Chapter 10

Noise and Vibration

10.0 NOISE & VIBRATION

10.1 INTRODUCTION

This chapter of the EIAR identifies and assesses the potential noise and vibration impacts and related effects arising as a result of construction and operation of the Project at Hacketstown Co. Dublin.

The Project comprises a proposed SHD comprises 345 no. residential units, childcare facility, vehicular access, pedestrian and cycle infrastructure, and all associated site development and infrastructural works, on a site of 6.7ha. zoned for residential use the Fingal County Development Plan 2017-2023.

The proposed SHD which is the subject of assessment in this chapter, will be facilitated by advance infrastructural works. These works were the subject of a Section 34 application to Fingal County Council (FCC F21A/0287) and are currently on appeal to An Bord Pleanala (ABP Reg. Ref. 312189). They consist of a connecting road to the north, drainage infrastructure, cycle and pedestrian facilities, and associated landscaping (the "AI Works"). The Project is assessed to ensure that all cumulative and in combination effects of the Project with other plans and projects within the zone of influence, including the Advance Infrastructure Works (Ref. ABP-312189-21), the prior application for off-site road improvements serving the wider area (ABP Reg. Ref. 309409; FCC Reg. Ref. F20A/0324), and the proposals by Noonan Construction for Ballygossan Park Phase 2 have been fully assessed. In terms of defining a zone of influence, it should be noted that noise and vibration impacts dissipate with distance and air absorption, can be screened by topography/structures and also masked by other sources. The zone of influence in terms of noise and vibration, can vary between the short-term construction and long-term operational phases. Therefore, it is broadly defined to the west, south and east by existing transportation routes and to the north by existing development at Ballygossan Park Phase 1 and Hillside.

The project, which is the subject of assessment in this chapter, will be facilitated by advance infrastructural works.. They are currently on appeal to An Bord Pleanala (ABP Reg. Ref. 312189), (Refer to Figure 1.1 in Chapter 1.0). They consist of a connecting road to the north, drainage infrastructure, cycle and pedestrian facilities, and associated landscaping (the "AI Works"). The Project, including these AI Works, is assessed in this chapter to ensure that all cumulative and in combination noise and vibration effects of the Project itself and any cumulative and in combination effects of the Project with other plans and projects within the zone of influence, including the off-site road improvements serving the wider area which are permitted under (ABP Reg. Ref. 309409) and Ballygossan Park Phase 1 (complete) and proposed Phase 2 have been fully assessed.

Key issues to be addressed in this chapter include identification and assessment of potential temporary/short-term construction noise and vibration impacts arising from the construction and development phases and potential long-term noise impact at nearby Noise Sensitive Receptors (NSRs) arising from increased traffic on the surrounding road network. Decommissioning stage, as outlined in the EIA Directive, is not relevant to this project. A separate assessment of the exposure of future residential to airborne noise from transportation sources (namely rail noise) has also been completed and included in this chapter.

10.1.1 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 is also a Member of the Association of Acoustic Consultants Ireland (AACI).

Ms. Siobhan Maher 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 a range of areas principally including noise and vibration impact assessment for new and proposed developments, environmental noise monitoring and prediction modelling and development of mitigation measures for noise abatement and control.

10.2 STUDY METHODOLOGY

10.2.1 Characterisation of the Receiving Environment

The receiving sound environment or existing soundscape has been characterised by field survey and desk-based study.

10.2.1.1 Field Survey

Site visits and surveys were completed on the 3rd – 6th December 2019 and on the 25th – 26th February 2021.

Unattended monitoring was conducted over 24 hours at 3 locations , NMP 4, NMP5 and NMP6 described below in Table 10.1 and indicated on Figure 10.1 to capture rail noise.

Attended monitoring was also conducted at a further three Noise Monitoring Points (NMPs) , NMP1, NMP 2 and NMP3 described below in Table 10.1 and indicated on Figure 10.1 during the day (07.00 – 19.00hrs), evening (19.00 – 23.00 hrs) and night-time (23.00 – 07.00 hrs) periods in the December 2019 site visit.

The measurement methodology followed was in accordance with best practice as set out in the following:

- International Standards Organisation Document: ISO 1996 Acoustics – Description, Measurement and Assessment of Environmental Noise, Part 1, Basic Quantities and Assessment Procedures (2016) and Part 2 Determination of Environmental Noise Levels (2017), and,
- The EPA Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities, (NG4), revised January 2016.

Ambient noise monitoring was undertaken at the locations as illustrated in Figure 10.1 overleaf and described in Table 10.1 below. The locations were chosen to be representative of Noise Sensitive Receptors (NSRs) and also to evaluate the typical existing transportation noise sources affecting the proposed Development lands and future residents for the assessment of exposure of future residents to airborne noise.

Table 10.1 Noise Monitoring Points

Location	Grid Ref.	Description
Attended (in red on Figure 10.1)		
NMP1	325107E;258993N	Approx. 32m northwest from Golf Links Road and 19m from boundary with nearest NSR.

NMP2	325109E;259126N	Centre of site and approx. 52m from boundaries with nearest NSRs southeast. Approx. 175m from between the two rail lines.
NMP3	324986E;259260N	Approx. 35m from northern boundary, 100m from nearest NSR and 44m from between the two rail lines.
Un-attended (in blue on Figure 10.1)		
NMP4	324987E; 258994N	Approx. 29m from between the two rail lines.
NMP5	324971E; 259035N	Approx. 15m from the rail line.
NMP6	324954E; 259147	Approx. 15m from the rail line.

Figure 10.1 Noise Monitoring Locations and nearest NSRs

Figure 10.1: Site Location with approximate SHD site outlined in red and approximate Advanced infrastructure application outlined in Blue. Locations 1 and 2 are part of the desk-based study. (Source: Google Maps, 2022).

Photographs of each monitoring location are shown overleaf.

Plate 10.1: NMP1

Plate 10.2: NMP2

Plate 10.3: NMP3

Plate 10.4: NMP4

Plate 10.5: NMP5

Plate 10.6: NMP6

Ambient monitoring was conducted during the day, evening and night - time periods using both attended and un-attended meters.

Attended measurements were conducted at NMP1 – NMP3 on 6/12/2019 between 11.00 – 17.15 hrs and on 3 - 4/12/2019 between 20.30 – 01.00 hrs.

An unattended meter was set up at NMP4 at 20.00 hrs on 3/12/2019 - 11.30 hrs on 6/12/2019 at NMP4. The parameters measured included L_{Aeq}, L_{A90}, L_{A10}, L_{Amax} and L_{Amin}.

Two further unattended meters were set up at NMP5 and NMP6 on 24/2/2021 at 12.06 hrs until 26/2/2021 at 15.04hrs. Data was extracted for train noise from 25/2/2021 06.00 hrs until midnight on 25/2/2021 as this was the most appropriate period to extract train noise based on the prevailing weather conditions at the time in accordance with best practice.

During the attended measurements on the 3 - 4 and 6th December 2019 and during set-up of the unattended meters in December 2019 and February 2021, survey personnel noted all primary noise sources contributing to the ambient sound environment. Detailed field notes were recorded during the attended survey.

Overall weather conditions prevailing during both the December 2019 and February 2021 surveys were suitable for noise monitoring with some exceptions affecting the unattended meter (the data from these periods have not been used) at NMP4 during the December 2019 survey.

Weather Conditions - December 2019

Temperatures were above average for the time of year ranging from a low of 5°C during the night up to 11 °C during the daytime. The average windspeed recorded during the attended evening and night-time measurements on the 3rd - 4th December 2019 was 2-3m/s from a southerly direction. Higher windspeeds up to 5m/sec occurred on the 6th December during the attended daytime survey. Westerly winds prevailed. No rainfall occurred throughout the survey except during the morning of the 6th December and for an hour at approx. 19.00 hrs on the 5th December. Unsuitable windspeeds occurred on 5th December from 07.00 – 23.00 hrs. Accordingly, only the data from the 3-4th December and from 01.00 - 07.00hrs on the 5th December has been used from the unattended measurement at NMP4.

