



Stag Brewery, Mortlake

Noise Impact Assessment

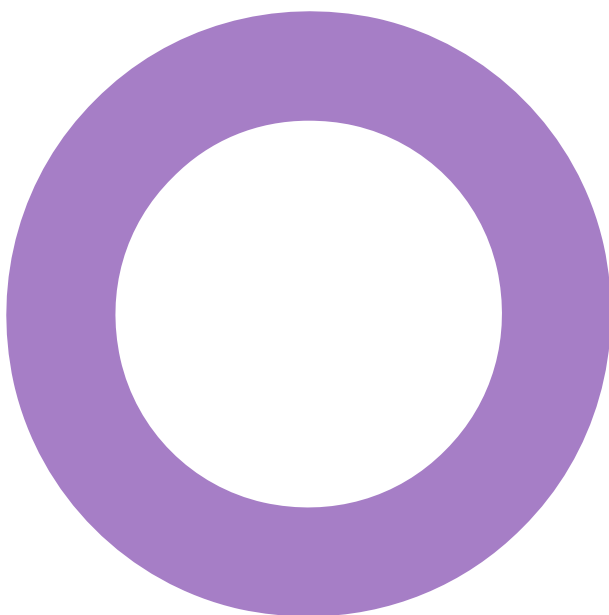
For Reselton Properties

February 2018

**Former Stag Brewery.
Mortlake.
Reselton Properties Limited.**

ACOUSTICS
NOISE IMPACT ASSESSMENT

REVISION 03 – 09 MARCH 2018



Audit sheet.

Rev.	Date	Description	Prepared	Verified
00	02/02/2018	For Comment	TH	BRD
01	05/02/2018	For Issue	TH	BRD
02	09/02/2018	For Issue	TH	-
03	09/03/2018	Measurement positions updated	TH	-

This document has been prepared for Dartmouth Capital Advisors Limited only and solely for the purposes expressly defined herein. We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law. The consequences of climate change and the effects of future changes in climatic conditions cannot be accurately predicted. This report has been based solely on the specific design assumptions and criteria stated herein.

Document reference: REP-1006369-TH-20180309-Noise Impact Assessment-Rev03

Contents.

Audit sheet.	2
Executive summary	5
1. Introduction.	6
2. Site description.	7
2.1 Existing site.	7
2.2 Local noise environment.	7
3. Basis of assessment.	9
3.1 National planning policy framework (NPPF): 2012.	9
3.2 BS 4142: 2014 – Methods for rating and assessing industrial and commercial sound.	9
3.3 BS 8233: 2014 – Guidance on sound insulation and noise reduction for buildings.	10
3.4 The British Council for Offices (BCO) Guide to Specification 2014.	10
3.5 Building Bulletin 93.	11
3.6 Local planning policy.	11
3.7 Proposed standards.	13
4. Environmental noise survey.	14
4.1 Methodology	14
4.2 Results summary.	15
5. Noise emissions of fixed plant.	17
6. Building envelope & ventilation strategy.	18
6.1 Compliance	20
7. Building services plant.	21
7.1 Assessment methodology.	21
7.2 Attenuation requirements.	22
8. Summary & conclusions.	24
References	25
Appendix A – Acoustic terminology.	26
Appendix B – Preliminary MEP information.	30
Appendix C - Example calculation for proposed items of building services plant.	31

Executive summary

Hoare Lea has conducted a noise impact assessment in support of the three linked planning applications for the comprehensive redevelopment of the former Stag Brewery Site in Mortlake ('the Site') within the London Borough of Richmond upon Thames ('LBRuT'). The noise impact assessment considers the proposed noise sensitive uses within the Proposed Development.

The following summarises the assessment procedure and findings contained within this report:

- Background noise levels typical of the daytime and night-time as measured by Waterman IE have been used to define building services plant noise emission limits at the nearest residential dwellings at the Proposed Development.
- During the daytime and night-time the combined building services plant noise emission contribution limit advised is 36 dB(A) and 29 dB(A) respectively, one metre from the nearest residential façade of the Proposed Development.
- An assessment of the building envelope acoustic performance is provided and indicates that the ventilation strategy should allow for full mechanical ventilation of all spaces as the level differences required are above those achievable by simple means of natural ventilation. Windows may be openable for purge ventilation.
- Notional glazing requirements and indicative primary glazing configurations have been provided for guidance purposes only. Detailed calculations will be required to be undertaken to determine refined glazing requirements during subsequent design stages.
- An assessment of noise associated with the proposed items of plant has been undertaken. Outline attenuation requirement for each item of plant have been provided and will be sufficient to limit noise emissions to the derived limits at the nearest adjacent on-site residential receptor during the daytime and night-time.

1. Introduction.

This noise impact assessment has been prepared by Hoare Lea on behalf of Reselton Properties Limited ('the Applicant') in support of three linked planning applications for the comprehensive redevelopment of the former Stag Brewery Site in Mortlake ('the Site') within the London Borough of Richmond upon Thames ('LBRuT').

The former Stag Brewery Site is bounded by Lower Richmond Road to the south, the river Thames and the Thames Bank to the north, Williams Lane to the east and Bulls Alley (off Mortlake High Street) to the west. The Site is bisected by Ship Lane. The Site currently comprises a mixture of large scale industrial brewing structures, large areas of hardstanding and playing fields.

The redevelopment will provide homes (including affordable homes), accommodation for an older population, complementary commercial uses, community facilities, a new secondary school alongside new open and green spaces throughout. Associated highway improvements are also proposed, which include works at Chalkers Corner junction. The proposal will also include the installation of new mechanical service plant.

The three planning applications are as follows:

- Application A - hybrid planning application for comprehensive mixed use redevelopment of the former Stag Brewery site consisting of:
 - i. Land to the east of Ship Lane applied for in detail (referred to as 'Development Area 1' throughout); and
 - ii. Land to the west of Ship Lane (excluding the school) applied for in outline detail (referred to as 'Development Area 2' throughout).
- Application B - detailed planning application for the school (on land to the west of Ship Lane).
- Application C - detailed planning application for highways and landscape works at Chalkers Corner.

This report provides a description of the results from the noise survey, the defined external noise limits for building services plant, advice regarding the building envelope and ventilation strategy and an assessment indicating how the new mechanical services plant associated with the development will comply with the external noise limits at the new noise sensitive uses introduced as part of the Proposed Development.

To aid in the understanding of the assessment, definitions of technical terms used have been included in Appendix A.

