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Project:

Stem Extension, Gospel Oak School, London NW3 2JB

Title:

Plant Noise Impact Assessment

quietly moving forward

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CONTENTS:

1 INTRODUCTION

1.01 Environmental Equipment Corporation Limited has been commissioned by Hayhurst and Co. to undertake a noise assessment of an outdoor condenser unit proposed to serve a new ICT classroom constituting a part of the proposed building extension at Gospel Oak School, London NW3 2JB.

1.02 This noise assessment has been conducted in accordance with the policies and requirements of Camden Council and is based on a noise survey carried out at the site during representative periods on a typical school day.

1.03 This assessment includes:

- the setting of condenser noise limits in accordance with the requirements of Camden Council and national planning policy, standards and guidance; and
- the prediction of noise impacts at the closest noise sensitive receptors based on the proposed condenser and its location.

1.04 This report is prepared solely for Hayhurst and Co. Environmental Equipment Corporation Limited accepts no responsibility for its use by any third party.

1.05 Whilst every effort has been made to ensure that this report is easy to understand, it is necessarily technical in nature. To assist the reader, an explanation of the terminology used in this report is contained in Appendix A.

2 SITE

2.01 Gospel Oak is a community primary school located in a predominantly residential area of Camden.

2.02 The school grounds are bound by the following:

- North – railroad tracks;
- East – Gospel Oak train station;
- South – Gordon House Road, Mansfield Road and mixed commercial/residential properties beyond (up to two-storey); and
- West – Savernake Road, and Gospel Oak Early Years school as well as residential properties beyond (up to four-storey).

The general site plan is shown in Figure B1 in Appendix B.

2.03 The condenser is proposed to be located in the south-western part of the site, by the external walls of the proposed Food Technology classroom and WC, and behind a weather louvered screen. Portions of the walls directly behind and to the side of the condenser are proposed to be acoustically lined. The location of the condenser is indicated in Figures B1 and B2 in Appendix B.

2.04 The condenser is proposed to operate during school days, typically between 0830-1530 hours. The condenser operation may occasionally extend beyond these hours, with the extended operation period restricted to 0700-1900 hours.

2.05 The closest noise sensitive receptors to the proposed plant items are the following:

- R1: 2nd floor window located within the eastern elevation of the residential property of 128 Mansfield Road;
- R2: 1st floor windows located within the northern elevation of the residential flats of 17A-79B Mansfield Road; and
- R3: 1st floor window located within the eastern elevation of the caretaker's house.

The locations of the above receptors are indicated in Figures B1 and B2 in Appendix B. Receptors R1 and R2 are located approximately 30 metres away from the condenser, whereas receptor R3 is approximately 9 metres away. All receptors are within the line of site to the condenser.

2.06 All other noise sensitive receptors are at a greater distance from the proposed location of the units, or are protected by more screening by the intervening structures, and as such will be subject to lower levels of noise.

3 GUIDANCE

3.01 Guidance on noise management, control and rating pertinent to this application is provided by the planning policy for Camden Council, National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE), and British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound'. The relevant parts of these documents are presented in Appendix C.

3.02 Typically Camden Council require that noise from the mechanical services is designed to a level of 5 dB below the existing L_{A90} noise level, as assessed outside of any noise sensitive facades. A criterion of 10 dB below the existing L_{A90} noise level is required if the plant generates noise that has distinguishable tonal components, or includes distinct impulsive sounds.

4 MEASUREMENTS

4.01 Environmental noise measurements were carried out between approximately 1200-1310 hours on Tuesday 3rd May 2016, to obtain representative samples of existing noise levels at the site.

4.02 The weather during the survey was suitable for noise measurement – it was dry with little wind for the duration of the survey.

4.03 The measurements have been carried out at the following location:

- Position 1: located approximately 1.5 metres above the walkway of Savernake Road, approximately 6 metres to the west from receptor R1. The measurement was located not closer than 3.5 m from any significant reflective surface other than the mounting surface.
- Position 2: located approximately 1.5 metres above the access walkway, approximately 4 m to the north-west from receptor R3. The measurement was located approximately 1.5 metres away from the closest facade.

The measurement positions are indicated on the site plan in Appendix B.

4.04 The predominant source of noise on site was road traffic on Mansfield Road and Gordon House Road. Other significant sources of noise included the children's activity on the school playground located approximately 30 and 25 metres to the north from the measurement positions 1 and 2 respectively, and train traffic noise originating from approximately 85-100 metres to the west and north from the measurement positions.

