Acoustic Design Statement

Proposed Development at Barnes Hospital, South Worple Way, London, SW14 8SU

For South West London and St George's Mental Health Trust

Report No. JAE10417-REPT-01-R2

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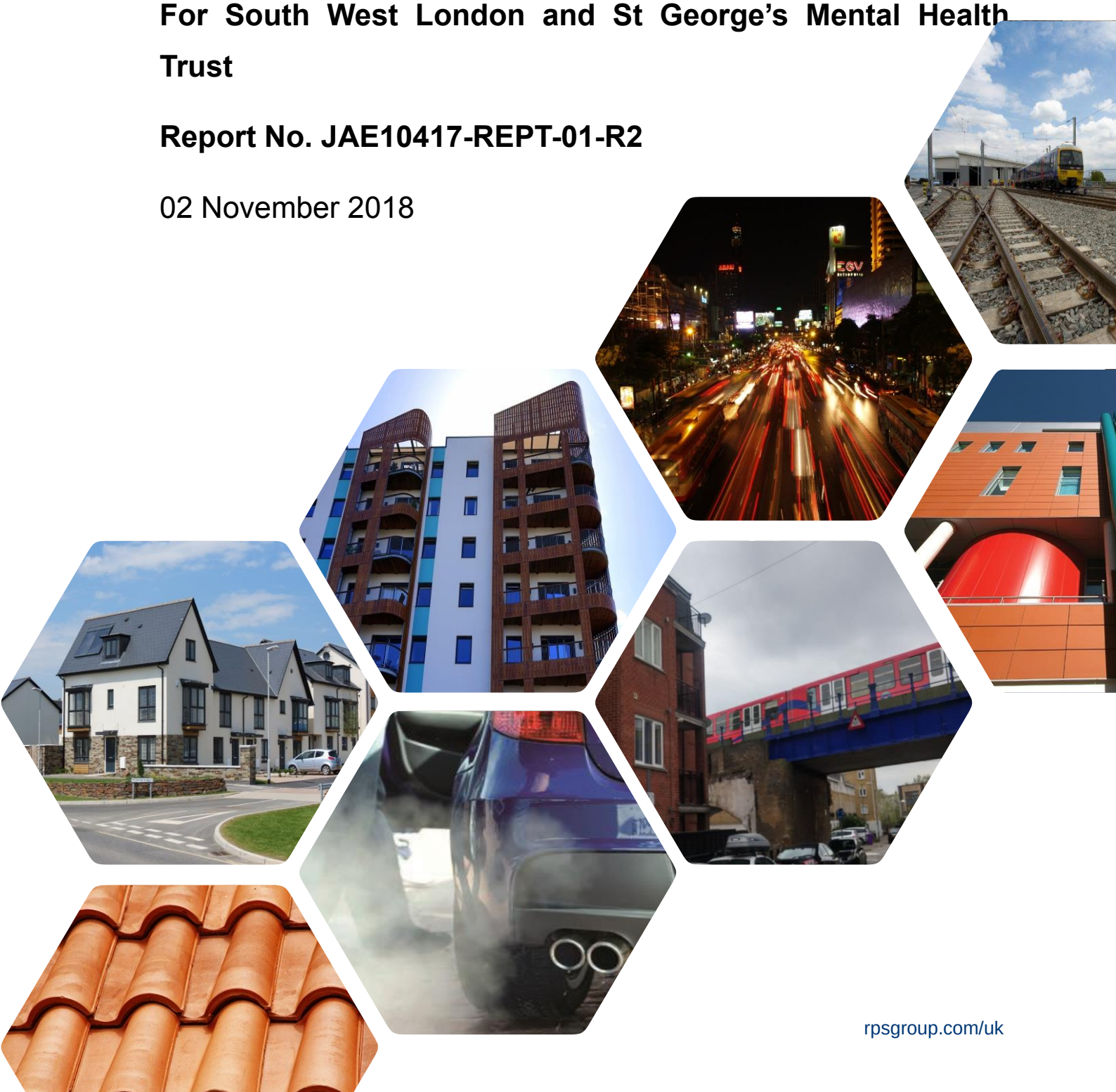

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Quality Management

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1 Introduction

1.1 The Acoustics Team of RPS Planning and Environment (RPS) has been appointed by South West London and St George's Trust to provide a noise assessment to accompany a planning application for a proposed mixed-use development at Barnes Hospital, South Worple Way, London, SW14 8SU. The site is located within the administrative area of the London Borough of Richmond upon Thames (LBRT).

1.2 A pre-planning application proposal for the development was submitted in November 2017, comprising of a proposed replacement healthcare facility and residential units. The development proposal has since been revised to comprise of: residential accommodation; a replacement health care facility; and a Special Education Needs (SEN) school. A description of the proposed development is provided below:

Outline planning permission for the demolition and comprehensive redevelopment (phased development) of land at Barnes Hospital to provide a mixed use development comprising a health centre (Use Class D1), a Special Educational Needs (SEN) School (Use Class D1), up to 80 new build residential units (Use Class C3), the conversion of one BTM for medical use (Use Class D1), car parking, landscaping and associated works. All matters reserved save for the full details submitted in relation to access points at the site boundaries.

1.3 The structure and content of this report is based upon the requirements of the Professional Practice Guidance on Planning and Noise (ProPG) [1], which provides a focused methodology for assessing noise effects on residential developments. This report represents the Acoustic Design Statement (ADS) for the development which is required as the output from the ProPG methodology.

1.4 The assessment has been undertaken based upon appropriate information on the proposed development provided by the project team. RPS is a member of the Association of Noise Consultants (ANC), the representative body for acoustics consultancies, having demonstrated the necessary professional and technical competence. The assessment has been undertaken with integrity, objectivity and honesty in accordance with the Code of Conduct of the Institute of Acoustics (IOA) and ethically, professionally and lawfully in accordance with the Code of Ethics of the ANC.

1.5 The technical content of this assessment has been provided by RPS personnel, all of whom are corporate (MIOA) or non-corporate, associate members (AMIOA) of the IOA (the UK's professional body for those working in acoustics, noise and vibration). This report has been peer reviewed within the RPS team to ensure that it is technically robust and meets the requirements of our Quality Management System.

2 Assessment Methodology, Policy, Standards and Guidance

Basis of the Assessment

2.1 This assessment has been carried out on the basis of the guidance in the ProPG. A Stage 1 risk assessment has been carried out based on a long term unattended baseline noise survey. The risk assessment has been used to determine the level of detail required for the subsequent Stage 2 assessment, which has been carried out in accordance with the guidance.

2.2 In accordance with Stage 2: Element 4 of the ProPG, the development has been designed to comply with relevant national guidance in the Noise Policy Statement for England (NPSE) [2], National Planning Policy Framework (NPPF) [3], Planning Practice Guidance on Noise (PPG-N) [4] and local noise and vibration planning policy in the London Borough of LBRT Local Plan.

National Planning Policy

2.3 Appendix A provides a complete summary of the relevant guidance contained within national planning policy in the NPSE, the NPPF and the PPG-N. These documents do not contain guidance in terms of numerical noise levels. Guidance is provided descriptively, which may be transposed to numerical noise levels for site-specific situations, using the methods contained within BSs. However, there is no specific guidance on this; the research that Defra promoted has largely been inconclusive and is likely to vary by source.

2.4 Relevant experience and professional judgment are fundamental to all stages of the assessment that leads to the determination of the significance of a noise effect. The non-numeric guidance contained within the PPG-N, based upon the initial advice in the NPSE, is summarised in Table 2.1 below.

Table 2.1 Summary of Guidance from NPSE and PPG-N

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level (LOAEL)			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum

Perception	Examples of Outcomes	Increasing Effect Level	Action
Significant Observed Adverse Effect Level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

2.5 The PPG-N states that there are many factors which should be considered when determining if a noise is of concern; one factor is the number of noise events and the frequency and pattern of occurrence of the noise.

2.6 The PPG-N provides further information on the adverse effects of noise and how it can be mitigated. For noise sensitive development, mitigation measures can include: avoiding noisy locations; designing the development to reduce the impact of noise from the local environment, including noise barriers; and optimising the sound insulation provided by the building envelope including through noise insulation.

