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INWARD NOISE IMPACT ASSESSMENT FOR A PROPOSED RESIDENTIAL DEVELOPMENT AT MILL ROAD, SAGGART, CO. DUBLIN

Technical Report Prepared For

Tetrarch Residential Limited

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EXECUTIVE SUMMARY

AWN Consulting has been commissioned to carry out a study in relation to the potential inward noise impact on a proposed residential development at Mill Road, Saggart, Co Dublin.

A noise survey and review of published noise maps has been undertaken to determine baseline noise environment. In accordance with the guidance set out in ProPG and the Dublin Agglomeration Environmental Noise Action Plan December 2018 – November 2023 Vol. 4 – South Dublin County Council Public Consultation Document (NAP). The site has been classified as having a range of noise levels associated with a '*Low to Medium to High Risk'* of noise impacts based on the proximity to the N7 road.

Incident noise levels at dwellings located close to the N7 will be very high without appropriate mitigation in the form of noise screening from noise barriers and/or earth berms. Detailed mitigation measures for some facades have been specified for building element to ensure that when windows are closed good internal noise levels will be achieved.

The Acoustic Design Statement presented in this report has assessed the impact of traffic noise levels on the proposed development and has been prepared in accordance with the requirements of ProPG as required by the South Dublin County Council NAP. The proposed development can be designed to function in compliance with the requirements of ProPG once appropriate consideration is given at the detailed design stage to the sound insulation mitigation measures and principles outlined in this report.

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1.0 INTRODUCTION

AWN Consulting Limited (AWN) has been commissioned to carry out a study in relation to the potential noise impacts incident on the proposed residential development at Mill Road, Saggart, Co. Dublin. This report provides input and direction into the acoustic design of the proposed development, identifies potential noise impacts, and outlines detailed measures required to mitigate the potential impacts.

Figure 1 presents the approximate outline of the proposed development site (red line boundary) in the context of the surrounding environment. The N7 road is located to the northwest of the site boundary with Mill Road located along the northern boundary.

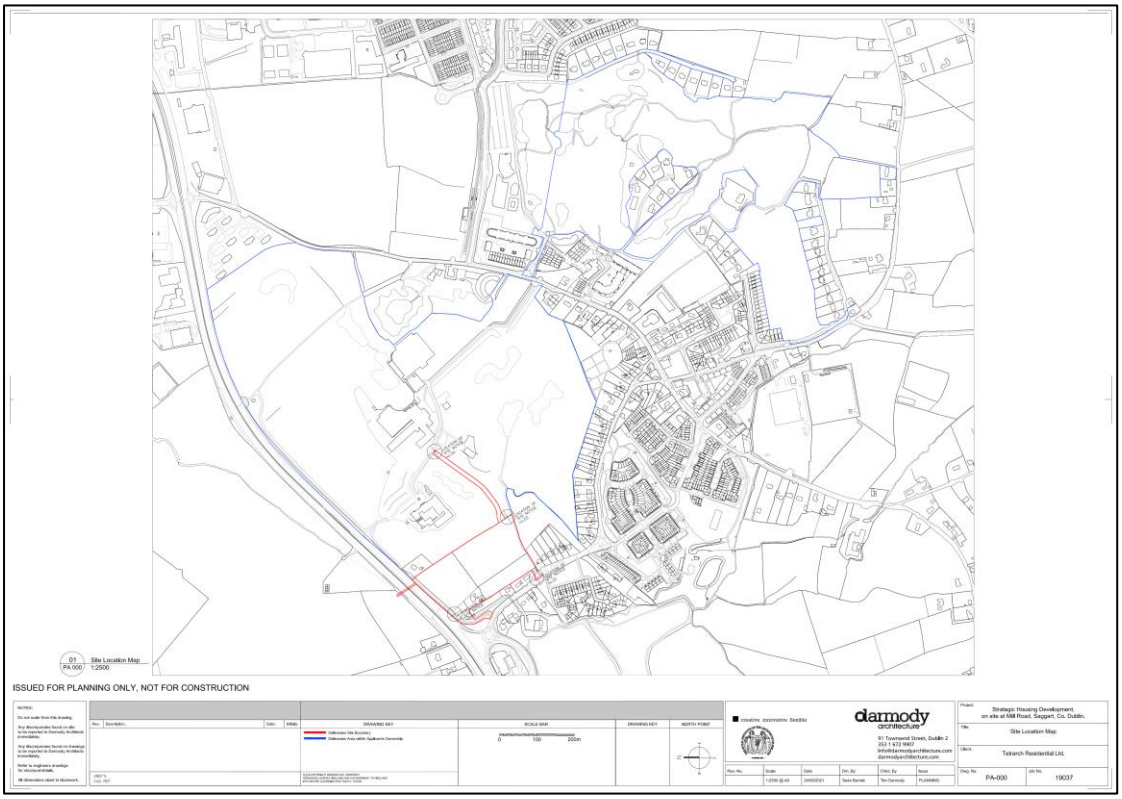

Figure 1 Location of proposed development indicated by red line boundary

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

2.0 DESIGN GUIDANCE

2.1 South Dublin County Council Noise Action Plan (NAP)

The *Dublin Agglomeration Environmental Noise Action Plan December 2018 – November 2023 Vol. 4 – South Dublin County Council* (NAP) was published in December 2018. The NAP states the following with respect to assessing the noise impact on new residential development:

> *"When new developments are being constructed it is important that both houses and apartments are designed, orientated and located in such a way so as to limit the impacts of noise from traffic. All new applications for residential developments will be assessed and where there is the likelihood of an adverse noise impact the applicant will be required to produce a noise impact assessment carried out by appropriately qualified acousticians and competent persons. The noise impact assessment should demonstrate that all facets of the UK "Professional Practice Guidance on Planning & Noise" (2017) (ProPG) have been followed."*

In addition to the above, the following is also stated in the NAP:

> *"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 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 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.*
> c. *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)."*

In accordance with this NAP, the following Acoustic Design Statement (ADS) has been prepared to comply with the requirements of this policy.

2.2 ProPG: Planning & Noise

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 its 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, and;
    - Element 4 - Other Relevant Issues.

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

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

Section 3.0 of the ProPG provides a more detailed guide on decision making to aid local authority planners on how to interpret the findings of an accompanying Acoustic Design Statement (ADS). A summary of the ProPG approach is illustrated in Figure 2.

