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PROPOSED RESIDENTIAL DEVELOPMENT ON LANDS AT EDMONDSTOWN

ACOUSTIC DESIGN STATEMENT

Technical Report Prepared For

BCDK Limited and
Coill Avon Limited

Technical Report Prepared By

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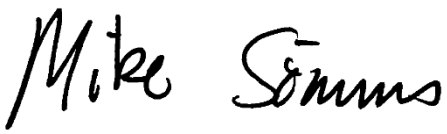
Signature		
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EXECUTIVE SUMMARY

AWN Consulting has been commissioned to carry out a study in relation to the potential noise impacts incident to the proposed residential developments on lands at Edmondstown, South County Dublin.

A baseline noise survey has been carried out to quantify the existing noise climate at the site. This information, along with available noise mapping in the wider area and has classified the development site as having a range of noise levels associated with a '*Low to Medium to High Risk'* depending on the proximity to the M50 motorway.

A noise assessment has been undertaken based on the results of the noise survey as recommended in the ProPG: Planning & Noise guidance document. The assessment concludes that all residents will enjoy a 'Good' internal noise environment when the appropriate enhanced acoustic glazing and acoustic vents are employed.

As a mitigation measure, double glazing systems will be selected to provide, as a minimum, the octave band sound reduction indices as outlined in the relevant sections of this document. It should be noted that the example glazing specifications contained within this report are readily available as double-glazed units. A minimum acoustic performance for the fresh air vents has also specified.

All residents will be able to access external areas that are predicted to achieve the external noise levels recommended in the ProPG document and that are also below the threshold set out in the South Dublin Council Noise Action Plan 2018 – 2023 where a daytime level above 70 dB(A) is considered undesirably high.

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1.0 INTRODUCTION

AWN Consulting has been commissioned to carry out a study in relation to the potential noise impacts incident to the proposed residential development at Whitchurch Road, Edmondstown, Rathfarnham, Co. Dublin. The focus of this report is to provide input into the acoustic design of the proposed development, identify any potential noise impacts and provide measures to minimise or mitigate those impacts. Figure 1 presents the approximate outline of the proposed development site.

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

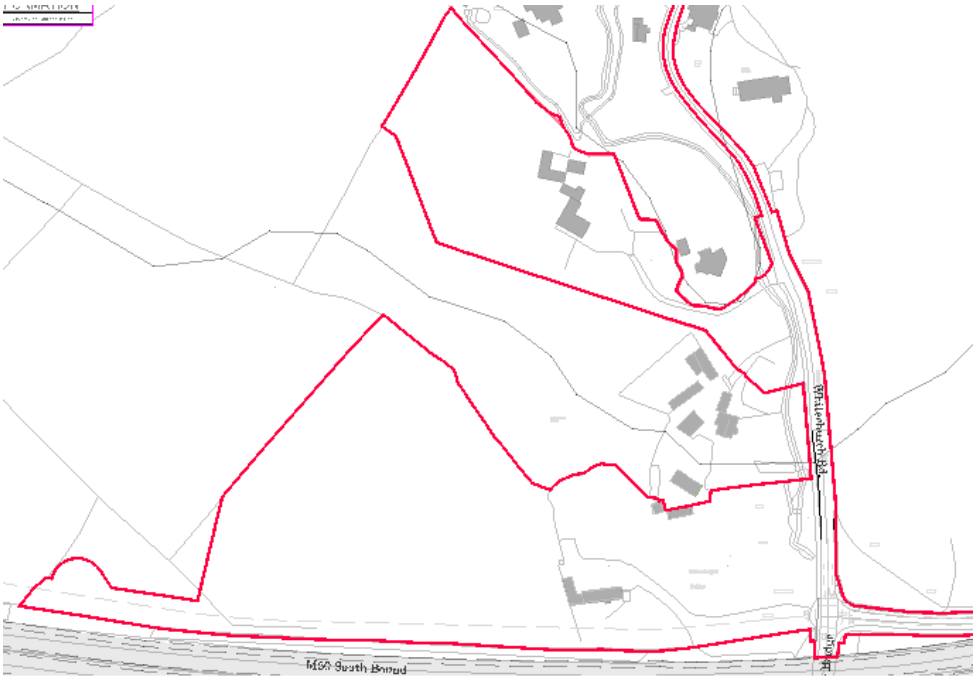

Figure 1 Location of proposed development

2.0 DEVELOPMENT DESCRIPTION

The proposed development on a site that extends to 6.77 hectares includes the derelict Kilmashogue House (southern lands) and Coill Avon house (northern lands), adjacent roads in the control of South Dublin County and Dun Laoghaire Rathdown County Councils and consists of the following developments: -

- Demolition of Kilmashogue House and outbuildings and demolition of Coill Avon house and outbuildings;
- The refurbishment and re-use of 2 no. stone outbuildings for community use, to be incorporated into an area of public open space on the southern lands;
- The construction of a mixed-use development comprising neighbourhood centre and 178 no. residential units comprising 72 no. houses, 38 no. apartments and 68 no. duplex apartments;
- The 72 no. houses will comprise 2, 2.5 and 3-storey detached, semi-detached and terraced units to include:-
    - 7 no. 2-bed houses
    - 44 no. 3-bed houses;
    - 21 no. 4-bed houses;
- The 38 no. apartments and 68 no. duplex apartments are located across 7 no. buildings ranging in height from 3 to 5-storey consisting of 1 no. Block A/B, 1 no. Block C, 1 no. Block E, 1 no. Block S and 3 no. Blocks T-type as follows: -
    - Block A/B: 5-storey over basement and podium accommodating 10 no. 1-bed apartments, 16 no. 2-bed duplex apartments and 1 no. 3-bed duplex apartment with associated balconies/terraces;
    - Block C: 5-storey over basement accommodating 4 no. 1-bed apartments and 8 no. 2-bed duplex apartments with associated balconies/terraces;
    - Block E: 4-storey over basement accommodating 8 no. 1-bed apartments and 16 no. 2-bed duplex apartments with associated balconies/terraces;
    - Block S: 3-storey accommodating 2 no. 2-bed duplex apartments and 1 no. 3-bed apartment and 1 No. 3-bed duplex apartments with associated balconies/terraces;
    - Block T: 3no. 3-storey buildings accommodating 6 no. 1-bed apartments, 18 no. 2-bed duplex apartments, 9 no. 3-bed apartments and 6 no. 3-bed duplex apartments, all with associated balconies/terraces;
- Block A/B and Block C are arranged around a landscaped podium. The neighbourhood centre is located below this podium and accommodates a 2-level creche (313m²) at lower ground and ground floor level, and 3 no. retail/non-retail/cafe service units (470m2) at ground level;
- The basement below Block A/B and Block C accommodates 50 no. car parking spaces, bicycle parking, bin stores, plant and staff service area (80m2);
- The basement below Block E accommodates 35 no. car parking spaces, bicycle parking, bin store and plant;
- A section of link street with footpath and cycle path (approx. 438 linear metres) extending from the junction of Whitechurch Road and College Road on an alignment parallel to the M50, to provide access to the southern development lands and incorporating a bus turning circle;
- Upgrade works to College Road including a new two-way cycle track and relocated footpath from the Whitechurch Road junction to provide connectivity to the Slang River pedestrian/cycle Greenway;
- A new signalised crossroads junction to connect the proposed link street with Whitechurch Road and College Road;
- Upgrade to the existing vehicular access at the entrance to Coill Avon house on Whitechurch Road;

