

Jollibee
81 Broad Street
Reading
RG1 2AP

Plant Noise
Impact Assessment

On behalf of

BEE WORLD UK LIMITED

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1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned by Bee World UK Limited to undertake a noise impact assessment for new plant serving the proposed Jollibee restaurant at 81 Broad Street, Reading.
- 1.2. An environmental sound survey has been undertaken to establish the prevailing background sound pressure levels at a location representative of the sound levels outside the nearest noise sensitive receptors to the site.
- 1.3. Cumulative plant noise emission levels for the proposed plant have been predicted at the most affected noise sensitive receptors and assessed following the Reading Borough Council's usual requirements.
- 1.4. To assist with the understanding of this report a glossary of acoustic terms can be found in [Appendix A](#). An in-depth glossary of acoustic terms can be viewed online at www.acoustic-glossary.co.uk.

2.0 Details of development proposals

- 2.1. The proposed Jollibee restaurant will occupy the currently-vacant unit at 81 Broad Street, Reading.
- 2.2. Plant is to be located on the roof of the building and is to comprise a supply air handling unit (AHU), kitchen extract, general extract, three air conditioning (AC) condensers and two catering condensers.
- 2.3. The kitchen extract fan will be enclosed within an acoustic enclosure providing at least 15dB of attenuation. The AHU and kitchen extract fans will be fitted with suitable in-duct attenuators.
- 2.4. All plant will operate when the restaurant is trading. Proposed opening hours are 09.00 hours to midnight, daily. Only the catering condensers will operate outside of the opening hours.
- 2.5. [Appendix B](#) contains a table with the manufacturer's published sound pressure levels for the proposed plant.

3.0 Nearest noise sensitive receptors

- 3.1. The area surrounding the site is predominantly commercial in use and many of the neighbouring properties have significant numbers of plant items serving them.

- 3.2. The nearest residential properties are understood to be flats above 83 Broad Street (Receptor R1), approximately 14m from the roof plant area but screened from it by the intervening building geometry. Flats above shops along St Mary's Butts (Receptor R2) are approximately 23m from the roof plant and may have a view of some plant items.
- 3.3. An aerial view showing the site and surrounding area, the nearest noise sensitive properties and noise monitoring location used in this assessment is presented in [Appendix C](#).

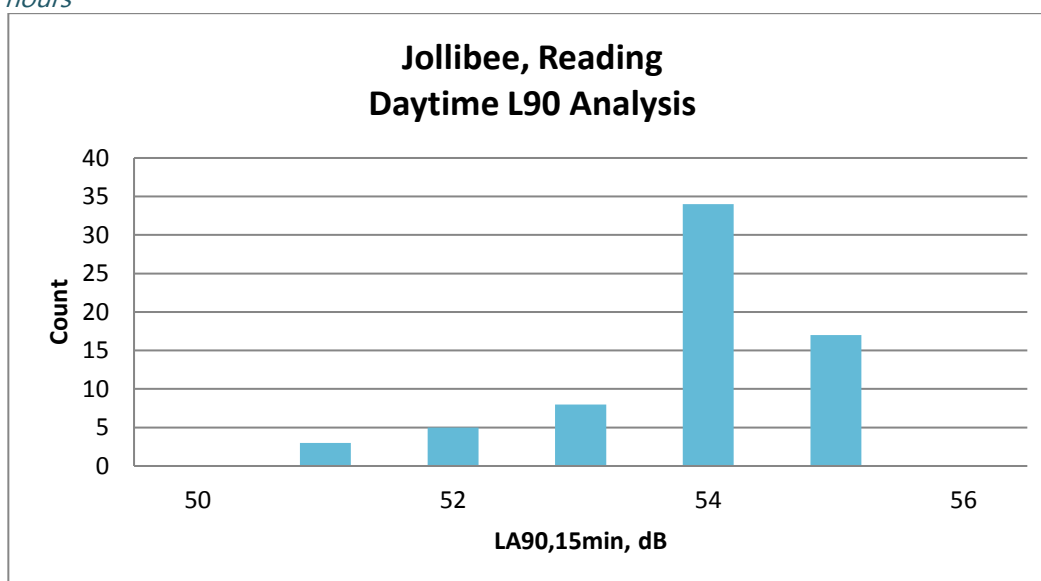
4.0 Existing noise climate

- 4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate.
- 4.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in [Appendix D](#).