2. Site description.

2.1 Existing site.

The Site comprises the following elements:

- The former Stag Brewery which sits between Lower Richmond Road and the river Thames, to the north of Mortlake Green;
- Land at Chalkers Corner;
- Land to the east of Ship Lane included in Application A ('Development Area 1'); and
- Land to the west of Ship Lane included in Application B ('Development Area 2').

The former Stag Brewery Site is bounded by Lower Richmond Road to the south, the river Thames and the Thames Bank to the north, Williams Lane to the east and Bulls Alley (off Mortlake High Street) to the west. The Site is bisected by Ship Lane. The Site currently comprises a mixture of large scale industrial brewing structures, large areas of hardstanding and playing fields.

The surrounding buildings to the wider site are generally residential in nature, with existing residential dwellings along Lower Richmond Road, Watney Road and Thames Bank. In addition to the south along Mortlake High Street is the Richmond English School and Mortlake Business Centre and along Lower Richmond Road is the Jolly Gardeners public house.

The proposed sites (indicative only) are identified in Figure 1 overleaf.

2.2 Local noise environment.

The surrounding noise climate is predominantly formed of road traffic noise from the immediate road network around the site, in particular Lower Richmond Road and Mortlake High Street to the south, but also Clifford Avenue to the west.

The noise climate was also observed to include contributions from aircraft serving Heathrow Airport (approximately 11 km to the east).



Figure 1: Existing site (indicative only).

© Google Earth.

3. Basis of assessment.

3.1 National planning policy framework (NPPF): 2012.

The National Planning Policy Framework (1) sets out the Government's current planning policies for England and how these are expected to be applied.

With regards to local noise planning policies, Section 11 paragraph 123 of the NPPF states:

'Planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put upon them because of changes in nearby land uses since they were established;*
- *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.'*

Reference is made to the DEFRA Noise Policy Statement for England 2010 (NPSfE). This latter document is intended to apply to all forms of noise other than that which occurs in the workplace and includes environmental noise and neighbourhood noise in all forms.

The NPSfE advises that the impact of noise should be assessed on the basis of adverse and significant effect but does not provide any specific guidance on assessment methods or limit sound levels. Moreover, the document advises that it is not possible to have *'a single objective noise-based measure...that is applicable to all sources of noise in all situations'*. It further advises that the sound level at which an adverse effect occurs is *'likely to be different for different noise sources, for different receptors and at different times'*.

In the absence of specific guidance for assessment of environmental noise within the NPPF and the NPSfE, it is considered appropriate to base assessment on current British Standards and national guidance. These are considered to be Local Authority guidance, BS 4142 (2), BS 8233 (3) and the World Health Organisations (4) (WHO) guidelines.

3.2 BS 4142: 2014 – Methods for rating and assessing industrial and commercial sound.

Current Government advice to Local Planning Authorities in both England and Wales makes reference to BS 4142 as being the appropriate guidance for assessing commercial operations and fixed building services plant noise. This British Standard provides an objective method for rating the likelihood of complaint from industrial and commercial operations. It also describes means of determining noise levels from fixed plant installations and determining the background noise levels that prevail on a site.

The assessment of impacts is based on the subtraction of the measured background noise level from the rating level determined. The rating level is the source noise level (either measured or predicted) corrected for tone or character (if necessary). The difference is compared to the following criteria to evaluate the impact.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact.
- A difference of around +5 dB indicates is likely to be an indication of an adverse impact.
- Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact.

This method is only applicable for external noise levels.

3.3 BS 8233: 2014 – Guidance on sound insulation and noise reduction for buildings.

BS 8233: 2014 provides guidance for control of noise in and around buildings, and suggests appropriate criteria and limits for different situations. The criteria and limits are primarily intended to guide the design of new or refurbished buildings undergoing a change of use.

Table 4 within BS 8233 provides desirable internal ambient noise levels for spaces in residential dwellings when they are unoccupied.

Activity	Location	Daytime (0700 to 2300)	Night-Time (2300 to 0700)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room / Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

Table 1: Indoor ambient noise levels in spaces for dwellings.

Supplementary Note 2 and 4 to Table 4 within BS 8233 are copied below for reference:

'NOTE 2 – the levels shown in Table 4 are based on the existing guidelines issued by the WHO...'

'NOTE 4 – regular individual noise events (for example, schedule 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.'

Guidance provided within the superseded BS 8233: 1999 (5) stated that *'for a reasonable standard in bedrooms at night, individual noise events (measured with F-time weighting) should not normally exceed 45 dB L_{Amax} '*. This follows current guidelines issued by the WHO.

BS 8233 also provides guidance for indoor ambient noise levels in non-domestic buildings. These are replicated in Tables 2 and 3 below.

Objective	Typical Situations	Design Range $L_{Aeq,T}$ dB
Typical noise levels for acoustic privacy in shared spaces	Open Plan Office	45 – 50

Table 2: Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important.

Activity	Location	Design Range $L_{Aeq,T}$ dB
Speech or telephone communications	Department store	50 – 55
	Cafeteria, canteen, kitchen	
Study and work requiring concentration	Library, gallery, museum	40 – 50
	Staff / meeting room, training room	35 – 45
	Executive office	35 – 40

Table 3: Typical noise levels in non-domestic buildings.

3.4 The British Council for Offices (BCO) Guide to Specification 2014.

The British Council for Offices Guide provides guidance on sustainability, cost and value, building form, engineering systems and finishes within commercial offices. In particular, the BCO Guide provides advice within Section 8 regarding the acoustic environment within an office building, as summarised below.

External noise intrusion levels should not be more than the following ratings when measured in terms of $L_{eq,T}$.

- Open plan offices: NR 40 ($L_{eq,T}$)
- Speculative offices: NR 38 ($L_{eq,T}$)
- Cellular offices / meeting rooms: NR 35 ($L_{eq,T}$)

In addition, $L_{Amax,F}$ noise intrusion levels should not normally be more than 55 dB in open plan / speculative offices or 50 dB in cellular offices.

3.5 Building Bulletin 93.

Building Bulletin 93 (BB93) (6) is the current Building Control requirement document for the acoustic design of schools and its performance standards are applicable for secondary schools. The document provides performance standards suitable to provide acoustic conditions in schools that facilitate clear communication of speech between teachers and students, and that do not interfere with study activities.

BB93 states that the sound insulation performance of the building envelope needs to be sufficient to reduce the external environmental noise in sensitive areas to the internal ambient noise levels in Table 1. The indoor ambient noise level includes noise contributions from external sources outside the school premises (including road, rail and air traffic) and building services.

