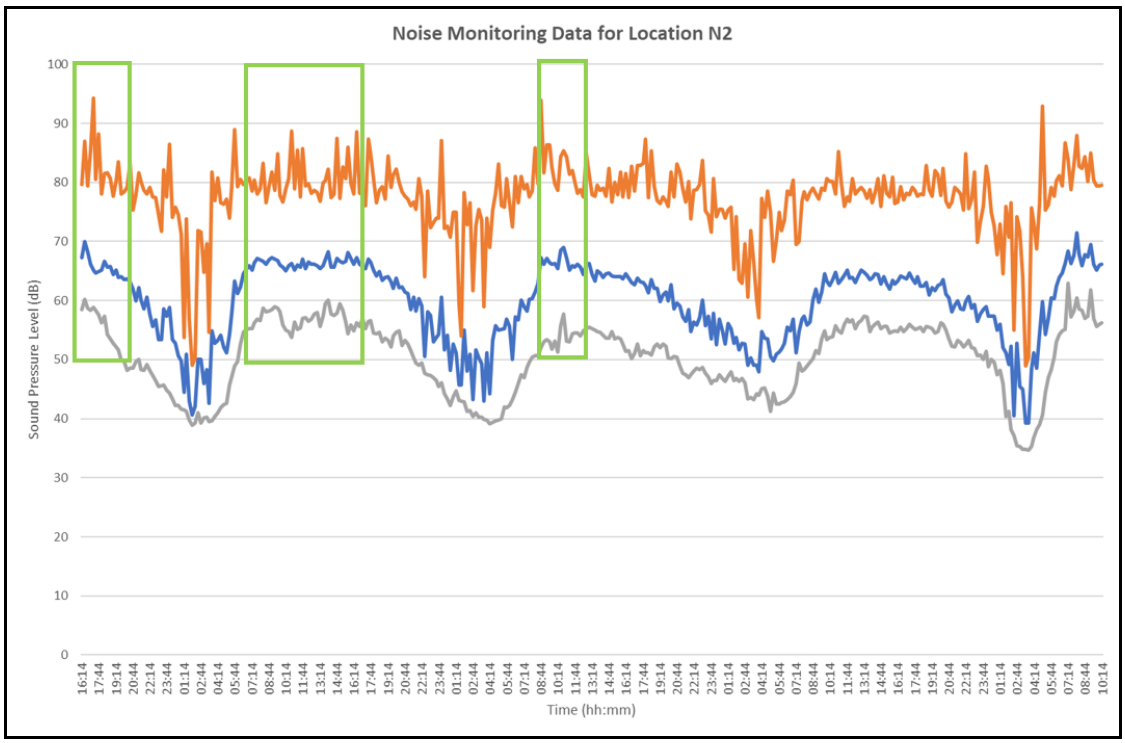

Figure 12.5: Noise Monitoring Data at Location N2.

The results over the daytime 16hr period (07:00 – 23:00hrs) are summarised in Table 12.3.

Date	Measured Ambient Noise Levels, Daytime dB		
	$L_{Aeq,16hr}$	$L_{A90,16hr}$	L_{AFmax} Note 1
14/02/2019	64	52	75 – 94 (81)
15/02/2019	65	55	64 - 89 (80)
16/02/2019	64	52	74 – 94 (80)
17/02/2019	63	54	70 – 85 (78)
18/02/2019	68	58	79 – 88 (82)

Table 12.3: Survey Results N2 – Daytime.

During the daytime period, the dominant intermittent noise source was noted to be road traffic noise along Carmanhall Road and Blackthorn Avenue. Construction within an adjacent site in addition to occasional vehicle movements within a temporary car park within the bounds of the site also contributed to the measured ambient noise environment.

On review of the measured data, ambient noise levels were recorded in the range of 63 to 65 dB $L_{Aeq,16hr}$ with higher values (68 dB L_{Aeq}) recorded during the 3 hour morning period of Monday 18th February between 07:00 and 10:00hrs.

Overall, on review of the measured data, ambient noise levels are typically of the order of 2 dB higher during daytime weekday periods and Saturday morning periods when construction activities were taking place compared to noise levels recorded outside these hours. In the absence of construction activities, noise levels are expected to be nominally equivalent to those recorded to the north of the site at Location N1, i.e. between 62 to 64 dB $L_{Aeq,16hr}$ during weekday periods and marginally lower ~61 dB $L_{Aeq,16hr}$ during weekend periods.

The measured noise levels recorded over the night-time 8hr period (23:00 – 07:00hrs) are summarised in Table 12.4 below.

Date	Measured Ambient Noise Levels, Daytime dB		
	$L_{Aeq,16hr}$	$L_{A90,16hr}$	L_{AFmax} Note 1
15/02/2019	57	44	49 – 89 (73)
16/02/2019	54	43	54 – 87 (73)
17/02/2019	54	45	57 – 84 (72)
18/02/2019	58	44	49 – 93 (73)

Table 12.4: Survey Results N2 – Night-time.

Figure 12.6 presents the distribution of the magnitude of L_{AFmax} events during the night period at noise monitoring location N2.

