24Acoustics
Armstrong House
3 Bassett Avenue
Southampton
SO16 7DP

T: 023 8155 5000

TOWN AND COUNTRY PLANNING ACT 1990
(AS AMENDED BY THE PLANNING AND COMPENSATION ACT 1991)

PROPOSED RESIDENTIAL DEVELOPMENT AT 55 VASTERN ROAD, READING

PROOF OF EVIDENCE ON NOISE

VOLUME 1

REUBEN PECKHAM BENG MPHIL CENG MIOA

Technical Report: R8848-6 Rev Final rev 1

Date: 27 September 2021

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

SUMMARY

My proof of evidence on noise is produced on behalf of the appellant, Berkeley Homes Ltd (Oxford and Chiltern), into Reading Borough Council's refusal to grant planning consent for a residential development on the appeal site at 55 Vastern Road in Reading.

The site is affected by noise from transportation sources and from the operation of an electricity substation. It is common ground between myself and Mr Scrivener (employed on behalf of Reading Borough Council) that noise from transportation sources may be satisfactorily mitigated and hence my proof of evidence addresses the noise impact from the substation operations only.

I have been involved with this site, on Berkeley Homes' behalf, since the Summer of 2018 (prior to their purchase of the site) and have worked closely with their architects and design teams to ensure that the scheme is designed to mitigate the noise impact upon the proposed new dwellings.

Noise from the substation operations is characterised by a continuous low level, low frequency 'hum' from the operation of the transformers and from the operation of the transformer cooling fans. The cooling fans operate extremely infrequently and have been found to operate for a total of 7 hours in the period between 21 May and 20 September 2021. This is 0.2% of the time period considered.

I have considered the noise impact both externally to and inside of the new dwellings. In external amenity areas the noise from the transformer hum will be acceptable at all times. The noise impact from the transformer cooling fans when they operate will be greater at some locations, however, it must be stressed that the fans operate very infrequently. The absolute level of the noise from the cooling fans will be acceptable and in any case there is public open space nearby.

In order to achieve an acceptable internal noise environment it will be necessary for some windows in a relatively small proportion of the site to be closed at some times. Other areas of the development will require windows to be closed during the infrequent periods when the transformer cooling fans operate. Where it is necessary for windows to be closed in order to achieve a satisfactory internal noise environment full alternative means of ventilation (providing both background and purge ventilation in accordance with Part F of the Building Regulations) together with measures to prevent overheating will be provided. I note that Reading Borough Council consider that this will not provide a satisfactory internal environment, however, I must stress that it is an extremely common form of noise mitigation and one that they have accepted, and conditioned in planning consents, in the past themselves.

As a result I am of the opinion that the design of the site and the noise impact from the neighbouring SSE operations is mitigated to a minimum and fully compliant with the requirements of the Agent of Change as described in the NPPF and PPG.

The development is engineered to ensure an acceptable acoustic environment both inside and outside of the proposed new dwellings. On this basis I consider that there is no reason, on noise grounds, why this appeal should not be allowed and planning consent granted.

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0.0 REUBEN PECKHAM - STATEMENT OF CAPABILITY AND EXPERIENCE

0.1 I am a principal consultant and director of 24 Acoustics Ltd. I hold an undergraduate degree in Engineering Acoustics and Vibration and a post-graduate research degree in Whole Body Vibration, both awarded by the Institute of Sound and Vibration Research at Southampton University. I am a corporate member of the Institute of Acoustics and a Chartered Engineer. 24 Acoustics Ltd is a full member of the Association of Noise Consultants.

0.2 I have in excess of 25 years' experience in industry, research and consultancy relating to engineering acoustics, noise and vibration. I have particular expertise and tend to specialise, within my consulting practice, in the assessment and control of noise and vibration from industrial sources. This includes within oil and gas installations (both offshore and onshore), ports, food and other manufacturing facilities, wind farms and power generation facilities (primarily gas powered and nuclear electricity generation sites).

0.3 Prior to joining 24 Acoustics Ltd in 2005, I held senior positions at two major multi-disciplinary engineering/ environmental consultancycompanies.

0.4 I have presented expert evidence relating to noise, vibration and acoustics in planning appeals, public inquiries and courts of law (at Magistrates, County and High Court level) on many previous occasions.

1.0 INTRODUCTION

1.1 This Proof of Evidence on Noise has been prepared by Reuben Peckham of 24 Acoustics Ltd on behalf of Berkeley Homes Ltd (Oxford and Chiltern) ('the Appellants') who have submitted an appeal under Section 78 of the Town and Country Planning Act 1990 (as amended), following the refusal by Reading Borough Council ('RBC') to grant full planning permission in respect of planning application reference 200188 ('the Planning Application) by notice dated 9 April 2021.

1.2 The Planning Application relates to 55 Vastern Road, Reading ('the Site') and is described as follows:

> *"Demolition of existing structures and erection of a series of buildings ranging in height from 1 to 11 storeys, including residential dwellings (C3 use class) and retail floorspace (A3 use class), together with a new north-south pedestrian link, connecting Christchurch Bridge to Vastern Road."*

1.3 The site is affected by noise from road traffic using Vastern Road, from aircraft movements and from the operation of the neighbouring electricity substation.

1.4 Reason for refusal 4 relates to noise, as follows:

> *The proposed development has failed to demonstrate that a suitable quality of accommodation can be provided for all future occupiers as the mitigation measures submitted would not be sufficient to minimise the impact of nearby noise pollution thereby contrary to Policies CC8, EN16 and CR6 of the Reading Borough Local Plan (2019).*

1.5 My proof of evidence is divided into the following sections:

- Section 2 provides some detail relating to the proposals, the sources of noise affecting the proposed new dwellings and the measures that Berkeley Homes have taken to mitigate the noise impact;
- Section 3 considers the policy context and standards and guidance that are relevant to the assessment;
- Section 4 addresses the scope of my assessment and this proof of evidence;
- Section 5 considers the noise impact in external amenity areas;
- Section 6 considers the noise impact internally in the proposed dwellings;
- In Volume 2 I have provided copies of the appeal decisions and case histories that I have referred to in this proof.

1.6 In producing this Proof of Evidence I have made reference to and commented upon, where necessary, the information contained in the Statement of Case (Version 1.2 dated 12 August 2021) of Mr Rhys Scrivener of KR Associates (UK) Ltd who has been appointed by Reading Borough Council to provide technical guidance and evidence on noise on their behalf.

1.7 I would like to make the Inspector aware that during the production of this proof of evidence I made contact with Mr Scrivener on several occasions with a view to discussing additional common ground which I felt in the best interests of all. I received no reply to these requests, however.

2.0 SUMMARY OF PROPOSED DEVELOPMENT, NOISE SOURCES AND SITE ACOUSTIC DESIGN CONSIDERATIONS

2.1 The appeal site is located on land formerly occupied by Scottish and Southern Electric (SSE) between Vastern Road and the River Thames in Reading. The site currently comprises the former SSE office buildings (fronting Vastern Road) with car parking and a substation to the rear.

2.2 It is proposed to redevelop the site and erect 209 residential units and a café together with a new north-south pedestrian link connecting Christchurch Bridge to Vastern Road.

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 and low frequency 'hum' from the transformers and a higher level of broadband noise from the transformer cooling fans which operate intermittently and infrequently.

2.4 Dialogue with SSE has identified that the cooling fans are used to cool the circulating oil in each transformer when a combination of system load and ambient temperature reaches a set trigger point. They are described as 'running infrequently and usually during hot weather periods' (please see the associated correspondence with SSE in Appendix A). Consideration of the frequency of the operation of the fans is important when determining noise impact. SSE do not have data showing the historical operation of the fans. As a result of this I have monitored the noise levels and associated audio on site (close to each transformer fan) continuously between 21 May and 20 September 2021 to determine the frequency of their operation.

2.5 In his Statement of Case (paragraph 3.7) Mr Scrivener advises that SSE 'appear to be refurbishing or upgrading the current transformers' and that they are not currently operating. This is not correct. SSE have advised that in August and September of this year they replaced the power supply cable to each transformer. This commenced at the beginning of August 2021. As a result Tranformer 1 (further from the appeal site) was shut down between 1st and 31st August and Transformer 2 between 2nd and the time of writing. SSE have further advised that the overall power throughout at the site was unchanged during the shutdown, meaning all power that would normally be routed through both transformers was routed through the remaining operational transformer during the shutdown. As a result of this it could be expected that the cooling fans within the operational transformer would have run more frequently than normal.

2.6 Table 1 below summarises the periods since 21 May when I have established that the transformers were operational.

Transformer 1	Transformer 2	Notes/ Observations
n/a	26 June 12:00 to 15:45 hours	Temp 69 deg F
29 June 09:25 to 12:35 hours		Temp 67 deg F
July no operation		n/a
August no operation		n/a
1- 20 September no operation		n/a

Table 1: Periods of Cooling Fan Operation, 21 May- 20 September 2021

2.7 It is worth noting that the data indicates that the fans did not operate during the hot weather that occurred in mid July (with temperatures in the region of 90 degrees F on 19th and 20th July). It is clear from both the data and the information provided by SSE that the units operate extremely infrequently (for approximately 7 hours in the 122 days of analysis which amounts to approximately 0.2% of the total period assessed). Liaision with an SSE engineer on site identified that the fans were probably operated on the June dates as part of routine maintenance which occurs 4 times a year.

2.8 It may be that Mr Scrivener did not know that the cooling fans associated with the transformers operate only very intermittently (as described above) and for the vast majority of the time the only noise emission from the units is the underlying low frequency 'hum' and as a result he appears to have mistakenly assumed that the site was shutdown.

2.9 I have been involved with this site, on Berkeley Homes' behalf, since the Summer of 2018 (prior to their purchase of the site) and have worked closely with their architects and design teams to ensure that the scheme is designed to mitigate the noise impact upon the proposed new dwellings. Fundamental design measures that have been taken include the following:

- Orientation of flat blocks with single aspect facades/ habitable rooms facing away from the SSE site where appropriate;
- Provision of acoustic screening by building orientation and use of the site blast wall;
- Provision of acoustically rated glazing and alternative means of ventilation together with measures to prevent overheating in the proposed dwellings where appropriate.

3.0 POLICY AND ASSESSMENT CRITERIA

Local Policy

Reading Borough Council EN16 & CR6

3.1 These policies form part of the Reading Borough Local Plan (adopted November 2019) and relate to '*New development in a historic context*' and '*Accessibility and intensity of the development respectively'*. As such they do not relate to noise and these aspects of reason for refusal 4 are not considered within this proof of evidence.

Reading Borough Council CC8- Safeguarding Amenity

3.2 Policy CC8 of Reading Borough Council's local plan (adopted November 2019) [Reference 1] relates to the safeguarding of amenity. Of relevance to noise and the appeal site, the policy states that development should not cause unacceptable living conditions for new residential properties.

3.3 The policy states overall that a 'key concern' is to ensure that new development creates a quality living environment for future residents. It states that tensions between different uses can mostly be avoided by **careful design, siting and orientation of buildings and space**, paying particular attention to those aspects which are most likely to cause issues and which are most sensitive to effects (e.g. outdoor spaces, habitable rooms and children's play areas).

National Policy

3.4 A more detailed description of national planning policy and guidance which relates to noise is provided in Section 3 of 24 Acoustics' technical report (Reference R8220-2 Rev 0) which was submitted as part of the planning application for the. The pertinent points from the relevant policies are summarised below:

National Planning Policy Framework (NPPF)

3.5 The NPPF [Reference 2] states (paragraph 180) that planning policies and decisions should '*mitigate and reduce to a minimum, potential adverse impacts resulting from noise from new developments- and avoid noise giving rise to significant adverse impacts on health and quality of life*'. It also refers (paragraph 182) to the Agent of Change, stating that existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. It states that, where the operation of an existing business or community facility could have a significant adverse effect on new development in its vicinity, the applicant (or agent of change) should be required to provide suitable mitigation before the development has been completed.

Noise Policy Statement for England (NPSE)

3.6 The NPSE [Reference 3] sets out the government's 'long-term vision to promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development'. This is supported by the following aims:

3.6.1 Avoiding significant adverse impacts on health and quality of life;

3.6.2 Mitigating and minimising adverse impacts on health and quality of life.

Planning Practice Guidance (PPG)

3.7 The Planning Practice Guidance (PPG) [Reference 4] reflects the NPSE and states (Paragraph 001) 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 (Paragraph 001) that opportunities should be taken, where practicable, to achieve improvements to the acoustic environment. The PPG states (Paragraph 002) that noise can override other planning concerns but should not be considered in isolation from the other economic, social and environmental dimensions of the proposed development.

3.8 The PPG expands upon the concept of Significant Observable Adverse Effects Level (SOAEL) (together with Lowest Observable Adverse Effect Level, LOAEL and No Observed Effect Level, NOEL) (Paragraphs 003 and 004) as introduced in the NPSE and provides a table of noise exposure hierarchy for use in noise impact assessments in the planning system as shown below.

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
No present	No effect	No observed effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of an area but not such that there is a change in the quality of life	Observed adverse effect	Mitigate and reduce to a minimum
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the noise because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of an area such that there is a small actual or perceived change in the quality of life .	Observed Adverse Effect	Mitigate and Reduce to a minimum
Significant Observed Adverse Effect Level			
Present and Disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where the is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminsed due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	extensive and regular changes in behaviour, attitude or other physiological response and/ or an inability to mitigate effect of noise leading to psychological stress e.g. regular sleep deprivation/ awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 1:PPG Noise Exposure Hierachy Table

3.9 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) and indeed a noise impact at the lower end of SOAEL should be 'avoided' but not prevented. There are currently, however, limited objective technical criteria for use in planning noise impact assessments which reflect the above semantics. Nevertheless, objective technical criteria in accepted technical documents set out criteria for what is an acceptable noise level for housing. 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 development and those of British Standard 4142 for proposed plant items associated with the development. In addition, the guidance of NAN45 applies to the assessment of low frequency noise from SSE operations inside the proposed dwellings.

