ENVIRONMENTAL NOISE SURVEY

AT

TAYLORS LANE
BALLYBODEN
DUBLIN 16

Prepared for
Shannon Homes Dublin Unlimited Company

Prepared by:
Traynor Environmental Ltd

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Traynor Environmental Ltd
Belturbet Business Park,
Creeny.
Belturbet,
Co Cavan
T: + 353 49 9522236
E: nevin@traynorenv.ie
www.traynorenv.ie

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Authorised By:	 *Nevin Traynor BSc. Env, H. Dip I.T, Cert SHWW, Certified Env Noise Assessor* *Environmental Consultant*

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This report refers, within the limitations stated, to the condition of the site at the time of the report. No warranty is given as to the possibility of future changes in the condition of the site. The report as presented is based on the information sources as detailed in this report, and hence maybe subject to review in the future if more information is obtained or scientific understanding changes.

CONTENTS

1.0 INTRODUCTION

Traynor Environmental Ltd has been commissioned to carry out a study in relation to the potential noise impacts incident to the proposed development at Taylors Lane, Ballyboden, Dublin 16 on behalf of Shannon Homes Dublin Unlimited Company.

The proposed development is located at Taylors Lane, Ballyboden, Dublin 16. The proposal is for a development comprising the demolition of the former institutional buildings and associated out-buildings, and the construction of 402 no. apartments (in a mix of 1, 2 and 3 bed units), retail units, creche, car and cycle parking, bin stores, substations, pedestrian and vehicular accesses and open spaces and all associated works.

Included within this report is an assessment of the impact of inward noise across the development site as per the guidance provided in the ProPG: Planning & Noise document. Furthermore, the report assesses the outward noise impact of the construction and operational phases of the development.

The site contains a former institutional building on its western side and a former pitch and putt course on its eastern side. In addition, there are some smaller buildings on the western boundary of the site, fronting onto Edmondtown Road. There are mature trees within the site and along the boundaries.
Taylor's Lane bounds the site to the north, while Edmondstown Road bounds the site to the west. Lands to the east and south are in private ownership. The site to the south is a HSE Primary Care Centre.
There is vehicular access into the site from the Edmondstown Road and a separate pedestrian gate in the north western corner of the site adjacent to a roundabout junction.

Figure 1 & 2 presents the site location & plan of the proposed development.

Figure 1: Site Location Map.

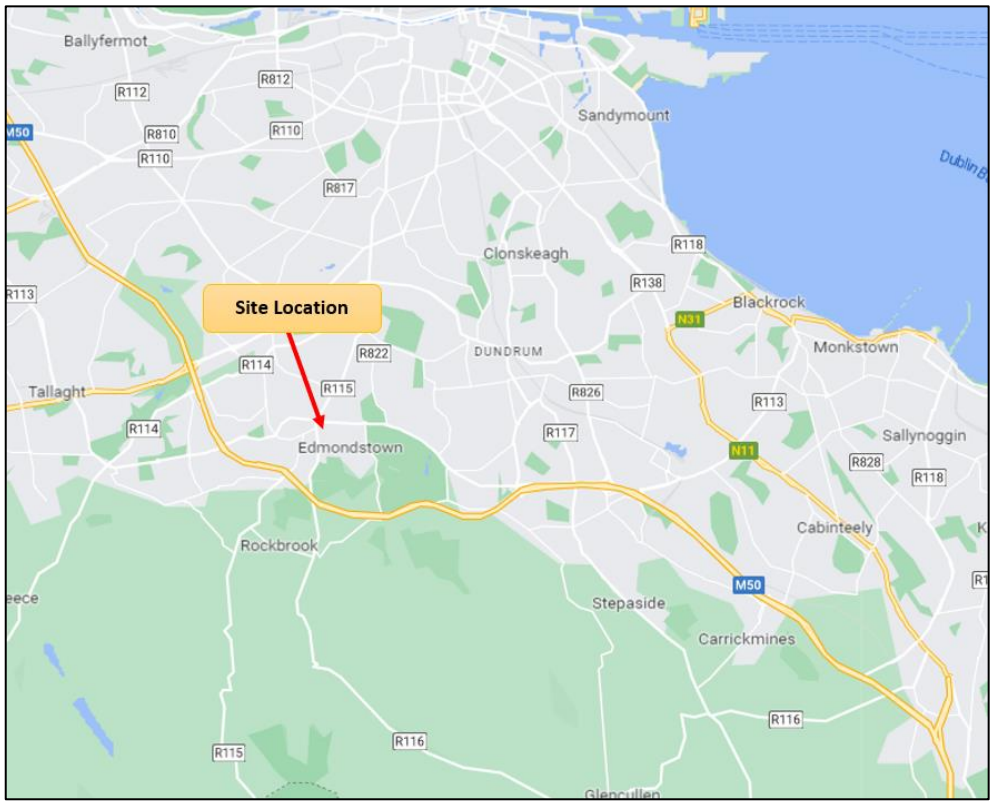


Figure 2: Proposed Site Layout

In the first instance it is considered appropriate to review relevant noise and vibration criteria being adopted for the assessment and to present a discussion of the site in the context of the existing noise and vibration environment.

2.0 DESIGN CRITERIA

2.1 Inward Noise Assessment

2.1.1 South Dublin County Development Plan 2022 - 2028

The South Dublin County Development Plan 2022 – 2028 states the following in terms of the proposed noise control measures to be adopted when considering developments which introduce people to noise:

"11.0.2 Planning Policy Context

NPO 65 requires local authorities to 'Promote the pro-active management of noise where it is likely to have significant adverse impacts on health and quality of life and support the aims of the Environmental Noise Regulations through national planning guidance and Noise Action Plans".

"11.7.2 Noise

The European Communities (Environmental Noise) Regulations (2018) (S.I. No. 549 of 2018), implements EC Directive 2002 / 49 / EC (END) on assessment and management of environmental noise in Ireland. The END requires Member States to prepare and publish, every 5 years, strategic noise maps and noise management action plans for transport noise sources (that is, roads, railways and airports) and industry. The Dublin Agglomeration Environmental Noise Action Plan 2018-2023 was developed jointly by the four Local Authorities in the Dublin Region in their role as designated Action Planning Authorities under Article 10 of the Environmental Noise Regulations (2006). The purpose of the Noise Action Plan is to avoid, prevent and reduce, where necessary, on a prioritised basis the harmful effects including annoyance, caused by long-term exposure to environmental noise. Under the Noise Regulations (2018), all Local Authorities will review strategic noise mapping of non National major roads, that is, all roads with more than 3 million vehicle passages per year. The EPA is the national competent authority under the Regulations. Development Management Policies on noise are set out in Chapter 12: Implementation and Monitoring".

"Policy IE8: Environmental Quality

Seek to take appropriate steps to reduce the effects of air, noise and light pollution on environmental quality and residential amenity in line with European, National and Regional policy and legislation".

"IE8 Objective 1:

To implement the provisions of national and EU Directives on air and noise pollution and other relevant legislative requirements in conjunction with other agencies as appropriate, consistent with RPO 10.10 of the RSES".

"IE8 Objective 5:

To ensure that future developments are designed and constructed to minimise noise disturbance and take into account the multi-functional uses of streets including movement and recreation as detailed in the Urban Design Manual (2009) and the Design Manual for Urban Roads and Streets (2013, updated 2019)".

"IE8 Objective 7:

To ensure that noise sensitive development in proximity to national and other roads provides a noise impact assessment and includes appropriate mitigation measures, such as noise barriers, set back landscaping and / or buffer zones between areas of land where development is proposed and existing and proposed national and other roads".

"IE8 Objective 8:

To work alongside relevant stakeholders NTA, TII, EPA to promote and improve safer noise protection infrastructure in line with population growth and traffic increases along all our national roads".

2.1.2 British Standard BS 8233 (2014)

The standard, BS 8233 (2014) Guidelines for Sound Insulation and Noise Reduction for Buildings, sets out recommended internal noise levels for several different building types from external noise sources such as transport noise. The guidance is primarily for use by designers and hence BS 8233 may be used as the basis for an appropriate schedule of noise control measures. The recommended internal noise levels for residential developments are set out below.

Table 1: Summary of recommended internal noise levels from BS 8233 (2014)

Activity	Location	Day 07:00 to 23:00hrs dB L_{Aeq},16hour	Night 23:00 to 07:00hrsdB L_{Aeq},8hour
Resting	Living room	35	-
Dining	Dining room/area	40	-
Sleeping (daytime resting)	Bedroom	35	30

The document also notes that where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.
In relation to noise levels in external amenity areas, BS 8233 provides the following guidance:

> *"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB L_{Aeq}, T, with an upper guideline value of 55 dB L_{Aeq}, T which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited".*

2.1.3 WHO COMMUNITY NOISE (1999)

The World Health Organization (WHO) document Guidelines for Community Noise (1999) provides the following design criteria and guidelines in relation to noise:

> *"The effects of noise in dwellings, typically, are sleep disturbance, annoyance, and speech interference. For bedrooms, the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30dB L_{Aeq} for continuous noise and 45dB LA_{max} for single sound events. Lower noise levels may be disturbing depending on the nature of the noise source. To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35dB L_{Aeq}".*

2.1.4 ProPG: Planning & Noise

The Professional Guidance on Planning & Noise (ProPG) document was published in May 2017. The document was prepared by a working group comprising members of the Association of Noise Consultants (ANC), the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH). Although not a government document, since it's adoption it has been generally considered as a best practice guidance.

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

- Stage 1 - Comprises a high-level initial noise risk assessment of the proposed site considering either measured and or predicted noise levels; and,

- Stage 2 – Involves a full detailed appraisal of the proposed development covering four "key elements" that include:

    - Element 1 - Good Acoustic Design Process.
    - Element 2 - Noise Level Guidelines.
    - Element 3 - External Amenity Area Noise Assessment
    - Element 4 - Other Relevant Issues

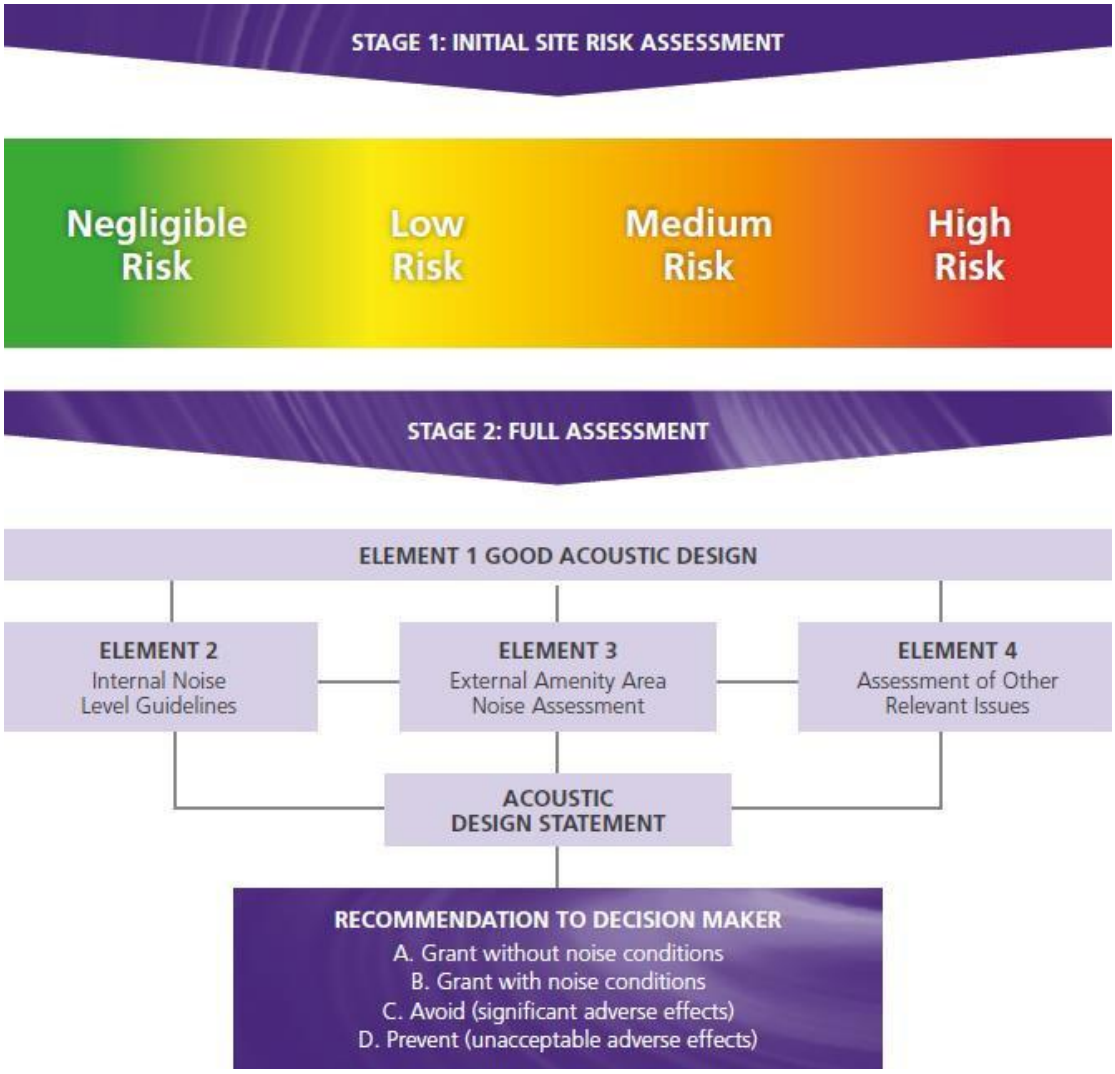
A key component of the evaluation process is the preparation and delivery of an Acoustic Design Statement (ADS) which is intended for submission to the planning authority. This document is intended to clearly outline the methodology and findings of the Stage 1 and Stage 2 assessments, so as the planning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

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

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

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

Figure 3: ProPG Approach (Source: ProPG)



2.1.5 Verification from EPA Strategic Noise Mapping

The background noise and the predevelopment noise model have been verified using the EPA strategic noise mapping. The results of the monitoring were compared against the noise levels expected under the EPA strategic noise round 3 road and rail - Lden mapping.

Figure 4: EPA Strategic Noise Mapping Noise Round 3 Road - Lden Maps at the site

Figure 5: EPA Strategic Noise Mapping Noise Round 3 Rail - L_{den} Maps at the site

2.2 Outward Noise Assessment – Construction Phase

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction/demolition phase of a project. South Dublin County Council (SDCC) typically controls construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

In order to set appropriate construction noise limits for the development site, reference has been made to *BS 5228 -1:2009 +A1 2014 Code of practice for noise and vibration control on construction and open sites- Noise*. Part 1 of this document Noise provides guidance on selecting appropriate noise criteria relating to construction works.
BS 5228-1:2009+A 1:2014 gives several examples of acceptable limits of construction and demolition noise, the most simplistic being based on upon the exceedance of fixed noise limits. For example, paragraph E.2 states:
'noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with windows shut.'
Paragraph E.2 goes on to state:
'noise levels, between 07:00 and 19:00 hours; outside the nearest window of the occupied room closest to the site boundary should not exceed:
70 decibels (dBA) in rural, suburban areas away from the main road traffic and industrial noise.
75 decibels (dBA) in urban areas near main roads in heavy industrial areas.'

Note that a typical planning condition in relation to construction noise issued by Local Authorities refer also to the compliance with BS 5228 part 1 as a means of controlling impacts to the surrounding environment. BS 5228 has therefore been used to inform the assessment approach for construction noise in line with Local Authorities requirements.

