HOARE LEA

Stag Brewery, Mortlake

Noise Impact Assessment

For Reselton Properties

February 2018

HOARE LEA

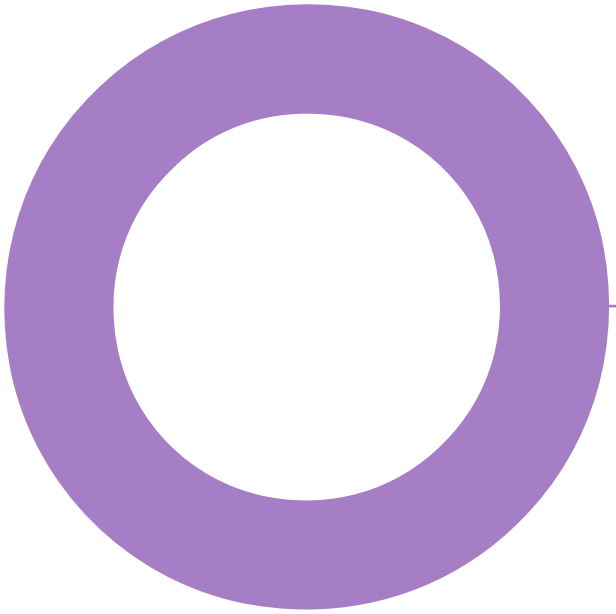
Former Stag Brewery. Mortlake.

Reselton Properties Limited.

ACOUSTICS

NOISE IMPACT ASSESSMENT

REVISION 02 – 09 FEBRUARY 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	-

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-20180209-Noise Impact Assessment-Rev02

Contents.

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 Cafeteria, canteen, kitchen	50 – 55
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 document 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. Contributory noise from human activities, distant road noise and distant aircraft also influence the noise climate to some extent.
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.	
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 activates 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	Fee 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).

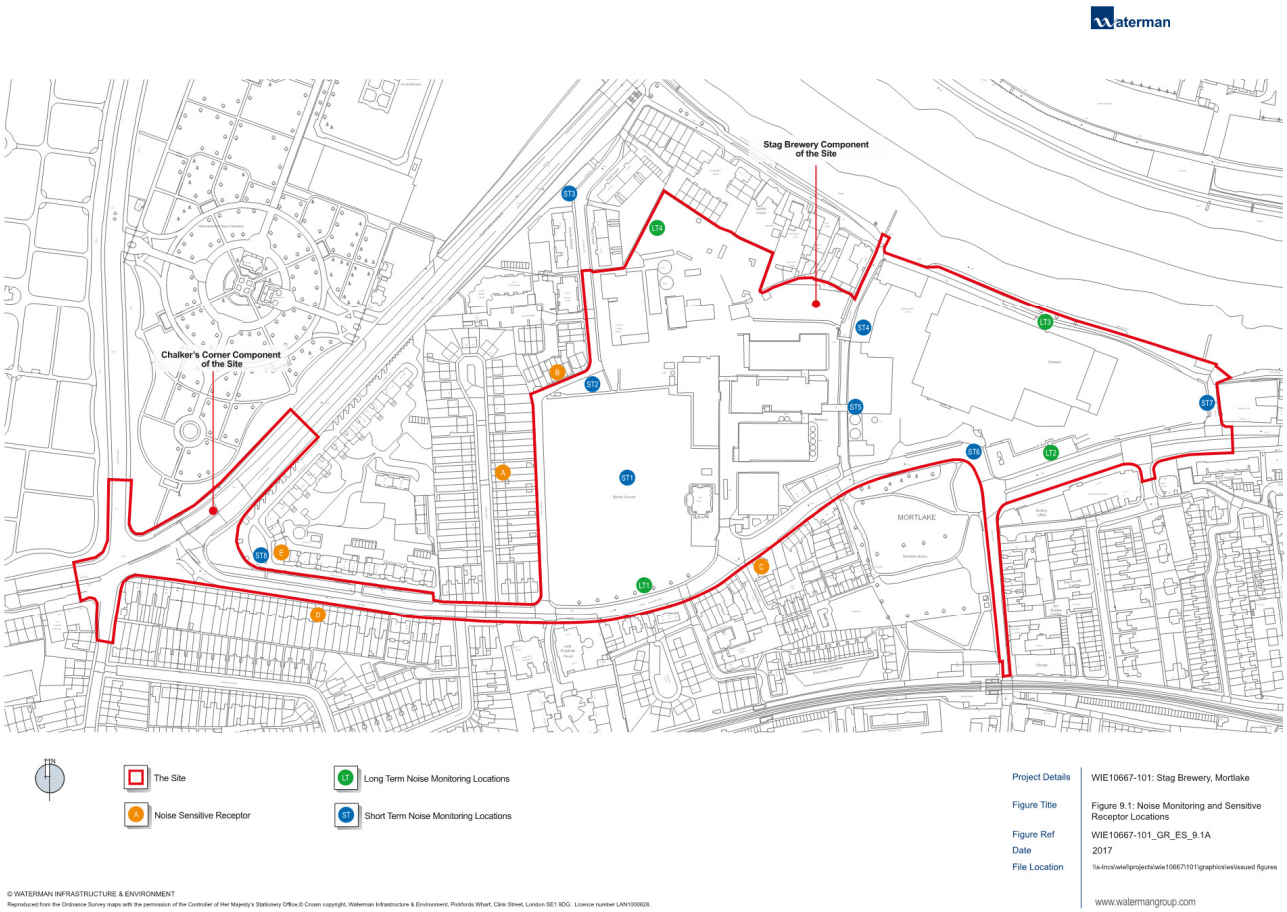


Figure 2: Location plan of the Site and noise monitoring locations (ref: Waterman IE).

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	90th 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
CRTN	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.

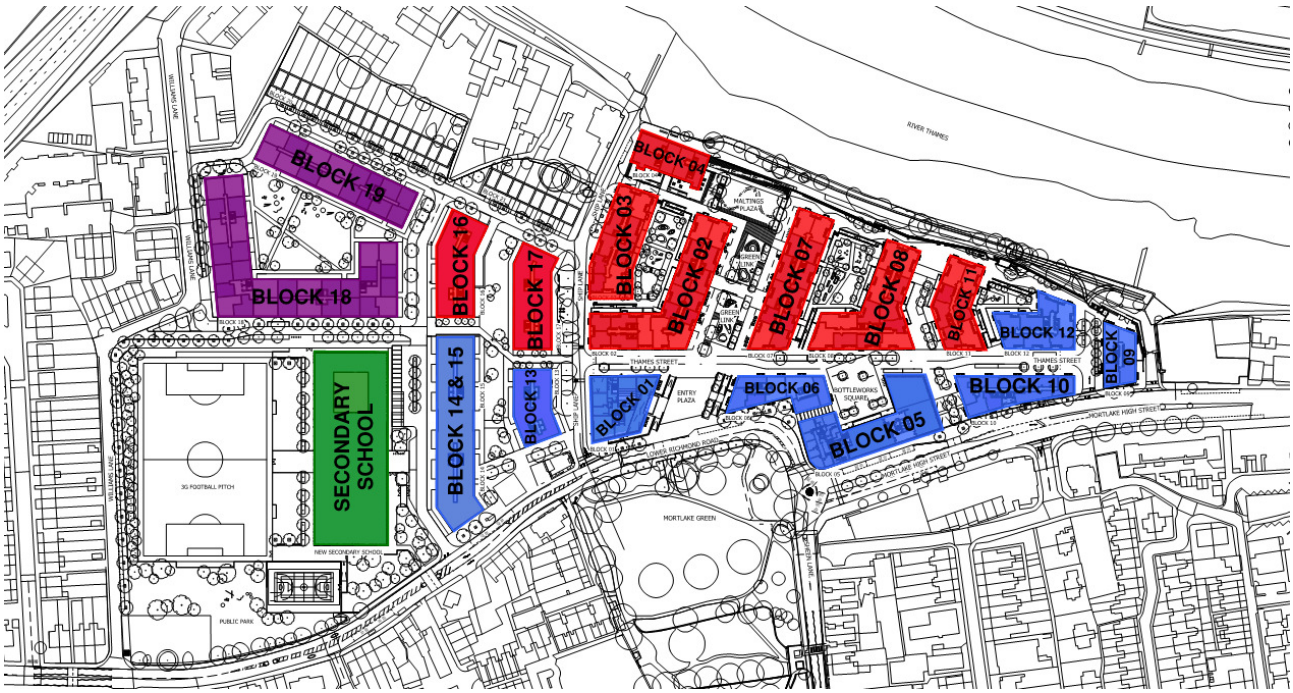


Figure 3: Block locations.

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 undertake 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:

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

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

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:

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

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 Bulleting 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 Propogation 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 x 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 x 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.

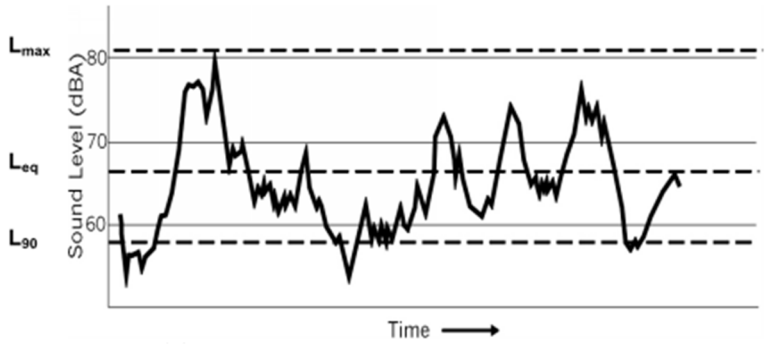
The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequency than to low frequencies within the range. This is the basis of the A-weighting.