3.10 The PPG also makes reference to the agent of change (Paragraph 009), stating that the applicant will need to clearly identify the effects of existing businesses that may cause a nuisance (which includes noise) and the likelihood that they could have a significant adverse effect on new residents.

3.11 It further states (paragraph 009) that the agent of change will also need to define clearly the mitigation being proposed to address any potential significant adverse effects that are identified. Adopting this approach may not prevent all complaints from the new residents/users about noise or other effects, but can help to achieve a satisfactory living or working environment, and help to mitigate the risk of a statutory nuisance being found if the new development is used as designed (for example, keeping windows closed and using alternative ventilation systems when the noise or other effects are occurring). The PPG adds that it can be helpful for developers to provide information to prospective purchasers or occupants about mitigation measures that have been put in place, to raise awareness and reduce the risk of post-purchase/occupancy complaints.

Technical Noise Guidance

3.12 The following technical references have been used in my assessment. All are considered to represent use of best practice.

Professional Practice Guidance on Planning and Noise (ProPG)

3.13 The ProPG (published by the Association of Noise Consultants, Institute of Acoustics and Chartered Institute of Environmental Health) [Reference 5] applies to transportation noise sources upon proposed new residential development sites and strives to ensure good acoustic design and consideration of internal and external amenity space noise levels. Primarily, it is considered that the spirit of its intent is to ensure that, for sites which are dominated by transportation noise, that appropriate acoustic design measures are considered at an early stage in the project.

Acoustics, Ventilation & Overheating- Residential Design Guide (AVO Guidance)

3.14 The Association of Noise Consultants and Institute of Acoustics' publication Acoustics, Ventilation & Overheating-Residential Design Guide (known as the AVO Guide) [Reference 6] provides guidance on measures to assess the risk of overheating in dwellings which are reliant on closed windows as a means of mitigation against sources of transportation noise. Section 1.13 of the guidance makes it clear that its scope does not apply to sources of industrial noise. In addition, Berkeley Homes intend to install full ventilation and measures to prevent overheating to relevant plots (so that residents need not open windows for any reason) and therefore I consider this publication has little relevance to the appeal site. I have referenced it, however, for completeness, as Mr Scrivener has made reference to it in his Statement of Case.

British Standard 8233:2014/ World Health Organisation Guidelines for Community Noise

3.15 BS 8233 [Reference 7] and World Health Organisation Guidelines [Reference 8] both provide acoustic design advice and guidance for dwellings and specifically suggest acceptable upper internal noise levels in habitable rooms.

British Standard 4142:2014+A1:2019

3.16 BS 4142 [Reference 9] provides a method for rating the effects of industrial and/ or commercial sound on residential areas.

3.17 The standard (Section 11) advocates a comparison between the typical measured L_{A90} background sound level and L_{A90} sound 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.

3.18 The standard (Section 11) states that a difference between the rating level and the background sound level of around + 10 dB is likely to be an indication of a significant adverse impact, depending on the context. 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 on the context.

3.19 The standard emphasises the context in which an impact may occur and states (Section 11, first paragraph) '*an effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound(s) occur/ will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context*'.

3.20 The standard further states (Section 11) that factors that should be taken into account when considering the context include consideration of the absolute level of the sound from the industrial/ commercial source and the nature of the character of the residual noise environment (compared to the noise from the industrial/ commercial source) together with the frequency of operation of the noise source (which is particularly relevant to this appeal). 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 :

- Façade insulation treatment;
- Ventilation and/ or cooling that will reduce the need to have windows open so as to provide rapid and/ or purge ventilation and;
- Acoustic screening.

3.21 Further issues which should be taken into account (and also influence the context of the assessment) include, in my experience:

- whether the source of industrial / commercial sound is introduced to an existing receptor or a new receptor introduced to an existing source. Residents are more tolerant to noise if they have no pre-expectations. This is highlighted in Section 8.5 of the standard which states '*where a new noise-sensitive receptor is introduced and there is extant industrial and / or commercial sound it should 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*'.

- The frequency of operations of noise sources. Residents can be expected to be more tolerant of a noise source which operates rarely/ infrequently (such as the SSE transformer cooling fans) than a noise source which is continuous in operation.

3.22 It is my understanding that when BS 4142 was updated in 2014 the descriptors 'adverse' and 'significant adverse' were introduced in order to provide unity with the PPG. It is my professional opinion that these descriptors are unfortunately worded and, at face value, imply an impact greater than the reality. It is worthy of note that the previous version of the standard, BS 4142:1997, described an impact of +5 dB as 'of marginal significance'. My subjective experience, from over two decades of assessing the noise from a wide variety of different types of industrial sites, is that a 5dB difference between the BS 4142 rating and background sound levels is indeed subjectively marginal and that a +10 dB difference should not necessarily be regarded as significantly adverse. This is particularly so in this case as new housing is being provided in an area with existing sources of industrial sound and where (as in the case of the cooling fans) the noise events are rare.

3.23 Furthermore, it should be noted that the planning system does not prohibit an adverse or indeed a significant adverse noise impact. As stated above in Table 1 an impact greater than 'significant adverse' should be 'avoided' but not prevented.

3.24 The standard has been used for determining acceptable levels of noise from the substation within external amenity areas and at habitable room windows where they are to be opened by residents.

3.25 It is relevant to note that the scope of the standard (Section 1.3) excludes the assessment of low frequency noise. NANR45 (described below) is recommended. BS 4142, however, applies externally to a dwelling and NANR45 internally. There is therefore no defined methodology for the assessment of low frequency noise in an external environment (e.g amenity areas).

NANR45

3.26 NANR 45 (published by the University of Salford on behalf of Defra) [Reference 10] identifies a maximum threshold noise level for low frequency noise inside dwellings. This is shown in Table 2 below.

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

Table 2: NANR45 Low Frequency Noise Thresholds

3.27 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 guidance has been used to set internal design criteria for noise from the substation in the proposed new dwellings.

4.0 SCOPE OF ASSESSMENT

4.1 The site is affected by noise from road traffic using Vastern Road and from other transportation sources including railway and aircraft movements together with the noise from the SSE substation. The noise from the substation comprises a low level, low frequency (100 Hz) 'hum' and broadband noise from the transformer cooling fans which, as detailed in Section 2, operate extremely infrequently.

4.2 It is agreed between myself and Mr Scrivener that the noise from Vastern Road (and other sources of transportation noise) may be mitigated satisfactorily and therefore I have not considered this further in my proof which therefore addresses the noise from SSE operations on the appeal site only.

5.0 NOISE IMPACT IN EXTERNAL AMENITY AREAS

5.1 The noise impact from the operation of the SSE substation comprises continuous, low level, low frequency noise (or 'hum') from the transformers which is barely audible on much of the site during the day together with the noise from the transformer cooling fans which operate extremely infrequently, as established in Section 2 above.

5.2 The rating method of British Standard 4142:2014+A1:2019 is the most appropriate means of assessing the noise impact from the substation operations on external amenity areas and I have used this methodology to determine the noise impact from the transformers and the cooling fans separately. I acknowledge that the scope of BS 4142 does not apply to the assessment of low frequency noise, however, in an external environment there is no other established means of assessing the noise impact of the transformer 'hum'. The source remains industrial in nature and the standard provides a means for addressing the tonal character of the sound and therefore within this context I feel it an appropriate means of objective assessment.

<u>External Noise Impact of Low Frequency Transformer 'Hum'</u>

5.3 The transformers emit a continuous low-frequency tonal noise centred in the 100 Hz 1/3 octave band. I have undertaken a number of site visits and surveys over the preceeding couple of years both during the day and at night and have measured the noise level from the transformers accordingly. The measured 100 Hz 1/3 octave band values on the undeveloped site were reported at ground and first floor levels in Figures B2 and B3 of my original noise impact assessment (Reference R8820-2 Rev 0).

5.4 I am aware that the magnitude of the 100 Hz tone (hum) varies over time and I have taken steps to quantify the variation in noise level via measurement on site between 21 May and 9 July 2021. This established that the noise level (at 1 m above grade level at the palisade fence closest to Transformer 2- the nearer transformer to the appeal site) varied in noise level from 49 to 71 dB $L_{eq,\ 100\ Hz,\ 5\ min}$ and averaged 66 dB $L_{eq,\ 100\ Hz}$. A chart showing the data is provided in Figure 1. Analysis of the data shows that the greatest noise level (71 dB $L_{eq,\ 100\ Hz}$) occurred for 0.01% of the time and the average (or typical- the mode of the measured data) (66 dB $L_{eq,100\ Hz}$) or greater for 30% of the time.

5.5 I have used this data to estimate the typical overall A-weighted noise levels from the transformer hum in external amenity areas (taking account of acoustic screening and reflections that will be provided on the developed site) and have performed an assessment of the noise impact relative to the prevailing background noise level in accordance with BS 4142:2014+A1:2019.

5.6 Given Mr Scrivener's comments regarding the nature of the background noise environment (SoC Paragraphs 3.7 and 5.5) I have taken the opportunity to resurvey background noise levels on site. Measurements were undertaken between 23rd and 31st August 2021 at the location shown in Figure A below (the north of the site well away from Vastern Road and close to the boundary adjacent to the River Thames). This was chosen to be representative of the typical background noise level on the site but not influenced by noise from the operation of the transformers. Measurements were undertaken using a Class 1 accuracy sound level meter which was calibrated before and after the survey in accordance with manufacturer's instructions. I am aware that certain non-representative activities were undertaken on site during the surveys. This includes works being undertaken by SSE at the substation site (including the operation of a generator). I have filtered the data accordingly and removed periods of non-representative data to ensure a fair and reasonable representative background noise level.

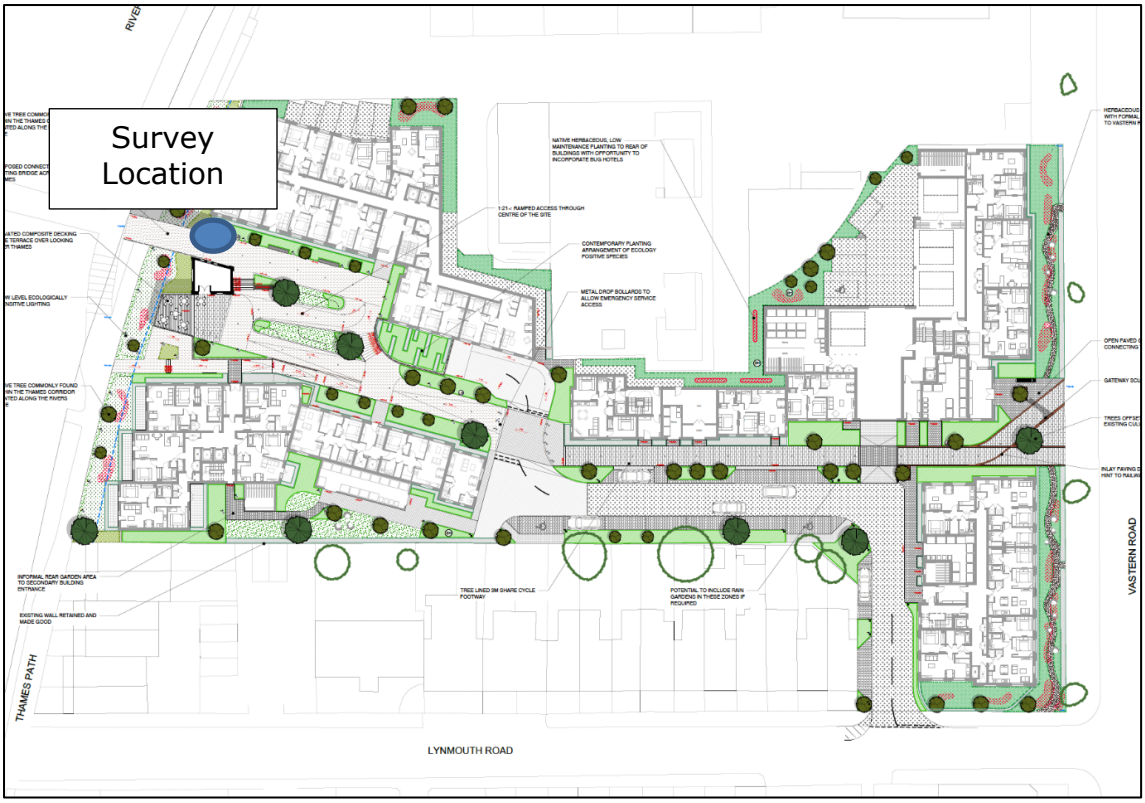


Figure A: Background Noise Survey Location 23- 31 August 2021

5.7 The results of the survey is shown graphically in Figure 2 and are summarised in Table 3 below.

Day and Date	Representative Background Noise Level, dB $L_{A90, 1 hour}$
Monday 23/8/2021	44*
Tuesday 24/8/2021	45
Wednesday 25/8/2021	46
Thursday 26/8/2021	48
Friday 27/8/2021	45
Saturday 28/8/2021	45
Sunday 29/8/2021	43
Monday 30/8/2021	43
Tuesday 31/8/2021	45*
Representative	**45**

Table 3: Daytime (07:00- 23:00 hours) Representative Background Noise Survey Results
Data showing * represents a part-sample

5.8 It should be noted that BS 4142 does not provide a means of determining the representative background noise level. 24 Acoustics' approach is to take the average less one standard deviation.

5.9 BS 4142:2014+A1:2019 (in Section 9) states that certain acoustic features can increase the significance of impact over that expected from a basic comparison between the source noise level and background noise level and advocates several methods of determining a weighting to this level. The subjective method defined in the standard was used in my original planning submission and provides the most straightforward means of determining a rating correction. For tonal noise, this advocates the following:

- A correction of + 2 dB for a tone which is just perceptible at a receptor;
- + 4 dB for a tone which is clearly perceptible and
- + 6 dB for a tone which is highly perceptible.

