

Walls Construction Ltd.

Rosemount House SHD

Rosemount House,
Mayne River Avenue,
Northern Cross,
Malahide Road,
Dublin 17.

Noise & Vibration Impact Assessment Report

August 2022

Control Sheet

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1.0 Introduction

Redkite Environmental Ltd. was commissioned by Walls Construction Ltd. to complete a noise and vibration impact assessment report in support of a planning application for a proposed SHD comprising 176 no. apartments with associated residential amenities, office, and café use on a 0.65 ha site at Rosemount House, Mayne River Avenue, Northern Cross, Malahide Road, Dublin 17.

1.1 Report Objectives

The principal aims of this report are to:

- Characterise the existing environment in terms of noise and vibration sources, ambient sound levels, existing noise sensitive receptors (NSRs) and site context;
- Determine the site noise risk for future residents;
- Determine suitable noise and vibration criteria for assessment;
- Assess the short-term impact of the site development and construction phase on the existing ambient environment and the corresponding effect on existing NSRs in terms of both vibration and noise;
- Assess the long-term impact on the ambient sound environment and the corresponding effect on NSRs with the proposed development completed;
- Identify mitigation measures and/or factors where necessary, including measures for protection of new residential living conditions and amenity against road traffic and aircraft noise impact;
- Identify residual impacts (if any) after mitigation.

2.0 Methodology

2.1 Competence

This assessment has been prepared by Ms. Siobhan Maher whose qualifications include a B.Sc. in Analytical Science, M.Tech. in Environmental Management and a post graduate Diploma in Acoustics and Noise Control Engineering. Siobhan is a full Member of the Institute of Acoustics (MIOA) since 2003 and also a Member of the Association of Acoustic Consultants Ireland (AACI). Siobhan was recently involved in the preparation of the AACI Environmental Noise Guidelines for Local Authority Enforcement and Planning Sections published in June 2019. <http://aaci.ie/industry-publications/>

Siobhan is the Managing Director of Redkite Environmental with over 20 years of experience providing environmental consultancy and environmental assessment services to business, industry and public sectors. In the area of acoustics, she has experience in environmental noise and vibration impact assessment, building acoustics (design and standard assessment), environmental noise monitoring and prediction modelling and occupational noise assessment.

The methodology used in completing this report is presented overleaf.

2.2 Characterisation of the Receiving Environment

The receiving environment has been characterised by desk-based study of two ambient sound surveys completed in the Northern Cross development area in January and September 2020 by Redkite Environmental Ltd. These surveys are available to the public on the Dublin City Council planning portal under the following references:

1. Planning file reference number – SHD0017/20 (ABP Case No. TC29N.306776), relating to an adjacent site to the east of the subject site, known as Site 2 or Block 2, and,
2. Planning file reference number – 3506/20 relating to a site further east directly off the Malahide Road, known as Site 5 or Block 5.

The need for additional surveys was not considered necessary for the subject site for a number of reasons including the following:

- The site is directly adjacent to Site 2 which was subject to survey pre-COVID in January 2020;
- Transportation (road and aircraft) noise mapping is available for the locality;
- The Dublin Airport Local Area Plan, Variation No. 1, published in January 2020 provides estimated aircraft noise levels for the location zone;
- Measurement of individual aircraft events will not significantly change from measurements at adjacent sites as the flight path is the same distance. Each aircraft event can be used to calculate different time periods based on number of events;
- Any effects from reduced transportation noise due to COVID restrictions in September 2020, when Site 5 was surveyed, have been accounted for in the calculations in this report.

Therefore, the receiving environment, in terms of noise and vibration, has been characterised based on a desk-based study of previous surveys and transportation noise mapping available on <https://gis.epa.ie/EPAMaps/> for the area.

2.3 Impact Assessment

The following guidance and standards have been used in the setting of suitable noise and vibration criteria and assessment of impacts and effects on human beings:

- BS5228-1:2009 +A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites: Part 1: Noise and Part 2: Vibration;
- BS 7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration;
- BS6472-1:2008: Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting;
- ISO 9613.-2 – 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation,
- UK Highways Agency Design Manual for Roads and Bridges, Sustainability and Environmental Appraisal, LA11, Noise and Vibration, Rev 2, May 2020, and,
- Transport Infrastructure Ireland (TII) publication Guidelines for the Treatment of Noise & Vibration in National Road Schemes, March 2014.

The EPA document entitled Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, 2022 also contains general guidance on

the assessing of environmental effects in terms of quality, significance, duration, magnitude and type. This document has also been considered where appropriate in defining noise and vibration impacts, however the above guidance and standards listed form the main basis of setting of criteria and assessment.

The UK ProPG: Planning & Noise, New Residential Development, May 2017¹ was used as guidance in completing the inward noise impact assessment on future residents. This document outlines a systematic risk based 2 stage approach for evaluating noise exposure on prospective sites for residential development. Stage 1 comprises an initial noise risk assessment of sites proposed for residential development considering either measured and/or predicted noise levels. A site is then characterised as negligible to high risk in terms of exposure to transportation noise of future residents. A full stage 2 assessment including implementing a good acoustic design process is triggered depending on the existing ambient noise environment and findings of the Stage 1 Noise Risk Assessment.

3.0 Definitions

The following definitions may apply in this report:

L_{Aeq} is the A – weighted equivalent continuous sound level – the sound level of a steady sound having the same energy as a fluctuating sound over a specified measurement period.

L_{A10} is the A-weighted noise level which is exceeded for 10% of the specified measurement period. This gives an indication of the upper limit of fluctuating noise such as that from intermittent road traffic over the measurement period.

L_{A90} is the A-weighted noise level exceeded for 90% of the measurement period and is useful in providing an indication of the background noise level experienced over the measurement period.

L_{AFmax} is the maximum A-weighted noise level measured during a cycle with a fast time weighting, and,

L_{AFmin} is the minimum A-weighted noise level measured during a cycle with a fast time weighting.

L_{day} Day equivalent level: A-weighted, Leq. Sound Level, measured over the 12-hour period 07.00 - 19.00 hours

L_{evening} Evening equivalent level: A-weighted, Leq. Sound Level, measured over the 4-hour period 19.00 - 23.00 hours

L_{den} Day-evening-night level. It is a descriptor of noise level based on energy equivalent noise level (Leq) over a whole day with a penalty of 10 dB(A) for night-time noise (22.00-7.00) and an additional penalty of 5 dB(A) for evening noise (i.e. 19.00-23.00).

¹ This document was prepared by a working group comprising members of the UK 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 for assessing inward noise risk for new residential development.

L_{night} Night equivalent level: Leq. A-weighted, Sound Level, measured overnight 23.00 - 0700 hours.

The “A” suffix denotes sound levels that have been “A-weighted” in order to account for the non-linear nature of human hearing to sounds of different frequencies.

R_w – weighted sound reduction index - a single-number quantity which characterises the airborne sound insulation of a material or building element over a range of frequencies. (Laboratory measurement). The apparent R_w is the value as measured in the field.

SEL – Single Event Level - the dB(A) level which if it lasted for one second would produce the same A-weighted sound energy as the actual event. Also known as L_{Ae}.

Spectrum Adaptation Terms: C and C_{tr} -The single number rating method defined in BS EN ISO 717 uses a standard reference curve to determine the weighted value of airborne sound insulation. The spectrum adaptation terms C and C_{tr} may be used to take into account different source spectra as indicated in the standard.

C is an [A-weighted Pink Noise](#) spectrum. C is added for aircraft noise at short distance

C_{tr} is an [A-weighted](#) urban traffic noise spectrum.

C_{tr} can also be added to [R_w](#) to take into account low frequency noise.

All sound levels in this report are expressed in terms of decibels (dB) relative to 2x10⁻⁵ Pa.

4.0 Description of Existing Conditions

4.1 Locational Context

The proposed development site covers an area of approx. 0.65 ha and is located at Northern Cross, an area under development on the edge of more mature existing suburban development to the south and west. Northern Cross is a mixed-use development with residential, commercial and industrial uses present.

Rosemount House, an office block occupied by the applicant, is currently located on the site with associated parking and landscaping.

The site directly adjoins another proposed SHD site (Site 10 – ABP Case Reference TC29N. 312108) to the north. Lands further to the north of the Mayne River corridor are currently under development for residential use (planning permission reference No. F15A/0609). In addition to this development, a new SHD application entitled “*Belcamp SHD*” comprising 2,572 units was made with respect to a 67ha site directly to the north of the proposed Site 10 development site. The lands within the Belcamp SHD, which directly adjoin Site 10 to the north will not be built on but will be part of a greenbelt (Mayne River Corridor) developed during Phase 1 of that development. According to the Belcamp SHD EIAR, Phase 1 will be built out from Quarter 1 2023 – Quarter 3 2028. The main proposed built elements associated with Belcamp SHD, Phase 1 are to the west and screened from the proposed development site by the Bewleys roastery and office block.