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.

MEP ENGINEERING

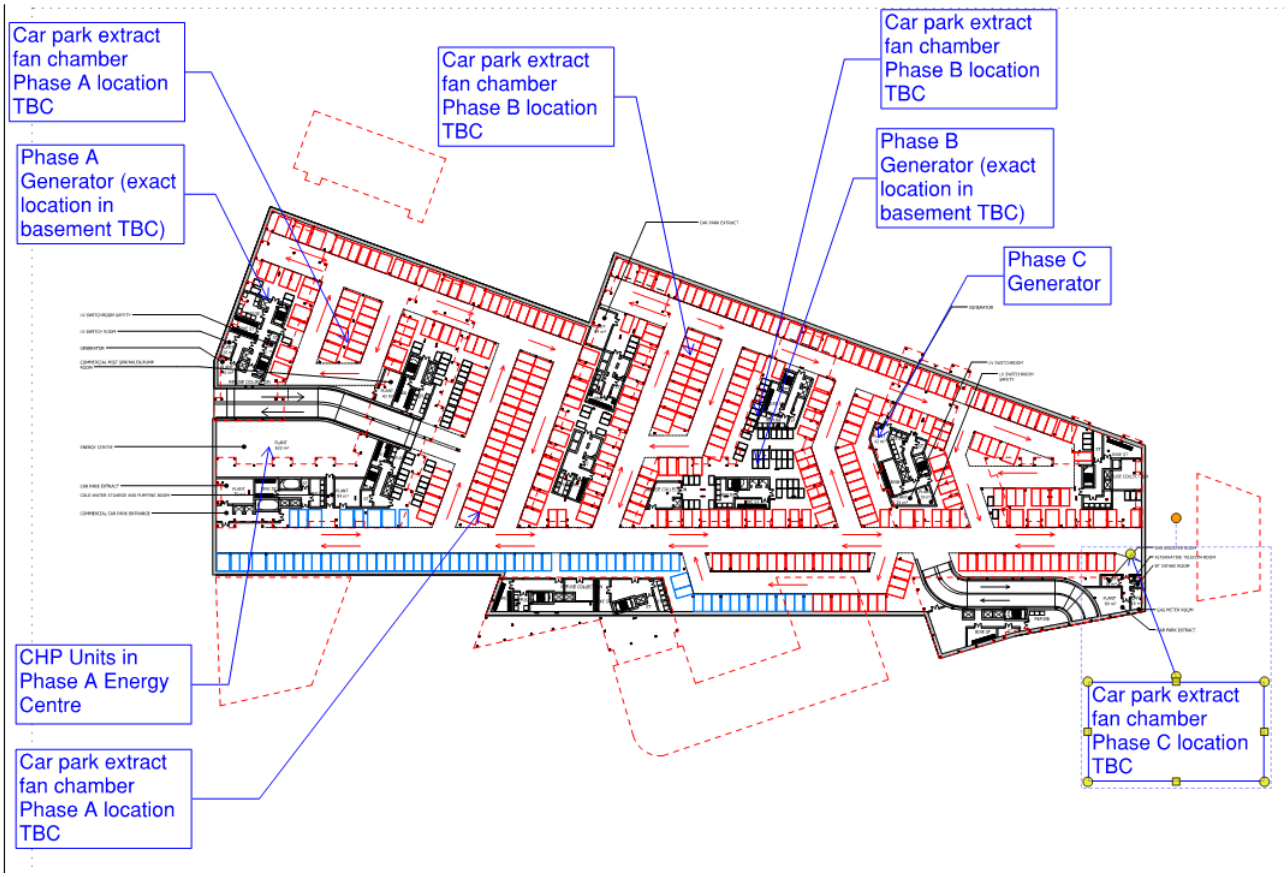
Stag Brewery MEP Preliminary Information for Waterman EIA

05 October 2017

Item 39 – Main plant items and noise output

39.	Details and location of fixed building services plant within the development site with significant noise output e.g. chillers, AHUs, condensers, pumps and generators etc. Require manufacturer/supplier plant sound power levels (Lw) or plant sound pressure levels at a given distance (Lp @ Xm).

Basement Plant – Phase A, B, C



Preliminary Plant Selection	Typical Noise level	Approximate Location
3no. CHP units Ener-G E185 (Low Noise Version) Ener-G E185 (Low Noise Version) Ener-G E165 (Low Noise Version)	 65 dB(A) @ 1m 65 dB(A) @ 1m 65 dB(A) @ 1m	 Phase A Basement Energy Centre
Standby generator Phase A	See typical 300kVA generator data overleaf – testing and emergency only	Phase A Basement
Standby generator Phase B	See typical 300kVA generator data overleaf – testing and emergency only	Phase B Basement
Standby generator Phase C	See typical 300kVA generator data overleaf – testing and emergency only	Phase C Basement

05 October 2017

Typical 300kVA generator noise data

Genset Model: P330-3
Engine Type : 1506A-E88TAG5
Frequency (Hz): 50
Enclosure: OPEN

				Average Sound Power Levels at 1m dB							
kVA	kWe	% Load	dBA	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
330	264	100.0	116.8	114.4	112.5	113.7	109.0	110.9	110.7	108.5	109.5
	238	90.0	118.1	114.0	112.1	113.7	109.1	111.0	110.2	108.0	113.5
	211	80.0	119.0	113.4	111.6	113.7	109.1	111.1	109.6	107.5	116.4
	185	70.0	119.6	112.5	111.0	113.6	109.1	111.2	109.1	107.0	118.1
	158	60.0	119.9	111.5	110.3	113.6	109.0	111.2	108.7	106.5	118.7
	132	50.0	119.8	110.2	109.5	113.5	109.0	111.1	108.2	106.0	118.2
	106	40.0	119.3	108.7	108.6	113.4	108.9	110.9	107.8	105.6	116.5
	79	30.0	118.5	107.0	107.6	113.3	108.7	110.7	107.5	105.1	113.7
	53	20.0	117.3	105.1	106.6	113.1	108.5	110.4	107.2	104.6	109.7
	26	10.0	115.8	103.0	105.4	113.0	108.3	110.1	106.9	104.2	104.6

Preliminary Plant Selection	Typical Noise level	Approximate Location
Car Park Ventilation Fans Phase A	See below	Phase A Basement
Car Park Ventilation Fans Phase A	See below	Phase A Basement
Car Park Ventilation Fans Phase B	See below	Phase B Basement
Car Park Ventilation Fans Phase B	See below	Phase B Basement
Car Park Ventilation Fans Phase C	See below	Phase C Basement

Typical car park smoke extract fan data

Sound Criteria

Sound Power Levels re 1 pWatts (Hz):

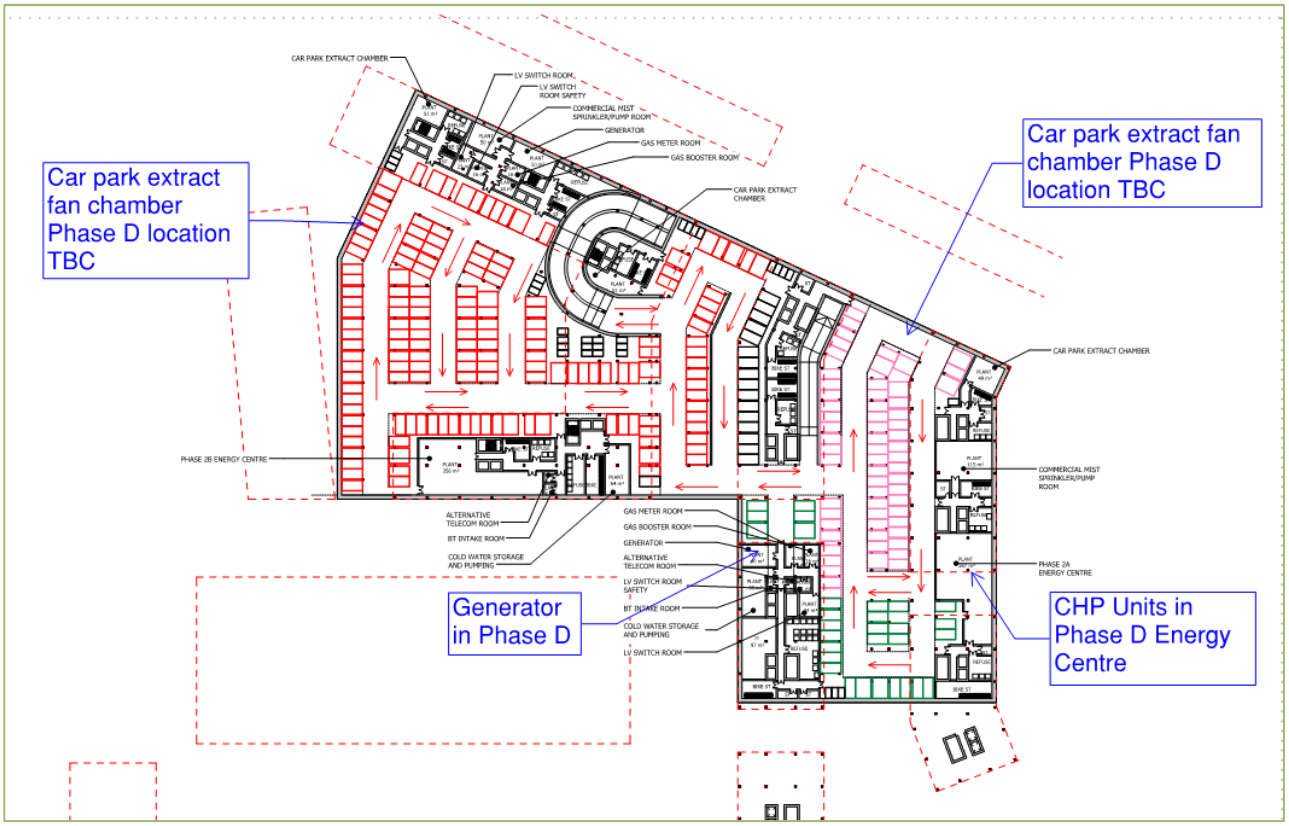
Hz	63	125	250	500	1k	2k	4k	8k
Induct Inlet	100	106	104	102	97	94	93	89
Induct Outlet	103	109	106	104	99	95	93	89
Open Inlet	96	103	104	101	96	94	93	89
Open Outlet	99	106	106	103	98	95	93	89
Breakout	80	86	90	78	70	77	74	64

Breakout Noise (dBA): 63 dBA @ 3m

Values shown are for inlet Lw and outlet Lw sound power levels for: Installation Type D: ducted inlet, ducted outlet.
Ratings include the effects of duct end correction.