5.10 It is difficult to determine how perceptible the tone from the transformer operation will be in external amenity areas at receptors which are not yet constructed, however, on site the noise is only subjectively 'highly percepible' at locations very near to the substation. In order to improve the accuracy of the assessment I have used audio recordings undertaken on site and have updated the assessment using the objective reference method advocated in the standard (in Annex D) to accurately determine the rating correction. This has confirmed the worst-case rating correction for tonality (at the closest amenity space) of + 6 dB. This reduces, however, to +1.6 dB at further amenity spaces in circumstances in which the transformer noise level (BS4142 specific source noise level) is 5 dB below the background noise level and to 0 dB when the transformer noise level is 10 dB below the background noise level. I have used these rating corrections in my calculations.

5.11 I have calculated the difference between the BS 4142:2014+A1:2019 rating noise level and representative background noise level at amenity space locations and this is shown graphically in Figures 3 to 5 (ground, first floor and second floor/above respectively). This indicates throughout that the difference between the background noise level and the rating level from the transformer hum will be below +0 dB.

5.12 On this basis I do not consider the impact of the noise from the low frequency transformer hum in the proposed external amenity areas to be of any significance.

External Noise Impact of Transformer Cooling Fans

5.13 The noise level associated with the operation of the transformer cooling fans in external amenity areas has been determined from on-site noise measurements of the cooling fan operations (as referenced in 24 Acoustics' report Reference R8220-2 Rev 0) and from the use of an acoustic model to determine the noise level from the operation at external amenity areas. The model has been produced using proprietary software (Immi v 2017) and using the propagation methodology of ISO 9613 [Reference 11].

5.14 I have again used the rating methodology of BS 4142:2014+A1:2019 relative to the prevailing daytime background noise levels (established at 45 dB $L_{A90, 1 hour}$) referenced above to determine the noise impact. Again I have updated my assessment (from that in the original planning submission) using the objective reference method advocated in BS 4142 from audio recordings undertaken on site to determine the rating correction for noise character. This indicates that there should be no rating correction for tonality (although I appreciate I used a correction of + 4 dB in the original planning assessment- based upon the subjective method in the standard). The noise, however, is intermittent in nature and I have therefore applied a rating correction of + 3 dB in accordance with Section 9.2 of the standard.

5.15 Figures 6 to 8 show the modelled noise impact in terms of acoustic contours across the site at ground, first and second & above floor levels.

5.16 The assessment indicates that the majority of external amenity spaces and balconies will be subject to noise levels no greater than + 5 dB (difference between the BS 4142 background noise level and rating levels). A small number of balconies, however, (3 on Block C and 4 in Block D) will be subject to noise impacts greater than + 10 dB when the cooling fans operate. The maximum noise impact on any balcony will be + 13 dB and the maximum noise level (without rating correction- the BS 4142 specific source level) 55 dB L_{Aeq}.

5.17 It is my opinion that the external noise impact at amenity spaces will be acceptable for the points raised below.

Frequency of Operation

5.18 It must be stressed that the cooling fans operate extremely infrequently. Studies undertaken between 21 May and 20 September 2021 have indicated that the cooling fans operated for a total of 7 hours (0.2% of the time). This includes during the period in July 2021 when daytime ambient temperatures exceeded 90 degrees F.

5.19 The frequency of the operation of the cooling fans is outside of the control of Berkeley Homes and it could be argued that they may operate more frequently in the future. In practice, however, their operation is limited by the presence of the existing residential properties in Lymouth Road and Thames Court. I measured a noise level from the cooling fans at the boundary of the appeal site with the rear of the Lynmouth Road houses as high as 59 dB L_{Aeq} and have established a representative background noise level at night of 37 dB L_{A90} (detailed in Section 6 below). I estimate therefore that at night, when the fans operate, the difference between the BS 4142 rating noise level and the background noise level would be in the region of + 22 dB at first floor bedroom windows. The Lynmouth Road properties have not been designed to accommodate excess external noise and therefore residents would need to open windows for cooling and ventilation as required. A noise impact at this level would therefore unquestionably generate a very high level of disturbance if the fans intensified in operation. It is worthy of note that the noise impact on existing properties in Lymouth Road from the operation of the cooling fans would be greater than that on some of the proposed new development.

Absolute noise levels

5.20 As stated above the maximum noise level from the cooling fan operation on any balcony will not exceed 55 dB L_{Aeq} (and on the vast majority of balconies will be substantially lower). Section 7.7.3.2 of British Standard 8233 addresses absolute noise levels in external amenity spaces, as follows:

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

5.21 The standard further states (also paragraph 7.7.3.2):

> *Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available. Ie in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses.*

5.22 This guidance, from BS 8233, is based upon community annoyance research into road traffic noise published by the World Health Organisation [Reference 8] but provides further context into the acceptability of the absolute magnitude of the noise impact upon the future residents of the proposed scheme during the rare occasions when the cooling fans may operate.

5.23 On the above basis, given the context, the highly infrequent operation of the cooling fans, the fact that residents are being bought to the noise rather than the reverse situation and the worst-case absolute noise level is commensurate with that advocated in BS 8233 I am therefore of the opinion that the noise impact from the operation of the SSE cooling fans in all external amenity areas will be acceptable.

Availability of nearby open space

5.24 Even if the Inspector considers that the operation of the cooling fans would have a significant adverse impact I would wish to draw her attention to Section 3v of the ProPG which states:

> *Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are providing [SIC], through design of the development or the planning process, with access to:*
>
> - *A relatively quiet façade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (ie an enclosed balcony) as part of their dwelling; and/ or*
> - *A relatively quiet alternative or additional external amenity space for sole use by a household (e.g. a garden, roof garden or large open balcony in a different, protected, location) and/ or*
> - *A relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/ or*
> - *A relatively quiet, protected, publically accessible, external amenity space (e.g. a public part or a local green space designated becayse of its tranquility) that is nearby (e.g. within a 5 minutes walking distance).*

5.25 Clearly, Christchurch Meadow, which is located across the River within a 5 minute walk, provides such space.

<u>Conclusion Relating to External Noise Impact/ Residential Amenity</u>

5.26 I am of the opinion that the impact of the low frequency noise from the substation transformers will be acceptable in all external amenity areas at all times. My findings are also supported by subjective observations undertaken on site.

5.27 The cooling fans operate extremely infrequently. They operated for 7 hours between 21 May and 20 September 2021 (0.2 % of the time). When they do operate a greater degree of noise impact can be expected on some amenity areas, however, noise levels will not exceed 55 dB L_{Aeq} which is cited in BS 8233:2014 as acceptable in urban environments affected by road traffic noise. The operation of the cooling fans is outside of the control of the appellant, however, the impact of the fan operations on the rear of the existing dwellings on Lymouth Road is high and this will prevent SSE from increasing the frequency of use (and otherwise generating complaints). Further, and in any event, even if there is any impact, it is reduced by the presence of Christchurch Meadow nearby.

6.0 INTERNAL NOISE IMPACT

6.1 As stressed above the noise from SSE operations comprises the low-level, low frequency continuous 'hum' from the transformers together with the intermittent and infrequent noise from the operation of the transformer cooling fans.

6.2 My approach to the assessment of the internal noise impact from the cooling fans is to use the rating methodology of BS4142:2014+A1:2019 in the first instance. This applies externally to the dwelling. Providing the external noise impact is acceptable then the internal impact (when windows are open) will also be. In circumstances in which this indicates a (theoretical) excessively high noise impact then this is mitigated by the use of acoustic glazing and alternative means of ventilation/ measures to prevent overheating so that residents need not open their windows for any reason. The noise impact has then been assessed internally using the guidance of BS 8233:2014 and NANR 45 (for the assessment of low frequency noise).

6.3 As the scope of BS 4142:2014+A1:2019 does not strictly apply to the assessment of low frequency noise I have assessed the impact of the noise from transformer 'hum' internally only using the guidance of NANR 45. This has a 'limit' of 38 dB L_{eq} in the 100 Hz 1/3 octave band.

6.4 I have considered the noise impact from the low frequency transformer 'hum' and cooling fans separately and each are addressed below, focussing on estimating the number of dwellings that may require closed windows in order to achieve a satisfactory internal noise environment and the likely specification of the glazing systems.

<u>Internal Noise Impact from SSE Transformer 'Hum'</u>

6.5 I have undertaken tests to determine the acoustic attenuation of an open window to tonal noise at 100 Hz and these established a difference in noise level between outside and in in the 100 Hz 1/3 octave band of approximately 16 dB. On the basis that in order to comply with NANR45 noise levels internally should not exceed 38 dB $L_{eq\ 100\ Hz}$ then it follows that external noise levels at the building facade should not exceed 54 dB $L_{eq\ 100\ Hz}$ in properties which are not reliant on closed windows as a means of noise mitigation. Figure 9 shows the properties that may be reliant on closed windows in order to achieve an acceptable internal acoustic environment. This is based upon the near highest recorded 100 Hz noise level from the subtation (which occurs for less than 3% of the time). I have described this scenario as 'worst case'.

6.6 As stated in Section 5 and illustrated in Figure 1 the low frequency noise emission from the transformers is highly variable. The recommendations in Figure 9 are based upon the worst-case noise level (occurring for less than 3% of the time). In practice, however, the noise level associated with the typical case (which occurs for 30% of the time) is lower. It is clearly appropriate to ensure that all residents are provided with the means to protect their dwellings against the transformer noise (via provision of alternative means of ventilation and measures to prevent overheating), however, it must be stressed that it will not be necessary for all dwellings highlighted in Figure 9 to occupy with windows closed all of the time. Figure 10 shows the properties that will need to be reliant on closed windows in order to control the low frequency noise internally for 30% of the time (based upon the typical case). However, the variability in the 100 Hz noise level from the transformers is such that it will not be necessary for any resident to close their windows for all of the time to protect against the noise. I have estimated the total number of habitable room windows/ flats that would need windows closed for each scenario. This is shown in Table 4 below.

	No of Closed Windows		**No of Apartments**	
	No of Closed Windows	**% of Site**	**No of Apartments Affected**	**% of Site**
Worst Case 3% of time	140	18%	54	26%
Typical Case 30% of time	59	8%	26	13%

Table 4: Estimation of No of Properties Requiring Closed Windows in Order to Control Low Frequency Transformer Hum Noise

6.7 In order to achieve compliance with NANR45 acoustically rated glazing will be required to some properties. My original planning report identified three glazing specifications. Mr Scrivener in Paragraph 3.10 of his statement of case has challenged the acoustic performance of the 'Type 3' glazing specified. I can confirm, however, that the required specification is achievable and has been substantiated by a test undertaken in a mock up of a typical residential room on site undertaken on 3rd September 2021. The glazing tested comprised a Velfac proprietary sealed unit triple glazed system (9.5 mm glass, 6 mm airgap, 4 mm glass, 14 mm airgap and 4 mm glass) with a 200 mm airgap and a 8.8 mm acoustic laminate secondary glazed unit. The substation was still subject to upgrade works and hence simulated tests were undertaken using a sound source which reproduced the transformer hum at the window of the test room at the highest level that has been recorded from the site and estimated at the nearest proposed residential window. This indicated the following internal noise levels:

- 18 dB L_{Aeq}/ 36 dB $L_{eq,\ 100\ Hz}$

6.8 This is compliant with both the requirements of BS8233 and NANR45 and hence I am confident that it will be possible to achieve the required internal noise levels and that the internal noise environment from the transformer 'hum' will be acceptable at all times.

Internal Noise Impact of Cooling Fan Operations

6.9 In order to determine the noise impact in accordance with the rating methodology of BS4142:2014 I have re-considered the background noise levels during the day and at night (when background levels are lowest). I have used the daytime background noise levels reported in Table 3 and have further analysed the background noise levels reported in Section 5 for the night-time period and these are reported below.

Day and Date	Representative Background Noise Level, dB $L_{A90, 15 min}$
Monday 23/8/2021	35
Tuesday 24/8/2021	34
Wednesday 25/8/2021	34
Thursday 26/8/2021	47
Friday 27/8/2021	37
Saturday 28/8/2021	39
Sunday 29/8/2021	38
Monday 30/8/2021	35
Representative	**37**

Table 5: Night Time (23:00- 07:00 hours) Background Noise Survey Results

6.10 For the purposes of this assessment I consider a night-time background noise level of 37 dB $L_{A90, 15 min}$ representative.

6.11 The noise internal noise impact from the operation of the cooling fans has been determined using the same methodology as described above for the low frequency transformer hum for the daytime and night time periods. For the benefit of this assessment, I have assumed that residents may choose to close windows in order to achieve an acceptable internal acoustic environment when the difference between the BS 4142 rating and background noise levels is greater than + 10 dB. Figures 11 to 13 show the properties that will require windows to be closed during the day and Figures 14 to 16 at night. Table 6 below summarises the number of windows and properties affected.

Room	No of Closed Windows		No of Apartments	
	No of Closed Windows	% of Site	No of Apartments Affected	% of Site
Lounges/ dining/ kitchens (daytime)	127	17%	96	46%
Bedrooms (night)	215	28%	131	63%

Table 6: Estimation of No of Properties Requiring Closed Windows in Order to Control Transformer Cooling Fan Noise

6.12 Again, where windows are required to be kept closed, calculations and the noise break-in tests referred to in Paragraph 6.7 (undertaken with the cooling fans operational) above have been undertaken to determine the acoustic specification for glazing systems to ensure compliance with the requirements of BS 8233 and NANR45. The test room is closer to the transformer cooling fans than the nearest proposed habitable rooms with different source directivity patterns and hence I have measured a transfer function (difference between internal and external noise level) on site and then applied this to to the noise levels calculated at the closest habitable room window from the acoustic model of the cooling fan operations. The break-in tests and calculations described above resulted in the following internal noise levels at the nearest proposed habitable room window:

- 20 dB L_{Aeq}/ 43 dB $L_{eq, 50\ Hz}$, 26 dB $L_{eq, 100\ Hz}$

6.13 The tests and caculations indicate compliance with NANR45 and therefore I am confident that the internal noise environment will be acceptable at all times.