The proposed development site is directly bounded to the east by Site 2, which was granted planning permission (ABP Ref. 307887-20) for residential development comprising 191 apartments in a part seven/part eight storey building over a lower groundfloor/upper basement level and lower basement level. Site 2 is currently under construction.

Un-developed land and the Bewley's facility lie to the immediate west. Part of the Belcamp SHD, Phase 1 will lie beyond Bewleys and bounds the R139 to the west.

The site lies along Mayne River Avenue, the main access route or spine road into Northern Cross but is set back and screened by existing buildings from the R139 and R107 road traffic routes.

The centre line of the main flight path of Dublin Airport is approximately 1km north of the site at St. Doolaghs. The airport is approximately 4km northwest.

Accordingly, the main noise sources potentially affecting the site are overhead aircraft and local traffic on Mayne River Avenue.

The nearest existing noise sensitive receptors (NSRs) to the development site are Block 6B, a nursing home development located approximately 46m east and other office blocks/commercial development approximately 25 - 35m to the south. Site 2 is currently under construction to the east. Accordingly, it is envisaged that this will be the nearest NSR to the proposed development site in the future.

4.2 Findings of Previous Surveys

4.2.1 Site 2 (eastern site boundary)

A noise survey was completed on the adjoining Site 2 in January 2020 at NMPs 1 – 3 as indicated on Figure 1 overleaf.

NMP1 is directly on the eastern boundary of the proposed development site.

NMP2 is a roadside location on the grass verge of Mayne River Avenue.

NMP3 is located approximately 50m east of the proposed development site boundary and is close to an existing NSR, Block 6B.

NMP4 is approximately 9m set-back from the roadway (Mayne River Avenue). 24-hour monitoring was completed at NMP2. Local traffic monitoring at NMP4 is representative of local traffic noise on the southern boundary of the proposed development site.

Attended measurements were completed at NMPs1 - 3 during the day, evening and night-time periods.

Figure 1 Previous Monitoring Locations



Source: Google Maps. Red-line boundary is indicative only.

The summary findings are as follows for Site 2:

“The sound environment can be described as typical urban/suburban in nature. Continuous distant traffic on the surrounding road network (R139 and R137) is the main noise source affecting the locality and dominates the soundscape with individual overhead aircraft events also audible. The southern boundary is directly affected by local road traffic on Mayne River Avenue. At night-time, some fixed sources from the Bewleys facility were audible but distant traffic was predominant. Sources from a sub-station lying along the western boundary within the Walls Construction office boundary were not audible. Any associated roof-level air conditioning plant was also not audible at ground level and would not be expected to be significant sources.”

The results for NMPs 1 - 3, as indicated on Figure 1 above are presented in Tables 1 -3 overleaf.

Table 1 Summary Results of Monitoring – NMP1

No.	Time	L _{Aeq,t}	L _{A10,t}	L _{A90,t}	L _{AFmax}	Description of Ambient Sound Environment
21 st January 2020 Daytime (07.00 – 19.00 hrs)						
1.	13.46	55	57	51	72	Constant road traffic noise is the predominant background noise source emanating from the R139 and R107. Sirens, during #1 and some sounds from a mini-digger in use emanated from the development site during #1 and #3. Approx. 5 aircraft per 30-minute measurement.
2.	15.42	56	57	53	68	
3.	17.29	56	57	53	67	
21 st January 2020 Evening time (19.00 – 23.00 hrs)						
1.	20.42	54	56	50	71	Constant road traffic noise from R139 and R107. 5 aircraft overhead. L _{Amax} due to aircraft.
21 st – 22 nd January Night-time (23.00 – 07.00 hrs)						
1.	23.00	52	54	48	65	As above. 2 aircraft per each 15 minute measurement.
2.	23.50*	53	56	48	66	

*Measurement was 10 minutes in duration due to meter clock resetting at midnight.

Table 2 Summary Results of Monitoring – NMP2

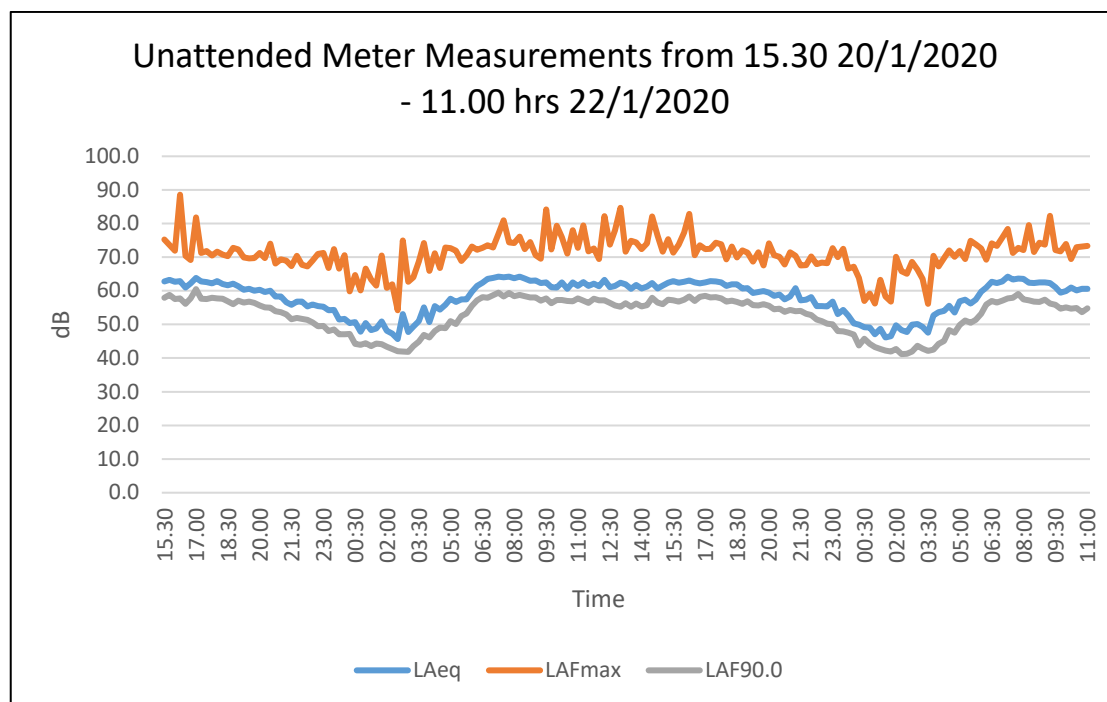
No.	Time	L _{Aeq,t}	L _{A10,t}	L _{A90,t}	L _{AFmax}	Description of Ambient Sound Environment
21 st January 2020 Daytime (07.00 – 19.00 hrs)						
1.	14.24	69	73	56	89	Constant road traffic noise is the predominant background noise source from the R139 and R107. Bus pulled in for service beside meter during #2. Local passing vehicles on Mayne River Avenue close to meter resulted in higher L _{Amax} values recorded. Sirens during #3. Approx. 5 aircraft per each 30-minute measurement.
2.	16.20	70	74	58	84	
3.	18.04	69	73	56	81	
21 st January 2020 Evening time (19.00 – 23.00 hrs)						
1.	21.14	62	65	53	82	Constant road traffic noise from R139 and R107. 5 aircraft overhead. Local passing vehicles on Mayne River Avenue close to meter resulted in L _{Amax} value recorded.
21 st – 22 nd January Night-time (23.00 – 07.00 hrs)						
1.	23.17	57	60	49	74	As above. 3 aircraft per each 15 minute measurement. Bewleys fixed plant audible but not predominant.
2.	00.22	53	54	47	70	

Table 3 Summary Results of Monitoring – NMP3

No.	Time	L _{Aeq,t}	L _{A10,t}	L _{A90,t}	L _{AFmax}	Description of Ambient Sound Environment
21 st January 2020 Daytime (07.00 – 19.00 hrs)						
1.	15.08	60	60	55	76	Constant road traffic noise is the predominant background noise source from the R139 and R107. Local passing vehicles on access route close to meter resulted in L _{Amax} values recorded. Approx. 5 aircraft per each 30-minute measurement. Dogs barking and van unloading during #3.
2.	16.54	57	59	54	73	
3.	18.39	57	58	54	70	
21 st January 2020 Evening time (19.00 – 23.00 hrs)						
1.	21.47	55	57	52	66	Constant road traffic noise from R139 and R107. 4 aircraft overhead. L _{Amax} due to aircraft.
21 st – 22 nd January Night-time (23.00 – 07.00 hrs)						
1.	23.33	52	55	46	64	Constant road traffic noise from R139 and R107. 2 aircraft overhead per each 15 minute measurement.
2.	00.38	51	52	47	64	

In addition to the above, an unattended meter recorded sound levels at NMP4 during a 44 - hour period from approx. 15.30 hrs on the 20th January 2020 through to 11.00 hrs on 22nd January 2020. Noise levels during this period are illustrated on Figure 2 below:

Figure 2 Results of Unattended Measurement



Average noise levels on site are fairly steady from 06.45 – 21.00 hrs. Noise levels then start to fall off and, as expected, the quietest period was between 01.00 -03.00hrs which is when distant traffic noise typically reduces before increasing again around 04.00hrs. Aircraft noise also started to reduce and generally ceases around 01.30 hrs before re-starting again around 05.00 hrs as flights increase between 05.00 - 07.00 hrs.