Weather Conditions - February 2021

Weather conditions from 25 – 26/2/2021 were calm with no rainfall and windspeeds <5 m/sec. Temperatures were on average 11°C during the daytime. Wind direction was from the south.

The effects of weather conditions and any associated uncertainty are discussed under Section 10.3.

Equipment

Sound measurement was carried out using two Type 1 Sound Level Meters and associated hardware (calibrators and tripods, outdoor kits etc) and software. The meters were placed in open areas >3.5m from reflecting surfaces and a minimum of 1.2m above ground level. The unattended meter microphones were placed 4m above ground level (refer to Plates 10.4,10.5 and 10.6). The meters were calibrated before and after use. The observed drift during measurement was within acceptable limits. The sound levels were measured using the A-weighted network, and a fast sampling interval. Sample intervals for attended measurements were 30 minutes during the daytime and evening and 15 minutes during the night-time period. Wind speed was measured using a portable anemometer. Further details of the monitoring equipment used are set out in Table 10.2 below.

Instrument Type	Manufacturer	Model Numbers	Serial Numbers
Sound Level Meters	Bruel & Kjaer	2238 & 2250	2151874, 3001350, 3037375, 2821417
Acoustic Calibrator	Bruel & Kjaer	4231	3011175

Table 10.2 Monitoring Equipment

The meters and calibrators are all externally calibrated in accordance with recommended standards.

10.2.1.2 Desk-Based Study

Noonan Construction Company Ltd Adjoining Lands to the North

In addition to the monitoring undertaken for the Proposed Development lands, noise and vibration monitoring has also been completed for lands to the north in the location of Ballygossan Park Phase 2 as shown on Figure 10.1. These lands are within the ownership of Noonan Construction Company Ltd. An inward noise and vibration impact assessment for the proposed residential development on these lands has been completed by AWN Consulting.[1] The noise monitoring at Locations 1 and 2 on Figure 10.1 was therefore targeted at establishing rail noise levels affecting future residents on these lands. The monitoring undertaken by AWN Consulting has been reviewed to inform the overall characterisation of the soundscape in proximity to NSRs such as Ballygossan Park and Hillside.

Transportation Noise Maps

Transportation noise mapping available on the EPA's website https://gis.epa.ie/EPAMaps/ has been reviewed as part of the desk-based study. The Project is outside Dublin Airport Noise Contour Maps as set out in Variation No. 1 to the Fingal Development Plan 2017 – 2023 adopted in December 2019. The latest map can be found at

10.2.2 Impact Assessment

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

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;

- BS8233:2014: Guidance on Sound Insulation and Noise Reduction for Buildings;
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes, March 2014;
- ISO 9613.-2 – 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation;

[1] Assessment of Inward Noise and Vibration Impact on Proposed Residential Development, 28 October 2020, LW/20/11421NR01b

- UK LA111 Noise and Vibration, Standards for Highways, Highways England, Version 2, May 2020.

The EPA draft document entitled *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, 2017* 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 2017[2] was used as guidance in completing the assessment of exposure of future residential to airborne noise from transportation sources. 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 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.

10.2.3 Definitions

The following definitions apply in this chapter:

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 road traffic.

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.

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_{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 (23.00-07.00) and an additional penalty of 5 dB(A) for evening noise (i.e.19.00-23.00).

L_{night} Night equivalent level**:** Leq. A-weighted, Sound Level, measured overnight 23.00 – 07.00 hours.

$L_{Aeq,16\ hours,}$ 16 hour equivalent level: Leq. A-weighted, Sound Level, measured from 07.00 – 23.00 hours.

[2] 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_{Ae} See SEL below.

Rw – 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 Rw 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 referred to as L_{Ae}.

Spectrum Adaptation Terms: C and Ctr -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 Ctr 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 rail at medium to high speeds.

Ctr is an A-weighted urban traffic noise spectrum.

Ctr can also be added to Rw to take into account low frequency noise.

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.

All sound levels in this report are expressed in terms of A-weighted decibels (dB(A).

10.3 THE EXISTING RECEIVING ENVIRONMENT

The Project site is greenfield in nature, comprises 6.7 ha, and is located to the south of Skerries town centre in Hacketstown. The lands, outlined in red on Figure 10.1, are bound to the North by lands in the ownership of Noonan Construction including recently completed residential development 'Ballygossan Phase 1', to the west by the Dublin – Belfast railway line, to the east by Golf Links Road and to the south by agricultural lands and a number of rural dwellings.

Surrounding lands to the immediate west, south and east are also greenfield and in agricultural use. Skerries Golf course lies further to the south. The approximate extent of the landholding is indicated earlier in Figure 10.1.

The site is served by farm gate access points off the Golf Links Road which links the site to Skerries town centre to the North. The site is within 1km of Skerries train station.

The nearest Noise Sensitive Receptors (NSRs) to the proposed Development Site are existing detached dwellings along the Golf Links Road and Phase 1 of the new development, *Ballygossan Park* to the north which overlooks the northern portion of the site. Hillside, an existing mature residential development, also lies further north of Ballygossan Park. Refer to Figure 10.1.for locations. The proposed Development Site is rolling in nature which is typical of the lands at Skerries. Generally, the land rises up from east to west. The lowest points are at the north-eastern boundary with the Golf Links Road. The highest points are at the southwestern portion of the site. As a result, the railway line is generally in cut to the southwest but is more level with the land as it travels north and is then elevated above ground off-site close to the bridge crossing of the R127 at Miller's Lane.

Intermittent trains on the Dublin to Belfast line and, to a lesser extent, intermittent traffic on the Golf Links Road are the main anthropogenic noise sources currently affecting the site.

10.3.1 Ambient Sound Surveys

The scientific basis of the site survey was to characterise the ambient sound environment at the site, at existing NSRs and to evaluate transportation noise exposure for new residential proposed.

December 2019

The summary findings of the attended ambient sound survey at NMP1, NMP2 and NMP3 conducted in December 2019 are presented in Tables 10.5, 10.6 and 10.7 below and overleaf.

Table 10.5 Day, Evening & Night-time Levels – NMP1

No.	Time	$L_{Aeq,t}$	$L_{A10,t}$	$L_{A90,t}$	L_{AFmax}	Description of Ambient Sound Environment
6/12/2019 Daytime (07.00 – 19.00hrs)						
1.	13.15	51	52	47	69	Local road traffic noise, sounds from school, occasional distant aircraft, birdsong, rustling vegetation.
2.	15.03	51	52	46	71	
3.	16.43	48	49	43	63	
3/12/2019 Evening time (19.00 – 23.00 hrs)						
1.	20.40	48	50	39	68	Local road traffic noise, distant train x2, distant aircraft, rustling vegetation.
3/12/2019 Night-time (23.00 – 07.00 hrs)						
1.	23.00	48	53	36	64	Local road traffic noise, train x1, rustling vegetation.
2.	23.56	44	41	31	61	