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	L _{Aeq} (5mins)	L _{Amax} (5mins)	L _{A10} (5mins)	L _{A90} (5mins)
Proposed plant operating hours (09.00 hours – midnight)	52-58	59-78	52-59	51-55
Plant off (midnight to 09.00 hours)	51-58	56-81	51-59	50-55

Figure 1 Histogram of L_{A90} background sound pressure levels during proposed plant operating hours



- 4.3. Additional statistical analysis has been undertaken. As shown in Table 2, the mean, median, and modal values have been calculated:

Table 2 Statistical analysis of $L_{A90,5min}$ levels during the proposed plant operating period

dB, L_{A90} 09.00 hours - midnight	
Mean	54
Modal	54
Median	54

- 4.4. From review of the histogram in Figure 1 it is considered that the lowest-measured background sound level of 51 dB(A) is a robust representation of the background sound level outside the nearest premises, during restaurant operating hours.
- 4.5. To provide a robust assessment at night, when only the catering condensers will operate, the lowest-measured background sound level of 50dB L_{A90} is considered to be representative.

5.0 Plant noise design criteria

Reading Borough Council

- 5.1. For similar applications for fixed plant, Reading Borough Council usually applies the following Condition:

The rating level of the plant / equipment hereby approved, $L_{Ar,Tr}$ (specific sound level plus any adjustment for the characteristic features of the sound) as measured at a point 1 metre external to sensitive facades, shall be at least 10 dB below the existing background sound level, $L_{A90,T}$ when all plant/equipment (or any part of it) is in operation.

Reason: To safeguard the amenities of the adjoining premises and the area generally, in accordance with Policy CS34 of the Reading Borough LDF Core Strategy 2008 (Altered 2015) and Policy DM4 of the Reading Borough LDF Sites and Detailed Policies Document 2012 (Altered 2015).

- 5.2. The reference to "rating" and " $L_{Ar,Tr}$ " implies that the assessment is to be made using the methodology set out in BS 4142:2014.

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

- 5.3. BS 4142:2014 is intended to be used to assess the likely effects of sound on people residing in nearby dwellings. The scope of BS 4142:2014 includes "sound from fixed plant installations which comprise mechanical and electrical plant and equipment".
- 5.4. The procedure contained in BS 4142:2014 is to quantify the "*specific sound level*", which is the measured or predicted level of sound from the source in question over a one hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.
- 5.5. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements, but notes that it is acceptable to subjectively determine these effects.
- 5.6. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: "Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."
- 5.7. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: "Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."
- 5.8. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:
- *Typically, the greater this difference, the greater the magnitude of the impact.*
 - *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
 - *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;*
 - *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*

- 5.9. The standard does state that “adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.”
- 5.10. The standard goes on to note that: “Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.”
- 5.11. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:
- “An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.”
- 5.12. BS 4142:2014 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Summary of criteria

- 5.13. In accordance with Reading Borough Council’s usual requirements it is proposed that the rating noise level of the new plant, at 1m from the façade of the nearest noise-sensitive residential receptor, is at least 10dBA below pre-existing representative background sound level. The proposed plant noise limits are shown in Table 3.

Table 3 Proposed plant noise emissions level limits at nearest receptor

Period	Cumulative plant rating level, dB(A)
All plant operating (09.00 hrs to midnight)	41
All other times (midnight to 09.00 hours)	40

- 5.14. It should be noted that the above is significantly below the level at which BS 4142:2014 predicts there would be a “low impact”

6.0 Plant noise impact assessment

- 6.1. The cumulative plant noise levels at the nearest noise sensitive receptors have been predicted. The assessment has considered attenuation, directivity, any screening between source and receivers and distance attenuation. The predictions during the proposed operating period (09.00 hours to midnight) have been based on the proposed plant all operating at full capacity. Predictions outside of opening hours are based on only the catering condensers operating.
- 6.2. The predictions are inclusive of the insertion losses due to the acoustic enclosure surrounding the kitchen extract fan. Predictions are also inclusive of the following atmospheric-sided silences fitted to the fans:

Table 4 Proposed atmospheric side attenuators to ventilation systems

Attenuator	Insertion losses dB, at octave band centre frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Supply intake AHU	6	12	24	34	40	33	26	17
Kitchen extract EF1	5	9	16	25	31	28	22	15

- 6.3. It should be noted that all proposed plant is high-quality and no impulsive characteristics are anticipated provided the equipment is well maintained. All plant items are inverter driven, which means the fans gently ramp to cope with system demands. As a result, the plant items are not considered to operate intermittently. Although 1/3 octave band data is not available from the unit manufacturers to assess tonality, experience of comparable plant operating at other similar sites indicates that no tonal components are present.
- 6.4. In view of the above, and since the noise-environment of the area is dominated by noise from existing similar plant serving other premises, it is considered inappropriate to apply a BS 4142:2014 feature correction to derive the rating level.
- 6.5. Table 5 summarises the results of the assessment at the most affected properties. All other nearby receptors benefit from increased distance/screening to the plant such that resulting noise levels will be lower than at the receptors considered. The full set of calculations can be found in [Appendix E](#).

Table 5 Assessment of predicted noise levels at the nearest noise sensitive receptors

Receptor	Period	Predicted sound level at receptor, L_{Aeq} (dB)	Design criterion (dB(A))	Difference (dB)
R1. Residential	Proposed operating hours (09.00 hours – midnight)	40	41	-1
	All other times (midnight to 09.00 hours)	26	40	-14
R2. Residential	Proposed operating hours (09.00 hours – midnight)	40	41	-1
	All other times (midnight to 09.00 hours)	26	40	-14

- 6.6. The noise level predictions demonstrate that cumulative noise emissions from the proposed plant will comply with the proposed limits at the nearest overlooking window.

Context and uncertainties

- 6.7. Where possible uncertainty in the above assessments has been minimised by taking the following steps:
- The meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
 - Uncertainty in the calculated impacts has been reduced by the use of a well-established calculation method.
 - Care was taken to ensure that the measurement positions were representative of the noise climate outside the nearby noise sensitive receptors and not in positions where higher noise levels were present.
- 6.8. As BS 4142:2014 advises, the impact must be considered within the context of the site and the surrounding acoustic environment. The following must, therefore, also be taken into consideration when determining the potential impact that may be experienced:
- The assessment is undertaken at the nearest residential windows. The impact on all other nearby windows will be lower due to screening and distance attenuation.

- The site is located within a busy commercial area. Many of these premises will have existing building services plant and, therefore, noise emitted from the restaurant will be in keeping with the existing noise climate.
- It should be noted that the above assessment is based on all plant operating at maximum duty. Given that the plant will not operate at maximum design duty all of the time the above assessment is considered to be representative of the worst case.

Vibration isolation

- 6.9. To control plant vibration into the building structure it is recommended that all plant is installed on suitable anti-vibration mounts providing an isolation efficiency of at least 95%.

7.0 Summary

- 7.1. Noise Solutions Ltd has been commissioned by Bee World UK Limited to undertake a noise impact assessment for new plant serving the proposed Jollibee restaurant at 81 Broad Street, Reading.
- 7.2. An environmental noise survey has been undertaken to establish the existing prevailing noise levels at locations representative of the noise climate outside the nearest noise sensitive receptors to the proposed plant area.
- 7.3. The cumulative plant noise emission levels for the proposed plant (incorporating noise control measures) have been predicted at the most affect noise sensitive receptor location and assessed taking into consideration Reading Borough Council's usual requirements. Therefore, the plant proposals should not be a reason for refusal of planning permission.