- Foul sewer drainage works along Whitechurch Road from the Kilmashogue junction to the existing junction at Glinbury housing estate;
- All landscaping, surface car parking, boundary treatments, infrastructure works, ESB substation, and associated site works and services.

3.0 DESIGN GUIDANCE

3.1 South County Dublin Council Noise Action Plan (NAP)

The *Dublin Agglomeration Environmental Noise Action Plan December 2018 – July 2023 Volume 4 – South Dublin County Council* (NAP) states the following regarding how noise should be dealt with in the planning system for new noise-sensitive developments, from section 8.2.3:

> *"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 that in the interim that Action Planning Authorities should examine the 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 accordance with this NAP policy, the following Acoustic Design Statement (ADS) has been prepared to comply with the requirements of this policy.

In addition to ProPG, the South County Council Noise Action Plan 2018 – 2023 has been published in order to address the requirements of the European Noise Directive 2002/49/EC. This NAP produced noise maps in order to determine the population exposure to undesirably high noise levels and also to identify areas with desirably low noise that should be preserved into the future. The NAP defines the following ranges for these descriptions:

- Undesirably high external noise levels are defined as being above 55 dB at night and/or above 70 dB during the day, and;
- Desirably low external noise levels are defined as being below 50 dB at night and/or below 55 dB during the day.

It is important to note that the NAP does not recommend that residential development be restricted within areas identified as having undesirably high noise levels. Rather it recommends a range of noise mitigation measures be required for new residential developments within these areas.

3.2 ProPG: Planning & Noise

The *Professional Practice Guidance on Planning & Noise* (ProPG) document was published in May 2017. The document was prepared by a working group comprising members of the Association of Noise Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH). Although not a government document, since 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

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

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

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

A summary of the ProPG approach is illustrated in Figure 3.

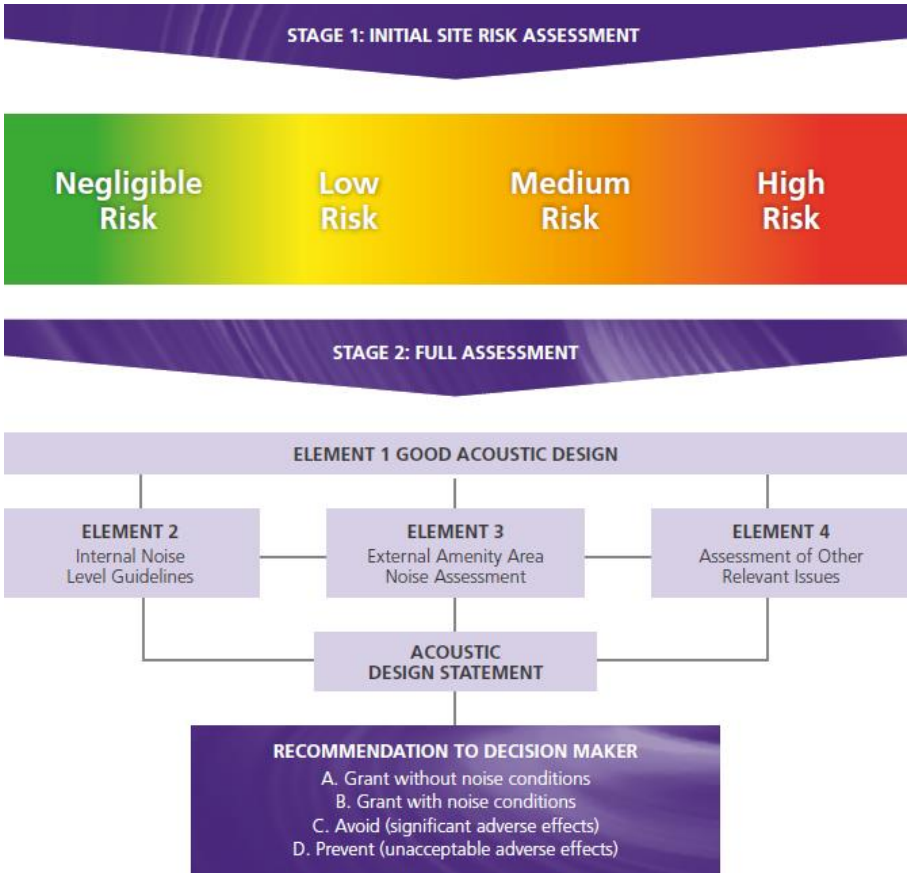

Figure 2 ProPG Approach (Source: ProPG)

4.0 STAGE 1 – NOISE RISK ASSESSMENT

4.1 Methodology

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 4 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.