For residential properties it is considered appropriate to adopt the 65dB(A) during daytime. The construction noise limits, which are presented in Table 2 represent a reasonable compromise between the practical limitations in a construction project, and the need to ensure an acceptable noise level for the nearby residents and their sensitive receptors including amenity space. Table 2 specifies the recommended Project Noise Limit Criteria in accordance NRA Maximum Permissible Construction Phase Noise Levels at the Façade of Dwellings during road developments.

Table 2: NRA Maximum Permissible Construction Phase Noise Levels at the Façade of Dwellings during Road Developments

Construction Phase Noise Limit Criteria		
Days & Times	**L_{Aeq}, (1hr) dB**	**$L_{pA(max)}$ slow dB**
Monday to Friday - 07:00 to 19:00	70	80
Monday to Friday - 19:00 to 22:00	60	65
Saturday - 08:00 to 16:30	65	75
Sundays and Bank Holidays - 08:00 to 16:30	60	65

Note 1: Construction activity at these times, other than that required in respect of emergency works, will normally require the explicit permission of the relevant local authority. For the appropriate assessment period (i.e., daytime in this instance) the ambient noise level is determined. If the construction noise exceeds, then a significant effect is deemed to occur.

The closest neighbouring noise sensitive property to the proposed development is a residential dwelling located approximately 13m east of the proposed site.

2.3 Outward Noise Assessment – Operational Phase

2.3.1 Vehicular Traffic

In order to assist with the interpretation of the noise associated with vehicular traffic on existing public roads, Table 3 offers guidance as to the likely impact associated with any particular change in traffic noise level due to the proposed development (Source DMRB, 2011).

Table 3: Likely Impact Associated with Change in Traffic Noise Level

Change in Sound Level (dB L_{A10})	Subjective Reaction	Magnitude of Impact
0	Inaudible	No Change
0.1 – 2.9	Barely Perceptible	Negligible
3 – 4.9	Perceptible	Minor
5 – 9.9	Up to a doubling of loudness	Moderate
10+	Doubling of loudness and above	Major

2.3.2 Plant Noise Emissions

British Standard 4142: 2014: Methods for Rating and Assessing Industrial and Commercial Sound is the industry standard method for analysing building services plant noise emissions to residential receptors.

BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

For an appropriate BS 4142 assessment it is necessary to compare the measured external background noise level (i.e., the LA_{90}, T level measured in the absence of plant items) to the rating level (LAr, T) of the various plant items, when operational. Where noise emissions are found to be tonal, impulsive in nature or irregular enough to attract attention, BS 4142 also advises that a penalty be applied to the specific level to arrive at the rating level.

The subjective method for applying a penalty for tonal noise characteristics outlined in BS 4142 recommends the application of a 2 dB penalty for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

The following definitions as discussed in BS 4142 as summarised below

"*Ambient noise level, LAe, T*"	is the noise level produced by all sources including the sources of concern, i.e., the residual noise level plus the specific noise of mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"*Residual noise level, LAe, T*"	is the noise level produced by all sources excluding the sources of concern, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"Specific noise level, $L_{Aeq,T}$"	is the sound level associated with the sources of

	concern, i.e., noise emissions solely from the mechanical plant, in terms of the equivalent continuous A-weighted sound pressure level over the reference time interval [T].
"Rating level, $L_{ar,T}$"	is the specific sound level plus any adjustments for the characteristic features of the sound (e.g., tonal, impulsive, or irregular components);
"Background noise level, $L_{A90,T}$"	is the sound pressure level of the residual noise that is exceeded for 90% of the time period T.

If the rated plant noise level is +10 dB or more above the pre-existing background noise level, then this indicates that complaints are likely to occur and that there will be a significant adverse impact. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.
Please refer to Section 6.1 of this document for details in relation to the recommended plant noise criteria for the development.

3.0 PROPG STAGE 1 – NOISE RISK ASSESSMENT

3.1 Methodology

The initial noise risk assessment is intended to provide an early indication of any acoustic issues that may be encountered. It calls for the categorisation of the site as a negligible, low, medium, or high risk based on the pre-existing noise environment.

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

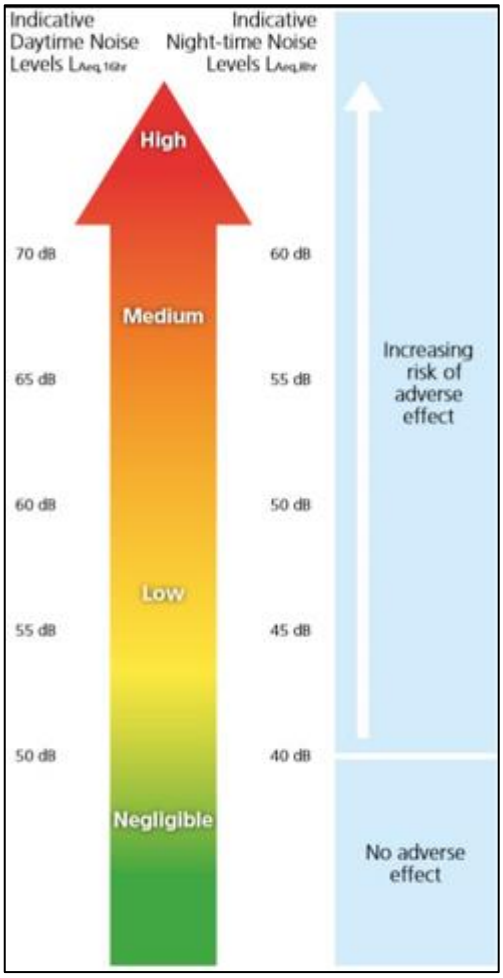
Paragraph 2.9 of ProPG states that,

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

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

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

Figure 6: ProPG Noise Risk Assessment



The ProPG advocates a risk-based approach to noise with a two-stage sequential approach, which is:

- *Stage 1 – an initial noise risk assessment of the proposed development site; and*
- *Stage 2 – a systematic consideration of four key elements –*
  Element 1 – demonstrating a 'Good Acoustic Design Process.
  Element 2 – observing internal 'Noise Level Guidelines'.
  Element 3 – undertaking an 'External Amenity Area Noise Assessment' and
  Element 4 – consideration of 'Other Relevant Issues'
- *The ProPG approach is underpinned by the preparation and delivery of an 'Acoustic Design Statement' (ADS), whereby the higher the risk the site, the more detailed the ADS. The ADS should address the following issues:*
- *Present the initial site noise risk assessment, including the pre-development acoustic conditions prior to development.*
- *Describe the external noise levels that occur across the site both before and after mitigation measures. The external post mitigation noise assessment should use an informed judgement of typical worst-case conditions.*
- *Demonstrate how good acoustic design is integrated into the overall design and how the proposed acoustic design responds to specific circumstances of the site.*

- *Confirm how the internal noise level guidelines will be achieved, including full details of the design measures, and building envelope specifications.*
- *A detailed assessment of the potential impact on occupants should be undertaken where individual noise events are expected to exceed 45 dB L_{AFmax} more than 10 times a night inside bedrooms.*
- *Priority should be given to enable the use of openable windows where practical across the development. Where this is not practical to achieve the internal noise level guidelines with windows open, then full details of the proposed ventilation and thermal comfort arrangements must be provided.*
- *Present the findings of the external amenity area noise assessment.*
- *Present findings of the assessment of other relevant issues.*
- *Confirm for a low-risk site, however adverse impacts of noise will be mitigated and minimised.*
- *Confirm for a medium or high noise risk site how adverse impacts of noise will be mitigated and minimised and clearly demonstrate that a significant adverse noise impact has been avoided.*

3.2 Environmental Noise Survey

Environmental noise surveys have been conducted in order to quantify noise emissions across the existing site. The external survey was conducted in general accordance with ISO1996-2:2017 Acoustics - Description, Measurement and Assessment of Environmental Noise -- Determination of Environmental Noise Levels. Specific details are set out in the following sections.

3.2.1 Methodology

An unattended environmental noise survey was conducted at the site from the 05th to the 06th of January 2020 by Traynor Environmental Ltd in order to quantify the existing noise environment. Additional attended 'spot' measurements were under-taken on the 05th to the 06th of January 2020. The approximate noise measurement locations were selected at the proposed site as shown in Figure 7.

The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measure-ments, in accordance with recommended practice and no drift was observed.

Measurements were taken in general accordance with BS 7445-1:2003 The Description and Measurement of Environ-mental Noise: Guide to quantities and procedures. Weather conditions during the survey period were observed as being dry with no showers. Anemometer readings confirmed that wind speeds were less than 2.2 – 4.9 m/s at all times during the surveys.

3.2.2 Measurement Parameters

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

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

L_{AFMax} is the maximum sound pressure level recorded during the sample period.

L_{AFMin} is the minimum sound pressure level recorded during the sample period.

L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

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

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to 2x10-5 Pa.

3.3 Survey Period

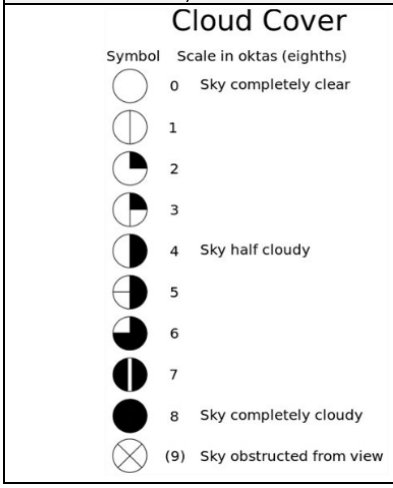
Noise levels were logged over 30-minute periods at each location,

Table 4: Instrumentation Details.

Instrumentation Details		
Manufacturer	**Instrument**	**Calibrated by**
Larson Davis Sound Expert 831	(Serial No.3913)	Environmental Measurements, Unit 12, Tallaght Business Park, Dublin 24
Larson Davis Sound Expert LxT	(Serial No.5901)	Environmental Measurements, Unit 12, Tallaght Business Park, Dublin 24
Larson Davis Sound Expert LxT	(Serial No.5595)	Environmental Measurements, Unit 12, Tallaght Business Park, Dublin 24

3.4 Weather Conditions

Table 5: Meteorological Conditions during the Survey – 05th - 06th January 2020

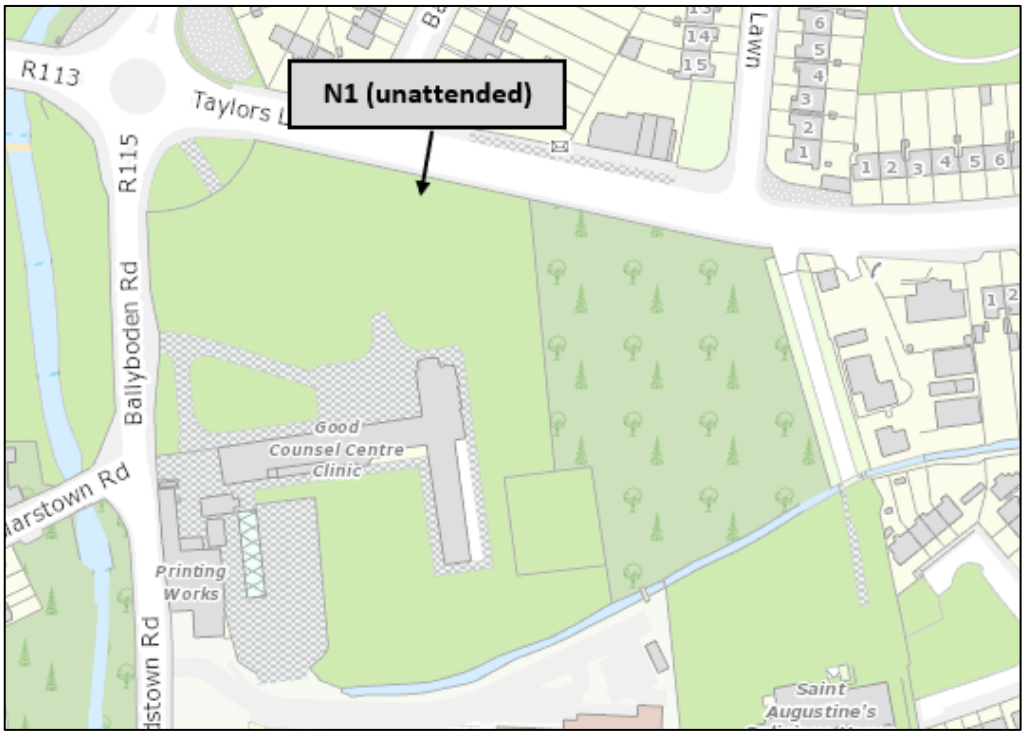
Date/Time	**Weather Conditions**		
	Description	**At the Start of Survey**	**On Completion**
05th - 06th January 2020	**Temperature**	**4 ℃**	**4 ℃**
	Precipitation	Showery	Showery
	Cloud cover	5	4
	Any fog/snow/ice	No	No
	Any damp roads/wet ground	Yes	Yes
	Wind Speed	2.2 m/s	4.9 m/s
	Wind Direction	South	South
	Any conditions that may cause temp, inversion (e.g., calm nights with no cloud)	No	No

3.5 Unattended Environmental Monitoring Noise Survey

3.5.1 Survey Location

Location No.1 (Unattended) – is located within the development to the north boundary of the site

Figure 7: Unattended – Long Term Noise Monitoring Location



3.5.2 Unattended – Long Term Environmental Noise Survey Results

Table below presents a summary of noise levels measured during the N1 unattended environmental noise survey for both day and night-time periods from 05th to the 06th of January 2020.