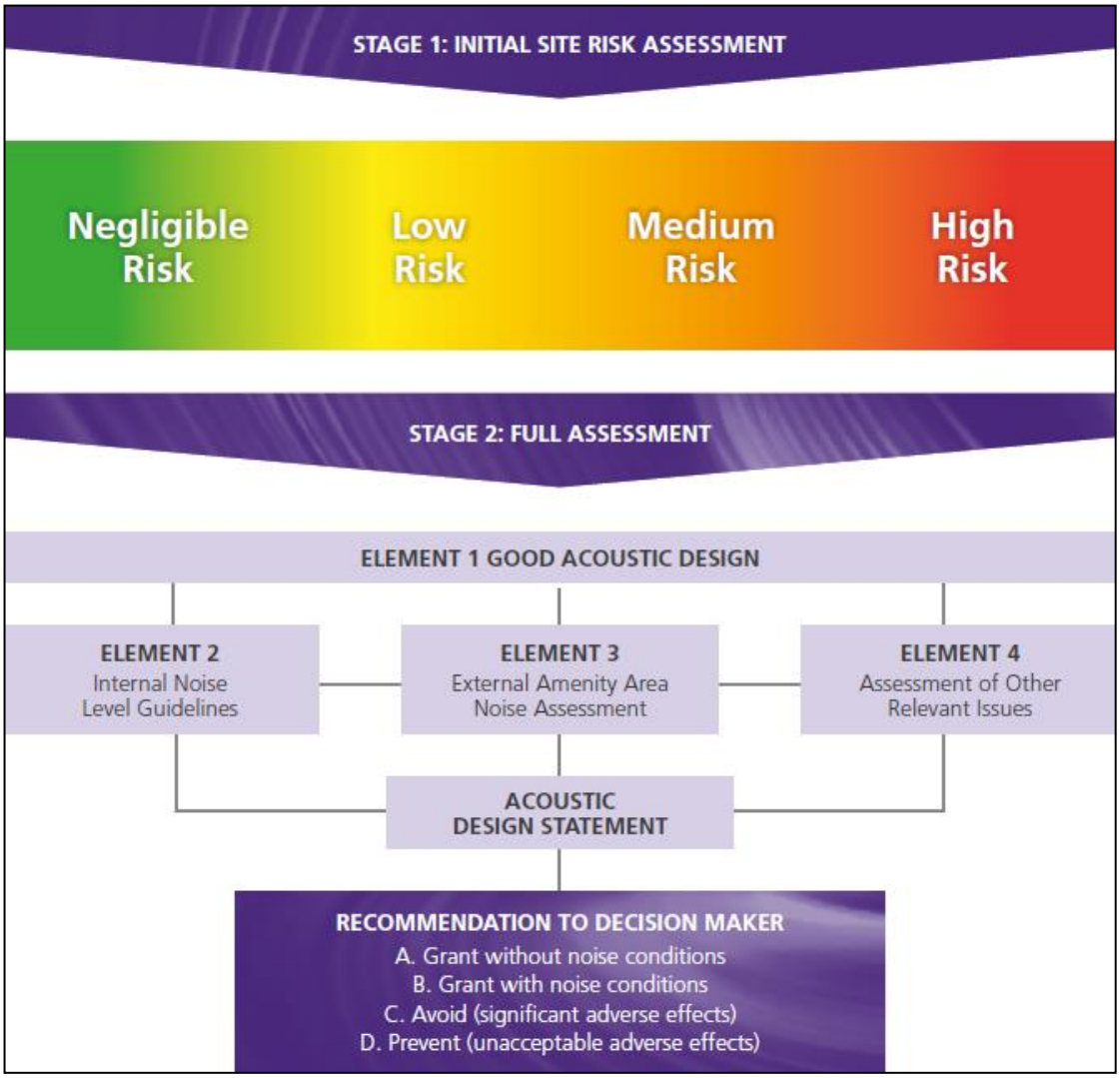

Figure 2 ProPG Approach (Source: ProPG)

3.0 STAGE 1 – NOISE RISK ASSESSMENT

3.1 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 3 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.

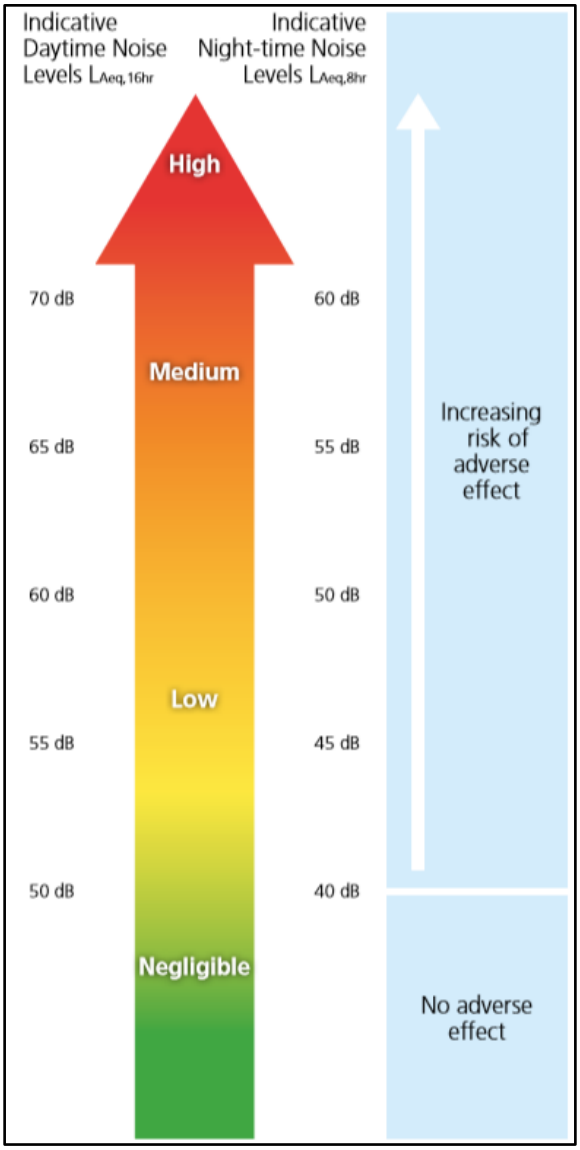

Figure 3 ProPG Stage 1 - Initial Noise Risk Assessment

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 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."*

3.2 Baseline Noise Environment

Environmental noise surveys have been conducted to quantify noise emissions across the existing site. The survey was conducted in general accordance with ISO1996-2:2017 *Acoustics - Description, Measurement and Assessment of Environmental Noise - Determination of Sound Pressure Levels*. The following sections presents the result of the survey and discussion of the existing noise environment.

3.2.1 Measurement Locations

An unattended noise survey was conducted to obtain a profile of typical incident noise levels at the most exposed façade of the development over a period of four days on:

- 14:45hrs on 2 December 2020 to 13:30hrs on 7 December 2020.

The monitoring location was set up in secure lands approximately 450 m northwest of the development site. The meter was set back approximately 40 m from the edge of the N7 road at a height of 4 m above ground. The site itself was not secure to install the meter and access to the golf course at City West adjacent to the site was not available.