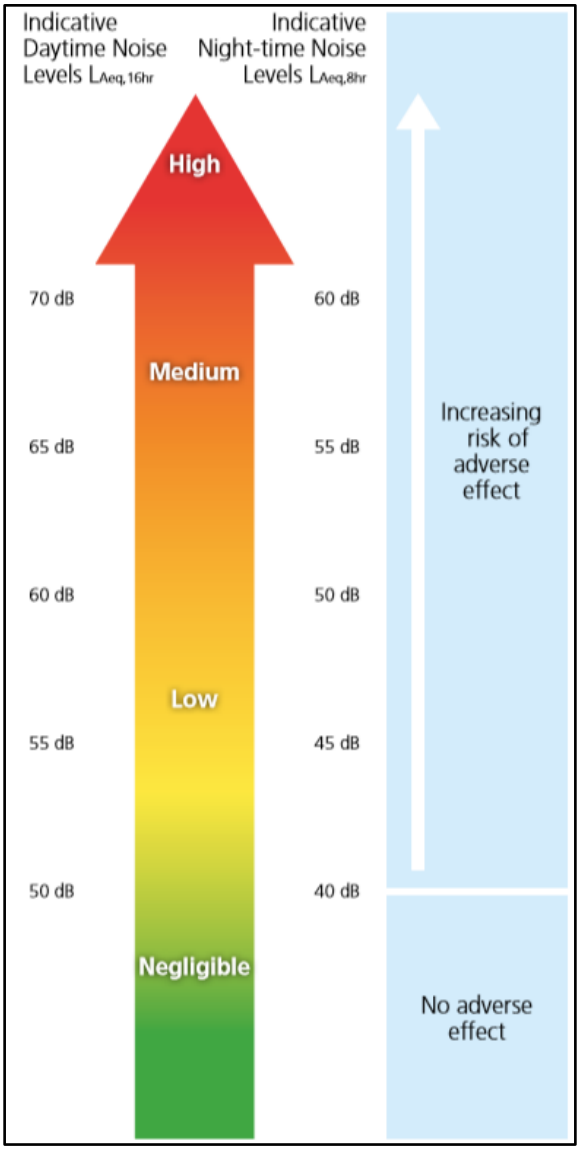

Figure 3 ProPG Stage 1 - Initial Noise Risk Assessment

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.

Paragraph 2.9 of ProPG states that,

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

In this instance it is proposed to develop a 3D computer noise model of the development site and predict the noise levels across the entire site in order to investigate the initial noise risk. The noise model will use the measured noise levels during the survey, discussed in Section 3.2, to validate the model. Furthermore, the model allows the site to be assessed considering the changes in topography that are required to allow development. This is to comply with the requirements of paragraph 2.8 of ProPG which states,

> *"The risk assessment should not include the impact of any new or additional mitigation measures that may subsequently be included in development proposals for the site and proposed as part of a subsequent planning application. In other words, the risk assessment should include the acoustic effect of any existing site features that will remain (e.g. retained buildings, changes in ground level) and exclude the acoustic effect of any site features that will not remain (e.g. buildings to be demolished, fences and barriers to be removed) if development proceeds."*

4.2 Baseline Noise Environment

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.

4.2.1 Methodology

An environmental noise survey was conducted at the site on from 29 September to 1 October 2020 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 4.

Location UN1 is located within the existing site, at a distance of the order of 30 m from the edge of the M50 motorway.

Location AT1 is located at the eastern boundary of the site near the existing entrance.

Location AT2 is located along the northern boundary of the larger part of the site.

Location AT3 is located along the northern boundary of the larger part of the site.

Figure 4 Noise Survey Locations

4.2.2 Survey Periods

Unattended noise measurements were conducted between 11:30hrs on 29 September and 12:00hrs on 1 October 2020. Attended measurements were carried out between 12:35 and 14:15 on 29 September 2020.

The weather during the survey period was mainly dry with varying cloud cover, although roads were wet at during the installation of the sound level meters. Wind speeds were moderate; however they were not considered to have had a detrimental effect on the noise measurements.

It is noted that the noise survey was undertaken during Covid-19 lockdown conditions and that the primary noise source, i.e. traffic noise, was not at "normal" levels due to reduced traffic flows and activity in the immediate area surrounding the development site.

In order to allow for robust assessment, it has been assumed that a 50% reduction in traffic flows is prevalent surrounding the development site during the noise survey. A correction of +3dB will be added to measured noise levels for the purposes of the façade assessment.

4.2.3 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_{day} the 12 hour A-weighted long-term average sound level, determined over all the day periods of a year;

$L_{evening}$ the 4 hour A-weighted long-term average sound level, determined over all the evening periods of a year;

L_{night} the 8 hour A-weighted long-term average sound level, determined over all night periods of a year.

L_{den} "Lday, evening, night": This is based on 24-hour L_{Aeq} values but includes 'weightings' for evening and night-time noise levels: 5 dB is added to the evening levels and 10 dB to the night-time levels. It is by definition a value that is based on long-term averaging over a full year.

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.

4.2.4 Unattended Noise Measurements

Table 1 presents a summary of noise levels measured during the noise survey at location UN1 during day and night-time periods.

Start Time	Period	Overall $L_{Aeq,\,T}$ dB
Tuesday 29 September	Day	67
Tuesday 29 to Wednesday 30 September	Night	62
Wednesday 30 September	Day	68
Wednesday 30 to Thursday 1 October	Night	63
Thursday 1 October	Day	70
Highest Day		70
Highest Night		63

Table 1 Summary of Measured Noise Levels at location UN1

At Location UN1, daytime noise levels were in the range 67 to 70 dB $L_{Aeq,16hr}$ and night-time noise levels were in the range 62 to 63 dB $L_{A90,8hr}$. The measured value of L_{den} at this location is 71 dB.

L_{Aeq} and L_{AFMax} values were measured at 15-minute intervals over the duration of the survey. Figures 5 and 6 present the number of measured L_{Aeq} and L_{AFMax} events for each decibel level during the day and night periods. It is noted from Figure 6 the noise level of 75 dB L_{Amax} is not normally exceeded.