L_{Amax} values during the night-time are most likely due to individual passing vehicles on Mayne River Avenue and overhead aircraft. L_{Amax} values above 60 dB were infrequent during the period from 23.00 – 05.00 hrs but then started to increase, coinciding with expected airport activity. L_{Amax} values recorded between 05.00 – 05.30 hrs are most likely to represent aircraft noise as at other times passing vehicles including buses on Mayne River Avenue also contribute.

Based on monitoring at NMP4 the following have been calculated:

- $L_{Aeq,16hr}$ (07.00 – 23.00hrs) is 62 dB.
- $L_{Aeq,8hr}$ or L_{night} (23.00 – 07.00hrs) is 56 dB. As noted above, there are periods during the night-time when aircraft activity increases and also local traffic. The $L_{Aeq,1hr}$ values between 05.00 -07.00 hrs are 60 - 62 dB.
- L_{den} is 64 dB.

NMP4 is approx. 9m from the local road which significantly influenced the parameters listed above. The proposed development site is less influenced by this road further north into the site. However, continuous distant traffic and intermittent aircraft noise affect all areas of the site equally.

4.2.2 Site 5 – Malahide Road

A survey was also conducted at Site 5, as indicated on Figure 1, in September 2020. Both attended and unattended 24-hour monitoring was completed at 2 locations. The summary findings for Site 5 are as follows:

“The sound environment can be described as typical urban/suburban in nature. The traffic on the Malahide Road predominates and is punctuated by overhead aircraft noise. During the night-time after approx. 01.00hrs, traffic on the Malahide Road was very intermittent and continuous distant traffic on the surrounding road network was the main noise source affecting the locality.”

This site is not as representative of the proposed development site in terms of overall ambient sound conditions compared to Site 2. However more specific aircraft noise monitoring was completed which is applicable.

Table 4 contains a summary of SELs recorded at NMP5 for overhead aircraft coming in from the east to land at Dublin Airport. These measurements are considered to also be applicable to the proposed development site for individual aircraft noise characterisation and calculation of $L_{Aeq,16\text{ hr}}$ and $L_{Aeq8\text{hour}}$ values for aircraft noise.

During the September 2020 survey 25 planes were estimated as landing during the night-time period from the audio recording at Site 5. This equates to an $L_{Aeq,8\text{hr}}$ of 44 dB for night-time aircraft noise based on the average SEL recorded. It is however noted that the airport was not operating at full capacity then. Accordingly, further detail is presented in Section 4.4 on derived aircraft noise to account for increased plane numbers normally expected.

The L_{Amax} values for aircraft are above 60 dB and occur more than 10 times during the night-time period.

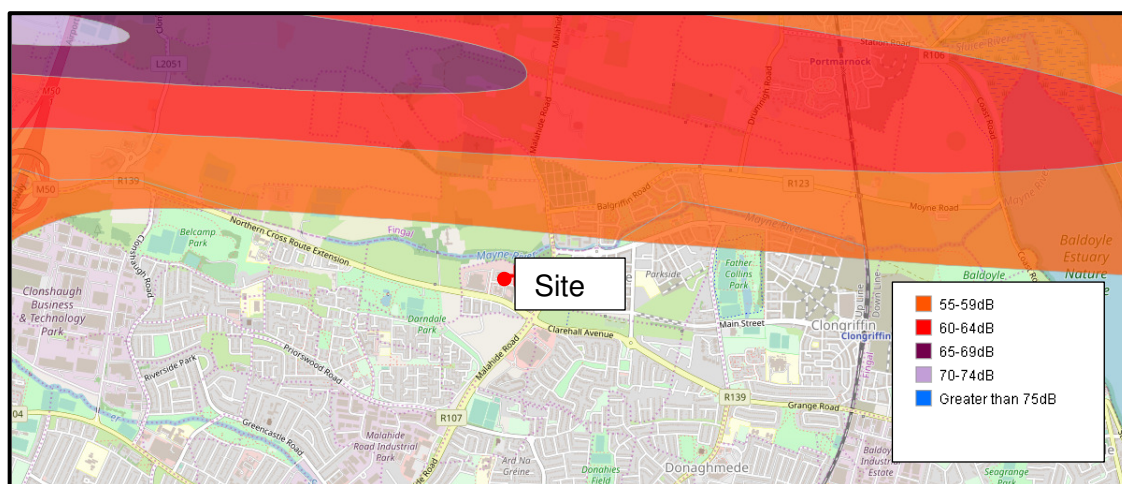
Table 4 Summary Results of Single Event Level Monitoring for Aircraft Landing. Measured at NMP5

Measurement No.	31.5	63	125	250	500	1000	2000	4000	8000	L _{Aeq,t}	L _{Amax}	L _{Ae}
	Hz dB(A)											
1	25	39	43	48	54	54	47	33	21	58	66	75
2	25	37	44	46	50	53	50	39	25	57	62	73
3	26	36	42	48	54	54	48	37	27	58	67	74
4	24	38	42	47	52	53	46	34	26	57	65	76
5	20	35	42	49	54	55	48	33	23	58	66	76
6	20	36	42	47	57	56	48	31	19	60	67	75
7	21	36	44	48	59	57	48	31	19	61	72	77
8	18	36	40	48	56	56	48	31	24	60	68	76
9	18	33	39	46	52	52	45	29	19	56	65	75

4.3 Aircraft Noise Mapping

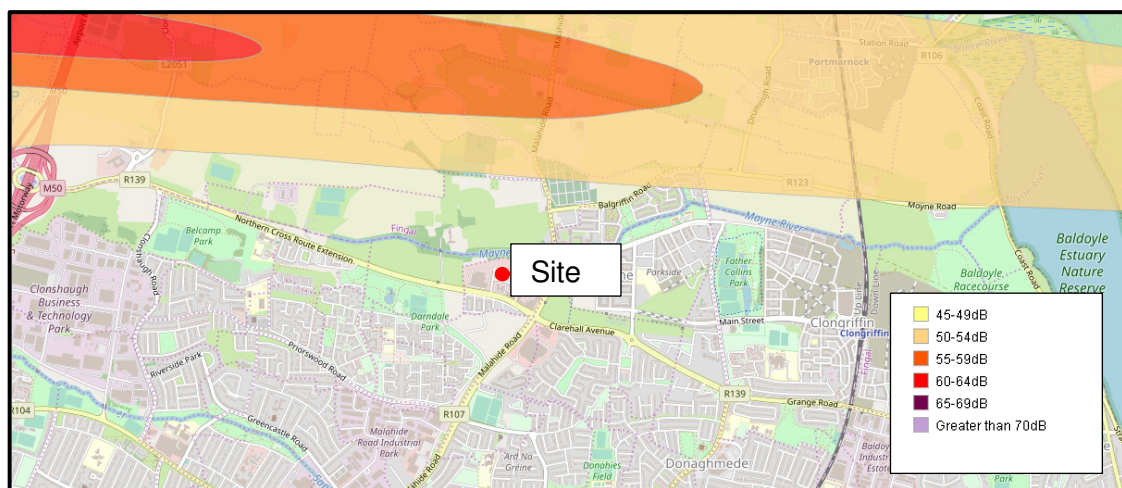
Figures 3 and 4 below indicate the mapping available on <https://gis.epa.ie/EPAMaps/> for aircraft noise. The site falls outside the main contours predicted for the 2km wide flightpath. The site is outside of the Outer Airport Noise Zone. It is also outside of the contours presented in the EIS for the Northern Runway for Option 7b (as approved by An Bord Pleanála), year 2025.

