



Armstrong House  
3 Bassett Avenue  
Southampton  
SO16 7DP

T: 023 8155 5000

**PROPOSED RESIDENTIAL DEVELOPMENT AT VASTERN ROAD, READING**  
**NOISE IMPACT ASSESSMENT**

Technical Report: R8220-2 Rev 0 (draft)

Date: 10th January 2020

For: Berkeley Homes (Chiltern) Ltd  
Berkeley House,  
Farnham Lane,  
Slough  
SL2 3RQ

## 24 Acoustics Document Control Sheet

**Project Title:** Proposed Residential Development at Vastern Road, Reading  
Noise Impact Assessment

**Report Ref:** R8220-2 Rev 0 (draft)

**Date:** 10th January 2020

|                                       | Name                                   | Position | Signature                                                                           | Date    |
|---------------------------------------|----------------------------------------|----------|-------------------------------------------------------------------------------------|---------|
| <b>Prepared by</b>                    | Reuben Peckham<br>BEng MPhil CEng MIOA | Director |  | 10/1/20 |
| <b>Reviewed by</b>                    | Stephen Gosling<br>BEng MIOA           | Director |   | 10/1/20 |
| <b>Approved by</b>                    | Stephen Gosling<br>BEng MIOA           | Director |   | 10/1/20 |
| For and on behalf of 24 Acoustics Ltd |                                        |          |                                                                                     |         |

### Document Status and Approval Schedule

| Revision | Description                  | Prepared By | Reviewed By | Approved By |
|----------|------------------------------|-------------|-------------|-------------|
| 0        | Draft for initial discussion | RP          | SG          | SG          |
|          |                              |             |             |             |
|          |                              |             |             |             |
|          |                              |             |             |             |
|          |                              |             |             |             |

### DISCLAIMER

This report was completed by 24 Acoustics Ltd on the basis of a defined programme of work and terms and conditions agreed with the Client. The report has been prepared with all reasonable skill, care and diligence within the terms of the Contract with the Client and taking into account the project objectives, the agreed scope of works, prevailing site conditions and the degree of manpower and resources allocated to the project.

24 Acoustics Ltd accepts no responsibility whatsoever, following the issue of the report, for any matters arising outside the agreed scope of the works.

This report is issued in confidence to the Client and 24 Acoustics Ltd has no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

Unless specifically assigned or transferred within the terms of the agreement, 24 Acoustics Ltd retains all copyright and other intellectual property rights, on and over the report and its contents.

© 24 Acoustics Ltd 2020

## **EXECUTIVE SUMMARY**

24 Acoustics Ltd has been retained by Berkeley Homes (Chiltern) Ltd to assess the impact of noise upon their proposed residential development at Vastern Road in Reading.

The site is affected by noise from road traffic using Vastern Road, from aircraft and train movements and from the SSE transformer substation which neighbours the proposed development site.

In order to assess the noise impact on the site detailed noise surveys and acoustic calculations have been undertaken between September 2018 and December 2019. Following this feedback has been provided to the design team to optimise the design of the site to minimise noise impact.

Measures have been taken to ensure that the noise levels both externally and internally within the proposed new development will be acceptable. This will involve detailed acoustic design post-planning and will require alternative means of ventilation and design measures to prevent excess thermal build up to allow residents to occupy their dwellings with windows closed (if they so wish).

On this basis it is considered that an acceptable noise environment can be obtained within the proposed development and it is considered that there are no noise grounds for refusal of planning consent.

## TABLE OF CONTENTS

|     |                                           |    |
|-----|-------------------------------------------|----|
| 1.0 | INTRODUCTION                              | 5  |
| 2.0 | SITE DESCRIPTION AND PROPOSED DEVELOPMENT | 5  |
| 3.0 | ACOUSTIC ASSESSMENT CRITERIA              | 6  |
| 4.0 | ASSESSMENT AND CALCULATION METHODOLOGY    | 10 |
| 5.0 | NOISE SURVEYS AND CALCULATIONS            | 11 |
| 6.0 | NOISE IMPACT ASSESSMENT                   | 13 |
|     | REFERENCES                                | 17 |

## **1.0 INTRODUCTION**

- 1.1 24 Acoustics Ltd has been retained by Berkeley Homes (Chiltern) Ltd to assess the impact of noise upon their proposed residential development at Vastern Road in Reading.
- 1.2 The site is affected by noise from road traffic using Vastern Road, from aircraft and train movements and from the SSE transformer substation which neighbours the proposed development site.
- 1.3 This report presents the findings and recommendations for the assessment following detailed on-site noise surveys and acoustic modelling undertaken on site between September 2018 and December 2019.
- 1.4 All noise levels are presented in dB relative to 20  $\mu$ Pa. A glossary of the acoustic terminology used in this report is provided in Appendix A.

## **2.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT**

- 2.1 The proposed development site is located on land formerly occupied by Scottish and Southern Electric (SSE) between Vastern Road and the River Thames. The site currently comprises the former SSE office buildings (which front Vastern Road) with car parking and a substation to the rear. Figure 1 provides an aerial image of the undeveloped site.
- 2.2 It is proposed to demolish a number of the existing structures and erect a series of buildings to form a predominantly residential scheme (specified as 208 residential units – 59x1, 137x2 & 12x3-bed units) with a cafe and a new north-south pedestrian link connecting Christchurch Bridge to Vastern Rd towards Reading Station. Figure 2 provides a plan of the proposed development scheme.
- 2.3 The site is affected by noise from road traffic using Vastern Road together with ambient city noise which includes distant road traffic, aircraft and rail movements. In addition, the site is affected by noise from the neighbouring SSE transformer substation. This generates a continuous low level low frequency 'hum' from the transformers (which is more noticeable at night when background noise levels are lower) and a higher level of broadband noise from the transformer cooling fans which operate intermittently at any time (according to the status of the transformers and the ambient temperature/ humidity).

### 3.0 ACOUSTIC ASSESSMENT CRITERIA

#### National Planning Policy Framework and Noise Policy Statement for England

3.1 The National Planning Policy Framework (NPPF) [Reference 1] states that planning policies and decisions should ensure that new development is appropriate for its location taking into account the likely 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:

- Mitigate and reduce to a minimum, potential adverse impacts resulting from noise from new development- and avoid noise giving rise to significant adverse impacts on health and quality of life;
- Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

3.2 The NPPF refers to the Noise Policy Statement for England (NPSE) [Reference 2] which is intended to apply to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise. The NPSE sets out the Government's long-term 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' which is supported by the following aims.