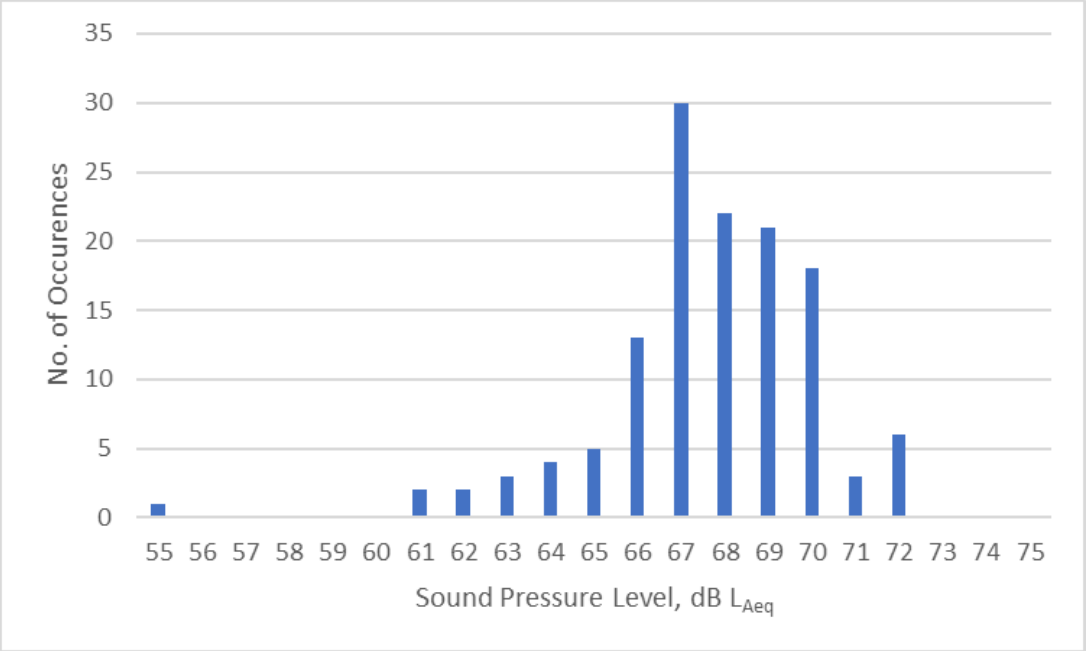

Figure 5 Number of Events at Each Decibel Level – Day

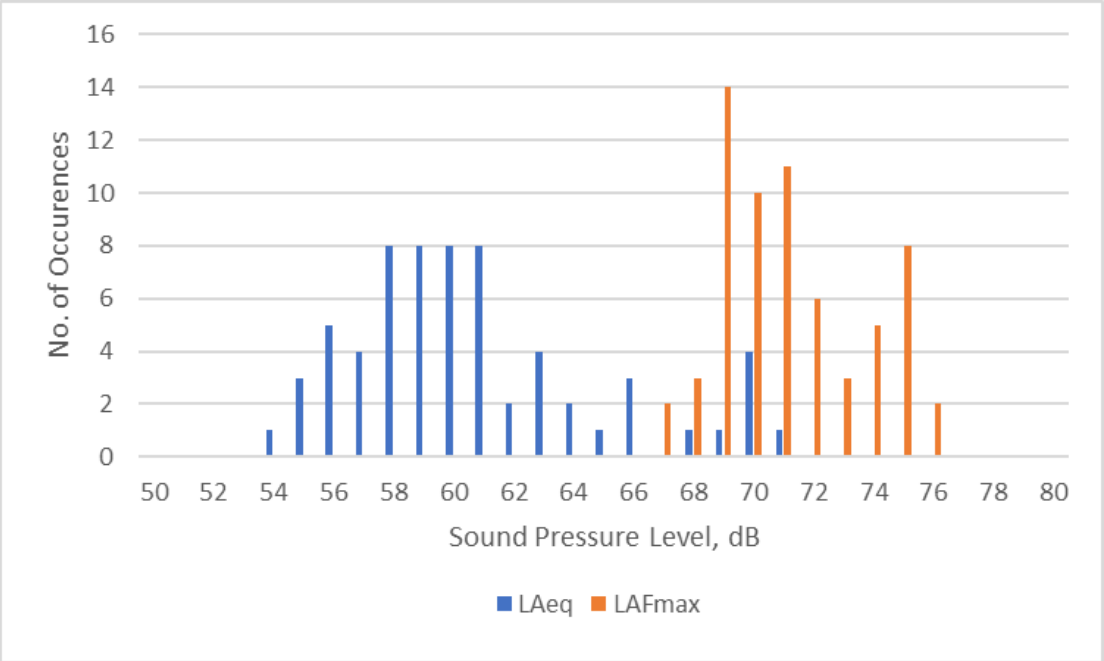

Figure 6 Number of Events at Each Decibel Level – Night

4.2.5 Attended Noise Measurements

The survey results for the attended monitoring are given in Table 2.

Location	Start Time (hrs)	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)	
		$L_{Aeq.15min}$	L_{A90}
AT1	12:35	64	61
	12:50	65	62
	13:05	65	63
AT2	11:41	58	55

Location	Start Time (hrs)	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)	
		$L_{Aeq.15min}$	L_{A90}
	11:58	58	55
	12:13	59	56
AT3	13:29	56	52
	13:44	57	54
	13:59	58	56

Table 2 Summary of Attended Results

Noise levels were in the range 56 to 65 dB $L_{Aeq,15min}$ and 52 to 63 dB $L_{A90,15min}$. The M50 motorway was the dominant noise source, with occasional local road traffic audible at locations AT1 and AT3.

4.3 Round 3 Road Noise Maps

Transport Infrastructure Ireland (TII) have produced noise maps for major roads[1] in Dublin City and County. Figure 7 presents the predicted noise levels across the development site for road traffic in terms of L_{den}. The measured L_{day} of 67 to 70 dB $L_{Aeq16hr}$ at UN1 compares favourably with the TII noise map which indicates noise levels of >70 dB L_{den} for the same point on the site, considering that traffic flows are likely to have been reduced due to movement restrictions for COVID-19.