4.05 The measurement position 1 is considered to be representative of receptor R1. It also represents the worst-case measurement for receptor R2, as the measurement was further away and partially screened from the traffic on Mansfield Road and Gordon House Road, which is the main source of noise at this receptor. Measurement position 2 is considered representative of receptor R3.

4.06 The measurements were taken during the off-peak road traffic period on a typical school day, and as such are considered to represent the lowest ambient and background noise levels typically occurring on site during the proposed period of operation for the condenser.

5 EQUIPMENT

5.01 Equipment for the survey was as follows:-

- Brüel & Kjær type 2250 Light Integrating Sound Level Meter conforming to Class 1 BS EN 61672, Type 1 BS EN 60804 & BS EN 60651: 1994.
- Brüel & Kjær Outdoor Microphone, type 4952/UA1679;
- Tripod.

5.02 The equipment holds current UKAS or equivalent accreditation and serial numbers as follows:

Sound Level Meter B&K2250L	Serial No.	2766725
	Calibration Date	28th July 2015
	Cal Certificate No.	U19314
Outdoor ½" Condenser Mic. B&K 4952	Serial No.	2751633
	Calibration Date	28th July 2015
	Cal Certificate No.	19313
Calibrator B&K4231	Serial No.	2389051
	Calibration Date	27th July 2015
	Cal. Certificate No.	U19312

N.B. Copies of calibration certificates are available upon request.

5.03 The equipment was calibrated both before and after the survey with no difference noted in the levels.

6 RESULTS

6.01 The measured ambient and background noise levels are shown in Table 6.1.

6.02 At position 1 the lower background noise level $L_{A90,T}$ was recorded between 1216-1226 hrs, and this noise level will be used to set the condenser noise limits at the closest receptors represented by this position to represent the worst case noise impact assessment.

6.03 A -3 dB facade correction has been applied to the measurements at position 2 to represent free-field measurement conditions.

Position	Period	$L_{Aeq,T}$ – dB	$L_{A90,T}$ – dB
1	1216-1226 hrs (T=10 min)	62	52
	1258-1308 hrs (T=10min)	64	58
2	1246-1251 (T=5min)	56	52

Table 6.1: Free-field measured ambient and background noise levels. The measurements at Position 2 include a -3 dB facade correction to represent free-field measurement conditions.

7 PLANT ASSESSMENT

7.01 In the following, the impact of noise from the proposed condenser on the closest noise sensitive receptors is assessed.

7.02 The assessed condenser is a Mitsubishi PUHZ-ZRP125VKA/YKA unit, with the manufacturer's published sound power level (SWL) of 70 dB(A) in cooling mode. Based on the manufacturer's published sound pressure level (SPL) data for the cooling and heating modes, it is expected that the unit's SWL in the heating mode will be 72 dB(A).

7.03 The results of the noise measurements on site were used to establish the noise rating level limits that the plant will need to meet at the closest noise receptors described in Section 2.05. Following the standard recommendations of Camden Council, it is proposed that the noise at 1 metre from the noise sensitive windows should not exceed 5 dB below the lowest measured $L_{A90,T}$, as shown in Table 7.1 below.

Location	Period	Measured Lowest Existing $L_{A90,T}$	Proposed Noise Limit L_{Ar}
1 and 2	Condenser operation (0700-1900 hrs)	52 dB	47 dB

Table 7.1: Suggested plant noise emission limits based on lowest measured $L_{A90,T}$.

7.04 Note that the limits suggested above are rating levels and as such any design should take into account the acoustic characteristics of the plant. In this instance the proposed unit displays none of the characteristics whereby the acoustic correction should be applied.

7.05 Predicted noise levels have been calculated at receptors R1, R2, and R3. Tables 7.2-7.3 further below present the worst-case condenser noise predictions for these receptors.

7.06 Other noise sensitive receptors will be subject to lower noise levels than those predicted at the above locations.

7.07 To ensure the adopted noise limits are met at all assessment locations, it is proposed that the sound pressure increase due to reflections from the walls in the immediate vicinity of the condensers is nullified by the installation of acoustic lining to portions of these walls.

7.08 It can be seen that the predicted noise levels will be significantly below the adopted criteria during the period of condenser operation at the closest noise sensitive receptors. The noise is predicted to be -10 dB below the lowest measured background noise level of 52 dB(A) in the worst case, and so it will be below the NOEL with respect to the NPPF.