Table 6: Night-time N1 Unattended Measured Noise Levels

Date	Time	L_{AFeq}	L_{AFmax}	L_{AF10}	L_{AF90}
05-01-2020	23:00:00	45	56	49	39
05-01-2020	23:30:00	41	55	43	36
06-01-2020	00:00:00	38	45	40	35
06-01-2020	00:30:00	38	46	40	35
06-01-2020	01:00:00	37	45	39	34
06-01-2020	01:30:00	37	50	39	34
06-01-2020	02:00:00	36	46	39	33
06-01-2020	02:30:00	35	45	37	33
06-01-2020	03:00:00	40	53	42	35
06-01-2020	03:30:00	44	56	47	39
06-01-2020	04:00:00	45	58	48	38
06-01-2020	04:30:00	47	59	50	41
06-01-2020	05:00:00	52	64	56	43
06-01-2020	05:30:00	51	64	55	45
06-01-2020	06:00:00	53	62	57	48
06-01-2020	06:30:00	55	65	59	50
Average		**40**	**43**	**54**	**46**

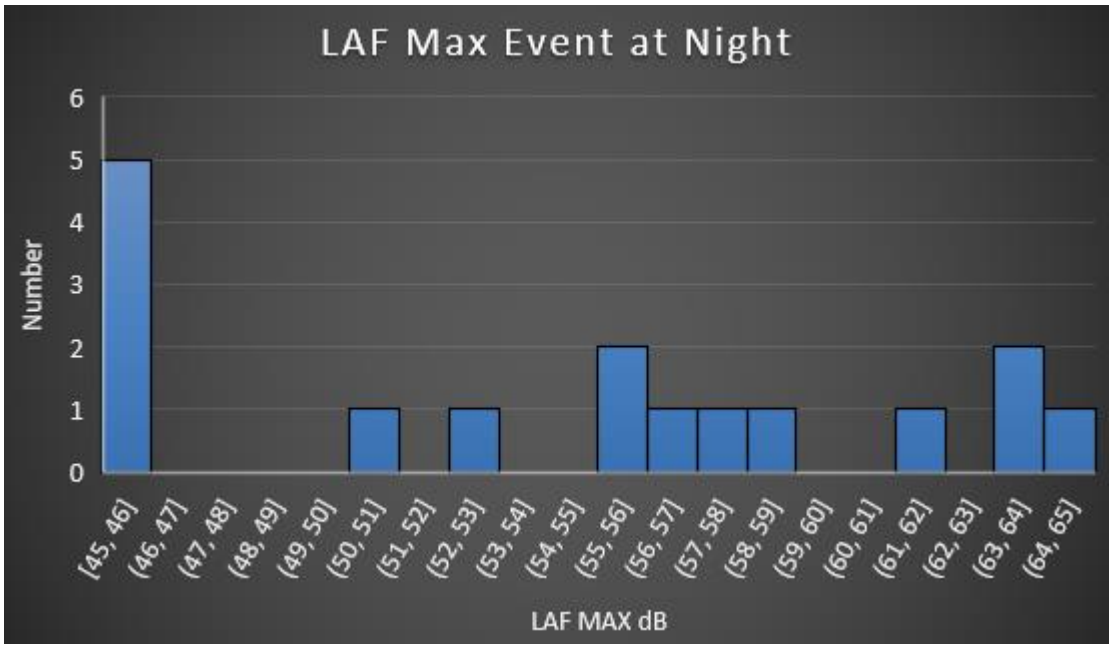
Table 7: Daytime N1 Unattended – Measured Noise Levels

Date	Time	L_{AFeq}	L_{AFmax}	L_{AF10}	L_{AF90}
06-01-2020	07:00:00	54	64	57	49
06-01-2020	07:30:00	52	61	55	49
06-01-2020	08:00:00	52	62	55	49
06-01-2020	08:30:00	53	65	54	49
06-01-2020	09:00:00	52	60	54	50
06-01-2020	09:30:00	53	66	55	50
06-01-2020	10:00:00	52	62	54	49
06-01-2020	10:30:00	51	59	53	49
06-01-2020	11:00:00	51	65	54	49
06-01-2020	11:30:00	50	58	51	48
06-01-2020	12:00:00	50	56	51	48
06-01-2020	12:30:00	50	60	51	48
06-01-2020	13:00:00	50	63	52	48
06-01-2020	13:30:00	51	58	52	49
06-01-2020	14:00:00	50	54	51	48
06-01-2020	14:30:00	49	64	50	48
06-01-2020	15:00:00	48	52	49	47
06-01-2020	15:30:00	48	55	49	47
06-01-2020	16:00:00	48	54	49	47
06-01-2020	16:30:00	49	61	50	47
06-01-2020	17:00:00	48	63	49	47
06-01-2020	17:30:00	48	52	49	48
06-01-2020	18:00:00	48	55	49	47
06-01-2020	18:30:00	48	52	49	47
06-01-2020	19:00:00	48	57	48	46
06-01-2020	19:30:00	46	50	47	45
06-01-2020	20:00:00	47	55	47	45
06-01-2020	20:30:00	45	54	46	44
06-01-2020	21:00:00	45	50	46	44
06-01-2020	21:30:00	44	47	45	43
06-01-2020	22:00:00	44	50	45	42
06-01-2020	22:30:00	42	49	44	40
Average		**49**	**57**	**50**	**47**

LAF_{max} values were measured at 30-minute intervals over the duration of the unattended monitoring surveys. Figures below presents the number of measured LAF_{max} events for various decibel levels during the night period.

Figure 8: LAF_{max} Monitoring Data for N1 Unattended – from 05/01/2020 – 06/01/2020

Figure 9: Distribution of the magnitude of L_{AFmax} events (N1 Unattended)



As can be seen the L_{AFmax} values typically range from 45 to 65dB during the night period at points N1 unattended.

In addition to the unattended monitor, various attended spot measurements were conducted around the site. The results of these measurements are presented in section below.

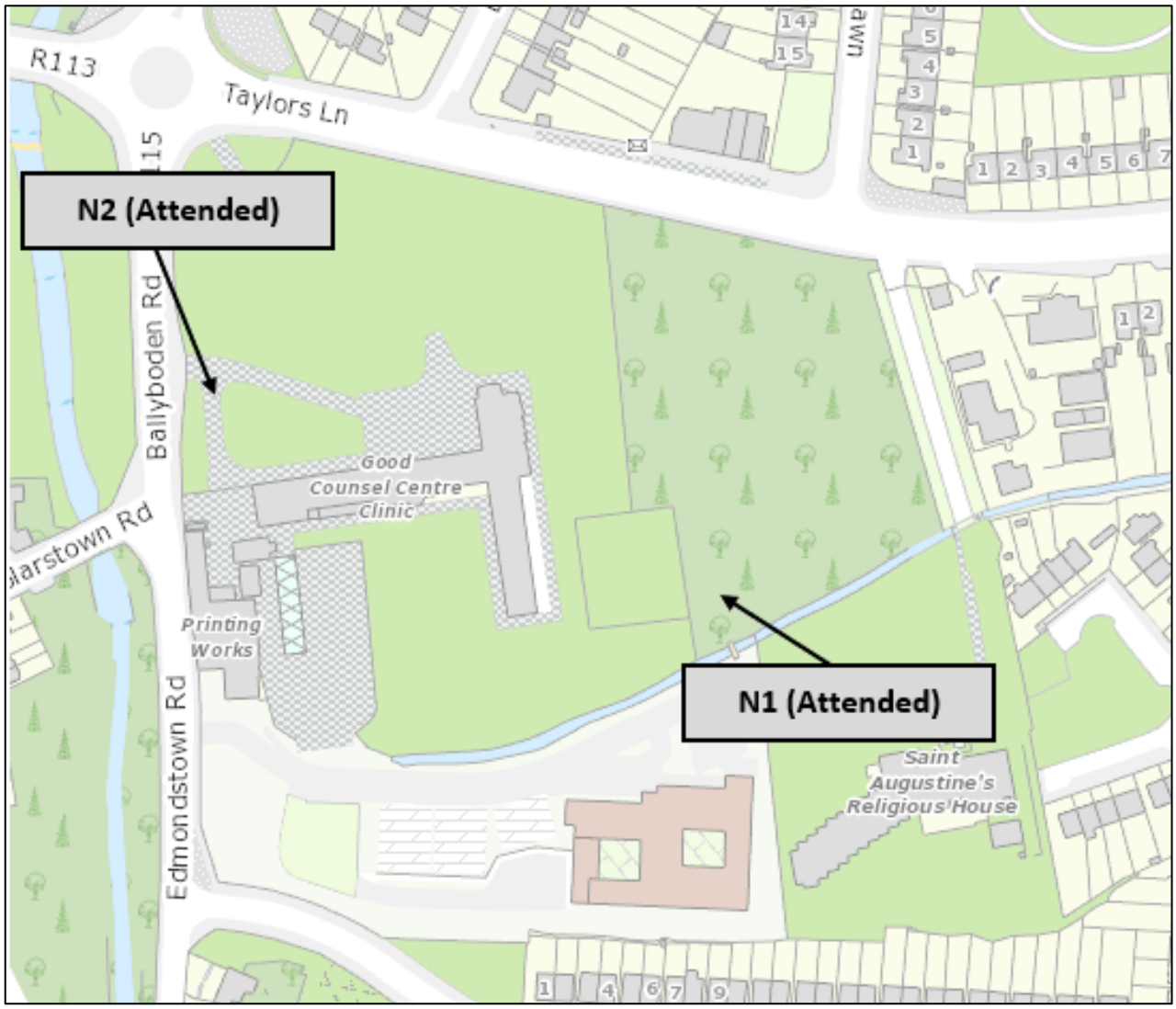
3.6 Attended Environmental Monitoring Noise Survey

3.6.1 Survey Location

Location No.1 (Attended) – is located within the development site to the south boundary of the site.

Location No.2 (Attended) - is located within the development to the east boundary of the site and is near the Edmondstown Road

Figure 10: Attended Noise Monitoring Locations



3.6.2 Attended – Short Term Monitoring Survey Results

Two attended measurement locations were selected as shown in figure 10 and the tables below. These were completed along with the unattended Environmental Noise Survey. Table below presents a summary of noise levels measured during the noise survey for both day and night-time periods from 05th to the 06th of January 2020.

Table 8: Noise Survey at Location No.1 Attended

Monitoring Location	Period	L_{Aeq}dB	L_{A10}dB	L_{A90}dB	L_{Amax}dB
Location No.1 Attended (Day)	12:00 - 12:30	49	51	47	56
	12:30 - 01:00	51	53	49	57
	01:00 - 01:30	50	52	48	56
	Average	**50**	**52**	**48**	**56**
Location No.1 Attended (Night)	00:00 – 00:30	37	39	35	52
	01:30 – 02:00	39	41	36	53
	Average	**38**	**40**	**36**	**53**

Table 9: Noise Survey at Location No.2 Attended

Monitoring Location	Period	L_{Aeq}dB	L_{A10}dB	L_{A90}dB	L_{Amax}dB
Location No.2 Attended (Day)	09:00 - 09:30	63	66	59	70
	09:30 - 10:00	62	66	57	71
	10:00 - 10:30	62	65	57	75
	Average	**63**	**66**	**58**	**72**
Location No.2 Attended (Night)	02:00 – 02:30	46	48	40	64
	02:30 – 03:00	44	45	40	64
	Average	**45**	**47**	**40**	**64**

Table 10: Noise Survey Summary (Daytime) Attended – Short Term Monitoring

Monitoring Location	L_{Aeq}dB	L_{A10}dB	L_{A90}dB	L_{Amax}dB
Location No.1 Attended	50	52	48	56
Location No.2 Attended	63	66	58	72

Table 11: Noise Survey Summary (Night-time) Attended – Short Term Monitoring

Monitoring Location	L_{Aeq}dB	L_{A10}dB	L_{A90}dB	L_{Amax}dB
Location No.1 Attended	38	40	36	53
Location No.2 Attended	45	47	40	64

The noise climate at the site is dominated by road traffic noise from Taylors Lane Road to the north, and Edmondstown Road to the west of the site. Background noise from people walking on the footpaths to the north and east of the site was also noise

source at the proposed site. During the survey traffic flow on the neighbouring roads was noted as being continuous during the daytime and frequent at night-time.

3.7 Noise Model of Site

3.7.1 Methodology

Proprietary noise calculation software was used for the purposes of establishing the prevailing noise levels on the proposed site. The selected software, NoisePLAN, calculates noise levels in on the Department of Transport Calculation of Road Traffic Noise (CoRTN) and ISO 9613 noise propagation methodology.

The following information was included in the model:

- Site layout drawings of the proposed development.
- OS mapping of the surrounding environment, and
- Topographical survey data for the development and adjacent road.

3.7.2 Model Validation

Noise levels recorded during the environmental noise survey were used to calibrate the noise model. It is considered that a strong correlation in respect of predicted noise levels has been achieved.

Table 12-13 details the results of the noise model predictions and compares them to the measured values at each survey location.

Table 12: Daytime Modelled vs. Monitored Results L_{Aeq}, T

Monitoring Position	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between modelled and measured noise level (dB)
N1 Unattended	49	51	2
N1 Attended	50	48	2
N2 Attended	63	62	1

All values are sound pressure levels in dB re: 2x 10-5 Pa.

Table 13: Night-time Modelled vs. Monitored Results L_{Aeq}, T

Monitoring Position	Monitored L_{Aeq}	Modelled L_{Aeq}	Difference between modelled and measured noise level (dB)
N1 Unttended	40	42	2
N1 Attended	38	40	2
N2 Attended	45	46	1

All values are sound pressure levels in dB re: 2x 10-5 Pa.

As all of the verification points show a divergence between monitored and modelled results of no more than 3 dB, the models are considered suitably verified.

3.7.3 Noise Model Output

To assess the initial noise risk assessment across the development site the noise model has been used to prepare noise contour maps for both daytime and night-time periods. These maps are presented in Figures 11 to 14.

Figure 11: Daytime Noise Levels Undeveloped Site

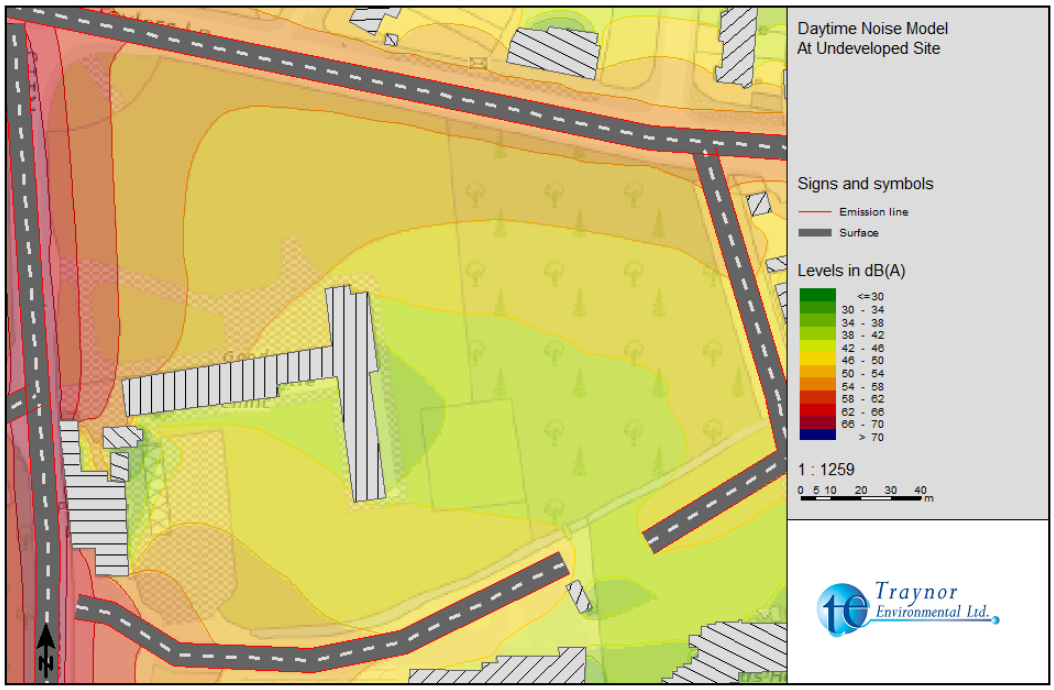


Figure 12: Night-time Noise Levels Undeveloped Site

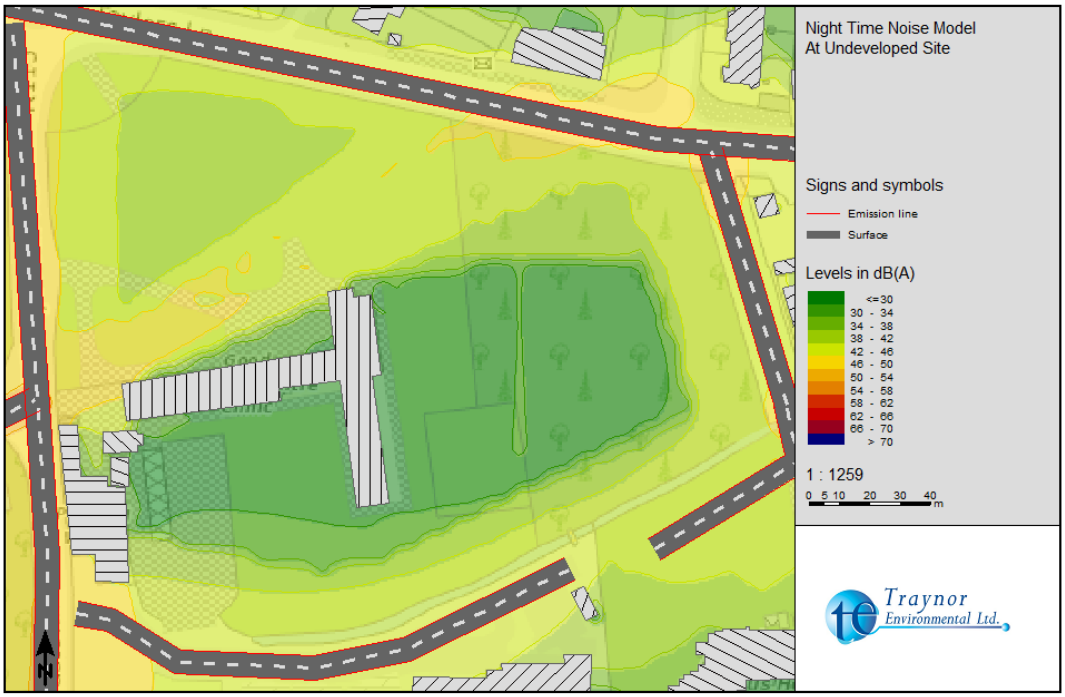


Figure 13: Daytime Noise Levels at Developed Site

Figure 14: Night-time Noise Levels at Developed Site

3.8 Noise Risk Assessment Conclusion

Considering the measured and predicted noise levels presented in the previous sections the initial site noise risk assessment has concluded that the level of risk across the site varies from low to medium noise risk.