Table 4 below provides the performance standards for typical secondary school spaces as shown within BB93 when they are unoccupied and unfurnished.

Type of room	Upper limit for the indoor ambient noise level $L_{Aeq,30min}$ dB
Secondary school: classrooms, general teaching areas, seminar rooms, tutorials rooms, language laboratories	35

Table 4: Performance standards for indoor ambient noise levels within secondary schools.

3.6 Local planning policy.

3.6.1 London Borough of Richmond upon Thames, Core Strategy, Adopted April 2009.

The London Borough of Richmond upon Thames' Core Strategy adopted in April 2009 is one of the documents that makes up the Local Development Framework for the Borough and sets out the Strategic Planning Framework for the Borough over the next 15 years.

In respect of noise, the Core Strategy contains a single relevant policy, *Policy CP1 – Sustainable Development*.

This policy states the following principles will be promoted in the consideration of applications:

'Reducing environmental impact

The environmental benefits of retaining and, where appropriate, refurbishing existing buildings, should be compared against redevelopment.

Development should seek to minimise the use of open land for development and seek to maintain the natural vegetation, especially trees, where possible.

Local environmental impacts of development with respect to factors such as noise, air quality and contamination should be minimised.'

3.6.2 London Borough of Richmond Upon Thames, Development Management Plan, Adopted November 2011.

The London Borough of Richmond upon Thames' Development Management Plan (DMP) adopted in November 2011 is one of the documents that makes up the Local Development Framework alongside the Core Strategy and includes the detailed policies which are used when new developments are considered.

In respect of noise, a single policy is contained within the DMP; *Policy DM DC 5 – Neighbourliness, Sun lighting and Daylighting.*

3.6.2.1 Policy DM DC 5 – Neighbourliness, Sun Lighting & Daylighting.

Policy DM DC 5 states the following:

'In considering proposals for development, the Council will seek to protect adjoining properties from unreasonable loss of privacy, pollution, visual intrusion, noise and disturbance.

To protect privacy, for residential development there should normally be a minimum distance of 20m between main facing windows of habitable rooms.

The Council will generally seek to ensure that the design and layout of buildings enables sufficient sunlight and daylight to penetrate into and between buildings, and that adjoining land or properties are protected from overshadowing in accordance with established standards.'

3.6.3 London Borough of Richmond Upon Thames, Emerging Local Plan.

The LBRuT is currently preparing a new Local Plan for the borough which will replace the existing policies contained within the Core Strategy and Development Management Plan. The Plan will set out policies and guidance for the development of the borough over the next 15 years and is expected to be adopted in spring 2018.

In respect of noise, the emerging local plan contains two policies; *Policy LP 8 – Amenity and Living Conditions* and *Policy LP 10 – Local Environmental Impacts, Pollution and Land Contamination.*

3.6.3.1 Policy LP 8 – Amenity and Living Conditions.

Policy LP 8 states the following:

'All development will be required to protect the amenity and living conditions for occupants of new, existing, adjoining and neighbouring properties. The Council will:

- 1. Ensure the design and layout of buildings enables good standards of daylight and sunlight to be achieved in new development and in existing properties affected by new development, where existing daylight and sunlight conditions are already substandard, they should be improved where possible;*
- 2. Ensure there is a minimum distance of 20 metres between facing windows of habitable rooms (this includes living rooms, bedrooms and kitchens with a floor area of 13sqm or more) to preserve the privacy of existing properties affected by the new development;*
- 3. Ensure balconies does not raise unacceptable overlooking or noise or disturbance to nearby occupiers;*
- 4. Ensure that proposals are not visually intrusive or have an overbearing impact as a result of their height, massing or siting, including through creating a sense of enclosure.*
- 5. Ensure there is no harm to the reasonable enjoyment of the use of buildings, gardens and other spaces due to increases in traffic, servicing, parking, noise, light, disturbance, air pollution, odours or vibration or local micro-climatic effects.'*

3.6.3.2 Policy LP 10 – Local Environmental Impacts, Pollution and Land Contamination.

Policy LP 10 states the following:

'A. The Council will seek to ensure that local environmental impacts of all development proposals do not lead to detrimental effects on the health, safety and the amenity of existing and new users or occupiers of the development site, or the surrounding land. These potential impacts can include, but are not limited to, air

pollution, noise and vibration, light pollution, odours and fumes, solar glare and solar dazzle as well as land contamination.

Developers should follow any guidance provided by the Council on local environmental impacts and pollution as well as on noise generating and noise sensitive development. Where necessary, the Council will set planning conditions to reduce local environmental impacts on adjacent land uses to acceptable levels.

Noise and Vibration

C. 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.'*

3.7 Proposed standards.

Given the lack of specific guidance contained within the LBRuT's adopted planning policy, it is deemed appropriate to base assessment on guidance contained within relevant standards and guidance. These are considered to be BS 8233: 2014, the BCO Guide, BB 93 and BS 4142: 2014.

3.7.1 Environmental noise – internal noise levels.

On the basis of guidance contained within BS 8233: 2014 and BB 93, the development shall be designed to enable achievement of the internal noise levels stated within Table 5 below.

Location	Daytime (0700 to 2300)	Night-Time (2300 to 0700)
Residential dwellings		
Living room	35 dB L _{Aeq,16hr}	-
Bedroom	35 dB L _{Aeq,16hr}	30 dB L _{Aeq,8hr} & 45 dB L _{Amax,T}
Dining rooms	40 dB L _{Aeq,16hr}	-
School		
Classrooms, general teaching areas	35 dB L _{Aeq,30min}	-
Commercial spaces		
Retail / restaurant space	40 dB L _{Aeq,T}	-
Open plan office space	45 dB L _{Aeq,T} & 55 dB L _{Amax,T}	-

Table 5: Proposed internal noise levels.

3.7.2 Building services – noise.

On the basis of guidance contained within BS 4142: 2014, noise emissions from building services plant shall be limited to at least 10 dB below the measured background noise levels.

4. Environmental noise survey.

An acoustic survey was carried out by Waterman Infrastructure & Environment (Waterman IE). Full details of the noise survey undertaken by Waterman IE are provided within the ES Noise & Vibration Chapter, however, for ease of reference, a summary of the noise survey is provided within this Section.