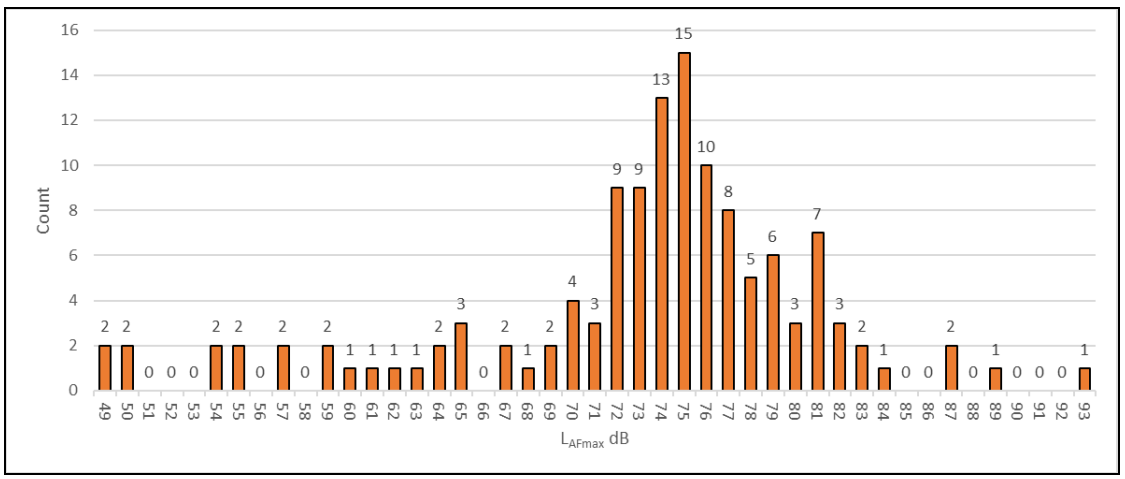

Figure 12.6: Distribution of the Magnitude of Night Time Noise Events at Location N2.

Night-time noise levels are governed by road traffic movements along the local road network. During weekday periods, there is a marked increase in measured noise levels from 6am onwards which is likely to be associated with road traffic movements, dawn chorus and construction activities commencing. Taking account of construction activities and construction site compound activities likely contributing to these levels, an overall ambient night-time noise level of 55 dB L_{Aeq} has been assumed as a worst case for this boundary.

12.3.7 Baseline Summary

The baseline environment within the development site is found to be typical of a suburban environment where road traffic is the dominant source of noise. Luas trains were audible in the background but were not noted to contribute any significant source of noise over and above that associated with road traffic.

12.4 Potential Impacts

12.4.1 Potential Construction Phase Impact

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. In lieu of statutory guidance, an assessment of significance has been undertaken as per British Standard BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise.

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

BS 5228-1:2009+A1:2014 sets out guidance on permissible noise levels relative to the existing noise environment. Table 12.5 sets out the values which, when exceeded, signify a significant effect at the façades of residential receptors.

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

Table 12.5: Example Threshold of Potential Significant Effect at Dwellings.

[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

[B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

[C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) 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 the ambient noise level is determined through a logarithmic averaging of the measurements for each location and then rounded to the nearest 5 dB. If the construction noise exceeds the appropriate category value, then a significant effect is deemed to occur. Based on the results of the noise survey measured at Locations N1 and N2, and considering attenuation due to distance propagation, the significance criteria for construction noise is set in accordance with threshold values in Category B. This sets a limit value of 65 dB L_{Aeq} for construction noise at residential dwellings during daytime periods.

It's also noted that there is a temporary school located on the eastern boundary of the site. The limit for the school, when in use, is 65 dB L_{Aeq}.

Vibration

In terms of vibration, BS 5228-2:2009+A1:2014 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 (PPV) (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 12.6 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 12.6: Recommended Construction Vibration Thresholds for Structurally Sound Buildings.

12.4.2 Operational Phase – Mechanical and Electrical Services

In relation to external services plant noise, reference is made to *BS 4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound*. This document describes methods for rating and assessing sound of an industrial and/or commercial nature to a residential receptor. The methods described in this 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, 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.

The results of baseline surveys of the prevailing background sound level allow for the noise impact associated with proposed new external plant items to be assessed. With reference to BS 4142:2014, it is noted that, depending on context, adverse impacts are likely to occur when rated plant sound level exceeds the prevailing background sound level by + 5 dB, with a significant adverse impact occurring at + 10 dB or more. Where the rating level does not exceed the background sound level, BS 4142 comments that this is an indication of the specific sound source having a low impact, again depending on the context.

12.4.3 Operational Phase – Vehicular Traffic

In order to assist with the interpretation of the noise associated with vehicular traffic on existing public roads, Table 12.7 offers guidance as to the likely impact associated with any particular change in traffic noise level (Source Design Manual for Roads and Bridges (DMRB), 2011).

Change in Sound Level (dB LA10)	Magnitude of Impact (DMRB)	Impact Guidelines on the Information to be contained in EIAR (EPA)
0	No Impact	Imperceptible
0.1 – 2.9	Negligible	Not Significant
3 – 4.9	Minor	Slight, Moderate
5 – 9.9	Moderate	Significant
10+	Major	Very Significant

Table 12.7: Likely Impact Associated with Change in Traffic Noise Level.

The corresponding significance of impact presented in the 'EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017 is presented in Table 12.7 for consistency in wording and terminology for the assessment of impact significance.