6.14 As stated above my rationale for determining the number of windows that would need to be closed (with alternative means of ventilation/ cooling provided) when the cooling fans operate is based upon the external noise level not exceeding + 10 dB (difference between BS 4142 background noise level and rating level). This is justified on the basis of the infrequent operation of the cooling fans. In any case, this matter can readily be addressed by condition requiring approval by the local planning authority of a scheme of mechanical ventilation for relevant properties.

<u>Acceptability of windows closed approach</u>

6.15 I note that, in his Statement of Case, Mr Scrivener has provided six appeal decisions in which, for all, the Inspector determined that the occupation of dwelling(s) with window(s) closed would not result in an acceptable internal living environment. However, all the appeals on which he relies were decided on the basis of written representations and it is not clear what if any expert noise evidence was submitted or, if it was, the extent to which the issues raised in this proof of evidence were addressed in that evidence. Further, in at least two of the cases

(11 Newbridge Street Old Whittington and 57 River Road Barking) mechanical ventilation was not provided.

6.16 The acceptability of internal noise levels in reliance on windows closed has been accepted in a number of appeal decisions determined after either an informal hearing or public inquiry with expert evidence and debate before the Inspector. Relevant case history is summarised below.

Land to the East of North Street, Stilton PE7 3RP (APP/H0520/W/19/3228494)
Outline planning for up to 90 houses. Concern was expressed by the council on the reliance of fixed shut (unopenable) windows to some dwellings to to mitigate against noise and air quality from the adjacent road network. (Paragraph 17). The Inspector was of the opinion that in such situations mechanical ventilation systems are an acceptable form of development which he acknowledged was supported by the professional practice guidance on noise [Reference 5]. He concluded (Paragraph 18) that he had no complelling evidence to demonstrate that the living conditions of the occupiers of those properties that would be required to use mechanical ventilation would be harmed to the extent that the development would be oppressive or poor.

Crewe Road, Crewe APP/R0660/A/12/2170820.
Outline planning application for up to 40 houses. There was concern about the noise impact from a neighbouring freight and plant hire business particularly in bedrooms at night. As a result the appellant proposed closed windows with alternative means of ventilation by means of MVHR. The Inspector concluded that this would provide a suitable means of mitigation, that the use of MVHR in dwellings was becoming increasingly common and that residents would quickly adapt to its use. The appeal was allowed accordingly.

Razor's Farm Chineham APP/H1705/A/13/2205929
Outline planning application for up to 425 dwellings. Site neighbouring an industrial complex operated by Air Products. The appeal was allowed subject to conditions and Condition 13 related to noise stating (in part):

> *If the internal noise limits can only be achieved with closed windows then alternative means of both whole dwelling and purge ventilation should be provided to allow residents to occupy the properties at all times with windows closed.*

As a side note the Inspector's comments regarding the Council's objection to the proposals (on the grounds of noise impact) are relevant to the appeal site at Vastern Road. Paragraph 10.28 of the appeal decision states:

> *Indeed, it is very difficult to understand the Council's initial resistance to the proposal on this ground when they are continuing to promote the site as a*

housing allocation in their emerging Local Plan. That promotion would be illogical in the extreme if they did not think a solution could not be arrived at.

5-6 Waterworks Road, Brixton APP/N5660/W/17/3170507

Detailed planning application for a mixed use scheme including 28 residential units affected by mixed noise from both industrial and transportation sources. Although the appeal was dismissed on other grounds both sides agreed that acceptable internal noise levels could be achieved when windows are closed. The Inspector concluded (at paragraphs 41-44) that there was nothing to suggest in the guidance of BS 8233:2014 and the ProPG document that reliance on closed windows to achieve satistactory internal noise levels in unreasonable, providing satisfactory ventilation and thermal comfort can be achieved. He also reasoned that the inclusion of openable windows would not necessarily lead to complaints (about noise) stating that residents would be aware that noise concerns could be remedied by closing windows and that adequate ventilation would be maintained.

6.17 In practice the reliance of closed windows as a means of noise mitigation is common. Without it many urban sites, even in relatively quiet areas, would not be viable. Indeed, Reading Borough Council have accepted such measures many times before. I was involved in the Kennet Island residential development in Reading (RBC application reference 131633) which backed on to industrial units and which required closed windows at all times with acoustically rated glazing and alternative means of ventilation in order to secure an acceptable acoustic environment. This was enforced by condition in the reserved matters consent, which I reproduce below:

5. Noise attenuation measures (e.g. glazing and mechanical ventilation) for dwellings within Phase 3C shall accord with the minimum performance levels outlined with the submitted Noise Impact Assessment; or whatever specifications, or other measures, may be deemed necessary to satisfy the requirements of Condition 28 of the extant permission 12/00481/OUT. Reason: To protect the amenities of residents of the proposed properties from surrounding noise sources.

6.18 A copy of the full decision notice and accompanying noise impact assessment (see paragraphs 6.3-6.4 for reference to windows closed) is provided in Volume 2 of this proof of evidence.

6.19 Other relevant RBC case histories (in which reliance on closed windows has been accepted) have been identified and are summarised below (decision notices and the relevant noise impact assessments are provided in Volume 2).

RBC Reference 151944, Worton Grange Reading

Hybrid application including outline consent for up to 175 residential units. Condition 14 of the consent states:

> *Sound Insulation from External Noise*
>
> *No development shall take place within the Outline Element until a detailed scheme, informed by an assessment of the current noise environment, for protecting the dwellings from the external noise environment of the area has been submitted to and approved, in writing, by the Local Planning Authority. The scheme itself shall be designed, specified and constructed so that the sound insulation performance of the structure and the layout of the dwellings are such that the indoor ambient noise levels do not exceed the values detailed in Table 4 of BS8233:2014.*

The accompanying noise impact assessment, by Peter Brett Associates identifies (Section 4.4) the requirement for windows to be closed in order to comply with internal noise levels is provided.

RBC Reference 150019, King's Point, Reading

Full planning consent for 103 residential units.

Condition 14 of the consent is very similarly worded to the noise condition referenced above (relating to Worton Grange) and Paragraphs 4.6 and 4.11 of the accompanying noise impact assessment by Entran stresses that it will be necessary for windows to be closed in order to meet the internal target noise levels

RBC Reference 171814, Cox & Wyman Ltd, Cardiff Road, Reading

Full planning consent for 96 dwellings.

Condition 13 of the consent states the following:

> *Prior to occupation of the dwellings hereby permitted all glazing and ventilation shall be installed in accordance with the specifications set out within the acoustic assessment submitted with the application (Paragon Acoustics, 28 September 2017….) and thereafter retained in accordance with these approved details.*

The accompanying noise impact assessment by Paragon Acoustics identifies (Section 11) that windows need to remain shut in order to meet the internal target noise levels.

6.20 The use of closed windows as a means of noise mitigation is further illustrated, in the most simplest of forms, in the Acoustics, Ventilation and Overheating Design Guide published by the Association of Noise Consultants and Institute of Acoustics which Mr Scrivener makes reference to in Paragraphs 4.2 and 4.8 of his Statement of Case. Paragraph 1.6 of this document refers to a recent review of planning applications for major developments in London. It states that 85% of the applications reviewed required closed windows in order to achieve reasonable noise conditions. The study goes on to refer to the potential for overheating, with a need to then open windows to prevent overheating. This differs from the proposals at the appeal site which will be designed to provide sufficient ventilation and not overheat at all times when windows are closed.

6.21 The technical guidance I have relied upon in this proof of evidence also supports the use of closed windows and alternative means of ventilation as an effective means of mitigation. BS 4142:2014+A1:2019 describes *ventilation and/ or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation* as a design measure to secure good internal acoustic conditions (Section 11, note 3, Page 16). BS 8233:2014 (7.7.2 Note 5) describes reliance on closed windows in order to comply with internal noise guideline value as acceptable providing there is appropriate alternative means of ventilation. Section 8.4.5.4 of the standard also describes the ventilation options in situations where windows cannot be opened.

6.22 The ProPG (published by the Association of Noise Consultants, Institute of Acoustics and Chartered Institute of Environmental Health) [Reference 5], whilst strictly applying to noise from transportation sources, addresses the use of closed windows as a means of noise mitigation in some length and states, for example, in Paragraph 2.34:

> *Where the LPA accepts that there is a justification that the internal target noise levels can only be achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, vibration and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide 'whole dwelling ventilation' in accordance with Building Regulations Approved Document F…*

6.23 Finally, it is noteworthy that the PPG describes in the Noise Exposure Hierarchy Table (reproduced in Table 1 in this proof of evidence) as examples of outcomes '*having to close windows where alternative means of ventilation is not available*'. This implies that where alternative means of ventilation is available closing windows as a means of mitigation is acceptable. Furthermore, when addressing the risk of conflict between new development and existing business (noise sources) the PPG refers to the agent of change who, it states, will need to define mitigation being proposed to address any potential significant adverse effects that are identified. It specifically identifies keeping windows closed and using alternative ventilation systems as a means of such mitigation (Paragraph: 009 Reference ID: 30-009-20190722).

Internal Noise Environment-overall summary

6.24 When the cooling fans are not operational (the vast majority of the time) the majority of the proposed dwellings may be occupied with windows open without an unacceptable internal noise impact. However, in order to ensure an acceptable noise impact from the transformer 'hum' some residents in the proposed dwellings closest to the substation may need to occupy their dwellings with windows closed, for some of the time.

6.25 During the rare occasions when the cooling fans operate it will also be necessary for the occupants of some other blocks to occupy their properties with windows closed in order to achieve a satisfactory internal noise environment.

6.26 All dwellings that may require occupation with windows closed in order to achieve an acceptable internal noise environment will be provided with mechanical means of both background and purge ventilation and will be designed to prevent overheating and, on this basis, there will be no requirement for any resident to open windows at times when to do so would result in excessive internal noise levels.

7.0 SUMMARY AND CONCLUSIONS

7.1 My proof of evidence on noise is produced on behalf of the appellant, Berkeley Homes Ltd (Oxford and Chiltern), into Reading Borough Council's refusal to grant planning consent for a residential development on the appeal site at 55 Vastern Road in Reading.

7.2 The site is affected by noise from transportation sources and from the operation of an electricity substation. It is common ground between myself and Mr Scrivener (employed on behalf of Reading Borough Council) that noise from transportation sources may be satisfactorily mitigated and hence my proof of evidence addresses the noise impact from the substation operations only.

7.3 I have been involved with this site, on Berkeley Homes' behalf, since the Summer of 2018 (prior to their purchase of the site) and have worked closely with their architects and design teams to ensure that the scheme is designed to mitigate the noise impact upon the proposed new dwellings.

7.4 Noise from the substation operations is characterised by a continuous low level, low frequency 'hum' from the operation of the transformers and from the operation of the transformer cooling fans. The cooling fans operate extremely infrequently and have been found to operate for a total of 7 hours in the period between 21 May and 20 September 2021. This is 0.2% of the time period considered.

7.5 I have considered the noise impact both externally to and inside of the new dwellings. In external amenity areas the noise from the transformer hum will be acceptable at all times. The noise impact from the transformer cooling fans when they operate will be greater at some locations, however, it must be stressed that the fans operate very infrequently. The absolute level of the noise from the cooling fans will be acceptable and in any case there is public open space nearby.

7.6 In order to achieve an acceptable internal noise environment it will be necessary for some windows in a relatively small proportion of the site to be closed at some times. . Other areas of the development will require windows to be closed during the infrequent periods when the transformer cooling fans operate. Where it is necessary for windows to be closed in order to achieve a satisfactory internal noise environment full alternative means of ventilation (providing both background and purge ventilation in accordance with Part F of the Building Regulations) together with measures to prevent overheating will be provided. I note that Reading Borough Council consider that this will not provide a satisfactory internal environment, however, I must stress that it is an extremely common form of noise mitigation and one that they have accepted, and conditioned in planning consents in the past themselves.

7.7 As a result I am of the opinion that the design of the site and the noise impact from the neighbouring SSE operations is mitigated to a minimum and fully compliant with the requirements of the Agent of Change as described in the NPPF and PPG.

7.8 The development is engineered to ensure an acceptable acoustic environment both inside and outside of the proposed new dwellings. On this basis I consider that there is no reason, on noise grounds, why this appeal should not be allowed and planning consent granted.

REFERENCES

1. Reading Borough Council. Local Plan Policy CC8, Safeguarding Amenity, adopted November 2019.

2. National Planning Policy Framework, Department for Communities and Local Government, 2019.

3. Noise Policy Statement for England, Defra, 2010.

4. National Planning Practice Guidance, Department of Communities and Local Government, 2019.

5. Association of Noise Consultants, Institute of Acoustics, Chartered Institute of Environmental Health. Pro PG Planning and Noise, May 2017.

6. Association of Noise Consultants & Institute of Acoustics. Acoustics, Ventilation and Overheating- Residential Design Guide, January 2020.