ProPG Planning and Noise – New Residential Development

2.7 This ProPG provides practitioners with guidance on a recommended approach to the management of noise within the planning system in England for new residential developments. The guidance has been produced by the Association of Noise Consultants, the Institute of Acoustics and the Chartered Institute of Environmental Health and is expected to be widely adopted by planning authorities as best practice when considering noise affecting new residential development. The scope of this ProPG is restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from transport sources, though it is considered appropriate to incorporate other sources of noise where they are present but not dominant.

Overview

2.8 This ProPG advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging. The two sequential stages of the overall approach are:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of four key elements.

2.9 The four key elements to be undertaken in parallel during Stage 2 of the recommended approach are listed below, with further details in the following sections:

- Element 1 – demonstrating a “Good Acoustic Design Process”;
- Element 2 – observing “Internal Noise Level Guidelines”;
- Element 3 – undertaking an “External Amenity Area Noise Assessment”; and
- Element 4 – consideration of “Other Relevant Issues”.

2.10 The approach is underpinned by the preparation and delivery of an “Acoustic Design Statement” (ADS). An ADS for a site assessed as high risk should be more detailed than for a site assessed as low risk. An ADS should not be necessary for a site assessed as negligible risk.

Local Planning Policy

2.11 The LBRT Local Plan [5] was adopted in February 2017 and states that:

“the Council encourages good acoustic design to ensure occupiers of new and existing noise sensitive buildings are protected. The following will be required, where necessary:

1) a noise assessment of any new plant and equipment and its impact upon both receptors and the general background noise levels;

2) mitigation measures where noise needs to be controlled and managed;

3) time limits and restrictions for activities where noise cannot be sufficiently mitigated;

4) promotion of good acoustic design and use of new technologies;

5) *measures to protect the occupiers of new developments from existing sources.”*

Additional relevant planning guidance is provided in the following documents:

- Development Control for Noise Generating and Noise Sensitive Development – Supplementary Planning Document [6];
- The London Plan [7]; and
- The Mayor of London’s ‘Sustainable Design and Construction’ Supplementary Planning Practice Guidance (SPG) [8].

Stage 1 Risk Assessment

2.12 Table 2.1 summarises the Stage 1 Initial Site Noise Risk Assessment that is provided in Figure 1 of ProPG, which is based on indicative noise levels derived from current guidance and experience. The indicative noise levels are intended to provide a sense of the noise challenge at a potential residential development site and should be interpreted flexibly having regard to the locality, the project and the wider context. In the final column, the initial noise risk assessment is aligned with pre-planning application guidance that highlights the increasing importance of good acoustic design as the noise risk increases.

Table 2.2 ProPG External Noise Level Guidelines

Noise Risk Assessment	Potential Effect Without Noise Mitigation	Pre-planning Application Advice
Indicative Daytime Noise Levels $L_{Aeq,16hr}$ / Indicative Night-time Noise Levels $L_{Aeq,8hr}$ **High** 70 dB / 60 dB **Medium** 65 dB / 55 dB 60 dB / 50 dB **Low** 55 dB / 45 dB 50 dB / 40 dB **Negligible**	Increasing risk of adverse effect	**High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.** **As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.** **At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.**
	No adverse effect	**These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.**

Notes:

a. Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.

b. Indicative noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present but is “not dominant”.

c. $L_{Aeq,16hr}$ is for daytime 0700 – 2300, $L_{Aeq,8hr}$ is for night-time 2300 – 0700.

d. An indication that there may be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F}$ > 60 dB means the site should not be regarded as negligible risk.

Stage 2 Element 1 - Good Acoustic Design Process

2.13 The ProPG states that planning applications for new residential development should include evidence that the following have been properly considered:

- The feasibility of relocating, or reducing noise levels from relevant sources.
- The options for planning the site or building layout.
- The orientation of proposed building(s).
- Construction types and methods for meeting building performance requirements.

- The effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc.
- The viability of alternative solutions.
- The noise in external amenity areas.

Stage 2 Element 2 – Internal Noise Level Guidelines

2.14 The internal noise level guidelines provided under Element 2 above in Figure 2 of ProPG are provided in Table 2.2 below. These are based upon the guidance in BS 8233:2014: 'Guidance on sound insulation and noise reduction for buildings' [9].

Table 2.3 ProPG Internal Noise Level Guidelines

Activity	Location	07:00 – 23:00 hrs	23:00 – 07:00 hrs
Resting	Living room	35 dB $L_{Aeq,16r}$	-
Dining	Dining room / area	40 dB $L_{Aeq,16r}$	-
Sleeping (daytime resting)	**Bedroom**	**35 dB $L_{Aeq,16r}$**	**30 dB $L_{Aeq,16r}$ 45 dB $L_{Amax,F}$ (Note 4)**

2.15 Accompanying Notes [1,4-7] from Figure 2 of ProPG state the following:

NOTE 1 The Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 4 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. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A).

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form (see Section 3.D).

2.16 Paragraphs 2.34 to 2.36 of ProPG contain guidance regarding the use of open windows in relation to ventilation and overheating:

Where the LPA accepts that there is a justification that the internal target noise levels can only be practically 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, ventilation 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 [10] (e.g. trickle ventilators) in the open position (see Supplementary Document 2). Furthermore, in this scenario the internal L_{Aeq} target noise levels should not generally be exceeded.

It should also be noted that the internal noise level guidelines are generally not applicable under "purge ventilation" conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food).

In addition to providing purge ventilation, open windows can also be used to mitigate overheating. Therefore, should the LPA accept a scheme is to be assessed with windows closed, but this scheme is reliant on open windows to mitigate overheating, it is also necessary to consider the potential noise impact during the overheating condition. In this case a more detailed assessment of the potential impact on occupants should be provided in the ADS. It should be noted that overheating issues will vary across the country and any specific design solutions will need to be developed alongside advice from energy consultants.

2.17 Paragraph 2.38 of the ProPG states the following with respect to mechanical service plant:

Where mechanical services are used as part of the ventilation or thermal comfort strategy for the scheme, the impact of noise generated by these systems on occupants should also be assessed.

Stage 2 Element 3 – External Amenity Area Noise Assessment

2.18 The ProPG refers to the design ranges in BS 8233:2014 with respect to the assessment of external amenity, as well as guidance in the PPG-N. Based on these two documents, the following guidance is provided with respect to the assessment of noise in external amenity areas:

3(i) "If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended".

3(ii) "The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$."

3(iii) "These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces."

3(iv) "Whether or not external amenity spaces are an intrinsic part of the overall design, consideration of the need to provide access to a quiet or relatively quiet external amenity space forms part of a good acoustic design process."

3(v) "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 provided, through the design of the development or the planning process, with access to:

- *a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. 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 park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance)."*

Stage 2 Element 4 – Other Relevant Issues

2.19 The ProPG states that the following other relevant issues, should be considered, where appropriate:

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

Planning Recommendations

2.20 Having followed this approach to its end, it is envisaged that noise practitioners will then have a choice of one of four possible recommendations to present to the decision maker. In simple terms the choice of recommendations are as follows:

- grant without conditions;
- grant with conditions;
- "avoid" significant adverse effects (corresponding to SOAEL within national planning policy); or
- "prevent" unacceptable adverse effects (corresponding to the UAEL within national planning policy).

2.21 Full details of where/when the above recommendation apply are provided in Section 3 of ProPG.

Consultation

2.22 Jon Baldwin, Senior Consultant for RPS contacted Chris Hurst, Principal Environmental Health Officer for the LBRT, on 24th October 2017. Confirmation of agreement of the proposed noise assessment methodology was received via email; a copy of which is provided in Appendix D.

Guidance Relevant to the Assessment of Noise Effects on Schools

Building Bulletin 93 'Acoustic Design of Schools: A Design Guide', 2003

2.23 The Department of Education and Skills has produced Building Bulletin 93, Acoustic Design of Schools: A Design Guide (BB 93) [11]. The aim of the Bulletin is to provide guidance on the acoustic design for schools and is supported by the Building Regulations. It provides a comprehensive guide for architects, building control bodies, building services engineers and others involved in the design of new school buildings. The objective is to provide suitable internal ambient noise levels for clear communication between students and teachers, between students themselves and for quiet study.