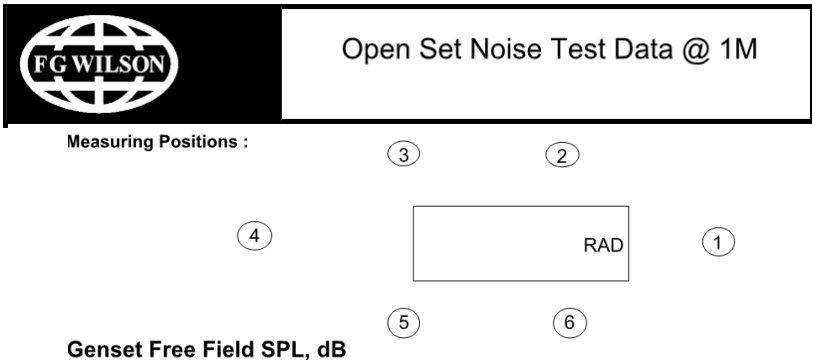
05 October 2017

Basement Plant – Phase D



Preliminary Plant Selection	Typical Noise level	Approximate Location
3no. CHP units Ener-G E185 (Low Noise Version) Ener-G E185 (Low Noise Version) Ener-G E165 (Low Noise Version)	 65 dB(A) @ 1m 65 dB(A) @ 1m 65 dB(A) @ 1m	Phase D Basement Energy Centre
Standby generator Phase D	See typical 600kVA generator data below. Emergency use and testing only.	Phase D Basement

Typical 600kVA generator noise data



05 October 2017

	OCTAVE BAND A-WEIGHTED								
S/BY	63	125	250	500	1K	2K	4K	8K	dBA
1	72.9	83.0	91.3	94.6	99.3	99.1	92.9	82.8	103.7
2	77.5	84.8	89.3	97.7	103.9	105.6	101.6	92.0	109.3
3	75.4	86.7	93.0	100.2	105.4	105.6	100.9	91.6	109.9
4	71.6	85.0	85.8	88.3	90.1	92.3	88.2	84.7	97.0
5	75.9	83.8	90.4	97.8	102.4	103.3	98.1	97.9	107.7
6	77.9	85.1	89.0	96.8	103.4	104.8	100.0	99.3	108.8
	75.7	84.9	90.3	97.1	102.5	103.5	98.9	94.8	
						Average FF SPL @ 1m, dBA :			107.6

2806 E18 50Hz Open Set Noise 29.02.04, 21/09/2006, 11:32

Preliminary Plant Selection	Typical Noise level	Approximate Location
Car Park Ventilation Fans Phase D	See below	Phase D Basement
Car Park Ventilation Fans Phase D	See below	Phase D Basement

Typical car park smoke extract fan data

Sound Criteria

Sound Power Levels re 1 pWatts (Hz):

Hz	63	125	250	500	1k	2k	4k	8k
Induct Inlet	100	106	104	102	97	94	93	89
Induct Outlet	103	109	106	104	99	95	93	89
Open Inlet	96	103	104	101	96	94	93	89
Open Outlet	99	106	106	103	98	95	93	89
Breakout	80	86	90	78	70	77	74	64

Breakout Noise (dBA): 63 dBA @ 3m

Values shown are for inlet Lw and outlet Lw sound power levels for: Installation Type D: ducted inlet, ducted outlet.
Ratings include the effects of duct end correction.

05 October 2017

Roof Plant (all blocks)

Preliminary Plant Selection	Noise level	Approximate Location
Corridor/Lobby Smoke Extract Fans	See below	Roof level on every block for every stair/lift core.
Kitchen extract fans	Unknown at this stage	To be installed by retail unit tenants at roof level as required

Typical corridor/lobby smoke extract fan data

Sound Power Levels re 1 pWatts (Hz):

Hz	63	125	250	500	1k	2k	4k	8k
Induct Inlet	95	102	98	96	90	83	80	74
Induct Outlet	99	104	99	97	91	84	80	75
Open Inlet	89	100	97	95	90	83	80	74
Open Outlet	92	102	98	96	91	84	80	75
Breakout	76	81	83	71	63	66	61	50
For 100% Speed	+0	+1	+1	+1	+1	+1	+1	+1

Breakout Noise (dBA): 54 dBA @ 3m
Breakout Noise (dBA): 55 dBA @ 3m
Above noise calculated speed controlled to required duty (99%)
For 100% Speed:
Breakout Noise (dBA): +0

Chillers/Condensers (Roof Level)

Space provision shall be made at roof level to allow ground floor retail unit tenants to install their own condensers. Noise data not provided at this time as this is a fit-out item.

Cooling is not currently confirmed for the residential elements.

05 October 2017

Air Handling Plant at Roof Level

Typical Acoustic data for different VES 'MAX' Models (Assume Plug Fans)

Power Level Guide

MAX Model		250 Pa External									
		21	22	23	24	25	26	27	28	29	30
Direct Drive	Plug	80	70	86	81	83	82	82	84	82	83
	Rotor Motor	87	N/A	95	88	86	86	85	86	86	86
Belt Drive	Forward Curved	83	85	88	84	84	86	85	85	85	90
	Backward Curved	85	85	76	85	86	86	85	86	86	N/A

MAX Model		250 Pa External									
		31	32	33	34	35	36	37	38	39	40
Direct Drive	Plug	85	84	84	84	83	85	88	87	86	88
	Rotor Motor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Belt Drive	Forward Curved	88	87	89	90	93	88	**92**	89	90	94
	Backward Curved	N/A	N/A	N/A	N/A	94	88	94	90	90	90

MAX Model		350 Pa External									
		41	42	43	44	45	46	47	48	49	50
Direct Drive	Plug	85	88	93	89	92	95	96	98	97	100
	Rotor Motor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Belt Drive	Forward Curved	97	95	94	96	99	98	97	99	98	100
	Backward Curved	95	97	95	96	99	101	97	96	98	97

Spectrum Correction

These corrections will give a sound power level spectrum in dB (re 10^{-12}wPWL). To obtain the NR level within a conditioned space or at a given distance acoustic analysis calculations are necessary. VES engineers will be pleased to give advice on this and with any necessary silencer selections.

MAX Model	Centre Frequency Hz	63	125	250	500	1k	2k	4k	8k
Direct Drive	Plug	-12	-8	-5	-5	-10	-14	-19	-23
	Rotor Motor	-6	-3	-8	-10	-15	-17	-20	-18
Belt Drive	Forward Curved	-6	-7	-10	-12	-13	-15	-19	-23
	Backward Curved	-4	-6	-7	-9	-11	-15	-19	-23

Block 1 (Cinema) Roof Plant

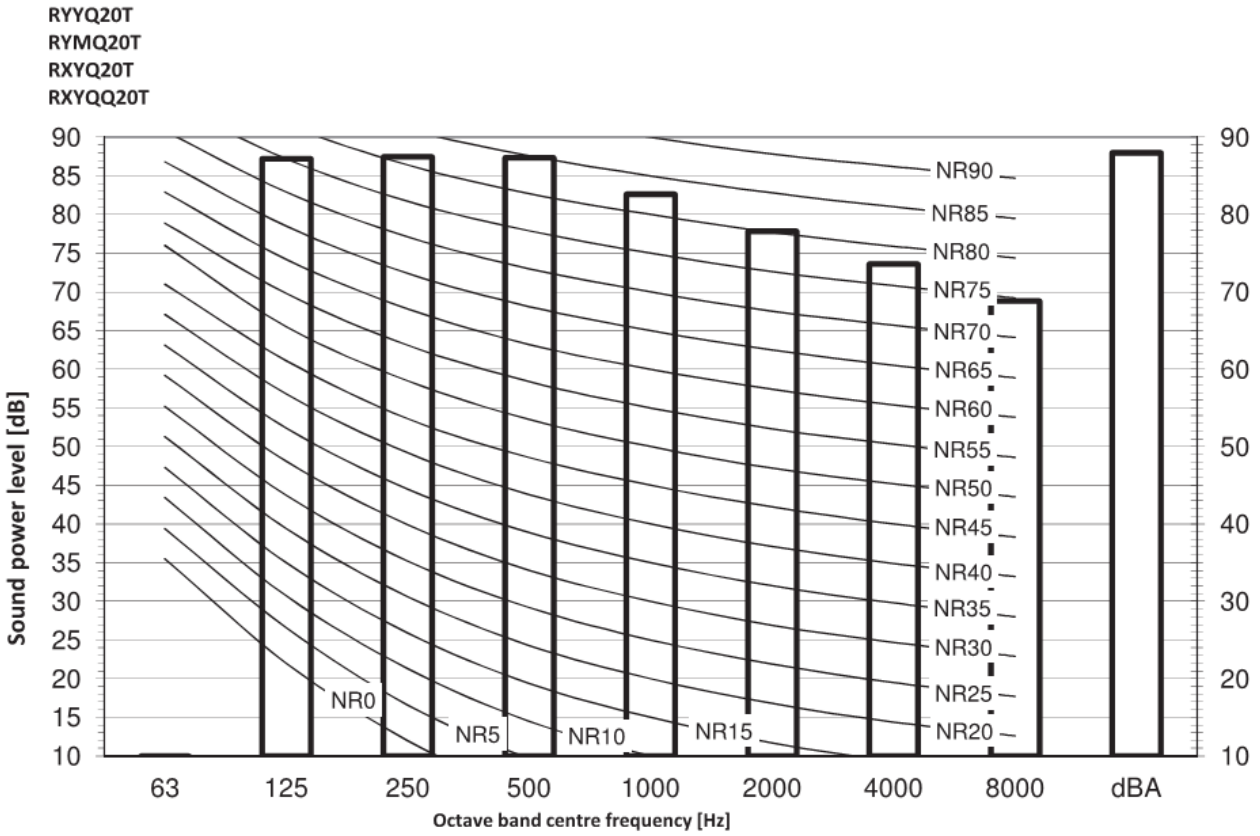
Preliminary Plant Selection	Noise level	Approximate Location
Air Handling Unit VES MAX 45 Air Handling Unit VES MAX 35 VES Ecovent Size 7, 70HZ VES Ecovent Size 7, 70HZ	See VES 'MAX 45' noise data See VES 'MAX 35' noise data See below See below	Block 1 roof level
8no. VRF Condensers (Daikin RYQ20T typical)	See Daikin VRF noise data (p.7)	Block 1 roof level

