



Environmental Noise Survey, Noise Break-In Assessment & Sound Insulation Scheme

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Executive Summary

An environmental noise survey and noise impact assessment has been undertaken to assess the suitability of the site at Station House, Kings Road, Spalding, PE11 1QB for residential development. The measured ambient sound levels have allowed a BS8233:2014 noise assessment to be carried out.

A sound insulation scheme has been provided in Section 4.0, including glazing and an alternative ventilation strategy. These recommendations should be sufficient to achieve appropriate internal noise levels for the proposed development according to the BS8233:2014 criteria. In order to ensure that future occupants will not be adversely affected by commercial noises sources in the area, the façade sound reduction has been specified considering the highest 1-hour global and octave band measurements as opposed to the average 16-hour (day) and 8-hour (night) measurements specified in BS8233:2014.

An overview of all recommendations can be found in the table below:

Recommendations and Mitigation Overview

- All glazing requires the octave band sound reduction specified in Tables 5.0 and 6.0.
- Appropriate glazing specifications can be found in Tables 8.0.
- Appropriate acoustically treated alternative ventilation can be found in Table 9.0.

The findings of this report will require written approval from the Local Authority prior to work commencing.

1. Introduction

Overview

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a residential development ('the Proposed Development') at Station House, Kings Road, Spalding, PE11 1QB ('the Site').

The applicant is preparing an application ('the Application') to be submitted to South Holland District Council. The proposed development is a Class ZA Permitted Development for the conversion of an existing residential dwelling into 7no. Apartments.

The following technical noise assessment has been prepared to support the planning application to South Holland District Council. The report details the ambient sound climate at the proposed development site and provides a sound insulation scheme to protect the amenity of the occupants of the proposed residential dwellings.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

Scope & Objectives

The scope of the noise assessment can be summarised as follows:

- Ambient sound monitoring survey to evaluate the prevailing ambient and maximum sound levels incident on the proposed development;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the surrounding noise sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Policy Framework (2019), Noise Policy Statement for England (2010) and British Standard BS8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'. Further information on the legislation can be found in Appendix B.

2. Environmental Noise Survey

Measurement Methodology

In order to characterise the sound profile of the area at the proposed development, an environmental sound survey was carried out from 11/06/21 to 14/06/21. For the long-term sound monitoring, two sound level meters were placed protruding from 1st floor windows of the existing building. The microphones of the sound level meters were positioned approximately 1m from the front and rear façades of the building. The monitoring positions were chosen in order to collect representative sound levels at the proposed development during the day time and night time periods and can be seen in Figure 1.0 below.