Appendix A Acoustic terminology

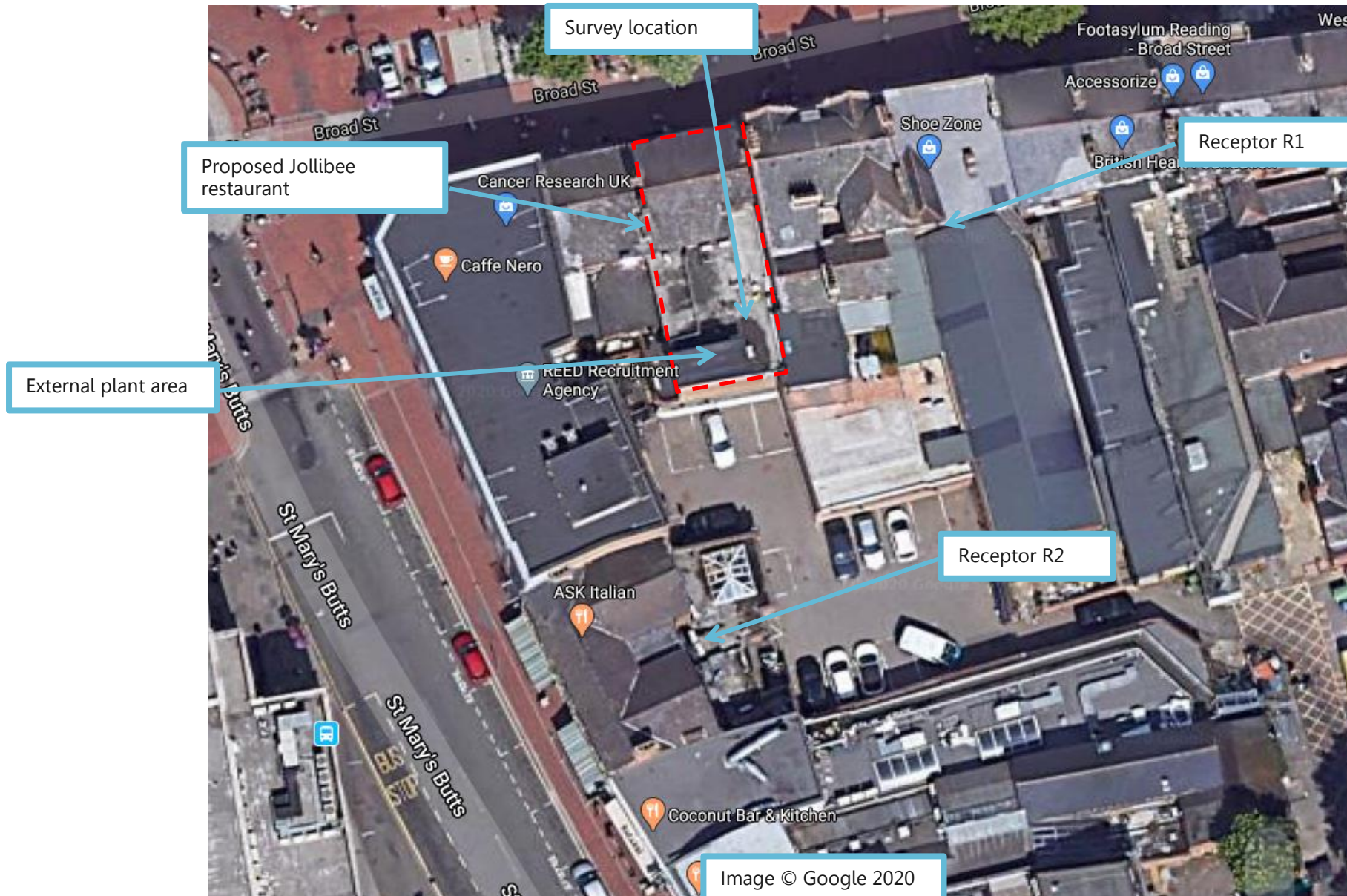
Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A-weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level that is exceeded for 90% of the measurement time interval, T. It gives an indication of the lower levels of fluctuating noise. It is often used to describe the background noise level and can be considered to be the "average minimum" noise level and is a term used to describe the level to which non-specific noise falls during quiet spells, when there is lull in passing traffic for example