Figure 3 Latest Round 3 Aircraft Noise Mapping L_{den}



Source: <https://gis.epa.ie/EPAMaps/>

Figure 4 Latest Round 3 Aircraft Noise Mapping L_{night}

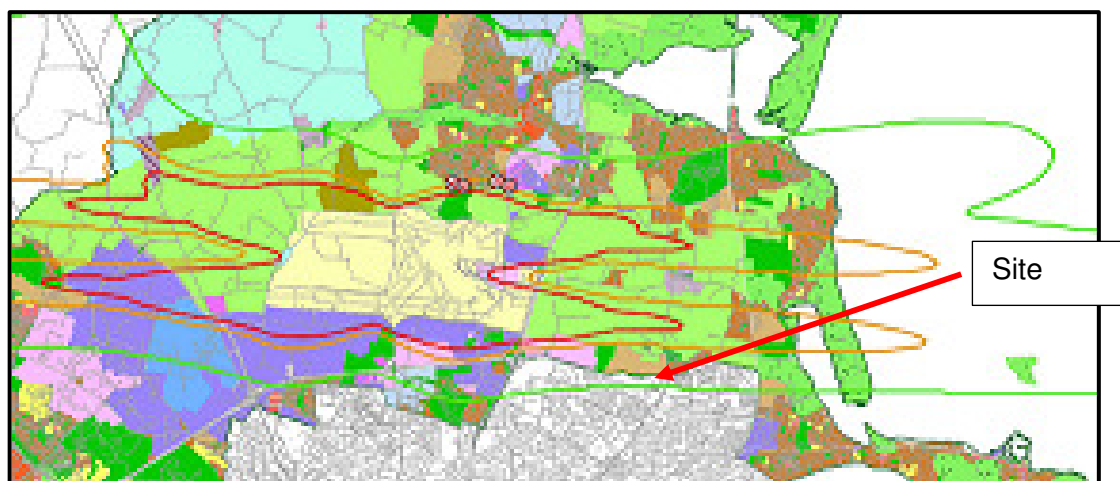


Source: <https://gis.epa.ie/EPAMaps/>

The Dublin Airport Local Area Plan (LAP) was published in January 2020. Section 9.1 of the LAP refers to Noise and specifically to updated Noise Zones and policies related to development in Noise Zones as set out in Variation No. 1 to the Fingal Development Plan, 2017-2023 adopted in December 2019.

Part of Figure 9.1 from the LAP is reproduced below with the site indicated as just within Zone C as indicated by the green line on Figure 5 below.

Figure 5 Airport Noise Zones



Source: Dublin Airport Local Area Plan, 2020

The following is noted with regard to Zone C:

Potential noise exposure in Zone C for aircraft noise is indicated as follows in the Development Plan Variation No. 1:

≥ 54 and <63 dB $L_{Aeq,16hr}$

and,

≥ 48 and <55 dB L_{night}

4.4 Derived Aircraft Noise

The site-specific monitoring for Site 5 (but also applicable to the proposed development site with regards to aircraft noise) indicates that the aircraft noise is lower than that indicated in the Plan for Zone C. However, it is acknowledged that the airport was not likely to be operating at normal capacity during the September 2020 survey due to Covid-19 restrictions. It may have been as low as 30-40%. 25 planes were estimated as landing during the 8-hour night-time period from the audio recordings. If this is assumed to be 35% of normal operations, then the L_{night} for full operations is calculated as 49 dB(A). The site is also close to the outer boundary of Zone C with Zone D and therefore, is considered to be at the lower end of the range specified in the Development Plan Variation No. 1.

The following is also stated in relation to Zone C:

To manage noise sensitive development in areas where aircraft noise may give rise to annoyance and sleep disturbance, and to ensure, where appropriate, noise insulation is incorporated within the development

*Noise sensitive development in this zone is less suitable from a noise perspective than in Zone D. A noise assessment **must** be undertaken in order to demonstrate good acoustic design has been followed.*

*The noise assessment must demonstrate that relevant internal noise guidelines will be met. This **may** require noise insulation measures.*

*An external amenity area noise assessment **must** be undertaken where external amenity space is intrinsic to the development's design. This assessment should make specific consideration of the acoustic environment within those spaces as required so that they can be enjoyed as intended. Ideally, noise levels in external amenity spaces should be designed to achieve the lowest practicable noise levels.*

4.5 Road Traffic Noise Mapping

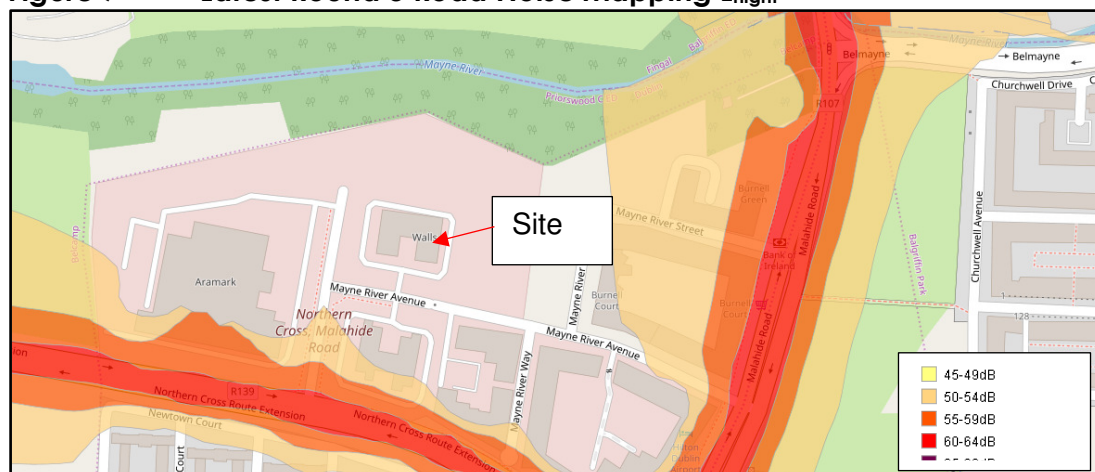
Dublin City Council, Dun Laoghaire Rathdown, Fingal and South Dublin County Councils have jointly prepared an Environmental Noise Action Plan, 2018 - 2023 for the Dublin Agglomeration. Related road noise mapping is available on the EPA's website <https://gis.epa.ie/EPAMaps/>. Figures 6 and 7 re-produce the Round 3 road traffic noise mapping in the vicinity of the site.

Figure 6 Latest Round 3 Road Noise Mapping L_{den}



The monitoring results for Site 2 and mapping are not directly comparable as the mapping only deals with the main transportation noise sources and not local noise sources affecting the site such as traffic on Mayne River Avenue. However, if the L_{den} and L_{night} for NMP4 is calculated using the L_{A90} data representing steady noise sources such as traffic on the R107 and R139, then the L_{den} is within the range predicted in Figure 6 while the L_{night} is higher at 50 dB(A) than predicted (see Figure 7 below).

Figure 7 Latest Round 3 Road Noise Mapping L_{night}



4.6 WHO Noise Guidelines

In October 2018, the World Health Organisation (WHO) published new Environmental Noise Guidelines for the European Region. The new Guidelines deal with individual types of noise such as road, rail, aircraft, wind turbine and leisure noise.

The following Guidelines are set for external road traffic noise:

For average noise exposure, the GDG strongly recommends reducing noise levels produced by road traffic below 53 dB L_{den} , as road traffic noise above this level is associated with adverse health effects.

For night noise exposure, the GDG strongly recommends reducing noise levels produced by road traffic during night-time below 45 dB L_{night} , as night-time road traffic noise above this level is associated with adverse effects on sleep.

To reduce health effects, the GDG strongly recommends that policy-makers implement suitable measures to reduce noise exposure from road traffic in the population exposed to levels above the guideline values for average and night noise exposure. For specific interventions, the GDG recommends reducing noise both at the source and on the route between the source and the affected population by changes in infrastructure.

It is considered that part of the site close to Mayne River Avenue is above the WHO Guidelines for road traffic noise.

The following are set for external aircraft noise:

For average noise exposure, the GDG strongly recommends reducing noise levels produced by aircraft below 45 dB L_{den} , as aircraft noise above this level is associated with adverse health effects.

For night noise exposure, the GDG strongly recommends reducing noise levels produced by aircraft during night-time below 40 dB L_{night} , as night-time aircraft noise above this level is associated with adverse effects on sleep.