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life.

3.3 The NPSE defines the concept of a 'significant observed adverse effect level' (SOAEL) as 'the level above which significant adverse effects on health and quality of life occur'. The following guidance is provided within the NPSE:

*"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."*

- 3.4 In 2014 the Planning Practice Guidance (PPG) was finalised [Reference 3]. This is written to support the NPPF with more specific planning guidance. The PPG reflects the NPSE and states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. It also states that opportunities should be taken, where practicable, to achieve improvements to the acoustic environment. The PPG states that noise can over-ride other planning concerns but should not be considered in isolation from the other economic, social and environmental dimensions of the proposed development.
- 3.5 The PPG expands upon the concept of SOAEL (together with Lowest Observable Adverse Effect Level, LOAEL and No Observed Effect Level, NOEL) as introduced in the NPSE and provides a table of noise exposure hierarchy for use in noise impact assessments in the planning system.
- 3.6 In general terms it is considered that a noise impact with an effects level which is lower than SOAEL is acceptable (providing the effect is mitigated to a minimum). There is currently, however, a discontinuity between the above guidance and objective technical criteria for use in planning noise impact assessments. For this site it is considered that the appropriate (technical and objective) standards for use in assessing the noise impact are British Standard 8233: 2014 and guidance from the World Health Organisation for habitable rooms in the proposed hotel and those of British Standard 4142 for proposed plant items associated with the development.

#### Professional Practice Guidance on Planning & Noise (ProPG)

- 3.7 The Professional Practice Guidance on Planning and Noise (ProPG) [Reference 4] was published jointly by the Association of Noise Consultants, Institute of Acoustics and Chartered Institute of Environmental Health in May 2017. The guidance relates to the consideration of existing sources of transportation noise upon proposed new residential development and strives to:
- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
  - Encourage the process of good acoustic design in and around new residential developments;
  - Outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
  - Improve understanding of how to determine the extent of potential noise impact and effect; and
  - Assist the delivery of sustainable development.

3.8 The guidance describes a recommended approach for new residential development, which includes four key elements of the assessment process, identified below:

- i. Good acoustic design process;
- ii. Internal noise level guidelines;
- iii. External amenity area noise assessment;
- iv. Assessment of other relevant issues.

3.9 It is important to note that the guidance in the ProPG does not constitute an official government code of practice and neither replaces nor provides an authoritative interpretation of the law or government policy. It is provided for guidance only and has no formal place within planning legislation.

#### BS 8233:2014 and WHO Guidelines

3.10 BS 8233:2014 [Reference 5] provides design guidance for dwelling houses, flats and rooms in residential use and recommends that internal noise levels in dwellings do not exceed 35 dB  $L_{Aeq,16\text{ hr}}$  in living rooms and bedrooms during the day, 40 dB  $L_{Aeq,16\text{ hr}}$  in dining rooms during the day and 30 dB  $L_{Aeq,8\text{ hr}}$  in bedrooms at night.

3.11 The standard states that the above limits apply to steady external noise sources without specific character, and also states the following:

*"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."*

3.12 BS 8233:2014 also notes that *"Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or  $L_{Amax,F}$ , depending on the character and number of events per night."*

3.13 Although the guidelines have no formal standing, the World Health Organisation (WHO) provides guidance on desirable internal noise levels to minimise the risk of sleep disturbance. The WHO 2000 guidelines [Reference 6] suggest internal night-time noise levels not exceeding 30 dB  $L_{Aeq,8\text{ hr}}$  or regularly (10 – 15 times per night) exceeding 45 dB  $L_{Amax,f}$  for 'a good night's sleep'.

#### BS 4142:2014 Methods for Rating Industrial and Commercial Sound

3.14 BS 4142:2014 [Reference 7] provides a method for rating the effects of industrial and commercial sound on residential areas.

- 3.15 The standard advocates a comparison between the typical measured  $L_{A90}$  background noise level and  $L_{Aeq}$  noise level from the source being considered. For rating purposes if the noise source is tonal, intermittent, or otherwise distinctive in character, a rating correction should be applied.
- 3.16 The standard states that a difference between the rating level and the background level of around +10 dB is an indication of a significant adverse impact, depending on the context and a difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context. Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact (depending upon the context).
- 3.17 BS 4142 requires the noise impact to be assessed depending on the context. In relation to situations where background noise levels are low, the standard states *"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."*
- 3.18 If the noise emissions are tonal or contain other noticeable characteristics then a suitable correction is applicable, in accordance with BS 4142:2014.

#### Low Frequency Noise- NANR45

- 3.19 Research by the University of Salford for DEFRA [Reference 8] identifies a maximum threshold for low frequency noise. This is shown in Table 1 below.

| <b>1/3 Octave Band, Hz and <math>L_{eq}</math> Sound Pressure Level</b> |             |           |           |           |             |           |           |           |           |            |            |            |
|-------------------------------------------------------------------------|-------------|-----------|-----------|-----------|-------------|-----------|-----------|-----------|-----------|------------|------------|------------|
| <b>10</b>                                                               | <b>12.5</b> | <b>16</b> | <b>20</b> | <b>25</b> | <b>31.5</b> | <b>40</b> | <b>50</b> | <b>63</b> | <b>80</b> | <b>100</b> | <b>125</b> | <b>160</b> |
| 92                                                                      | 87          | 83        | 74        | 64        | 56          | 49        | 43        | 42        | 40        | 38         | 36         | 34         |

**Table 1:** NANR45 Low Frequency Noise Thresholds

- 3.20 The guidance is intended to provide a procedure to help determine whether a low frequency environmental noise exists that could be the cause of complaints and therefore is considered to represent a reasonable maximum threshold for low frequency noise inside the proposed new dwellings. The guidelines are broadly consistent with national criteria in Germany, Sweden, Denmark, Poland and the Netherlands.

### Consultation with LPA

- 3.21 Feedback from Reading Borough Council's Environmental Health Department has indicated that they are happy with the use of the standards described above to assess the noise impact. They also stressed that complaints about noise from the transformers have been received in the past and they would expect to see BS 4142 used to assess the noise impact in private external amenity spaces.