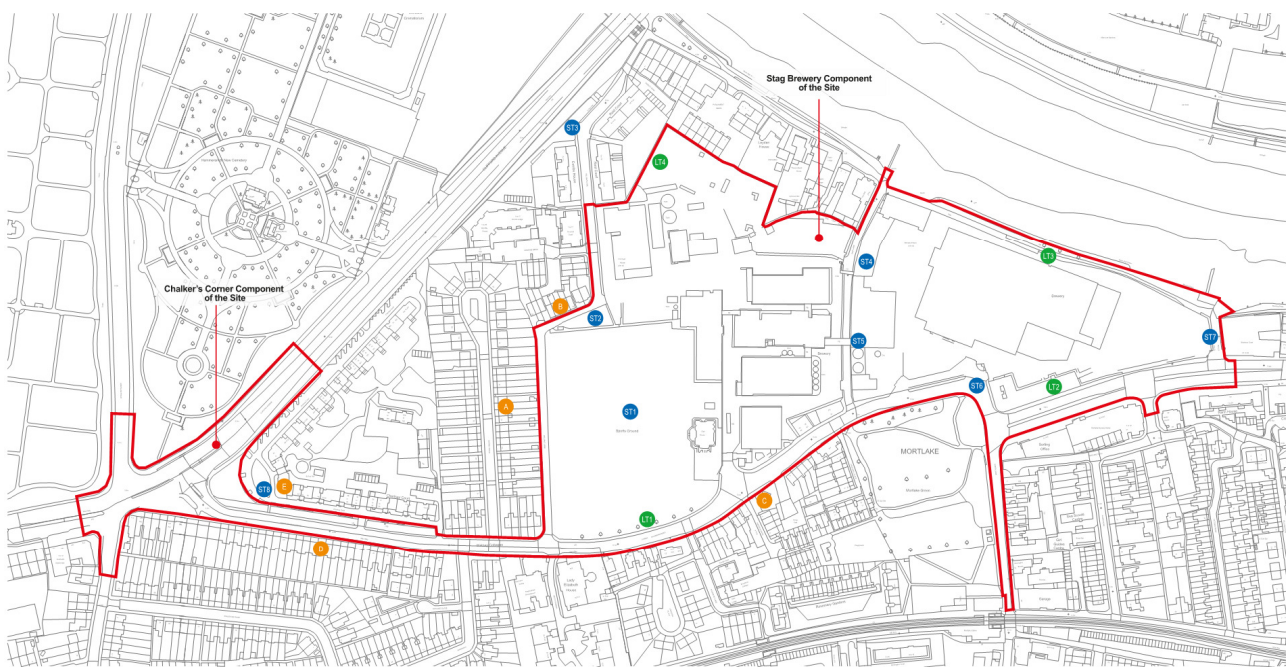
4.1 Methodology

The noise survey comprised five days of unattended automatic noise measurements at four strategic locations from Friday 24th June 2016 to Wednesday 29th June 2016. For ease of reference, the table summarising the measurement locations and the figure identifying the measurement locations are replicated in Table 6 below and Figure 2 overleaf.

Monitoring Location (Figure 9.1)	Description	Observations and Predominant Noise Sources
LT1	Free-field measurement at the south-western Site boundary overlooking Lower Richmond Road (the A3003). Microphone located 1.2 m AGL.	Noise climate dominated by constant vehicular traffic on Lower Richmond Road / Mortlake High Street. Although intermittent in comparison, noise from low flying aircraft movements in to Heathrow Airport (located approx. 11 km to the east) was significant, with approximately one plane every minute going over the Site.
LT2	Façade measurement on the second floor of the Stag Brewery Co. building at the south-eastern Site boundary overlooking Mortlake High Street. Microphone located 6.0 m AGL.	Contributory noise from human activities, distant road noise and distant aircraft also influence the noise climate to some extent.
LT3	Façade measurement on the boundary wall to the north-east of the Site overlooking the River Thames. Microphone located 4.0 m AGL.	Noise climate dominated by aircraft noise, as detailed above. Contributory noise from local and distant road traffic and occasional passing cyclists and joggers on the footpath over the river.
LT4	Free-field measurement at the south-western boundary of the Site orientated towards Clifford Avenue / Chiswick Bridge (the A316). Microphone located 2.5 m AGL.	Noise climate influenced by constant vehicular traffic on Clifford Avenue. Contributory noise from domestic activities from nearby residential dwellings.
ST1	Free field measurement at the centre of existing sports ground.	Noise climate influenced by distant road traffic noise and some intermittent low flying aircraft noise.
ST 2	Free field measurement north western corner of existing sports ground adjacent to Williams Lane.	Noise climate influenced by distant road traffic noise associated with Clifford Avenue and some intermittent low flying aircraft noise.
ST 3	Free field measurement north western corner of existing sports ground adjacent to Williams Lane.	Noise climate influenced by constant vehicular traffic on Clifford Avenue.
ST 4	Free field measurement adjacent to Ship Lane.	Noise climate influenced by distant road traffic noise and some intermittent low flying aircraft noise.
ST 5	Free field measurement adjacent to Ship Lane.	Noise climate influenced by distant road traffic noise and some intermittent low flying aircraft noise.

Monitoring Location (Figure 9.1)	Description	Observations and Predominant Noise Sources
ST 6	Free field measurement on southern site boundary adjacent to Lower Richmond Road.	Noise climate influenced road traffic noise associated with Lower Richmond Road.
ST 7	Free field measurement on eastern site boundary with Bulls Alley.	Noise climate influenced road traffic noise associated with Lower Richmond Road.
ST 8	Free field noise measurement on Lower Richmond Road at Chalkers Corner.	Noise climate influenced road traffic noise associated with Lower Richmond Road.

Table 6: Noise monitoring locations (ref: Waterman IE).



Project Details	WIE10667-101: Stag Brewery, Mortlake
Figure Title	Figure 9.1: Noise Monitoring and Sensitive Receptor Locations
Figure Ref	WIE10667-101_GR_ES_9.1A
Date	2017
File Location	\\s:\projects\w\projects\site10667101\graphics\issued\figures
	www.watermangroup.com

© WATERMAN INFRASTRUCTURE & ENVIRONMENT
Reproduced from the Ordnance Survey maps with the permission of the Controller of Her Majesty's Stationery Office. Crown copyright, Waterman Infrastructure & Environment, Plotlands What, Clerk Street, London SE1 1QG. Licence number LAN100023.

Figure 2: Location plan of the Site and noise monitoring locations (ref: Waterman IE).

4.2 Results summary.

A summary of the results from the noise survey conducted by Waterman IE is provided below in Tables 7 and 8 overleaf.