Table 10.6 Day, Evening & Night-time Levels – NMP2

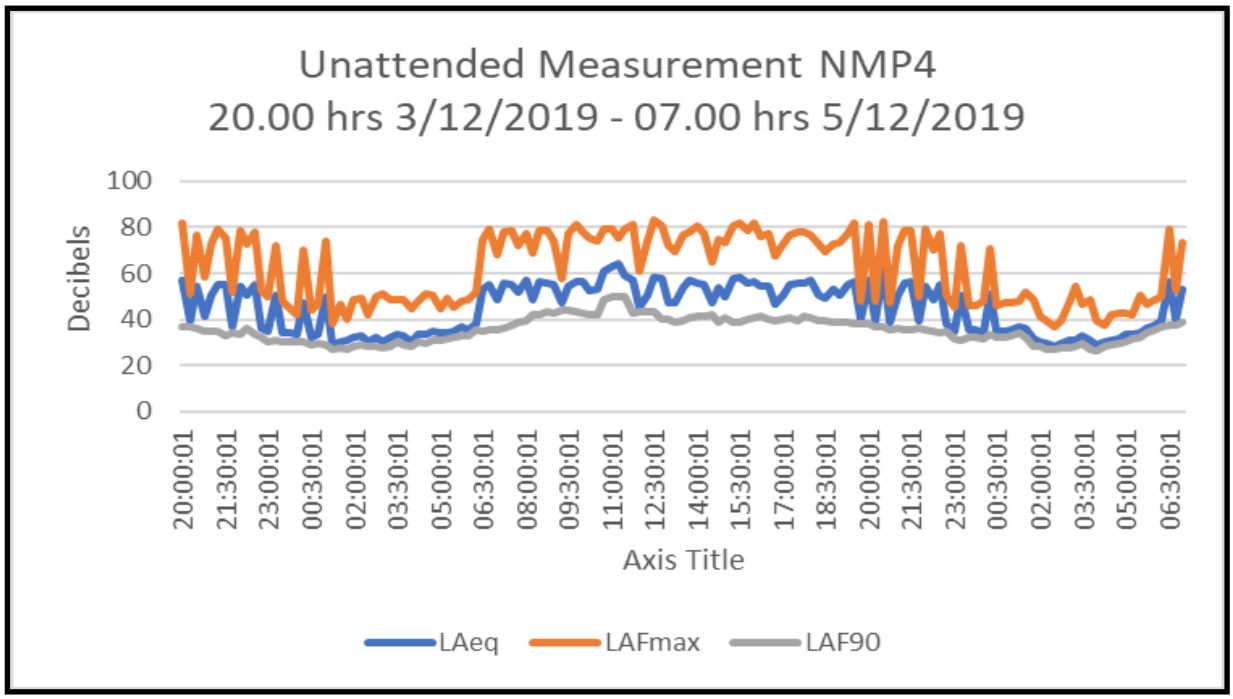
No.	Time	$L_{Aeq,t}$	$L_{A10,t}$	$L_{A90,t}$	L_{AFmax}	Description of Ambient Sound Environment
6/12/2019 Daytime (07.00 – 19.00hrs)						
1.	11.48	49	50	46	62	Distant train and road traffic noise, rustling vegetation and some distant industrial type noise audible.
2.	14.29	49	50	46	66	
3.	16.09	48	48	43	62	
3/12/2019 Evening time (19.00 – 23.00 hrs)						
1.	21.18	46	45	36	65	Local road traffic noise, distant train noise x 2.
3-4/12/2019 Night-time (23.00 – 07.00 hrs)						
1.	23.18	52	57	36	69	Increased local road traffic for a period during #1 distant train #1 and rustling vegetation.
2.	00.13	46	46	32	64	

Table 10.7 Day, Evening & Night-time Levels – NMP3

No.	Time	$L_{Aeq,t}$	$L_{A10,t}$	$L_{A90,t}$	L_{AFmax}	Description of Ambient Sound Environment
6/12/2019 Daytime (07.00 – 19.00hrs)						
1.	11.09	62	53	46	98	Trains predominant. Distant road traffic noise, some vegetation rustling. Distant industrial noise audible.
2.	13.53	59	54	46	86	
3.	15.34	57	50	44	83	
3/12/2019 Evening time (19.00 – 23.00 hrs)						
1.	21.52	44	43	35	65	Distant road traffic noise, train x 1.
3 - 4/12/2019 Night-time (23.00 – 07.00 hrs)						
1.	23.36	47	47	33	65	Distant road traffic noise, train x1 during #1, rustling vegetation.
2.	00.31	43	39	31	66	

In addition to the above, the data from the unattended meter recorded sound levels at NMP4 in December 2019 is set out below:

Figure 10.2 Unattended Noise Measurement



NMP4 is approximately 29m from the centre between both rail lines. The graph above, shows an expected pattern of reduced noise levels during the period 01.15 – 06.30 hrs when trains did not pass by the site. Skerries train station is open from 05.45 -00.30 hrs reflecting passenger train movements.

The current train timetables[3] indicate that approximately 59 commuter trains will travel past the site Monday to Friday between 06.25 and 00.22 hrs. Of these, the number of commuter trains outside of the period 07.00 -23.00 hrs is 4 in total. A total of up to 17 intercity trains pass by the site Monday-Friday. These occur within day and evening time hours only.

In total, up to 76 trains pass the site within a 24-hour period.

It is understood that there is no schedule for freight trains which can run 24 hours. Current volume is very low, and the noise survey observations support this.

During the 15-minute logged intervals on the night (23.00 - 07.00hrs) of the 3-4/12/2019, up to 5 intervals had L_{Amax} values above 60 dB. Three occurred from 23.15 -1.15 hrs and the remaining two occurred from 06.30 - 07.00 hrs. These were fast events and therefore very likely to be passing trains as the L_{A10} values were lower than the corresponding L_{Aeq} values for the intervals in question. Similar findings occurred on subsequent nights in December 2019.

[3] Valid from 26.09.21. Train timetable is currently operating as per pre-COVID.

In summary from the monitoring undertaken at NMP4, located approximately 29m from the centre between both rail lines:

- L_{night} or $L_{Aeq,8h}$ is 44 dB.
- L_{day} and $L_{Aeq,16h}$ are both 56 dB.
- L_{den} is 57 dB.

Less than 10 L_{Amax} values over 60 dB occurred during the night-time period.

The findings relate to all sources potentially affecting NMP4.

February 2021

The survey conducted in February 2021 was designed to collate rail noise specifically at locations where the Project is closest to the rail line.

Table 10.8 overleaf lists the single event level (SEL) values for passing trains as extracted from the data. Forty trains passed the site in an 18-hour period from 06.00 – 24.00hrs on the 25/2/2021.

Using the logarithmic mean values from Table 10.8, the following has been calculated for rail noise only based on current timetables for number of trains passing by the site.

NMP5

- L_{night} or $L_{Aeq,8h}$ is 44 dB.
- L_{day} and $L_{Aeq,16h}$ is 53 dB.
- L_{den} is 54 dB.

NMP6

- L_{night} or $L_{Aeq,8h}$ is 44 dB.
- L_{day} and $L_{Aeq,16h}$ is 54 dB.
- L_{den} is 55 dB.

Table 10.8 Single Event Levels for Passing Trains at NMP5 and NMP6

Train Number	Time Passing	SEL NMP5 dB(A)	SEL NMP6 dB(A)
1	25/02/2021 06:28	84.2	85.3
2	25/02/2021 07:05	84.5	85.5
3	25/02/2021 07:20	83.9	85.2
4	25/02/2021 08:22	78.6	80.0
5	25/02/2021 08:58	83.6	84.0
6	25/02/2021 09:23	80.3	79.7
7	25/02/2021 09:43	81.6	78.6
8	25/02/2021 09:51	82.5	83.6
9	25/02/2021 09:56	81.3	79.0
10	25/02/2021 10:05	81.7	83.1
11	25/02/2021 10:38	77.0	78.1
12	25/02/2021 11:03	83.8	84.8
13	25/02/2021 11:25	82.5	82.5
14	25/02/2021 11:38	80.8	83.3
15	25/02/2021 11:41	80.8	82.5
16	25/02/2021 12:21	82.7	79.3
17	25/02/2021 12:23	84.4	85.4
18	25/02/2021 13:24	78.9	77.3
19	25/02/2021 13:36	83.8	81.7
20	25/02/2021 14:01	83.6	85.3
21	25/02/2021 14:44	78.1	80.0
22	25/02/2021 15:05	83.3	83.6
23	25/02/2021 15:19	83.0	80.6
24	25/02/2021 15:37	80.9	79.9
25	25/02/2021 15:41	78.1	80.0
26	25/02/2021 15:57	82.2	83.0
27	25/02/2021 16:19	78.1	80.8
28	25/02/2021 16:35	82.6	77.4
29	25/02/2021 16:39	81.4	83.5
30	25/02/2021 17:14	82.4	81.2
31	25/02/2021 17:36	80.1	81.1
32	25/02/2021 17:50	77.0	84.6
33	25/02/2021 17:52	82.0	80.9
34	25/02/2021 17:56	82.2	83.2
35	25/02/2021 19:13	87.0	87.6
36	25/02/2021 19:25	82.5	81.7
37	25/02/2021 20:34	80.0	81.8
38	25/02/2021 22:26	81.6	82.3
39	25/02/2021 22:34	83.8	84.9
40	25/02/2021 23:23	79.2	80.0
Logarithmic Mean		82.2	82.8

10.3.2 Desk-Based Study

10.3.2.1 Transportation 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 transportation noise mapping is available on the EPA's website https://gis.epa.ie/EPAMaps/.