To reduce health effects, the GDG strongly recommends that policy-makers implement suitable measures to reduce noise exposure from aircraft in the population exposed to levels above the guideline values for average and night noise exposure. For specific interventions, the GDG recommends suitable changes in infrastructure.

It is considered that the site is above the WHO Guidelines for aircraft noise.

The local authority noise action plan sets the following interim target values (where the WHO Guidelines cannot be immediately achieved) for desirable low and undesirable high sound levels:

Desirable Low Sound levels

< 50 dB(A) L_{night}

< 55 dB(A) L_{day}

Undesirable High Sound levels

> 55 dB(A) L_{night}

> 70 dB(A) L_{day}

Overall, the proposed development site is not considered to be above undesirable high sound levels except for the immediate southern boundary at night-time where, based on the monitoring undertaken on the adjacent Site 2, levels marginally exceed 55 dB(A) by 1 decibel.

4.7 Stage 1 - Determination of Noise Risk

The noise risk has been determined from review of EPA mapping and historic noise monitoring on adjacent sites. ProPg requires that the site be assessed for noise risk without any potential screening from existing buildings or structures that do not form part of the proposed development.

The majority of the site is generally considered to fall under a low to medium noise risk rating with the exception of the part of the site immediately fronting onto Mayne River Avenue which is closer to a medium risk rating. Localised road traffic noise is the main noise source affecting the proposed development site from the monitoring undertaken.

Aircraft noise alone would account for a low-risk rating however local road traffic is predominant.

The majority of the site is expected to fall within $L_{Aeq,16hr}$ values of 55 - 62 dB(A) and L_{night} values of 50 – 55dB(A) based on the analysis for the adjacent Site 2 and in the absence of the existing building.

5.0 Description of Development

5.1 General Project Description

The proposed development shall consist of:

- Demolition of existing c. 3,315 sq.m, 3 storey office building on site and existing ancillary facilities and the construction of a single mixed-use block (Block A) of up to 9 storeys (over basement), consisting of a 4-sided structure based around a central courtyard area.
- c. 1,050 sq.m. of office space at ground floor level with own door access and associated infrastructure including staff kitchen, meeting rooms and designated parking at basement level.
- A café unit of c. 143.7 sq.m at ground floor level with own door access to the south and east, accessed via proposed public open space.
- 176 no. residential units from 1st to 8th floor level comprising 72 no. 1 bed units (41%), 57 no. 2 bed units (32%) and 47 no. 3 bed units (27%) [each with private amenity space in the form of balcony or terrace], with main access from the south of the block, with ancillary access to the rear at the north end.
- c. 1,846 sq. m. of communal open space at ground floor, first floor podium, 4th floor and 7th floor level, and public open space of c. 1,577 sq.m. at ground floor level, including a public courtyard area located to the southeast of the proposed block.

- Resident amenity and support services are proposed at ground floor level to include a cinema room, post room, games room, co-working spaces, gym and concierge services.
- 134 no. car parking spaces, 7 of which are accessible, and 6 no. motorcycle parking spaces, all of which are located at basement level and accessed by a vehicular ramp via Mayne River Avenue to the west (with a vehicular set down areas fronting Mayne River Avenue), in addition to 2 no. car club spaces at the southern boundary, with 392 no. bicycle parking spaces at ground floor and at surface level.
- All associated vehicular and pedestrian access routes (including links to the adjoining site to the north), external communal play facilities, substation, foul and surface water drainage, hard and soft landscaping, lighting, plant at basement level, bin stores, photovoltaic panels at roof level, green roofing, all associated and ancillary site works.

A centralised mechanical heat recovery and ventilation system (MEV) will be provided.

5.1.1 External Amenity

All apartments are provided with private amenity space in the form of balcony or terrace. Terraces are provided on the 7th floor only.

The proposal includes public open space at ground floor level to the east and north of the proposed building. This area is linked to the public open space of the adjoining proposed development to the north (Site 10) which in turn links to the Mayne River Corridor.

Communal open space will be provided in the centre of the proposed development and therefore will be enclosed to the north, south, east and west by the proposed building at ground floor and 1st floor. Further communal open space is provided at the 4th and 7th floor level within the south and north sides of the block respectively. The 4th floor communal area overlooks Mayne River Avenue while the 7th floor communal space will be screened to the north by the parallel planning application on Site 10.

The landscape strategy envisages some soft features including planting and a water lily pond, and waterfall feature at ground and 1st floor levels.

5.2 Site Development and Construction Phases

The envisaged duration of the demolition, site development and construction phases will be 24–26-months.

The demolition phase, which presents the highest potential for noise impact will occur over an estimated 8–10-week period. The majority of the schedule will be dedicated to construction of the superstructure.

Demolition of the existing structure will be completed as follows:

- Internal strip out of M&E, fixtures and finishes.
- Removal of all glazing and then structural demolition of concrete frame via mechanical jaws/crusher.

No piling is proposed.

Construction traffic will on average be 5-6 HGVs per hour during earlier phases of demolition and site development.

6.0 Assessment of Impact on Existing NSRs

6.1 Demolition, Site Development & Construction Phases

The demolition, site development and construction phases can potentially give rise to temporary to short term noise and vibration impact and effects through the use of mobile and non-mobile heavy machinery and equipment. The following section discusses the applicable criteria applied to site development and construction phase noise and vibration.

6.1.1 Applicable Noise Criteria

There is no definitive published Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project.

BS5228:2009 + A1:2014: *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise* describes applicable noise level thresholds (construction noise plus ambient) not to be exceeded at noise sensitive receptors, depending upon existing ambient levels, as described in Table 5 below. This table is based upon report E3.2, Table E.1 of BS5228:2009 + A1:2014 Part 1.

It should be noted that this assessment method is only valid for residential properties and not for commercial NSRs.

Table 5 Threshold of Significant Effect at Dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A	Category B	Category C
Night-time (23:00-07:00)	45	50	55
Evening and Weekends	55	60	65
Daytime (07:00-19:00) and Saturday (07:00-13:00)	65	70	75
NOTE 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.			
NOTE 2: If the ambient noise level exceeds the threshold values given, in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3dB due to construction activity.			
NOTE 3 Applied to residential receptors only.			
A) Cat A: Threshold values to use when ambient noise levels (rounded to nearest 5dB) are less than these values			
B) Cat B: Threshold values to use when ambient noise levels (rounded to the nearest 5dB) are the same as Cat A values			
C) Cat C: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Cat A values			
D) 19:00-23:00 weekdays, 13:00-23:00 Saturday and 07:00-23:00 Sunday is deemed 'evening and weekend' period.			

In addition to the above, the following acceptable levels are described in the Transport Infrastructure Ireland (TII) publication Guidelines for the Treatment of Noise & Vibration in National Road Schemes, 2014. These limits are applied during the construction of road infrastructure projects at the facades of NSRs:

Table 6 TII Acceptable Levels for Construction

Day	Working Hours	Level dB ($L_{Aeq,1hr}$)	Level dB (L_{Amax})
Mon-Fri	07.00 – 19.00	70	80
Mon-Fri	19.00 – 22.00	60*	65*
Saturday	08.00 – 16.30	65	75
Sundays & Bank Holidays	08.00 – 16.30	60*	65*

*Note *: Construction activity at these times, other than emergency works, will normally require specific permission from the local authority.*

Monitoring undertaken at NMP3 is representative of noise exposure of existing residential NSRs to east (nursing home and potential future residents of Site 2). Accordingly, Category A daytime (07.00 -19.00) threshold values apply at these NSRs.

The nearest commercial properties to the south fall into Category B, although as noted earlier, the method as set out in Table 5 does not apply to commercial properties.

It is unlikely that there will be a requirement for night-time or evening (19.00 – 23.00 hrs) construction works. Accordingly, the following construction noise criteria or threshold values are proposed for residential and commercial properties:

- 65 dB $L_{Aeq,1hr}$, Mon-Fri (07.00 – 19.00hrs) and Sat (07.00 – 13.00 hrs) at residential properties to the east (Block 6B - nursing home);
- 70 dB $L_{Aeq,1hr}$ at commercial properties (to the south and west).

Limits or threshold values are typically applied to control construction noise as it is temporary to short term in nature and will not have long-term effects on NSRs. BS5228-1 notes that a potentially significant negative effect will occur if the predicted construction noise level plus ambient at an NSR exceeds the applicable threshold value. BS5228-1 also notes that factors such as the number of receptors affected, and the duration and character of the impact may need to be considered to determine if there is an actual significant effect.