Monitoring Location	Period	Duration	Average L _{Aeq,T} dB	Average L _{A10,T} dB	Average L _{A90,T} dB	90 th Percentile L _{AFmax,5min} dB
LT1	Day	12 hr	71	74	59	86
	Evening	4 hr	69	73	52	83
	Night	8 hr	65	65	42	83
LT2	Day	12 hr	70	71	62	89
	Evening	4 hr	68	69	57	85
	Night	8 hr	63	63	43	80
LT3	Day	12 hr	61	63	50	78
	Evening	4 hr	59	61	47	75
	Night	8 hr	55	51	42	73
LT4	Day	12 hr	60	64	48	76
	Evening	4 hr	58	61	46	74
	Night	8 hr	55	50	39	73

Table 7: Summary of unattended baseline noise measurements (free-field) (ref. Waterman IE).

Monitoring Location	Period	Duration	Average L _{Aeq,T} dB	Average L _{A10,T} dB	Average L _{A90,T} dB	Average L _{AFmax,5min} dB
ST1	Day	30 mins	61	64	54	74
ST2	Day	30 mins	66	63	53	76
ST3	Day	25 mins	75	78	65	88
ST4	Day	20 mins	61	65	51	72
ST5	Day	20 mins	61	64	50	77
ST6	Day	30 mins	69	71	64	80
ST7	Day	20 mins	65	68	57	76
ST8	Day	3 hrs	72	76	62	84

Table 8: Summary of attended baseline noise measurements (free-field) (ref. Waterman IE).

5. Noise emissions of fixed plant.

Limits for noise levels due to building services serving the proposed development have been defined by Waterman IE on the basis of the measured background noise levels. The plant noise emission limits for the nearest off-site noise sensitive receptors as defined by Waterman IE are replicated in Table 9 below. These limits apply one metre from the nearest noise sensitive area.

Nearest noise sensitive receptor	Period	Representative L _{A90,5min}	Plant Noise Emission Limit L _{Aeq,T} dB
6-68 Watney Road & 4-24 William Lane	Daytime (0700 to 2300)	48	38
	Night-time (2300 to 0700)	39	35
1-69 Lower Richmond Road	Daytime (0700 to 2300)	59	45
	Night-time (2300 to 0700)	42	35

Table 9: Building services noise emission limits at nearest off-site noise sensitive receptors.

Noise emission limits for future residential dwellings within the Proposed Development have been defined in accordance with the requirements of the LBRuT, as specified in Section 3.7.2 above.

Nearest noise sensitive receptor	Period	Representative L _{A90,5min}	Plant Noise Emission Limit L _{Aeq,T} dB
Future residential dwellings within the Development	Daytime (0700 to 2300)	46	36
	Night-time (2300 to 0700)	39	29

Table 10: Building services noise emission limits at future residential properties within the Development.

6. Building envelope & ventilation strategy.

The sound insulation properties of the building envelope depend upon the external noise levels present at the façade and the proposed design criteria for the internal noise levels of specific rooms, dependant on their use. Table 11 overleaf assumes compliance with the internal noise levels stated in Table 5 and shows the level differences for varying spaces within the proposed development.

The examples shown represent the highest level differences required for each block as identified in Figure 3 below, based on the noise levels measured by Waterman IE.

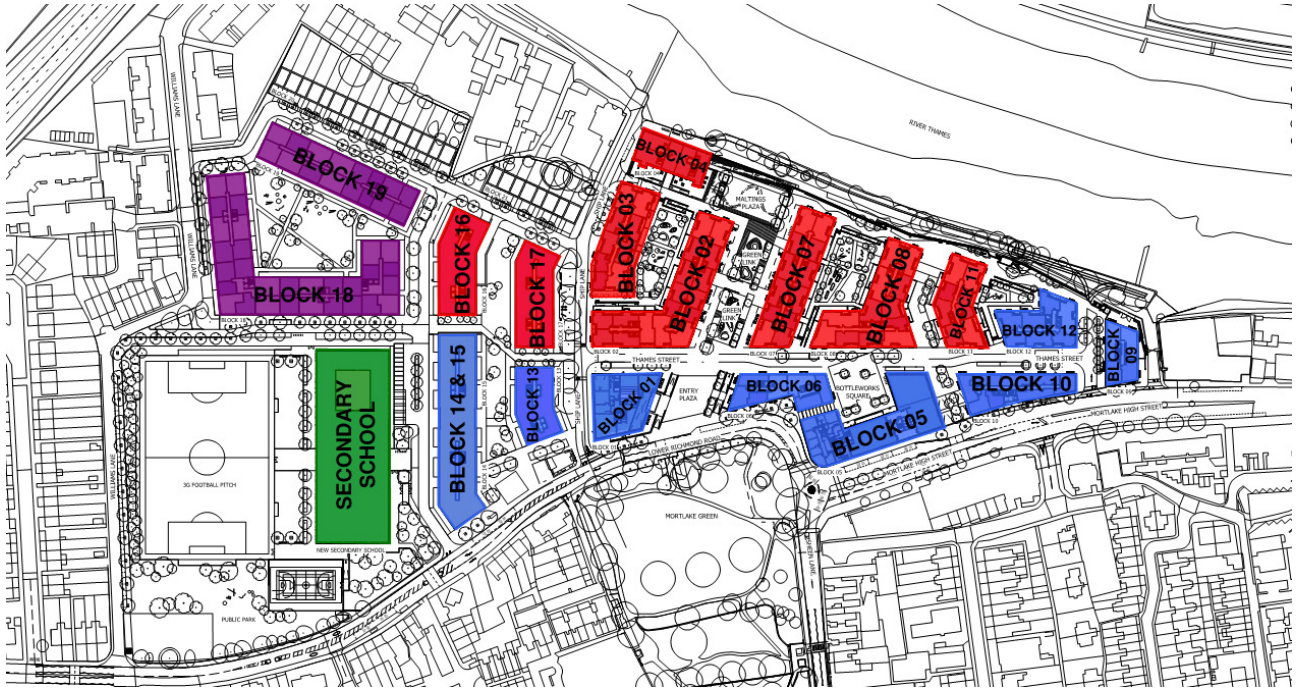


Figure 3: Block locations.

It should be noted that the highest level difference (D) shown for bedrooms and offices within Table 11 takes precedence.