Appendix B Plant information and manufacturer published sound pressure levels

Plant Reference	Unit/Model	No. of units	Description	Sound power level (dB) at octave band centre frequencies (Hz)								dBA (dB)
				63	125	250	500	1k	2k	4k	8k	
Kitchen Extract Fan (EF1)	Flakts Woods / Estoc Targe 80-630-3	1	Discharge L _w	117	97	91	88	84	81	76	70	
			Casing L _w	100	82	76	69	65	64	60	56	
Supply Air Fan (AHU)	Flakts Woods / Powerbox Estoc 80-630-3	1	Intake L _w	80*	87	80	78	73	72	69	66	
			Casing L _w	80*	83	74	59	54	51	47	44	
General Extract Fan (EF2)	Systemair / K250 Sileo	1	Discharge L _w	74	78	72	64	65	63	60	53	
			Casing L _w	56	45	51	47	45	42	39	30	
Air Conditioning Condensers (CU1-CU3)	Toshiba / RAV-GM1401ATP-E	3	Sound pressure level at 1m (each)									55
Catering Condensers (CU4 & CU5)	To be confirmed (typical unit data)	2	Sound pressure level at 10m (each)									35

**estimated value from other octave band data provided*

Appendix C Aerial photograph site showing areas of interest



Appendix D Environmental sound survey

Details of sound surveys

- D.1 Measurements of the existing background sound levels were undertaken between 11.45 hours on Wednesday 11th March and 13.30 hours on Thursday 12th March 2020.
- D.2 The sound level meter was programmed to record the A-weighted L_{eq} , L_{90} , L_{10} and L_{max} noise indices for consecutive 15-minute sample periods for the duration of the noise survey.

Measurement position

- D.3 The representative measurement position was located on the roof at the rear of the premises (location indicated on the site plan in [Appendix C](#)).
- D.4 In accordance with BS 7445-2:1991 '*Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use*', the measurements were undertaken under free-field conditions.

Equipment

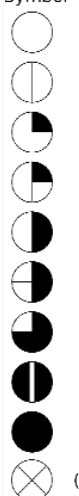
- D.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Rion NL-52 / 00876023	02/04/2019	TCRT19/1237
Condenser microphone	Rion UC-59 /14826		
Preamplifier	Rion NH-25 / 87474		
Calibrator	Rion NC-74 /34535932	24/05/2019	TCRT19/1409