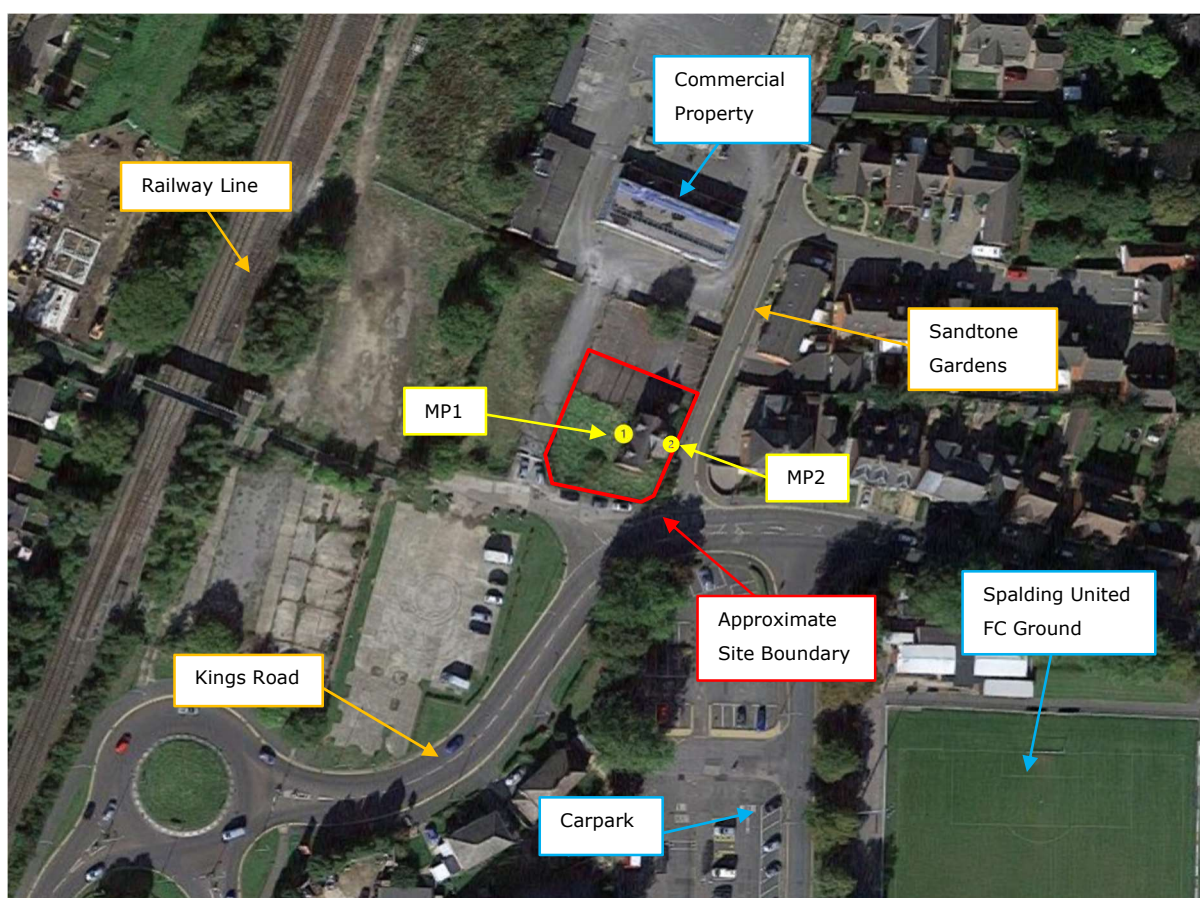


Figure 1.0 – Indicative Site Layout

Context & Subjective Impression

The area surrounding the site is primarily residential in nature with a minority of commercial properties. The noise profile of the area is deemed to be low to moderate in level and dominated by noise from traffic travelling along Kings Road. Located to the north of the site is a commercial property which is thought to be used for storage. There appeared to be little to no activity from the property during the site visit. To the south-east of the site is the Spalding United FC Ground which can operate from Monday to Saturday, 9:00 - 17:00 and 10:00 - 16:00 on Sundays.

Environmental Noise Survey Results

The following tables outline the highest 1-hour sound levels measured during the day time and night time periods that will be used in the noise break-in assessment. A full summary of all results can be found in Appendix D.

Measurement Position MP1								
Measurement Period ('t')	Octave Band $L_{eq,t}$ (dB, Hz)							$L_{Aeq,t}$ (dB)
	63	125	250	500	1k	2k	4k	
Highest $L_{eq,1hour}$ (Day)	63.0	57.0	54.0	52.0	53.0	51.0	44.0	56.0
Highest $L_{eq,1hour}$ (Night)	59.0	54.0	53.0	47.0	48.0	45.0	40.0	52.0

Table 1.0 – Highest Measurements During Day and Night – MP1

Measurement Position MP2								
Measurement Period ('t')	Octave Band $L_{eq,t}$ (dB, Hz)							$L_{Aeq,t}$ (dB)
	63	125	250	500	1k	2k	4k	
Highest $L_{eq,1hour}$ (Day)	66.0	62.0	58.0	57.0	62.0	56.0	51.0	62.0
Highest $L_{eq,1hour}$ (Night)	61.0	53.0	53.0	53.0	55.0	47.0	43.0	57.0

Table 2.0 – Highest Measurements During Day and Night – MP2

In the following section, the maximum noise level events are assessed. ProPG states:

"...in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night."

The following table shows a summary of the maximum sound level results.