2.24 The document states that all spaces within a school building should meet the performance standards defined within the document for ambient noise, reverberation time and airborne sound insulation for each of the areas defined. Table 1.1 of the document contains recommended

performance standards for indoor rooms, measured as the maximum internal ambient noise level, $L_{Aeq,30mins}$.

3 Baseline Characterisation and Stage 1 Risk Assessment

Site Description

3.1 The existing hospital site is located on the south side of South Worple Way, directly south of the main railway line and approximately 200 m north of the A205 South Circular Road, with residential areas on all sides. The site is located within the general flight path of Heathrow Airport. The location of the proposed site is shown in Figure 1.

3.2 Baseline sound measurements were undertaken in October 2017 in order to quantify the existing baseline sound environment and to inform the original noise assessment for the original development. Whilst the development proposal has since been modified, it is not considered that the noise environment on site has changed. As such, the baseline measurements carried out in 2017 are considered representative of the current noise environment.

Establishing Baseline Conditions

3.3 In order to determine the existing levels of environmental sound affecting the proposed development area, two long term baseline noise surveys were undertaken. For the first survey (LT1), the noise monitor was deployed on site on Wednesday 4th October and collected on Wednesday 11th October 2017. The second survey (LT2) was deployed on site on Friday 10th November and collected Monday 13th November 2017. The survey was repeated to better reflect the part of the development most exposed to noise from the railway. A plan showing the approximate location of the measurement positions is provided in Figure 1.

3.4 Long term survey LT1 was located at the entrance of Garden House, towards the centre of the proposed development site. Observations made whilst on site determined the dominant sound sources to be aircraft, occasional train movements and distant road traffic on the A205.

3.5 LT1 measurements were carried out using a ‘Class 1’ Rion NL-52 sound level meter (SLM) in accordance with BS 7445-2:1991 [12]. The SLM was calibrated before and after use with a Rion NC-74 calibrator with no significant drift occurring. Data were logged of the broadband A-weighted sound pressure level in 100 ms samples with the required periods extracted in post-processing.

3.6 Long term survey LT2 was located towards the northern boundary of the proposed development site closet to the railway line north of South Worpole Way. Observations made whilst on site determined the dominant sound sources to be aircraft, occasional train movements and distant road traffic on the A205.

3.7 LT2 measurements were carried out using a ‘Class 1’ Svantek 958 SLM in accordance with BS 7445-2:1991. The SLM was calibrated before and after use with a Rion NC-74 calibrator with no significant drift occurring. Data were logged of the broadband A-weighted sound pressure level in 5-minute periods.

3.8 Meteorological conditions were monitored and logged by a nearby Met Office meteorological station. Following an analysis of the meteorological data, and consideration of the topography of the site and survey location, no noise data have been excluded from the measurement results.

3.9 A summary of the measured data over the entire survey period is provided in Table 3.1 below; survey results are graphically presented in Appendix B.

Table 3.1 Summary of Baseline Sound Level Data

Location	Daytime (0700-2300)		Night-time (2300-0700)		Range of Night-time $L_{Amax,5min}$
	dB $L_{Aeq,16hr}$	dB $L_{A90,16hr}$	dB $L_{Aeq,8hr}$	dB $L_{A90,8hr}$	
LT1	62	41	55	34	32-88
LT21	60	45	55	42	39-82

[1] The LT2 $L_{Aeq,T}$ and $L_{A90,T}$ levels are the logarithmic and linear average of the 5-minute periods respectively.
[2] The upper range of L_{AFmax} level at LT2 is lower than at LT1. This suggests that the dominant source affecting L_{AFmax} levels across the site, including close to the railway, is aircraft passing overhead and not from train pass-bys.

Stage 1 Risk Assessment

3.10 As shown in Table 3.1, and with reference to Table 2.1 ProPG External Noise Level Guidelines, daytime and night-time sound levels across the site fall into the Low to Medium risk categories. An ADS is therefore required in order to demonstrate that noise levels at the proposed development can be controlled through appropriate design.

3.11 With regard to the L_{AFmax} levels, measured data show that the number of noise events measuring greater than 60 dB exceeds 10 per night at both the LT1 and LT2 survey locations. Analysis of the $L_{AFmax, 5min}$ events indicated that there was an average of 29 and 40 noise events at LT1 and LT2 exceeding 60 dB, each night during the survey periods respectively, concentrated between 04:00 and 07:00 hours, which were likely to be overflights from Heathrow Airport and train movements on the nearby railway..

Internal Levels

3.12 With reference to paragraph G.1 of BS 8233:2014, an estimate of the internal sound levels within typical dwellings may be made on the basis of the sound reduction provided by the windows. Research contained within Report NANR 116 [13] finds that a window partially open to provide background ventilation provides approximately 15 dB of attenuation to road traffic and railway noise and approximately 16 dB of attenuation to aircraft noise.

3.13 On this basis, and with reference to the design targets contained within the ProPG that are reproduced in Table 2.3 of this report, satisfactory internal acoustic environments are likely to be achievable where the external environmental sound level is no greater than 50 dB $L_{Aeq,16h}$ and 45 dB $L_{Aeq,8h}$ during the daytime and night-time periods, respectively. Based on the baseline sound level measurements presented in Table 3.1, acoustic treatment will be necessary across

the whole development in order to satisfy the internal noise level requirements for the proposed development.

Future Baseline Conditions

3.14 Due to the nature of the existing sound environment on site, and the observed dominant noise sources, it is not possible to accurately predict any potential increase in ambient sound levels in a future scenario, i.e. 15 years from opening. As such, a qualitative assessment of future baseline conditions has been undertaken based on professional judgement. In the absence of robust data predicting the future increase in noise due to increased aircraft movements at Heathrow and rail traffic, an assumption of a 3 dB increase over 2017 baseline sound levels has been adopted. It is considered that this represents a robust approach given that a doubling of rail and aircraft movements would be needed for a 3 dB increase to occur and any increase within this timeframe is likely to be less than this.

4 Acoustic Design Statement - Stage 2

Acoustic Design Process

4.1 With reference to paragraph 2.13, if a Stage 2 assessment is required, the ProPG states that planning applications for new residential development should include evidence that the following have been properly considered:

1. check the feasibility of relocating, or reducing noise levels from relevant sources;
2. consider options for planning the site or building layout;
3. consider the orientation of proposed building(s);
4. select construction types and methods for meeting building performance requirements;
5. examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc;
6. assess the viability of alternative solutions; and
7. assess external amenity area noise.

4.2 The above points are considered in the following sections.

Mitigating Existing Noise Levels and Design Considerations (Items 1 to 3 above)

4.3 With regards to the feasibility of relocating, or reducing noise levels from existing noise sources affecting the proposed site, as the dominant noise sources on site are aircraft overhead and train movements on the railway, it would not be possible to reduce noise levels at source.

4.4 Whilst buildings to the north of the development may provide screening from rail movements for buildings to the south, due to the frequency of flights, this is unlikely to greatly reduce overall noise levels across the site. It is therefore considered that changing the orientation or layout of the proposed development is unlikely to have any great effect on reducing ambient noise levels.

Internal Noise Levels (Item 4 above)

Building Performance Requirements and Construction Types/Methods

4.5 With reference to Table 2.3, the guidance in BS 8233:2014 proposes that the external building fabric for residential dwellings be designed such that a minimum steady-state internal daytime noise level of 35 dB $L_{Aeq,\ 16hr}$ and a night-time level of 30 dB $L_{Aeq,8hr}$ can be achieved within habitable rooms.

4.6 The specific acoustic performance requirements of the glazing and ventilation system are dependent on the exact layout the building, room size, wall and roof design. However, the

assessment has been based on generic assumptions based on typical room types. The total façade sound attenuations of various façade configurations have been calculated and the results provided in Table 4.1 below.

4.7 Table 4.1 below provides a summary of the façade build-up required to achieve suitable internal sound levels for typical habitable room types, on the basis of the external sound levels (as indicated in Table 3.1), the design targets contained within BS 8233:2014 and the façade sound reduction values detailed in Table 4.1. It should be noted that due to the nature of aircraft noise, in reality façades will likely be subject to lower incidental noise level due to shielding and barrier effects. The proposed façade treatment detailed in Table 4.1 is based on measured baseline sound levels in the absence of screening effects and as such, represents a worst case.