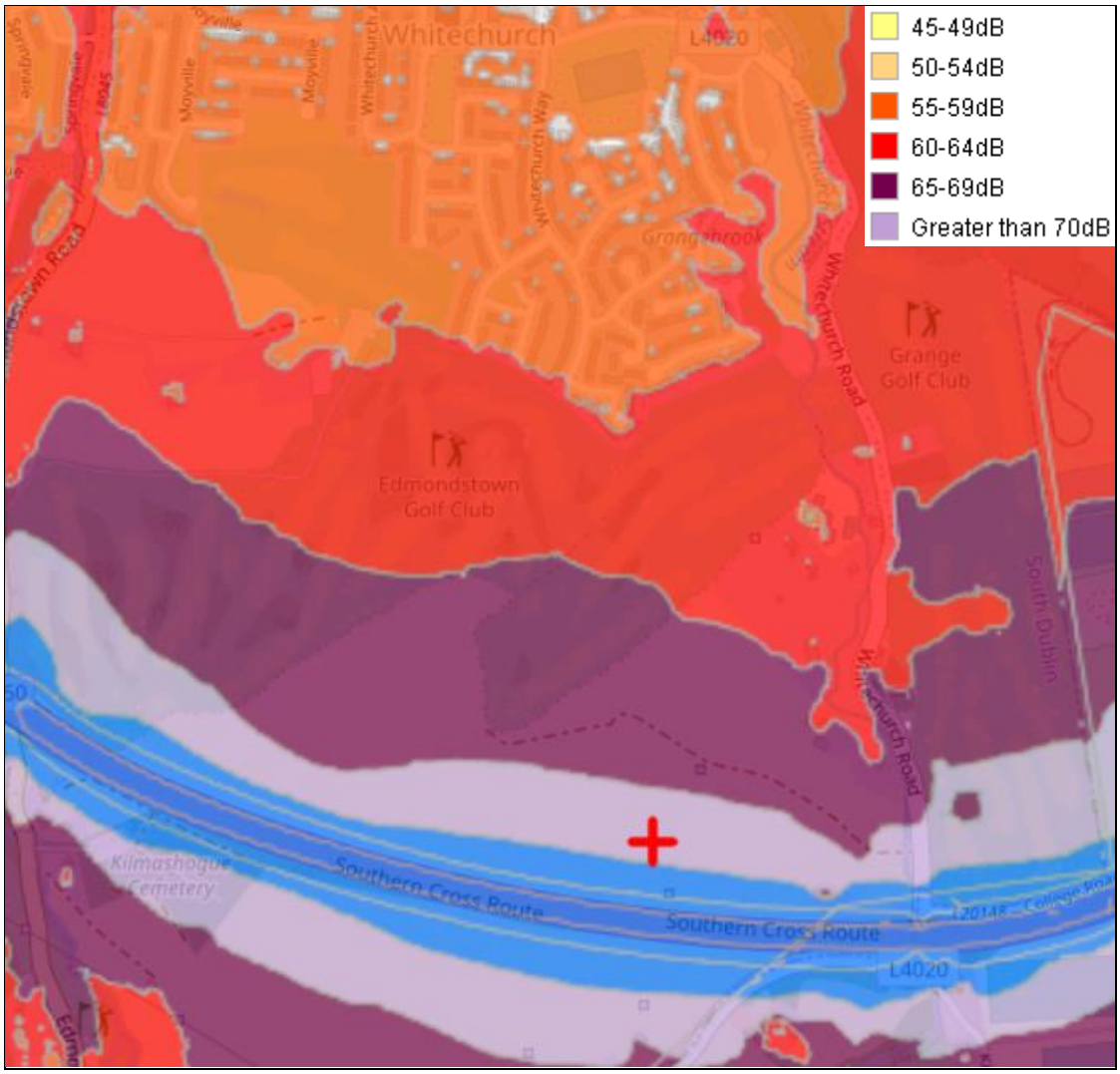

Figure 7 L_{den} Road Traffic Noise Levels

[1] Defined as roads with more than 3,000,000 vehicles per annum

4.4 Road Noise Model

In addition to the noise survey discussed in the previous section, proprietary noise calculation software has been used for the purposes of this impact assessment to calculate road traffic noise levels at various facades across the development site. The selected software, Brüel & Kjær Type 7810 Predictor, calculates noise levels in accordance with the UK's *Calculation of Road Traffic Noise* (CRTN 1988) which is the recommended procedure for Irish National routes as per Transport Infrastructure Ireland's (TII) *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (2004).

The resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- The magnitude of the noise source in traffic flow and average velocity;
- The distance between the source and receiver;
- The presence of obstacles such as screens or barriers in the propagation path;
- The presence of reflecting surfaces; and,
- The hardness of the ground between the source and receiver.

In order to determine the noise levels at the various façades of the proposed development, the following information was included in the model:

- Site layout drawings of proposed development, and;
- OS mapping of surrounding environment.

The results of the noise survey were used to calibrate the noise model. In this instance the noise model results are within 1 dB of the measured values indicating good agreement between the model and the measurements. Figure 8 shows a 3D view of the noise developed model.

Predicted noise levels for day and night periods over the site, in the absence of the proposed development are presented in Figure 9 and Figure 10. These are used to evaluate the Noise Risk at the site. Noise levels are predicted at 4 m above ground level in all cases.