VES Ecovent Size 7, 70HZ noise data

Fan Frequency	Fan Speed rpm	Sound Spectrum dB re 10^{-12} W PWL Centre Frequency (Hz)								Casing Noise Breakout			
		63	125	250	500	1k	2k	4k	8k	NR@1m	NR@3m	dBA@1m	dBA@3m
80 Hz	2250	81	85	90	90	86	82	78	73	54	48	55	49
70 Hz	2000	78	82	87	87	83	79	75	70	51	45	52	46

05 October 2017

Typical Daikin VRF condenser noise data



Block 4 (Community) Roof Plant

Preliminary Plant Selection	Noise level	Approximate Location
Air Handling Unit VES MAX 35 VES Ecovent Size 4, 100%	See VES 'MAX 35' noise data (p.6)	Block 4 roof level
5no. VRF Condensers (Daikin RYQ20T typical)	See Daikin VRF noise data above	Block 4 roof level

VES Ecovent Size 4, 100% noise data

Fan Voltage	Fan Speed rpm	Sound Spectrum dB re 10^{-12} W PWL Centre Frequency (Hz)								Casing Noise Breakout			
		63	125	250	500	1k	2k	4k	8k	NR @ 1m	NR @ 3m	dBA @ 1m	dBA @ 3m
100%	2010	67	67	69	70	69	68	63	58	42	35	42	36

05 October 2017

Block 5 (Office, Supermarket, Gym, Hotel) Roof Plant

Preliminary Plant Selection	Noise level	Approximate Location
Air Handling Unit VES MAX 24	See VES 'MAX 24' noise data	Block 5 roof level (office)
Air Handling Unit VES MAX 37	See VES 'MAX 37' noise data	Block 5 roof level (office)
Air Handling Unit VES MAX 39	See VES 'MAX 39' noise data	Block 5 roof level (hotel)
Air Handling Unit VES MAX 40	See VES 'MAX 40' noise data	Block 5 roof level (hotel)
Air Handling Unit VES MAX 41	See VES 'MAX 41' noise data	Block 5 roof level (supermarket)
Air Handling Unit VES MAX 44	See VES 'MAX 44' noise data (P.6)	Block 5 roof level (gym)
2no. VES Ecovent Size 7, 70Hz VES Ecovent Size 4, 100% VES Ecovent Size 7, 70Hz	See below	Block 5 roof level (office) Block 5 roof level (hotel) Block 5 roof level (gym)
19no. VRF Condensers (Daikin RYQ20T typical)	See Daikin VRF noise data (p.7)	Block 5 roof level

VES Ecovent Size 4, 100% noise data

Fan Voltage	Fan Speed rpm	Sound Spectrum dB re 10^{-12} W PWL Centre Frequency (Hz)								Casing Noise Breakout			
		63	125	250	500	1k	2k	4k	8k	NR @ 1m	NR @ 3m	dBA @ 1m	dBA @ 3m
100%	2010	67	67	69	70	69	68	63	58	42	35	42	36

VES Ecovent Size 7, 70HZ noise data

Fan Frequency	Fan Speed rpm	Sound Spectrum dB re 10^{-12} W PWL Centre Frequency (Hz)								Casing Noise Breakout			
		63	125	250	500	1k	2k	4k	8k	NR @ 1m	NR @ 3m	dBA @ 1m	dBA @ 3m
80 Hz	2250	81	85	90	90	86	82	78	73	54	48	55	49
70 Hz	2000	78	82	87	87	83	79	75	70	51	45	52	46

Block 9 (Community) Roof Plant

Preliminary Plant Selection	Noise level	Approximate Location
Air Handling Unit VES MAX 32 VES Ecovent Size 4, 90%	See VES 'MAX 32' noise data (p.6)	Block 9 roof level
1no. VRF Condensers (Daikin RYQ20T typical)	See Daikin VRF noise data (p.7)	Block 9 roof level

VES Ecovent Size 4, 90% noise data

Fan Voltage	Fan Speed rpm	Sound Spectrum dB re 10^{-12} W PWL Centre Frequency (Hz)								Casing Noise Breakout			
		63	125	250	500	1k	2k	4k	8k	NR @ 1m	NR @ 3m	dBA @ 1m	dBA @ 3m
100%	2010	67	67	69	70	69	68	63	58	42	35	42	36
90%	1809	65	66	66	67	66	65	60	57	38	31	39	33

05 October 2017

Block 17 (Healthcare) Roof Plant

Preliminary Plant Selection	Noise level	Approximate Location
Air Handling Unit VES MAX 38 VES Ecovent Size 5, 100%	See VES 'MAX 38' noise data (p.6)	Block 17 roof level
1no. VRF Condensers (Daikin RYQ20T typical)	See Daikin VRF noise data (p.7)	Block 9 roof level

VES Ecovent Size 5, 100% noise data

Fan Voltage	Fan Speed rpm	Sound Spectrum dB re 10^{-12} W PWL Centre Frequency (Hz)								Casing Noise Breakout			
		63	125	250	500	1k	2k	4k	8k	NR @ 1m	NR @ 3m	dBA @ 1m	dBA @ 3m
100%	1400	75	79	80	77	72	67	61	58	52	46	52	46

Item 40 – Ventilation Strategy – car park ventilation

40.	**Proposed ventilation strategy including:** Air volume (m^3/s). Velocity (m/s). Size of louvre (m^2). Location of louvres.

Phase A car park will be served by 2 main extract fan chambers in the basement, with discharge above ground via louvres integrated into the building facades/landscapes. Make-up air will be via air inlets/the car park ramp. Louvres will be sized on 2m/s free area velocity. Impulse/cyclone fans will be installed at soffit level in the car park to direct air towards the extract points.

Extract rates will be in accordance with ADB and ADF of the Building Regulations.

Phase B, C and D car parks, will be ventilated in a similar way.