Figures 10.3 and 10.4 below and overleaf re-produce the road and rail noise mapping in the vicinity of the site. As noted earlier, the site is not within the aircraft noise contours for Dublin Airport. The mapping indicates rail noise contours overlapping the western site boundary up to approximately 95m at the northwestern tip where the rail line is elevated.

The L_{den} 60 - 64 dB contour overlaps the site by up to 40m while the L_{den} 55 - 59 dB contour overlaps the site by up to 95m.

NMP3 occurs on the boundary of the L_{den} 60 - 64 and 55 - 59 contours.

NMP4 occurs just within the outer part of the L_{den} 60 - 64 contour and L_{night} 50 - 54 contour.

NMP5 and NMP6 occur within the L_{den} 65 – 69 contour and L_{night} 50 - 54 contour.

The on-site monitoring and modelling prepared as part of the Environmental Noise Action Plan are not directly comparable. The modelling is for strategic noise mapping and is not intended to replace on-site monitoring. The results of monitoring suggest that the modelling is conservative as trains were understood to be operating as normal during the survey in December 2019 and the L_{den} and and L_{night} values for NMP5 and NMP6 were calculated from measured SELs at both locations combined with current (and pre-COVID) timetables. The results of monitoring from both site visits undertaken correlate well.

Road traffic noise does not significantly affect the site as evidenced by the monitoring undertaken and the mapping.

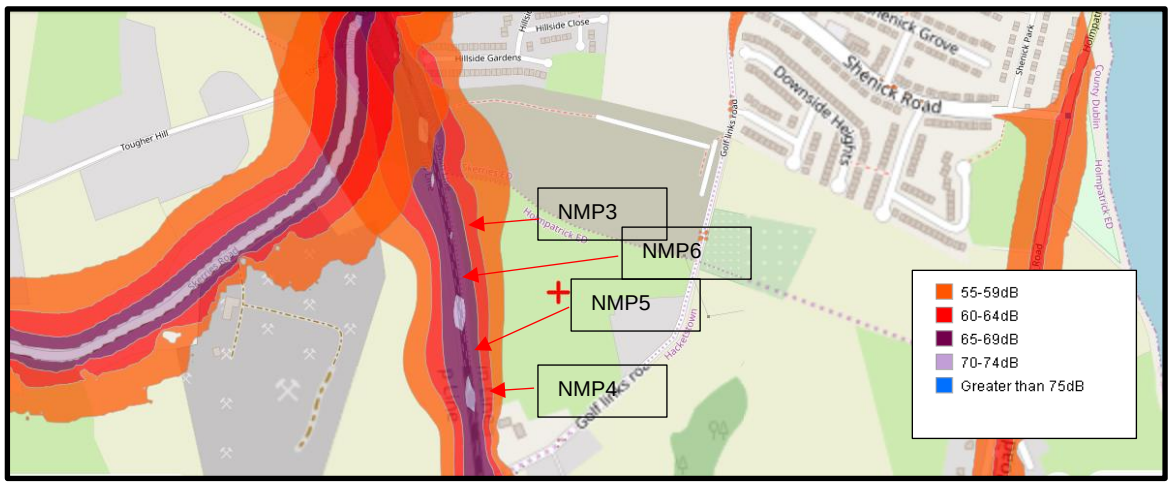


Figure 10.3: Latest Round 3 Road and Rail Noise Mapping L_{den}

(Source: *https://gis.epa.ie/EPAMaps/* **)**

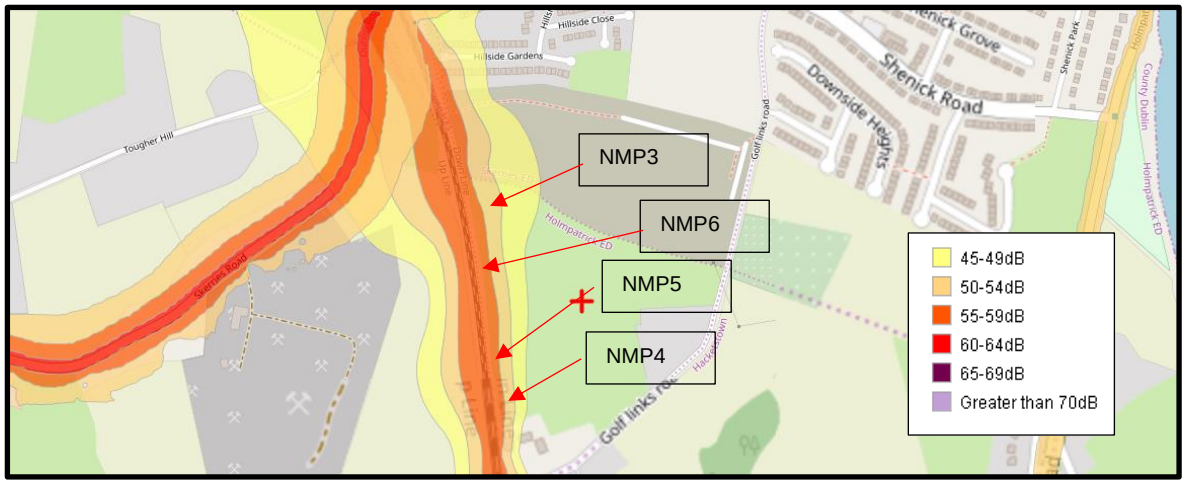


Figure 10.4: Latest Round 3 Road and Rail Noise Mapping L_{night}

(Source: *https://gis.epa.ie/EPAMaps/* **)**

WHO Guidelines & Target Values

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 rail traffic noise:

For average noise exposure, the GDG strongly recommends reducing noise levels produced by railway traffic below 54 dB L_{den}, as railway noise above this level is associated with adverse health effects.

For night noise exposure, the GDG strongly recommends reducing noise levels produced by railway traffic during night-time below 44 dB L_{night}, as night-time railway 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 railways in the population exposed to levels above the guideline values for average and night noise exposure. There is, however, insufficient evidence to recommend one type of intervention over another.

Based on the calculations of rail noise alone, NMP5 is at the L_{den} the L_{night} WHO Guidelines for rail noise.

NMP6 is at the L_{night} WHO Guideline but is marginally outside the L_{den} value for rail noise by 1 decibel.

The Environmental Noise Action Plan, 2018 - 2023 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}

The monitoring of train noise at NMP 5 and NMP 6 (both approx. 15m from the rail line boundary) indicates that desirable noise levels are achieved.

10.3.2.2 Monitoring Undertaken to North (Phase 2 Site, Ballygossan Park)

The monitoring data collated by AWN Consulting for the lands to the north of the proposed Development lands was reviewed. The survey was conducted on the 19th, March, 2020 between 10.30 and 12.45 hours. The data from Section 3.3 of the report, for Locations 1 and 2 as indicated on Figure 10.1 earlier, generally is within an expected range based on the findings presented in Tables 10.5 – 10.7.

The $L_{Aeq,t}$ and $L_{A,90,t}$ values recorded at Location 1 (approx.10m from the rail line) were 53 – 55 dB and 39dB respectively.

The $L_{Aeq,t}$ and $L_{A,90,t}$ values recorded at Location 2 (approx. 48m from the rail line) were 39 – 46 dB and 33dB respectively.

Sources noted included intermittent rail movements (Location 1), distant road traffic and construction noise, birdsong, pedestrians (Location 1) and sounds from the adjoining residential development (Location 2).

10.3.3 Existing Ambient Soundscape Summary

The proposed Development Site is on the outskirts of Skerries and is considered to be generally quiet and semi-rural in nature for the most part. Surroundings lands to the south are generally similar while lands to the north can be classified as more emerging suburban on the edge of more mature development and are therefore relatively quiet although anthropogenic sources influence the soundscape.