Blocks	Room Use	Noise Levels (dB)		
		Measured External	Proposed Internal (Maximum)	Minimum Level Difference D
Blocks 02, 03, 04, 07, 08, 11, 16 & 17	Commercial	61	40	21
	Living room ¹	61	35	26
	Bedroom ¹	56	30	26
	Bedroom (L _{Amax}) ²	73	45	28
Blocks 01, 05, 06, 09, 10, 12, 13 & 15	Commercial	70	40	30
	Open plan office	70	45	25
	Office (L _{Amax})	89	55	34
	Living room ¹	69	35	34
	Bedroom ¹	63	30	33
	Bedroom (L _{Amax}) ²	80	45	35
Secondary School	Classroom	71	35	36
Blocks 18 & 19	Living room ¹	59	35	24
	Bedroom ¹	55	30	25
	Bedroom (L _{Amax}) ²	73	45	28

Table 11: Notional sound insulation values of proposed façade construction.

Note 1: Living rooms $L_{Aeq,16hr}$ (0700 to 2300) and bedroom $L_{Aeq,8hr}$ (2300 to 0700).

Note 2: Bedrooms $L_{Amax,T}$ (2300 to 0700).

Simple natural ventilation through the use of opening windows will provide a level difference (D) in the order of 10 dB. It can be seen from Table 11 above that all internal spaces require greater levels of sound insulation based on the measured external noise levels.

As such, although windows may be openable for purge ventilation, provision for alternative forms of ventilation will need to be made such that windows are not required to be opened for ventilation purposes.

Table 12 below details the minimum required $R_w + C_{tr}$ of all window elements (glazing, seals, frames etc.) to each room on each block.

Blocks	Minimum Required $R_w + C_{tr}$ (dB)				
	Commercial	Open Plan Office	Classroom	Living Room	Bedroom
Blocks 02, 03, 04, 07, 08, 11, 16 & 17	21*	-	-	26*	28*
Blocks 01, 05, 06, 09, 10, 12, 13 & 15	30*	34	-	34	35
Secondary School	36	-	-	-	-
Blocks 18 & 19	-	-	-	24*	28*

Table 12: Minimum required $R_w + C_{tr}$ of glazed elements.

Note *: Achievable with a standard thermal double glazing unit.

It should be noted that at this stage it is assumed that the non-glazed element on all blocks will be capable of achieving a sound reduction of 46 dB $R_w + C_{tr}$. An example of an external wall capable of achieving this requirement is a 100mm cavity wall construction.

Examples of primary glazing configurations capable of achieving the minimum required $R_w + C_{tr}$ detailed within Table 12 are provided below:

- $R_w + C_{tr}$ 30 dB – 10mm glass, 16mm air gap, 4mm glass.
- $R_w + C_{tr}$ 34 dB – 6mm glass, 16mm air gap, 8.8mm acoustic glass.
- $R_w + C_{tr}$ 36 dB – 8mm glass, 16mm air gap, 10.4mm acoustic glass.

It should be noted that at this stage the required glazing sound insulation values have been based on a level difference comparison only. Detailed calculations will be required to be undertaken to determine refined glazing requirements during subsequent design stages of the project when finalised drawings are available. As such, the sound insulation values stated within Table 12 are indicative and for guidance purposes only.

The above guidance has also been based on an open-plan office. If the space is to be sub-divided to create cellular offices, an increased and more detailed glazing specification will be required to enable achievement of the internal ambient noise levels stated within BS 8233:2014 and the BCO Guide for cellular offices and meeting rooms.

Similarly, the requirements for the secondary school have been based on the internal noise level requirements for a standard teaching space (e.g. seminar room, laboratory etc.). Should specialist areas be proposed (e.g. music recital rooms, drama studios, SEN spaces etc.) then an increased glazing specification will be required.

It should also be noted that this assessment has been conducted on the basis that all buildings are constructed. It is understood that the development will be phased and as such, consideration for building façades that are exposed to higher noise levels until later phases are completed will need to be given. This may mean that façade requirements are increased in these circumstances.

6.1 Compliance

In order to confirm the suitability of the proposed glazed and non-glazed elements, evidence of the laboratory sound insulation performance will be required for the entire unit as it will be installed (including glass, frame, seals, mullions and transoms). All acoustic testing shall be undertaken in controlled laboratory conditions in accordance with BS EN 140-3: 1995, BS 2750-3: 1995 Acoustics – *“Measurement of Sound Insulation in Buildings and of Building Elements. Part 3: Laboratory Measurement of Airborne Sound Insulation of Building Elements.”*(7)

7. Building services plant.

As part of the Proposed Development various items of building services plant will be located within several basement level plant rooms and at roof level. Full details of the items of building services plant proposed are contained within Appendix B attached, however a summary is provided below in Table 13.

Phase / block	Approximate location	Items of plant proposed
Phases A, B & C	Basement energy centre	3 no. CHP units
	Phase A basement	Standby generator 2 no. car park extract chambers
	Phase B basement	Standby generator 2 no. car park extract chambers
	Phase C basement	Standby generator 1 no. car park extract chambers
Phase D	Basement energy centre	3 no. CHP units
	Phase D basement	Standby generator 3 no. car park extract chambers
Block 1	Block 1 roof	8 no. VRF condensers 2 no. AHU 2 no. VES Ecovent AHU
Block 4	Block 4 roof	5 no. VRF condensers 1 no. AHU 1 no. VES Ecovent AHU
Block 5	Block 5 roof	6 no. AHU 4 no. VES Ecovent AHU 19 no. VRF condenser
Block 9	Block 9 roof	1 no. AHU 1 no. VES Ecovent AHU 1 no. VRF condenser
Block 17	Block 17 roof	1 no. AHU 1 no. VES Ecovent AHU 1 no. VRF condenser

Table 13: Proposed items of building services plant.

7.1 Assessment methodology.

An assessment of the noise emissions from the proposed items of building plant for normal operation has been undertaken to ensure compliance with the building services noise emission limits. The manufacturer's acoustic data has been used and is provided in Appendix B attached.

The resultant sound pressure one metre from the nearest residential window of the proposed development has been calculated using the principles of ISO 9613-2 (8) and compared to the defined building services noise emission limits in order to determine suitable mitigation measures.