## **4.0 ASSESSMENT AND CALCULATION METHODOLOGY**

### Summary of Acoustic Design Criteria

- 4.1 On the basis of the review above 24 Acoustics is of the opinion that the noise environment at the proposed new dwellings will be acceptable if the following criteria are complied with:
- Noise levels internally in habitable rooms not to exceed 30 dB  $L_{Aeq, 16 \text{ hour}}$  during the day and 30 dB  $L_{Aeq, 8 \text{ hour}}$  at night;
  - Low frequency noise levels internally not to exceed the thresholds shown above in Table 1.
  - Where the above criterion is reliant on closed windows to provide ventilation by mechanical means and to ensure that each property is designed to minimise excessive thermal build up;
  - Noise levels in private external amenity areas, should not exceed the prevailing representative daytime background noise level by more than 5 dBA (with a correction applied for noise character, if necessary), in accordance with the requirements of BS 4142:2014.
- 4.2 24 Acoustics has liaised extensively with Berkeley Homes and their architects/ design team to optimise the acoustic design of the scheme to minimise noise impact.
-

### Calculation Methodology

- 4.3 The recommendations set out in this report are based upon noise surveys undertaken by 24 Acoustics in the Spring and Summer of 2018 and a further, detailed, sound power survey of the noise from the plant undertaken on Friday 1st March 2019. Further surveys were also taken on Monday 25th March 2019 to quantify the dominant tones from the plant. A night-time survey was undertaken in the early hours of 1 April 2019 and again on 5th December 2019 to quantify the noise from the substation alone (taken at night to minimise the impact of ambient noise) and a further site survey undertaken on 13th November 2019.
- 4.4 The survey data has been used to populate a three-dimensional acoustic model of the site. This has predicted the noise levels from SSE cooling fan operations at the proposed building facades at each floor of the proposed development. Noise from the transformer operation (dominant in the 100 Hz 1/3 octave band) was found to be too diffuse on site and hence cannot be modelled. Hence this has been determined from survey data at various locations across the site.
- 4.4 This data has been used to quantify noise levels in external amenity spaces and to determine the acoustic specification for window systems and alternative means of ventilation where required.

## **5.0 NOISE SURVEYS AND CALCULATIONS**

### Vastern Road Facade

- 5.1 The noise level from road traffic (and other sources) at the Vastern Road frontage of the site was measured in an unattended noise survey undertaken between 1st and 9th March 2019. Measurements were undertaken at a height of 1.5 m above local grade at the location of the proposed new façade fronting Vastern Road, as shown in Figure 3. An environmental windshield was fitted.
- 5.2 The measurements were undertaken in samples of 5 minutes in terms of the overall A-weighted and linear octave band  $L_{eq}$ ,  $L_{90}$  and  $L_{Max,f}$  sound pressure level in dB. The following instrumentation was used:
- Rion NL-32 Class 1 accuracy sound level meter;
  - Bruel and Kjaer 4231 acoustic calibrator.

- 5.3 The instrumentation was calibrated before and after the surveys in accordance with the manufacturer's recommendations. No drift in calibration was recorded.
- 5.4 The results of the survey are shown graphically in Appendix B and are summarised in Table 2 below.

| Day and Date          | Period and Noise Level, dB |                       |                     |
|-----------------------|----------------------------|-----------------------|---------------------|
|                       | Day                        | Night                 |                     |
|                       | L <sub>Aeq</sub> 16 hr     | L <sub>Aeq</sub> 8 hr | L <sub>Amax,f</sub> |
| Friday 1/3/2019       | -                          | 65                    | 80                  |
| Monday 4/3/2019       | 69                         | 63                    | 80                  |
| Tuesday 5/3/2019      | 69                         | 65                    | 81                  |
| Wednesday 6/3/2019    | 70                         | 63                    | 80                  |
| Thursday 7/3/2019     | 69                         | 64                    | 79                  |
| <b>Representative</b> | <b>70</b>                  | <b>64</b>             | <b>80</b>           |

**Table 2:** Noise Survey Results, Vastern Road Frontage

#### Noise from SSE Transformers

- 5.5 The SEE transformers emit a continuous low-frequency tonal noise centred in the 100 Hz 1/3 octave band. Observations on site have indicated that the propagation and prediction of this noise does not follow the usual 'rules' and is also somewhat variable (presumably as a result of the variation in power through the substation). For this reason, a number of site visits have been made and surveys undertaken at different locations across the site at different times of the day (and night). All measurements were undertaken in 1/3 octave bands used properly calibrated class 1 accuracy instrumentation.
- 5.6 The results from the various surveys have been collated and are presented graphically in Appendix B.

### Noise from SSE Cooling Fans

- 5.7 A noise survey was undertaken on 1st March 2019 to determine the sound power level from the transformer cooling fans, when operational under full duty. Measurements were undertaken using a Norsonic Nor-118 Class 1 accuracy sound level meter which was calibrated before and after the surveys using a Bruel and Kjaer 4231 acoustic calibrator. No drift in calibration was recorded. The measurements were undertaken in 1/3 octave bands and revealed the following plant sound power level. The full 1/3 octave band data is provided in Appendix B.

| Noise Source              | Overall Sound Power Level, dB L <sub>WA</sub> |
|---------------------------|-----------------------------------------------|
| A1MP (Main Transformer 1) | 96                                            |
| A2MP (Main Transformer 2) | 95                                            |
| Small fans (per package)  | 72                                            |

**Table 3:** Transformer Cooling Fans Sound Power Level

- 5.8 The cooling fan sound power data has been used to populate an acoustic model of the site, showing the propagation of noise from the cooling fans across the proposed development. Immi v2017 noise-mapping software has been used which has adopted the propagation methodology of ISO9613 [Reference 9]. Noise contour maps and predictions have been carried out for each building façade on each floor. An example of the noise contour map is shown in Appendix B (relating to the first floor only).

## **6.0 NOISE IMPACT ASSESSMENT**

### Noise Level in External Amenity Spaces

- 6.1 It is difficult to accurately establish the prevailing background noise level due to the continuous operation (and hence noise) from the transformers. However, the surveys have indicated typical representative background noise levels of around 40 dB L<sub>A90</sub> at the rear of the site (away from Vastern Road) during the day. On the basis of the criterion derived above this implies that rating noise levels from SSE operations (corrected for noise character, if necessary) determined on the basis of BS 4142:2014 in external areas during the day that may be used as amenity spaces should be no greater than 45 dB L<sub>Aeq</sub>.