Measurement Position MP1			
Measurement Period ('t')	$L_{AFmax,15min}$	*SMR $L_{AFmax,15min}$	No. of Exceedances of 71.0 $L_{AFmax,15min}$
Night 1	76.0	60.0	4
Night 2	84.0	62.0	2
Night 3	80.0	65.0	1

Table 3.0 – Maximum Sound Level Summary Results – MP1

Measurement Position MP2			
Measurement Period (‘t’)	L _{AFmax,15min}	*SMR L _{AFmax,15min}	No. of Exceedances of 72.0 L _{AFmax,15min}
Night 1	92.0	65.0	5
Night 2	88.0	66.0	3
Night 3	78.0	64.0	3

Table 4.0 – Maximum Sound Level Summary Results – MP2

*Statistically Most Repeated

Commercial Noise

BS4142:2014 provides commentary on situations where new noise sensitive premises are introduced to a site and where the new development incorporates specific noise control measures. Section 8.5 of the Standard states *‘Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognised that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances, other guidance and criteria in addition to, or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.’*

In addition, the standard states that it uses outdoor levels to assess the likely effects of sound on people who might be inside or outside a dwelling upon which the sound is incident. Where this is applied to new dwellings, the context is important. Subsequent to the publication of the standard, guidance notes have been issued in this respect.

Section 11 of the Standard advises that *‘When making assessments and arriving at decisions... it is essential to place the sound in context’* and further clarifies this by stating *‘Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following...’*

3) *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as;*

i) façade insulation treatment

ii) ventilation and/or cooling that will reduce the need to have windows open so as to avoid rapid or purge ventilation; and

iii) acoustic screening’

This commentary implies, therefore, that all control measures should be taken into consideration and that sound levels within a dwelling after allowance for these measures may be assessed on the basis of other design criteria appropriate to residential property.

During the site visit, it was noted that the following commercial noise sources could influence the acoustic environment at the proposed development:

- The commercial storage unit to the north
- The football ground and carpark to the south-east

In order to protect the amenity of future residents from the effects of the noise sources shown above, the following mitigation will be implemented:

- The sound reduction for façades will be specified using the highest 1-hour measurements as opposed to the average 16-hour and 8-hour measurements specified in BS8233:2014.
- The façade sound reduction will be specified using the highest 1-hour octave band sound levels to ensure that future occupants are fully protected against the effects of tonal noise.

3. Noise Break-in Assessment

Noise Break-In Assessment

The following section analyses the ambient sound levels incident on the development compared with the internal noise level criteria presented within BS8233:2014. Where octave band sound levels have been assessed these have been compared to the appropriate Noise Rating Curve (NR Curve). To ensure a robust analysis the following considerations have been taken:

- The $L_{AFmax,15min}$ during the night exceeded fewer than ten times.
- The highest $L_{eq,1hour}$ octave band measurements during the day time and night time periods.
- The highest $L_{Aeq,1hour}$ global measurements during the day time and night time periods.

The following table outlines the minimum octave band sound reduction required of the building envelope in order to achieve appropriate internal noise levels.

Measurement Position MP1									
Measurement Period ('t')	Octave Band $L_{eq,t}$ (Hz, dB)							$L_{Aeq,t}$ (dB)	$L_{Amax,t}$ (dB)
	63	125	250	500	1k	2k	4k		
Cumulative Highest $L_{eq,1hour}$ (Day)	63.0	57.0	54.0	52.0	53.0	51.0	44.0	56.0	--
NR30 Curve (dB)	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
Min. Sound Reduction (R_w)	4.0	9.0	15.0	18.0	23.0	25.0	20.0	21.0	--
Highest $L_{eq,1hour}$ (Night)	59.0	54.0	53.0	47.0	48.0	45.0	40.0	52.0	71.0
NR25 Curve (dB)	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
Min. Sound Reduction (R_w)	4.0	11.0	18.0	18.0	23.0	24.0	21.0	22.0	26.0

Table 5.0 – Internal Noise Level Analysis – MP1

Measurement Position MP2									
Measurement Period ('t')	Octave Band $L_{eq,t}$ (Hz, dB)							$L_{Aeq,t}$ (dB)	$L_{Amax,t}$ (dB)
	63	125	250	500	1k	2k	4k		
Highest $L_{eq,1hour}$ (Day)	66.0	62.0	58.0	57.0	62.0	56.0	51.0	62.0	--
NR30 Curve (dB)	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
Min. Sound Reduction (R_w)	7.0	14.0	19.0	23.0	32.0	30.0	27.0	27.0	--
Highest $L_{eq,1hour}$ (Night)	61.0	53.0	53.0	53.0	55.0	47.0	43.0	57.0	72.0
NR25 Curve (dB)	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
Min. Sound Reduction (R_w)	6.0	10.0	18.0	24.0	30.0	26.0	24.0	27.0	27.0

Table 6.0 – Internal Noise Level Analysis – MP2

External Noise Level Assessment

The predicted noise levels in the external amenity area are compared with the BS8233:2014 criteria in the table below. The noise levels have been taken from the average day time measurement from Measurement Position MP2 (found in Appendix D).