Based on the monitoring undertaken, the majority of the site falls below the WHO Guidelines for rail noise with the marginal exception of some land very close to the western boundary (<15m) with the rail line during the daytime. The proposed Development Site can be classified as negligible to low in terms of transportation noise risk exposure for future residential development.

10.3.4 Vibration

The rail line is potentially an existing vibration source affecting the site. During the site visits, no vibration monitoring was undertaken or subjectively noted on site. As part of the desk-based study, it is noted that vibration associated with rail movements on lands to north (Phase 2 of Ballygossan Park) in the ownership of Noonan Construction Company Ltd was measured by AWN Consulting. The executive summary of the report[1] notes the following:

> *"Vibration associated with rail movements has been measured on site. The daytime and night-time vibration dose value has been calculated to be lower than typical values which with reference to Guidance relating to human response to vibration, are lower than typical value which would have a "low probability of adverse impact.""*

It is likely that the above can also be applied to the lands in the ownership of the LDA due to similar site, rail and train characteristics.

10.4 CHARACTERISTICS OF THE PROJECT

10.4.1 Proposed Development

The Project entails 345 no. residential units comprising of 84 no. 1-bed units, 104 no. 2-bed units (68 no. 2-bed apartments and 36 no. 2-bed duplexes), 157 no. 3-bed units (118 no. 3-bed duplexes and 39 no. 3 - bed houses) ranging in height from 2 no. – 4 no. storeys on a site of 6.7 ha. located at Hacketstown in the townlands of Milverton, Townparks and Hacketstown, Skerries, Co. Dublin. The subject lands are accessed via Golf Links Road to the south and Ballygossan Park Phase 1 to the north. The proposed development is set out in 8 blocks which comprise the following:

- Block A1 comprises 39 No. units at 4 storeys in height (Comprising a mix of 26 No. apartments & 13 No. Duplexes)
- Block A2 comprises 33 No. units at 4 storeys in height (Comprising a mix of 22 No. apartments & 11 No. Duplexes)
- Block B1 comprises 16 No. units at 3 storeys in height (Comprising all 3 bed Duplexes)
- Block B2 comprises 16 No. units at 3 storeys in height (Comprising all 3 bed Duplexes)
- Block C comprises 42 No. units at 2-3 storeys in height (Comprising 15 No. apartments & 27 No. Duplexes)
- Block D comprises 32 No. units at 2-3 storeys in height (Comprising 12 No. apartments and 20 No. houses)
- Block E comprises 62 No. units at 2-3 storeys in height (Comprising 38 No. apartments & 24 No. Duplexes)
- Block F comprises 66 No. units at 2-3 storeys in height (Comprising 39 No. apartments & 27 No. Duplexes)
- Block G comprises 25 No units at 2-3 storeys in height. (Comprising 20 No. Duplexes and 5 No. houses)
- Block H comprises 14 No units at 2-3 storeys in height. (Comprising 14 No. houses)
- Public Open Space of c.16,670 sqm (25% of net developable area) is proposed including the parkland and main public square, in addition to the linear park of c.2,427 sqm;
- c.2,272 sqm communal open space is proposed to serve the apartments;
- 414 car parking spaces in total are proposed including 40 visitor spaces, 3 for creche set down and 2 for creche staff parking within undercroft and at surface level.
- 802 No. bicycle parking spaces comprising including 128 No. visitor spaces and 10 No. to serve the creche;
- Childcare and community facility of c.377 sqm. located in Block C;
- Upgrades to the Golf Links Road including new pedestrian and cycle infrastructure with frontage on Golf Links Road;
- Vehicular access off the Golf Links Road is to be provided to the south east of the subject site;
- In addition the proposal will provide a new internal link road. This internal link road will connect to the adjacent lands to the north, for which a separate planning application has been made to Fingal County Council under Reg. Ref. F21A/0287 (ABP Reg. Ref. 312189-21);

The proposed apartments include the provision of private open space in the form of balconies to elevations of the proposed buildings. The development also includes vehicular, pedestrian, and cycle accesses, bicycle stores, lighting, landscaping, amenity spaces, drop off areas, boundary treatments, refuse facilities, services, utilities, substations, internal roads, footpaths and shared surfaces and all associated ancillary and site development works.

10.4.2 Site Development and Construction

The site development and construction phase for the Project will take place over a 24-36-month period.

The development will be built in two phases.

The site development and construction phases will typically include for the use of heavy earthmoving equipment during the initial stages of each Phase, with other equipment such as plant tools, generators, con saws and drills during the building phases.

Due to the soil type present, and to ensure a conservative approach, pre-cast driven piles may be required throughout the site. Further, detail is provided in the assessment in Section 10.5 below.

Construction traffic will access the site on week-days only from 07.00 -19.00 hrs).

Employees are likely to be in shared transport. Up to 46 – 50 employees are estimated for this type of development generating 32 – 35 two-way trips in total per day.

Up to 9,863m^3 of soil may be transferred off-site during earthworks over the entire site. This equates to 963 trucks over a 6-9 month period or 24 trucks per day over 40 days to clear the entire site in one activity.

Material will also be imported, equating to 4,481m^3 or 438 loads arriving over 12 -18 months. At 12 per day this equates to 36-37 days in total.

10.5 POTENTIAL IMPACT OF THE PROJECT

10.5.1 Site Development & Construction Phase

The 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.

10.5.1.1 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 not to be exceeded at NSRs, depending upon existing ambient levels, as described in Table 10.9 below. This table is based upon report E3.2, Table E.1 of BS5228:2009 + A1:2014 Part 1.

Table 10.9 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.			

Generally, the Category A daytime threshold value can be applied to NSRs (as indicated on Figure 10.1) in the area based on the ambient sound levels recorded during the daytime baseline survey recorded during the daytime baseline survey ($L_{Aeq,t}$ < 55 dB). It should be noted that this assessment method is only valid for residential properties and not commercial properties. The threshold values apply to the sum of both the ambient and construction noise levels.

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

Table 10.10 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.*

It is unlikely that there will be a requirement for night-time or evening (19.00 – 23.00 hrs) construction works. Accordingly, based on current ambient sound levels, BS5228 and TII acceptable levels for construction and also the existing ambient sound environment, the following construction noise criteria are proposed:

- 65 dB $L_{Aeq,1hr,}$ Mon-Fri (07.00 – 19.00hrs) and Sat (07.00 – 13.00 hrs) at existing NSRs.

The following should also be noted in relation to the prediction of construction noise and to the use of the threshold values or limits:

Prediction of likely noise impact has been completed using data from BS5228:1 and is based on the prediction methodology set out in ISO9613-:1996. However, it is important to note that the construction process is subject to a tendering process. Therefore, with regards to prediction of construction noise at NSRs the following factors are relevant:

- The sound power ratings (or sound pressure levels at known distance) used in the assessment may vary from the ratings for the actual equipment chosen by the contractor and used on site;
- Depending on conditions encountered in real-time, different types of equipment may be chosen and the number of units may vary. Usage may also vary in terms of length of time operating or in terms of intensity, character and location.

As a result, limits or threshold values, are typically applied to control construction noise. *BS5228-1 notes that a potentially significant negative effect will occur if the predicted construction noise level at a 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 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.

In this regard, the standard notes that construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact 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.

10.5.1.2 Applicable Vibration Criteria

Vibration impacts can typically potentially occur during site development and construction phases of development through the use of equipment such as rock breakers or piling. Vibration can affect both human beings and buildings (although most concern is with damage to buildings from site development and construction). Accordingly, there are separate criteria for both.

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 10.11 below details the transient vibration guide values for cosmetic damage to buildings as set out in BS5228-2:

Table 10.11 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 be necessarily more vulnerable than new builds.

The following limits therefore are considered to 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 10.12 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.

Source: BS5228-2

As can be seen from Table 10.12 above, the limits for humans are much lower than for cosmetic damage to buildings.