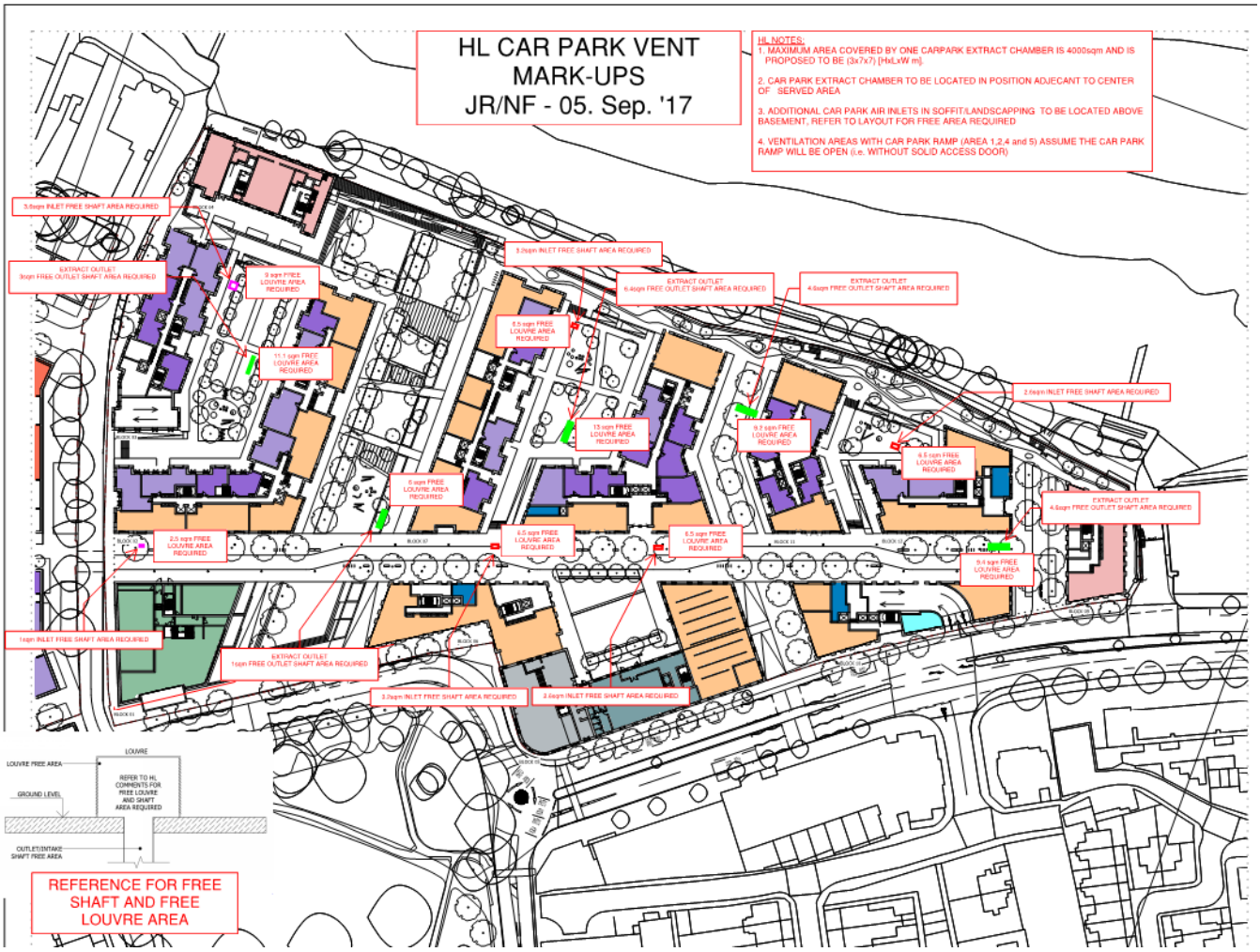
The enclosed mark-up PDF

Area	Preliminary Air volume m3/s	Velocity m/s	Louvre size/location
Car Park Ventilation Fans Phase A (Vent area 1)	37 m3/s (smoke) 22 m3/s (high CO)	2 m/s	Locations TBC Refer to mark-up
Car Park Ventilation Fans Phase A (Vent area 2)	19 m3/s (smoke) 12 m3/s (high CO)	2 m/s	Locations TBC Refer to mark-up
Car Park Ventilation Fans Phase B (Vent area 3)	42 m3/s (smoke) 25 m3/s (high CO)	2 m/s	Locations TBC Refer to mark-up
Car Park Ventilation Fans Phase B (Vent area 4)	30 m3/s (smoke) 19 m3/s (high CO)	2 m/s	Locations TBC Refer to mark-up
Car Park Ventilation Fans Phase C (Vent area 5)	30 m3/s (smoke) 19 m3/s (high CO)	2 m/s	Locations TBC Refer to mark-up

05 October 2017

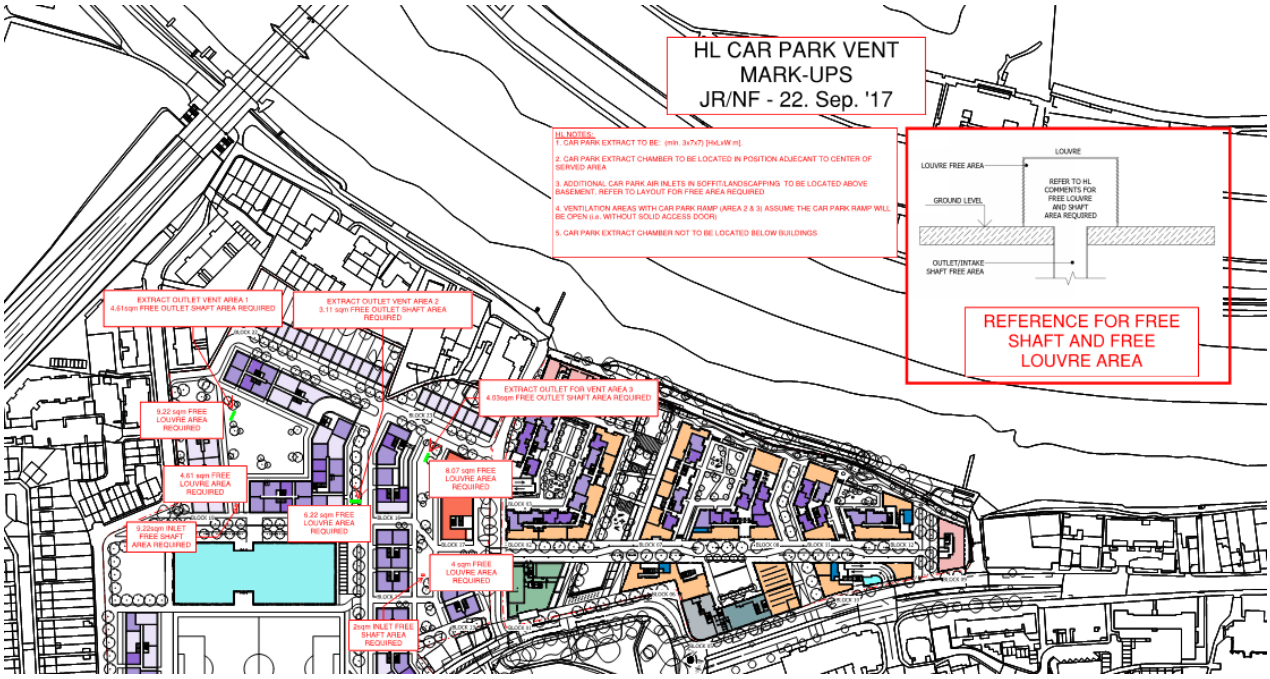
Area	Preliminary Air volume m3/s	Velocity m/s	Louvre size/location
Car Park Ventilation Fans Phase D (Vent area 6)	30 m3/s (smoke) 19 m3/s (high CO)	2 m/s	Locations TBC Refer to mark-up
Car Park Ventilation Fans Phase D (Vent area 7)	21 m3/s (smoke) 12 m3/s (high CO)	2 m/s	Locations TBC Refer to mark-up
Car Park Ventilation Fans Phase D (Vent area 8)	27 m3/s (smoke) 16 m3/s (high CO)	2 m/s	Locations TBC Refer to mark-up

Screenshot – see separate car park vent attachment Phase A,B,C



05 October 2017

Screenshot – see separate car park vent attachment Phase D



05 October 2017

Item 41 – Utilities

41.	Details of proposed utilities, capacity and demand. In particular, the supply and capacity of potable water to the Site and foul drainage capacity.

Electricity - A number of new substations will be provided at ground floor level around the site. These substations will connect to the existing HV network in and serve the LV supplies within the new development. The assessed load for the development is circa 6MVA, approximately 3MVA per development phase.

Telecomms - New connections to BT and other communication services will be requested after the planning consent has been granted. Due to the location of the site and the existing services it is highly likely that there will be sufficient capacity within the existing networks for the new development.

Gas - New gas connections will be required to serve the 2 new energy centres. The energy centre in Phase A will require a circa 12MW gas supply and the energy centre in Phase D will require a circa 10 MW gas supply. A number of smaller capacity connections will be requested to allow for A3 catering units.

Potable Water – New water supplies will be required to serve cold water storage plant in each phase. Water supply rate is based on a tank-fill rate of 4 hours:

- Phase A – 2.5l/s
- Phase B – 2.8l/s
- Phase C – 2 l/s
- Phase D – 6.4 l/s
- Phase E (Terrace Houses) – each will be provided with their own domestic mains water supply

Each retail unit will be provided with their own mains water supply, each with circa 0.5l/s capacity.

Commercial buildings (cinema, office, school, community centres etc) will each have their own water supply, ranging from 0.5l/s to 1.5l/s depending on fit out requirements.

Each phase will require its own fire supply to serve sprinkler plantrooms.

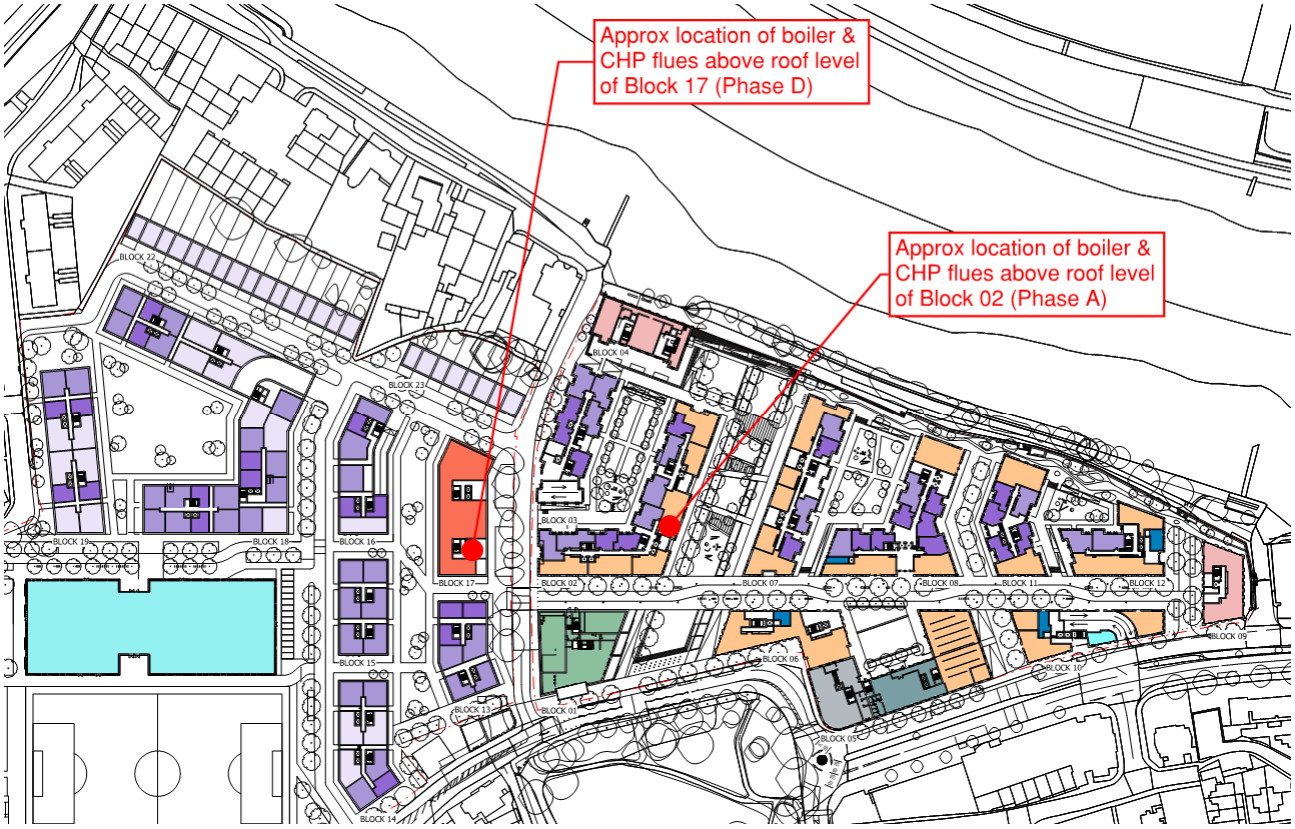
Foul Drainage – By Watermans.