Location	Measurement Position	Garden Noise Level (dB)	BS8233:2014 Criteria (dB)	Min. Attenuation Required (dB)
Loudest Section of External Amenity Area	MP2	59.0	50.0 – 55.0 L _{Aeq,16hour}	4.0

Table 7.0 – External Noise Level Analysis

As can be seen in the table above, the external noise levels are predicted to be 4 dB above the BS8233:2014 criteria in the loudest section of the external amenity area. In order to reduce noise levels, it is recommended that 1.8m tall close-board fencing is installed at the perimeter of the external amenity area. The fencing must be of timber construction, contain no holes or gaps, and must have a minimum surface mass of 10 kg/m². An example product that achieves the criteria is Jackson '12k Envirofence'. The proposed location of the fencing can be found in Appendix C.

4. Sound Insulation Scheme

The following section outlines the required sound insulation scheme that should be installed at the proposed development to protect the amenity of the future residents. The sound insulation scheme should be installed prior to occupation and be retained thereafter.

Building Envelope

The noise levels within the proposed dwellings will be dictated by the configuration, materials, and elements of the façade. The non-glazed elements of the facade will contribute significantly to the reduction of ambient noise levels. The façade construction for lightweight or heavyweight constructions will provide ample levels of sound insulation, for the purposes of this report it is assumed the façade provides a minimum sound reduction of 50.0 dB R_w . The following section provides a sound insulation scheme based on the weakest elements of the façade, including the glazing, ventilation and roof construction.

a) Roof Specification

If the development has rooms within the roof space the roof system will require additional sound insulation to achieve appropriate internal noise levels. Where the roof, is being utilized as a voided loft space with thermal insulation the following detailing is not required. Where rooms are within the roof, the ceilings should consist of standard roofing slates, 100mm 45kg/m³ insulation fitted tightly between the 200mm roof joists and 1no. 15mm SoundBloc plasterboard fixed to British Gypsum RB1 resilient bars to achieve a minimum sound reduction of 50dB R_w . Any other configuration of roof that would achieve at least 50dB R_w will be suitable for the development.

b) Glazing Specification

Windows can be considered the weakest point of a façade in terms of noise reduction from external noise. The glazed elements installed in all the living rooms and bedrooms require the minimum sound reduction as shown in Section 3.0. The glazing option shown in the following tables provides a suitable level of sound reduction, however any other window capable of providing this attenuation will be suitable. The performance is specified for the whole window unit, including frame and other design features. The glazing specifications have been taken from the Pilkington Optiphon Range.

All Façades								
Room Type	Glazing Configuration							
Bedrooms & Living Rooms	Double Glazing							
	6mm Glass – 16mm Air Cavity – 4mm Glass							
Description	63	125	250	500	1k	2k	4k	$R_w + C_{tr}$
Sound Reduction (R_w)	21.0	21.0	20.0	26.0	38.0	37.0	39.0	28.0

Table 8.0 – Glazing Specification – All Façades

The glazing suppliers are required to demonstrate the acoustic performance of their proposed system either by providing an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

c) Ventilation Specification

BS8233 States:

"If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

and

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice. Alternatively, acoustic ventilation units are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

An alternative ventilation system should be installed within habitable rooms to fully protect the amenity of future residents. As stated in BS8233:2014 section 5.4.4, having complete enclosure of the noise source or receiver is the most effective barrier of sound. An alternative ventilation strategy allows for maximum sound insulation from the noise source whilst still maintaining a sufficient level of ventilation. It is recommended that the alternative ventilation should provide the same resistance to sound as the glazed elements. The following table provides ventilation systems that meet the above recommendations.