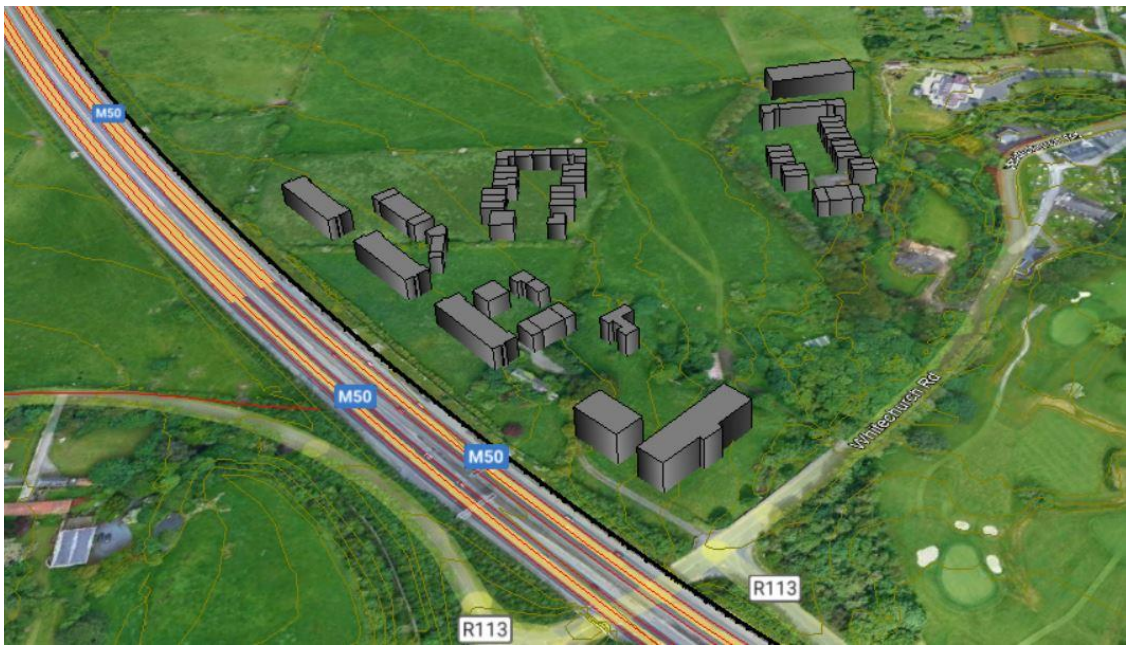

Figure 8 3D Noise model of site

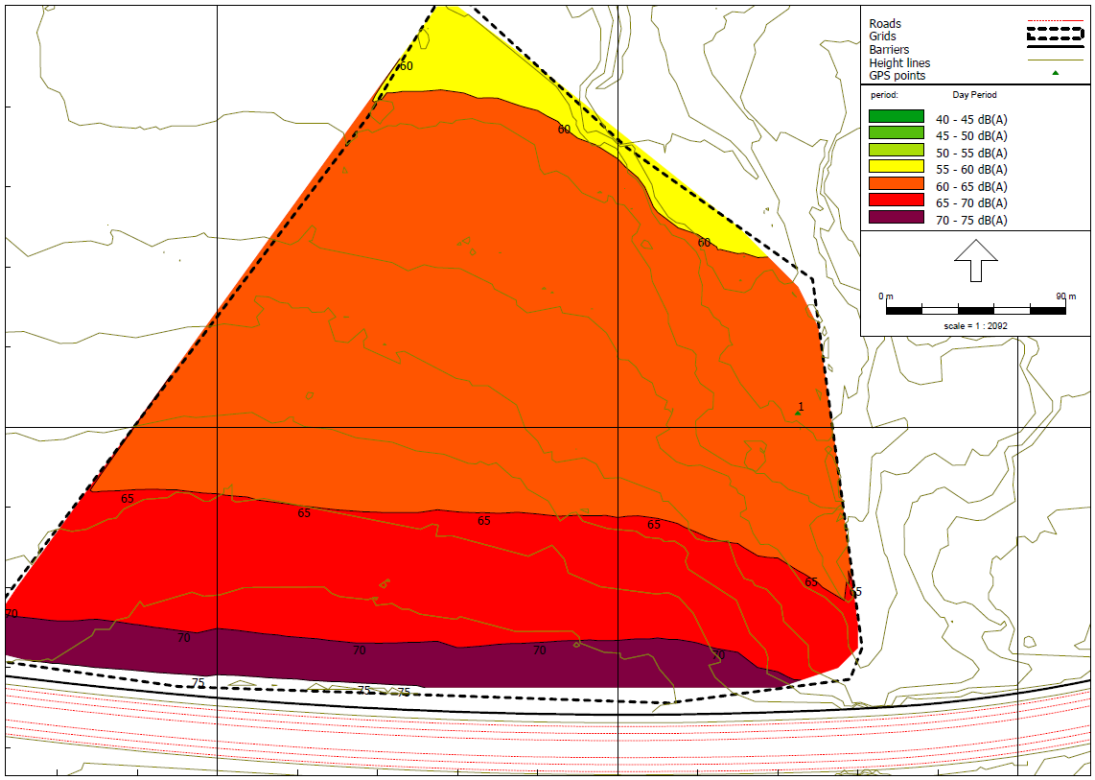

Figure 9 Daytime noise contours at 4 over existing site – in the absence of the development

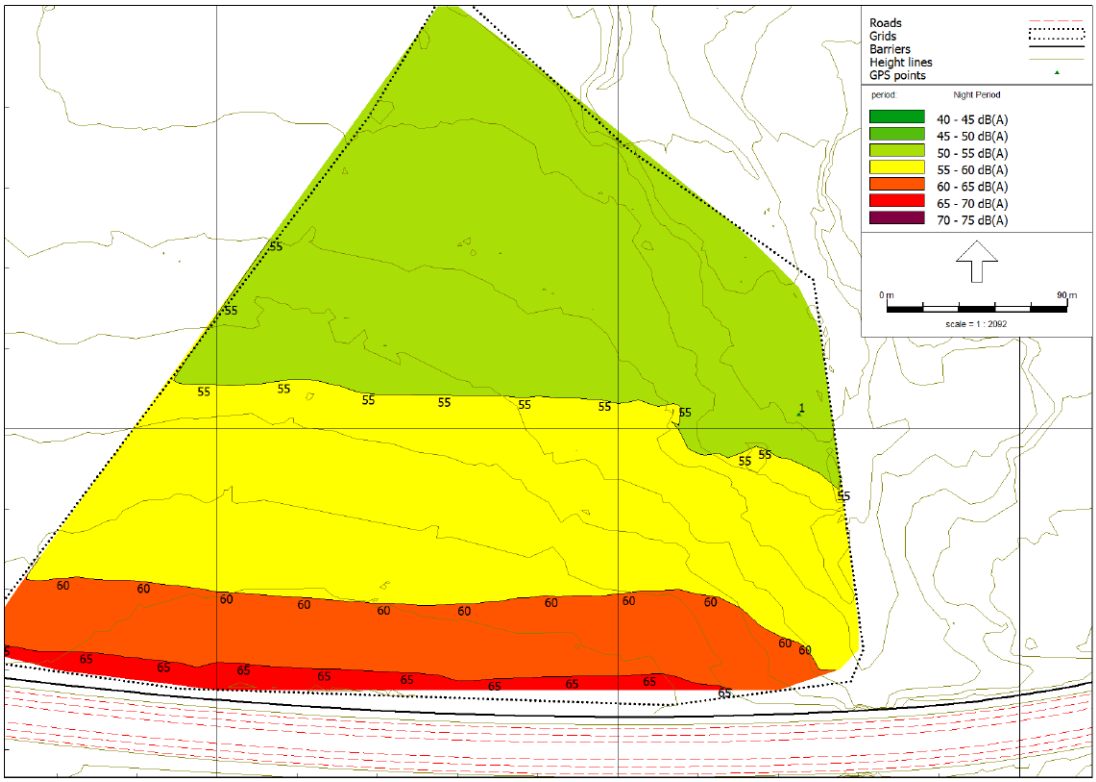

Figure 10 Night-time noise contours over existing site – in the absence of the development

Figures 9 and Figure 10 show the predicted noise level contours over the site with the proposed development in place. Daytime noise levels range from over 70 dB L_{day} at the southern edge of the site, to 55 L_{day} in the northern part of the site.

Similarly, night noise levels range from 65 dB L_{night} at the southern edge of the site, to 50 dB L_{night} in the northern part of the site.

For the purposes of developing noise mitigation measures, the façades in the site are assigned in 'zones' based on the predicted noise level. Figure 11 place the façades into one of three zones, A, B or C. These zones will be referred to in Section 5.2.2 in the discussion of noise mitigation measures.