The methodology used to determine noise emissions at the nearest residential window for each item of plant are as follows:

- Apply a distance correction to the manufacturer's sound power level ($L_{w(\text{man})}$) for the distance to the noise sensitive receptor (r) assuming hemispherical sound propagation:

$$\text{Distance Correction} = 20 \log_{10} r + 8$$

7. Derive the screening (*Screen*) provided by the parapet wall in accordance with ISO 9613-2, if appropriate.
8. Apply a directivity correction (*Dir*) based on the angle of view between the source and receiver in accordance with guidance provided within "*Fläkt Woods Practical Guide to Noise Control*".
9. Derive L_p at receiver location based on the manufacturer's sound power level ($L_{w(man)}$) using the following equation:

$$L_{p(receiver)} = L_{w(man)} - \text{Distance Correction} - \text{Screen} + \text{Dir}$$

10. Predict sound pressure level for all units in operation.

7.2 Attenuation requirements.

In order for the proposed plant associated with the Proposed Development to achieve the building services noise emission limits stated in Table 10 at the nearest on-site residential window, provision for the following outline attenuation measures as detailed in Table 14 is required. An example of the full calculation procedure is provided in Appendix C attached.

Phase / block	Approximate location	Items of plant proposed	Mitigation required (inc. notional dimensions)
Phases A, B & C	Basement energy centre	3 no. CHP units	Exhaust silencer approximately 1200mm long on each CHP.
	Phase A, B & C basement	Standby generator	Enclosed set generator with silencer approx. 1200mm long.
		2 no. car park extract chambers	Primary silencer – 20% free area, 3000mm long. Secondary silencer – 33% free area, 1500mm long. Night-time operation limited to 75% daytime load.
Phase D	Basement energy centre	3 no. CHP units	Exhaust silencer approximately 1200mm long on each CHP.
	Phase D basement	Standby generator	Enclosed set generator with silencer approx. 1200mm long.
		3 no. car park extract chambers	Primary silencer – 20% free area, 3000mm long. Secondary silencer – 33% free area, 1500mm long. Night-time operation limited to 75% daytime load.
Block 1	Block 1 roof	8 no. VRF condensers	Acoustic enclosure with attenuated openings to fully surround condensers. Night-time operation limited to 70% daytime load.
		2 no. AHU	Silencers on intake and exhaust – no noise data available for selections.
		2 VES Ecovent AHU	Silencers on atmospheric connections – 33% free area, 1500mm long. Night-time operation limited to 70% daytime load.
Block 4	Block 4 roof	5 no. VRF condensers	Acoustic enclosure with attenuated openings to fully surround condensers. Night-time operation limited to 70% daytime load.
		1 no. AHU	Silencers on intake and exhaust – no noise data available for selections.

Phase / block	Approximate location	Items of plant proposed	Mitigation required (inc. notional dimensions)
		1 VES Ecovent AHU	Silencers on atmospheric connections – 33% free area, 900mm long. Night-time operation limited to 70% daytime load.
Block 5	Block 5 roof	6 no. AHU	Silencers on intake and exhaust – no noise data available for selections.
		4 VES Ecovent AHU	Silencers on atmospheric connections – 33% free area, 1500mm long. Night-time operation limited to 70% daytime load.
		19 no. VRF condenser	Acoustic enclosure with attenuated openings to fully surround condensers. Night-time operation limited to 70% daytime load.
Block 9	Block 9 roof	1 no. AHU	Silencers on intake and exhaust – no noise data available for selections.
		1 no. VRF condenser	Acoustic enclosure with attenuated openings to fully surround condenser unit. Night-time operation limited to 70% daytime load.
		1 VES Ecovent AHU	Silencers on atmospheric connections – 33% free area, 900mm long. Night-time operation limited to 70% daytime load.
Block 17	Block 17 roof	1 no. AHU	Silencers on intake and exhaust – no noise data available for selections.
		1 no. VRF condenser	Acoustic enclosure with attenuated openings to fully surround condenser unit. Night-time operation limited to 70% daytime load.
		1 VES Ecovent AHU	Silencers on atmospheric connections – 33% free area, 900mm long. Night-time operation limited to 70% daytime load.

Table 14: Outline attenuation requirements.

Provision for the above attenuation requirements will be made within the proposals, however a precise specification of attenuators and screening will be defined during subsequent design stages once finalised plant selections and locations are available to ensure the proposed plant will achieve the defined noise emission limits.

It should be noted that the assessment provided within this Section is considered worst case as it assumes the plant is operating at maximum duty. Therefore noise levels actually produced are likely to be significantly lower during many periods.

8. Summary & conclusions.

Hoare Lea has conducted a noise impact assessment in support of the three linked planning applications for the comprehensive redevelopment of the former Stag Brewery Site in Mortlake within the London Borough of Richmond upon Thames.

Background noise levels typical of the daytime and night-time as measured by Waterman IE have been used to define building services plant noise emission limits at future residential receptors as part of the Proposed Development.

During the daytime and night-time the combined building services plant noise emission contribution limit advised is 36 dB(A) and 29 dB(A) respectively, one metre from the nearest residential façade of the Proposed Development .

An assessment of the building envelope acoustic performance is provided with the minimum level difference (D) in accordance with the internal ambient noise levels stated within BS 8233 and BB 93. The ventilation strategy should allow for the full mechanical ventilation of all spaces as the level differences required are above those achievable by simple means of natural ventilation.

Notional glazing requirements for various internal spaces and indicative primary glazing configurations have been provided however, it should be noted that these performances are for guidance purposes only. Detailed calculations will be required to be undertaken to determine refined glazing requirements during subsequent design stages of the project.

An assessment of noise associated with the outline proposed items of building services plant has been undertaken. Outline attenuation requirements for each item of plant have been provided and will be sufficient to limit noise emissions to the derived limits at the nearest adjacent on-site residential receptor during the daytime and night-time.

The guidance provided within this report meets the requirements of the London Borough of Richmond upon Thames.

References

1. *National Planning Policy Framework, Department for Communities and Local Government, March 2012.*
2. *BS 4142: 2014: 'Method for rating industrial and commercial sound'.*
3. *BS 8233: 2014, "Guidance on Sound Insulation and Noise Reduction for Buildings", BSI.*
4. *World Health Organisation (WHO) - Guidelines for Community Noise, 2000.*
5. *BS 8233: 1999, 'Sound Insulation and Noise Reduction for Buildings - Code of Practice'.*
6. Skills, Department for Education and. *Building Bulletin 93, Acoustic Design of Schools.*
7. *BS EN 140-3:1995, BS 2750-3:1995 Acoustics - "Measurement of Sound Insulation in Buildings and of Building Elements. Part 3: Laboratory Measurement of Airborne Sound Insulation of Building Elements".*
8. *ISO 9613-2: 1996, 'Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2'.*

Appendix A – Acoustic terminology.