6.2 The noise from the transformers is tonal in nature and hence a character correction of + 6 dB is considered appropriate. When operating with the transformers the fans are less tonal (and mask the transformer noise) and a correction of + 4 dB is considered appropriate. This results in the following noise 'limits' in external amenity areas:

- Transformers: 39 dB  $L_{Aeq}$ ;
- Cooling fans: 41 dB  $L_{Aeq}$ .

6.3 The acoustic model has been optimised to show the boundary between the 41 dB  $L_{Aeq}$  noise contours and this is presented in Figure 4. The areas in red are representative of the areas external areas which are likely to be subject to noise levels from the cooling fans in excess of 41 dB  $L_{Aeq}$  which potentially may be unacceptable. The design of the scheme has been optimised such that there are no private amenity areas within this region and hence, on this basis, it is considered that noise from SSE operations will not cause disturbance in the private amenity spaces which are located within other parts of the development.

#### Internal Noise Levels from SSE Operations

6.4 A small number of the properties facing the River Thames will be capable of achieving the internal noise limits using natural ventilation (opening windows), however, the vast majority of new dwellings will be reliant on closed windows as a means of noise mitigation in order to achieve the internal noise targets. These are identified in Figures 5 to 7. Mechanical ventilation and heat recovery systems (MVHR) together measures to prevent excess thermal build-up will be provided throughout so that residents need not open their windows for any reason. In addition, ventilation air will not be drawn/ extract via vents in the building facades or windows. All will be ducted into each room.

6.5 Calculations have been undertaken to determine the acoustic specification for glazing systems on each building façade to ensure that the development complies with the acoustic criteria set in Section 3 above. Figure 7 shows our recommendations relating to the type of glazing likely on each façade in the vicinity of the SSE site.

6.6 The table below summarises the window acoustic specifications recommended in Figure 8. These will be revised and rationalised as necessary during the detailed design phase of the project.

| Glazing Type | Minimum Level of Sound Insulation |                                       | Example of Glazing Type                                         |
|--------------|-----------------------------------|---------------------------------------|-----------------------------------------------------------------|
|              | 125 Hz Octave Band SRI            | Weighted Sound Reduction Index, $R_w$ |                                                                 |
| 1            | 24 dB                             | 31 dB                                 | 4mm glass, 16 mm airgap, 4 mm glass                             |
| 2            | 30 dB                             | 39 dB                                 | 10 mm glass, 9 mm airgap, 6.4 mm Stadip Silence                 |
| 3            | 36 dB                             | 57 dB                                 | 6 mm glass, 150 mm airgap, 4 mm glass, 16 mm airgap, 4 mm glass |

**Table 4:** Acoustic Specification of each Window System

- 6.7 The sound insulation performance data shown in Table 4 applies to the entire window system including the frame and seal and not just the glass and Berkeley Homes will commit to ensuring that the acoustic performance of each window system will be guaranteed by the vendor, supported with laboratory acoustic test reports as appropriate.

#### Noise from Road Traffic Using Vastern Road

- 6.8 The noise environment on the southern façade of the proposed new flat blocks will be dominated by road traffic using Vastern Road and it will be necessary to engineer these to ensure that internal noise levels do not exceed the standards defined in Section 3. Our recommendations are provided in Figure 8 (and assume that MVHR will be provided throughout).

## 7.0 SUMMARY

- 7.1 24 Acoustics Ltd has been retained by Berkeley Homes (Chiltern) Ltd to assess the impact of noise upon their proposed residential development at Vastern Road in Reading.
- 7.2 The site is affected by noise from road traffic using Vastern Road, from aircraft and train movements and from the SSE transformer substation which neighbours the proposed development site.
- 7.3 In order to assess the noise impact on the site detailed noise surveys and acoustic calculations have been undertaken between September 2018 and December 2019. Following this feedback has been provided to the design team to optimise the design of the site to minimise noise impact.

- 7.4 Measures have been taken to ensure that the noise levels both externally and internally within the proposed new development will be acceptable. This will involve detailed acoustic design post-planning and will require alternative means of ventilation and design measures to prevent excess thermal build up to allow residents to occupy their dwellings with windows closed (if they so wish).
- 7.5 On this basis it is considered that an acceptable noise environment can be obtained within the proposed development and it is considered that there are no noise grounds for refusal of planning consent.

## REFERENCES

1. Ministry of Housing, Communities and Local Government. National Planning Policy Framework, , 2018.
2. DEFRA. Noise Policy Statement for England, 2010.
3. Department of Communities and Local Government, National Planning Practice Guidance, 2019.
4. Association of Noise Consultants, Institute of Acoustics, Chartered Institute of Environmental Health. Pro PG Planning and Noise, May 2017.
5. British Standards Institution. British Standard 8233: Guidance on Sound Insulation and Noise Reduction for Buildings, 2014.
6. World Health Organisation. Guidelines for Community Noise, 2000.
7. British Standards Institution. British Standard 4142: Methods for rating and assessing industrial and commercial sound, 2014.
8. University of Salford, Manchester. DEFRA Research Contract NANR45. Proposed criteria for the assessment of low frequency noise disturbance, 2011.
9. International Standards Organisation. ISO 9613: Acoustics- Attenuation of sound during propagation outdoors, 1993.