Figure 11 Daytime noise contours over developed site

Figure 12 Night-time noise contours over developed site

Figure 13 Façade Zoning for noise mitigation purposes

4.5 Summary of Assumed Façade Noise Levels

Based on a review of the predicted noise levels, the following noise levels are assumed at the various noise zones of the development; values include a +3dB correction for potentially reduced traffic flows:

Façades	Overall dB(A)
Zone A Daytime L_{Aeq}	73
Zone A Night-time L_{Aeq}	66
Zone A Night-time L_{Amax}	78
Zone B Daytime L_{Aeq}	68
Zone B Night-time L_{Aeq}	61
Zone B Night-time L_{Amax}	73
Zone C Daytime L_{Aeq}	61
Zone C Night-time L_{Aeq}	55
Zone C Night-time L_{Amax}	70

Table 3 Assumed noise levels

4.6 Noise Risk Assessment Conclusion

Considering the noise levels presented in the previous sections, the initial site noise risk assessment has concluded that the level of risk across the site varies from medium to high noise risk.

ProPG states the following with respect to negligible, low, medium and high risks:

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

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.*

High Risk — *High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.*

Given the above it can be concluded that the development site may be categorised as *Low to Medium to High Risk* depending on the proximity to the M50 motorway. As such an Acoustic Design Strategy will be 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 impact will be avoided in the final development.

It should be noted that ProPG states the following regarding 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."*

Therefore, following the guidance contained in ProPG does not preclude residential development on sites that are identified as having medium or high-risk 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.

5.0 STAGE 2 – FULL ACOUSTIC ASSESSMENT

5.1 Element 1 – Good Acoustic Design Process

5.1.1 ProPG Guidance

In practice, GAD should deliver the optimum acoustic design for a particular site without adversely affecting residential amenity or the quality of life or occupants or compromising other sustainable design objectives. It is important to note that ProPG specifically states that GAD is not equivalent to overdesign or "*gold plating"* of all new development but that it seeks to deliver the optimum acoustic environment for a given site.

Section 2.23 of the ProPG outlines the following checklist for GAD:

- Check the feasibility of relocating, or reducing noise levels from relevant sources;
- Consider options for planning the site or building layout;
- Consider the orientation of proposed building(s);
- Select construction types and methods for meeting building performance requirements;
- Examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc;
- Assess the viability of alternative solutions; and,
- Assess external amenity area noise.

In the context of the proposed development, each of the considerations listed above have been addressed in the following subsections.

5.1.2 Application of GAD Process to Proposed Application

Relocation or Reduction of Noise from Source

The surrounding road network is located outside the redline boundary of the site and therefore it is beyond the scope of this development to introduce any noise mitigation at source.

Planning, Layout and Orientation

The layout of the site places a set of taller buildings along the southern boundary, with a roadway providing a degree of buffer distance between the façades and the M50 motorway. The screening effect of these larger buildings reduces noise levels in the open areas and private gardens in the centre of the site, and even in the northern part of the site, as can be seen by comparing Figures 7 & 9 and 8 & 10.

Select Construction Types for meeting Building Regulations

A mix of construction types could be considered for the building envelope including masonry and curtain wall elements. Masonry construction types offers high levels of sound insulation performance. However, as is typically the case the glazed elements and any required ventilation paths to achieve compliance with Part F of the Building Regulations will be the weakest elements in the façade in terms of sound insulation performance.

Consideration will therefore be given to the provision of upgraded glazing and acoustic ventilators. Note that it will not be possible to achieve the desirable internal acoustic environments with windows open. Instead the proposal here will be to provide dwelling units with glazed elements and ventilators that have good acoustic insulation properties so that when the windows are closed the noise levels internally are good. Inhabitants will be able to open the windows if they wish, however, doing so will increase the internal noise level. This approach to mitigation is supported in ProPG where it states the following (note emphasis has been added in bold),

> "2.22 *Using fixed unopenable glazing for sound insulation purposes is generally unsatisfactory and should be avoided;* ***occupants generally prefer the ability to have control over the internal environment using openable windows, even if the acoustic conditions would be considered unsatisfactory when open****. Solely relying on sound insulation of the building envelope to achieve acceptable acoustic conditions in new residential development, when other methods could reduce the need for this approach, is not regarded as good acoustic design. Any reliance upon building envelope insulation with closed windows should be justified in supporting documents* "
>
> *Note 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators)*

should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded

2.34 *Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed,* ***which may be the case in urban areas and at sites adjacent to transportation noise sources****, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide "whole dwelling ventilation" in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position (see Supplementary Document 2). Furthermore, in this scenario the internal L_{Aeq} target noise levels should not generally be exceeded*."

Impact of noise control measures on fire, health and safety etc

The GAD measures that have been implemented on site, *e.g.* locating taller buildings at the sound end of the site, placing shared outdoor amenity space on the quiet side of buildings, are considered to be cost neutral and do not have any significant impact on other issues.

Assess Viability of Alternative Solutions

Due to the height and location of the proposed buildings it is considered that any acoustic screens along the boundary of the site to attenuate traffic noise would be ineffective. There is an existing barrier of c. 2m height along the southern boundary, which is to be retained.

Assess External Amenity Area Noise

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 $L_{Aeq,16hr}$."

The values are largely based on WHO guideline values. Due to site constraints and the intention to minimise the noise incident on private spaces, the public open space in the southern part of the site has noise levels higher than the desirable range. However, certain external amenity areas including private gardens in the northern part of the site have predicted noise levels less than 55 dB $L_{Aeq,16hr}$.

The ProPG document goes on to comment, on pages 16 and 17:

"These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces."

Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or

balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:

[…]

- *a relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance).*

At approximately 500 m from the proposed development, there are quiet open spaces within Marlay Park available to the inhabitants of the proposed development.

All external spaces north of the main line of buildings on the southern within the development are below the SDCC thresholds of 70 dB L_{den} and 57 dB L_{night} as outlined in the Noise Action Plan.

5.1.3 Summary

Considering the constraints of the site, in so far as possible and without limiting the extent of the development area, the principles of GAD have been applied to the development.

In terms of viable alternatives to acoustic treatment of façade elements, currently it is not considered likely that there will be further options for mitigation outside of proprietary acoustic glazing and ventilation.

5.2 Element 2 – Internal Noise Guidelines

5.2.1 Internal Noise Criteria

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 and WHO's *Community Noise Guidelines*. The recommended indoor ambient noise levels are set out in Table 4 and are based on annual average data.

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 $L_{Amax,T}$*

Table 4 ProPG Internal Noise Levels

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

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

5.2.2 Proposed Façade Treatment

The British Standard BS EN 12354-3: 2000: *Building acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound* provides a calculation methodology for determining the sound insulation performance of the external envelope of a building. The method is based on an elemental analysis of the building envelope and can take into account both the direct and flanking transmission paths.