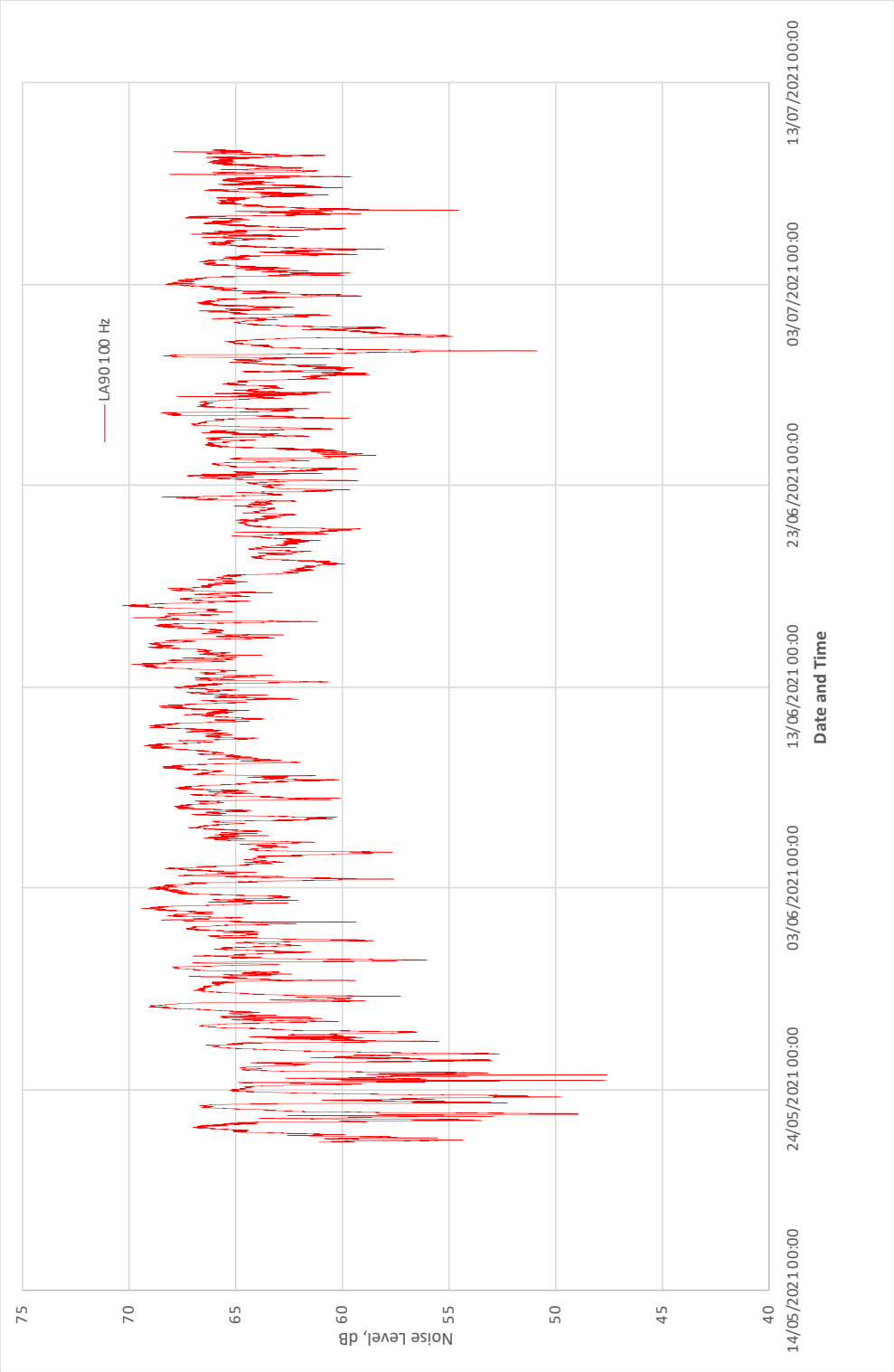
7. British Standards Institution. British Standard 8233: Guidance on Sound Insulation and Noise Reduction for Buildings, 2014.World Health Organisation, Guidelines for Community Noise, 2000.

8. World Health Organisation. Guidelines for Community Noise, 2000.

9. British Standards Institution. British Standard 4142+A1:2019: Methods for rating and assessing industrial and commercial sound, 2019.

10. University of Salford, Manchester. DEFRA Research Contract NANR45. Proposed criteria for the assessment of low frequency noise disturbance, 2011.

11. International Standards Association. ISO 9613. Acoustics- Attenuation of sound during propagation outdoors, 1993.



Project: Vastern Road Reading	**Title:** Variation in 100 Hz Noise Emission From Transformers	
DWG No: Figure 1	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0

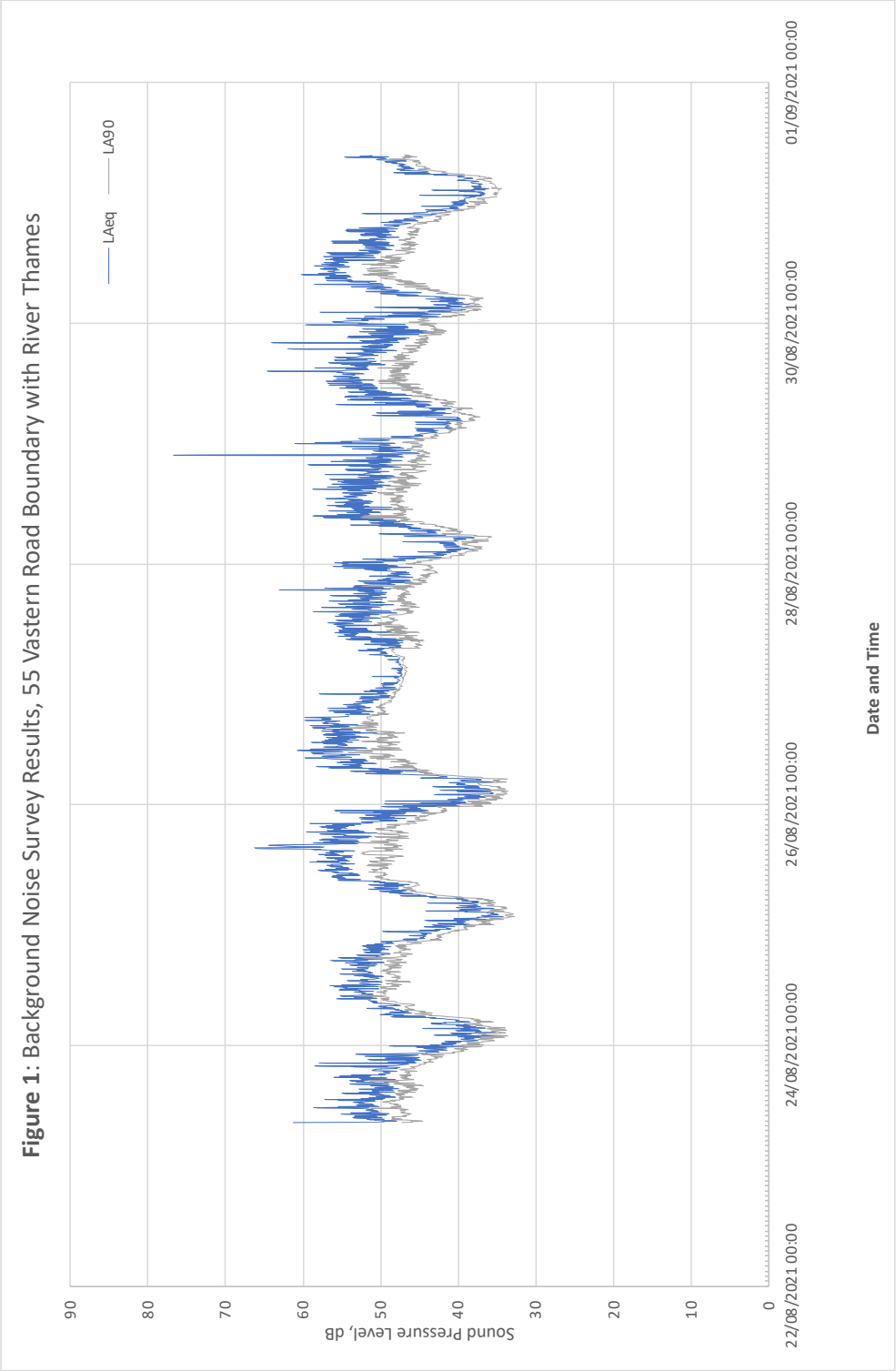
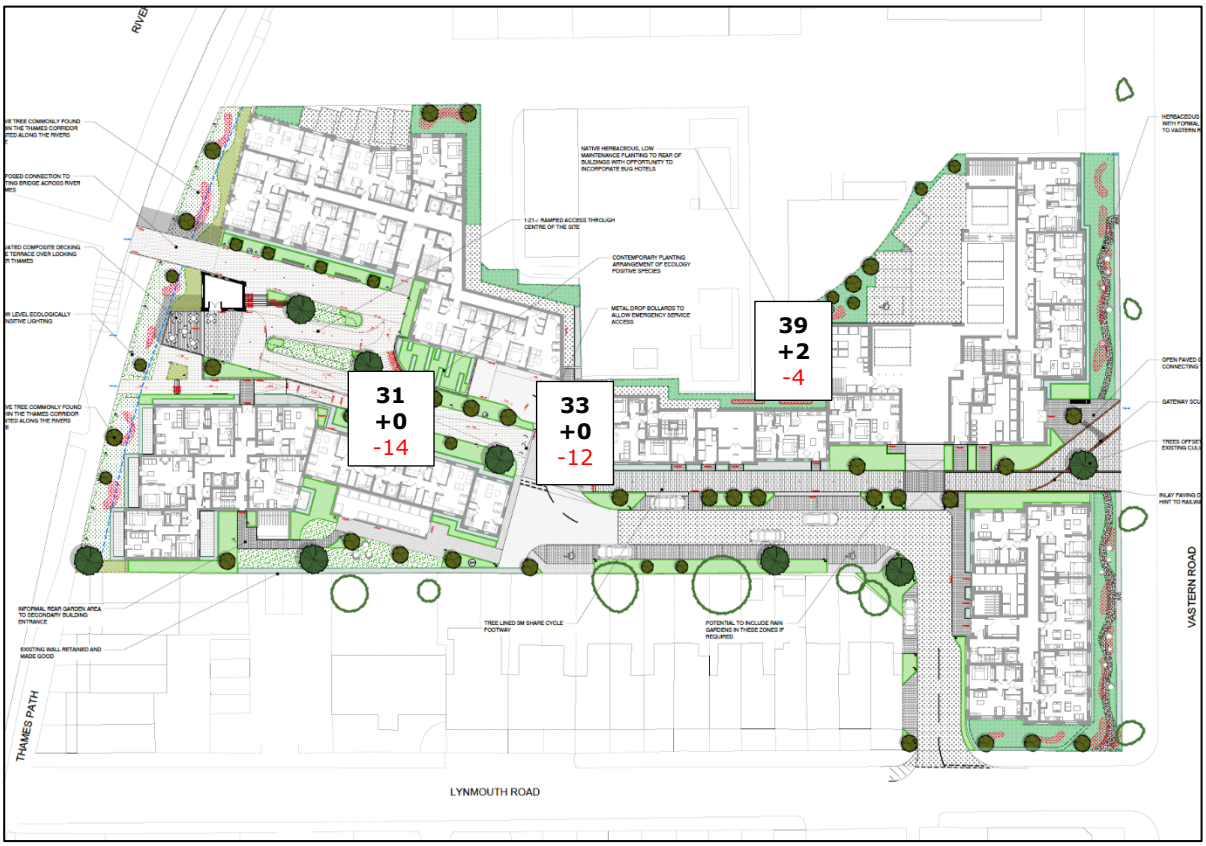


Figure 1: Background Noise Survey Results, 55 Vastern Road Boundary with River Thames

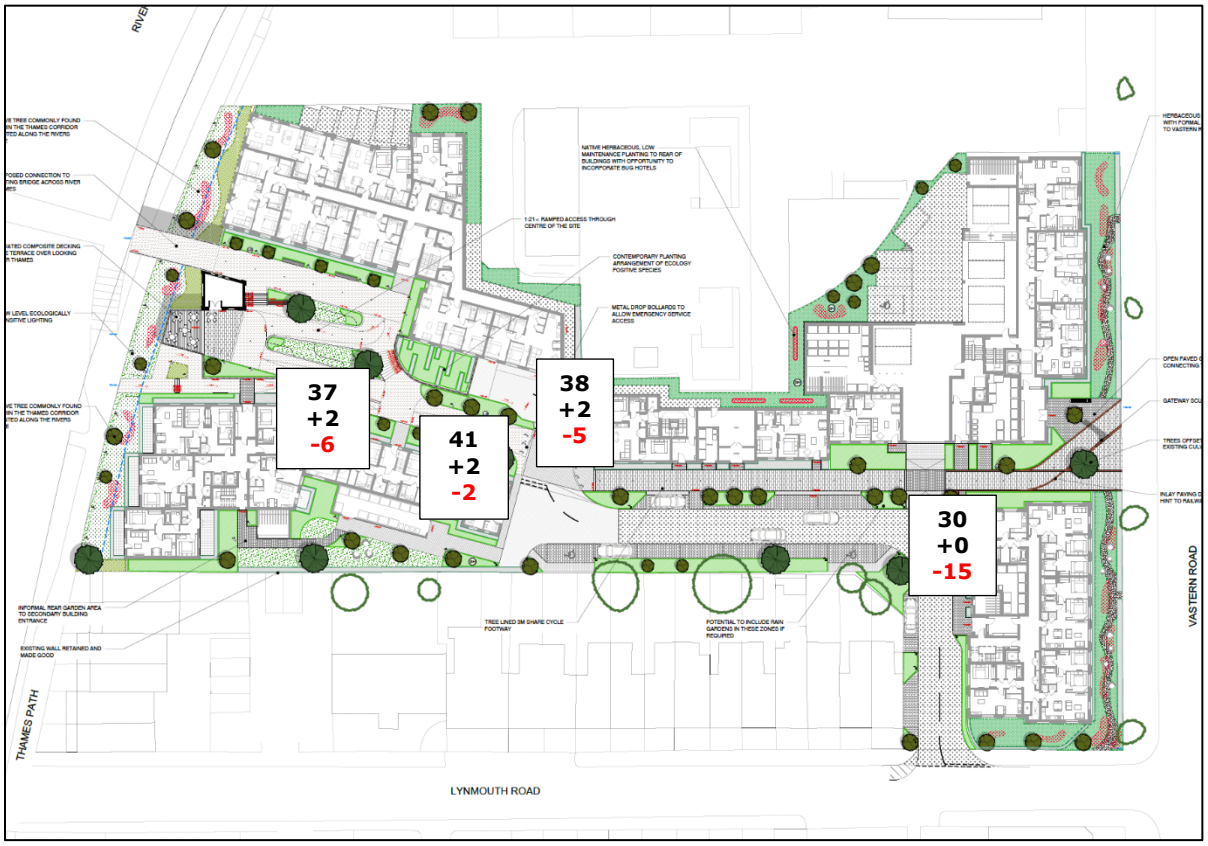
Project: Vastern Road Reading	**Title:** Background Noise Survey Results	
DWG No: Figure 2	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0