Table 4.1 Calculated Façade Reduction of Façades with various Façade Elements

Façade Treatment	External Wall, $R_w + C_{tr}$ (dB)	Window, $R_w + C_{tr}$ (dB)	Ventilation, $D_{n,ew}$ (dB)	Total Façade Sound Attenuation (dB)
All façades	47 [1]	32 [2]	40 [3]	**32**
[1] Standard wall construction (based on BS 8233:2014) [2] Acoustic laminated thermal double glazed window unit, 6/12/6 mm (based on manufacturer's data) [3] Acoustic trickle vents (based on manufacturer's data)				
Calculations have been carried out following the guidance contained within BS 8233:2014 and BS EN 12354-3:2000 [14] and are based on a typical receiver room.				

4.8 The external sound levels indicate that, to achieve acceptable internal noise environments, windows will be required to be closed. All façades of the proposed development will require the façade treatment detailed in Table 4.1. The number of, and level of instantaneous L_{Amax} noise events during the night are such that Treatment 1 will be required to ensure internal noise levels do not exceed 45 dB L_{Amax} more than 10 times a night.

4.9 Accompanying note 4 of Figure 2 in the ProPG explains that:

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

4.10 With the proposed façade treatments outlined in Table 4.1, the analysis of the internal L_{Afmax} levels indicates that there will be an average of two events a night at the façades of dwellings across the site when the criterion is exceeded. The highest L_{AFmax} levels during the night are due to a combination of aircraft and train movements. Due to the source direction of noise from aircraft, the roof build-up of the proposed buildings will need to provide total façade sound attenuation of 32 dB. Based on the above, it is concluded that the L_{AFmax} noise levels are acceptable.

4.11 For Treatment 1, a standard external wall construction (providing a sound insulation performance of 47 dB $R_w + C_{tr}$) and an acoustic laminate thermal double glazed window unit (providing a sound insulation performance of 32 dB $R_w + C_{tr}$), with windows closed, will be required. Ventilation can either be provided by fitting acoustic trickle vents in the window frames or through the wall type passive acoustic vents that meet the 40 $D_{n,e,w}$ requirement indicated in Table 4.1. Mechanical ventilation with a similar acoustic performance may also be used.

4.12 It should be noted that the internal noise level guidelines are generally not applicable when windows or other natural ventilators are open solely to provide “purge” ventilation as this should only occur occasionally.

4.13 Non-habitable rooms (i.e. kitchens, bathrooms and hallways/stairs/landings) will not require any treatments in any of the proposed dwellings, unless the building design includes open plan living, in which case, the room should be treated as habitable and treatment will be required.

Effects of Noise Control and Noise from Mechanical Services (Item 5 above)

4.14 The primary proposed method of noise control considered involves the provision of passive acoustic trickle ventilation, such that background ventilation can be provided without the need for opening windows. Nevertheless openable windows should be provided that can be opened at residents discretion for purge ventilation or to prevent overheating etc.

4.15 Passive acoustic trickle ventilation units are in effect not different than standard trickle ventilation units. As such the inclusions of these will not affect ventilation, fire regulation, health and safety or CDM considerations. Provision of acoustic trickle ventilation units would incur a minor cost increase above standard trickle ventilation units.

4.16 The ProPG states that the impact of noise generated from mechanical services as part of the scheme should be assessed. Plant rooms that may be proposed as part of the development should be assessed at the detailed design stage of the scheme. Noise generated by mechanical services in habitable rooms should be within the internal noise level guidelines outlined in Table 2.3.

Viability of Alternative Solutions (Item 6 above)

4.17 The primary proposed method to ensure appropriate noise involves the provision of passive acoustic trickle ventilation. Another viable solution would be the provision of mechanical ventilation; this would ensure appropriate internal noise levels with the additional benefit of maintaining indoor air quality. Whilst viable, such a scheme would need to be considered at early design stages.

External Noise Levels in Amenity Areas (Item 7 above)

4.18 The ProPG refers to the design ranges in BS 8233:2014 with respect to the assessment of external amenity. The ProPG also refers to guidance in the PPG-N. Based on these two documents, the following guidance is provided with respect to the assessment of noise in external amenity areas:

3(ii) "The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$."

4.19 Current plans show that external amenity space is proposed as part of the SEN school site. It is not currently known whether external amenity space for the residential dwellings will be provided. Existing ambient $L_{Aeq,16hr}$ sound levels exceed the upper range of the preferred external noise level criteria as stated above by up to 7 dB.

4.20 The ProPG states:

3(iii) "These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces."

4.21 Through appropriate siting and screening, the noise impact from rail movements may be reduced. Due to the nature of aircraft noise, it will not be practicable to screen this source. It is therefore considered that, although appropriate design and siting of external amenity spaces may provide some attenuation, noise levels in these spaces are still likely to exceed guideline values as stated in the ProPG.

4.22 It should be noted that there are existing residential properties in the immediate area around the proposed site with external amenity areas. On this basis, there is therefore an assumed precedence and acceptance of elevated external noise within external residential amenity space.

4.23 Whilst noise levels within the SEN school amenity areas will likely not be able to achieve BS 8233 guideline values, it is considered that, in this instance, the development of the school is desirable. LBRT proposed a change in the Local Plan to include a SEN school as part of the development and, as such, the development should aim to achieve the lowest practicable noise levels within the associated external amenity space. The provision of noise barrier fencing on the boundary of the SEN school will provide screening from train movements and localised ground level noise sources and therefore minimise noise levels to a degree within this area.

Noise Effects on SEN School

4.24 The current proposal is for the construction of an SEN school building on the south east of the development site. The location of the school is shown in Figure 1.

4.25 The upper limit for the indoor ambient noise level within classrooms designed specifically for use by hearing impaired students is 30 dB $L_{Aeq,30mins}$, as given in Table 1.1 of Building Bulletin 93. Accompanying '*Note 1'*, to Table 1.1 states;

"Research indicated that teaching can be disrupted by individual noisy events such as aircraft flyovers, even where the noise level is below the limits in Table 1.1. For rooms identified in Table 1.1 having limits of 35 dB or less the noise level should not regularly exceed 55 dB $L_{A1,30min}$."

4.26 Table 4.2 below provides a summary of the façade build-up required to achieve suitable internal sound levels within the SEN school classrooms, on the basis of the external sound levels (as indicated in Table 3.1).

Table 4.2 Calculated Façade Reduction of SEN School building

Façade Treatment	External Wall, $R_w + C_{tr}$ (dB)	Window, $R_w + C_{tr}$ (dB)	Ventilation, $D_{n,ew}$ (dB)	Total Façade Sound Attenuation (dB)
SEN School Façade	47 [1]	34 [2]	42 [3]	**32**
[1] Standard wall construction (based on BS 8233:2014) [2] Acoustic laminated thermal double glazed window unit, 8/6/6 mm (based on manufacturer's data) [3] Acoustic trickle vents (based on manufacturer's data)				
Calculations have been carried out following the guidance contained within BB 93, BS 8233:2014 and BS EN 12354-3:2000 and are based on an assumed classroom size.				

4.27 The external sound levels indicate that, to achieve acceptable internal noise environments, windows will be required to be closed. A standard external wall construction (providing a sound insulation performance of 47 dB $R_w + C_{tr}$) and an acoustically laminated thermal double glazed window unit (providing a sound insulation performance of 34 dB $R_w + C_{tr}$), with windows closed, will be required. Ventilation can either be provided by fitting acoustic trickle vents in the window frames or through the wall type passive acoustic vents that meet the 42 $D_{n,e,w}$ requirement indicated in Table 4.2. Mechanical ventilation with a similar acoustic performance may also be used.

4.28 It should be noted that the internal noise level guidelines are generally not applicable when windows or other natural ventilators are open solely to provide "purge" ventilation as this should only occur occasionally. However, due to the nature of the use and sensitivity of occupants to instantaneous noise events (i.e. aircraft flying overhead), it is advised that mechanical ventilation is used to prevent the need to open windows.

4.29 With the proposed façade treatment outlined in Table 4.1, the analysis of the internal L_{AFmax} levels indicates that during the day there will an average of one noise event that will result in internal noise levels greater than 55 dB L_{AFmax}. The metric L_{AFmax}, is equal to the maximum noise level

measured during a set period and, as such, represents a worst case assessment over and above the threshold level of 55 dB $L_{A1,30min}$, as stated in paragraph 4.25.