Additionally, the Stage 1 Noise Risk Assessment requires analyses of the LAF_{max} noise levels. In the case of the Traynor Environmental Ltd survey the LAF_{max} noise levels typically ranged from 45 to 65 dB during the night. The results indicate that there is not the potential for LAF_{max} noise levels to exceed 80 dB more than 20 times per night at the site. ProPG recommends that a site is considered as high risk if the LAF_{max} noise levels exceed 80 dB more than 20 times per night. The proposed site is not considered as high risk.

The results indicate that there is the potential for LAF_{max} noise levels to exceed 60 dB more than 10 times per night for which ProPG recommends that the site should not be regarded as negligible risk.

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

Low Risk	*At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.*
Medium Risk	*As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.*

Given the above it can be concluded that the development site may be categorised as low to medium risk and as such an Acoustic Design Strategy will confirm how the adverse impacts of noise will be mitigated and minimised and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.

It should be noted that ProPG states the following with regard to how the initial site noise risk is to be used,

"2.12 It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner, and the decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced. Thus, a site considered to be high risk will be recognised as presenting more acoustic challenges than a site considered as low risk. A site considered as negligible risk is likely to be acceptable from a noise perspective and need not normally be delayed on noise grounds. A potentially problematical site will be flagged at the earliest possible stage, with an increasing risk indicating the increasing importance of good acoustic design."

Therefore, following the guidance contained in ProPG does not preclude residential development on sites that are identified as having low or medium noise levels. It merely identifies the fact that a more considered approach will be required to ensure the developments on the higher risk sites are suitable designed to mitigate the noise levels. The primary goal of the approach outlined in ProPG is to ensure that the best possible acoustic outcome is achieved for a particular site.

4.0 ProPG STAGE 2 – ACOUSTIC DESIGN STATEMENT

4.1 Element 1 – Good Acoustic Design Process

4.1.1 ProPG Guidance

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

Section 2.23 of the ProPG outlines the following checklist for Good Acoustic Design (GAD):

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

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

4.1.2 Application of GAD Process to Proposed Application

Relocation or Reduction of Noise from Source

The Taylors Lane Road and Edmondstown Road is located outside the redline boundary of the site and therefore it is beyond the scope of this development to introduce any noise mitigation at source.

Planning, Layout and Orientation

Mitigating against noise from the neighbouring roads has formed an integral part of the design process. This exercise established that the most appropriate and beneficial form of mitigation is the positioning of the buildings facing Taylors Lane Road and Edmondstown Road to act as a barrier.

Select Construction Types for meeting Building Regulations

Masonry constructions will be used in constructing the external walls of the development. This construction type offers high levels of sound insulation performance. However, as is typically the case the glazed elements and ventilation will be the weakest elements in the façade in terms of sound insulation performance.

Consideration will therefore be given to the provision of upgraded glazing and mechanical ventilation. The proposal here will be to provide dwelling units with glazed elements that have good acoustic insulation properties so that when the windows are closed the noise levels internally are good.

In order to ensure indoor air-quality, a mechanical ventilation system with heat recovery will be utilised as per Part F of the Building Regulations, providing the requisite air changes per hour. The fresh air provided to all the apartments is tempered and

filtered as part of the delivery process. Residents will not need to open their windows in terms of providing fresh air. In terms of extract, all of the bathrooms, kitchens and utility spaces will be exhausted to the outside via the mechanical ventilation system on a continuous basis. Inhabitants will be able to open the windows if they wish, however, doing so will increase the internal noise level. This approach to mitigation is supported in ProPG where it states the following:

2.22 Using fixed unopenable glazing for sound insulation purposes is generally unsatisfactory and should be avoided; occupants generally prefer the ability to have control over the internal environment using openable windows, even if the acoustic conditions would be considered unsatisfactory when open. Solely relying on sound insulation of the building envelope to achieve acceptable acoustic conditions in new residential development, when other methods could reduce the need for this approach, is not regarded as good acoustic design. Any reliance upon building envelope insulation with closed windows should be justified in supporting documents "

Note 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g., trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal LAeq target levels should not normally be exceeded

2.34 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 LAeq target levels should not normally be exceeded

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

The good acoustic design measures that have been implemented on site, e.g., placing outdoor space on the quiet side of buildings, are considered to be cost neutral and do not have any significant impact on other issues.

Assess Viability of Alternative Solutions

It is considered that type 2 glazing (sound insulation performance of 37dB Rw) predominately relates to the living spaces of the blocks along the Taylors Lane Road and Edmondstown Road. For all other property facades, glazing Type 1 and standard glazing units provide a sufficient level of sound insulation would be effective providing, they comply with industry standard.

Assess External Amenity Area Noise

ProPG provides the following advice with regards to external noise levels for amenity areas in the development:

"The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB LAeq,16hr."

In general, it is expected to achieve daytime noise levels of the order of 55 dB LAeq,16hr or lower at ground level. Referring to the guidance in ProPG this level of external noise would be considered to offer good amenity for an outdoor space.

There are communal open spaces and public open spaces onsite. Figure 15 & 16 illustrates that the open spaces. The vast majority of the open spaces achieves a noise level ≤ 55 dB LAeq,16hr.

Figure 15: Public Open Space

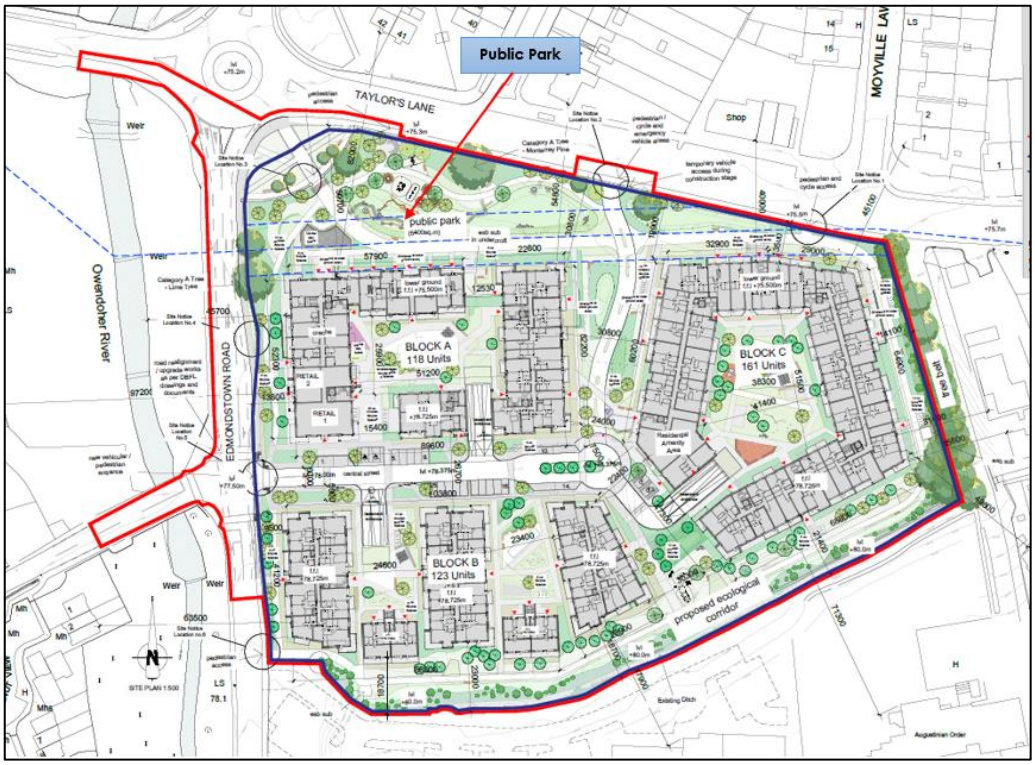
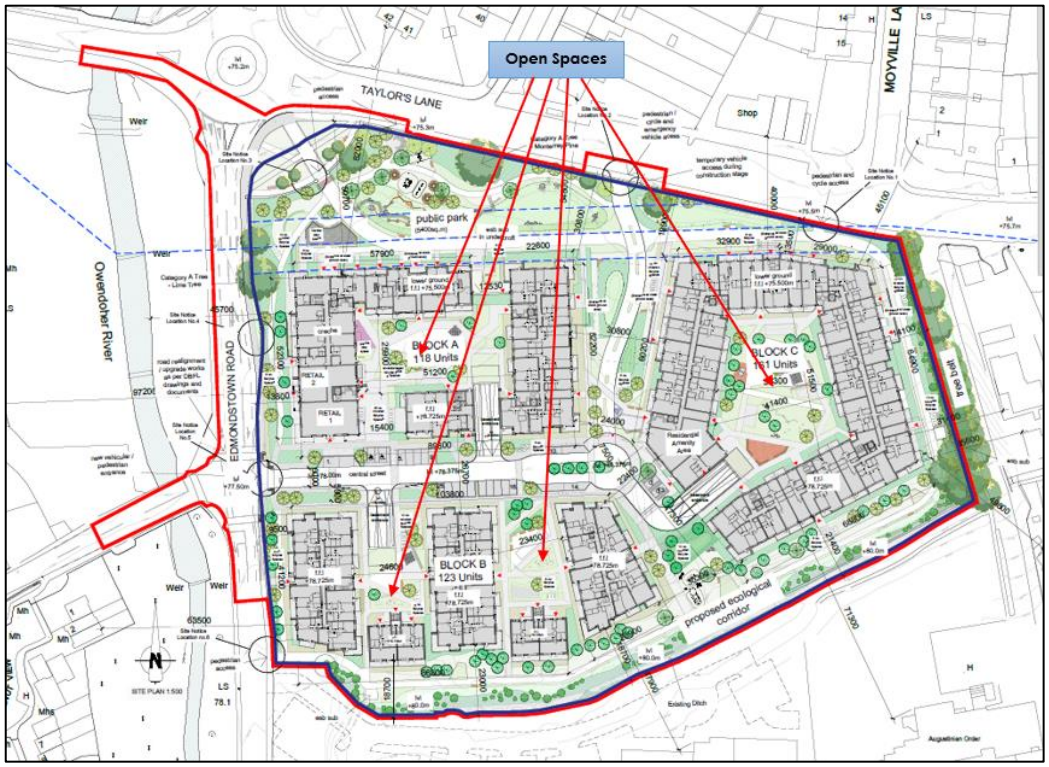


Figure 16: Open Spaces



Summary

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

In terms of viable alternatives to acoustic treatment of façade elements, there are no further options for mitigation outside of proprietary glazing and mechanical ventilation.

4.2 Element 2 – Internal Noise Guidelines

4.2.1 Internal Noise Criteria

Element 2 of the ProPG document sets out recommended internal noise targets derived from BS 8233 and WHO's Community Noise Guidelines. The recommended indoor ambient noise levels are set out in Table 14 and are based on annual average data, that is to say they omit occasional events such as New Year's Eve.

Table 14: ProPG Internal Noise Levels

Activity	Location	(07:00 to 23:00hrs)	(23:00 to 07:00hrs)
Resting	Living room	35 dB LAeq,16hr	-
Dining	Dining room/area	40 dB LAeq,16hr	-
Sleeping (daytime resting)	Bedroom	35 dB LAeq,16hr	30 dB LAeq,8hr 45 dB Lama, T*

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

Considering the external noise levels, it will be necessary to use glazing and mechanical ventilation to meet the recommended internal noise levels.

In terms of the ventilation strategy, it is understood that the air supply will be via mechanical ventilation which typically provides a sound insulation performance substantially improved over passive in-frame or wall vents.

4.2.2 Façade Levels

Table 15 along with Figures 17 and 18 present the noise levels predicted to be incident on the façade during:

1. Day periods (16hr) when developed.
2. Night-time periods (8hr) when developed.

Figure 17: Designation of Predicted Noise Levels for Each Façade (Lower Levels)

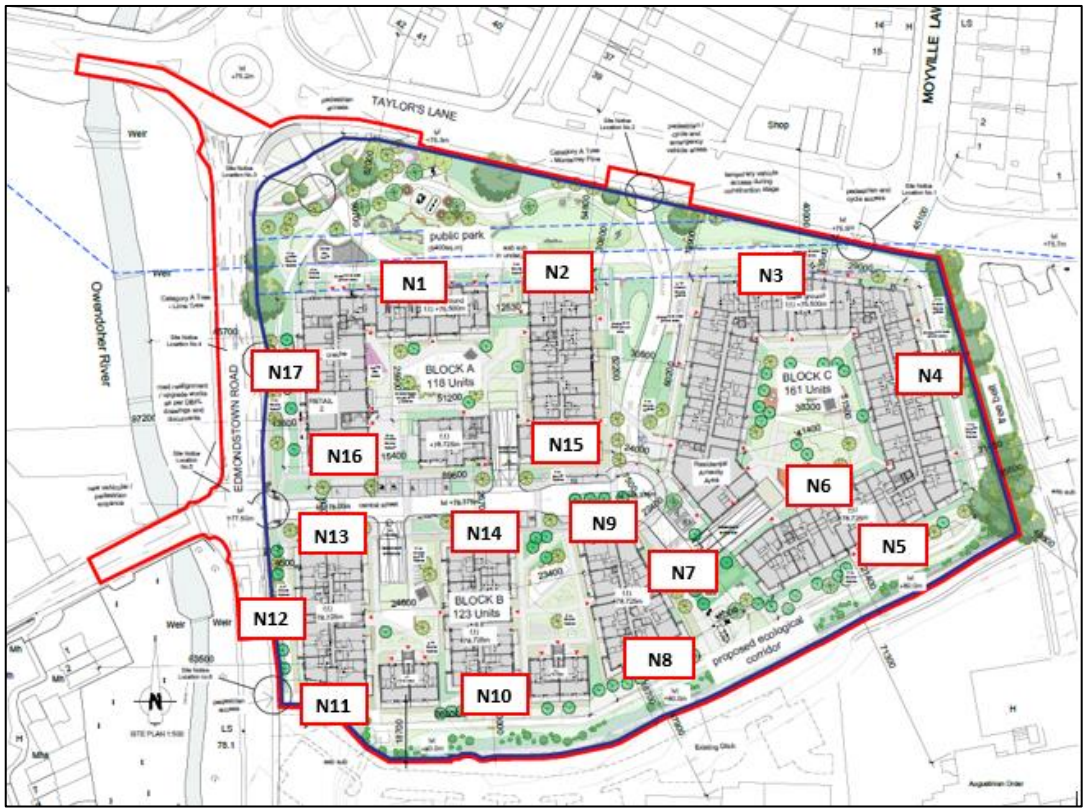


Figure 18: Designation of Predicted Noise Levels for Each Façade (Upper Levels)