Key

XX BS 4142 source noise level, dB L_{Aeq}
Y BS 4142 rating correction for noise character, dB
X Difference between daytime background and rating noise levels, dB

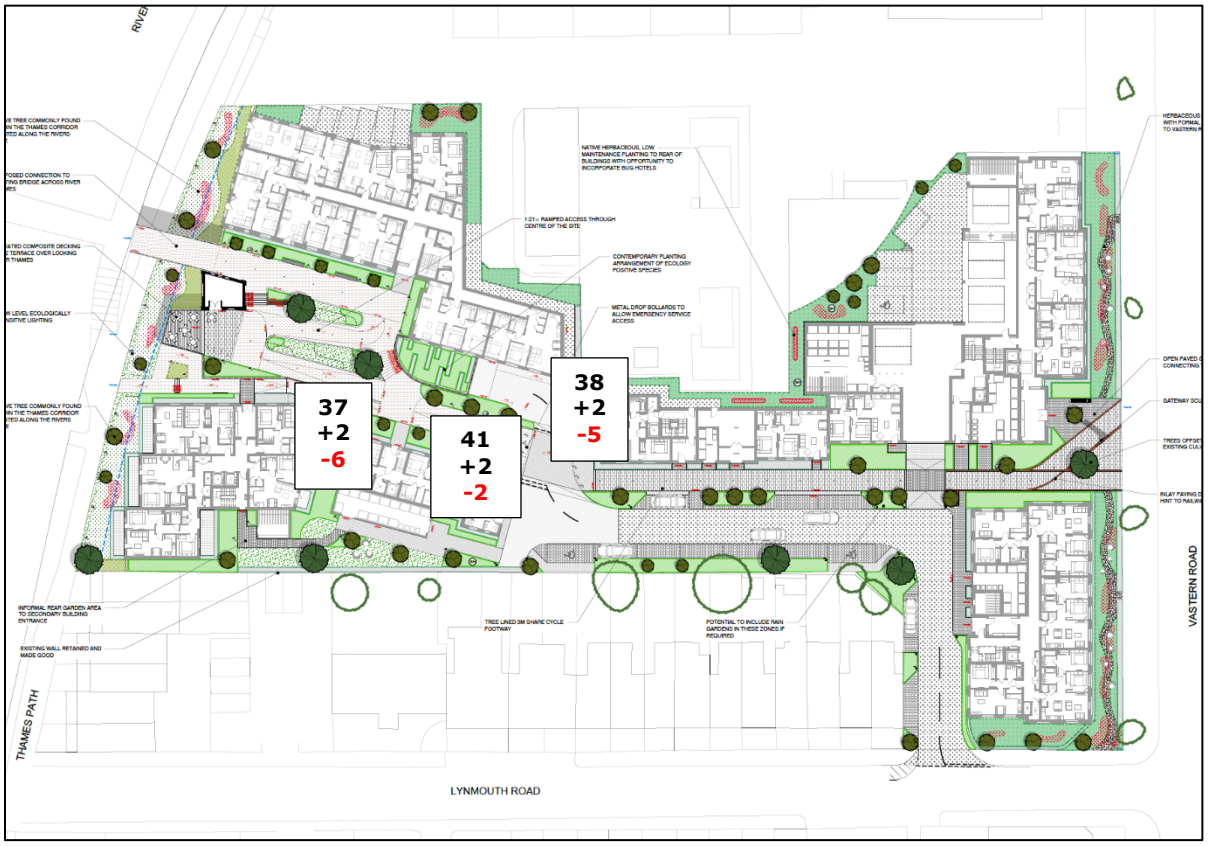
Project: Vastern Road Reading	**Title:** Daytime Transformer Hum Noise Levels, Ground Floor Amenity Areas	
DWG No: Figure 3	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0



Key

XX BS 4142 source noise level, dB L_{Aeq}
Y BS 4142 rating correction for noise character, dB
X Difference between daytime background and rating noise levels, dB

Project: Vastern Road Reading	**Title:** Daytime Transformer Hum Noise Levels, First Floor Amenity Areas	
DWG No: Figure 4	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0



Key

XX BS 4142 source noise level, dB L_{Aeq}
Y BS 4142 rating correction for noise character, dB
X Difference between daytime background and rating noise levels, dB

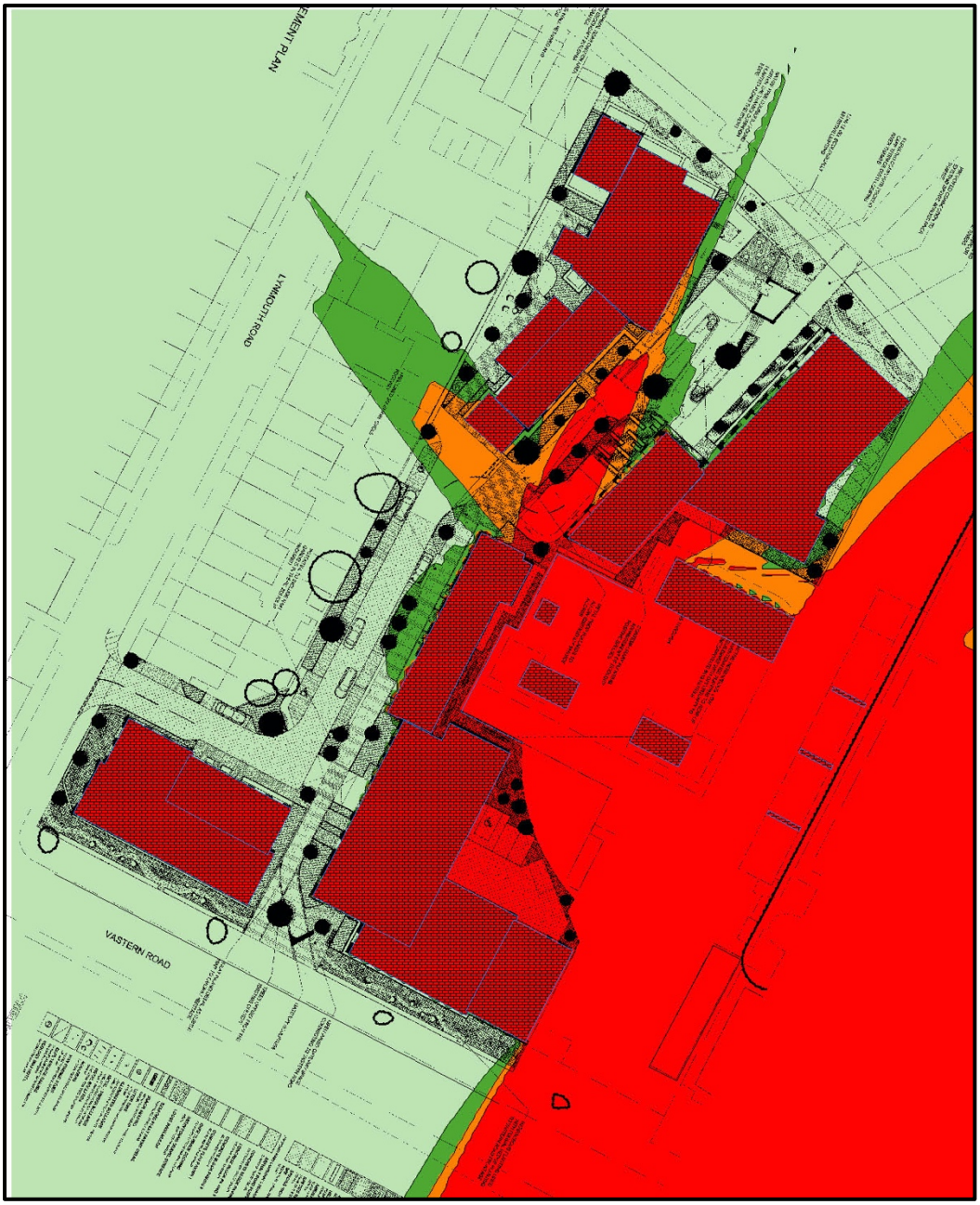
Project: Vastern Road Reading	**Title:** Daytime transformer Hum Noise Levels, Second Floor Amenity Areas	
DWG No: Figure 5	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0

	< 0 dB
	0 to +5 dB
	+5 to +10 dB
	> +10 dB

Project: Vastern Road Reading	**Title:** Difference Between Cooling Fan Rating Noise Levels and Background Noise Levels, dB Ground Floor	
DWG No: Figure 6	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0

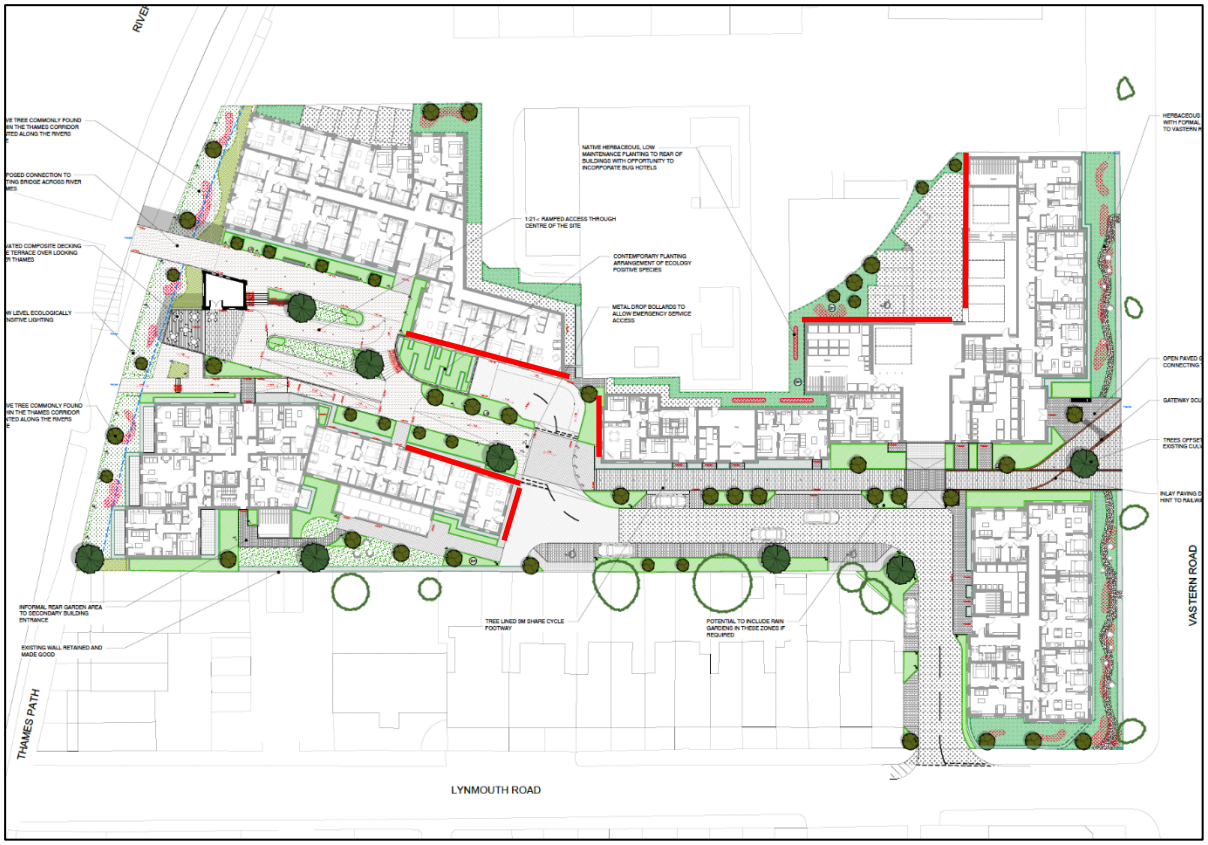
	< 0 dB
	0 to +5 dB
	+5 to +10 dB
	> +10 dB

Project: Vastern Road Reading	**Title:** Difference Between Cooling Fan Rating Noise Levels and Background Noise Levels, dB First Floor	
DWG No: Figure 7	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0



	< 0 dB
	0 to +5 dB
	+5 to +10 dB
	> +10 dB

Project: Vastern Road Reading	**Title:** Difference Between Cooling Fan Rating Noise Levels and Background Noise Levels, dB Second Floor	
DWG No: Figure 8	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0