This location was the most suitable location that could be accessed for installing the unattended meter. It was also suitable location for calibrating the road traffic noise prediction model and representative of baseline noise levels in the northern boundary of the development site.

In addition to the unattended measurements, an attended noise survey was conducted at the site between 12:50hrs and 17:00hrs on 2 December 2020. The attended measurements were carried out at three locations around the site to obtain a baseline noise level in the surrounding environment as part of the noise impact assessment for the proposed development. Reference has been made to the measurements where

necessary to inform this inward noise impact assessment and for calibrating the road traffic noise prediction model.

Figure 4 indicates the noise monitoring locations (NML's) within the site.

Figure 4 Noise monitoring Locations

During the attended survey and the installation/removal of the unattended monitoring equipment, it was observed that the noise environment was dominated by road traffic noise from the N7 and Mill Road.

3.2.2 Equipment

The noise survey was carried out using the equipment listed in Table 1. All equipment was set to measure at intervals of 15 minutes and was check-calibrated before and after the survey using a Brüel and Kjaer Type 4231 Calibrator.

Item	Detail	Equipment	Serial Number
Sound Level Meter	Unattended Noise Survey	RION NL-52	186669
Sound Level Meter	Attended Noise Survey	Brüel & Kjaer 2250	2818080
Calibrator	Calibration	Brüel & Kjaer 4231	2263026

Table 1 Details of Survey Equipment

3.2.3 Survey Results

Attended Results

The results of the attended survey at the three locations are summarised in the Tables 2 to 4.

Date	Time (hrs)	Measured Noise Levels (dB re. 2x10-5 Pa)		
		L_{Aeq}	L_{AFMax}	L_{AF90}
Day	12:50 – 13:05	61	77	59
	13:08 – 13:23	61	72	60
	13:26 – 13:41	60	80	58

Table 2 Summary of Measured Noise Levels at Location 1

Location 1 was representative of baseline road traffic noise level in the vicinity of Mill Road.

Date	Time (hrs)	Measured Noise Levels (dB re. 2x10-5 Pa)		
		L_{Aeq}	L_{AFMax}	L_{AF90}
Day	15:15 – 15:30	64	74	62
	16:03 – 16:18	64	68	62
	16:48 – 17:03	63	67	62

Table 3 Summary of Measured Noise Levels at Location 2

Location 2 was representative of baseline noise level at the south of the site, set back from the surrounding road network.

Date	Time (hrs)	Measured Noise Levels (dB re. 2x10-5 Pa)		
		L_{Aeq}	L_{AFMax}	L_{AF90}
Day	14:42 – 14:57	74	78	71
	15:38 – 15:53	74	79	72
	16:35 – 16:50	74	79	72

Table 4 Summary of Measured Noise Levels at Location 3

Location 3 was representative of baseline road traffic noise level at the north of the site.

Unattended Results (Location 3)

A summary of the measured noise data from the unattended noise survey location is presented in Table 5. The values are presented in terms of the ambient $L_{Aeq,16hr}$ value over the daytime periods (07:00 and 23:00hrs) and the $L_{Aeq,8hr}$ over the night-time periods (23:00 to 07:00hrs) measured during the unattended survey at Location 3.

Start Date	Measured Ambient Noise Levels at Location	
	Location 3	
	Daytime dB $L_{Aeq,16hr}$	Night-time dB $L_{Aeq,8hr}$
02/12/2020	73	64
03/12/2020	74	66
04/12/2020	76	61
05/12/2020	73	56
06/12/2020	71	56
07/12/2020	74	--

Table 5 Review of Noise Levels Measured at Location 3

The measured noise data is considered typical of that associated with a site near a busy roadway. Further investigation on the unattended survey data revealed that the noise levels on the night of the 3 December and daytime on 4 December were higher

that typical and therefore considered outliers due to high wind speeds and rainfall during this period. The incident noise levels at dwellings located close to the N7 will be very high without appropriate mitigation in the form of noise screening from noise barriers and/or earth berms, as will be discussed in the sections below.

Review of the measured data from the attended survey confirms that the noise levels across the development site are dominated by road traffic noise predominantly from the N7.

3.3 EPA Noise Maps

In addition to the baseline noise level measured on site, reference has been made to the *Round 3 Noise Maps for Roads – Dublin Agglomeration*. noise maps prepared by Transport Infrastructure Ireland (TII) and published by the EPA[1]. The noise maps are provided for the overall day evening night period in terms of L_{den} and for the night-time period in terms of $L_{night.}$

Figures 5 and 6 present the predicted noise levels across the development site for road traffic in terms of L_{den} and L_{night}.

[1] Available to download on the Environmental Protection Agency (EPA) Mapping website https://gis.epa.ie/EPAMaps/