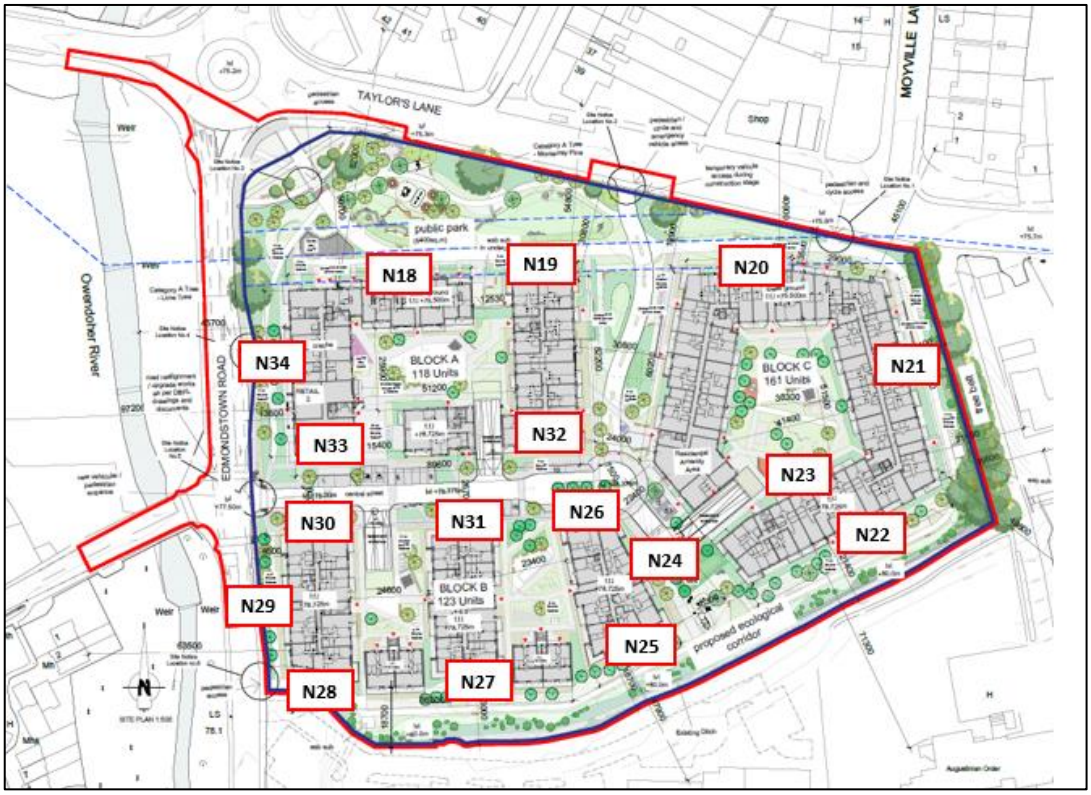


Table 15: Summary of Predicted Façade Noise Levels

Ref	Period	LAeq, T dB
N1	Day (16hr)	56
	Night (8hr)	42
N2	Day (16hr)	53
	Night (8hr)	42
N3	Day (16hr)	56
	Night (8hr)	44
N4	Day (16hr)	50
	Night (8hr)	45
N5	Day (16hr)	46
	Night (8hr)	40
N6	Day (16hr)	31
	Night (8hr)	22
N7	Day (16hr)	40
	Night (8hr)	26
N8	Day (16hr)	48
	Night (8hr)	44
N9	Day (16hr)	46
	Night (8hr)	21
N10	Day (16hr)	51
	Night (8hr)	43
N11	Day (16hr)	60
	Night (8hr)	49
N12	Day (16hr)	66
	Night (8hr)	48
N13	Day (16hr)	58
	Night (8hr)	42
N14	Day (16hr)	33
	Night (8hr)	15
N15	Day (16hr)	32
	Night (8hr)	18
N16	Day (16hr)	59
	Night (8hr)	49
N17	Day (16hr)	65
	Night (8hr)	48
N18	Day (16hr)	58
	Night (8hr)	41
N19	Day (16hr)	54
	Night (8hr)	43
N20	Day (16hr)	56
	Night (8hr)	44
N21	Day (16hr)	52
	Night (8hr)	46
N22	Day (16hr)	49
	Night (8hr)	34
N23	Day (16hr)	35
	Night (8hr)	20
N24	Day (16hr)	42
	Night (8hr)	29
N25	Day (16hr)	50
	Night (8hr)	36
N26	Day (16hr)	48
	Night (8hr)	24
N27	Day (16hr)	52

	Night (8hr)	41
N28	Day (16hr)	61
	Night (8hr)	46
N29	Day (16hr)	65
	Night (8hr)	49
N30	Day (16hr)	59
	Night (8hr)	33
N31	Day (16hr)	39
	Night (8hr)	20
N32	Day (16hr)	37
	Night (8hr)	23
N33	Day (16hr)	60
	Night (8hr)	50
N34	Day (16hr)	65
	Night (8hr)	51

4.2.4 Proposed Façade Treatment

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

The Standard allows the acoustic performance of the building to be assessed considering the following:

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

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

Glazing

As is the case in most buildings, the glazed elements of the building envelope are typically the weakest element from a sound insulation perspective. In this instance it has been calculated that the various facades are to be provided with glazing that, when closed, achieve the minimum sound insulation performance as set out in Table 16.

On review of the calculated noise levels across the development site over day and night-time periods, two glazing specifications have been determined for the residential properties to achieve the recommended internal noise levels for day and night-time periods within living rooms and bedrooms.

Table 16: Required Sound Insulation Performance Per Octave Band for The Glazing Specification

Glazing Specification	Octave Band Centre Frequency (Hz)							Overall Rw
	63	125	250	500	1k	2k	4k	
Type 1	15	17	21	30	38	36	35	**33**
Type 2	23	26	27	34	40	38	46	**37**

Figure 19: Façade Designations

As is the case in most buildings, the glazed elements of the building envelope are typically the weakest element from a sound insulation perspective. Glazing Type 1 offers a minimum sound insulation performance of 33dB Rw. A standard thermal double-glazed system will typically achieve this level of performance -Type 2 provides an enhanced sound insulation performance of 37dB Rw or greater.

Figure 19 above show the recommended location of glazing types proposed. Type 2 glazing predominately relates to the living spaces of blocks along the Taylors Lane Road and Edmondstown Road. For all other property facades, glazing Type 1 and standard glazing units provides a sufficient level of sound insulation.

It is important to note that the acoustic performance specifications detailed herein are minimum requirements which apply to the overall glazing system. In the context of the acoustic performance specification the 'glazing system' is understood to include any and all of the component parts that form part of the glazing element of the façade, i.e., glass, frames, seals, openable elements etc.

The assessment has demonstrated that the recommended internal noise criteria can be achieved through consideration of the proposed façade elements at the design stage. The calculated glazing specifications are preliminary and are intended to form the basis for noise mitigation at the detailed design stage. Consequently, these may be subject to change as the project progresses.

Wall Construction

In general, all wall constructions (i.e., block work or concrete) offer a high degree of sound insulation, much greater than that offered by the glazing systems. Therefore, noise intrusion via the wall construction will be minimal. The calculated internal noise levels across the building façade have assumed a minimum sound reduction index of 50 dB Rw for this construction.

Internal Noise Levels

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

4.3 Element 3 – External Amenity Area Noise Assessment

In general, at ground level. Referring to the guidance in ProPG this level of external noise would be considered to offer good amenity for an outdoor space.

As previously discussed, the development is expected to achieve daytime noise levels of the order of 55 dB LAeq,16hr or lower. In terms of the external area the majority of this area achieves a noise level of ≤ 55 dB LAeq,16hr.

4.4 Element 4 – Assessment of Other Relevant Issues

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

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

Each is discussed in turn below.

4.4.1 Compliance with Relevant National and Local Policy

There are no National policy documents relating to the acoustic design of residential dwellings. Locally South Dublin County Council Air Quality Monitoring and Noise Control Unit has produced a Good Practice Guide for Construction and Demolition.

In relation to Noise at Planning Stage the South Dublin County Development Plan 2022 – 2028 specifies that South Dublin County Council will give careful consideration to the location of noise-sensitive developments, including the horizontal and vertical layout of apartment schemes, so as to ensure they are protected from major noise sources where practical.

4.4.2 Magnitude and Extent of Compliance with ProPG

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

- All dwellings as part of the development have been designed to achieve the good level of internal noise levels specified within ProPG.
- All external amenity areas have been shown to have an external noise level that complies with the recommended criterion set out in ProPG.

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

4.4.3 Likely Occupants of the Development

The proposed development will be occupied by occupants for the full year. The criteria adopted in this assessment is based upon criteria recommended for long- term/permanent dwellings and therefore considered appropriate.

4.4.4 Acoustic Design v Unintended Adverse Consequences

Design measures taken to reduce intrusion by noise have not had any unintended adverse consequences for the proposed development or the nearby environment.

4.4.5 Acoustic Design v Wider Planning Objectives

This assessment has demonstrated the living areas of the proposed development will achieve a good internal noise environment.

4.5 Predicted Impact

4.5.1 Proposed Development on Existing Noise Sensitive Locations

Based on the existing environmental noise results, it was considered reasonable to assume that the majority of local NSLs will not find a noticeable change to the ambient sound character from the Proposed Development during the operational phase.

4.5.2 Construction Impact on Existing Noise Sensitive Locations

The Site is in close proximity to offsite NSLs therefore there is the potential for the exceedance of construction phase limits during the construction phase. However, best practice methods and noise mitigation principles within this document will ensure compliance with the construction limits.

4.5.3 Impact of the Existing Environment on the Proposed Development

The existing environment is dominated by traffic on the Taylors Lane Road and Edmondstown Road to the north and west of the site. There is also background noise from people walking on neighboring footpaths. The proposed development utilising acoustic design as per ProPG to minimise impacts of noise on proposed residential developments has shown the proposed development will not be adversely impacted by the existing environment.

4.6 Acoustic Design Statement Conclusion

An initial site noise risk assessment has been carried out on the proposed residential development at Taylors Lane, Ballyboden, Dublin 16. The assessment has classified the development site as having a range of noise risks associated ranging from low - medium risk. This was determined through a combination of measurements of noise levels on site and through the development of noise models of the site and surrounds.

Further discussion is presented in terms of the likely noise impact of both the external and internal areas of the proposed development. It has been found that the majority of the inhabitants will have access to open spaces that achieve daytime noise levels of the order of 55 dB LAeq,16hr or lower. All habitable rooms will achieve a good internal noise environment with the enhanced acoustic glazing and mechanical ventilation.

5.0 OPERATIONAL PHASE

The potential noise impacts associated with the operational phase of the proposed development are discussed in the following sections.

5.1 Noise

There are eight primary potential sources of noise associated with the development once operational these are:

- Additional vehicular traffic on public roads
- Inward Noise Impact
- Mechanical plant noise.
- Residential
- Retail Units
- Creche

Each of these primary noise sources is addressed in turn in the following sections.
Note there is no significant source of vibration associated with the operational phase of the proposed development.

5.1.2 Additional Traffic on Adjacent Roads

During the operational phase of the proposed development, there will be a slight increase in vehicular traffic associated with the site on some surrounding roads. With the scale of this development, the predicted change in noise level associated with additional traffic accessing the proposed development, for the existing road network, has a negligible effect.

5.1.3 Inward Noise Impact

An assessment of the inward noise impact from road traffic sources has been carried out. In summary the noise levels across the site ranges from low to medium noise risk in accordance with the guidance in ProPG.

5.1.4 Mechanical Plant

It is expected that the principal items of building and mechanical plant noise will be associated with the proposed Retail Units and & Creche. These items will be selected at a later stage, however, they will be designed and located so that there is no negative impact on sensitive receivers within the development itself. The services plant will be designed/attenuated to meet the relevant plant noise criteria for day and night-time periods at nearby sensitive receivers as set out in table 1.

Considering the recommendation from BS 4142 that if the plant noise level does not exceed the background sound level it is an indication of a low impact, it is recommended in this instance that noise emissions from all plant installed on site (considered cumulatively) do not exceed the background noise levels on site.

It is understood that various external plant items are proposed for the development. These items of plant have the potential to emit noise to the environment and consequently an exercise should be undertaken at detailed design stage to ensure that the finalised items of plant do not exceed the proposed noise thresholds.

5.1.5 Residential

The noise impact of the residential aspect of the development on the receiving environment will be slight. It will be limited to internal vehicle movements entering and exiting the carparking areas and residents using open areas.

5.1.6 Retail Units

The retail units of the development will have a potential noise impact on the residential aspect of the development; however, this aspect of the development will not occur during the night-time period. The main noise associated with a commercial premises is from deliveries by lorries or vans. External speakers shall not be used at any of the retail units. All deliveries will be only permitted between 07:00hrs – 19:00hrs, to ensure that this activity does not impact the more sensitive night-time period. retail units shall be posted appropriate signage to this effect.

Retail units shall be designed and insulated to ensure a high degree of sound insulation between adjoining rooms. Mechanical services associated with these areas will be selected with low noise/vibration capabilities.

5.1.7 Creche

The Creche which is located to the east of the site will serve the residents of the development. The opening hours of the creche is expected to be from 7am – 7pm Monday to Friday. No early morning noise associated with the creche is expected before 7am. The noise of children playing in any environment is regarded as a natural aspect of life in any area of a development.

Considering that sensitive receivers within the development are much closer than off-site sensitive receivers, once the relevant noise criteria is achieved within the development it is expected that there will be no negative impact at sensitive receivers off site.

6.0 CONSTRUCTION PHASE

A variety of items of plant will be in use for the purposes of site clearance/groundworks and construction/demolition. There will be vehicular movements to and from the site that will make use of existing access. Due to the nature of these activities, there is potential for the generation of elevated levels of noise.