4.30 Based on the above, it is considered that noise levels within the nursery are able to be controlled to an acceptable level.

Compliance with National and Local Policy and ProPG

4.31 On the basis of the above, internal and external sound levels will meet the guideline values contained within the ProPG.

4.32 The proposed development accords with the national guidance of the NPSE, NPPF and local planning policy and, with reference to the PPG-N, it is considered that internal levels will result in effects below the LOAEL and are therefore acceptable.

5 Summary and Conclusions

5.1 The Acoustics Team of RPS Planning and Environment (RPS) has been appointed by South West London and St George's Trust to provide a noise assessment to accompany a planning application for a proposed mixed-use development at Barnes Hospital, South Worple Way, London, SW14 8SU. The site is located within the administrative area of the London Borough of Richmond upon Thames (LBRT).

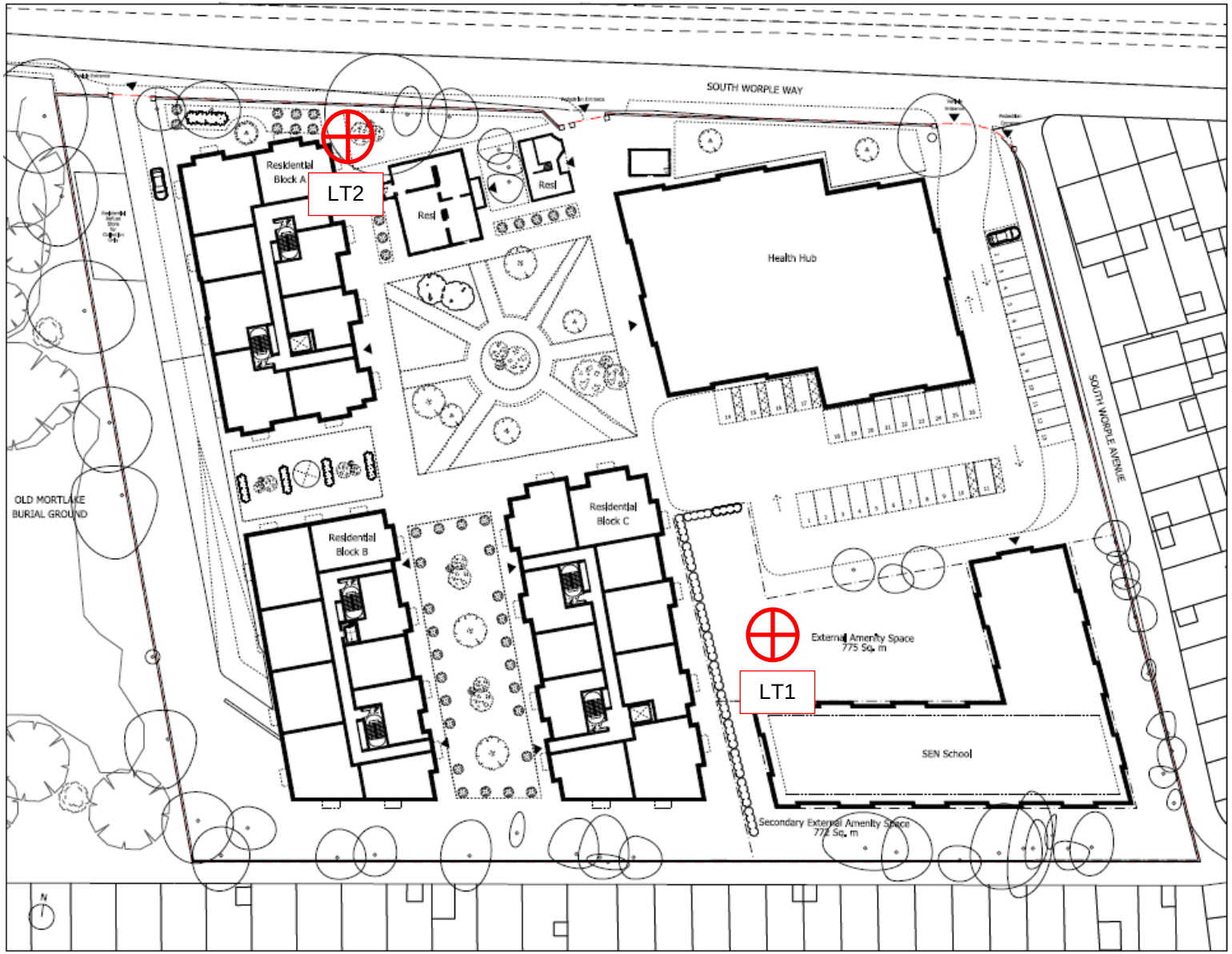
5.2 A pre-planning application proposal for the development was submitted in November 2017, comprising of a proposed replacement healthcare facility and residential units. The development proposal has since been revised to comprise of: residential accommodation; a replacement health care facility; and a Special Education Needs (SEN) school. Two long term baseline noise surveys were deployed on the site in 2017 in order to determine the existing baseline sound levels. The dominant noise sources affecting the site were observed to be trains on the nearby railway line and aircraft overflights.

5.3 The proposed residential development ranges from Low to Medium risk with respect to the ProPG guidance and assessment methodology. Through appropriate design outlined in this report, the proposed residential development would be subject to satisfactory internal acoustic environments with respect to the ProPG and British Standard 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'.

5.4 Predictions have shown that, assuming the façade achieves the specified attenuation, internal noise levels within the proposed SEN school building will meet required threshold levels as given in BB 93.

5.5 On the basis of the above, the proposed development accords with national (Noise Policy Statement for England, National Planning Policy Framework, Planning Practice Guidance on Noise) and local planning guidance. Therefore, there are no reasons, with regards to noise, why planning permission should not be granted for the proposed development.

Figures



Notes

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Project: Barnes Hospital

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Figure 1: Site layout and survey location

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Appendices

Appendix A: National Planning Policy and Guidance

National Planning Policy Framework

A.1 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The emphasis of the Framework is to allow development to proceed where it can be demonstrated to be sustainable. In relation to noise, Paragraph 180 of the Framework states:

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

- *mitigate and reduce to a minimum potential adverse impacts resulting from noise from the development – and avoid noise giving rise to significant adverse impacts on health and the 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; and*
- *limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.'*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

Noise Policy Statement for England

A.2 The NPSE, published in March 2010 by Defra, aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion.

A.3 Paragraph 1.6 of the NPSE sets out the long-term vision and aims of Government noise policy:

"Noise Policy Vision

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

"Noise Policy Aims

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

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*

- *where possible, contribute to the improvement of health and quality of life."*

A.4 The aims require that all reasonable steps should be taken to avoid, mitigate and minimise adverse effects on health and quality of life whilst also taking into account the guiding principles of sustainable development, which include social, economic, environmental and health considerations.

A.5 With regard to the terms 'significant adverse' and 'adverse' included in the 'Noise Policy Aims', these are explained further in the 'Explanatory Note' as relating to established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation which are:

'NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on human health and quality of life due to noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.'

A.6 Defra has then extended these concepts for the purpose of the NPSE to introduce the concept of:

'SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.'

A.7 The accompanying explanation states:

'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'.

Planning Practice Guidance - Noise (PPGN)

A.8 The Government has published Planning Practice Guidance on a range of subjects including noise. The guidance forms part of the NPPF and provides advice on how to deliver its policies. The PPGN reiterates general guidance on noise policy and assessment methods provided in the NPPF, NPSE and British Standards (BSs) and contains examples of acoustic environments commensurate with various effect levels. Paragraph 006 of the PPGN explains that:

'The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation.'