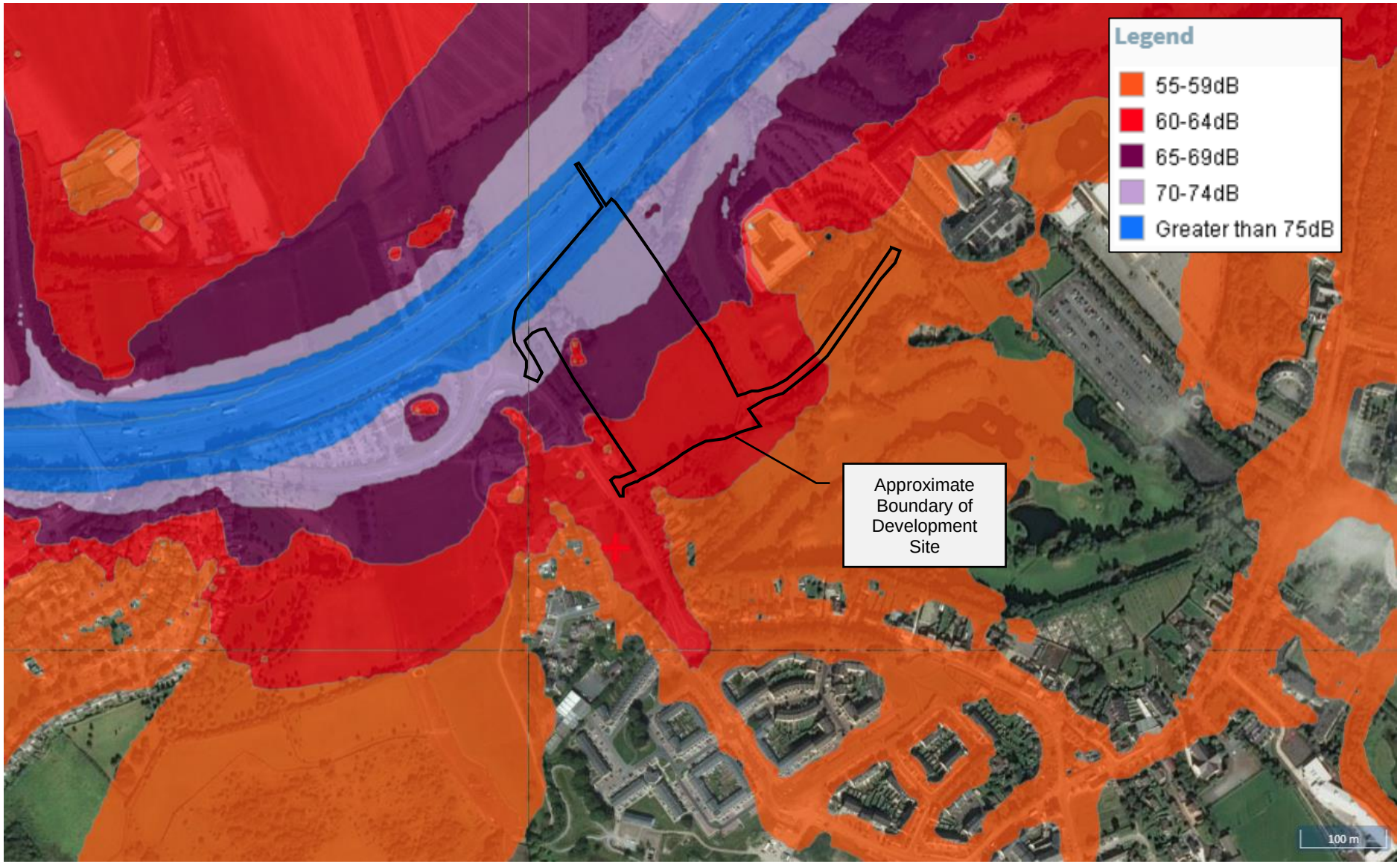

Figure 5 L_{den} Road Traffic Noise Levels

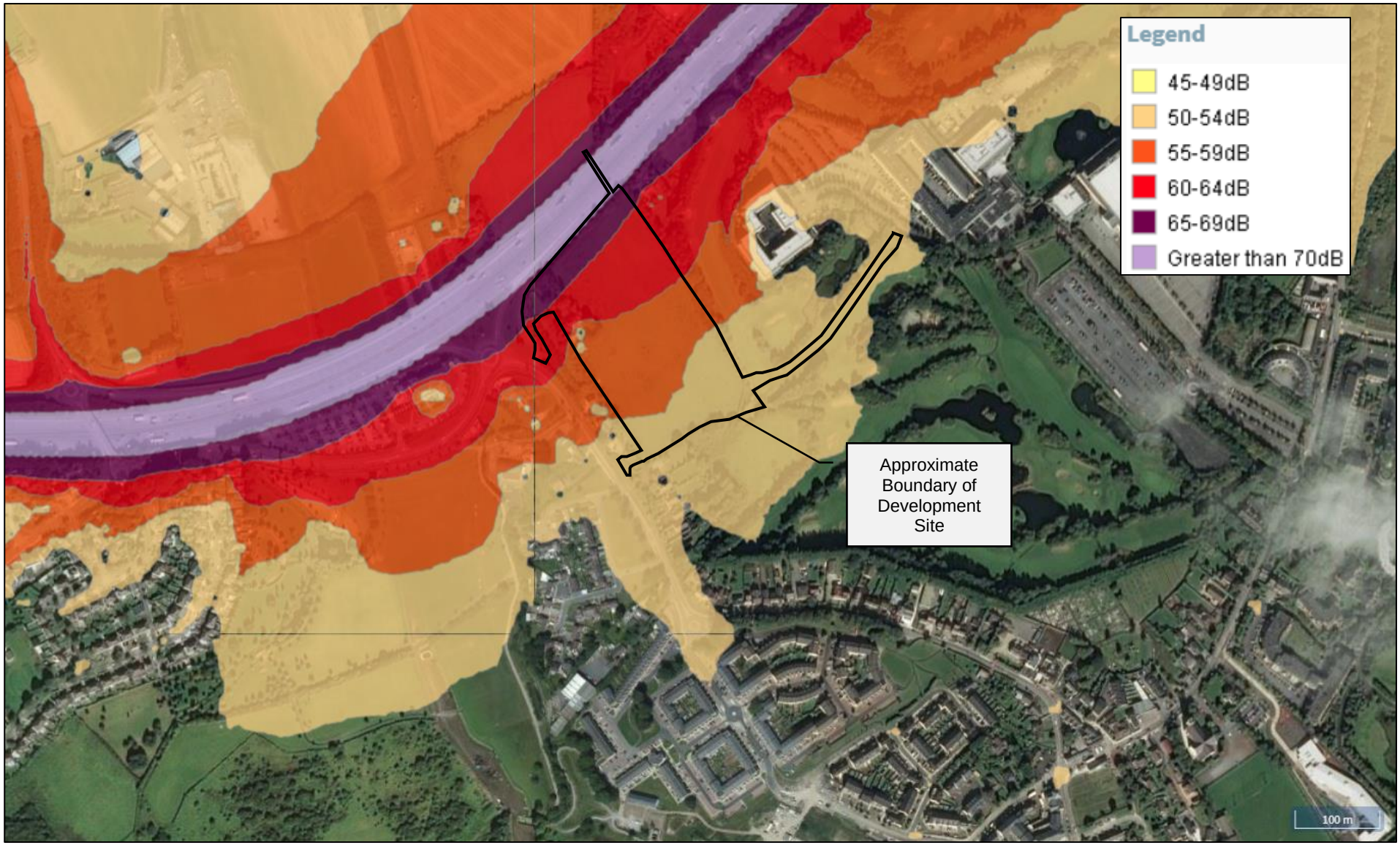

Figure 6 L_{night} Road Traffic Noise Levels

Table 6 summarises the TII predicted road traffic noise levels across the site.

Noise Source	L_{den}, dB	L_{night}, dB	L_{day}, dB Note A
Road Traffic	60 – >75	50 – 69	58 – 72

Table 6 Estimated Noise Levels at Development Site

Note A L_{day} has been estimated by assuming day and evening noise levels are equal

The measured data from the baseline noise survey indicates that levels may be slightly higher during certain periods of the day which is expected, overall, the measured levels indicate good alignment with the EPA noise road traffic noise maps.

Comment on Impact of Covid on Measured Baseline Levels

Based on the review of TII traffic counter data[2] from a counter at N07 between Jn 4 & Jn 3 at EB VMS Citywest, Co. Dublin, it is evident that there was a marked reduction in traffic volumes on the N7 arising from restrictions linked to the Covid-19 Pandemic. The most recent year with "normal" traffic flows in terms of the Annual Average Daily Traffic (AADT) is 2019 and comparison of the traffic flows for the period of the survey in 2020 to the traffic flows for a similar period in 2019. 2020 saw a reduction in traffic numbers of around 17%. A 25% reduction in traffic numbers corresponding to a reduction in noise of 1 dB. Therefore, it is reasonable to assume that noise levels at locations close to the N7 would typically see a reduction in noise levels of no more than ~1 dB lower when compared to 'normal' conditions i.e., 2019, when Covid-19 travel restrictions were not in place.