Background Ventilation		
Room Type	Model	Attenuation (dB)
Living Rooms and Bedrooms	Titon Standard Vent + C25 (trickle)	34.0 Open / 50.0 Closed $D_{n,e,w} + C_{tr}$
Through Wall Ventilation (not purge)		
Room Type	Model	Attenuation (dB)
All Façades – All Rooms	Titon Sonair F+ Mechanical Input Ventilator with G3 filter and DV100F duct ¹	56.0 dB $D_{n,e,w}$

Table 9.0 – Ventilation Specification

¹ The self-generated noise from the Titon Sonair F+ when measured at the maximum ventilation capacity of 60m³/h emits 23.5dB $L_{PA:10m2}$ which is below the required internal noise criteria from BS8233:2014.

The through wall ventilation specified within the table above is also capable of providing background ventilation. If the mechanical ventilation option is opted for the background trickle ventilation option is not required to be installed.

The following table outlines recommended noise levels from mechanical ventilation in dwellings.

Ventilation Condition	Possible System	Desirable Internal Ambient Noise Levels from Mechanical Services, L_{Aeq} (dB)		
		Bedrooms	Living Rooms	Bathrooms / Kitchens
Whole dwelling ventilation	Continuous MEV ¹ at low ventilation rates	≤ 26.0	≤ 30.0	--
	Continuous MVHR ² at minimum ventilation rates			
Extract ventilation	Intermittent Extract Fans	≤ 26.0	≤ 35.0	≤ 45.0
	Continuous MEV at high ventilation rates			

Table 10.0 – Recommended Internal Noise Levels from Mechanical Ventilation

The ventilation suppliers are required to demonstrate the acoustic performance of their proposed system either by providing an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

Appendix A – Acoustic Terminology

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log ₁₀ (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
L _{eq,T}	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
L _{max,T}	A noise level index defined as the maximum noise level during the period T. L _{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L _{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L _{90,T}	A noise level index. The noise level exceeded for 90% of the time over the period T. L ₉₀ can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L _{10,T}	A noise level index. The noise level exceeded for 10% of the time over the period T. L ₁₀ can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided. The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source. A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10} , the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the

time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq} .

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound. To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS4142:2014 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1\text{hour}}$ dB and $L_{A90,15\text{mins}}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125ms.

Appendix B – Legislation, Policy and Guidance

This report is to be primarily based on the following legislation, policy and guidance.

B.1 – National Planning Policy Framework (2019)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2019. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 170e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 180 states:

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 180 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life;*
- Mitigate and minimise adverse impacts on health and quality of life;*
- Where possible, contribute to the improvement of health and quality of life.*

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that “significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development”.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: “all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.”

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: “where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.”

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – BS8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’

The British Standard BS 8233: 2014, Guidance on Sound insulation and noise reduction for buildings provides additional guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, WHO Guidelines on Community Noise, 1999. The criteria desirable levels of steady state, “anonymous” noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below:

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 11.0 – BS8233:2014 Internal Noise Level Criteria