A.9 According to the PPGN, factors that can influence whether noise could be of concern include:

- *the source and absolute level of the noise together with the time of day it occurs;*
- *for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;*
- *the spectral content and the general character of the noise;*
- *the local topology and topography along with the existing and, where appropriate, the planned character of the area.*
- *where applicable, the cumulative impacts of more than one source should be taken into account along with the extent to which the source of noise is intermittent and of limited duration;*
- *whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time;*
- *in cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur;*
- *where relevant, Noise Action Plans, and, in particular the Important Areas identified through the process associated with the Environmental Noise Directive and corresponding regulations;*
- *the effect of noise on wildlife;*
- *if external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces; and*
- *the potential effect of a new residential development being located close to an existing business that gives rise to noise should be carefully considered. This is because existing noise levels from the business even if intermittent (for example, a live music venue) may be regarded as unacceptable by the new residents and subject to enforcement action. To help avoid such instances, appropriate mitigation should be considered, including optimising the sound insulation provided by the new development's building envelope. In the case of an established business, the policy set out in the third bullet of paragraph 123 of the NPPF should be followed.*

A.10 The PPGN provides a relationship between various perceptions of noise, effect level and required action in accordance with the NPPF. This is reproduced in Table 1.

Table 1: Noise Exposure Hierarchy Based On the Likely Average Response

Perception	Increasing Effect Level	Action
Not noticeable	No Observed Effect	No specific measures required
Noticeable and not intrusive	No Observed Adverse Effect	No specific measures required
LOAEL		
Noticeable and intrusive	Observed Adverse Effect	Mitigate and reduce to a minimum
SOAEL		
Noticeable and disruptive	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Unacceptable Adverse Effect	Prevent

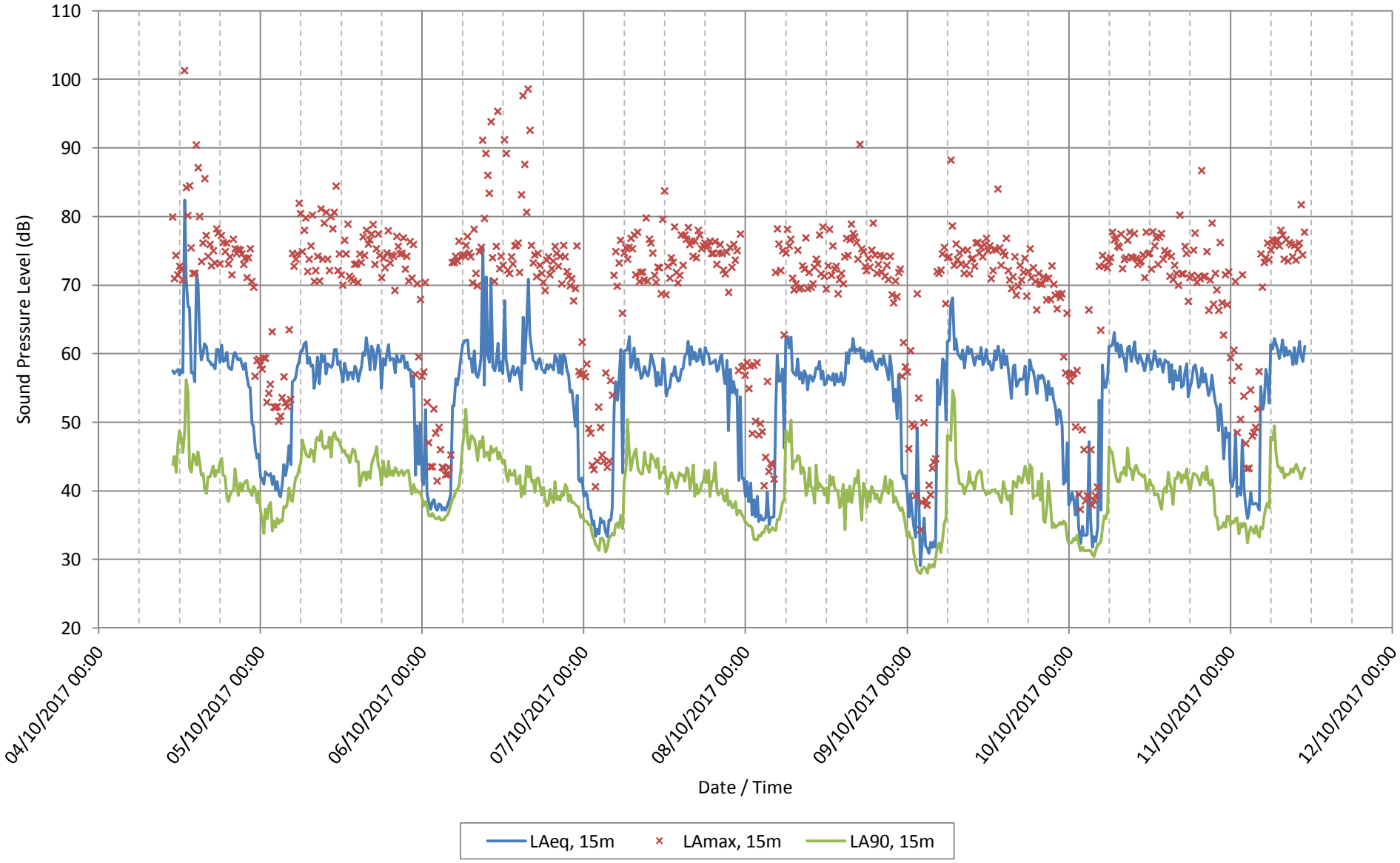
A.11 The PPGN describes sound that is not noticeable to be at levels below the NOEL. It describes exposures that are noticeable but not to the extent there is a perceived change in quality of life as below the LOAEL and need no mitigation. With reference to the definition of noise in the NPSE, such immissions are ‘sound’ and not ‘noise’. On this basis, the audibility of sound from a development is not, in itself, a criterion to judge noise effects that is commensurate with national planning policy.

A.12 The PPGN suggests that noise exposures above the LOAEL cause small changes in behaviour. Examples of noise exposures above the LOAEL provided in the PPGN is having to turn up the volume on the television; needing to speak more loudly to be heard; where there is no alternative ventilation, closing windows for some of the time because of the noise; or, a potential for some reported sleep disturbance. In line with the NPPF and NPSE, the PPGN states that consideration needs to be given to mitigating and minimising effects above the LOAEL but taking account of the economic and social benefits being derived from the activity causing the noise.

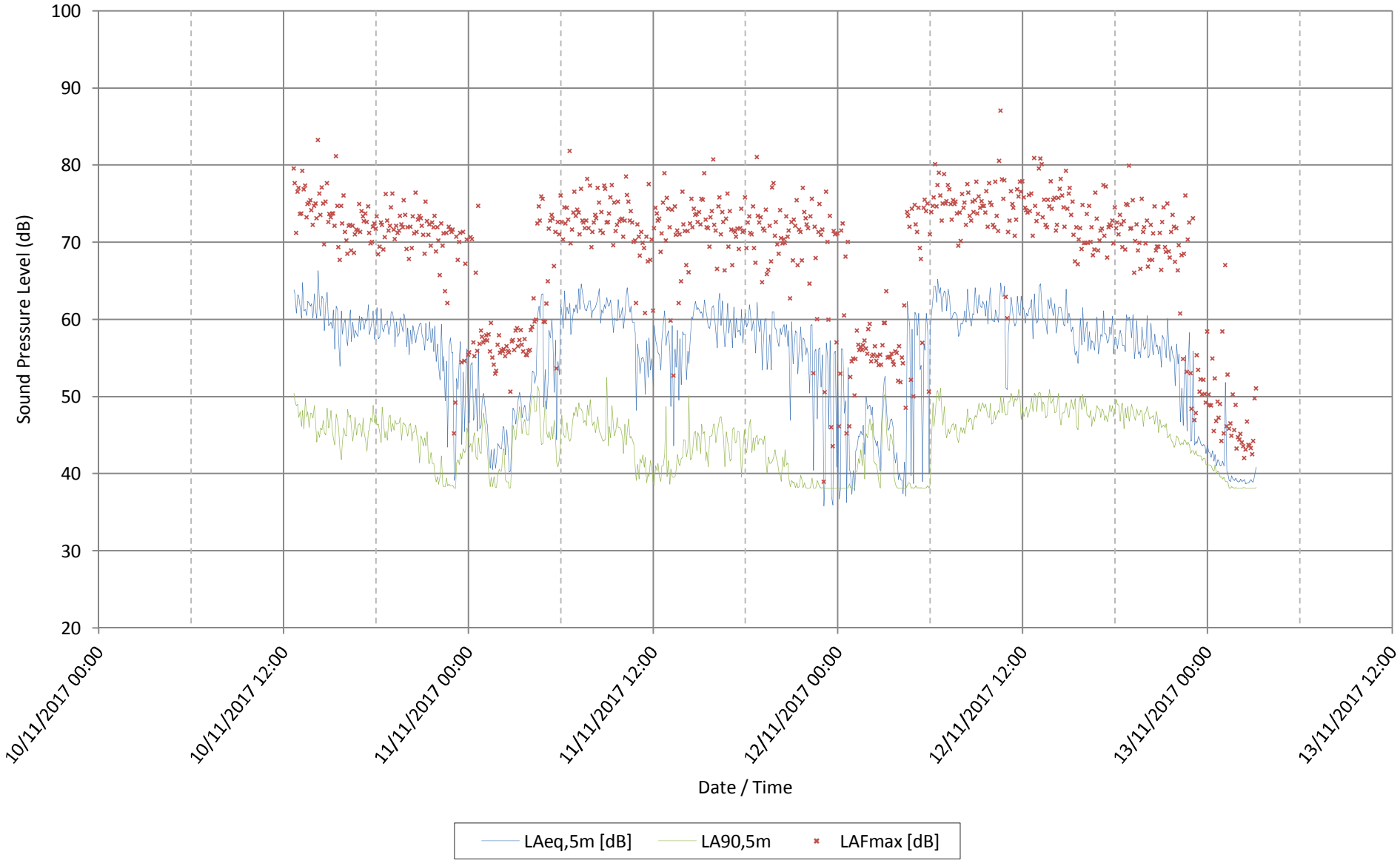
A.13 The PPGN suggests that noise exposures above the SOAEL cause material changes in behaviour. Examples of noise exposures above the SOAEL provided in the PPGN are, where there is no alternative ventilation, keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present; and/or there is a potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. In line with the NPPF and NPSE, the PPGN states that effects above the SOAEL should be avoided and that whilst the economic and social benefits being derived from the activity causing the noise must be taken into account, such exposures are undesirable.