The recently published UK LA111 Noise and Vibration Assessment Guidance for road projects similarly notes that the magnitude of impact is major if the construction noise impact is greater than or equal to the threshold value (from BS5228-1) +5dB. A moderate impact magnitude is above or equal to the threshold value and below the threshold value +5 dB. Impacts of major and moderate magnitude are then considered to constitute a significant effect *depending* on duration.

A significant effect is deemed to have occurred where an impact of major or moderate magnitude will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights;
- A total number of days exceeding 40 in any 6 consecutive months.

The following summary table applies with regards to magnitude of impact and construction noise level:

Table 7 Magnitude of Impact & Construction Noise Descriptors

Magnitude of Impact	Construction Noise Description
Major	Above of equal to threshold value +5 dB
Moderate	Above of equal to threshold value and below threshold value +5 dB
Minor	Above or equal to baseline and below threshold value
Negligible	Below baseline.

LA111 also offers guidance on construction related traffic noise as follows:

Table 8 Magnitude of Impact at NSLs for Construction Traffic

Magnitude of Impact	Increase in Baseline Noise Level of Closest Public Road Used for Construction Traffic (dB)
Major	Greater than or equal to 5.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Minor	Greater than or equal to 1.0 and less than 3.0
Negligible	Less than 1.0

The same durations apply as stated for construction noise.

6.1.2 Applicable Vibration Criteria

Vibration impacts can typically potentially occur during demolition, site development and construction phases of development particularly through the use of equipment such as rock breakers (transient) or piling (transient or continuous, depending on method employed). Vibration can affect both human beings and buildings. Humans are more sensitive to vibration stimuli although the risk of cosmetic or structural damage to buildings is the more usual concern for site development/ construction.

Guidance relevant to the protection of building structures is contained in the following documents:

- British Standard BS 7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration, and;
- British Standard BS 5228: 2009+A1 2014: Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

Both standards contain similar guidance relating to building damage criteria. Table 9 below details the transient vibration guide values for cosmetic damage to buildings as set out in BS5228-2:

Table 9 Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 – 15 Hz	15 Hz and above
Reinforced or Framed Structures Industrial and Heavy Commercial Buildings	50mm/sec at 4 Hz and above	50mm/sec at 4 Hz and above
Unreinforced or Light-weight Structures Residential or Light Commercial Buildings	15mm/sec at 4Hz increasing to 20mm/sec at 20Hz	20mm/sec at 15Hz increasing to 50mm/sec at 40Hz

The above values are for transient or intermittent vibrations which do not cause a resonant response in buildings. The criteria should be reduced by 50% for more sustained or continuous vibration which may occur during activities such as continuous piling methods. The values should also be reduced by 50% for listed buildings although they may not necessarily be more vulnerable than new builds.

The following limits therefore apply for continuous vibrations:

- Light Buildings – 7.5mm/sec
- Heavy Buildings – 25mm/sec

BS7385-2 indicates that the probability of damage tends towards zero at a component PPV of 12.5 mm/sec.

BS5228-2 also provides the following range of vibration values and associated potential effects on humans:

Table 10 Vibration Criteria – Human Beings

Vibration Level mm/sec PPV	Effect
0.14	Vibration might just be perceptible in the most sensitive in the most sensitive situations for most vibration frequencies.
0.3	Vibration might just be perceptible in residential environments.
1	A vibration level of this magnitude is likely to cause complaint.
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

As can be seen from Table 10 above, the limits for humans are much lower than for cosmetic damage to buildings.

6.1.3 Prediction of Site Development and Construction Phase Impacts & Effects - Noise

A variety of potentially noisy equipment will be used during the demolition, earthworks and construction phases of development.

Prediction of likely noise impact has been completed using data from BS5228:1. However, with regards to prediction of demolition, site development and construction noise at NSRs the following factors are relevant:

- The sound power ratings used for each piece of equipment in the assessment, as taken from BS5228, may vary from the actual equipment used on site (Annex C of the Code of Practice outlines various noise levels for each type of equipment);
- It is not possible to outline for definite the type of equipment which will be in use, or the duration of time each piece of equipment will be in use; and,
- Noise emissions from construction vary in intensity and character but also in location and over time.

The demolition phase will proceed with the contractor initially removing internal fittings, mechanical plant, doors, windows, roof tiles and other materials potentially suitable for re-use/recycling. As noted earlier, this phase of works will take place over an 8–10-week period and is likely to also generate the most construction traffic.

Typical sources that may be in operation during demolition include:

- Breakers mounted on excavators to knock down the concrete frame and superstructure.
- Pulverisers on excavators to further crush and break-up demolition material prior to removal off-site. A tracked crusher can be used as an alternative.
- Intermittent use of hand-held pneumatic breakers and lump hammers.
- Tracked excavators to dig out and load material, and,
- Lorries to transport material off-site.

Typical sources that may be in operation during basement excavation and installation of foundations include:

- Tracked excavators to dig out and load material, and,
- Lorries to transport material off-site.

No piling is proposed.

Sources potentially in operation during the superstructure construction include:

- Pumping of pre-mixed concrete;
- Lifting crane to move and place pre-cast floors and/or steel beams;
- A variety of handheld tools including saws for cutting concrete, drills and welding;
- Generators for power supply.

Some of the above will be more easily screened as construction works progress compared to the initial stages of demolition and site development.

Site 2, which is currently under construction and may be completed and occupied before construction on the proposed development site commences, adjoins the site to the east. The nearest façade of apartment blocks on Site 2 will be approximately 9.5m from the proposed development site boundary and approx. 30m from the existing office building footprint. Site 2 is assessed as a worst-case scenario.

Office buildings and a nursing home (Block 6B) are located approximately 25 - 35m and 46m from the southern and eastern site boundaries respectively. Block 6B, a nursing home to the east, will be screened from the construction works by Site 2 buildings. The nearest office block is approximately 56m from the existing building.

Therefore, the new apartments on Site 2 will be the closest NSRs potentially affected and will overlook the development works.

Table 11 below provides source data from BS5228-1 used in the assessment of impact during the demolition phase which is likely to generate the most noise and therefore represents a worst-case scenario.

Table 11: Source Data Used for Prediction of Construction Noise

Source	Frequency (Hz)								SPL@ 10m
	63	125	250	500	1k	2k	4k	8k	
	dB(A)								
Pulveriser mounted on Excavator (breaking up concrete)	59	60	65	72	74	76	71	64	80
Hand-held Pneumatic Breaker	57	67	72	71	73	77	79	76	84
Tracked Crusher (crushing rubble)	67	70	70	78	75	72	67	58	81
Tracked Excavator Loading a Lorry with crushed material	54	63	67	74	73	71	67	58	78

Not all sources will be in operation at a given time or location. A conservative estimate of noise arising from a pulverizer breaking rubble, a crusher reducing size and a tracked excavator loading a lorry beside the crusher has been calculated for Site 2 assuming the pulveriser at a distance of 30m and the crusher/tracked excavator at 50m. No screening will be provided to the upper levels of the new apartments on Site 2.

Table 12 Potential Noise Levels Arising from Demolition

Source	Source Data	Predicted LAeq,1hour* (dB)
Tracked Excavator	78 LAeq,t @10m	@ façade of Site 2 for crusher and excavator at 50m and pulverizer at 30m from apartment façade. 71
Pulverizer	80 LAeq,t @10m	
Tracked Crusher	81 LAeq,t @10m	

**Assume equipment is on for 66% of hour. Conservative attenuation from distance. No screening for upper floors of building. Inclusive of daytime ambient 50 -55 dB(A).*

The prediction set out in Table 12 indicates that the site development and construction works may potentially result in elevated noise levels above existing ambient noise levels at the nearest NSRs at times. The main contributory source is the pulveriser operating in close proximity to Site 2. However, it is noted that this source will be at greater distances for much of the works and the crusher can be located further distant with partial enclosure.

The prediction indicates that noise levels +5 dB above the threshold value (LAeq,1h 65 dB) may occur indicating a major negative impact on nearby residential receptors. As noted earlier with regards to UK LA111, a significant effect is deemed to occur where an impact of major or moderate magnitude will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights;
- A total number of days exceeding 40 in any 6 consecutive months.

The works will be controlled to ensure that the above durations are not exceeded. Notwithstanding, this, mitigation measures will be applied to ensure that the threshold values for residential and commercial receptors are not exceeded as much as possible as detailed later in Section 8.1 of this report.

It is envisaged that construction traffic will access the site off Mayne River Avenue, directly adjacent to the site, arriving from, and departing to, the Malahide Road (R107). Based on an SEL value of 85 dB(A) for a HGV pass-by and 6 events per hour, the predicted roadside noise level is LAeq,1hr is 57 dB. Existing roadside traffic noise levels are >65 dB(A). Accordingly, this element of noise impact magnitude is predicted to be negligible and not significant.