05 October 2017

Item 41 – Heating plant, flues, emissions

42.	Details of type of building plant and location, including flue location, height and specification: • Location of flue(s) (NGR). • Height and internal diameter (m) of the stack / flue. • Emission rates (NOx and PM10 in g/s). • Temperature of release (oC). • Velocity of release (m/s). • Operational hours of plant per day and likely seasonal profile. • Manufacturer / supplier plant sound power level (Lw) data or alternatively plant sound pressure level at a given distance (Lp@xm).

Approximate location of flues



Energy centre – Phase A

The energy centre in Phase A shall serve phases A, B and C. Heating plant shall comprise:

- 5no. gas fired boilers with total 12MW gas input
  - 88% approx. gross efficiency
  - 95% approx. Part L efficiency
  - 39mg/kwh NOX at 0% excess oxygen
  - Temp at boiler outlet at ground floor = 69°C. Temp at top of stack unknown at this stage.
  - Flue gases 3130kg/h per boiler (5no. boilers)

05 October 2017

        - 2 boilers on 700mm diameter flue = 6260 kg/h
        - 2 boilers on 700mm diameter flue = 6260 kg/h
        - 1 boiler on 500mm diameter flue = 3130 kg/h
    - Sound power level 85dB(A)

- 3no. gas fired CHP units with combined output 500-530kWe, i.e.
    - 165kWe CHP / 280kWth, 560kW gas input, total 89% efficiency
    - 165kWe CHP / 280kWth, 560kW gas input, total 89% efficiency
    - 185kWe CHP / 310kWth, 610kW gas input, total 89% efficiency
    - Temp at CHP outlet at ground floor = 120°C. Temp at top of stack unknown at this stage.
    - 50mg/kwh NOX at 5% oxygen each CHP
    - Flue gases 165kW CHP = 736m3/h
    - Flue gases 185kW CHP = 803m3/h
    - 65 dB(A) @ 1m for each CHP
    - Seasonal profile – refer to Hoare Lea Energy Strategy and estimated operating profiles

Boiler and CHP flues from the Energy Centre in Phase A will terminate above roof level of Block 2. Flue height approx. 3.7m above roof level and above any structure within 30m of the flues.

Screenshot – see separate estimated operating profiles

Stag Brewery - estimated boiler/CHP operating profile

	CHP(1)			CHP(2)			CHP(3)			Boilers01			Boiler02			Boiler03			Boiler04			Boiler05			Boiler06		
	CHP_Winter	CHP_Mid	CHP_Summer	CHP_Winter	CHP_Mid	CHP_Summer	CHP_Winter	CHP_Mid	CHP_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	0	0
8	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0	0	0
9	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0.25	0	0
10	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0.25	0	0
11	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	1	0
12	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	0	0
17	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	0	0
18	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0.25	0	0
19	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0.25	0	0
20	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0	0	0
21	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Energy centre – Phase D

The energy centre in Phase D shall serve phase D. Heating plant shall comprise:

- 4no. gas fired boilers with total 10MW gas input
    - 88% approx. gross efficiency
    - 95% approx. Part L efficiency
    - 39mg/kwh NOX at 0% excess oxygen
    - Flue gas temperature at boiler 69°C, temperature at flue outlet unknown
    - Flue gases 3130kg/h per boiler (4no. boilers)
    - Sound power level 85dB(A)
    - Seasonal profile – refer to Hoare Lea Energy Strategy and estimated operating profiles

- 3no. gas fired CHP units with combined output 500-530kWe, i.e.
    - 165kWe CHP / 280kWth, 560kW gas input, total 89% efficiency
    - 165kWe CHP / 280kWth, 560kW gas input, total 89% efficiency
    - 185kWe CHP / 310kWth, 610kW gas input, total 89% efficiency

- Temp at CHP outlet at ground floor = 120°C. Temp at top of stack unknown at this stage.
- 50mg/kwh NOX at 5% oxygen each CHP
- Flue gases 165kW CHP = 736m3/h
- Flue gases 185kW CHP = 803m3/h
- 65 dB(A) @ 1m for each CHP
- Seasonal profile – refer to Hoare Lea Energy Strategy and estimated operating profiles

Boiler and CHP flues from the Energy Centre in Phase A will terminate above roof level of Block 17. Flue height approx. 3.3 m above roof level and above any structure within 27m of the flues.

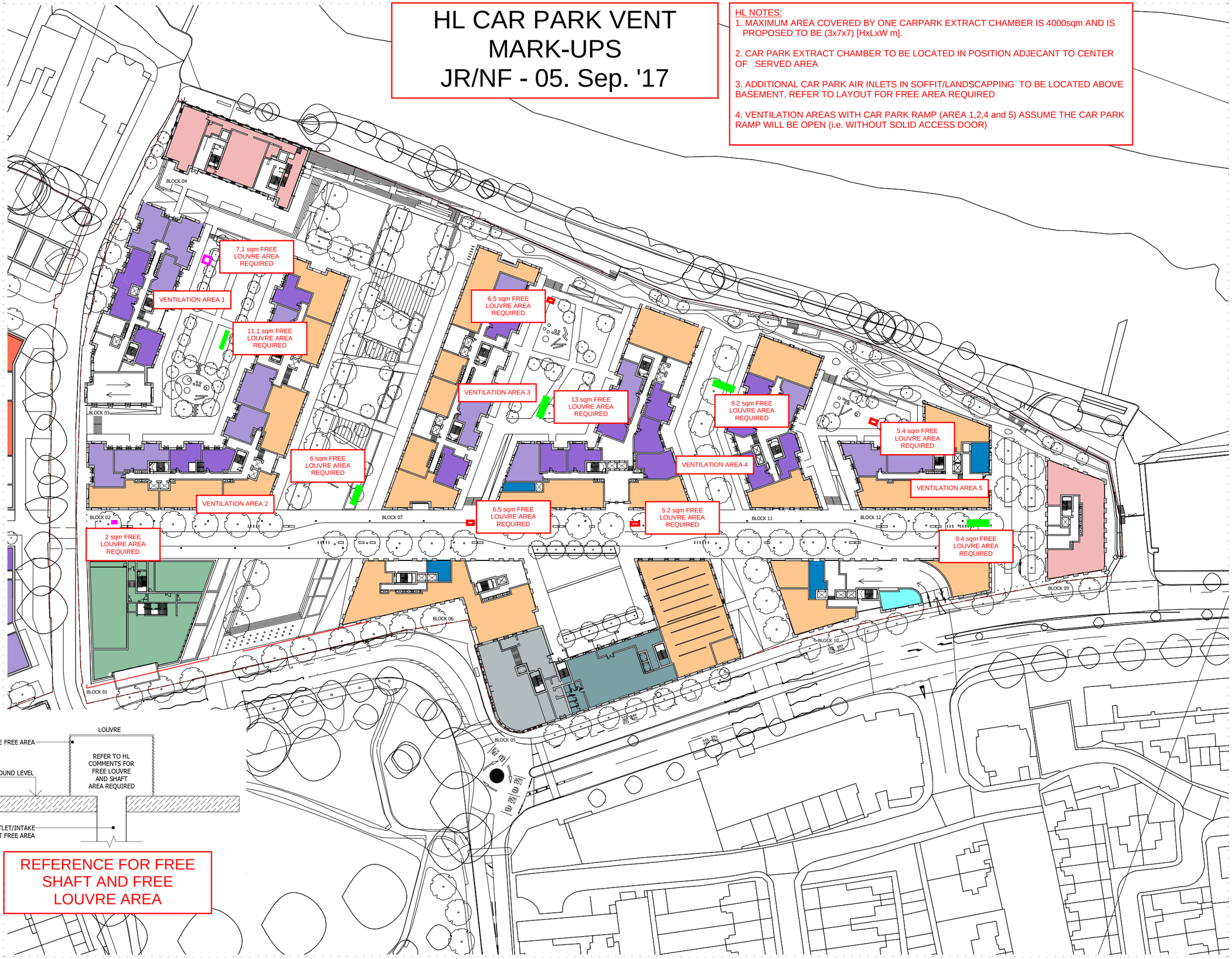
HL CAR PARK VENT MARK-UPS
JR/NF - 05. Sep. '17

HL NOTES:
1. MAXIMUM AREA COVERED BY ONE CARPARK EXTRACT CHAMBER IS 4000sqm AND IS PROPOSED TO BE (3x7x7) [HxLxW m].