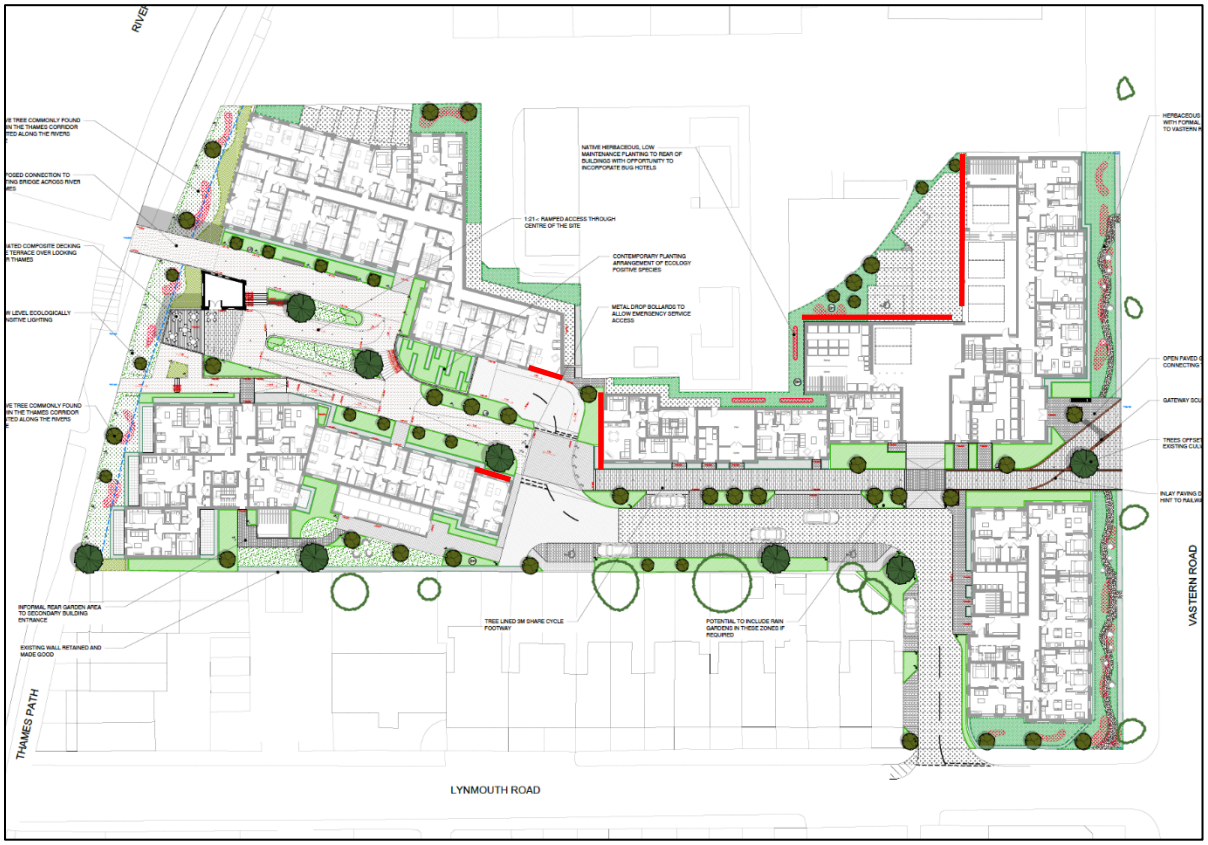


WORST CASE (3% of time)- Maximum transformer noise level

Recommendations apply to all floors on the facades illustrated

Habitable room windows on the facades illustrated may need to be closed in order to achieve acceptable internal noise levels during the highest low frequency noise (hum) noise output from the transformers.

Project: Vastern Road Reading	**Title:** Building facades reliant on closed windows in order to protect against transformer hum noise	
DWG No: Figure 9	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0

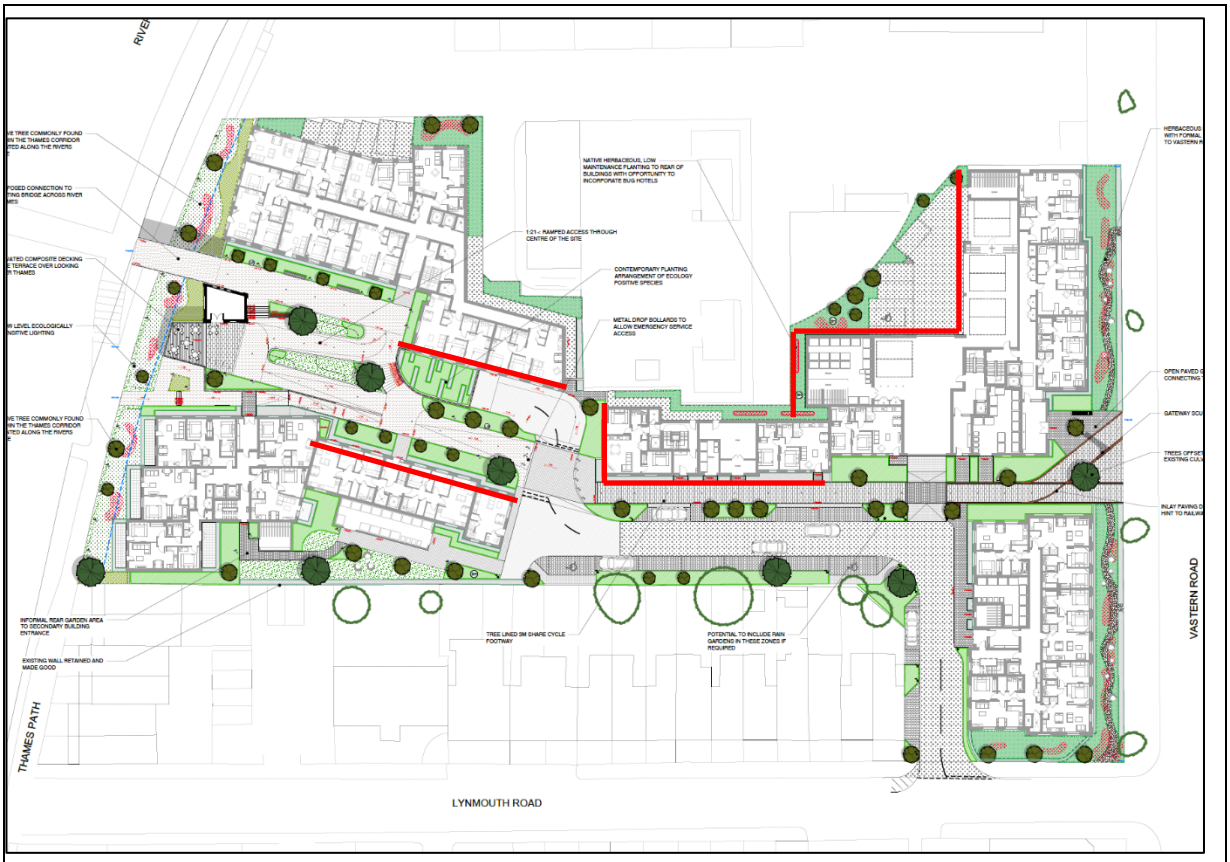


TYPICAL CASE (30% of the Time)- Average Transformer Noise Level

Recommendations apply to floors 0- 2 on the facades illustrated

Habitable room windows on the facades illustrated may need to be closed in order to achieve acceptable internal noise levels during the typical low frequency noise (hum) noise output from the transformers.

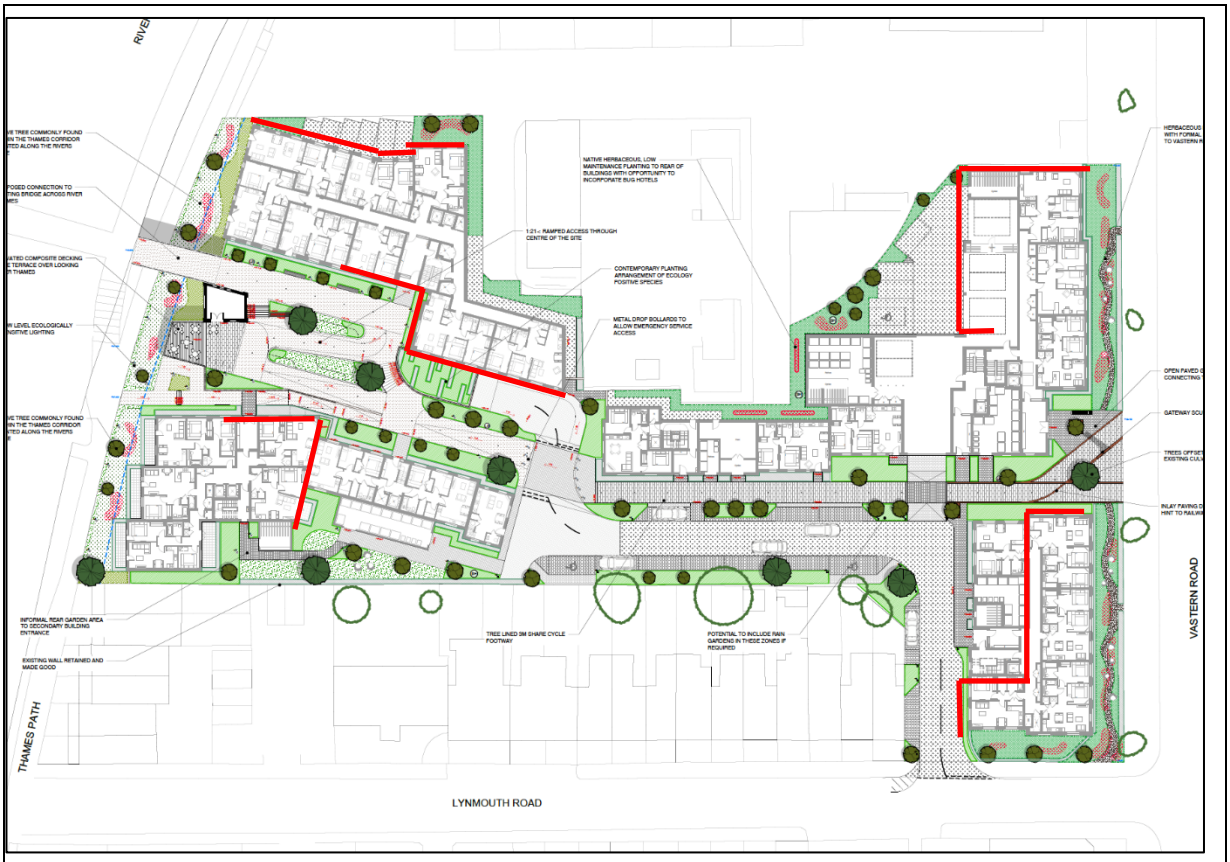
Project: Vastern Road Reading	**Title:** Building facades reliant on closed windows in order to protect against transformer hum noise	
DWG No: Figure 10	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0



DAY-TIME

Ground to Third Floors Inclusive

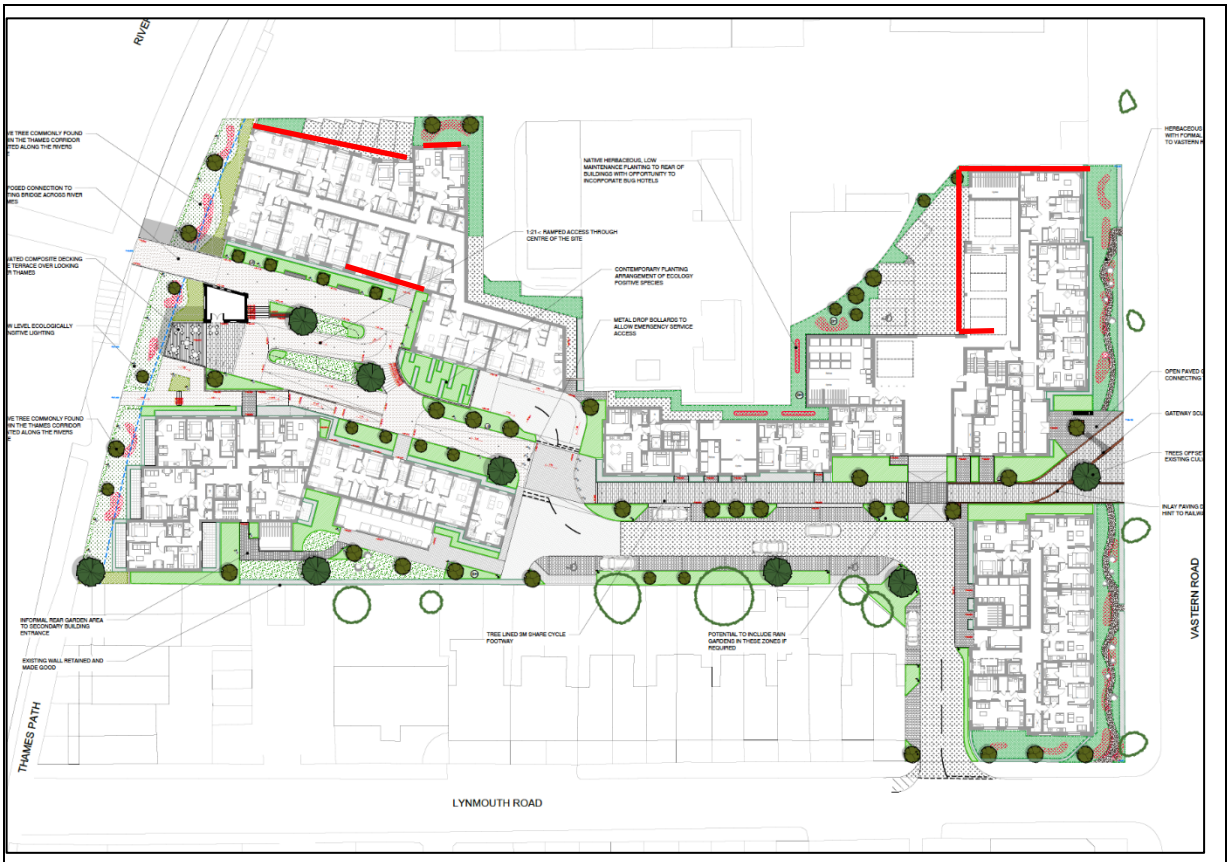
Project: Vastern Road Reading	**Title:** Building facades reliant on closed windows in order to protect against transformer cooling fan noise	
DWG No: Figure 11	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0