The potential for cumulative temporary/short-term adverse noise impact associated with the site development and construction phases of the proposed development and other developments such as Site 10 directly adjacent to the north and the Belcamp SHD further north of the Mayne River corridor has been considered.

The element of the Belcamp SHD adjoining Site 10 to the north will comprise a greenbelt as part of the Mayne River Corridor. Accordingly, use of heavy equipment liable to give rise to additional cumulative adverse impact on Site 2, Block 2 apartments (when constructed) is not anticipated.

Site 10 adjacent to the north may be developed in parallel to the proposed development. It is however unlikely that demolition on the proposed development and the use of heavy-duty equipment during site excavation will directly coincide. Notwithstanding this, the threshold values set out in this report will apply to the cumulative noise impact during both site developmental phases. Further mitigation measures in this regard are listed in Section 8.1.

6.1.4 Prediction of Site Development and Construction Phase Impacts & Effects - Vibration

No piling is proposed.

Other sources may potentially produce transient vibrations although these are not likely to be significant. Precautionary measures in terms of monitoring are proposed in Section 8.1. of this report.

6.2 Operational Phase

6.2.1 Traffic Noise Generation

The potential long-term effect of additional traffic related noise impact on existing NSRs has been considered. As a general rule of thumb, a doubling of traffic flow will likely result in a 3 decibel increase in traffic noise levels. In order to assist with the interpretation of the noise impact associated with vehicular traffic on public roads, Table 13 below offers guidance as to the likely noise impact and effect.

Table 13 Likely Impact and Effect Associated with Change in Traffic Noise Level

Change in Sound Level dB(A)	Subjective Reaction	Magnitude of Impact
0	Inaudible	Neutral
0-2.9	Barely perceptible	Imperceptible
3-4.9	Perceptible	Slight
5-9.9	Up to a doubling of loudness	Moderate
10+	Doubling of loudness and above	Significant

Source: UK Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3 2011²

The new UK LA111 refers to the following for assessing magnitude of long-term change due to operational traffic:

Table 14 Magnitude of Change Long-term Traffic

Long-term Magnitude	Long-term Noise Change (dB L _{A10.18hr} or L _{night})
Major	Greater than or equal to 10.0
Moderate	5.0 – 9.9
Minor	3.0-4.9
Negligible	Less than 3

The magnitude of change as set out in Table 14 is determined on the basis of change between the Do Minimum Opening Year (DMOP) and the Do Something Future Year (DSFY). The use of the above table arguably, gives a more standard approach to determining magnitude of impact with Major used in lieu of Significant. For the purposes of this assessment, both Tables have been used and give a similar result.

Northern Cross is close to Clarehall Shopping Centre and also has a number of retail/commercial units including creches, restaurants and a pharmacy to serve residents. It is also served by public transport. It is envisaged that this will reduce

² Now withdrawn in UK and replaced with LA111. Irish 2014 guidelines are still current and based on DMRB Vol 11.

reliance on the use of private cars as a mode of transport. The proposed development reflects this in the number of bicycle spaces provided.

The expected traffic arising from the proposed development is negligible and in the context of the current ambient noise environment, the impact in terms of long-term traffic noise generation is expected to be negligible (Table 14).

6.2.2 Plant Equipment & Refuse Handling

The main plant and refuse store will be located in the basement. Activities and equipment will be enclosed within the building which will most likely have a minimum level of sound insulation provided of R_w 50 dB. Accordingly, no impact is expected on existing NSRs.

7.0 Inward Noise Impact Assessment

The proposal is an infill development within an urban area. The need for new housing is well documented. Therefore, while noise is a significant consideration, it is not the only consideration in the design to maximise the site potential for the provision of housing. Other design considerations come into play. For example, the southern boundary of the site adjoins Mayne River Avenue, a busy local traffic route. Pro-PG requires that good acoustic design does not rely entirely on the sound insulation of the building envelope. However, it would not be possible to erect a noise barrier along the roadside due to other design needs such as connectivity to the environment, landscape and visual concerns etc. Nevertheless, the design does incorporate features that form part of good acoustic design:

- The proposed building forms a full screen from local traffic and partial screen to aircraft noise to the ground and 1st floor communal amenity areas.
- The majority of balconies proposed do not face out directly onto Mayne River Avenue.
- The proposed development site is screened from major road traffic noise sources.

7.1. External Amenity Areas

BS8233:2014 states that *“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 $L_{Aeq,16hr}$.”*

ProPG goes further to extend the advice contained within BS8233:2014 to include:

“Whether or not external amenity spaces are an intrinsic part of the overall design, consideration of the need to provide access to a quiet or relatively quiet external amenity space forms part of a good acoustic design process.”

Based on the transportation source monitoring and predictions for aircraft noise (Refer to Sections 4.2 - 4.4 earlier), the following is expected to be achieved with regards to compliance with ideal external amenity criteria:

- All communal amenity areas on the ground, 1st and 7th floor areas are expected to comply with the external amenity criteria as these areas will be screened and/or are sufficiently set back from Mayne River Avenue. The 4th floor area is

expected to comply for the majority of the area except on the southern edge directly overlooking Mayne River Avenue where local traffic noise is likely to exceed the criteria.

- Public open space directly fronting onto Mayne River Avenue by the proposed café is unlikely to achieve the external criteria. However, as the area becomes more set back between Block 2 and the proposed development, the criteria are expected to be achieved for the most part through distance attenuation and screening.
- Balconies are expected to achieve the external criteria with the exception of those on the southern, southwestern and southeastern facades overlooking Mayne River Avenue.
- Roof terraces are expected to meet the external criteria.

In addition, the following is noted with regards to good acoustic design and external amenity provision for residents:

- A link through Site 10 to the north to the Mayne River corridor to the north will be provided. The Mayne River corridor will be enhanced as an amenity with additional planting as part of other permitted and proposed developments in the area. Access to the Mayne River corridor also provide additional external amenity to residents.
- Waterfall and a lilypond will also form part of the landscaping strategy. Softer as opposed to hard surfaces, however minor, may help reduce the impact of any reflected noise from incoming aircraft in the green space.
- The provision of planted areas and water features in urban settings can *qualitatively* improve the soundscape for local residents and enjoyment of the proposed amenity areas. Natural features as provided in the design have been shown to improve perceived tranquillity.³

7.2 Internal Noise

Appropriate guidance in relation to noise intrusion in residential and other buildings is also contained within BS8233:2014 – *Guidance on Sound Insulation and Noise Reduction for Buildings*. This British standard sets out recommended noise limits for indoor ambient noise levels and takes account of guidelines issued by bodies such as the WHO. Details taken from the standard are presented in Table 15 below.

Table 15 Recommended Indoor Ambient Noise Levels

Criteria	Typical Situation	Design Range $L_{Aeq, T}$	
		07.00-23.00	23.00 -07.00
Resting	Living Room	35 $L_{Aeq, 16hr}$	-
Dining	Dining Room	40 $L_{Aeq, 16hr}$	-
Sleeping (daytime resting)	Bedroom	35 $L_{Aeq, 16hr}$	30 $L_{Aeq, 8hr}$ 45 L_{Amax, f^*}

Source: BS8233:2014 and Pro-PG

³ Tranquillity and Soundscapes in Urban Green Spaces, Predicted and Actual Assessments from a Questionnaire Survey, Environment and Planning B: Planning and Design, 2013, Vol 40.

Column 4 in the table above includes for an additional $L_{Amax,f}$ value as per Pro-PG guidelines. The following is noted in this regard:

Note 4:

“Regular individual noise events (for example scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,f}$ depending on the character or number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night time (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB $L_{Amax,f}$ more than 10 times a night.

Pro-PG also notes the following with regards to achieving internal target levels:

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 values subject to the further advice in Note 7.

Note 7:

Where development is considered necessary or desirable, despite external noise levels above WHO Guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

Due to the location of the development, the criteria specified in the above table may be relaxed by 5 decibels. Taking account of a 10 -15 decibel reduction of external noise levels to internal across a partially open window, the following external noise levels apply:

Table 16 External Noise Levels to Achieve Internal Criteria with Partially Open Windows

Internal Condition	$L_{Aeq,16hr}$ (dB)	$L_{Aeq,8hr}$ (dB)
Good	50 - 55	45
Reasonable	55 - 60	50

Taking account of the desk-based review of monitoring undertaken, mapping available the proposed layout, derived aircraft noise predictions, and transportation noise risk across the site the following is expected:

- Reasonable internal criteria will be achieved with open or partially open windows for the majority of units with the exception of those on the southern, southwestern and south-eastern facades affected by both road and aircraft noise combined.