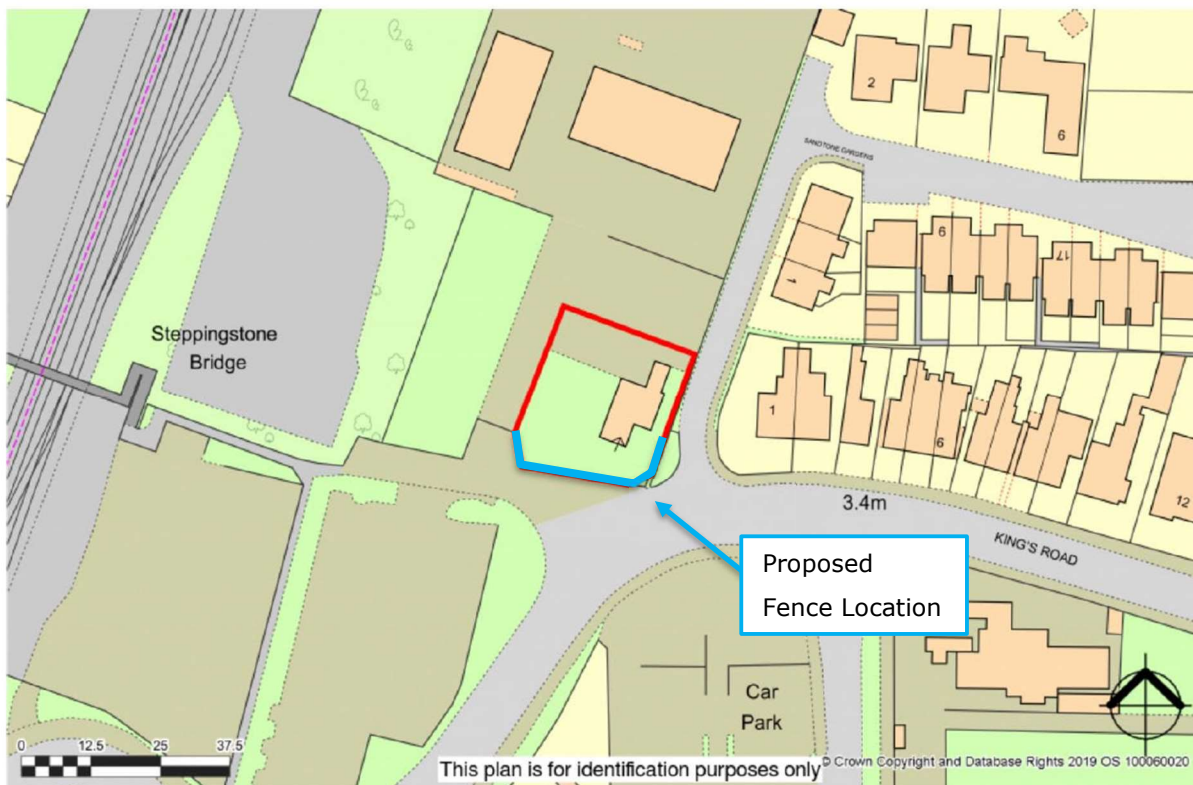
It is noted, however that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

The standard also recommends that for traditional external amenity areas, such as gardens, it is desirable that external noise levels do not exceed 50 dB $L_{Aeq,T}$, and that 55 dB $L_{Aeq,T}$ would be acceptable in noisier environments. However, it is recognised that these values may not be achievable in all areas where development is desirable and in such locations, development should be designed to achieve the lowest practicable levels.

General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

For this assessment, the above criteria are considered to be the LOAEL as defined in the NPSE above.

Appendix C – Location Plans



Appendix D – Environmental Survey

D.1 – Tabulated Summary Noise Data

Measurement Position MP1									
Measurement Period ('t')	Octave Band $L_{eq,t}$ (Hz, dB)							$L_{Aeq,t}$ (dB)	$L_{AMax,t}$ (dB)
	63	125	250	500	1k	2k	4k		
Day 1 – 11/06/21: 15:00 – 23:00	60.0	53.0	51.0	48.0	51.0	46.0	38.0	54.0	76.0
Night 1 – 11/06/21: 23:00 – 07:00	55.0	51.0	46.0	44.0	45.0	42.0	36.0	49.0	76.0
Day 2 – 12/06/21: 07:00 – 23:00	58.0	53.0	51.0	48.0	49.0	44.0	36.0	52.0	82.0
Night 2 – 12/06/21: 23:00 – 07:00	49.0	46.0	46.0	42.0	41.0	37.0	31.0	45.0	84.0
Day 3 – 13/06/21: 07:00 – 23:00	56.0	51.0	49.0	45.0	47.0	43.0	36.0	50.0	83.0
Night 3 – 13/06/21: 23:00 – 07:00	50.0	43.0	42.0	42.0	42.0	38.0	34.0	45.0	80.0
Day 4 – 14/06/21: 07:00 – 12:25	58.0	52.0	51.0	47.0	49.0	45.0	38.0	53.0	80.0