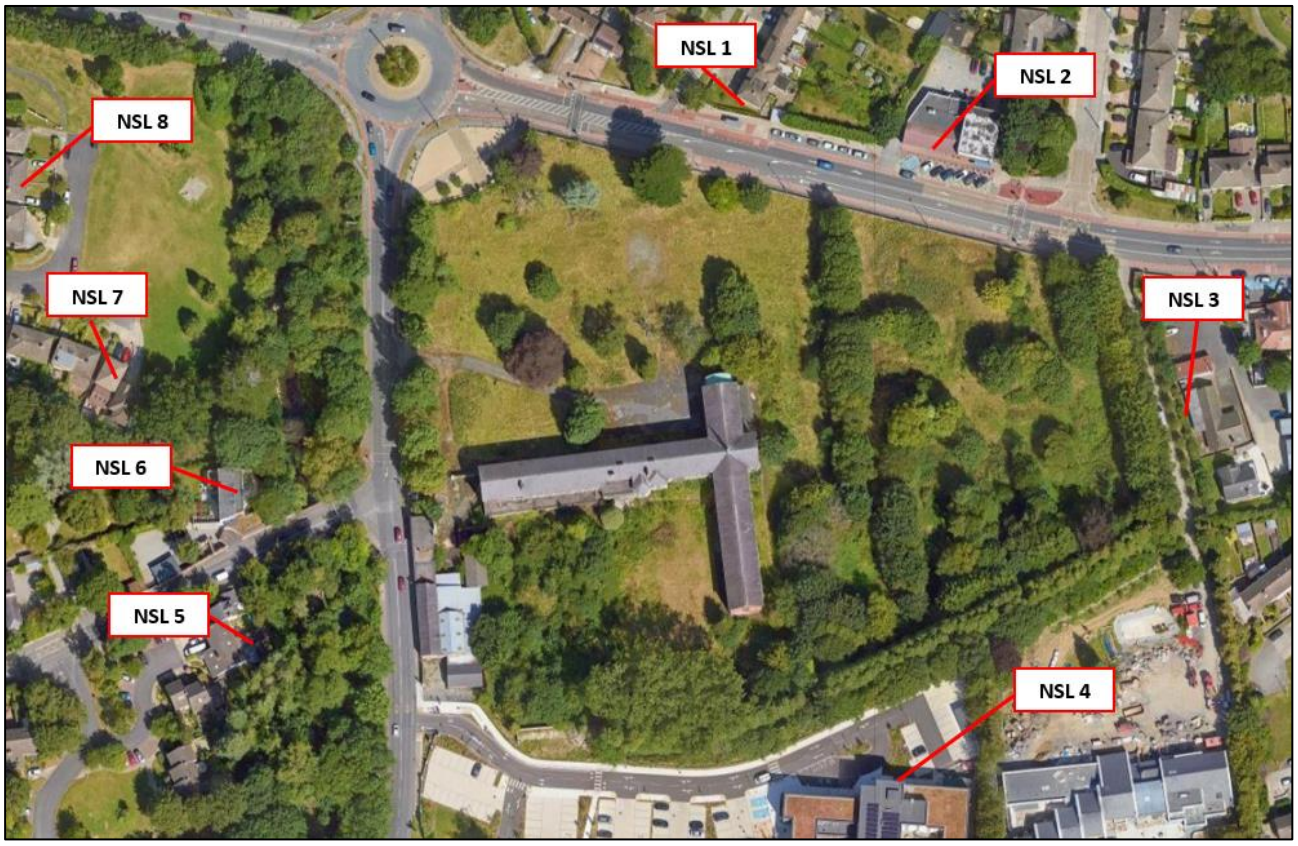
During the construction phase which includes demolition, it is anticipated that there will be a number of HGV's to/from site. Excavators will be employed to move existing ground for foundation work following which standard construction tools and methods will be employed for general construction and landscaping.

The closest noise sensitive locations (NSL) have been identified as shown in Figure 20 and described below in table 17.

Table 17: Description of NSLs and Noise Levels

Noise Sensitive Locations	Description
Location NSL1	This represents residential dwelling to the north of the proposed site approximately 24m from the potential nearest significant site work.
Location NSL2	This represents commercial units along the Taylors Lane Road to the north of the proposed site approximately 25m from the potential nearest significant site work.
Location NSL3	This represents residential dwellings to the east of the proposed site approximately 13m from the nearest significant site work.
Location NSL4	This represents Ballyboden Medical Practice in located to the south of the proposed site approximately 35m from the nearest significant site work.
Location NSL5	This represents residential dwellings located to the east of the proposed site approximately 52m from the nearest significant site work
Location NSL6	This represents a residential dwelling located to the east of the proposed site approximately 53m from the potential nearest significant site work.
Location NSL7	This represents residential dwellings located at The Rise Housing Estate to the east of the proposed site approximately 87m from the nearest significant site work
Location NSL8	This also represents residential dwellings located at The Rise Housing Estate to the east of the proposed site approximately 120m from the potential nearest significant site work.

Figure 20: Site Context & Noise Assessment Locations



A review of the baseline noise survey and the threshold values detailed in Table 2 indicates that the daytime noise guidance limit for construction/demolition noise is 65dB LAeq. It is assumed that construction/demolition works will take place during normal working hours only. During the construction/demolition phase of the proposed development, a variety of items of plant will be in use, such as excavators, dumper trucks, compressors and generators.

Due to the nature of daytime activities undertaken on a construction site of this nature, there is potential for generation of significant levels of noise. The flow of vehicular traffic to and from a construction site is also a potential source of relatively high noise levels.

Taking into account the outline construction/demolition programme, it is possible to predict typical noise levels using guidance set out in BS 5228-1:2009+A1:2014. Table 18 outlines typical plant items and associated noise levels that are anticipated for various phases of the construction programme.

Table 18: Predicted Noise Levels from Key Pieces of Equipment

Activity	Item of Plant (BS5228 Ref)	Noise level at 10m Distance (dB $L_{Aeq\ (1hour)}$)
Site Preparation	Wheeled Loader Lorry (D3 1)	75
	Track Excavator (C2 22)	72
	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
	Cumulative Site Preparation	82
Demolition Phase	Pulveriser on Tracked Excavator (C1.5)	72
	Tracked Crusher (C1.14)	82
	Pulveriser on Tracked Excavator (C1.4)	76
	Dump Truck (C2.30)	79
	Diesel Generator (C4.76)	61
	Cumulative Demolition	85
General Construction	Dump Truck (C2.30)	79
	Tracked excavator (02.21)	71
	Compressor (D7.08)	70
	Telescopic Handler (C4.54)	79
	Handheld Circular Saw (C4.72)	79
	Diesel Generator (C4.76)	61
	Internal Fit out	70
	Cumulative General Construction	84
Road Works/Landscaping	Asphalt Paver & Tipping Lorry (C5.30)	75
	Electric Water Pump (C5.40)	68
	Vibratory Roller (C5.20)	75
	Cumulative General Landscaping and Road Work	78

The calculations also assume that the equipment will operate for 66% of the 12-hour working day (i.e. 8 hours) and that a standard site hoarding, typically 2.4m height will be erected around the perimeter of the construction site for the duration of works. It is assumed that construction works will take place during normal working hours only.

It is possible to predict indicative noise levels using guidance set out in BS 5228- 1:2009+A1:2014 for the main phases of the proposed construction works. Table 19 summarises the construction noise prediction calculations at the nearest residences (i.e., NSL3, 13m from the residence to the outline plan of the proposed Apartment block). The predictions assume a 66 % on-time for all items of plant (i.e., the items of plant are operational for 8 of the 12-hour period).

Table 19: Indicative Construction Noise Levels at Nearest Noise Sensitive Locations

Construction Phase	Item of Plant (BS5228-1 Ref)	L_{Aeq} at distance (m)							
		NSL1	NSL2	NSL3	NSL4	NSL5	NSL6	NSL7	NSL8
		24m	25m	13m	35m	52m	54m	87m	120m
		dB	dB	dB	dB	dB	dB	dB	dB
Site Preparation	Wheeled Loader Lorry (D3 1)	64	63	70	61	59	59	56	55
	Track Excavator (C2 22)	61	60	67	58	56	56	53	52
	Dozer (C2.13)	67	66	73	63	61	61	58	57
	Dump Truck (C4.2)	67	66	73	63	61	61	58	57
	Cumulative Site Preparation	**71**	**70**	**77**	**68**	**66**	**66**	**63**	**62**
Demolition Phase	Pulveriser on Tracked Excavator (C1.5)	61	60	67	58	56	56	53	52
	Tracked Crusher (C1.14)	73	72	79	68	66	66	63	62
	Pulveriser on Tracked Excavator (C1.4)	67	66	73	62	60	60	57	56
	Dump Truck (C2.30)	68	67	74	65	63	63	60	59
	Diesel Generator (C4.76)	50	49	56	47	45	45	42	41
	Cumulative Demolition	**74**	**73**	**80**	**71**	**69**	**69**	**66**	**65**
General Construction	Dump Truck (C2.30)	68	67	74	65	63	63	60	59
	Tracked excavator (02.21)	60	59	66	57	55	55	52	51
	Compressor (D7.08)	59	58	65	56	54	54	51	50
	Telescopic Handler (C4.54)	68	67	74	64	62	62	59	58
	Handheld Circular Saw (C4.72)	68	67	74	64	62	62	59	58
	Diesel Generator (C4.76)	50	49	56	47	45	45	42	41
	Internal Fit out	59	58	65	56	54	54	51	50
	Cumulative General Construction	**73**	**72**	**79**	**70**	**68**	**68**	**65**	**64**
Road Works/ Landscaping	Asphalt Paver & Tipping Lorry (C5.30)	64	63	70	61	59	59	56	55
	Electric Water Pump (C5.40)	57	56	63	54	52	52	49	48
	Vibratory Roller (C5.20)	64	63	70	61	59	59	56	55
	Cumulative General Landscaping and Road Work	**67**	**66**	**73**	**64**	**62**	**62**	**59**	**58**

Taking into account these assumptions and allowing for the attenuation of sound over distance, the predicted construction noise level at the nearest sensitive properties is above the relevant construction noise criteria, i.e. the level at which a potential significant impact could be expected to occur, at noise sensitive locations within 120m of site work. Also, considering the proximity of NSL1 (approx. 25m at nearest point), NSL2 (approx. 25m at nearest point) and NSL3 (approx. 13m at nearest point) has a potential significant impact at all construction phases. Also, NSL4 and NSL6 (approx. 35m-54m at the nearest point) has potential significant impact associated with site preparation, demolition, and general construction in the absence of

mitigation. NSL7 (approx. 87m at nearest point) has potential significant impact associated with demolition and general construction in the absence of mitigation.

Review of the predicted noise levels at these locations are above the criteria at which a significant impact is deemed to occur (65dB LAeq,T) and therefore, in the absence of noise mitigation, a negative, significant and short-term impact is likely.

At greater distances (property represented by NSL8) predicted construction noise levels are lower for site preparation, demolition, general construction and road works/Landscaping, therefore any impact is expected to be negative, moderate, and short-term.

6.2 Vibration Assessment - Construction Phase

In terms of vibration, *British Standard BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration* recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. The standard also notes that below 12.5 mm/s PPV the risk of damage tends to zero. It is therefore common, on a cautious basis to use this lower value. Taking the above into consideration the vibration criteria in Table 20 are recommended.

Table 20: Recommended Vibration Criteria During Construction Phase

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:		
Less than 15Hz	**15 to 40Hz**	**40Hz and above**
12 mm/s	20 mm/s	50 mm/s

Human Perception

People are sensitive to vibration stimuli at levels orders of magnitude below those which have the potential to cause any cosmetic damage to buildings. There are no current standards which provide guidance on typical ranges of human response to vibration in terms of PPV for continuous or intermittent vibration sources.

BS5228-2:2009+A1:2014, provides a useful guide relating to the assessment of human response to vibration in terms of the PPV. Whilst the guide values are used to compare typical human response to construction works, they tend to relate closely to general levels of vibration perception from other general sources.
Table 21 below summarises the range of vibration values and the associated potential effects on humans.

Table 21: Guidance on Effects of Human Response to PPV Magnitudes

Vibration Level, PPV (mm/s)	Effect
0.140	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies. At lower frequencies people are less sensitive to vibration.
0.30	Vibration might be just perceptible in residential environments
1.00	It is likely that a vibration level of this magnitude in residential environments will cause complaint.

Vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short-term duration, particularly during construction projects and when the origin and or the duration of vibration is known. For example, ground-breaking can typically be tolerated at vibration levels up to 2.5 mm/s if adequate public relations are in place and timeframes are known. These values refer to the day-time periods only. During surface construction works (demolition and groundbreaking etc.) the vibration limits set within would be perceptible to building occupants and have the potential to cause subjective effects. The level of effect is, however, greatly reduced when the origin and time frame of the works are known and limit values relating to structural integrity are adequately communicated. In this regard, the use of clear communication and information circulars relating to planned works, their duration and vibration monitoring can significantly reduce vibration effects to the neighbouring properties.

Interpretation of the Human Response to Vibration

In order to assist with interpretation of vibration thresholds, Table 22 presents the significance table relating to potential impacts to building occupants during construction based on guidance from BS5228-2:2009+A1:2014.

Table 22: Human Response Vibration Significance Ratings

Criteria	Impact Magnitude	Significance Rating
10 mm/s PPV	Very High	Very Significant
1 mm/s PPV	High	Moderate to Significant
0.3 mm/s PPV	Medium	Slight to Moderate
0.14 mm/s PPV	Low	Not significant to Slight
Less than 0.14 mm/s PPV	Very Low	imperceptible to Not significant

Additional measures will be adopted by the Contractor during construction as per health and safety requirements and best practice as per Section 6.3 below

6.3 Construction Mitigation Measures

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228 (2009 +A1 2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2. Whilst construction noise impacts are expected to vary during the construction phase depending on the distance between the activities and noise sensitive locations, the contractor will ensure that all best practice noise control methods will be used, as necessary in order to ensure impacts at off-site noise sensitive locations are minimised.

The best practice measures set out in BS 5228 (2009) Parts 1 and 2 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- Selection of quiet plant.
- Noise control at source.
- Screening.
- Liaison with the public
- Monitoring

A detailed comment is offered on these items in the following paragraphs. Noise control measures that will be considered include the selection of quiet plant, enclosures, and screens around noise sources, limiting the hours of work and noise and vibration monitoring, where required.

6.3.1 Selection of Quiet Plant

This practice is recommended in relation to static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether said item can be replaced with a quieter alternative.

6.3.2 Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can often be controlled by fixing resilient materials in between the surfaces in contact.

Referring to the potential noise generating sources for the works under consideration, the following best practice mitigation measures should be considered:

- Site compounds will be more than 30m from noise sensitive receptors within the site constraints. The use lifting bulky items, dropping, and loading of materials within these areas should be restricted to normal working hours.
- For mobile plant items such as dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB. Mobile plant should be switched off when not in use and not left idling.
- For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system or utilising an acoustic canopy to replace the normal engine cover. For concrete mixers, control measures should be employed during cleaning to ensure no impulsive hammering is undertaken at the mixer drum.
- For all materials handling ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials.
- For compressors, generators, and pumps, these can be surrounded by acoustic lagging or enclosed with in acoustic enclosures providing air ventilation.
- Demountable enclosures can also be used to screen operatives using hand tools and will be moved around site, as

necessary.

- All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.
- Maintaining site access roads even so as to mitigate the potential for vibration from lorries.
- Selection of plant with low inherent potential for generation of noise and/ or vibration.
- Erection of barriers as necessary around items such as generators or high duty compressors.
- Situate any noisy plant as far away from sensitive properties as is reasonably practicable and the use of vibration isolated support structures where necessary
- Appointing a site representative responsible for matters relating to noise and vibration.

6.3.3 Screening

Screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of noise control. Construction site hoarding will be constructed around the site boundaries as standard. The hoarding will be constructed of a material to reduce noise by 25dB along the north, south and east boundaries of the site and by 10dB along the west boundary of the site as shown is Appendix C. This will ensure guidance limit for construction noise at nearest noise sensitive location is followed and potential impacts relating to noise nuisance and disturbance and vibration impacts are effectively minimised and controlled.

6.3.4 Liaison with the Public

A designated liaison officer(s) will be appointed to site during construction works. Any noise complaints should be logged and followed up in a prompt fashion by the liaison officer. In addition, where a particularly noisy construction activity is planned or other works with the potential to generate high levels of noise, or where noisy works are expected to operate outside of normal working hours etc., the liaison officer will inform the nearest noise sensitive locations of the time and expected duration of the noisy works.

The Liaison officer(s) will also take notes of the following during complaint logging:

- Maintenance of a site complaints log detailing
- Name and address of complainant
- Time and date complaint was made.
- Date, time, and duration of noise
- Characteristics, such as rumble, clatters, intermittent, etc.
- Likely cause or source of noise
- Weather conditions, such as wind speed and direction
- Investigative and follow -up actions.
- Response to complainant

The Liaison officer(s) will also:

- Liaison with Local Community and Businesses

- Appointment of a Liaison Officer as a single point of contact to engage with the community and respond to concerns.
- Keeping residents informed of progress and timing of construction activities that may impact on them.

6.3.5 Monitoring

It is recommended that monthly noise and vibration monitoring surveys be carried along the boundary of the proposed site to monitor the effectiveness of noise and vibration management for the duration of the construction phase. Noise and vibration levels at Noise Sensitive Locations should not exceed the construction phase noise and vibration limit criteria. Any breaches of these limits will require a review of operations and mitigation measures if the exceedance is due to the construction works on site.