A further key criterion is to ensure that the $L_{Amax,f}$ internal value at night time (23.00 - 07.00hrs) should not be exceeded more than 10 times. This is unlikely to be achieved with open windows due to overhead aircraft affecting the entire development and passing vehicles on Mayne River Avenue affecting the southern boundary.

Glazing is considered to be the weakest point in a structure whereby noise can break in. It is envisaged that at a minimum, a moderate level of sound insulation ($R_w 35+C$) will be required for the proposal to ensure that good internal criteria are achieved. This value should however be verified at the detailed design stage.

Conservative SELs, average and maximum external sound pressure levels are presented earlier in Table 4 for aircraft noise. In addition, the following applies with regard to road traffic noise on Mayne River Avenue affecting the southern façade:

Table 17 External Road Traffic Sound Pressure Levels

Source	31.5	63	125	250	500	1000	2000	4000	8000	Total
	Hz									
Average (dBA)	24	36	43	48	52	60	55	46	38	62
L_{max} (dBA)	38	53	60	62	65	72	69	63	56	75

Free-field values

Aircraft noise can also break-in through the roof to roof-level apartments. The proposals shall be fully validated at the detailed design stage to ensure that the criteria in Table 15 are achieved taking account of the external values listed in Table 4 and 17 above.

8.0 Mitigation Measures and/or Factors

8.1 Site Development & Construction Phases

The use of preformed built elements is a significant mitigating factor to reduce the duration of the construction phase and in turn the duration of the construction-related noise impacts.

The following noise and vibration management measures shall apply to the short-term site development and construction phases to ensure that the construction noise and vibration threshold values outlined in Sections 6.1.1 and 6.1.2 are not exceeded.

- A Site Representative shall be appointed for matters related to noise and vibration.
- Any complaints received shall be thoroughly investigated.
- A written complaints log shall be maintained by the Site Representative. This shall, at a minimum, record complainant's details (where agreed) the date and time of the complaint, details of the complaint including where the effect was observed, corrective and preventative actions taken and any close-out communications. This will ensure that the concerns of NSRs who may be

affected by site activities are considered during the management of activities at the site.

- The Site Representative will liaise with the corresponding personnel on Site 10 to ensure that the threshold values are complied with.
- Noise monitoring with capability for real-time review both on-site and remotely shall be conducted at the nearest NSR.
- In the event of exceedance of the threshold value at the NSR and depending on duration (measured or expected) works shall be ceased and measures implemented immediately to ensure that the threshold values are complied with including movement of equipment and temporary acoustic screening used directly to surround particularly noisy equipment when in use.
- Standard hoarding shall be placed around the site. This will provide further attenuation of noise to ground floor level units at Block 2 and offices opposite the site on Mayne River Avenue. It will also provide some additional attenuation to other floors when equipment is in operation close to the boundary.
- Equipment shall be chosen by the contractor to ensure that the threshold values are met.
- The operation of certain pieces of equipment, where substitution etc cannot be carried out shall be managed through monitoring and timing of use to ensure that the threshold values/criteria specified are complied with.
- During the construction phase all equipment shall be required to comply with noise limits set out in EC Directive 2000/14/EC and the 2005/88/EC amendment on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors. The directive covers equipment such as compressors, welding generators, excavators, dozers, loaders and dump trucks.

Vibration monitoring is recommended when sources potentially likely to cause vibration impact will be in use e.g. use of jack hammers or compaction rollers during roadworks. In this regard, test monitoring should be conducted with the equipment on at low levels before increasing incrementally to operational levels if deemed necessary. Works will be ceased, and mitigation measures implemented during the construction phase where monitoring detects vibration levels associated with the construction phase of the facility above the relevant guidance values set out in Section 6.1.2.

The outline CEMP submitted with this application shall include the noise and vibration management measures listed above.

8.2 Operational Phase (existing NSRs)

Any plant equipment proposed for installation in the future to serve commercial units will be assessed in accordance with the procedures set out in BS4142:2014+A1:2019 to ensure there is no significant effect on the nearest NSRs (Site 2).

At a minimum, these units must comply with the external day and night-time criteria specified in The World Health Organisation Community Guidelines for Noise, 1999:

- Night-time - L_{Aeq} 45 dB, 1 meter from the façade of a dwelling.
- Daytime – L_{Aeq} 55 dB, to protect the majority of people from being seriously annoyed during the daytime.

Tonal or impulsive noise shall be avoided.

8.3 Future Residents

The following mitigation measures apply in the long term:

- During construction, the final specifications for glazing, ventilation grilles and ceiling insulation to roof apartments will take account of the criteria in Table 15 and L_{Amax} values and spectra specified in Tables 4 and 17. As noted in Section 7.2, at a minimum, moderate performance glazing units will be required. Final specifications will be approved by an acoustic specialist at detailed design stage for all units.
- During construction, glazing suppliers will provide laboratory tests confirming the sound insulation performance to BSEN ISO 140 Part 3 1995 and BS EN ISO 717, 1997.

9.0 Conclusions

The site of the proposed development in Northern Cross is typical of an urban /suburban area. Local road traffic noise from Mayne River Avenue and, to a lesser extent, overhead aircraft are the main transportation noise sources affecting the site. Distant traffic is audible but not significant. The site is classified as low to medium noise risk rating from north to south for future residential development.

Elevated noise is expected to occur at times during the temporary site development and construction phases however this will be controlled to comply with standard criteria for these phases of development. Therefore, no significant effects will occur on existing NSRs.

The potential for cumulative adverse impact on existing NSRs during site development and construction phases coinciding with the development of other sites including Site 10 and Phase 1 of the Belcamp SHD has been considered. The development of the proposal and Site 10 may run concurrently, therefore threshold values specified in this document for construction noise will apply to the cumulative impact of both developments.

No significant additional cumulative impacts are expected as the area of the Belcamp SHD adjoining Site 10 is designated as part of the Mayne River corridor/greenbelt.

In the long term, the operational phase is not expected to significantly impact on existing NSRs given the nature of the development. Any future plant equipment for commercial units will be assessed in accordance with the procedures in BS4142:2014+A1:2019 prior to selection. At a minimum, these units must comply with the external day and night-time criteria specified in The World Health Organisation Community Guidelines for Noise, 1999.

External amenity criteria as specified in Pro-PG and BS8233:2014 are expected to be achieved in most of the communal and private amenity areas. The proposed landscaping will also positively benefit future resident's enjoyment and qualitative perception of the amenity soundscape.

During the construction and more detailed design phase, an acoustic specialist will be appointed to ensure that the final sound insulation specifications for glazing, ventilation grilles and ceiling insulation to roof apartments achieve the internal criteria for good living conditions taking account of the external noise levels as detailed in this report. It

is considered that the internal criteria for good living conditions will be achievable in the proposed development. Therefore, no significant adverse effects on the health of future residents from external noise is expected.

10.0 References

- BS5228:2009 +A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites: Part 1: Noise and Part 2: Vibration.
- BS4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound.
- BS 7385: 1993: Evaluation and Measurement for Vibration in Buildings Part 2: Guide to Damage Levels from Ground-borne Vibration.
- BS6472-1:2008: Guide to Evaluation of Human Exposure to Vibration in Buildings. Vibration Sources other than Blasting.
- BS8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings.
- Camgill Properties A Seacht, Proposed Development Site 5, Northern Cross Malahide Road, Dublin 17, Noise and Vibration Impact Assessment, Redkite Environmental Ltd. October 2020.
- Camgill Properties A Seacht, Proposed Development Site 2, Northern Cross Malahide Road, Dublin 17, Noise and Vibration Impact Assessment, Redkite Environmental Ltd. August 2020.
- Environmental Impact Assessment Report, Belcamp SHD, Downey Planning, April 2022.
- Environmental Noise Guidelines for the European Region, World Health Organisation (WHO), Oct 2018.
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Environmental Protection Agency, May 2022.
- ISO 9613.-2 – 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.
- LA111 Noise and Vibration, Standards for Highways, Highways England, Version 2, May 2020
- ProPG: Planning and Noise: Professional Practice Guidance on Planning and Noise, New Residential Development, ANC, IOA and UK CIEH, May 2017.
- Tranquillity and Soundscapes in Urban Green Spaces, Predicted and Actual Assessments from a Questionnaire Survey, Environment and Planning B: Planning and Design, 2013, Vol 40.