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3 dB(A) is generally considered to be the smallest change in environmental noise that is perceptible to the human ear. A 10 dB(A) change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

12.4.4 Operational Phase – Inward Noise Impact

The Draft Dun Laoghaire Rathdown Noise Action Plan (NAP) was published in November 2018. The NAP states the following with respect to assessing the noise impact on new residential development:

> *"In the scenario where new residential development or other noise sensitive development is proposed in an area with an existing climate of environmental noise, there is currently no clear national guidance on appropriate noise exposure levels. The EPA has suggested in the interim, that Action Planning Authorities should examine planning policy guidance notes issued in England titled, 'ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise'. This has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England."*

In addition, the following is provided:

> *"In advance of any national guidance relating to noise in the planning process, the following actions relating to planning and development will be considered for implementation:*
>
> *a. To review existing guidelines and policy relating to Noise in the County Development Plan and to ensure noise is a consideration in Local Area Plans and Part 8's and enhanced in the next County Development Plan.*
> *b. To develop guidance note on Noise considerations in the planning process that can be issued to developers at pre-planning stage.*
> *c. To require developers to produce a sound impact assessment and mitigation plans, where necessary, for any new development where the Planning Authority considers that any new development will impact negatively on pre-existing environmental noise levels within their Council area.*
> *d. To ensure that future developments are designed and constructed in accordance best Irish practice to minimise noise disturbances through good acoustic design and take into account the multifunction uses of street (e.g. movement, recreation) and to ensure central areas of large mixed used developments area quiet."*

The Professional 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 it's adoption it has been generally considered as a best practice guidance and has been widely adopted in the absence of equivalent Irish guidance.

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

- Stage 1 - Comprises a high-level initial noise risk assessment of the proposed site considering either measured and or predicted noise levels; and,
- Stage 2 – Involves a full detailed appraisal of the proposed development covering four "key elements" that include:
    - Element 1 - Good Acoustic Design Process;
    - Element 2 - Noise Level Guidelines;
    - Element 3 - External Amenity Area Noise Assessment
    - 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 12.7 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.

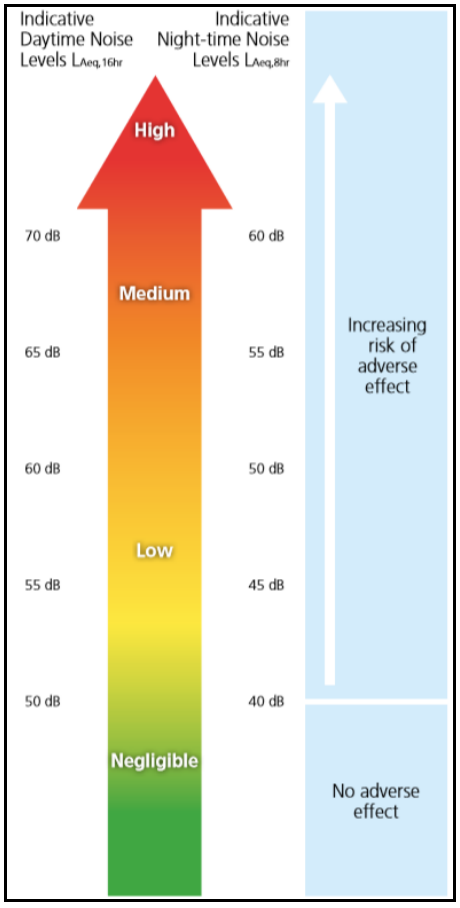

Figure 12.7: ProPG Stage 1 - Initial Noise Risk Assessment.

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

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 12.8 and are based on annual average data, that is to say they omit occasional events where higher intermittent noisy events may occur.

Activity	Location	(07:00 to 23:00hrs)	(23:00 to 07:00hrs)
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_{AFmax}*

Table 12.8: ProPG Internal Noise Levels.

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 $L_{Aeq,16hr}$."*

12.4.5 Operational Phase – Other Noise Sources

For other non-traffic related sources 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 follows:

Activity	Location	(07:00 to 23:00hrs)	(23:00 to 07:00hrs)
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 $L_{Aeq, 8hr}$

Table 12.9: Recommended Indoor Ambient Noise Levels from BS 8233: 2014

12.5 Predicted Impacts of the Proposed Development

12.5.1 Construction Phase – Noise

It is predicted that the construction programme will create typical construction activity related noise on site. During the construction phase of the proposed development, a variety of items of plant will be in use, such as excavators, lifting equipment, dumper trucks, compressors and generators.
The proposed general construction hours are 07:00 to 18:00hrs, Monday to Friday and 08:00 to 14:00 on Saturdays.

Due to the nature of daytime activities undertaken on a construction site of this nature, there is potential for generation of significant levels of noise.

Due to the fact that the construction programme has been established in outline form only, it is difficult to calculate the actual magnitude of noise emissions to the local environment. However, it is possible to predict typical noise levels using guidance set out in B*S5228-1:2009+A1:2014*. Table 12.10 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.

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
	Track 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
Foundations	Tracked Excavator (C3.24)	74
	Concrete Pump (C3.25)	78
	Compressor (D7 6)	77
	Poker Vibrator (C4 33)	78
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

Table 12.10: Typical Construction Noise Emission Levels.

For the purposes of the assessment we have assumed that standard good practice measures for the control of noise from construction sites will be implemented. These issues are commented upon in further detail in the mitigation section of this chapter.

Table 12.11 presents the predicted daytime noise levels from an indicative construction period on site at the nearest off-site receptor. Note construction noise sources for site are assumed to be running 50% of the time over soft ground. The predictions have been prepared at various distances to provide an overview of how construction works will effect noise sensitive at various locations across the site.

Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref.)	Construction Noise Level (dB L_{Aeq}) at Distance:		
		10m	25m	50m
Site Preparation	Wheeled Loader Lorry (D3 1)	65	57	51
	Track Excavator (C2 22)	62	54	48
	Dozer (C2.13)	68	60	54
	Dump Truck (C4.2)	68	60	54
Site Preparation Total		**72**	**64**	**58**

Demolition	Pulveriser on Tracked Excavator (C1.5)	62	54	48
	Tracked Crusher (C1.14)	72	64	58
	Breaker Mounted on Backhoe (C1.2)	82	74	68
	Dump Truck (C4.2)	68	60	54
Demolition Total		**83**	**75**	**69**
Foundations	Tracked Excavator (C3.24)	64	56	50
	Concrete Pump (C3.25)	68	60	54
	Compressor (D7 6)	67	59	53
	Poker Vibrator (C4 33)	68	60	54
	Large Rotary Bored Piling Rig (C3.14)	73	65	59
Foundations Total		**76**	**68**	**62**
General Construction	Hand tools	71	63	57
	Tower Crane (C4.48)	66	58	52
	Pneumatic Circular Saw (D7.79)	65	57	51
	Internal fit – out	60	52	46
General Construction Total		**73**	**65**	**59**
Landscaping	Dozer (C2.13)	68	60	54
	Dump Truck (C4.2)	68	60	54
	Surfacing (D8.25)	58	50	44
Landscaping Total		**71**	**63**	**57**

Table 12.11: Predicted Construction Noise Levels.

Construction predictions indicate that a significant impact may temporarily occur when works are on-going at the boundaries to the closest sensitive residential receptors at the west of the site. However, the vast majority of the construction works will take place at distances from the receptors where no significant impacts are predicted, for instance at distances of 25m only the demolition and piling works are expected to cause a significant impact.

It should be noted that where significant impacts are predicted, these are worst case scenarios that assume all plant for an activity will operate along the boundary line opposite a sensitive receptor, under real world conditions this is unlikely to occur. Construction noise levels will be lower than these levels for the majority of the time at the majority of properties in the vicinity of the proposed development.

In addition to this, the closest facades of the residential receptor located on the western perimeter has no sensitive windows on the façade overlooking the site. The result of this will be that any windows on the north and south façade of this receptor will benefit from the barrier effect of the building structure for many of the site activities.

Temporary School

Due to the close proximity of the temporary school (east of site) i.e. school building is some 10m distance from site boundary, there is a potential for the adopted criteria to be exceeded when construction works are taking place immediately along the boundary. This assumes, however, that all items of equipment assessed are operating simultaneously along this boundary. Given that these noise levels constitute worst case conditions with the listed construction activities all being conducted at the closest development area to the nearest noise sensitive location, actual construction noise level emission will likely be lower than the

levels listed above. Notwithstanding, suitable noise mitigation measures must be adopted to reduce the noise exposure at this location e.g. restricted operating hours during school times when the noisiest works are within 50m distance of the school building (e.g. piling and demolition works), if the school (which is subject to a temporary permission) is still located beside the subject site when construction works begin.

12.5.2 Construction Phase - Vibration

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

In order to assess potential vibration impacts at the closest sensitive buildings to the site works, a range of typical level of vibration during augured piling have been determined through reference to published empirical data within BS 5228 – Part 2. The following vibration magnitudes associated with rotary bored piling using a 600mm pile diameter for bored piling into soft ground over rock are summarised below:

- 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.

The residential dwellings situated on the western perimeter of the site are located at the closest distances to the site. Considering the low vibration levels at very close distances to augured piling rigs, vibration levels at the nearest receptors are not expected to pose any significance in terms of cosmetic or structural damage. At further distances from the works vibration magnitudes will dissipate further resulting in lower vibration levels to those noted above and hence are orders of magnitude below the limit values in Table 12.6 for both structurally sound and more vulnerable buildings. In addition, the range of vibration levels is typically below a level which would cause any disturbance to occupants of the closest buildings along western perimeter of the site.

During 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 50m 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 50m respectively.

The range of values recorded provides some context in relation 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 12.1 are likely to be below the limits set out in Table 12.6 to avoid any cosmetic damage to buildings.

In terms of 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. Mitigation and management of these works are discussed in Section 12.6.1.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 12.6 during all activities. Further discussion on mitigation measures during this phase are discussed in Section 12.6.1.

12.5.3 Operational Phase – Outward Noise Impact

Mechanical Plant and Services

Once operational, if building services plant items are required to serve the commercial and residential aspect of the development, the cumulative operational noise level at the nearest noise sensitive location within the development (e.g. apartments, etc.) will be designed/attenuated to meet the relevant BS 4142 noise criteria for day and night-time periods.

Given the baseline noise levels measured in Section 12.3 appropriate criteria for plant noise levels at the nearest sensitive noise receptors is considered to be 52 dB $L_{Aeq,1hr}$ for the day period and 42 dB $L_{Aeq,15min}$ for the night period.

Noise Breakout from Gymnasium, Café and Rooftop Function Room

The location of the gymnasium, café and rooftop function room is along the northern boundary of the site. The nearest external noise sensitive locations to this area of the site are residential properties approximately 50m west and 60m north.

Breakout noise from within the café or function room should be controlled to ensure that it is not audible inside the nearest residences, particularly during night time operational hours. Noise breakout should typically be limited to an external level of 35dB $L_{Aeq,5min}$ at the façade of any nearby noise sensitive location. In addition there should be no clearly audible tonal or impulsive component to the noise build-up at nearby noise sensitive locations.