Receptor	Item	Noise Level	Notes
R1, R2	Mitsubishi PUHZ-ZRP125VKA/YKA	72 dB(A)	SWL (heating mode)
	Reflections	0 dB	Effect of reflections from adjacent walls nullified by acoustic lining
	Conformal area propagation loss	-40 dB	Sound attenuation over 29 m
	Total noise level	32 dB(A)	SPL at 1 metre from receptors R1 and R2
R3	Mitsubishi PUHZ-ZRP125VKA/YKA	72 dB(A)	SWL (heating mode)
	Reflections	0 dB	Effect of reflections from adjacent walls nullified by acoustic lining
	Conformal area propagation loss	-30 dB	Sound attenuation over 8 m
	Total noise level	42 dB(A)	SPL at 1 metre from receptor R3

Table 7.2: Worst-case condenser noise calculation for receptors R1, R2, and R3.

Property	Period	Proposed Noise Limit L_{Ar} (dB)	Predicted $L_{Aeq,T}$ (dB)	Exceedance of noise limit (dB)
Receptors R1 and R2	Condenser operation (0700-1900 hrs)	47	32	-15
Receptor R3			42	-5

Table 7.3: Assessment of predicted noise levels based on proposed noise limits.

8 CONCLUSIONS

8.01 Environmental Equipment Corporation Limited has been commissioned by Hayhurst and Co. to undertake a noise assessment of an outdoor condenser unit proposed to serve a new ICT classroom constituting a part of the proposed building extension at Gospel Oak School, London NW3 2JB.

8.02 The assessment has been carried out in accordance with relevant standards, national planning guidance and the requirements of Camden Council, and was based on an environmental noise survey conducted at the site over representative periods on a typical school day.

8.03 The potential noise impact of the proposed condenser has been evaluated at the closest noise sensitive receptors.

8.04 To ensure the adopted noise limits are met at all assessment locations, a sound pressure increase due to reflections from the walls located behind and to the side of the condenser is proposed to be nullified by the application of acoustic lining to portions of these surfaces.

8.05 Predictions have shown that with the acoustic lining in place the proposed noise criteria are met at all assessment locations. Assessing the site in accordance with the principles of the NPPF has shown that the noise levels predicted outside the closest noise sensitive receptors will be below the level at which no effects are observed to occur, the NOEL.

8.06 On the basis of this assessment it is considered that noise should not pose a material constraint to the operation of the proposed condenser.

APPENDIX A

GLOSSARY OF TECHNICAL TERMS

TECHNICAL TERMS AND UNITS

Decibel (dB) - This is the unit used to measure sound. The human ear has an approximately logarithmic response to sound over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). We therefore use a logarithmic scale to describe sound pressure levels, intensities and power levels. The logarithms used are to base 10; hence, an increase of 10 dB in sound pressure level corresponds to a doubling in perceived loudness of the sound.

Sound Power Level (SWL) - This is a function of the noise source alone and is independent of its surroundings. It is a measure of the amount of sound power output measured in decibels.

Sound Pressure Level (SPL) - This is a function of the source and its surroundings and is a measure of the sound pressure at a point in space. For example, a sound pressure level measured at 1 metre from a sound source of certain sound power in reverberant room will not be the same as the sound pressure level a 1 metre from the sound source measured in open space.

Octave and One-Third Octave Bands - The human ear is sensitive to sound over a range of approximately 20 Hz to 20 KHz and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands and the sound pressure level is measured in each band. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For finer analysis, each octave band may be split into one-third octave bands.

"A" Weighting - A number of frequency weightings have been developed to imitate the ear's varying sensitivity to sound of different frequencies. The most commonly used weighting is the "A" weighting. The "A" weighted SPL can be measured directly or derived from octave or one-third octave band SPLs. The result is a single figure index which gives some idea of the subjective loudness of the sound, but which contains no information as to its frequency content.

Noise Rating (NR) Curves - The "A" weighted sound pressure level cannot be used to define a spectrum or to compare sounds of different frequencies. NR curves convey frequency information in a single-figure index. This is done by defining the maximum permissible sound pressure level at each frequency for each curve. To measure the noise rating of a given environment, the SPL is measured in octave or one-third octave bands and the noise rating is then the highest NR curve touched by the measured levels.