For this assessment, a conservative approach has been adopted in the 3D noise modelling to predicted future traffic noise levels incident on the site from the existing road network, this is outlined in Section 3.0.

3.4 Future Noise Environment

There are no planned changes to the surrounding noise environment expected within future years which will significantly alter the noise environment measured. Traffic volumes have the potential to increase along the N7 and Mill Road, however a doubling in traffic flows would be required to result in a 3 dB change in the noise environment. An increase of 25% in traffic is required to increase traffic noise levels by 1 dB which is insignificant in the overall context of the noise environment across the site. Given the limited capacity for significant traffic volume increases along the M7, the future noise environment assumed for this project is expected to be within at least 1dB of the baseline scenario.

3.5 Noise Prediction Modelling

3.3.1 Methodology

Proprietary noise calculation software was used for the purposes of establishing the prevailing noise levels at 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.

[2] Traffic Data gathered from www.trafficdata.tii.ie

The following information was included in the model:

- Site layout drawings of proposed development.
- OS mapping of surrounding environment.
- Topography data supplied by the design team.
- Annual Average Daily Traffic (AADT) flows used for the assessment have been obtained from data provided by the traffic consultant and the TTI data base
  - N7: AADT flow of 102,000 with 8% HGV
  - Mill Road: AADT flow of 10,000 with 3% HGV

3.3.2 Model Validation

Noise levels recorded during the unattended survey were used to calibrate the noise model to within 1 dB of the calculated values. This is regarded as a 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.

Position	Period	Average Measured Noise Level, dB	Predicted Noise Level, dB
Loc-1	Daytime, $L_{Aeq,16hr}$	73	72
	Night-time, $L_{Aeq,8hr}$	63	64
Loc-3	Daytime, $L_{Aeq,16hr}$	61	61
	Night-time, $L_{Aeq,8hr}$	n/a	56

Table 7 Calculated and measured Noise Levels at Development Site

Figures 7 and 8 overleaf display the calculated noise contours at 4 m height across the existing site for day and night-time periods.