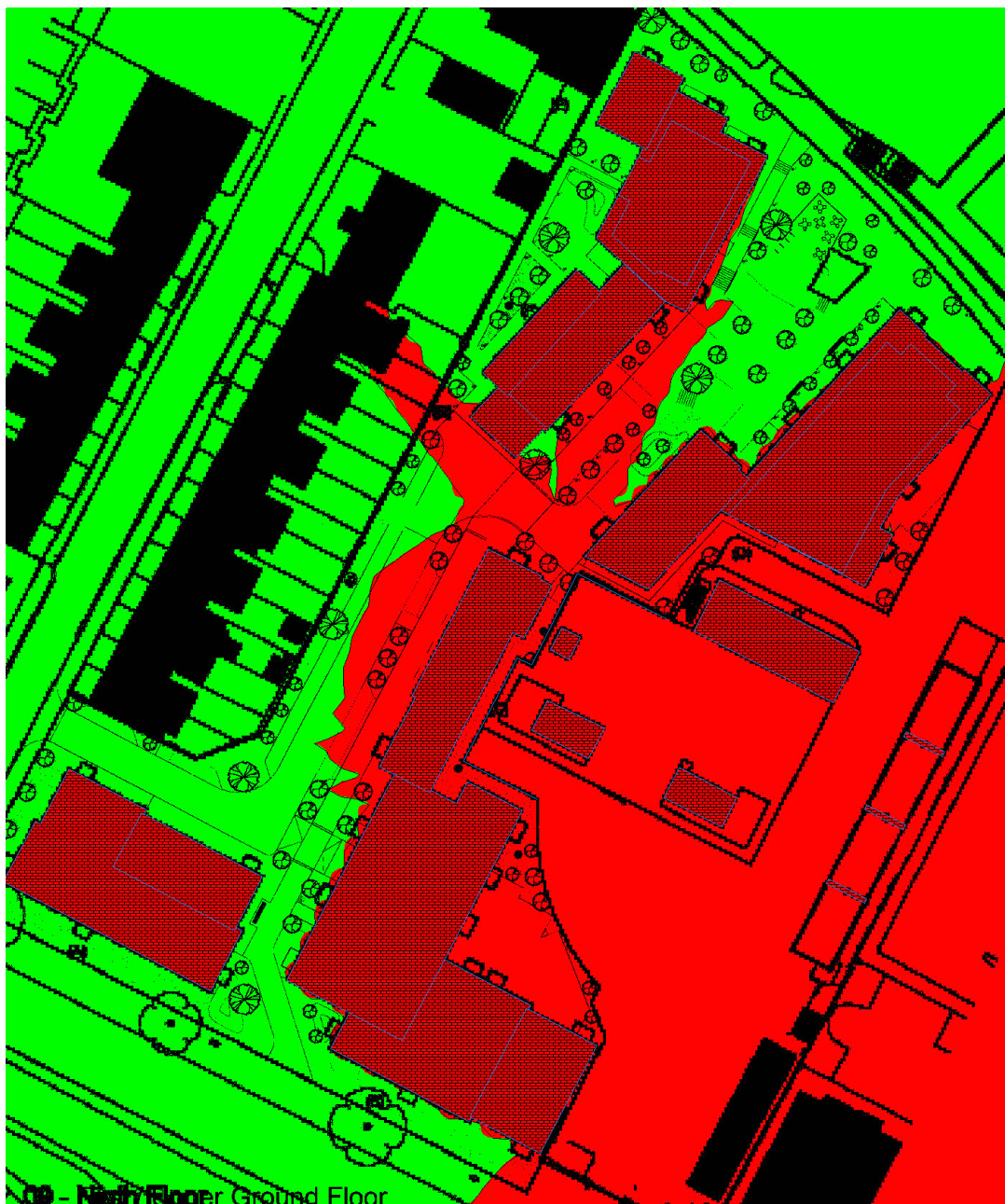


|                                          |                                                         |                       |                                                                                                      |
|------------------------------------------|---------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------|
| <b>Project:</b><br>Vastern Road, Reading | <b>Title:</b><br>Proposed Development Site (Indicative) |                       | <br>24Acoustics |
| <b>DWG No:</b> Figure 1                  | <b>Scale:</b> N.T.S.                                    | <b>Rev:</b> -         |                                                                                                      |
| <b>Date:</b> January 2020                | <b>Drawn By:</b> RP                                     | <b>Job No:</b> 8220-2 |                                                                                                      |



|                                          |                                                             |                       |                                                                                                      |
|------------------------------------------|-------------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------|
| <b>Project:</b><br>Vastern Road, Reading | <b>Title:</b><br>Proposed Development Scheme (Ground Floor) |                       | <br>24Acoustics |
| <b>DWG No:</b> Figure 2                  | <b>Scale:</b> N.T.S.                                        | <b>Rev:</b> -         |                                                                                                      |
| <b>Date:</b> January 2020                | <b>Drawn By:</b> RP                                         | <b>Job No:</b> 8220-2 |                                                                                                      |



**Note**

Red areas are subject to cooling fan noise levels > 41 dB  $L_{Aeq}$  and hence should not contain external amenity areas.

|                                          |                                                           |                       |                                                                                                      |
|------------------------------------------|-----------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------|
| <b>Project:</b><br>Vastern Road, Reading | <b>Title:</b><br>Ground Floor Noise Levels (Cooling Fans) |                       | <br>24Acoustics |
| <b>DWG No:</b> Figure 4                  | <b>Scale:</b> N.T.S.                                      | <b>Rev:</b> -         |                                                                                                      |
| <b>Date:</b> January 2020                | <b>Drawn By:</b> RP                                       | <b>Job No:</b> 8220-2 |                                                                                                      |





|                                          |                                                                                 |                       |                                                                                                      |
|------------------------------------------|---------------------------------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------|
| <b>Project:</b><br>Vastern Road, Reading | <b>Title:</b><br>Areas Requiring Closed Windows – Fourth Floor to Seventh Floor |                       | <br>24Acoustics |
| <b>DWG No:</b> Figure 6                  | <b>Scale:</b> N.T.S.                                                            | <b>Rev:</b> -         |                                                                                                      |
| <b>Date:</b> January 2020                | <b>Drawn By:</b> AR                                                             | <b>Job No:</b> 8220-2 |                                                                                                      |



|                                          |                                                                               |                       |                                                                                                      |
|------------------------------------------|-------------------------------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------|
| <b>Project:</b><br>Vastern Road, Reading | <b>Title:</b><br>Areas Requiring Closed Windows – Eighth Floor to Tenth Floor |                       | <br>24Acoustics |
| <b>DWG No:</b> Figure 7                  | <b>Scale:</b> N.T.S.                                                          | <b>Rev:</b> -         |                                                                                                      |
| <b>Date:</b> December 2020               | <b>Drawn By:</b> RP                                                           | <b>Job No:</b> 8220-2 |                                                                                                      |



## APPENDIX A: ACOUSTIC TERMINOLOGY

Noise is defined as unwanted sound. The range of audible sound is from 0 to 140 dB. The frequency response of the ear is usually taken to be around 18 Hz (number of oscillations per second) to 18000 Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than the lower and higher frequencies and because of this, the low and high frequency components of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most widely used and which correlates best with subjective response to noise is the dBA weighting. This is an internationally accepted standard for noise measurements.