To effectively manage noise and vibration at residential dwelling located approximately 4m east of the proposed site, installation of continuous data logging live noise and vibration monitoring system is required. This software will require remote login, data download and text/email alert functionality. It will measure key noise and vibration parameters (e.g., LAeq, LAFMAX, LA90, LA10, PPV (mm/sec) and Frequencies as Hz.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2017: Acoustics - Description, measurement, and assessment of environmental noise.

6.3.6 Project Programme

The phasing programme will be arranged to control the amount of disturbance in noise and vibration sensitive areas at times that are considered of greatest sensitivity. During excavation or when other high noise generating works are in progress on a site at the same time as other works of construction that themselves may generate significant noise and vibration, the working programme will be phased to prevent unacceptable disturbance at any time.

7.0 CONCLUSIONS

- The noise impact of the construction/demolition phase and operational phase of the proposed development has been assessed.

- During the construction/demolition phase noise is predicted while works are taking place in proximity to the nearest NSL's. Mitigation measures have been recommended so that any negative impact may be reduced, it is not expected that a negative impact will occur on existing noise sensitive locations.

- With respect to inward noise impact, to ensure that the noise climate within the residential units is appropriate, the following internal noise criteria are proposed:
    - Daytime in living areas – 35 dB L_{Aeq},16hr; and,
    - Night-time in bedrooms – 30 dB L_{Aeq},8hr.

- The measured noise levels across the site have been used to calculate noise levels at specific facades of proposed residential properties and to predict the internal noise levels within living room and bedroom spaces, taking account of the proposed building envelope and conditions in the receiving rooms (e.g., volumes and room acoustic characteristics).

- It is predicted that the open spaces will experience noise levels of the order ≤55dB L_{Aeq},16hr in line with the recommended noise level.

- Using guidance outlined in the current Dublin Agglomeration Environmental Noise Action Plan (Volume 2) December 2018 – July 2023, British Standard B5 8233 (2014), WHO Community Noise (1999) and ProPG (2017) an inward noise impact assessment inclusive of noise modelling has been undertaken at the proposed development site.

- The results of the assessment have concluded that during daytime and night-time periods, internal noise levels are calculated to be within acceptable levels for bedroom, living and dining areas, taking account of the proposed glazing and ventilation strategy recommended for the development.

- The assessment has recommended Type 2 glazing for the façade adjacent to Taylors Lane (North) and to Edmondstown Road (West) of the development. It is recommended to use Type 1 glazing for the remainder of the development.

- Mechanical ventilation is recommended for all the development.

- With the implementation of the recommendations included in the report, it is considered that a suitable level of protection against noise will be provided to the occupants of the proposed development.

- Considering that sensitive receivers within the development are much closer than off-site sensitive receivers, once the relevant noise criteria is achieved within the development it is expected that there will be no negative impact at sensitive receivers off site, and therefore no further mitigation required.

ENVIRONMENTAL NOISE ASSESSMENT

TAYLORS LANE

BALLYBODEN

DUBLIN 16

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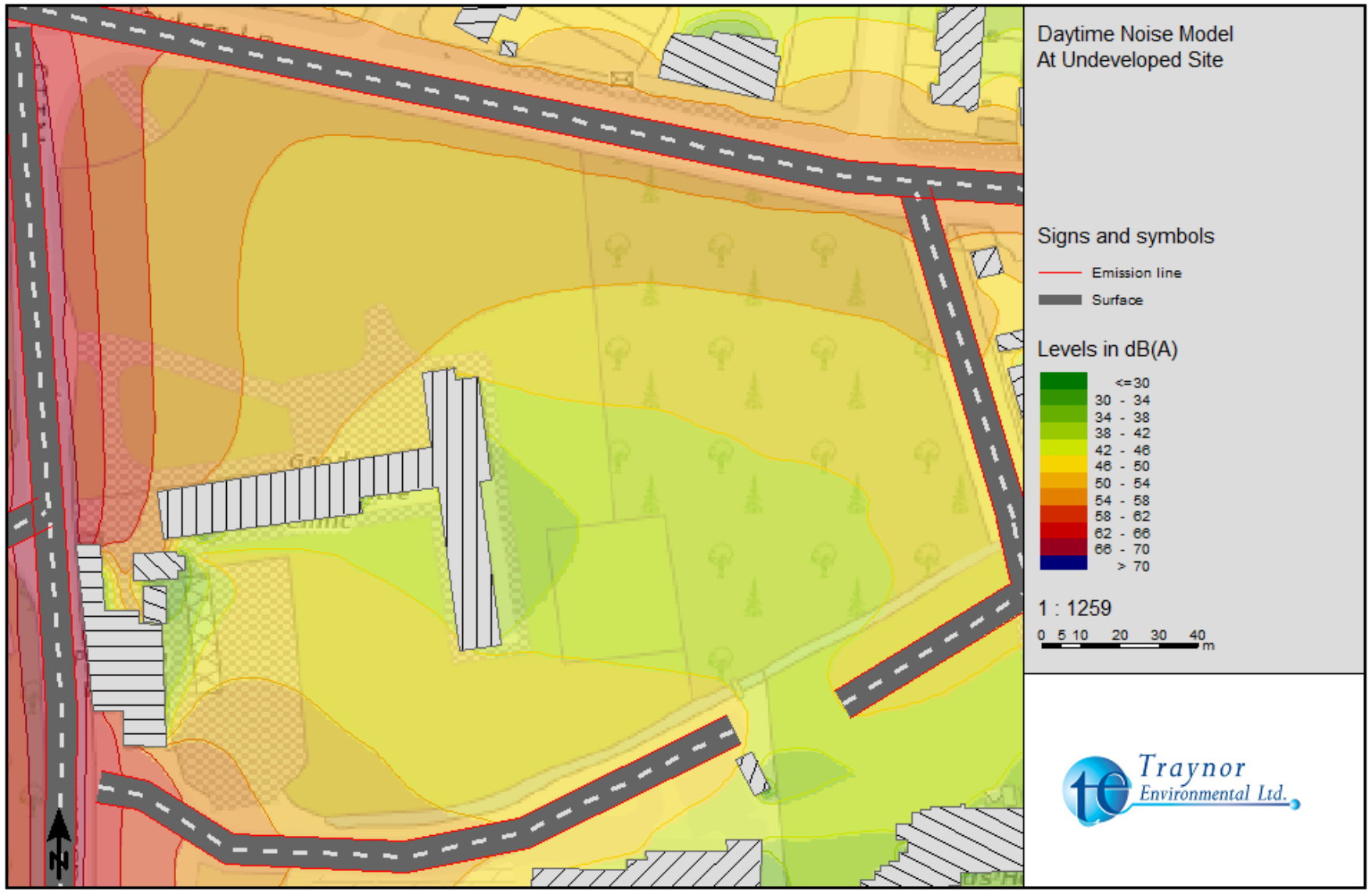
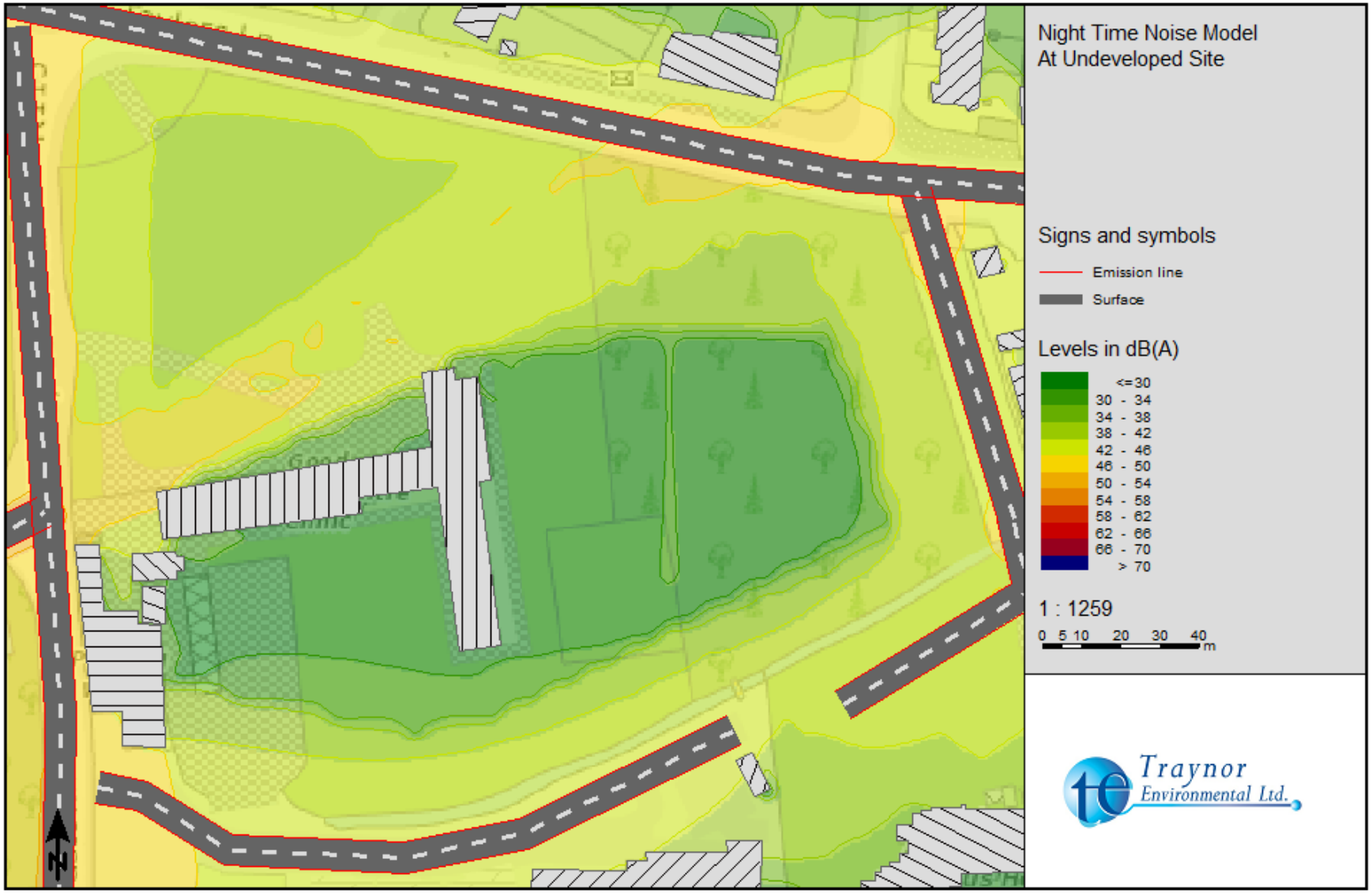
APPENDIX A – NOISE MODEL - NOISE AT UNDEVELOPED SITE

Noise Model of Daytime L_{Aeq} at the Undeveloped Site



Noise Model of Night-time L_{Aeq} at the Undeveloped Site



ENVIRONMENTAL NOISE ASSESSMENT

TAYLORS LANE

BALLYBODEN

DUBLIN 16

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APPENDIX B – NOISE MODEL PREDICTED - BUILDINGS CONSTRUCTED AND OPERATING

Predicted (development built and operational) Daytime Noise Model of L_{Aeq} at the site.

Predicted (development built and operational) Noise Model of L_{Aeq} at the site. (Night-time)

ENVIRONMENTAL NOISE ASSESSMENT
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BALLYBODEN
DUBLIN 16
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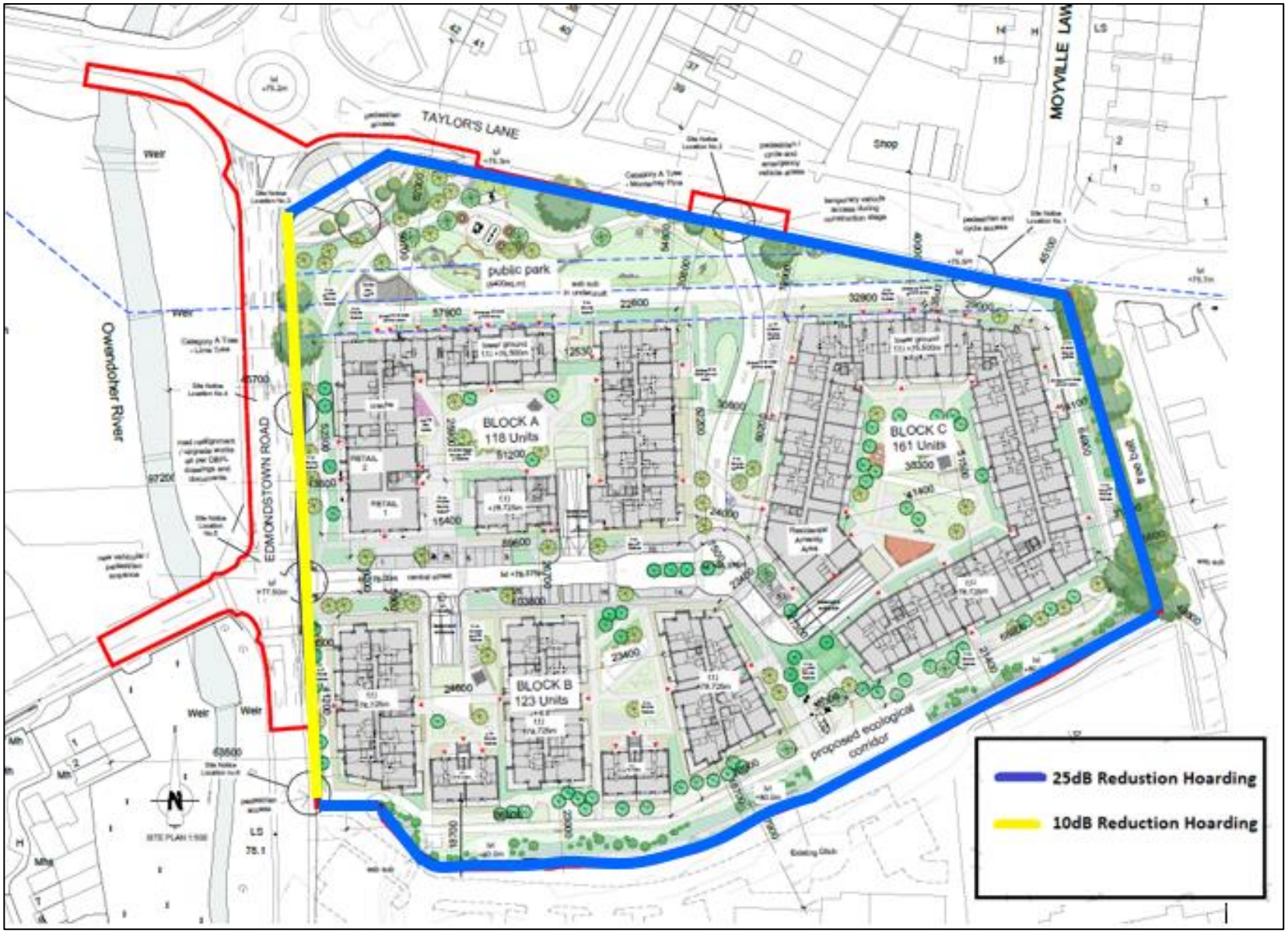
APPENDIX C – LOCATIONS OF SITE HOARDING FOR CONSTRUCTION PHASE


TAYLOR'S LANE
MOYVILLE LAW
Shop
public park
Weir
Owendoher River
EDMONDSTOWN ROAD
BLOCK A
118 Units
BLOCK B
123 Units
BLOCK C
161 Units
proposed ecological corridor
25dB Redustion Hoarding
10dB Reduction Hoarding

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APPENDIX D – NOISE METER CALIBRATION CERTIFICATES OF CALIBRATION

Certificate of Calibration

MTS Calibration

Certificate Number: 31550

Measurement Microphone
Half-Inch diameter – Free-Field, 0 degree incidence response

Client: Traynor Environmental

Instrument Make: PCB
Instrument Model: 377B02
Serial Number: 302020

Sensitivity is calculated by the Insert Voltage method. The frequency response calibration is one of three independent measurements of the pressure response of the Object Microphone obtained by the Electrostatic Actuator measurement method. Microphone Capacitance is the polarised capacitance of the test microphone measured on a capacitance bridge relative to a reference microphone.