Appendix B: Graphical Survey Results

LT1 - Baseline Sound Levels



LT2 - Baseline Sound Levels



Appendix C: Façade Calculation Sheets

Rigorous Façade Break in Calculation

Project Name	Barnes Hospital site
Project Number	10417
Date	15-Oct-15
Description	LT1 measurement area (residential) - Day

Calculation of Composite Façade Attenuation (in accordance with BS 8233:2014)

Typical Room Dimensions:		
	Volume	25.0
	Façade (m^2)	7.5
	Floor Area (m^2)	10.0

(approximate dimensions)

Equivalent absorption area of receiving room

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
A*	11	14	16	16	15

*From BS 8233:1999.

Typical Façade Element dimensions:		
	Window (m^2)	1.5
	Trickle Vent (m^2)	0.008
	Wall (m^2)	6.0
	Total Area (m^2)	7.5

Predicted broadband noise level:

$L_{Aeq,\ free\ field}$ (dB)	62
+3 dB future baseline increase	65

Predicted noise level spectrum:

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
$L_{eq,\ free\ field}$ (dB)	67	64	61	61	58

Specified sound reduction of façade elements:

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Window R_{wi} (dB)	24	25	31	42	44
Standard Blockwork Cavity Wall* R_{ew} (dB)	49	54	57	66	71
Trickle Vent $D_{n,e}$ (dB)	45	42	36	40	43

Apparent sound reduction per octave band

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Window* R_{wi}	0.00080	0.00063	0.00016	0.00001	0.00001
Standard Blockwork Cavity Wall* R_{ew}	0.00001	0.00000	0.00000	0.00000	0.00000
Trickle Vent* $D_{n,e}$	0.00005	0.00008	0.00032	0.00013	0.00007
Total (10*LOG(B+C+D)) (dB)	-31	-32	-33	-38	-41
SRI	*31*	*32*	*33*	*38*	*41*
A-weighting curve	*-16.1*	*-8.6*	*-3.2*	*0.0*	*1.2*
Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Predicted Internal Noise Level Spectrum (dB)	38	32	28	22	17
Predicted Internal Noise Level Spectrum (dBA)	22	24	25	22	18

Predicted Internal Broadband Noise Level in Receiving Room (dBA)	**30**
External to Internal Noise Level Difference (dBA)	**32**

Rigorous Façade Break in Calculation

Project Name	Barnes Hospital site
Project Number	10417
Date	15-Oct-15
Description	LT1 measurement area (residential) - Night

Calculation of Composite Façade Attenuation (in accordance with BS 8233:2014)

Typical Room Dimensions:		
	Volume	25.0
	Façade (m^2)	7.5
	Floor Area (m^2)	10.0

(approximate dimensions)

Equivalent absorption area of receiving room

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
A*	11	14	16	16	15

*From BS 8233:1999.

Typical Façade Element dimensions:		
	Window (m^2)	1.5
	Trickle Vent (m^2)	0.008
	Wall (m^2)	6.0
	Total Area (m^2)	7.5

Predicted broadband noise level:

$L_{Aeq,\ free\ field}$ (dB)	55
+3 dB future baseline increase	58

Predicted noise level spectrum:

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
$L_{eq,\ free\ field}$ (dB)	60	57	54	54	51

Specified sound reduction of façade elements:

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Window R_{wi} (dB)	24	25	31	42	44
Standard Blockwork Cavity Wall* R_{ew} (dB)	49	54	57	66	71
Trickle Vent $D_{n,e}$ (dB)	45	42	36	40	43

Apparent sound reduction per octave band

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Window* R_{wi}	0.00080	0.00063	0.00016	0.00001	0.00001
Standard Blockwork Cavity Wall* R_{ew}	0.00001	0.00000	0.00000	0.00000	0.00000
Trickle Vent* $D_{n,e}$	0.00005	0.00008	0.00032	0.00013	0.00007
Total (10*LOG(B+C+D)) (dB)	-31	-32	-33	-38	-41
SRI	*31*	*32*	*33*	*38*	*41*
A-weighting curve	*-16.1*	*-8.6*	*-3.2*	*0.0*	*1.2*
Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Predicted Internal Noise Level Spectrum (dB)	31	25	21	15	10
Predicted Internal Noise Level Spectrum (dBA)	15	17	18	15	11

Predicted Internal Broadband Noise Level in Receiving Room (dBA)	**23**
External to Internal Noise Level Difference (dBA)	**32**

Rigorous Façade Break in Calculation

Project Name	Barnes Hospital site
Project Number	10417
Date	15-Oct-15
Description	LT2 measurement area (residential) - Day

Calculation of Composite Façade Attenuation (in accordance with BS 8233:2014)

Typical Room Dimensions:		
	Volume	25.0
	Façade (m^2)	7.5
	Floor Area (m^2)	10.0

(approximate dimensions)

Equivalent absorption area of receiving room

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
A*	11	14	16	16	15

*From BS 8233:1999.

Typical Façade Element dimensions:		
	Window (m^2)	1.5
	Trickle Vent (m^2)	0.008
	Wall (m^2)	6.0
	Total Area (m^2)	7.5

Predicted broadband noise level:

$L_{Aeq,\ free\ field}$ (dB)	60
+3 dB future baseline increase	63

Predicted noise level spectrum:

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
$L_{eq,\ free\ field}$ (dB)	65	62	59	59	56

Specified sound reduction of façade elements:

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Window R_{wi} (dB)	24	25	31	42	44
Standard Blockwork Cavity Wall* R_{ew} (dB)	49	54	57	66	71
Trickle Vent $D_{n,e}$ (dB)	45	42	36	40	43

Apparent sound reduction per octave band

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Window* R_{wi}	0.00080	0.00063	0.00016	0.00001	0.00001
Standard Blockwork Cavity Wall* R_{ew}	0.00001	0.00000	0.00000	0.00000	0.00000
Trickle Vent* $D_{n,e}$	0.00005	0.00008	0.00032	0.00013	0.00007
Total (10*LOG(B+C+D)) (dB)	-31	-32	-33	-38	-41
SRI	*31*	*32*	*33*	*38*	*41*
A-weighting curve	*-16.1*	*-8.6*	*-3.2*	*0.0*	*1.2*
Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Predicted Internal Noise Level Spectrum (dB)	36	30	26	20	15
Predicted Internal Noise Level Spectrum (dBA)	20	22	23	20	16

Predicted Internal Broadband Noise Level in Receiving Room (dBA)	**28**
External to Internal Noise Level Difference (dBA)	**32**

Rigorous Façade Break in Calculation

Project Name	Barnes Hospital site
Project Number	10417
Date	15-Oct-15
Description	LT2 measurement area (residential) - Night

Calculation of Composite Façade Attenuation (in accordance with BS 8233:2014)

Typical Room Dimensions:		
	Volume	25.0
	Façade (m^2)	7.5
	Floor Area (m^2)	10.0

(approximate dimensions)

Equivalent absorption area of receiving room

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
A*	11	14	16	16	15

*From BS 8233:1999.