For variable sources, such as traffic, a difference of 3 dBA is just distinguishable. In addition, a doubling of traffic flow will increase the overall noise by 3 dBA. The 'loudness' of a noise is a purely subjective parameter, but it is generally accepted that an increase/ decrease of 10 dBA corresponds to a doubling/ halving in perceived loudness.

External noise levels are rarely steady, but rise and fall according to activities within an area. In attempt to produce a figure that relates this variable noise level to subjective response, a number of noise indices have been developed. These include:

- i) The  $L_{Amax}$  noise level

This is the maximum noise level recorded over the measurement period.

- ii) The  $L_{Aeq}$  noise level

This is "equivalent continuous A-weighted sound pressure level, in decibels" and is defined in British Standard BS 7445 as the "value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval,  $T$ , has the same mean square sound pressure as a sound under consideration whose level varies with time".

It is a unit commonly used to describe construction noise and noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise. In more straightforward terms, it is a measure of energy within the varying noise.

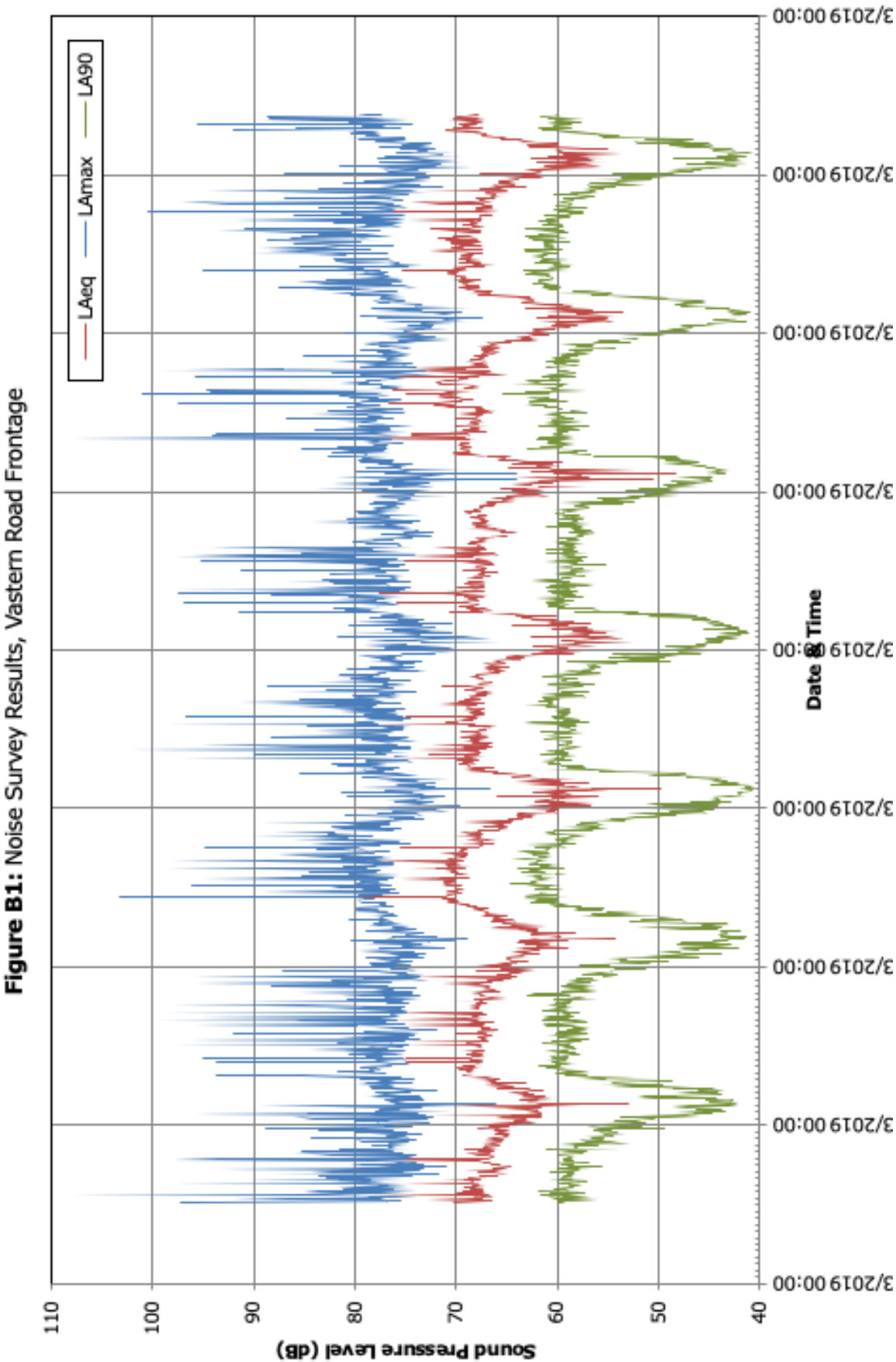
iii) The  $L_{A10}$  noise level

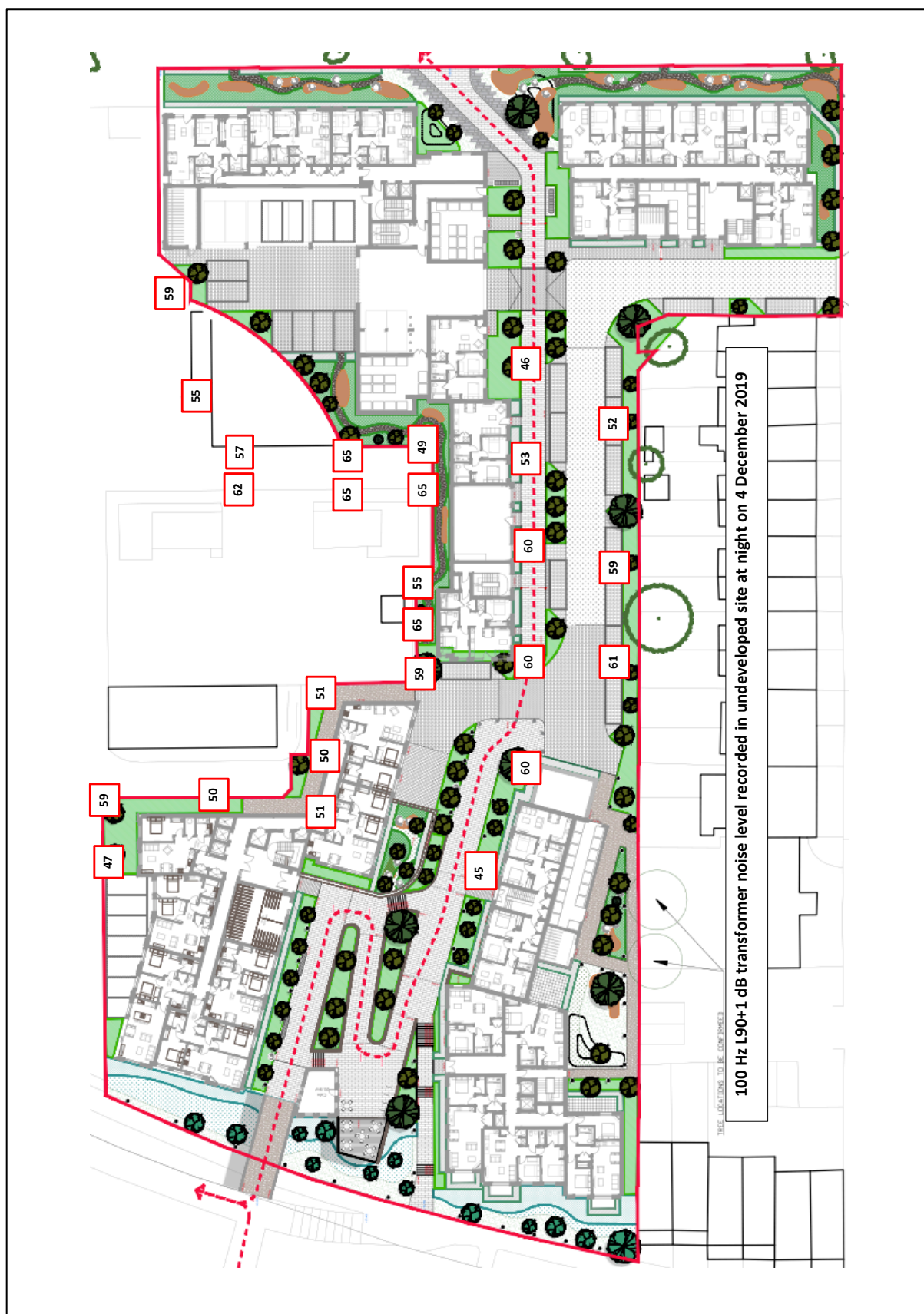
This is the noise level that is exceeded for 10% of the measurement period and gives an indication of the noisier levels. It is a unit that has been used over many years for the measurement and assessment of road traffic noise.

iv) The  $L_{A90}$  noise level

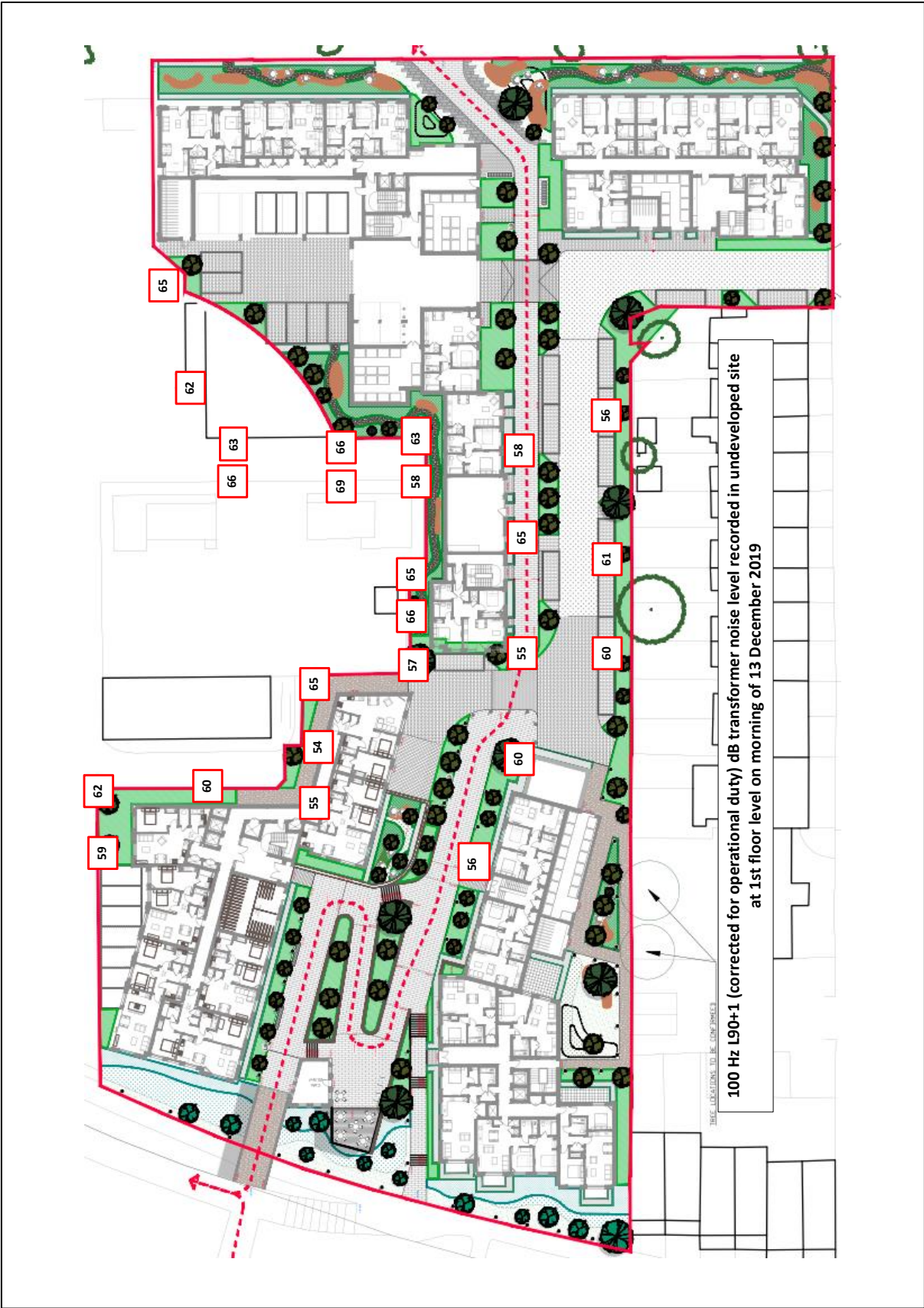
This is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during the quieter periods. It is often referred to as the background noise level and is used in the assessment of disturbance from industrial noise.