Sound

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

The Sound Pressure

The Sound Pressure is the force (N) of sound on a surface area (m²) perpendicular to the direction of the sound. The SI-units for the Sound Pressure are Nm⁻² or Pa (Pascal).

Sound is measured with microphones responding proportionally to the sound pressure – p. The power is proportional to the square of the sound pressure.

The Sound Pressure Level

The human ear has an approximately logarithmic response to sound pressure over a very large dynamic range. The lowest audible sound pressure approximately 2×10^{-5} Pa (2 ten billionths of an atmosphere) and the highest is approximately 100 Pa.

It is therefore convenient to express the sound pressure as a logarithmic decibel scale related to this lowest human audible sound, where:

$$L_p = 10 \log \left(\frac{p^2}{p_{ref}^2} \right) = 10 \log \left(\frac{p}{p_{ref}} \right)^2 = 20 \log \left(\frac{p}{p_{ref}} \right)$$

Where:

L_p = sound pressure level (dB)

p = sound pressure (Pa)

p_{ref} = 2×10^{-5} – reference sound pressure (Pa)

In accordance with the logarithmic scale, doubling the sound pressure level gives an increase of 6 dB.

Decibel (dB)

The decibel is the unit used to quantify sound pressure levels as well as sound intensity and power levels.

In accordance with the logarithmic scale, an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pa). Subjectively, this increase would correspond to a doubling of the perceived loudness of the sound.

Sound Pressure Level of Some Common Sources

An indication of the range of sound levels commonly found in the environment is given in the following Table.

Source	Sound Pressure Level dB
Threshold of Hearing	0
Rustling Leaves	20
Quiet Whisper	30
Home	40
Quiet Street	50
Conversation	60
Inside a Car	70
Loud Singing	80
Motorcycle (10m)	90
Lawn Mower (1m)	100
Diesel Truck (1m)	110
Amplified Music (1m)	120
Jet Plane (1m)	130

Frequency

The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz) or cycles per second.

Octave and Third Octave Bands

An octave is the interval between two points where the frequency at the second point is twice the frequency of the first.

There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz.

Third octave bands provided a fine resolution by dividing each octave band into three bands. For examples, third octave bands would be 160 Hz, 250 Hz and 315 Hz for the same 250 Hz octave band.

The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequency than to low frequencies within the range. This is the basis of the A-weighting.

A-Weighting

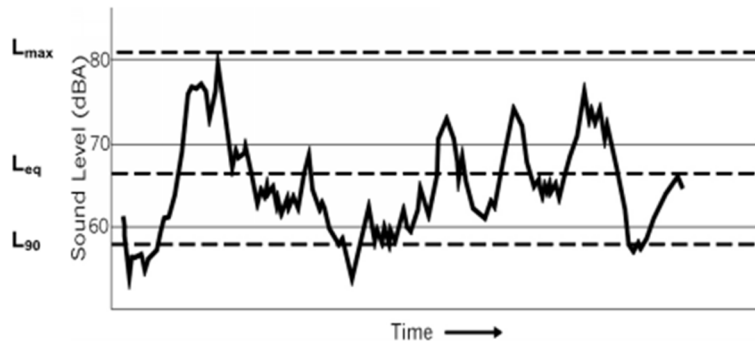
The A-weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies.

An A weighted value would be written as dB(A), or including A within the parameter term.

Noise Units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as five minutes, the statistically determined results being used to quantify various aspects of the noise.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of noise can be described by several different levels. The most common of these are described below.



$L_{eq,T}$

The $L_{eq,T}$ is a parameter defined as the equivalent continuous sound pressure level over a defined time period 'T'. It is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal.

The $L_{eq,T}$ can be thought of as an 'average' sound pressure level over a given time period (although it is not an arithmetic average). Typically the $L_{eq,T}$ will be an A-weighted noise level in dB(A) and is commonly used to describe all types of environmental noise sources.

$L_{01,T}$

The $L_{01,T}$ is a parameter defined as the sound pressure level exceeded for 1% of the measurement period 'T'. It is a statistical parameter and cannot be directly combined to other acoustic parameter.

$L_{10,T}$

The $L_{10,T}$ is a parameter defined as the sound pressure level exceeded for 10% of the measurement period 'T'. It is a statistical parameter and cannot be directly combined to other acoustic parameter and is generally used to describe road traffic noise.

$L_{90,T}$

The $L_{90,T}$ is a parameter defined as the sound pressure level exceeded for 90% of the measurement period 'T'. It is a statistical parameter and cannot be directly combined to other acoustic parameter and is generally used to describe the prevailing background noise level.

$L_{max,T}$

The $L_{max,T}$ is a parameter defined as the maximum noise level measured during the specified period 'T'.

Specific Noise Level, $L_{Aeq,Tr}$.

This is the equivalent continuous A-weighted sound pressure level at the assessment position due to a specific noise source operating over a given time interval.

Free Field

A measurement taken in the free field is at least 3.5m from reflecting vertical surfaces and 1.2m from the ground.

Façade

A measurement is influenced by the reflection of sound from the façade of a building within 3.5m. A façade measurement is made 1m in front of the vertical building surface.

R_w

A single-number quantity which characterizes the airborne sound insulation of a material or building element in the laboratory. See BS EN ISO 717-1: 1997.

Appendix B – Preliminary MEP information.

Appendix C - Example calculation for proposed items of building services plant.

Basement plant.

	Sound pressure level per octave band frequency in Hz (dB)								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Phase A, B, C – Car Park Extract Fan									
L _w	103	109	106	104	99	95	93	89	105
Distance correction (19m)	-19	-19	-19	-19	-19	-19	-19	-19	-
Directivity	+8	+8	+9	+9	+9	+9	+9	+9	-
Attenuation	-38	-55	-55	-50	-50	-50	-50	-50	-
L _{p(receiver)}	54	43	35	29	25	22	20	18	34

Roof Plant

	Sound pressure level per octave band frequency in Hz (dB)								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Block 1									
Condenser Units									
L _w	-	87	88	87	83	78	74	69	88
Distance correction (14m)	-	-31	-31	-31	-31	-31	-31	-31	-
Acoustic Enclosure	-	-20	-29	-34	-34	-32	-30	-27	-
L _{p(receiver)}	-	36	28	22	18	15	13	11	26
L _{p(receiver)} (8 units)	-	45	37	31	27	24	22	20	35



TOM HILLS
ASSOCIATE

+44 1202 654 644
tomhills@hoarelea.com

HOARELEA.COM

Enterprise House
Old School Close
Ferndown
Bournemouth
BH22 9UN
England