DAY-TIME

Fourth to Seventh Floor Inclusive

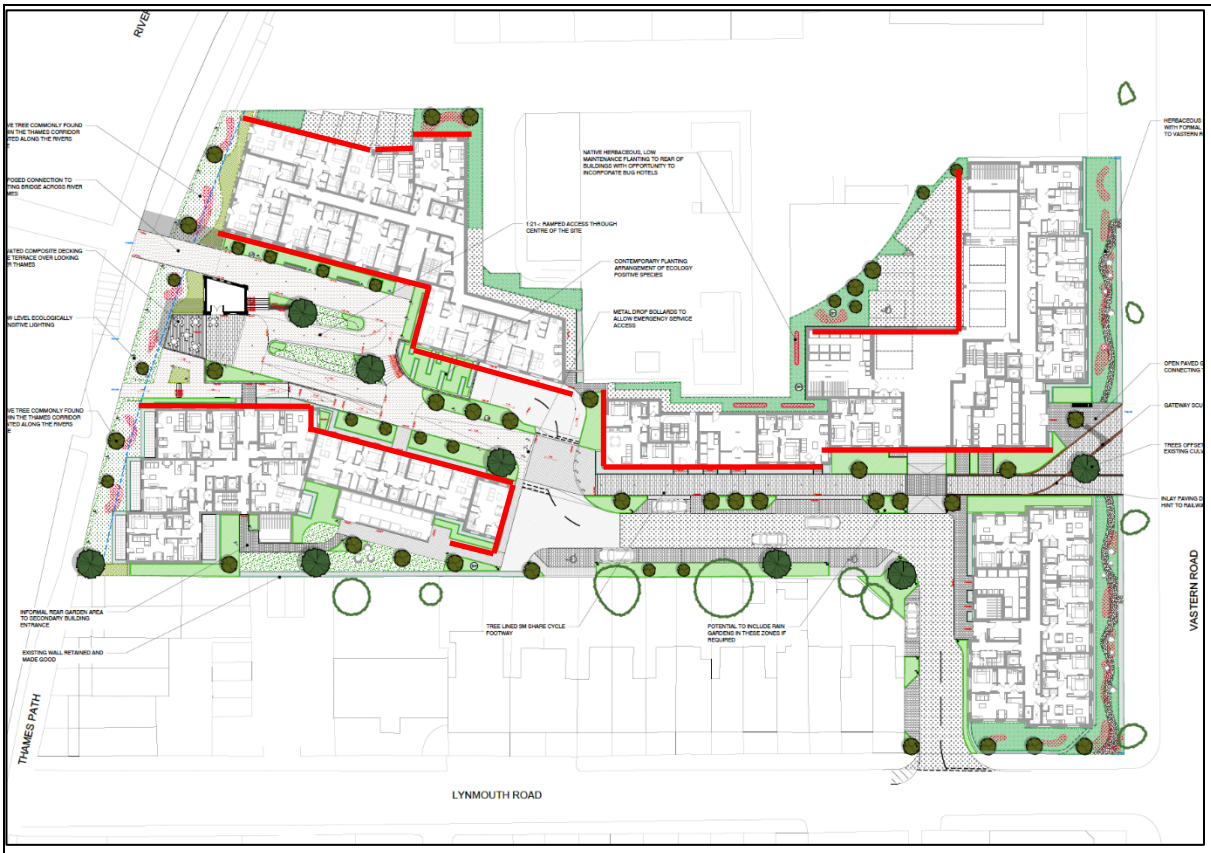
Project: Vastern Road Reading	**Title:** Building facades reliant on closed windows in order to protect against transformer cooling fan noise	
DWG No: Figure 12	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0



DAY-TIME

Eight to Tenth Floor Inclusive

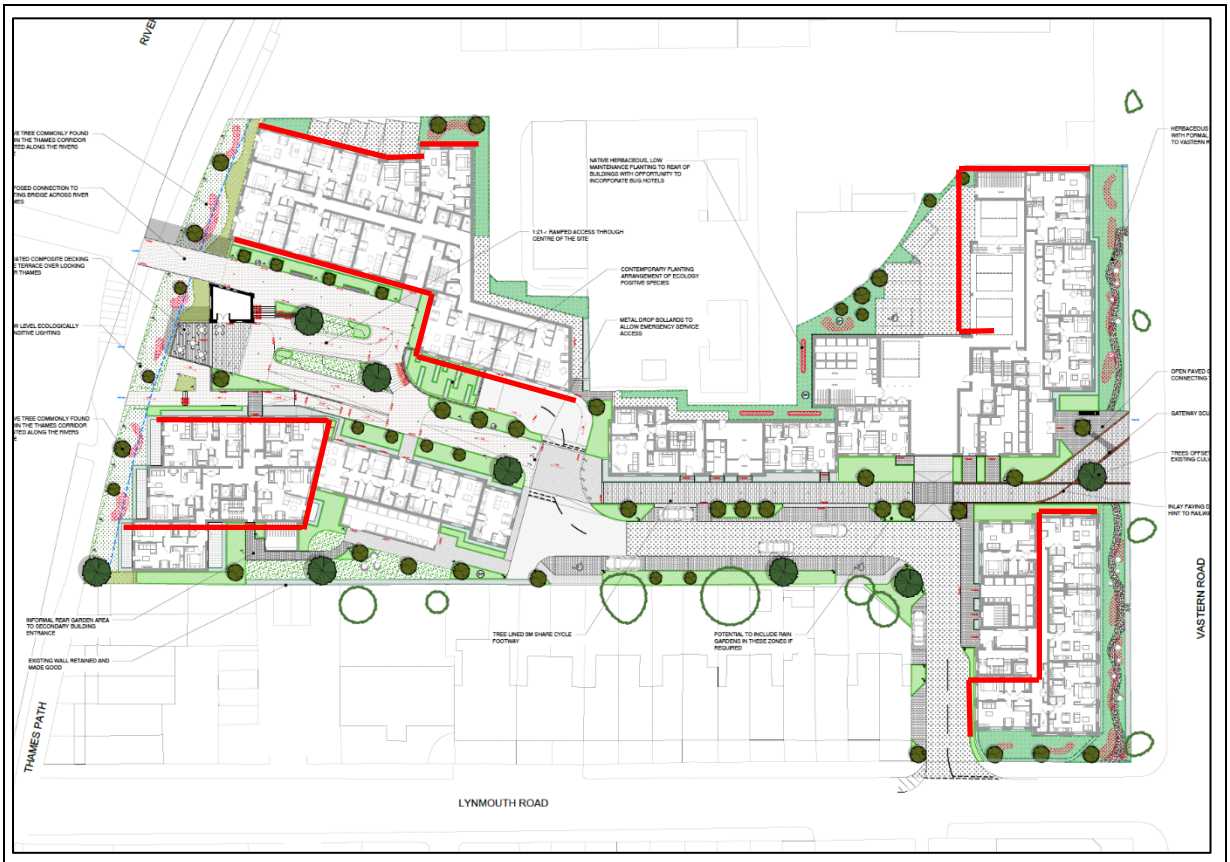
Project: Vastern Road Reading	**Title:** Building facades reliant on closed windows in order to protect against transformer cooling fan noise	
DWG No: Figure 13	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0



NIGHT-TIME

Ground to Third Floors Inclusive

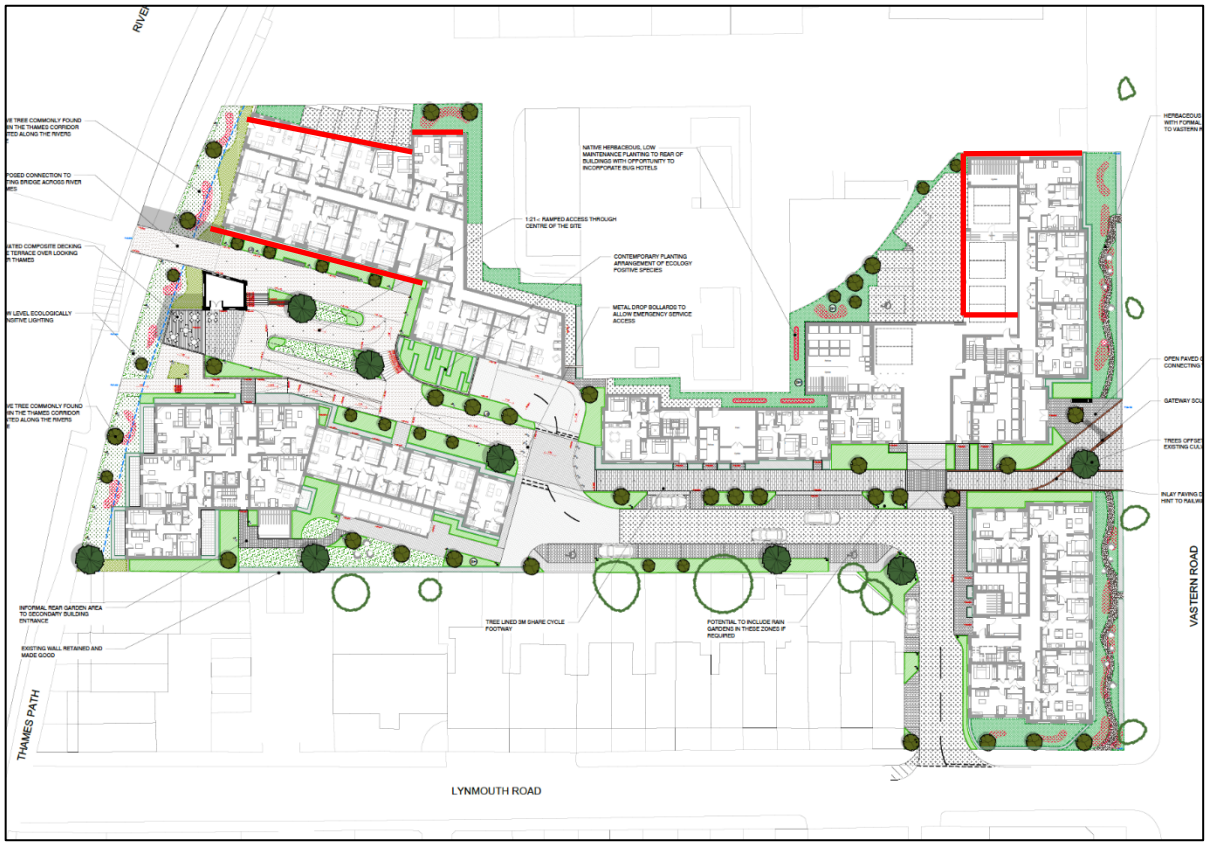
Project: Vastern Road Reading	**Title:** Building facades reliant on closed windows in order to protect against transformer cooling fan noise	
DWG No: Figure 14	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0



NIGHT-TIME

Fourth to Seventh Floor Inclusive

Project: Vastern Road Reading	**Title:** Building facades reliant on closed windows in order to protect against transformer cooling fan noise	
DWG No: Figure 15	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0



NIGHT-TIME

Eight to Tenth Floor Inclusive

Project: Vastern Road Reading	**Title:** Building facades reliant on closed windows in order to protect against transformer cooling fan noise	
DWG No: Figure 16	**Scale:** N.T.S.	**Rev:** -
Date: September 2021	**Drawn By:** RP	**Job No:** 8848-1 Rev 0

APPENDIX A: CORRESPONDENCE WITH SSE

Scottish & Southern Electricity Networks

No 1 Forbury Place
43 Forbury Road
Reading
Berkshire
RG1 3JH

Email: richard.gough@sse.com

16 July 2021

Dear Sir/ Madam

Re: Electricity Distribution System at 55 Vastern Road, Reading

Further to the respective planning applications committee on 31 March 2021, we are writing to provide additional information in relation to the land located adjacent to Berkeley Homes' land interest at 55 Vastern Road, Reading.

Berkeley acquired the land included within their planning application from SSE in 2019. There is no ongoing contractual relationship between SSE and Berkeley for the remaining part of the land allocated under Policy CR11g of Reading Borough Council's Local Plan. This land remains within SSE's ownership and provides vital infrastructure for Reading and the surrounding areas, as detailed further below.

The Vastern Road site and associated Electricity Distribution System assets are critical elements of the electricity infrastructure for Reading and the surrounding area, supplying power to thousands of homes and businesses and also helping to maintain Electricity System resilience and reliability. Given the future need to increase the capacity of the Electricity Distribution System to accommodate new demands such as electric vehicles and electric heating in the local community, the strategic requirement for the site is highly unlikely to change in either the short or long-term.

Although it is potentially possible for the electricity infrastructure at 55 Vastern Road to be relocated, this would be at significant cost to the requester, and only possible if a suitable location for the infrastructure could be identified. SSE is a regulated business, and our expenditure is recovered through consumer energy bills and any such major re-sitting of infrastructure would need to be justified as being in the interests of bill payers.

Notwithstanding the above, we note that Berkeley's plans have been designed to enable comprehensive development of the whole allocated site.

I trust this information is useful.

Yours faithfully

Richard Gough
Director of System Operations

Scottish & Southern Electricity Networks

No 1 Forbury Place
43 Forbury Road
Reading
Berkshire
RG1 3JH

Email: richard.gough@sse.com

16 July 2021

Dear Sir/ Madam

Re: Electricity Distribution System at 55 Vastern Road, Reading

Further to the respective planning applications committee on 31 March 2021, we are writing to provide additional information in relation to the equipment located adjacent to Berkeley Homes' land interest at 55 Vastern Road, Reading.

The electricity substation comprises of electrical transformers, cooling fans, switchgear, and other associated apparatus. The electrical transformers support customer electricity supplies within Reading and the surrounding area with relatively low impact on the neighbouring residential areas and amenity spaces. The cooling fans are used to cool the circulating insulating oil in each transformer when the combination of system load and ambient temperature reaches a set trigger point. These fans run infrequently and usually during hot weather periods.

It is my understanding that Berkeley were aware of these constraints when buying the site and have designed their scheme to accommodate the existing aspects of the site.

I trust that this information is useful in regard to Electricity Distribution System assets on the site and how they relate to the proposed development at 55 Vastern Road.

Yours faithfully

Richard Gough
Director of System Operations