APPENDIX B: NOISE SURVEY RESULTS





**Figure B2:** 100 Hz Leq Noise Levels from Transformer Operations, Ground Floor Level



**Figure B3:** 100 Hz Leq Noise Levels from Transformer Operations, First Floor Level

|                                 |                |                |                |                 |                |                |                |                |                 |                |                 |
|---------------------------------|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|-----------------|----------------|-----------------|
| <b>A1MP</b>                     | <b>A</b>       | <b>12.5 Hz</b> | <b>16 Hz</b>   | <b>20 Hz</b>    | <b>25 Hz</b>   | <b>31.5 Hz</b> | <b>40 Hz</b>   | <b>50 Hz</b>   | <b>63 Hz</b>    | <b>80 Hz</b>   | <b>100 Hz</b>   |
|                                 | 95.7           | 86.2           | 87             | 87.1            | 92.5           | 93.2           | 92.2           | 99.3           | 92.1            | 94.7           | 94.3            |
|                                 | <b>125 Hz</b>  | <b>160 Hz</b>  | <b>200 Hz</b>  | <b>250 Hz</b>   | <b>315 Hz</b>  | <b>400 Hz</b>  | <b>500 Hz</b>  | <b>630 Hz</b>  | <b>800 Hz</b>   | <b>1.0 kHz</b> | <b>1.25 kHz</b> |
|                                 | 91             | 89.3           | 89.6           | 87.4            | 88.8           | 86.8           | 88             | 88.2           | 87.7            | 87.3           | 85              |
|                                 | <b>1.6 kHz</b> | <b>2.0 kHz</b> | <b>2.5 kHz</b> | <b>3.15 kHz</b> | <b>4.0 kHz</b> | <b>5.0 kHz</b> | <b>6.3 kHz</b> | <b>8.0 kHz</b> | <b>10.0 kHz</b> |                |                 |
|                                 | 83.7           | 82.5           | 81.8           | 79.1            | 77.9           | 75.1           | 73.6           | 72.2           | 69.8            |                |                 |
| <b>A2MP</b>                     | <b>A</b>       | <b>12.5 Hz</b> | <b>16 Hz</b>   | <b>20 Hz</b>    | <b>25 Hz</b>   | <b>31.5 Hz</b> | <b>40 Hz</b>   | <b>50 Hz</b>   | <b>63 Hz</b>    | <b>80 Hz</b>   | <b>100 Hz</b>   |
|                                 | 95.3           | 87.1           | 86.5           | 90.8            | 94.5           | 94.7           | 94.6           | 100.2          | 96.3            | 96.2           | 94.2            |
|                                 | <b>125 Hz</b>  | <b>160 Hz</b>  | <b>200 Hz</b>  | <b>250 Hz</b>   | <b>315 Hz</b>  | <b>400 Hz</b>  | <b>500 Hz</b>  | <b>630 Hz</b>  | <b>800 Hz</b>   | <b>1.0 kHz</b> | <b>1.25 kHz</b> |
|                                 | 92.1           | 89.8           | 88.5           | 87.6            | 87.9           | 88.4           | 89.2           | 87.1           | 86.5            | 86.1           | 84.4            |
|                                 | <b>1.6 kHz</b> | <b>2.0 kHz</b> | <b>2.5 kHz</b> | <b>3.15 kHz</b> | <b>4.0 kHz</b> | <b>5.0 kHz</b> | <b>6.3 kHz</b> | <b>8.0 kHz</b> | <b>10.0 kHz</b> |                |                 |
|                                 | 83.8           | 82.4           | 80.9           | 78.9            | 77             | 74.8           | 73.1           | 71.8           | 69.4            |                |                 |
| <b>Small fans (per package)</b> | <b>A</b>       | <b>12.5 Hz</b> | <b>16 Hz</b>   | <b>20 Hz</b>    | <b>25 Hz</b>   | <b>31.5 Hz</b> | <b>40 Hz</b>   | <b>50 Hz</b>   | <b>63 Hz</b>    | <b>80 Hz</b>   | <b>100 Hz</b>   |
|                                 | 71.6           | 71.0           | 70.9           | 69.1            | 70.2           | 69.1           | 68.1           | 76.3           | 81.0            | 67.2           | 67.7            |
|                                 | <b>125 Hz</b>  | <b>160 Hz</b>  | <b>200 Hz</b>  | <b>250 Hz</b>   | <b>315 Hz</b>  | <b>400 Hz</b>  | <b>500 Hz</b>  | <b>630 Hz</b>  | <b>800 Hz</b>   | <b>1.0 kHz</b> | <b>1.25 kHz</b> |
|                                 | 69.1           | 67.5           | 66.8           | 67.5            | 69.0           | 65.2           | 65.2           | 65.2           | 63.1            | 62.2           | 59.9            |
|                                 | <b>1.6 kHz</b> | <b>2.0 kHz</b> | <b>2.5 kHz</b> | <b>3.15 kHz</b> | <b>4.0 kHz</b> | <b>5.0 kHz</b> | <b>6.3 kHz</b> | <b>8.0 kHz</b> | <b>10.0 kHz</b> |                |                 |
|                                 | 57.5           | 55.0           | 52.2           | 49.4            | 47.3           | 46.2           | 44.9           | 42.9           | 40.8            |                |                 |

**Table B1:** Transformer Cooling Fan Sound Power Levels (1/3 Octave Band Leq)

TBA

|                                          |                                                                                                       |                       |                                                                                                      |
|------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------|
| <b>Project:</b><br>Vastern Road, Reading | <b>Title:</b><br>First Floor Noise Contour Map, dB L <sub>Aeq</sub><br>(Noise from cooling fans only) |                       | <br>24Acoustics |
| <b>DWG No:</b> Figure B4                 | <b>Scale:</b> N.T.S.                                                                                  | <b>Rev:</b> -         |                                                                                                      |
| <b>Date:</b> January 2020                | <b>Drawn By:</b> RP                                                                                   | <b>Job No:</b> 8220-2 |                                                                                                      |