10.5.1.3 Prediction of Site Development and Construction Phase Impacts – Noise

The short-term site development and construction phases will involve works such as site preparation works, construction of buildings, road surfacing and landscaping etc., all of which will result in the use

of noisy machinery as well as the movement of Heavy Goods Vehicles (HGVs) on and off the site. It is anticipated that the Project will be constructed in two main phases over a 5-year period in total.

Works will to commence in the northern portion of the site initially and then advance southwards.

Pre-cast driven piling will be required throughout the site.

The existing NSRs most likely to be affected by the site development and construction phases are identified on Figure 10.5 below:

Figure 10.5: Location of Nearest NSRs (Source: Google Maps, 2022).

Piling Works

Piling works and excavation using heavy equipment during the initial stages are likely to represent the greatest potential for noise impact during temporary to short-term site development and construction.

The choice of piling is generally dictated by the ground conditions to be encountered, the loads to be supported and the economics of the system. Thereafter, the system least likely to give rise to noise and vibration impact is chosen. The level of noise and vibration produced will also depend on ground conditions, pile loads and distance to receptors.

The type of piling proposed for the Project is broad-based i.e. pre-cast driven piling. In this regard, it is noted that pre-cast driven piles generate lower noise and vibration levels than cast in situ piles. Driven piling can be precussion, pressing or vibratory. Each type can have different noise characteristics with more impulsive-type noise from hammers compared to vibration-driven piling. This can therefore be more disturbing and result in higher noise levels.

BS5228:1:2009+A1:2014 provides only one example of noise data for pre-cast concrete driven piling and that relates to using a hydraulic hammer which may not be the final piling method chosen but represents a conservative estimate. Assuming piling will occur for approximately 15 minutes during a one-hour period, the $L_{Aeq,1hr}$ at NSR5 the nearest NSR (refer to Figure 10.5 earlier for location) to proposed Block G is estimated at 77 dB without any mitigation. This is above acceptable levels for construction noise (65 dB $L_{Aeq,1hr}$). BS5228-1 notes that a potentially significant impact occurs when the applicable threshold value is exceeded. *"The assessor then needs to consider other project specific factors such as the number of receptors affected and the duration and character of the impact to determine if there is a significant effect".*

Additionally in this regard, UK LA111 notes that where a major or moderate impact occurs due to exceedance of the applicable threshold limit value, the following duration should be considered to determine if a significant negative effect occurs:

- 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.

It is likely that the duration of piling can be maintained within the above duration limits to ensure that a significant effect does not occur. Piling works are generally short in duration in relation to the length of construction works as a whole. Furthermore, it should be noted that works will move away from the closest NSRs relatively quickly and therefore more distance attenuation will apply. The above represents a worst-case scenario. Furthermore, as part of best practice, additional mitigation measures can be implemented to ensure that the threshold value is not exceeded.

Other activities giving rise to elevated noise levels in close proximity to existing NSRs on the Golf Links Road include the use of tracked excavators, lorries and dump trucks during site development works close to the site boundary. Table 10.13 below provides an example of typical noise impact during these works in close proximity (20m) to nearby NSRs.

Table 10.13 Potential Noise Levels Arising from Site Development Close to Boundary

Source	LAeq,t @10m	Predicted LAeq,1hour* (dB)
Site Development		
Tracked Excavator	77	@ façade of ground floor of Golf Links Road NSRs @ 20m distant from source **70**
Lorry	80	

**Assume excavator is on for 66% of hour and lorry on for 5 minutes. Conservative attenuation from distance included.*

This is also above acceptable levels for construction noise (65 dB $L_{Aeq,1hr}$). In reality, it is unlikely that the duration of heavy earthmoving equipment operating at close distances i.e. 20m will exceed the duration limits. However, mitigation measures will apply to ensure that the duration is minimised and/or the threshold value is not exceeded.

Construction Phase Traffic

A dedicated temporary construction access will be provided off the Golf Links Road to the south of the stream and Ballygossan Park and north of existing NSRs on the Golf Links Road. The proposed construction access point is shown in Figure 10.5.

An existing dormer type dwelling (NSR1 on Figure 10.5) is located directly on the south side of the construction access point.

During the period of excavation, it is estimated that up to 4 no. truck trips per hour (on average) will be generated by vehicles removing unsuitable spoil from the site over a total 6-9 month period.

During later stages, deliveries will arrive at a steady rate during the course of each day. It is estimated that peak delivery rates would be in the region of 1 - 2 deliveries per hour throughout the day.

Truck pass-bys are brief in nature. Assuming 4 trucks per hour passing NSR1 and using a SEL value of 85dB(A), the predicted $L_{A,eq,1hr}$ is 55 dB.

LA111 offers guidance on construction related traffic noise as follows:

Table 10.14 Magnitude of Impact at Receptors

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

Monitoring was not undertaken directly at NSR1. The closest points are NMP 1 and NMP 2 which are set back from the local road and therefore likely to have lower ambient noise levels compared to a roadside location, albeit a lightly trafficked road. Therefore, the impact magnitude is estimated as minor negative.

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.

Construction Phase Vibration

Pre-cast driven piles are proposed across the entire site. Driven piling is transient where a drop hammer is used but can be continuous where vibratory methods are applied. The limits as specified in Section 10.5.1.2 for continuous vibrations will be conservatively applied.

BS5228-2 includes historical measured vibration levels for the operation of different types of piling under specific circumstances i.e. soil conditions. Table C.1. of the standard provides historic case history data from 2006 on vibration levels measured at known distances during driven pre-cast concrete square piles. The soil conditions are different to those present on site. Levels range from 11.4 mm/sec at 5m to 4.32 mm/sec at 20m. Based on the data in BS5228:2, the potential exists for negative vibration impacts on human beings however the exact impact will be dependent on the soil conditions, project

requirements and type of equipment used. Precautionary mitigation measures are proposed in Section 10.8.1 of this report.

The maximum allowable vibrations (as measured by peak particle velocity (PPV)) along the Dublin-Belfast Railway tracks due to works will be in accordance with Irish Rail requirements and code of practice. A monitoring regime will be agreed with Irish Rail and implemented in advance of works commencing on site.

10.5.1.4 Cumulative Impacts

The cumulative impacts associated with the site development and construction phase of the Project have been considered with each of the following projects.

Ballygossan Park (Phase 2) Ref. ABP-308583-20

The anticipated development will provide for the construction of 149 no. residential units, creche, parkland, and two playing pitches at this site located to the south and west of Ballygossan Park, Skerries, Co. Dublin. The site area is 4.8 hectares. Refer to Chapter 2 for site location.

At the time of writing, planning permission for Phase 2 of Ballygossan Park has yet to be applied for. However, the development may be under construction in the future and therefore may coincide with the construction of the Project.

Accordingly, existing NSRs in Phase 1 of Ballygossan Park (NSR3 as indicated on Figure 10.5) may experience potential cumulative temporary to short-term site development and construction noise impacts from the development of the Project and Phase 2 of Ballygossan Park. The closest works in the Project to Phase 1 of Ballygossan Park will be approximately 65m from Ballygossan Park (Phase 1). Works associated with Phase 2 of Ballygossan Park will directly adjoin Phase 1. Therefore, the Ballygossan Park Phase 2 works will likely present the highest potential for noise impact compared to the Project. Cumulatively, the impact will likely derive predominantly from Ballygossan Phase 2 works due to proximity.

Notwithstanding this, the accepted criterium for short term site development and construction noise will apply as a cumulative limit regardless of which works are on-going. Mitigation measures to ensure that the limits are complied with are listed in Section 10.8.1.

Advance Infrastructure Application Ref. ABP-312189-21

The proposed AI Works to facilitate the Project and Ballygossan Park Phase 2 include:

1. Construction of a new Link Road, crossing the Regional Drainage Facility and providing access to the future residential zoned land to the south from the existing Ballygossan Park to the north.
2. Construction of Regional Drainage Facility (RDF) for the surface water management of the Hackettstown residentially zoned lands.
3. Foul, Surface Water and Water Supply Services to facilitate Ballygossan Park Phase 2.
4. Foul, Surface Water and Water Supply Services to facilitate the future development of lands to the south.
5. Planting & Landscaping of open space areas, including provision of footpaths and viewing point. Provision of Public Lighting on Link Road/ Footpaths.
6. Diversion and undergrounding of existing overhead power lines.
7. Utilisation of existing field gate on Golf Links Road as a temporary access road for construction traffic.