Care will be given at the design stage to ensure breakout noise to sensitive receptors within the development will not cause annoyance.

Noise Breakout from Creche

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 windows are located within the development, approximately 4m above the creche. 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 period) and the standard

noise insulation of the façade, it is predicted that the internal criteria in Table 12.9 will be met in all apartments and the resultant noise impact due to the creche is not significant.

12.5.4 Operational Phase – Additional Road Traffic

A traffic impact assessment relating to the proposed development has been prepared by O'Connor Sutton Cronin Consulting Engineers as part of this EIAR. Information from this report has been used to determine the predicted change in noise levels in the vicinity of a number of roads in the area surrounding the proposed development, for the opening and design years.

For the purposes of assessing potential noise impact, it is appropriate to consider the relative increase in noise level associated with traffic movements on existing roads and junctions with and without the development. Traffic flow data in terms of the AADT figures has been assessed and the calculated change in noise levels during these two periods are summarised in Table 12.12. The referenced route locations are presented in Figure 12.8.

Note that this assessment considers the worst-case cumulative impact of the proposed development as well as permitted nearby developments.

With reference to Table 12.7 the assessment indicates that changes in noise levels due to traffic volume increases will range from Imperceptible to Not Significant.

Route Ref	Change in Traffic Noise Levels, dB	
	Year 2023	Year 2038
A (Birch Avenue)	0.1	0.1
B (Blackthorne Drive)	0.5	0.5
C (Blackthorne Drive)	0.6	0.5
D (Carmanhall Road)	1.3	1.1
E (Carmanhall Road)	1.9	1.6
F (Carmanhall Road)	1.4	1.2
G (Corrig Road)	0.3	0.2
H (Blackthorne Road)	0.1	0.1
I (Blackthorne Road)	0.0	0.0
J (Blackthorne Road)	1.3	1.2
K (Blackthorne Road)	1.5	1.3

Table 12.12: Predicted Change in Noise Emissions (Comparison of Do Nothing and Do Something) (dB)

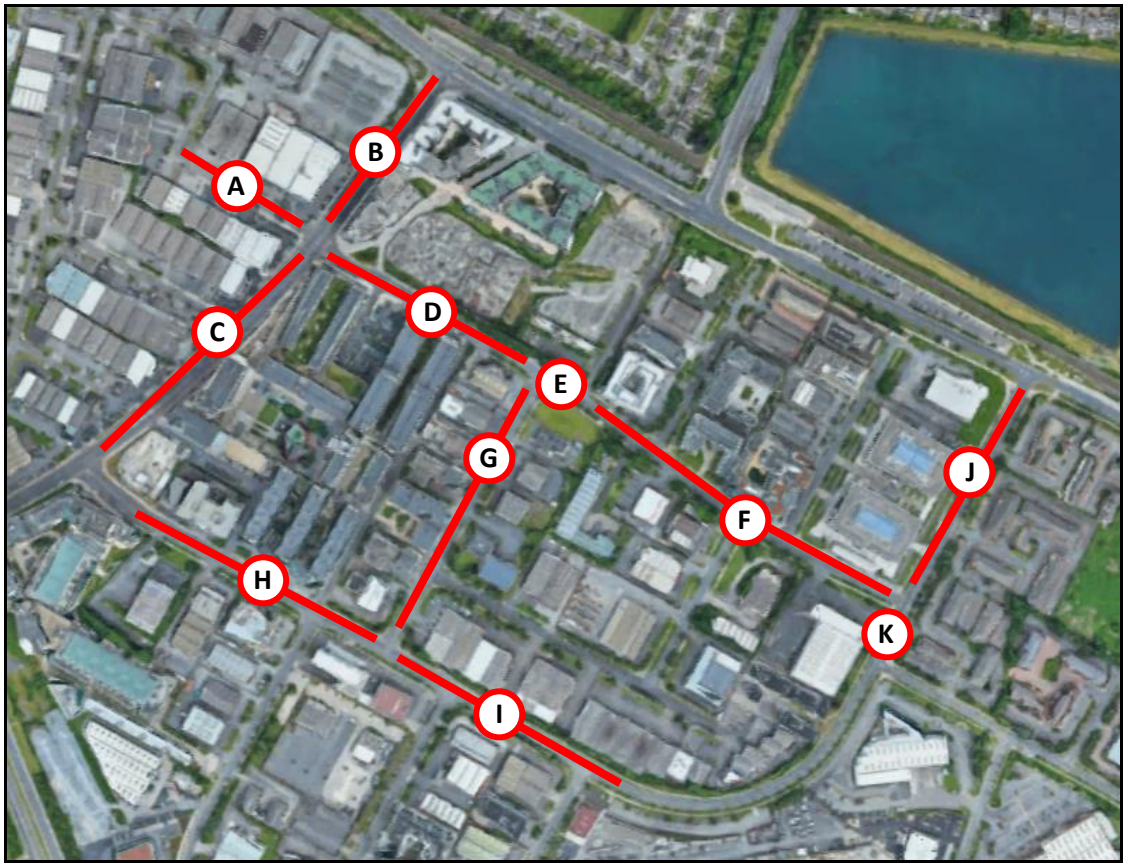

Figure 12.8: Plan of Assessed Routes

12.5.5 Operational Phase – Inward Noise Impact

The development lands in question are bound to the north by Blackthorn Avenue and to the south by Carmanhall Road 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.