Graphical Time History

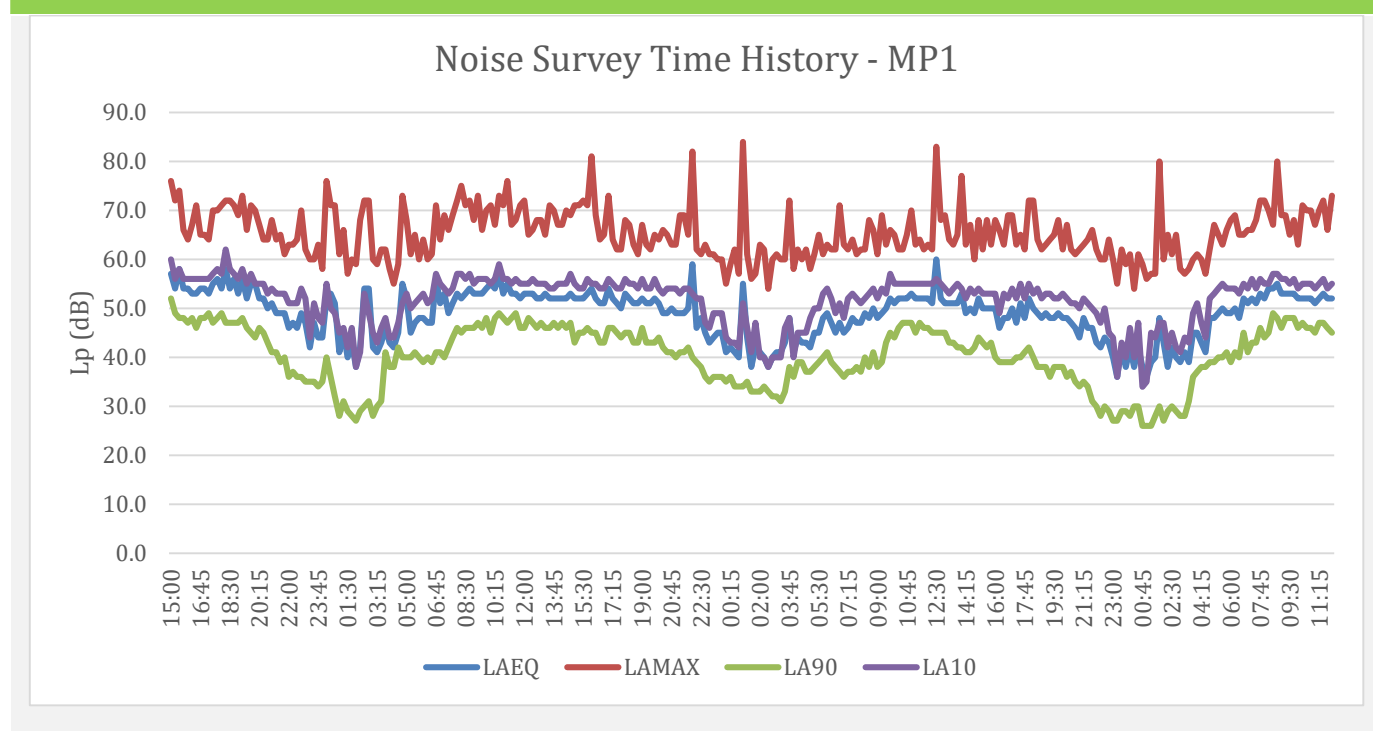


Table 12.0 – Sound Survey Summary Results – MP1

Measurement Position MP2									
Measurement Period ('t')	Octave Band $L_{eq,t}$ (Hz, dB)							$L_{Aeq,t}$ (dB)	$L_{Amax,t}$ (dB)
	63	125	250	500	1k	2k	4k		
Day 1 – 11/06/21: 15:00 – 23:00	63.0	58.0	55.0	53.0	57.0	49.0	40.0	59.0	96.0
Night 1 – 11/06/21: 23:00 – 07:00	56.0	50.0	48.0	47.0	49.0	43.0	37.0	52.0	92.0
Day 2 – 12/06/21: 07:00 – 23:00	64.0	59.0	56.0	54.0	56.0	50.0	44.0	58.0	88.0
Night 2 – 12/06/21: 23:00 – 07:00	54.0	49.0	52.0	47.0	47.0	42.0	38.0	51.0	88.0
Day 3 – 13/06/21: 07:00 – 23:00	62.0	57.0	54.0	52.0	54.0	47.0	42.0	56.0	92.0
Night 3 – 13/06/21: 23:00 – 07:00	56.0	49.0	47.0	46.0	48.0	42.0	35.0	51.0	78.0
Day 4 – 14/06/21: 07:00 – 12:25	65.0	57.0	55.0	53.0	55.0	49.0	43.0	58.0	84.0