The frequency response, capacitance, and sensitivity of the microphone are shown graphically on Page 2
Uncertainties of these measurements are:

31.5 Hz to 4kHz	0.41 dB (k = 2.04)
5kHz to 10 kHz	0.87 dB (k = 2.17)
12.5 kHz to 40 kHz	1.81 dB (k = 2.17)
Sensitivity at 250Hz	0.16 dB (k = 2.0)

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k (as above) to provide a level of confidence of approximately 95%. The uncertainty evaluation has been calculated in accordance with UKAS publication M 3003 (December 1997).

Measurement Conditions:

Polarisation Voltage	0V +/- 0.5V
Temperature	22.3 °C
Atmospheric Pressure	988.8 mBar **
Relative Humidity	37.6 %

** Note that the computer-produced Certificate shows a Pressure of 1013.3 mbar - this is in error. The above measurement is traceable

Test Equipment:

Equipment	Manufacturer	Model	Serial No.	Traceability Ref.	Cal. Due
Condenser Microphone	Larson Davis	2541	7300	TE 157	September 2019
Acoustic Calibrator 250Hz	Larson Davis	CAL250	4483	TE 116	September 2018
Real-Time Frequency Analyser	Larson Davis	2900	0492	TE 108	August 2018
Signal Generator	Hewlett Packard	33120A	US36016577	TE 111	July 2018
Digital Multimeter	Hewlett Packard	34401A	3146A63804	TE 105	July 2018

Date of Receipt : 8th March 2018
Date of Calibration : 8th March 2018
Date of Certificate: 8th March 2018

Authorised Signatory: .....
Tony Sherris

MTS Calibration Ltd
Company Registration Number: 06588525 England and Wales
The Grange Business Centre, Belasis Avenue, Billingham TS23 1LG, England
Telephone: 0044 1642 876410 Fax: 0044 1642 876411 E-Mail: dmarsh@slmcal.co.uk or tsherris@slmcal.co.uk
http\\www.slmcal.co.uk

CERTIFICATE OF CALIBRATION

Issued by: **MTS Calibration Ltd.**
Laboratory address: 17 Elvington Close
Telephone: +44 (0)1642 876 410 Billingham TS23 3YS
England
Please note delivery address below

Date of Issue: 08 March 2018 Certificate Number: 31417

Third-Octave Band Digital Filter

Third-Octave Band Filter verification to BS EN 61260:1996

Client: Traynor Environmental

Instrument Make: Larson Davis
Instrument Model: 831
Serial Number: 0003913

The centre frequency sequence of this filter set follows the exact base 10 midband frequency sequence of IEC 61260 and measurements have been made accordingly

Associated Preamplifier: - *Make :* Larson Davis — *Calibrated by:* MTS
- *Model :* PCB PRM801 — *Certificate Number:* 31417
- *Serial Number :* 36768 — *Date:* 08 March 2018

Associated Sound Level Meter - *Make:* Larson Davis — *Calibrated by:* MTS
- *Model:* Larson Davis 831 — *Certificate Number:* 31417
- *Serial Number:* 0003913 — *Date:* 08 March 2018

This is to certify that this instrument, whose calibration records are enclosed in this file, has been tested in accordance with MTS Calibration Ltd. Work Procedures. The instrument as configured above has been found to be in compliance with attenuation and frequency characteristics as specified by BS EN 61260: 1995 and the results are reported in the following pages and summarised below. The results obtained are only for limited tests and do not indicate conformance to the full requirements of the standard, and are only applicable to those filter bands tested. The measurements were carried out using equipment whose calibrations are traceable to UK National Standards. The management controls of MTS Calibration Ltd. are registered in the current issue of its Quality Manual, which are designed to be in conformity with BS EN ISO/IEC 17025: 2005. Test procedures and test results and details of the traceability of test equipment to National Standards are filed with MTS Calibration Ltd. and relevant extracts are available on request.

Because a digital filter will have the same amplitude characteristic relative to its centre frequency, only three filters were measured at each of the test frequencies specified by BS EN 61260:1996 for BASE-10 distribution. The measurements made were relative to the attenuation of the 1kHz filter at 1kHz input frequency and input level 1V. Because the measurements include a linearity contribution from the sound level meter, and could be variable with frequency, the assessment is valid only for this pairing. The sound level meter was set for "Linear" frequency response on the lowest range setting which did not give overload at any test frequency or test level. Its compliance with the standard was assessed by referring the measurements to the tolerances specified.

Third-Octave Band Filter — Compliance with BS EN 61260: 1996 Class 1

125 Hz complies
1000 Hz complies
8kHz complies

Uncertainties of measurements:
Within Passband (0.89 to 1.12 of centre frequency) dB: 0.42
Outside Passband dB: 2.40

Test Equipment:

Equipment	Manufacturer	Model	Serial No.	Traceability Ref.	Cal. Due
Signal Generator (ext. 3)	HP	33120A	US34007158	TE 163	Oct-18

Authorised signatory: RA Sh.

Date of Receipt: 01 February 2018
Date of Calibration: 08 March 2018
Date of Certificate: 08 March 2018

Tony Sherris Page: 1 of: 4

MTS Calibration Ltd.
The Grange Business Centre, Belasis Avenue, Billingham TS23 1LG
Telephone: 01642 876410 Fax: 01642 876411 E-Mail: dmarsh@slmcal.co.uk or tsherris@slmcal.co.uk

CERTIFICATE OF CALIBRATION

Issued by: **MTS Calibration Ltd**

Laboratory address: 17 Elvington Close
Billingham TS23 3YS
England

Telephone: +44 (0)1642 876 410

Please note delivery address below

Date of Issue: 08 March 2018 Certificate Number: 31417

Sound Level Meter Periodic Tests to BS EN 61672-3: 2006 Class 1

Client: Traynor Environmental

Instrument Make:	Larson Davis	*Microphone Make:*	PCB
Instrument Model:	831	*Microphone Model:*	377B02
Serial Number:	0003913	*Serial Number:*	302020
Preamplifier Make:	PCB	*Calibrator Make:*	Cirrus
Preamplifier Model:	PRM831	*Calibrator Model:*	CR:515
Serial Number:	036768	*Calibrator Serial Number:*	44501
		Calibrator Adaptor:	none
		Calibrator Certification Ref:	31420U

Other Accessories supplied:
Windshield

MTS Calibration Ltd has obtained evidence which is generally available to the public that an independent testing organisation responsible for pattern approvals has demonstrated that this model of sound level meter has successfully completed the pattern evaluation tests of IEC 61672-2: 2003. This instrument, which was constructed to the requirements of BS EN 61672-1:2002 Class 1, has been tested using the procedures for periodic testing as specified in BS EN 61672-3: 2006.

The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of IEC 61672-3: 2006 for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2: 2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1: 2002, the sound level meter submitted for testing conforms to the Class 1 requirements of IEC 61672-1: 2002

In conducting these measurements, it was necessary to use manufacturer's data. This was taken from the instruction manual of the instrument.

I831.01 Rev J

To achieve the above specification a replacement microphone was required

Ambient Temperature at Calibration (deg C ± 1)	22.8	Calibration check frequency (Hz)	1000.0
Ambient Pressure at Calibration (mPa ± 2)	989.75	Reference Sound Pressure Level (dBA)	114.0
Ambient Relative Humidity at Calibration (% ± 5)	33.85	Reference Level Range dB	Normal

Test Equipment:

Equipment	Manufacturer	Model	Serial No.	Traceability Ref.	Cal. Due
Condenser Microphone	Larson Davis	2541	7300	TE 157	Sep-19
Acoustic Calibrator 1kHz	Brüel & Kjær	4231	2343058	TE 132	Aug-19
Acoustic Calibrator	Brüel & Kjær	4226	2141963	TE 206	Oct-18
Signal Generator (set 3)	HP	33120A	US34007158	TE 163	Oct-18
Real-Time Frequency Analyser (set 4)	Larson Davis	2900	0271	TE 203	Jul-18

Authorised signatory:

Tony Sherris

Date of Receipt: 1 February 2018
Date of Periodic Test 8 March 2018
Date of Certificate: 8 March 2018

Page: 1 of: 12

MTS Calibration Ltd
The Grange Business Centre, Belasis Avenue, Billingham TS23 1LG
Telephone: 01642 876410 Fax: 01642 876411 E-Mail: dmarsh@slmcal.co.uk or tsherris@slmcal.co.uk

Calibration Certificate

Certificate Number 2018004505
Customer:
Environmental Measurement
Unit 12
Dublin, 24, Ireland

Model Number	LxT SE	***Procedure Number***	D0001.8384		
Serial Number	0005595	***Technician***	Ron Harris		
Test Results	**Pass**	***Calibration Date***	30 Apr 2018		
Initial Condition	As Manufactured	***Calibration Due***			
Description	Sound Expert LxT Class 1 Sound Level Meter Firmware Revision: 2.302	***Temperature***	23.2	°C	± 0.25 °C
		Humidity	51	%RH	± 2.0 %RH
		Static Pressure	85.79	kPa	± 0.13 kPa

Evaluation Method ***Tested with:*** ***Data reported in dB re 20 µPa.***

Larson Davis PRMLxT1L. S/N 055665
PCB 377B02. S/N 305480
Larson Davis CAL200. S/N 9079
Larson Davis CAL291. S/N 0108

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ACCREDITED Cert. #3822.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Calibration Certificate

Certificate Number 2018004501
Customer:
Environmental Measurement
Unit 12
Dublin, 24, Ireland

Model Number	PRMLxT1L	***Procedure Number***	D0001.8383		
Serial Number	055665	***Technician***	Ron Harris		
Test Results	**Pass**	***Calibration Date***	30 Apr 2018		
Initial Condition	As Manufactured	***Calibration Due***			
Description	Larson Davis 1/2" Preamplifier for LxT Class 1 -1 dB	***Temperature***	22.85	°C	± 0.01 °C
		Humidity	51	%RH	± 0.5 %RH
		Static Pressure	85.74	kPa	± 0.03 kPa

Evaluation Method Tested electrically using a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Larson Davis Model 2900 Real Time Analyzer	03/07/2018	03/07/2019	003003
Hart Scientific 2626-S Humidity/Temperature Sensor	06/11/2017	06/11/2018	006943
Agilent 34401A DMM	06/28/2017	06/28/2018	007165
SRS DS360 Ultra Low Distortion Generator	10/05/2017	10/05/2018	007167

CERTIFICATE OF CALIBRATION

Laboratory address:

Telephone: +44 (0)1642 876 410

MTS Calibration Ltd.
17 Elvington Close
Billingham TS23 3YS
England

Please note delivery address below

0607

Date of Issue:	07 February 2018	Certificate Number:	31420U

Sound Calibrator

Client: Traynor Environmental

Cirrus **Model CR:515** **Serial Number 44501**

A Reference Calibrator was used to establish the sensitivity of the measurement chain. The same measurement chain is then used to determine the output level of the Object Calibrator by the difference between its output and that of the nominated Reference Calibrator. Four independent measurements of the third-octave band sound pressure levels produced by the Reference Calibrators and the Object Calibrator are averaged to minimise uncertainties of the calibration. The measurement chain consists of a calibrated, Reference Microphone, Reference Preamplifier and Reference Analyser.

As well as providing a traceable measurement of the sound pressure level in the cavity of the Object Calibrator, the Calibrator's frequency and total harmonic distortion are also measured. Frequency is determined from the average of four independent measurements using a multimeter. The total harmonic distortion is measured from the average of three independent measurements by third octave analysis, subtracting the level of the fundamental frequency from the sum of the combined harmonics in the frequency band to 20kHz. The complete procedure is detailed in the MTS Calibration Ltd work procedure WP01.

The sound pressure level generated by the calibrator in its WS2 configuration was measured by reference to B&K Model 4133 Microphone and reference Sound Calibrator as shown in the Test Equipment section below.

The measured values were:

Output Level 1:	**94.21**	**dB re 20µPa**	**+/- 0.14 dB (k= 2.00)**
Fundamental Frequency 1:	**1000.03**	**Hz**	**+/- 0.11 Hz (k= 2.00)**
Total Harmonic Distortion 1:	**0.280**	**%**	**+/- 0.008 % (k= 2.00)**

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k (individually calculated as above), providing a coverage probability of approximately 95%. The uncertainty evaluation has been calculated in accordance with the current version of UKAS publication M3003. The uncertainty quoted for the Distortion Measurement is the Distortion Percentage as measured, multiplied by our Uncertainty as calculated for the individual measurement or our CMC, whichever is the larger.

Measurement Conditions:

Temperature	22.3	°C	± 1 °C
Atmospheric Pressure	1018.1	mBar	± 2 mBar
Relative Humidity	32.3	%	± 5 %

This measurement is valid only for the above device configured for calibration of a WS-2 microphone under the above environmental conditions. For deviation of prevailing conditions, the manufacturer's literature for the calibrator should be referred to.

Test Equipment:

Equipment	Manufacturer	Model	Serial No.	Traceability Ref.	Calibration Due
Reference Calibrator	Brüel & Kjær	4231	2343058	TE 132	Aug-19
Multimeter	HP	34401A	36146A63804	TE 105	Jul-18
Signal Generator (set 1)	HP	33120A	US36016577	TE 111	Jul-18
Real-Time Analyser (set 1)	Larson Davis	2900	0492	TE 108	Aug-18

Date of Receipt: 01 February 2018
Date of Measurement: 07 February 2018

Approved Signatory:

Tony Sherris

Page 1 of 1

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k (individually calculated as above), providing a coverage probability of approximately 95%. The uncertainty evaluation has been calculated in accordance with the current version of UKAS publication M3003. The uncertainty quoted for the Distortion Measurement is the Distortion Percentage as measured, multiplied by our Uncertainty as calculated for the individual measurement or our CMC, whichever is the larger.

PLEASE SEND ALL DELIVERIES TO:

MTS Calibration Ltd

Company Registration Number: 04588525 England and Wales

The Grange Business Centre, Belasis Avenue, Billingham TS23 1LG, England

Telephone: 0044 1642 876410 E-Mail: dmarsh@slmcal.co.uk or tsherris@slmcal.co.uk http://www.slmcal.co.uk

ENVIRONMENTAL NOISE ASSESSMENT
TAYLORS LANE
BALLYBODEN
DUBLIN 16
COMPLETED BY
TRAYNOR ENVIRONMENTAL LTD

APPENDIX E – COMPETENCY CERTIFICATE FROM INSTITUTE OF ACOUSTICS

Institute of Acoustics

Certificate of Competence in Environmental Noise Measurement

This is to certify that

Nevin Traynor

has completed a course of instruction approved by the Institute of Acoustics and designed to enable the candidate to undertake environmental noise measurements in a competent manner and has achieved a satisfactory performance in the written and practical examinations thereof and that this fact has been recorded in a Register kept by the Institute for this purpose.

Education Committee Chairman

Institute Secretary

Date 11/10/2019

Centre Maloney & Associates

Reference Number M0111

For the purposes of Credit Transfer or Professional Development this Certificate may be considered to be equivalent to 25 points an hours