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.

The following information was included in the model:

- Site layout drawings of proposed development;
- OS mapping of surrounding environment;
- 3D topographical survey data for the development and adjacent N11; and
- Annual Average Daily Traffic (AADT) along adjacent roads estimated from site calibration results.

Noise Model Validation

Noise levels recorded during the unattended survey were used to calibrate the noise model to within 1 to 2 dB of the calculated values. 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.

Location	Time Period	Measured Noise Level, dB	Calculated Noise Level, dB
N1	Daytime, $L_{Aeq,16hr}$	61 - 63	62
	Night-time, $L_{Aeq,8hr}$	53 - 55	55
N2	Daytime, $L_{Aeq,16hr}$	63 - 65	64
	Night-time, $L_{Aeq,8hr}$	54 - 58	56

Table 12.13: Calculated and measured Noise Levels at Development Site.

Figures 12.9 and 12.10 display the calculated noise contours across the site for day and night-time periods at a height of 4m above ground.

The results of the modelling exercise demonstrate that highest noise levels are experienced along the north and south of the site in proximity to the road edges and reduce considerably by the order of 10 – 15dB towards the central part of the site, in the absence of any development buildings.

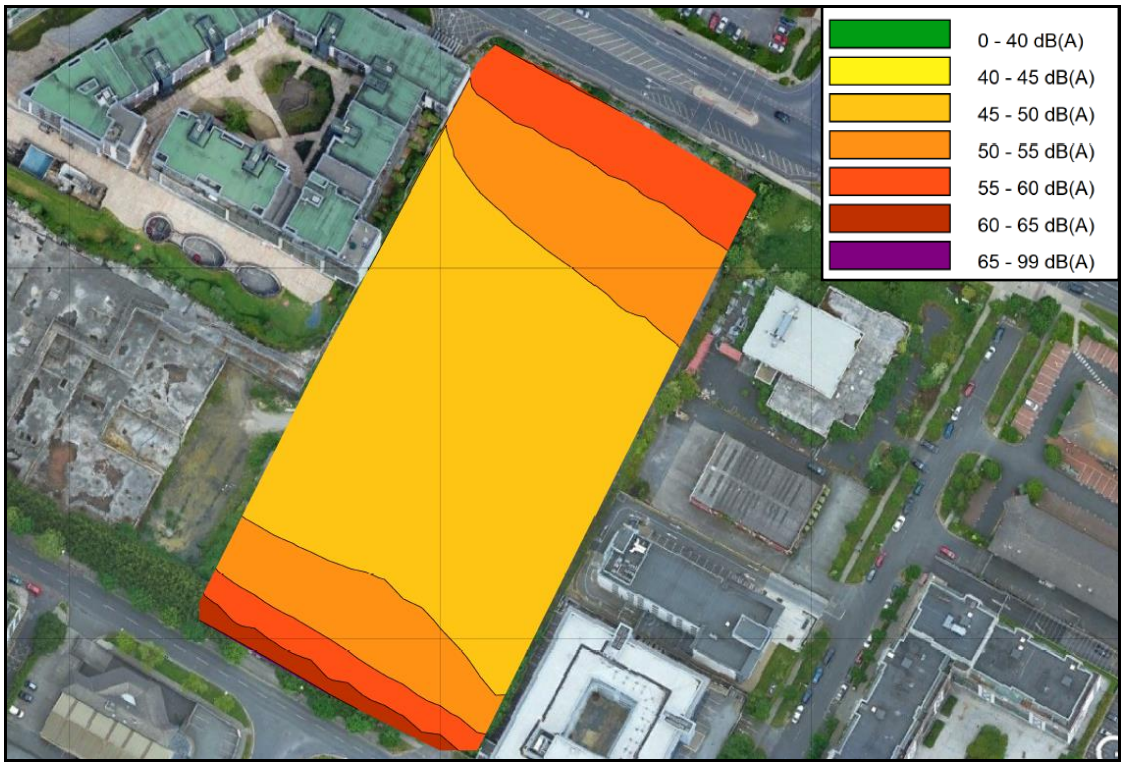

Figure 12.9: ProPG Stage 1 - Initial Noise Risk Assessment – Day Time.