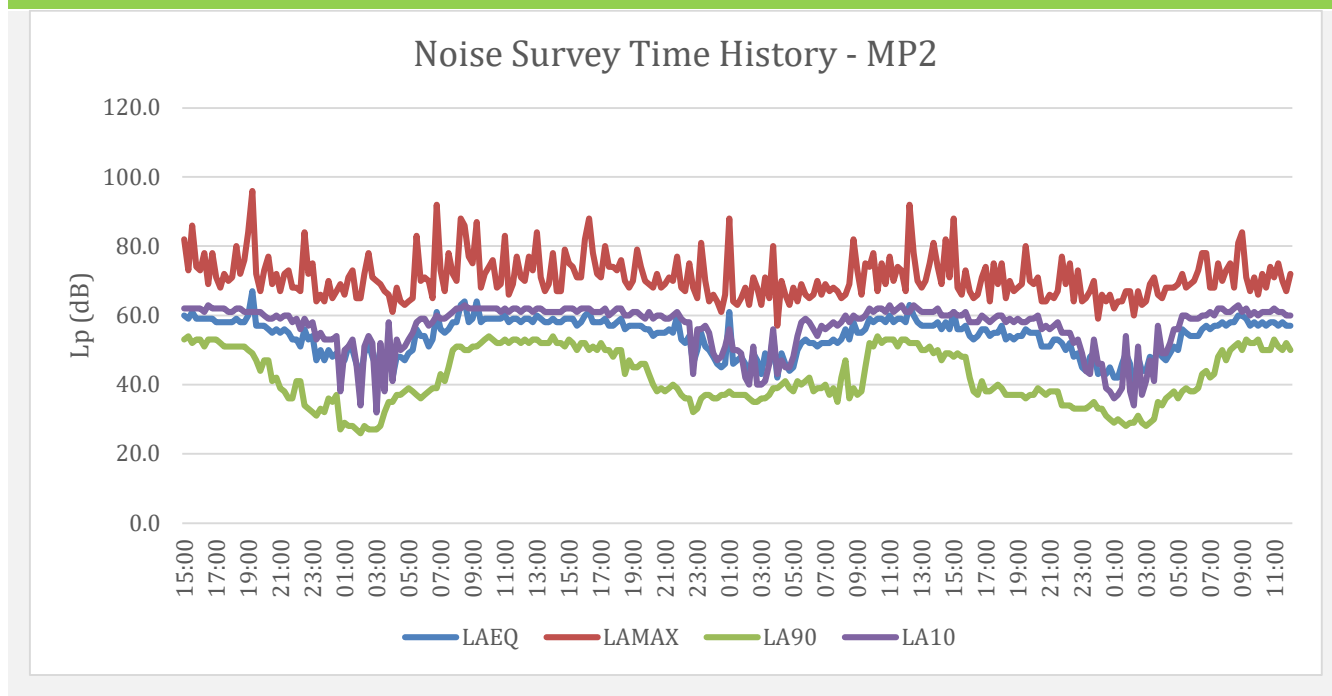


Table 13.0 – Sound Survey Summary Results – MP2

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
SVAN 977 Class 1 Sound Level Meter	34826	≤0.5
SVAN Class 1 Calibrator SV31	32569	
CESVA 310 Class Sound Level Meter	T221722	≤0.5
CESVA CB005 Class 1 Calibrator	37771	

Table 14.0 – Measurement Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤ 0.5 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Spalding – Adjacent to Site				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
11/06/21: 00:00 – 23:59	15.2 – 23.2	0.0	WSW	0.0 – 2.6
12/06/21: 00:00 – 23:59	13.3 – 23.0	0.0	W	0.0 – 2.2
13/06/21: 00:00 – 23:59	10.9 – 28.1	0.0	SW	0.0 – 0.9
14/06/21: 00:00 – 23:59	12.6 – 25.3	0.0	WSW	0.0 – 3.1

Table 15.0 – Weather Summary