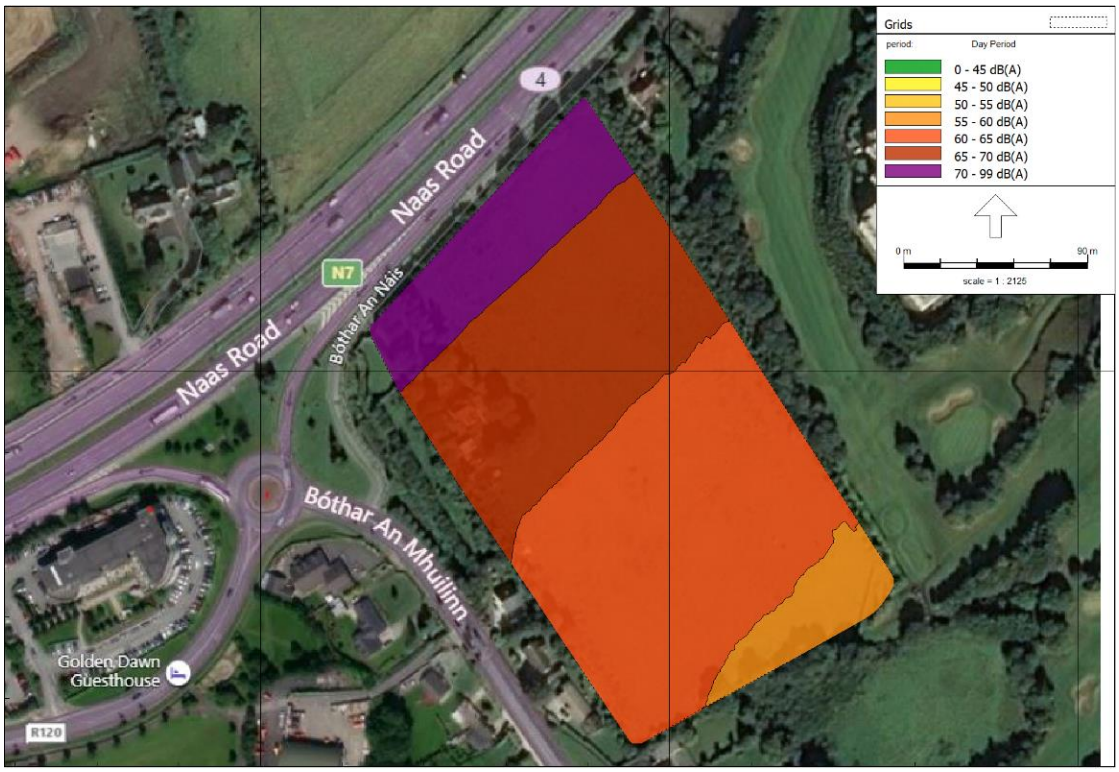

Figure 7 Predicted noise levels at 4m across existing site daytime

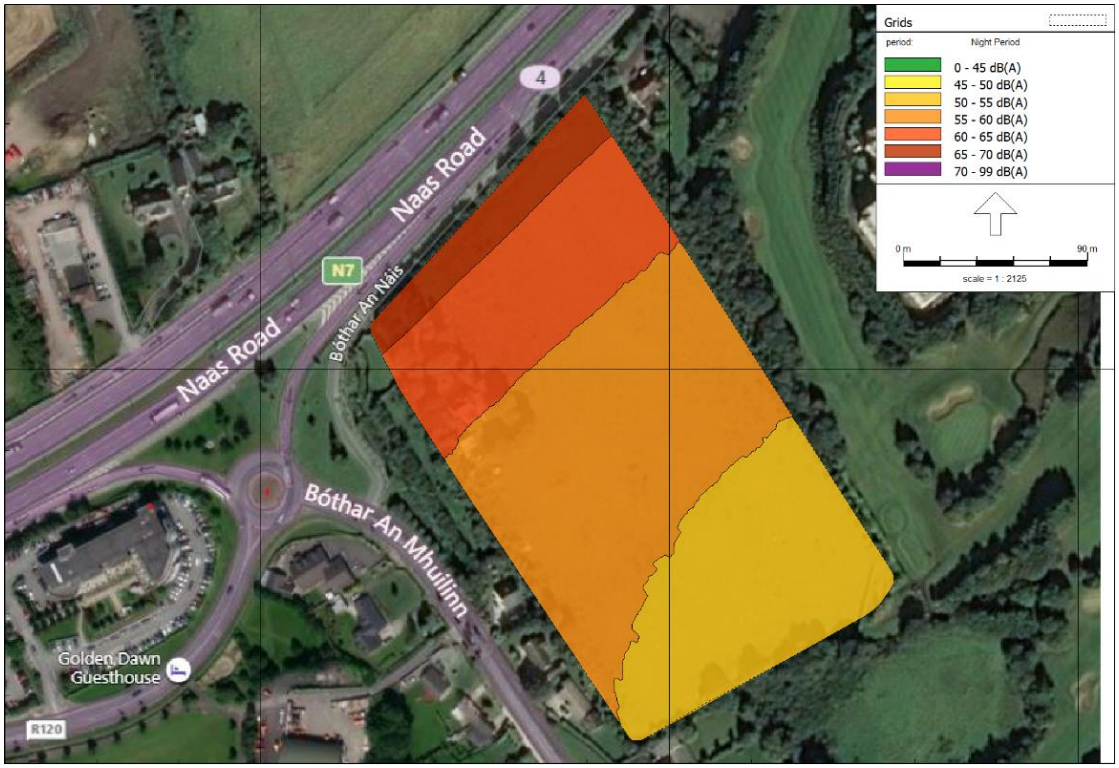

Figure 8 Predicted noise levels at 4m across existing site night time

3.6 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 low to medium to high noise risk. Most of the site falls into the medium risk with the north of the site in proximity to the N7 classed as high 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 surrounding road network i.e., the N7 and Mill Road. 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.

The runway at Baldonnel Airport is located approximately 800m to the north of the development site. Baldonnel Airport is not a commercial airport, and the number of aircraft events are considered low and the dominant source of noise across the development site remains road traffic.

ProPG states the following regarding how the initial site noise risk should 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.

4.0 STAGE 2 – FULL ACOUSTIC ASSESSMENT

4.1 Element 1 – Good Acoustic Design Process

4.1.1 ProPG Guidance

In practice, good acoustic design should deliver the optimum acoustic design for a 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 good acoustic design 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 Good Acoustic Design (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.

4.1.2 Application of GAD Process to Proposed Application

Relocation or Reduction of Noise from Source

Noise sources incident upon the development site (i.e. road traffic) are 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

In the first instance, a primary consideration was to ensure that residential units are set back as far as practicable from the N7 road network. This will reduce the incident noise levels at key facades however the nearest facades will be exposed to relatively high noise levels, i.e. the facades facing the N7. Options for noise screening will be assessed as part of the Acoustic Design Statement (ADS) in later sections of this report, for example, earth berms and barriers.

Select Construction Types for meeting Building Regulations

A mix of construction types could be considered for the building envelope. 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 appropriate ventilation (acoustic ventilation and/or mechanical). Note that it may 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 are typically implemented on sites of this nature, e.g. locating properties away from the road, placing outdoor 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

This will be explored as the project progresses and the noise model will be used to assess the acoustic benefit of any alternative solutions.

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 $L_{Aeq,16hr}$, which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited."*

As the design process develops the external areas will be assessed against this standard and where practicable, it will be endeavoured to achieve noise levels less than 55 dB $L_{Aeq,16hr}$.

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 will be 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 and noise screening using earth beams and/or noise barriers.

4.2 Element 2 – Internal Noise Guidelines

4.2.1 Internal Noise Criteria

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 8 and are based on annual average data, they omit occasional events where higher intermittent noisy events may occur, such as New Year's Eve.

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 8 ProPG Internal Noise Levels

*Note The document comments that the internal $L_{AFmax,T}$ noise level may be exceeded up to 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 guidelines, then a relaxation of the internal L_{Aeq} values by up to 5 dB can still provide reasonable internal conditions.

4.2.2 Predicted Façade Noise Levels

Incident noise levels have been predicted across the development site at the location of each façade in accordance with the methodology outlined in Section 3.5.

A noise barrier up to 3m in height is proposed along the northern boundary of the site has been included in the noise prediction model. For this barrier to be most effective, it is recommended that a barrier with a minimum height of 3m be installed on the site boundary beside the N7 road.

The exact height of the barrier is subject to confirmation; for the calculations presented in this report, a barrier with a height of 3m has been used. Based on calculations, incident noise levels at the north facades of the duplex units facing the N7 will be 1-2 dB higher at the 2nd floor level with a 2m high barrier in place compared to a 3m high barrier. At the detailed design stage, a specification for the noise barrier will be prepared and assessed to confirm that the noise criteria will be achieved. The design of the barrier must consider any traffic noise being reflected away from the proposed development site that may negatively impact other noise sensitive receptors. The use of a noise barrier with an absorbent side facing the road will typically mitigate negative noise impacts from reflections.

Figures 9 and 10 present visually the noise levels predicted across the site for day and night time period with a summary of the levels.