2. CAR PARK EXTRACT CHAMBER TO BE LOCATED IN POSITION ADJECANT TO CENTER OF SERVED AREA

3. ADDITIONAL CAR PARK AIR INLETS IN SOFFIT/LANDSCAPPING TO BE LOCATED ABOVE BASEMENT, REFER TO LAYOUT FOR FREE AREA REQUIRED

4. VENTILATION AREAS WITH CAR PARK RAMP (AREA 1,2,4 and 5) ASSUME THE CAR PARK RAMP WILL BE OPEN (i.e. WITHOUT SOLID ACCESS DOOR)



REFERENCE FOR FREE SHAFT AND FREE LOUVRE AREA

NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.

- 1 BED (L)
- 1 BED (S)
- 2 BED (L)
- 2 BED (M)
- 2 BED (S)
- CINEMA
- COMMUNITY
- HEALTH CENTRE
- HOTEL
- MANAGEMENT OFFICE
- OFFICE
- REFUSE STORE
- RETAIL

Revision description	Date	Check	Rev
SCENARIO 2 DESIGN FREEZE	09/08/17	BJ	A
SCENARIO 1 BASELINE SCHEME	26/07/17	BJ	-

SQUIRE & PARTNERS

The Department Store
248 Ferndale Road London SW9 8FR
T: 020 7278 5555 F: 020 7239 0495

info@squireandpartners.com
www.squireandpartners.com

Project
Stag Brewery
Richmond

Drawing
PHASE 01 PLAN
GROUND LEVEL

Drawn	Date	Scale
TF	09/08/17	1 : 500 @ A1 1 : 1000 @ A3

Job Number	Drawing number	Revision
16019	G100_P1_P_00_001	A

HL CAR PARK VENT MARK-UPS
JR/NF - 05. Sep. '17

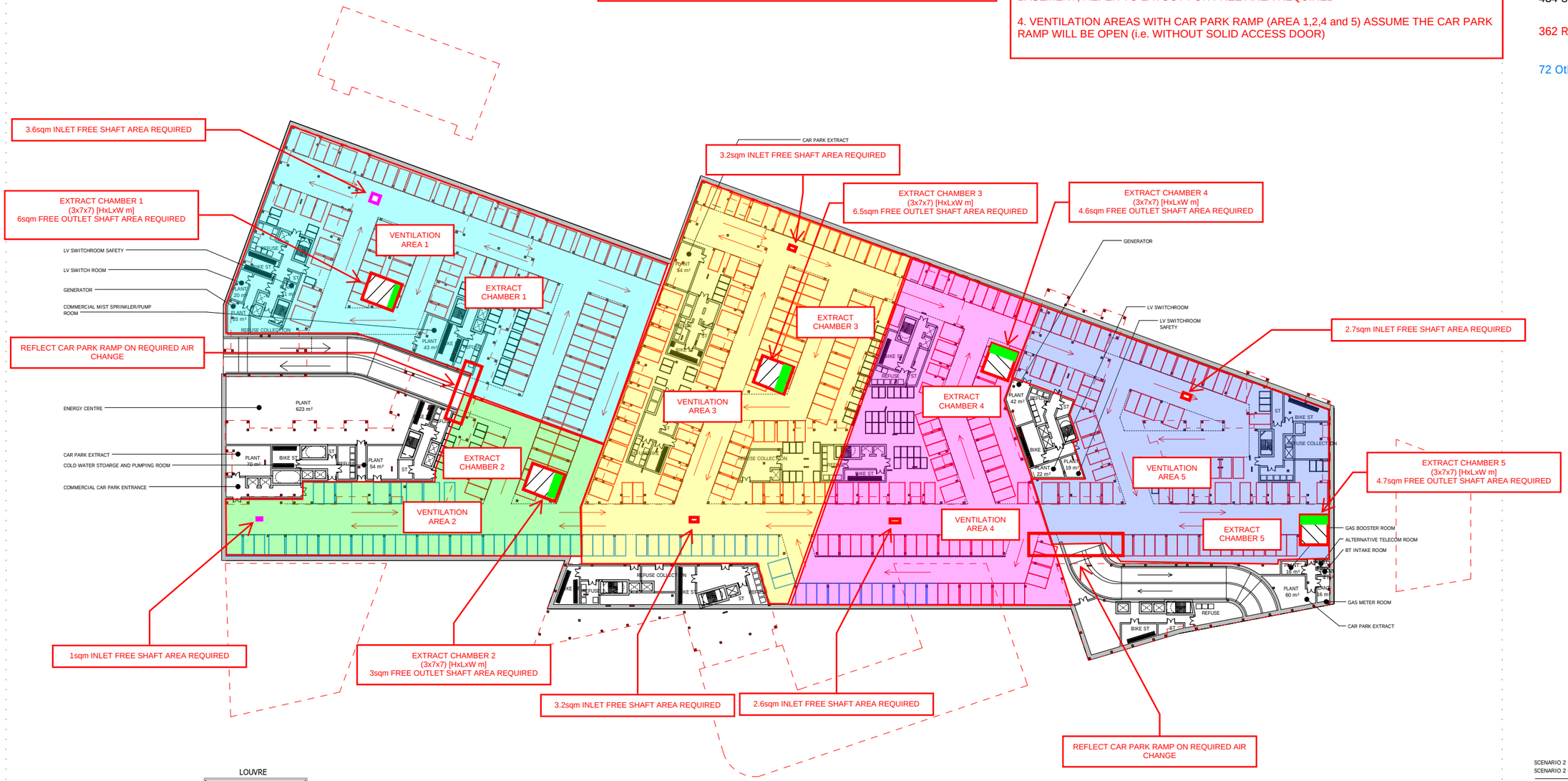
HL NOTES:

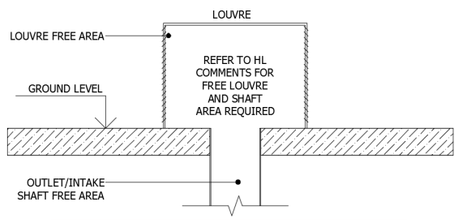
1. MAXIMUM AREA COVERED BY ONE CARPARK EXTRACT CHAMBER IS 4000sqm AND IS PROPOSED TO BE (3x7x7) [HxLxW m].

2. CAR PARK EXTRACT CHAMBER TO BE LOCATED IN POSITION ADJECANT TO CENTER OF SERVED AREA

3. ADDITIONAL CAR PARK AIR INLETS IN SOFFIT/LANDSCAPPING TO BE LOCATED ABOVE BASEMENT, REFER TO LAYOUT FOR FREE AREA REQUIRED

4. VENTILATION AREAS WITH CAR PARK RAMP (AREA 1,2,4 and 5) ASSUME THE CAR PARK RAMP WILL BE OPEN (i.e. WITHOUT SOLID ACCESS DOOR)





REFERENCE FOR FREE SHAFT AND FREE LOUVRE AREA

434 Spaces

362 Residential Spaces for 482 units

72 Other Spaces

Revision description	Date	Check	Rev
SCENARIO 2 DESIGN FREEXE	11/08/17	BJ	A
SCENARIO 2 OPTIMISED SCHEME	31/07/17	BJ	-

SQUIRE & PARTNERS

The Department Store
248 Ferndale Road London SW9 8FR
T: 020 7278 5555 F: 020 7239 0495