Intermittency and Time-Weighting - The degree of annoyance caused by a noise also depends on its duration and intermittency of a noise. Intermittent, impulsive or repetitive noises tend to be more annoying than continuous noises. Various time-weightings have been derived to measure sounds of differing intermittences and these can be measured directly on modern equipment. The most common time-weightings in use are as follows:-

L_{90} This is the sound pressure level exceeded for 90% of the measurement period. It is widely used to measure background noise levels.

L_{10} This is the sound pressure level exceeded for 10% of the measurement period. It is widely used to measure traffic noise. For a given measurement period, the L_{10} level is by definition greater than or equal to the L_{90} level.

L_{eq} The equivalent continuous noise level is often used to measure intermittent noise. It is defined as the notional steady noise level that would contain the same acoustic energy as the varying noise. Because the averaging process used is logarithmic, the L_{eq} level tends to be dominated by the higher noise levels measured.

APPENDIX B

SITE PLAN
&
MEASUREMENT LOCATION

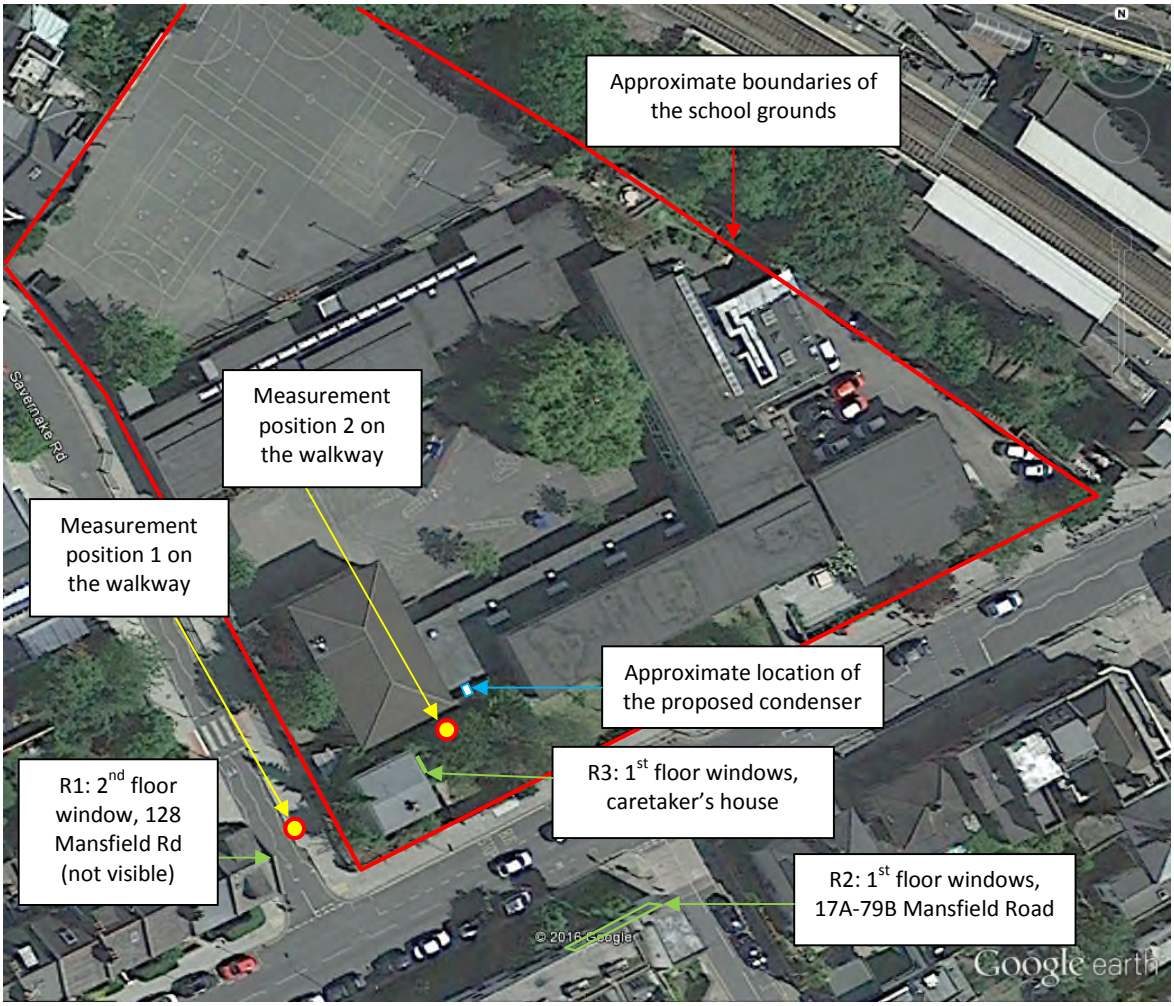

Figure B1: Existing site plan.