Typical Façade Element dimensions:		
	Window (m^2)	1.5
	Trickle Vent (m^2)	0.008
	Wall (m^2)	6.0
	Total Area (m^2)	7.5

Predicted broadband noise level:

$L_{Aeq,\ free\ field}$ (dB)	55
+3 dB future baseline increase	58

Predicted noise level spectrum:

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
$L_{eq,\ free\ field}$ (dB)	60	57	54	54	51

Specified sound reduction of façade elements:

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Window R_{wi} (dB)	24	25	31	42	44
Standard Blockwork Cavity Wall* R_{ew} (dB)	49	54	57	66	71
Trickle Vent $D_{n,e}$ (dB)	45	42	36	40	43

Apparent sound reduction per octave band

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Window* R_{wi}	0.00080	0.00063	0.00016	0.00001	0.00001
Standard Blockwork Cavity Wall* R_{ew}	0.00001	0.00000	0.00000	0.00000	0.00000
Trickle Vent* $D_{n,e}$	0.00005	0.00008	0.00032	0.00013	0.00007
Total (10*LOG(B+C+D)) (dB)	-31	-32	-33	-38	-41
SRI	*31*	*32*	*33*	*38*	*41*
A-weighting curve	*-16.1*	*-8.6*	*-3.2*	*0.0*	*1.2*
Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Predicted Internal Noise Level Spectrum (dB)	31	25	21	15	10
Predicted Internal Noise Level Spectrum (dBA)	15	17	18	15	11

Predicted Internal Broadband Noise Level in Receiving Room (dBA)	**23**
External to Internal Noise Level Difference (dBA)	**32**

Rigorous Façade Break in Calculation

Project Name	Barnes Hospital site
Project Number	10417
Date	15-Oct-15
Description	LT1 measurement area (SEN school building) - Night

Calculation of Composite Façade Attenuation (in accordance with BS 8233:2014)

Typical Room Dimensions:		
	Volume	62.5
	Façade (m^2)	12.5
	Floor Area (m^2)	25.0

(approximate dimensions)

Equivalent absorption area of receiving room

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
A*	11	14	16	16	15

*From BS 8233:1999.

Typical Façade Element dimensions:		
	Window (m^2)	3.0
	Trickle Vent (m^2)	0.016
	Wall (m^2)	9.5
	Total Area (m^2)	12.5

Predicted broadband noise level:

$L_{Aeq,\ free\ field}$ (dB)	62
+3 dB future baseline increase	65

Predicted noise level spectrum:

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
$L_{eq,\ free\ field}$ (dB)	67	64	61	61	58

Specified sound reduction of façade elements:

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Window R_{wi} (dB)	26	28	31	40	44
Standard Blockwork Cavity Wall* R_{ew} (dB)	49	54	57	66	71
Trickle Vent $D_{n,e}$ (dB)	46	44	38	43	43

Apparent sound reduction per octave band

Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Window* R_{wi}	0.00060	0.00038	0.00019	0.00002	0.00001
Standard Blockwork Cavity Wall* R_{ew}	0.00001	0.00000	0.00000	0.00000	0.00000
Trickle Vent* $D_{n,e}$	0.00002	0.00003	0.00013	0.00004	0.00004
Total (10*LOG(B+C+D)) (dB)	-32	-34	-35	-42	-43
SRI	*32*	*34*	*35*	*42*	*43*
A-weighting curve	*-16.1*	*-8.6*	*-3.2*	*0.0*	*1.2*
Octave band centre freq. (Hz)	**125**	**250**	**500**	**1000**	**2000**
Predicted Internal Noise Level Spectrum (dB)	39	32	28	21	17
Predicted Internal Noise Level Spectrum (dBA)	23	24	25	21	18

Predicted Internal Broadband Noise Level in Receiving Room (dBA)	**30**
External to Internal Noise Level Difference (dBA)	**32**

Appendix D: Email Correspondence with LBRT

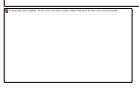
From: Christopher Hurst
Sent: 24 October 2017 13:02
To: Jon Baldwin
Cc: Peter Barling; Charlotte Birch
Subject: [EXT] RE: 10050e_Barnes Hospital_Noise assessment methodology

Hi Jon
I have no objections to the methodology you have outlined. I have attached the soon to be published SPD on noise which will provide you with all the design criteria details.
Please feel free to contact me if you wish to discuss further.

Kind Regards

Chris Hurst
Principal Environmental Health Officer

Commercial Environmental Health
Regulatory Services Partnership
London Boroughs of Richmond upon Thames & Merton
Second Floor | Civic Centre | 44 York Street | Twickenham | TW1 3BZ
Tel: | Mobile



From: Jon Baldwin
Sent: 24 October 2017 11:46
To: Christopher Hurst
Cc: Peter Barling; Charlotte Birch
Subject: 10050e_Barnes Hospital_Noise assessment methodology

Hi Chris,

Further to our conversation this morning, please find details on our noise assessment methodology for the proposed residential development at Barnes Hospital.

We have undertaken a long term sound survey at the location shown on the figure below in order to quantify the existing sound levels on site. The kit has been left to run over a 7 day period. It has been observed that the dominant noise on site is from aircraft associated with Heathrow airport and occasional train movements on the railway line to the north.

We propose to undertake a quantitative assessment of the proposed development on the basis of the results of the baseline sound level survey, identify any constraints on the proposed development from existing sound sources within the area and assess the suitability of the site for residential development. Environmental noise levels within houses and external amenity areas will be assessed in accordance with ProPG and BS 8233:2014. Consideration of industrial/commercial noise affecting the site will also be undertaken and assessed in accordance with BS 4142:2014. Where necessary, identify appropriate types of mitigation in accordance with best practice.

Can you confirm if the above approach is suitable from your perspective, and provide any comments you may have such as specific numeric criteria?

Many Thanks,
Jon

Jon Baldwin
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References

1 Association of Noise Consultants. Institute of Acoustics. Chartered Institute of Environmental Health. ProPG: Planning and Noise. Professional Practice Guidance on Planning and Noise. New Residential Development. 2017.

2 Department for Environment, Food and Rural Affairs. Noise Policy Statement for England. Defra. 2010.

3 Department for Communities and Local Government. National Planning Policy Framework: HMSO. July 2018.

4 Department for Communities and Local Government. National Planning Practice Guidance.

5 The London Borough of Richmond upon Thames Local Plan. Adopted 15th February 2017

6 Development Control for Noise Generating and Noise Sensitive Development – Supplementary Planning Document – Not yet formally adopted

7 The London Plan, Adopted January 2016.

8 The Mayor of London's 'Sustainable Design and Construction' Supplementary Planning Practice Guidance (SPG), Adopted January 2016.

9 British Standards Institution. British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings.

10 The Building Regulations 2010. Approved Document F: Ventilation. Office of the Deputy Prime Minster. 2010.

11 Department for Education and Skills. Building Bulletin 93. Acoustic Design of Schools: A Design Guide. The Stationery Office. 2003 as amended.

12 British Standards Institution. British Standard 7445-2:1991 Description and measurement of environmental noise - Part 2: Guide to the acquisition of data pertinent to land use. 1991.

13 Defra Report NANR116. Open/Closed Window Research – Sound Insulation through Ventilated Domestic open Windows. The Building Performance Centre, School of the Built Environment, Napier University. 2007.

14 British Standards Institution. British Standard BS EN 12354-3:2000 'Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound' July 2000.

RPS

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