info@squireandpartners.com
www.squireandpartners.com

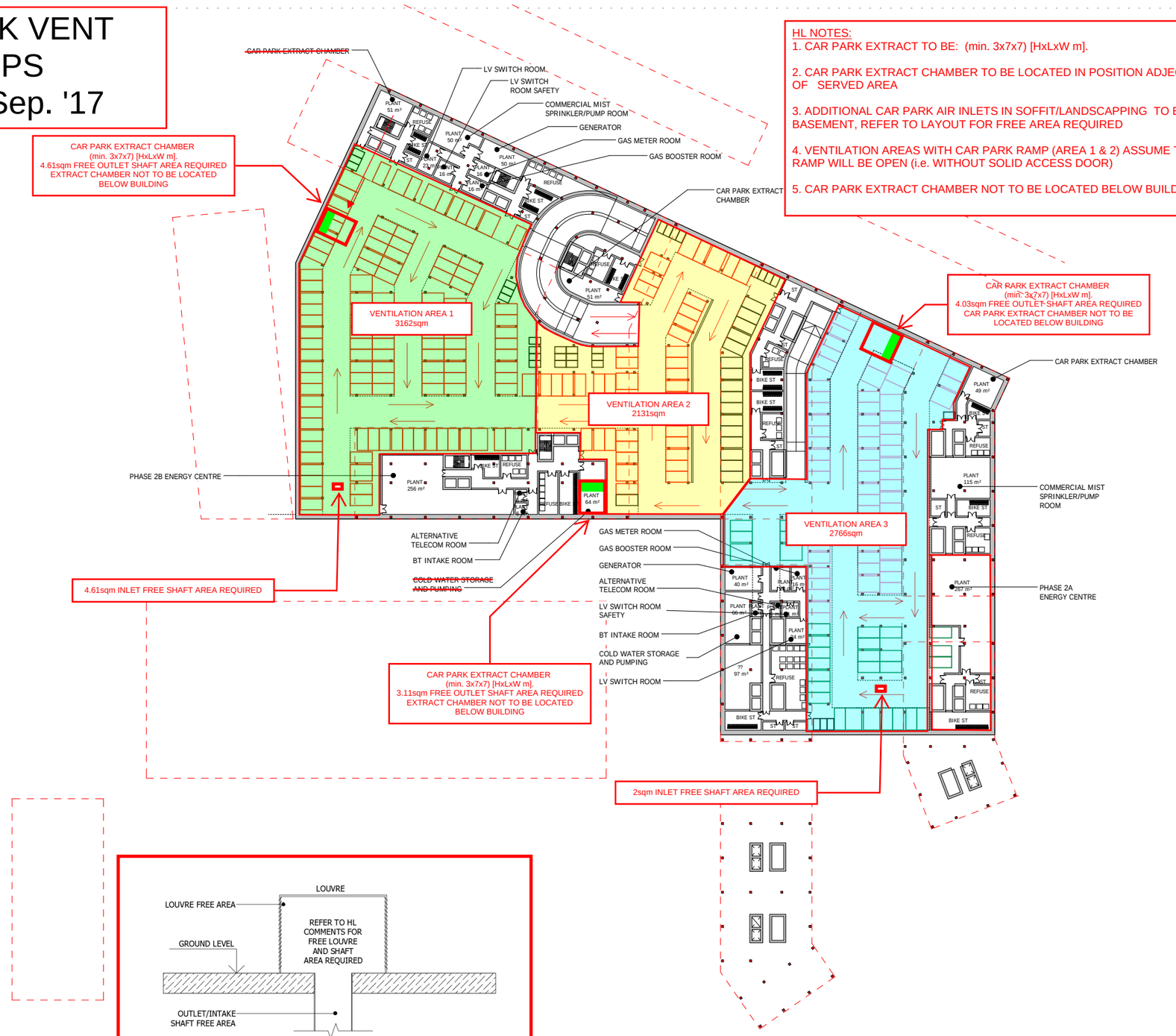
Project
Stag Brewery
Richmond

Drawing
PHASE 01 BASEMENT PLAN

Drawn	Date	Scale
RKL	10/13/16	1 : 500 @ A1 1 : 1000 @ A3

Job Number	Drawing number	Revision
16019	G200_P1_P_-01_001	A

HL CAR PARK VENT MARK-UPS
JR/NF - 22. Sep. '17



REFERENCE FOR FREE SHAFT AND FREE LOUVRE AREA

HL NOTES:

1. CAR PARK EXTRACT TO BE: (min. 3x7x7) [HxLxW m].
2. CAR PARK EXTRACT CHAMBER TO BE LOCATED IN POSITION ADJECANT TO CENTER OF SERVED AREA
3. ADDITIONAL CAR PARK AIR INLETS IN SOFFIT/LANDSCAPPING TO BE LOCATED ABOVE BASEMENT, REFER TO LAYOUT FOR FREE AREA REQUIRED
4. VENTILATION AREAS WITH CAR PARK RAMP (AREA 1 & 2) ASSUME THE CAR PARK RAMP WILL BE OPEN (i.e. WITHOUT SOLID ACCESS DOOR)
5. CAR PARK EXTRACT CHAMBER NOT TO BE LOCATED BELOW BUILDINGS

NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.

30 C2/Health Centre spaces

63 Assisted Living spaces

158 Residential spaces for 210 units

17 Extra spaces

31 Motorbike spaces

Revision description	Date	Check	Rev
SCENARIO 2 DESIGN FREEXE	11/08/17	BJ	A
SCENARIO 2 OPTIMISED SCHEME	31/07/17	BJ	-

SQUIRE & PARTNERS

The Department Store
248 Ferndale Road London SW9 8FR
T: 020 7278 5555 F: 020 7239 0495

info@squireandpartners.com
www.squireandpartners.com

Project

Stag Brewery
Richmond

Drawing

PHASE 02 BASEMENT PLAN
SCENARIO 2

Drawn	Date	Scale
RKL	01/08/17	1 : 500 @ A1 1 : 1000 @ A3

Job Number	Drawing number	Revision
16019	G200_P2_P_-01_002	A

HL CAR PARK VENT MARK-UPS
JR/NF - 22. Sep. '17

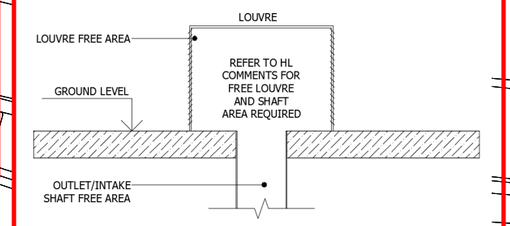
HL NOTES:
1. CAR PARK EXTRACT TO BE: (min. 3x7x7) [HxLxW m].

2. CAR PARK EXTRACT CHAMBER TO BE LOCATED IN POSITION ADJECANT TO CENTER OF SERVED AREA

3. ADDITIONAL CAR PARK AIR INLETS IN SOFFIT/LANDSCAPPING TO BE LOCATED ABOVE BASEMENT, REFER TO LAYOUT FOR FREE AREA REQUIRED

4. VENTILATION AREAS WITH CAR PARK RAMP (AREA 2 & 3) ASSUME THE CAR PARK RAMP WILL BE OPEN (i.e. WITHOUT SOLID ACCESS DOOR)

5. CAR PARK EXTRACT CHAMBER NOT TO BE LOCATED BELOW BUILDINGS



REFERENCE FOR FREE SHAFT AND FREE LOUVRE AREA

EXTRACT OUTLET VENT AREA 1
4.61sqm FREE OUTLET SHAFT AREA REQUIRED

EXTRACT OUTLET VENT AREA 2
3.11 sqm FREE OUTLET SHAFT AREA REQUIRED

EXTRACT OUTLET FOR VENT AREA 3
4.03sqm FREE OUTLET SHAFT AREA REQUIRED

9.22 sqm FREE LOUVRE AREA REQUIRED

4.61 sqm FREE LOUVRE AREA REQUIRED

8.07 sqm FREE LOUVRE AREA REQUIRED

6.22 sqm FREE LOUVRE AREA REQUIRED

9.22sqm INLET FREE SHAFT AREA REQUIRED

4 sqm FREE LOUVRE AREA REQUIRED

2sqm INLET FREE SHAFT AREA REQUIRED

BLOCK 01
BLOCK 02
BLOCK 03
BLOCK 04
BLOCK 05
BLOCK 06
BLOCK 07
BLOCK 08
BLOCK 09
BLOCK 10
BLOCK 11
BLOCK 12
BLOCK 13
BLOCK 14
BLOCK 15
BLOCK 16
BLOCK 17
BLOCK 19
BLOCK 20
BLOCK 21
BLOCK 22
BLOCK 23

NOTES:

DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE. ALL OMISSIONS AND DISCREPANCIES TO BE REPORTED TO THE ARCHITECT IMMEDIATELY.

- 1 BED
- 1 BED (L)
- 1 BED (S)
- 2 BED
- 2 BED (L)
- 2 BED (M)
- 2 BED (S)
- 3 BED
- 3 BED (H)
- 3 BED (L)
- 3 BED (S)
- 4 BED (H)
- CINEMA
- COMMUNITY
- HEALTH CENTRE
- HOTEL
- MANAGEMENT OFFICE
- OFFICE
- REFUSE STORE
- RETAIL
- SCHOOL

Revision description	Date	Check	Rev
SCENARIO 2 DESIGN FREEZE	09/08/17	BJ	A
SCENARIO 1 BASELINE SCHEME	26/07/17	BJ	-

SQUIRE & PARTNERS

77 Wicklow Street London WC1X 9JY
T: 020 7278 5555 F: 020 7239 0495

info@squireandpartners.com
www.squireandpartners.com

Project
Stag Brewery
Richmond

Drawing
Site Plan
Ground

Drawn	Date	Scale
TC	09/08/17	1 : 1250 @ A1 1 : 2500 @ A3

Job Number	Drawing number	Revision
16019	G100_P_00_001	A

Stag Brewery - estimated boiler/CHP operating profile - Phase A

	CHP(1)			CHP(2)			CHP(3)			Boilers 01			Boiler02			Boiler03			Boiler04			Boiler05			Boiler06		
	CHP_Winter	CHP_Mid	CHP_Summer	CHP_Winter	CHP_Mid	CHP_Summer	CHP_Winter	CHP_Mid	CHP_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winte	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winte	Boiler_Mid	Boiler_Summ
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	0	0
8	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0	0	0
9	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0.25	0	0
10	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0.25	0	0
11	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	1	0
12	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	0	0
17	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	0	0
18	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0.25	0	0
19	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0.25	0	0
20	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0	0	0	0
21	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Stag Brewery - estimated boiler/CHP operating profile - Phase B

	CHP(1)			CHP(2)			CHP(3)			Boilers 01			Boiler02			Boiler03			Boiler04			Boiler05		
	CHP_Winter	CHP_Mid	CHP_Summer	CHP_Winter	CHP_Mid	CHP_Summer	CHP_Winter	CHP_Mid	CHP_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winte	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer	Boiler_Winter	Boiler_Mid	Boiler_Summer
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0
8	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0
9	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0
10	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0
11	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0
12	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0
17	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0
18	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0
19	1	1	1	1	1	1	1	1	1	1	1	0.75	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0
20	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0.25	0	0
21	1	1	1	1	1	1	1	1	1	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	1	1	0	1	0.5	0	1	0	0	0.5	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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

HOARE LEA

TOM HILLS
ASSOCIATE

+44 1202 654 644
tomhills@hoarelea.com

HOARELEA.COM

Enterprise House
Old School Close
Ferndown
Bournemouth
BH22 9UN
England