The Standard allows the acoustic performance of the building to be assessed taking into account the following:

- Construction type of each element (i.e. windows, walls, etc.);
- Area of each element;
- Shape of the façade, and;
- Characteristics of the receiving room.

The principles outlined in BS EN 12354-3 are also referred to in BS8233 and Annex G[2] of BS8233 provides a calculation method to determine the internal noise level within a building using the composite sound insulation performance calculated using the methods outlined in BS EN 12354-3. The methodology outlined in Annex G of BS8233 has been adopted here to determine the required performance of the building facades.

Glazing

As is the case in most buildings, the glazed elements of the building envelope are the weakest element from a sound insulation perspective. In this instance the façades in Figure 13 will be provided with glazing that, when closed, achieve the minimum sound insulation performance as set out in Table 5.

Zone (See Figure 11)	Octave Band Centre Frequency (Hz)						R_w
	125	250	500	1k	2k	4k	
A	24	25	31	41	43	44	37
B	29	25	32	34	36	38	34
C	24	20	25	35	38	35	31

Table 5 Sound Insulation Performance Requirements for Glazing, SRI (dB)

The acoustic specifications listed in Table 5 can be achieved using a standard thermal double-glazed unit with slightly thicker glass.

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing system. 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.

[2] The methodology contained within Annex G of BS8233 is based on the assumption that the source is a line source (such as a road) and that the building facades are simple, i.e. do not have balconies. These assumptions are considered valid for the purposes of this assessment and have been adopted.

Wall Construction

In general, all wall constructions (i.e. block work or concrete) 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. The calculated internal noise levels across the building façade have assumed a minimum sound reduction index of 50 dB R_w for this construction.

Ventilation

The ventilation strategy for the development will be in accordance with Part F of the Building Regulations and will be finalised at the detail design stage. Options which will be considered to achieve compliance with background ventilation requirements will be adjustable hit and miss acoustic ventilators or trickle vents built into the façade or window frames respectively.

Table 6 presents the acoustic specification for the vents:

Zone (See Figure 13)	Octave Band Centre Frequency (Hz)						$D_{n,e,w}$
	125	250	500	1k	2k	4k	
A	39	34	40	46	60	64	44
B	29	30	37	39	36	42	37
C	29	30	31	32	28	28	31

Table 6 Sound Insulation Performance Requirements for Glazing, SRI (dB)

5.2.4 Internal Noise Levels

Taking into account the external façade levels and the specified building envelope the internal noise levels have been calculated. In all instances the good internal noise criteria are achieved for daytime and night-time periods.

5.3 Element 3 – External Amenity Area Noise Assessment

As previously discussed, the private gardens in the central and northern parts of the site have noise levels at the upper end of the desirable range for outdoor amenity spaces. While the shared open spaces in the southern part of the site have noise level above the ideal range, they are below the SDCC values of 70 dB L_{den} considered as undesirably high.

5.4 Element 4 – Assessment of Other Relevant Issues

Element 4 gives consideration to other factors that *may* prove pertinent to the assessment, these are defined in the document as:

- 4(i) compliance with relevant national and local policy
- 4(ii) magnitude and extent of compliance with ProPG
- 4(iii) likely occupants of the development
- 4(iv) acoustic design v unintended adverse consequences
- 4(v) acoustic design v wider planning objectives

Each is discussed in turn below.

5.4.1 Compliance with Relevant National and Local Policy

There are no National policy documents relating to the acoustic design of residential dwellings. Locally the South Dublin Noise Action Plan specifies desirably low external noise levels and also noise levels above which noise mitigation measures should be considered.

This Acoustic Design Statement has been prepared in compliance with the requirements of ProPG and therefore complies with the requirements of local policy.

5.4.2 Magnitude and Extent of Compliance with ProPG

As discussed within this report the following conclusions have been drawing with regards to the extent of compliance with ProPG:

- All dwellings within the development have been designed to achieve the good level of internal noise levels specified within ProPG.
- Outdoor amenity spaces are available within reasonable distances.

Based on the preceding it is concluded that the proposed development is in full compliance with the requirements of ProPG.

5.4.3 Likely Occupants of the Development

This element is not considered relevant here as the proposed units are permanent residential dwellings.

5.4.4 Acoustic Design v Unintended Adverse Consequences

Unintended adverse consequences did not occur on this project.

5.4.5 Acoustic Design v Wider Planning Objectives

It is understood that wider planning objectives have been adhered to during the process of developing the design for the proposed development.

6.0 CONCLUSION

Based on this assessment, the development site has been found to have a noise environment that is be suitable for residential development. Using the development building layout provided by the design team, noise levels at the facades of the proposed development have been predicted. Using guidance contained within BS 8233, appropriate mitigation measures in relation to the sound insulation performance of the building envelope have been formulated.

Following the implementation of the glazing specifications outlined above, the internal noise environment within the sensitive areas of the development are predicted to be within the recommended criteria adopted from BS 8233. It is noted that the mitigation measures considered within this assessment are in accordance with the recommendations contained within the South Dublin County Council Noise Action Plan as discussed in Section 2.1.

At pre-construction stage, the acoustic performances of the glazing and ventilation systems from this report will form part of the tender documentation. An acoustic compliance statement will be prepared which will confirm the specifications in terms of glass thicknesses and air gaps and the resulting internal noise levels. This will ensure that the acoustic environment within the completed dwellings is good.

External noise levels across the amenity areas of the proposed development have also been assessed and have been found to be below levels which are considered ‘undesirably high’ in the South Dublin County Council Noise Action Plan 2019 – 2023. The absolute noise levels across the external spaces are less than 70 dB L_{day} at all locations and many parts the development will experience noise levels well below this level. Therefore, the external noise environment is considered to be good and provides a good level of amenity.

In conclusion, with the implementation of mitigation measures proposed within this report, the noise impact on the proposed residential development can be controlled such that the impact is not considered to be significant or of a level that would have a negative impact on the residential amenity of the proposed dwellings and outdoor spaces.

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.

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

L_{den} — Is the 24 hour noise rating level determined by the averaging of the L_{day} with the $L_{evening}$ plus a 5 dB penalty and the L_{night} plus a 10 dB penalty. L_{den} is calculated using the following formula:

$$L_{\text{den}} = 10log\left(\frac{1}{24}\right)\left(12 * \left(10^{\frac{Lday}{10}}\right) + 4 * \left(10^{\frac{Levening+5}{10}}\right) + 8 * \left(10^{\frac{Lnight+10}{10}}\right)\right)$$

L_{day} — is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the day periods of a year

L_{night} — is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the night periods of a year.

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.