These works will take 12 months to complete and will commence before the Project. Although unlikely, there may be an overlap between the programmes with works completing on the AI Works when the Project works commence. As most earthmoving associated with the AI Works will have occurred at the

start, it is anticipated that the cumulative impacts on NSR1 which is in close proximity to the route into the Project site will mainly be associated with the Project as described earlier.

Off-site Road Improvement Works Ref. ABP-309409-21

These works, detailed in Chapter 2 of this document, will occur at least 400m from the proposed Project and are screened by intervening structures. Therefore, there will be no additional cumulative short term site development and construction related impacts on NSRs assessed.

10.5.2 Long term Operational Phase

Additional traffic arising from the proposed Development can give rise to increased traffic noise impact at existing NSRs in the long term. Accordingly, 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 10.15 below offers guidance as to the likely noise impact and effect.

Table 10.15 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 2011[4]

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

Table 10.16 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 10.16 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.

The Traffic and Transport Assessment Report prepared by DBFL Consulting Engineers was reviewed as part of this assessment. Two different traffic scenarios were assessed, namely, (a) the base "Do Nothing" traffic characteristics and (b) the post development "Do Something".

[4] **Now withdrawn in UK and replaced with LA111.**

The "Do-Nothing" traffic scenario takes into account the potential level of traffic that could be generated by existing 'Committed Developments' in addition to the existing flows travelling across the network. Therefore, the long-term cumulative impact has been considered.

The proposed development traffic flows are then added to the network's "Do-Nothing" (Base + Committed Development) traffic flows to establish the new 'Post Development' traffic flows. In summary the following scenarios are considered: -

Do Nothing

- A1 – 2024 Base Flows + Committed Developments
- A2 – 2029 Base Flows + Committed Developments
- A3 – 2039 Base Flows + Committed Developments

Do Something

- B1 – 2024 Do Nothing (A1) + Proposed Development Flows
- B2 – 2029 Do Nothing (A2) + Proposed Development Flows
- B3 – 2039 Do Nothing (A2) + Proposed Development Flows

The data from the above scenarios have been reviewed for 2 points along the Golf Links Road:

- Point A – North of the proposed southern entrance to the proposed Development but south of the entrance to Ballygossan Park.
- Point B – North of the existing entrance to Ballygossan Park.

Figure 10.6 overleaf indicates both locations.

Figure 10.6: Location of Points A and B (Source: Google Maps, 2022).

Table 10.17 below summarises the increased traffic flows at both points using available data i.e peak hour flow.

Table 10.17 Summary Traffic Increases on the Golf Links Road

Location	Year	Do Nothing	Do Something	%increase	Do Nothing	Do Something	%increase
		AM Peak	AM Peak		PM Peak	PM Peak	
Point A	2024	76	76	0	69	69	0
Point A	2029	85	152	79	76	150	97
Point A	2039	91	158	74	81	155	91
Point B	2024	150	195	30	138	186	35
Point B	2029	208	349	68	200	352	76
Point B	2039	217	358	65	208	360	73

As can be seen from Table 10.17 above, traffic levels will increase during peak hour on the Golf Links Road as a result of the proposed Development. The traffic will effectively double at Point A which correlates to a 3 dB increase. Based on Table 10.15, this equates to a magnitude rating of slight negative long-term. This will be perceptible to NSRs along the roadside based on Table 10.15. At Point B, the effect will be less and will be long-term imperceptible based on peak hour flows.

The alternative method from LA111 is based on assessing 18-hour traffic flows. However, it has been applied here to assess the changes in peak hour flow with a similar method of assuming a 3 dB increase with doubling of flow.

Table 10.18: Summary of % Increase in Traffic Flows from DMOY (2024) to DSFY (2039)

Link	DMOY (2024)	DSFY (2039)	% change
Point A (AM)	76	158	10
Point A (PM)	69	155	125
Point B (AM)	150	358	139
Point B (PM)	138	360	161

The greatest percentage change equates to a 3.0 – 4.9 decibel increase which is rated as a minor negative long-term impact.

10.6 DO NOTHING IMPACT

It is envisaged that the noise environment, in the absence of the proposed Development will largely remain unchanged at the nearest NSRs and across the development site.

Irish Rail has plans to implement the DART Plus programme under Project Ireland 2040. The DART Plus programme aims to "*modernise and improve existing rail services in the Greater Dublin Area."* This includes increasing the existing DART line from Malahide to Drogheda (Coastal North). According to the proposed programme brochure, A Railway Order, accompanied by an EIAR, is expected to be lodged to An Bord Pleanala in 2022.

Electric engines are quieter than diesel however the actual noise of a train rolling on the tracks will still be loud regardless of engine type. Therefore, noise levels may not be lower at close range to the track. Notwithstanding this, new technology such as coatings for rail tracks which are at least being trialled in the UK could potentially reduce rail noise in the future. Overall, however, in the absence of the EIAR, it is difficult to state what the "Do Nothing" impact will be although the programme aims to modernise therefore it is not likely to be adverse or significantly adverse.

10.7 FUTURE RESIDENTIAL NOISE EXPOSURE CONSIDERATIONS

The UK ProPG: Planning & Noise, New Residential Development, May 2017[5] outlines a systematic risk based two stage approach for evaluating noise exposure on prospective sites for residential development.

[5] 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.

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 noise exposure of future residents.

The 24-hour monitoring undertaken at NMP4 (29m from the rail line), NMP5 and NMP6 within 15m of the rail line and at the proposed closest facades to the rail line indicate that the site is negligible to low risk at those points. The new DART Plus programme could potentially increase noise levels close to the rail line however, there would need to be significant increases to increase the noise risk in the future. As noted above, this will be subject to a separate EIAR although future-proofing has been considered as part of this assessment.

In terms of potential future road transportation noise, a planned Southern Relief Road encompassing part of the Golf Links Road to the south could potentially increase transportation noise affecting the site. However it is understood that the development of the road is delayed and has therefore not been considered as part of this assessment.

10.7.1 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 measured sound levels on site, the proposed layout indicates that the vast majority of the public external amenity space (parkland) and all of the communal amenity areas associated with Blocks C, E and F will not be above the range 50 - 55 dB $L_{Aeq,16hr.}$ Therefore the development complies with Pro-PG requirements to provide access to quiet or relatively quiet external amenity space.

Balconies will also comply with the design criteria.

In addition, the following is noted with regards to the provision of good acoustic design:

- The public space will be enhanced with tree planting. Softer as opposed to hard surfaces, however minor, may help reduce the impact of any reflected noise from traffic in a green space.
- The provision of planted areas in urban or suburban settings can *qualitatively* improve the soundscape for local residents and enjoyment of the proposed amenity areas. Natural features have been shown to improve perceived tranquillity and are provided in the landscape strategy.[6]
- Access to the public spaces provide additional optional external amenity to residents.

10.7.2 Internal Areas

Appropriate guidance and best practice 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*

[6] 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.

which is referred to in Pro-PG. This British standard sets out recommended noise limits for good indoor ambient noise levels and takes account of guidelines issued by bodies such as the WHO. Details taken from the standard for good conditions are presented in Table 10.19 below.

Table 10.19 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

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 regard 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.

The relaxed criteria are indicated in Table 10.20 for reasonable conditions.

Table 10.20 Recommended Indoor Ambient Noise Levels

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

94% of the units in the scheme are >15m from the rail line boundary. Therefore, based on the monitoring undertaken,94% of the scheme will achieve good internal day and night-time limits for resting and sleeping as set out in Table 10.19 with partially open windows which give a 10 -15 decibel sound reduction.

There are 20 units facing the rail line that are approximately 14m distant. These will achieve reasonable (at a minimum) to good internal conditions with partially opened windows.