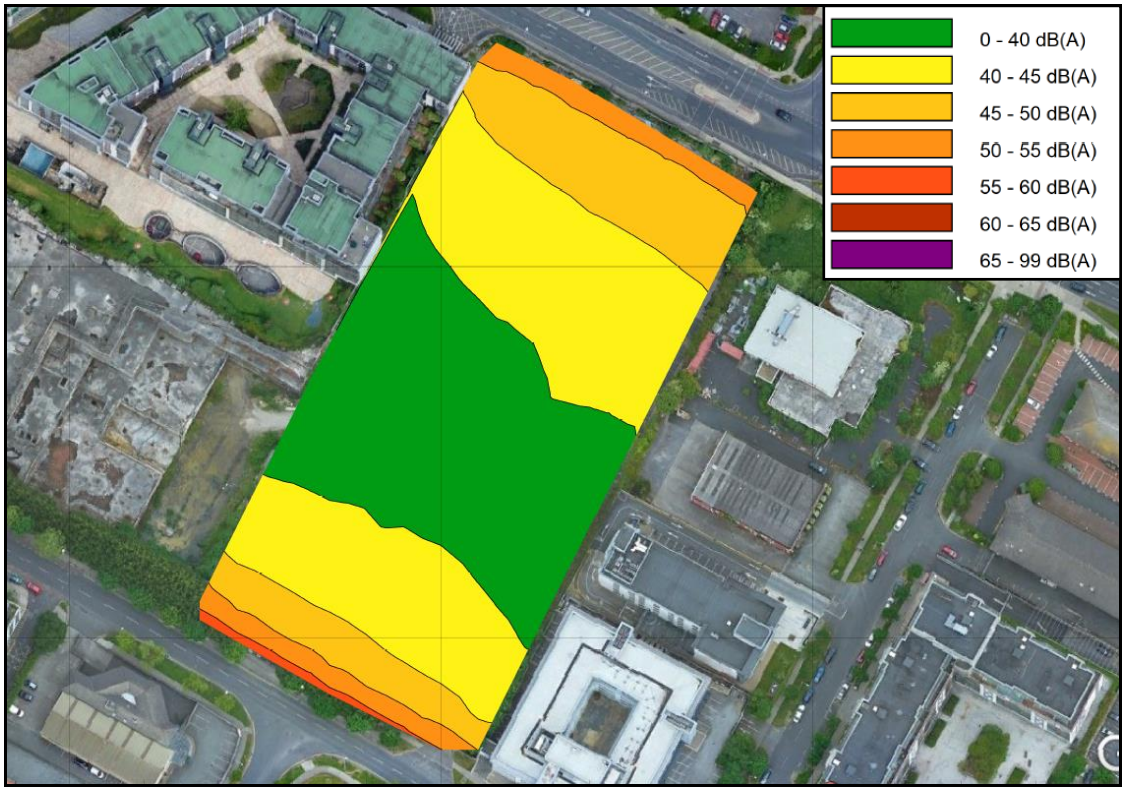

Figure 12.10: ProPG Stage 1 - Initial Noise Risk Assessment – Night Time.

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 low to medium noise risk categories.

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

Low Risk At low noise levels, the site is likely to be acceptable from a noise perspective provided that 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 in the finished development.

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.

Given the above it can be concluded that the development site may be categorised as *Low* to *Medium Risk* and as such the Acoustic Design Statement (following here and also in Section 12.6.3) 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 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 suitable 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.

Acoustic Design Statement – Part 1

Façade Noise Levels

Noise levels have been predicted across the development site during day and night-time periods using the noise model developed to include the development buildings. 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 ventilating the 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.

Where façade levels are above these levels 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 the internal noise criteria are achieved.

Figure 12.7 identifies those facades where the noise levels are higher and where mitigation in the form of enhanced glazing and ventilation will be required. The specification of this enhanced façade is discussed in Section 12.6.3.

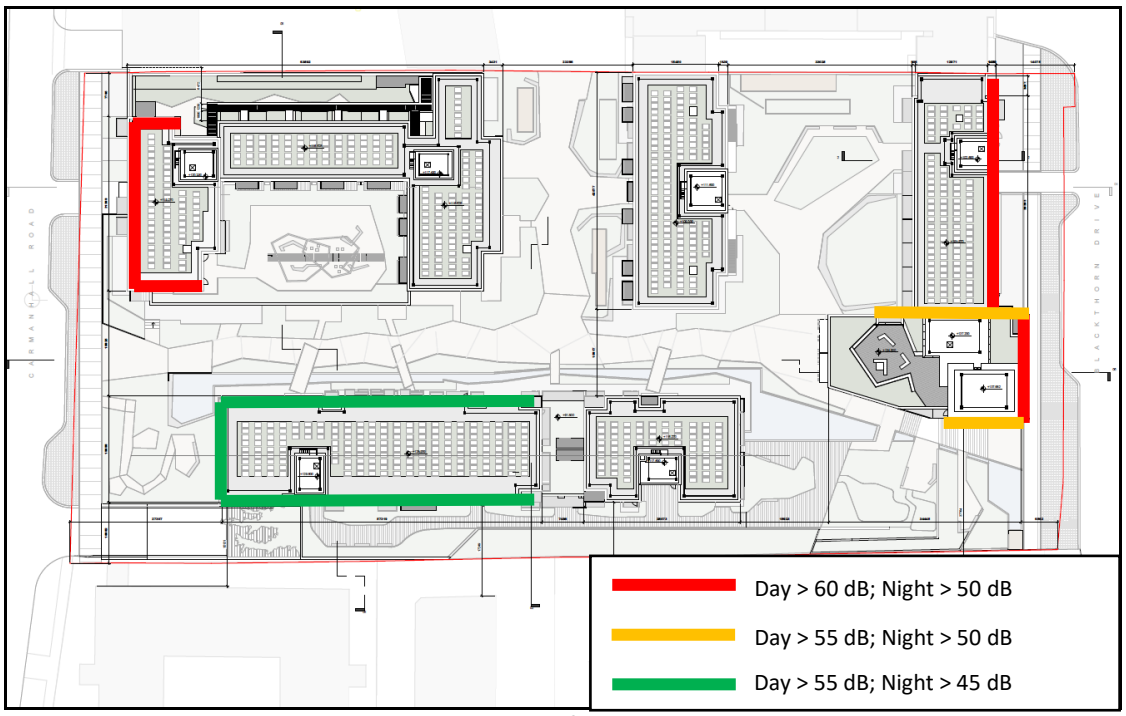

Figure 12.11: Facade Incident Noise Levels for Assessment

External Noise Levels

Figure 12.12 presents the calculated day time noise levels across the site with the development buildings in place. The contours are calculated for a height of 1.5m.