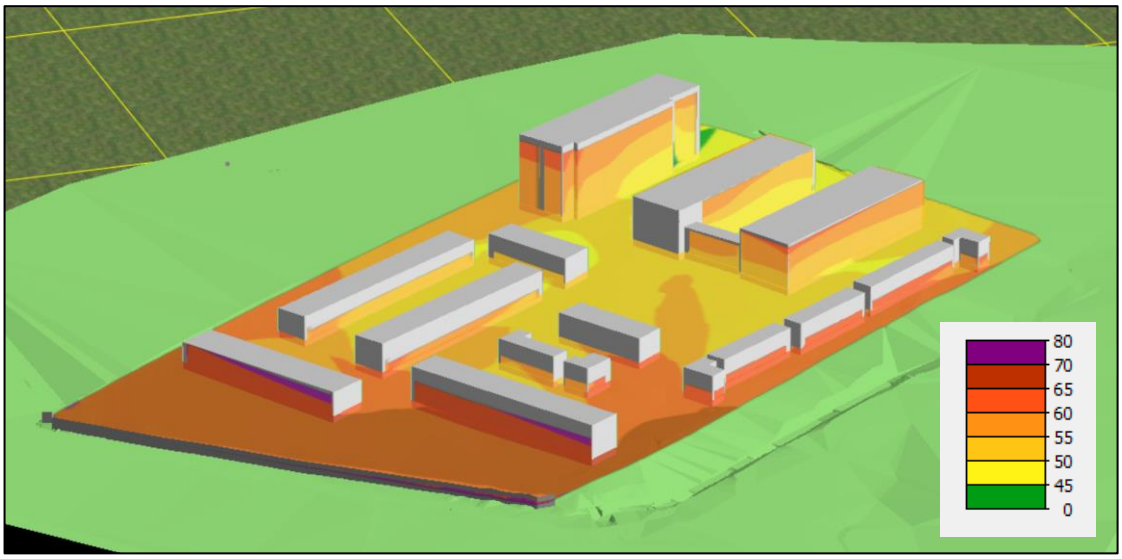

Figure 9 Calculated Daytime Noise Levels

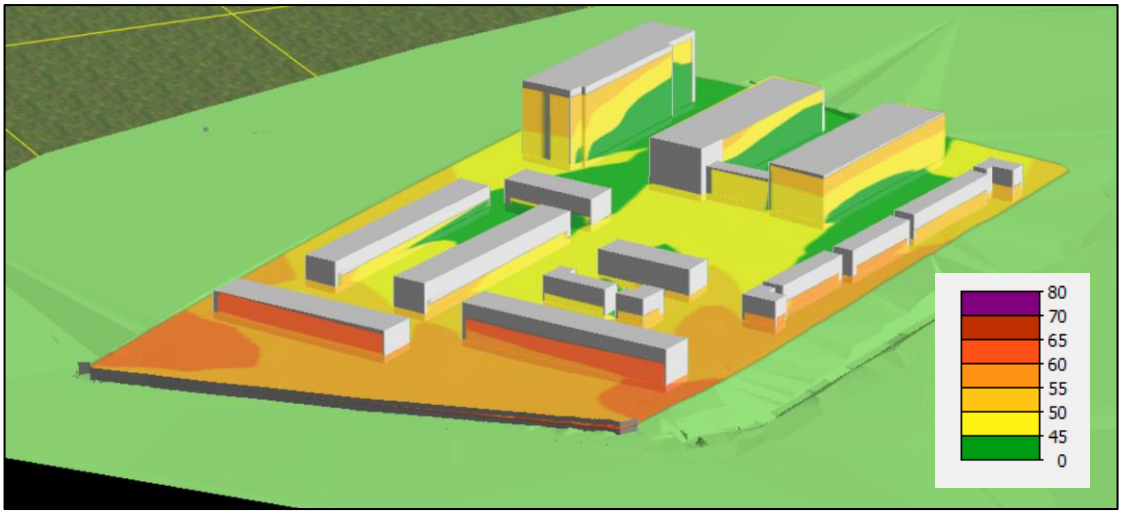

Figure 10 Calculated Night-time Noise Levels

Following a detailed review of the predicted noise levels at sensitive facades across the proposed development, buildings have been grouped into the following categories:

- Facades of duplex units as indicated by the red line in Figure 11,
- Facades of houses as indicated by the blue line in Figure 11, and
- Facades of apartment Blocks floor levels 4 and above indicated by the green line in Figure 11.

The following discussion is focused on the area described above as identified in Figure 11. All other building facades can be considered negligible risk for noise impacts and therefore no specific mitigation measured are specified in this assessment.

Figure 11 Mark-up of facades that require a minimum sound insulation specification on building elements.

4.2.3 Discussion on Open/Closed Windows

The typical level of sound reduction offered by a partially open window is typically applied as 15 dB[3] to 18 dB.

Considering the design goals outlined in Table 8 and sound reduction across an open window of 15 dB, the external free-field noise levels that would be required to ensure that internal noise levels do not exceed 'good' or 'reasonable' internal noise levels have been summarised in Table 9.

Level Desired	Day 07:00 to 23:00hrs	Night 23:00 to 07:00hrs
Good (i.e. at or below the internal noise levels)	50 – 55dB $L_{Aeq,16hour}$	45dB $L_{Aeq,8hour}$
Reasonable (i.e. 5 dB above the internal noise levels)	55 – 60dB $L_{Aeq,16hour}$	50dB $L_{Aeq,8hour}$

Table 9 External Noise Levels Required to Achieve Internal Noise Levels

Duplex Units (facades marked in red in Figure 11)

It is understood that background ventilation will be provided by wall mounted ventilators or trickle vents. For rooms with windows located on the north façade in the first and 2nd floors it expected that should occupants wish to open windows, the internal noise levels will be above the recommended internal noise thresholds for night time periods and daytime periods outlined in Table 9. For rooms located on the ground floor with windows facing the N7 is calculated that the day time internal levels with windows open will be reasonable.

Houses (facades marked in blue in Figure 11)

It is expected that an additional 3-5 dB of attenuation between outdoor to indoor with an open window can be achieved due to the angle of incidence between the road and these windows[4].

Therefore, these windows are expected to provide a level difference for road traffic noise of 18 to 20 dB from outside to inside. This may allow external noise levels of up to 63-65 dB $L_{Aeq,16hour}$ during the day night a 53-55 dB $L_{Aeq,8hour}$ at night while still achieving reasonable internal noise levels with an open window.

For houses adequate background ventilation will be provided by a MHRV or by wall mounted ventilators and/or trickle vents to be determined at the detailed design stage. Should occupants wish to open windows, good to reasonable internal noise levels will still be achieved internally rooms.

Apartments level 4 and above (facades marked in green in Figure 11)

Adequate background ventilation will be provided by a MHRV or by wall mounted ventilators and/or trickle vents to be determined at the detailed design stage. Should occupants wish to open windows, good to reasonable internal noise levels will still be achieved internally rooms.

[3] Section 2.33 of ProPG, additional information can be found in the DEFRA NANR116: *'Open/Closed Window Research' Sound Insulation Through Ventilated Domestic Windows'*

[4] See Table 4-3 of DEFRA NANR116: *'Open/Closed Window Research' Sound Insulation Through Ventilated Domestic Windows'*

4.2.4 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 account of both the direct and flanking transmission paths.

The Standard allows the acoustic performance of the building to be assessed taking account of 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 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. This approach corrects the noise levels to account for the frequency content of road traffic noise which has been determined from the baseline survey.

Glazing

As is the case in most buildings, the glazed elements of the building envelope are typically the weakest element from a sound insulation perspective. In this instance the facades will require a glazing system that, when closed, achieve the minimum sound insulation performance as set out in Table 10.

Table 10 includes an associated specification for an acoustic ventilator for each glazing type. 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. For this assessment we have assumed as a worse case that background ventilation will be provided via wall mounted vent or trickle ventilators with 2 no. vents required in living room / kitchens and 1 no. vent in bedrooms. A minimum sound insulation specification for the ventilators glass been provided with the glazing specification.

Type	Element	SRI (dB) - Octave Band Centre Frequency (Hz)						Overall Weighted Value, dB
		125	250	500	1k	2k	4k	
Type 1	Glazing	27	27	37	45	44	54	42 R_w
	Vent	39	37	46	55	60	62	50 $D_{n,e,w}$
Type 2	Glazing	24	25	36	44	43	53	39 R_w
	Vent	39	37	46	55	60	62	50 $D_{n,e,w}$
Type 3	Glazing	20	19	29	38	36	45	33 R_w
	Vent	29	30	37	39	36	42	39 $D_{n,e,w}$
Type 4	Glazing	20	19	29	38	36	45	33 R_w
	Vent	29	30	31	32	28	28	31 $D_{n,e,w}$

Table 10 Sound Insulation Performance Requirements for Glazing, SRI (dB)

There are three glazing specifications and three acoustic vent specifications for the development. The acoustic performance specifications apply to the overall glazing

system. In the context of the acoustic performance specification the 'glazing system' includes all component parts that form the glazing element of the façade, i.e., glass, frames, seals, openable elements etc. The specifications provided in Table 10 are indicative, and assumes natural ventilation of spaces as a worst-case, the specifications may be developed further during the detailed design stage.