Regardless of the above and taking account of the need to future-proof the development without over-specifying sound insulation an adequate level of sound insulation in glazing will be provided, taking account of the spectral characteristics of train noise. Further detail is provided in Section 10.8.2 below.

10.8 AVOIDANCE, REMEDIAL & MITIGATION MEASURES

10.8.1 Site Development and 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.

As development proceeds from north to south, intervening distances will increase from the bulk of receptors in Ballygossan Park.

The following noise and vibration management measures shall apply to the proposed project to ensure that the threshold value for noise and vibration (as applied to buildings) are complied with:

- 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 local residents who may be affected by site activities are considered during the management of activities at the site.
- Noise monitoring with capability for real-time review both on-site and remotely by Project Management shall be conducted at nearby NSRs throughout. Monitoring will be conducted at

NSR1 and 3 at a minimum. As development moves south, monitoring shall be conducted at NSRs 2 and 5.

- In the event of exceedance of the limits at NSRs, works shall be ceased and measures implemented immediately to ensure that the limits are complied with and/or duration in minimised.
- Noise monitoring with capability for real-time review will facilitate immediate mitigation at nearby NSRs especially when noisy activities are planned.
- Due to the proximity of separate development sites, and where works are occurring in tandem, individual Site Representatives or their appointed noise and vibration representatives will be required to liaise on management of construction noise impact through real-time review of monitoring data to ensure that the limits are met cumulatively.
- Temporary acoustic screening shall be placed along the boundaries with NSRs where works take place close to the boundary. As a general rule of thumb, it is recommended that temporary screening break the "line of sight" from the sources to the affected windows of the nearest NSRs where possible. It is likely that screening will be required at NSR1 throughout the duration of the proposed works.
- The screening should be of sufficient surface density (minimum 10 kg/m^2) to mitigate temporary noise impact associated with the construction phase.
- 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 as amended by Directive 2005/88/EC 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.
- While piling is dictated by constraints such as ground conditions (although a worst-case scenario has been assessed in this chapter) the design and final method chosen shall ensure compliance with the threshold limits for noise and vibration as set out in this chapter and limits proposed by Irish Rail for the rail line.
- Measures such as use of an acoustic shroud, damping of the hammer impact and enclosure of the hammer shall be considered for reducing noise impact if applicable to the final piling design.
- At the time of tender, the contractor will be obliged to review all systems taking noise and vibration into account in the choice of equipment. As noted in BS5228-1, *"the construction industry is generally innovative and constantly developing, and there may be proprietary systems available at the time of tender that were not known or available at the planning stage."*
- Vibration monitoring will be conducted when sources which potentially could cause vibration impact to buildings will be in use e.g. during piling at NSR5. In this regard, test monitoring will 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 works above the relevant guidance values for building damage as set out in Section 10.5.1.2.

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

10.8.2 Operational Phase

Existing NSRs

No additional specific mitigation measures are proposed for existing NSRs in the long term.

Future Residents

The following mitigation measures apply in the long term:

- Balustrades proposed on balconies for units close to rail line are as high as possible to further improve usability from a noise perspective. The balustrades will be made from a solid material (minimum surface density 10 kg/m^2) with no gaps in the construction taking account of other factors such as adequate daylighting.

- The following is an average A-weighted spectrum for passing trains recorded at NMP5 and NMP6 within 10-15m distance unscreened from the rail line:

Table 10.21 Passing Train Spectra

Source	63	125	250	500	1000	2000	4000	8000	Total L_{Ae} (dBA)
	Hz								
	64	73	72	75	76	73	67	57	82

Free-field.

- Although the Project will achieve the internal criteria with open or partially open windows, it is recommended that the final glazing chosen during the detailed design stage takes account of the spectral characteristics of train noise as indicated in Table 10.20 above and performs sufficiently at low frequencies to future proof the development and afford residents the option to further reduce noise ingress to indoor areas.
- Final specifications for glazing and ventilation shall be approved by an acoustic specialist at detailed design stage.
- Glazing suppliers shall provide laboratory tests confirming the sound insulation performance to BSEN ISO 140 Part 3 1995 and BS EN ISO 717, 1997.

10.9 RESIDUAL EFFECT

The site of the proposed development in Hacketstown is a quiet location punctuated by passing train noise. The immediate surrounding area is agricultural in nature with emerging suburban development to the north. Rail noise predominates on the western boundary of the site. The site is classified as a negligible to low noise risk rating for future residential development. The site generally falls within desirable noise levels for residential development.

Site development and construction noise arising from the proposed project will cause a temporary elevation of ambient sound levels in the vicinity of the existing NSRs at times when works are *close to the boundary*, but this will be controlled to comply with standard criteria or limit values for construction works. The criteria, by necessity, are higher than existing ambient levels as construction works are temporary to short term in nature. The mitigation measures as part of best practice will ensure that the limits combined with duration limits where applicable are not exceeded. As works move away from NSRs and/or as new buildings provide screening, construction noise levels will reduce to well below threshold value for the majority of the duration of the total works.

In the long term, the operational phase will not significantly impact on existing NSRs given its nature. Cumulative road traffic noise increases on the Golf Links Road will be minor adverse in the long term during peak hour flow but is likely to be less during the remainder of the day.

The development design incorporates a number of good acoustic design features such as provision of large areas of external amenity within desirable noise levels for future residents.

External amenity criteria as specified in Pro-PG will be achieved in the proposed communal amenity areas and private amenity associated with apartment blocks.

It is envisaged that the development will achieve good internal noise conditions for resting, sleeping etc with open or partially opened windows throughout 94% of the proposed development. The remainder will achieve reasonable to good conditions internal noise conditions for resting, sleeping etc with open or partially opened windows. Nevertheless, a minimum moderate level of sound insulation for glazing will be installed to future proof the development.

10.10 MONITORING

The contractor will be required by contractual obligation to ensure construction activities operate within the noise and vibration limits set out within this assessment. The contractor will be required to undertake real-time noise monitoring at locations representative of the closest NSRs to ensure the relevant criteria are not exceeded. Vibration test monitoring will be required at NSRs and at the rail line in accordance with Irish Rail requirements, especially during piling to ensure that limits are not exceeded.

10.11 INTERACTIONS

Human Health:	The World Health Organisation (WHO) identifies that noise is a public health issue. It has negative impacts on human health and well-being and is a growing concern. In particular, the effects from *long term* exposure to anthropogenic sources including transportation sources (road, air and rail), wind turbines and leisure have been identified in the WHO Environmental Noise Guidelines for the European Region, 2018, as sources of concern as they potentially contribute to sleep loss and depravation. The effects of additional road traffic arising as a result of the impact of the proposed project on human health have been assessed in this chapter.
Biodiversity:	Construction noise has the potential to temporarily impact on fauna. This has been specifically addressed in Chapter 5 dealing with biodiversity and is outside the scope of this chapter.
Material Assets:	Construction vibration has the potential to impact on the Dublin-Belfast Rail line. Limits specified by Irish Rail will be complied with. The contractor will be required to contractually comply with these limits.

10.12 DIFFICULTIES ENCOUNTERED IN COMPILING INFORMATION

None.

10.13 REFERENCES

- Assessment of Inward Noise and Vibration Impact on Proposed Residential Development, 28 October 2020, LW/20/11421NR01b, AWN Consulting.
- 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.
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes, March 2014.
- Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) as published by the Environmental Protection Agency in January 2016.
- Guidelines for Environmental Noise Impact Assessment, Institute of Environmental Management and Assessment, Version 1.2, Nov 2014.
- ISO 1996 Acoustics – Description, Measurement and Assessment of Environmental Noise, Part 1, Basic Quantities and Assessment Procedures (2016) and Part 2 Determination of Environmental Noise Levels (2017).
- ISO 9613.-2 – 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.
- Environmental Noise Guidelines for the European Region, World Health Organisation, Oct 2018.
- Measurement and Assessment of Groundborne Noise and Vibration, 3rd Edition, UK Acoustics and Noise Consultants (ANC), 2020
- ProPG: Planning and Noise: Professional Practice Guidance on Planning and Noise, New Residential Development, ANC, IOA and UK CIEH, May 2017.