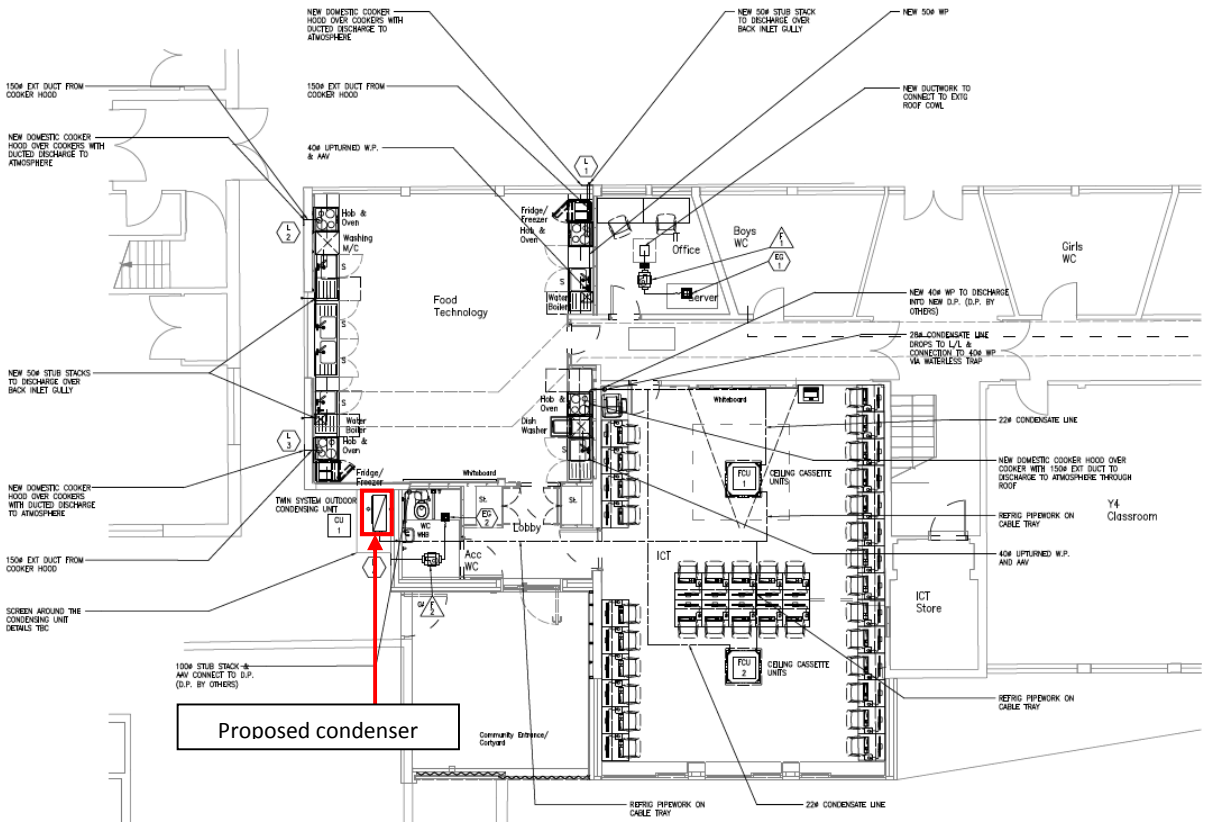

Figure B2: Proposed site plan.

APPENDIX C

PLANNING POLICY AND GUIDANCE

PLANNING POLICY AND GUIDANCE

Planning Policy in the London Borough of Camden

POLICY

DP28 – Noise and vibration

The Council will seek to ensure that noise and vibration is controlled and managed and will not grant planning permission for:

a) development likely to generate noise pollution; or

b) development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided.

Development that exceeds Camden's Noise and Vibration Thresholds will not be permitted.

The Council will only grant permission for plant or machinery if it can be operated without cause harm to amenity and does not exceed our noise thresholds.