Table 11 presents a matrix of the required glazing specification for the proposed development.

Units	Figure 11 Legend	Facade Glazing and Ventilation Specification Matrix	
		Bedrooms	Living Rooms
Duplex		Type 1	Type 2
Houses		Type 3	Type 3
Apartments		Type 4	Type 4

Table 11 Glazing Specification Matrix

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.

Roof Construction

There is the potential for the roof structure of the houses and Duplex units to allow the passage of sound into the attic rooms. The roof constructions that have been considered for the calculations are:

- Attic roof: Tile/slate Attic cavity insulation layer with 12.5mm plasterboard.
- Dormer roof: Tile/slate insulation layer with 12.5mm plasterboard and no attic space.

The sound insulation of the roof will be sufficient, provided the roof and internal linings within the attic rooms will provide an overall sound insulation performance of at least 10 dB higher than the glazing specification for the relevant attic room windows (see Tables 10 & 11). The sound insulation of the roof construction performance shall be confirmed during the detailed design stage.

The following build-up has been assumed for this assessment, plasterboard with a minimum surface mass of 8 kg/m^2, a layer of mineral / glassfibre quilt / slab in the void between the joists of at least 100mm thickness (which will normally be greater than this for thermal reasons) with a density of 22 kg/m^3, penetrations through the ceiling boards are small fully-sealed with plaster or with an acoustic sealant.

4.2.5 Internal Noise Levels

Considering the external façade levels and the specified acoustic performance to the building envelope, the internal noise levels have been calculated. In all instances the good to reasonable internal noise levels outlined in Table 9 are achieved for daytime and night-time periods.

However, at facades on the duplex units facing the N7, should occupants choose to open windows it will not be possible to achieve reasonable internal noise levels in these conditions.

4.3 Element 3 – External Amenity Area Noise Assessment

The ProPG document includes a requirement to address external noise levels across amenity spaces as part of the acoustic design statement. ProPG refers directly to the guidance contained within BS 8233 (2014) for this element of the assessment which states:

> *"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 $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited."*

Figure 12 shows the predicted daytime $L_{Aeq,16hour}$ noise levels across the site at a height of 1.5m, this height is used to assess noise impact in amenity areas e.g., persons using the areas for recreation.

Figure 12 Amenity Noise levels Across the Development Site dB $L_{Aeq,16\text{-}hour}$ at 1.5m height.

The SDCC NAP defines areas with noise levels of >70 dB(A) L_{day} as being undesirably high sound levels and desirably low levels at <55 dB(A) $L_{day.}$ It will not be possible to achieve desirably low levels in the area at the north of the site in proximity to the N7

Road. However, the predicted levels in this area are all below the upper threshold of undesirable high notwithstanding this, the development layout incorporates landscaped green spaces at ground level between buildings and most of the site amenity space has noise level predicted to be within the 55 dB(A) L_{day} desirably low noise threshold.

4.4 Element 4 – Assessment of Other Relevant Issues

Element 4 considers 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.

4.4.1 Compliance with Relevant National and Local Policy

There are no National policy documents relating to the acoustic design of residential dwellings. Locally the Draft *Dublin Agglomeration Environmental Noise Action Plan December 2018 – November 2023 Vol. 4 – South Dublin County Council* Pubic Consultation Document (NAP) recommends that the guidance contained within ProPG should be used in assessing the noise impact on new residential developments being introduced to existing noise sources.

4.4.2 Magnitude and Extent of Compliance with ProPG

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

- All dwellings as part of the development can designed to achieve good internal noise levels and provide adequate ventilation in accordance with Part F of the Building Regulations;
- External amenity areas have been assessed and are determined to be within the target level for most of the site. In the amenity space at the north of the site between the duplex units and the site boundary, the external noise levels under are above the target levels set out in ProPG but are considered acceptable for the development in line with the SDCC NAP.

Based on the preceding it is concluded that the proposed development can be designed to function in compliance with the requirements of ProPG once appropriate consideration is given at the detailed design stage to the sound insulation mitigation measures and principles outlined in this report.

4.4.3 Likely Occupants of the Development

The development consists of residential accommodation. The criteria adopted as part of this assessment are based on those recommended for permanent dwellings and are therefore considered robust and appropriate for the occupants.

4.4.4 Acoustic Design v Unintended Adverse Consequences

Unintended adverse consequences did not occur on this project.

4.4.5 Acoustic Design v Wider Planning Objectives

Acoustic design must be considered in the context of wider planning objectives, particularly the National Planning Framework 2040. The National Planning Framework (NPF) is an important document which must be taken into consideration in the making of local planning policy to be contained in new statutory plans. Please refer to the planning submission for further details.

5.0 CONCLUSION

An acoustics assessment has been undertaken at the proposed development site following the guidance set out in ProPG and the Dublin Agglomeration Environmental Noise Action Plan December 2018 – November 2023 Vol. 4 – South Dublin County Council Public Consultation Document (NAP).

The site has been identified as having a range of noise levels associated with a '*Low to Medium to High Risk'* of noise impacts based on the proximity to the N7 road.

A noise barrier will be required at the boundary of the site close to the N7 road to screen road traffic noise levels from the N7. In addition to this mitigation measures in the form of a minimum sound insulation specification on building element have been provided for key facades to ensure that the internal noise levels will be within the recommended criteria with windows closed.

In this assessment it has been assumed that background ventilation will be provided through acoustically attenuated wall mounted or trickle vents and an acoustic specification for these vents has been provided to achieve the internal noise criteria. However, should occupants choose to open windows it is expected that good to reasonable internal noise levels can be achieved in all rooms except for the rooms in duplex units facing the N7. In these rooms it will not be possible to achieve reasonable internal noise levels with windows open.

For most of the site the noise levels in external amenity areas will be within the threshold for desirably low noise levels as set out in the SDCC NAP. In the amenity space at the north of the site between the duplex units and the boundary, the external noise levels under are above the target levels set out in ProPG but are considered acceptable for the development in line with the SDCC NAP.

The Acoustic Design Statement presented in this report has assessed the impact of traffic noise levels on the proposed development and has been prepared in accordance with the requirements of ProPG as required by the South Dublin County Council NAP. The proposed development can be designed to function in compliance with the requirements of ProPG once appropriate consideration is given at the detailed design stage to the sound insulation mitigation measures and principles outlined in this report.

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.