External noise levels within the vast majority of public open spaces across the development site are generally within the recommended range of noise levels from ProPG of between 50 – 55 dB $L_{Aeq,16hr}$ as illustrated in Figure 12.12. 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 12.12: Predicted Noise Levels Across External Areas (1.5m Above Ground).

12.6 Mitigation Measures

12.6.1 Construction Phase

With regard to construction activities, best practice control measures from construction sites within *BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2* will be used to control noise and vibration impacts. The contractor will ensure that all best practice noise and vibration control methods will be used as necessary in order to ensure impacts to nearby residential noise sensitive locations are not significant. This will be particularly important during demolition, foundation construction including piling works which are likely to be the activities to have the highest potential noise and vibration impact.

Noise-related mitigation methods are described below and will be implemented for the project in accordance with best practice. These methods include:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;

- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- During construction, the contractor will manage the works to comply with noise limits outlined in *BS 5228-1:2009+A1 2014. Part 1 – Noise;*
- 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;
- Limiting the hours during which site activities which are likely to create high levels of noise or vibration are permitted;
- Monitoring levels of noise and vibration during critical periods and at sensitive locations.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:

- Selection of plant with low inherent potential for generation of noise and/ or vibration;
- Erection of good quality site hoarding to the site perimeters which will act as a noise barrier to general construction activity at ground level;
- Erection of barriers as necessary around items such as generators or high duty compressors, and;
- Situate any noisy plant as far away from sensitive properties as permitted by site constraints.

Temporary School

Specific mitigation measures apply to the temporary school on the east boundary. In this instance consideration of sensitive hours will be required when undertaking the works most likely to cause the highest impacts (e.g. piling and demolition works). It is recommended that these works, or any other works that have the potential to exceed the noise threshold, are only undertaken during less sensitive periods when within 50m distance to the school. We note that this only applies if the school (which is subject to a temporary permission) is still located beside the subject site when construction works begin.

Vibration

In terms of vibration management, it is recommended that the contractor is proactive in engaging with local sensitive receptors and should notify them of any works forecast to generate appreciable levels of vibration, explaining the nature and duration of the works. This will be of particular importance during periods of demolition or piling activities.

12.6.2 Operational Phase – 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.

12.6.3 Operational Phase – 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 12.11 will be provided with glazing and ventilation that achieves the minimum sound insulation performance as set out in Table 12.14 and Table 12.15. Other facades in the development have no minimum requirement for sound insulation.

Facade	Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
RED	30	32	38	36	40	49
ORANGE	30	29	33	41	46	49
GREEN	Standard Glazing Systems					

Table 12.14: Sound Insulation Performance Requirements for Glazing, SRI (dB)

Facade	Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
RED	42	42	36	40	43	45
ORANGE	37	34	35	43	51	50
GREEN	Standard Ventilation Systems					

Table 12.15: Sound Insulation Performance Requirements for Ventilation, SRI (dB)

The overall R_w and $D_{ne,w}$ outlined above 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 Tables 12.14 and 12.15 or greater.

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 can 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.

Note that the façade specifications are also relevant to the creche located in Block D.

12.7 Monitoring

12.7.1 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 for human disturbance and BS ISO 4866:2010 for building damage.

12.7.2 Operational Phase

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

12.8 Interactions

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 traffic flow projections associated with the development provided by the traffic consultants.

12.9 Difficulties Encountered

No difficulties were encountered during the formation of this chapter.

12.10 Residual Impacts

12.10.1 Construction Noise

Demolition and piling activities are predicted to exceed the noise threshold for potential significant effect when they occur at the closest proximity to the dwellings located on the boundary of the site. However, it should be noted that the assessment can be considered worst case and it is unlikely that all items of plant assessed will be in operational simultaneously. Additionally, the predictions only indicate a potential significant 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 demolition activities undertaken on site are categorised as:

Quality	*Significance*	*Duration*
Negative	Significant	Temporary

All other construction activities are categorised as:

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

12.10.2 Construction Vibration

It is expected that vibration from construction activities will be perceptible at receptor locations. The impacts are predicted to be as follows:

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

12.10.3 Additional Traffic on Roads

All impacts are predicted to be as follows:

Quality	*Significance*	*Duration*
Neutral	*Not Significant*	*Permanent*

12.10.4 Operational Outward Noise Impact

All impacts are predicted to be as follows:

Quality	*Significance*	*Duration*
Neutral	*Not Significant*	*Permanent*

12.10.5 Operational Inward Noise Impact

In terms of the inward noise impacts, specification of noise mitigation has been recommended so that internal noise criterion may be met. With mitigation measures in place the impacts are categorised as:

Quality	*Significance*	*Duration*
Neutral	*Not Significant*	*Permanent*

12.11 Cumulative impacts

As discussed in Section 9.5.4, this assessment already considers the cumulative operational impact for all known permitted sites.

In terms of construction noise, it's noted that construction works at the Rockbrock Phase II may be ongoing at the adjacent site simultaneous to this project. In this scenario elevated construction noise emissions due to cumulative noise are likely to occur at receptor locations equidistant to both sites, for instance receptors bounding the west and south of the site. Cumulative impacts will need to be considered and managed during the construction phase. It is recommended that liaison between both 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.

12.12 'Do Nothing' Scenario

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/noted during the baseline studies are considered representative of the Do-Nothing scenario. The Do-Nothing scenario is therefore considered neutral impact.