The Council will seek to minimise the impact on local amenity from the demolition and construction phases of development. Where these phases are likely to cause harm, conditions and planning obligations may be used to minimise the impact.

With relation to plant noise emissions, DP28 provides the following table which sets maximum noise criterion limits above which planning permission will not be granted. The policy explains that noise sensitive development includes housing, schools and hospitals as well as offices.

Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day, evening and night	0000-2400	5dB(A) <LA90
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade.	Day, evening and night	0000-2400	10dB(A) <LA90
Noise at 1 metre external to sensitive façade where LA90>60dB	Day, evening and night	0000-2400	55dB$L_{Aeq'}$

National Planning Policy Framework and the Noise Policy Statement for England

The Department for Communities and Local Government published the National Planning Policy Framework (NPPF) on 27th March 2012 and upon its publication, the majority of planning policy statements and guidance notes were withdrawn, including Planning Policy Guidance 24 Planning and Noise, which previously presented the government's overarching planning policy on noise.

The NPPF contains four aims, which are set out at paragraph 123 in Section 11 of the document, titled *Conserving and enhancing the natural environment*:

> *"Planning policies and decisions should aim to:*
>
> *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
>
> *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
>
> *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
>
> *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

The Department for Environment Food and Rural Affairs published the Noise Policy Statement for England (NPSE) in March 2010. The explanatory note of NPSE defines the following terms used in the NPPF:

> *"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.*
>
> *LOAEL – Lowest Observed Adverse Effect Level*
>
> *This is the level above which adverse effects on health and quality of life can be detected.*
>
> *2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.*
>
> *SOAEL – Significant Observed Adverse Effect Level*
>
> *This is the level above which significant adverse effects on health and quality of life occur."*

The NPSE does not define any of the above effect levels numerically.

The NPSE presents the Noise Policy Aims as:

> *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy and sustainable development:*
>
> *avoid significant adverse impacts on health and quality of life;*
>
> *mitigate and minimise adverse impacts on health and quality of life; and*
>
> *where possible, contribute to the improvement of health and quality of life."*

It can be seen that the first two bullet points are similar to Section 11 of the NPPF, with a third aim that seeks to improve health and quality of life. The NPSE later expands on the Noise Policy Aims, stating:

> *2.23 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development (paragraph 1.8).*
>
> *2.24 The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.*
>
> *2.25 This aim* (the third aim)*, seeks where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development (paragraph 1.8), 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."*

It is clear that noise described in the NPSE as SOAEL that would lead to significant adverse effects should be avoided, although there is no definition as to what constitutes a significant adverse effect. Similarly, noise should be mitigated where it is high enough to lead to adverse effects, termed the LOAEL, but not so high that it leads to significant adverse effects.

British Standard 4142

To assess the acceptability of the resultant noise levels we have consulted the relevant standards. BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' has been used to assess the likelihood any adverse impacts based on the resultant noise level from the new plant item, including any corrections for the character of the noise against the existing background noise level.

BS4142 gives guidance on assessing the likelihood of adverse impacts by calculating a 'rating level' of the new noise source and comparing its magnitude at noise sensitive locations to the existing or underlying background noise level. The background noise level is subtracted from the 'rating level' to assess the likelihood of complaints:

- The greater the difference the greater the likelihood of complaints.
- A difference of around +10dB or more is an indication of a significant adverse impact, depending on the context.
- A difference of +5dB 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 noise level, the less likely it is that the specific sound source will have an adverse impact or 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 sound impact, depending on the context.

This assessment is carried out over a one hour period for the daytime and a fifteen minute period for the night-time. For the purposes of the standard it states that daytime and night-time are typically 07:00 to 23:00 hours and 23:00 to 07:00 hours respectively.

The 'rating level' of the noise source is obtained taking the following factors into consideration:

- The new plant noise (the specific noise) is measured or predicted in terms of L_{Aeq}.
- An additional correction shall be included if the noise contains a distinguishable, discrete continuous note, if the noise contains distinct impulses or if the noise is irregular enough to attract attention. The value for any tonal noise can be an addition of up to 6dB and for impulsive noise of up to 9dB.

BS 4142 goes onto state that:

'The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.'

BS4142 has been referenced in setting noise limits for any fixed plant proposed as part of the proposed development.

APPENDIX D

SURVEY RESULTS
(TABULAR)

APPENDIX E

SURVEY RESULTS
(GRAPHICAL)