Weather Conditions

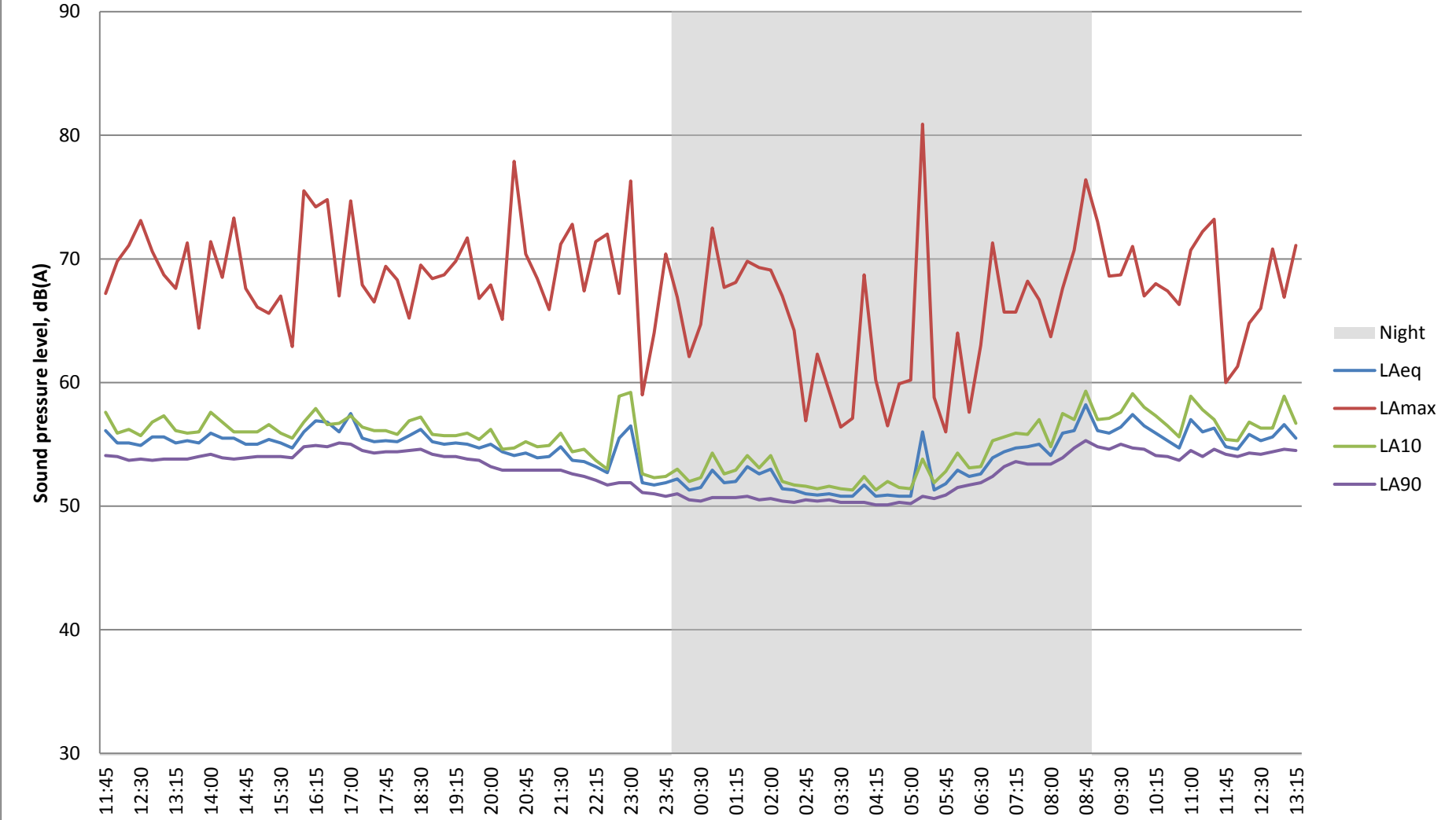
- D.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	Time/Date	Description	Beginning of Survey	End of Survey
As indicated on Appendix C	11.45 11 Mar - 13.30 12 Mar 2020	Temperature (°C)	13	10
Cloud Cover Symbol Scale in oktas (eighths)  0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	No	No
		Cloud cover (oktas - see guide)	7	7
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	3	3
		Wind Direction	N	N
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

- D.7 The results of the environmental survey are considered to be representative of the background sound pressure levels at the façades of the nearest noise sensitive receptors during the quietest times at which the plant will operate. The noise climate during the survey period was affected by services plant on neighbouring properties, with aircraft and road traffic intermittently audible. Plant currently at the site is to be replaced and was not operating during the survey. The results of the survey are presented in a time history graph overleaf.

Jollibee, Reading
Wednesday 11 - Thursday 12 Mar 2020



Appendix E Noise level predictions

Summary of predictions

Plant	Resultant at receptor (dBA)	
	R1	R2
Supply Air AHU inlet	24	19
Kitchen Extract EF1	37	39
General Extract EF2	34	26
CU1	23	23
CU2	23	23
CU3	23	23
CU4*	23	23
CU5*	23	22
Supply Air AHU Breakout	33	29
Kitchen Extract Breakout	25	26
General Extract Breakout	13	15
Opening Hours Cumulative	40	40
Outside of Opening Hours Cumulative	26	26

*Note: *Plant operating outside opening hours*

Condensers

Receptor R1 – 83 Broad Street

Unit	Distance				Directivity	Screening	Result
	L _{pA}	at / m	m	dB			
CU1	55	1	14	-23	+3	-12	23
CU2	55	1	14	-23	+3	-12	23
CU3	55	1	14	-23	+3	-12	23
CU4	35	10	14	-3	+3	-12	23
CU5	35	10	14	-3	+3	-12	23

Receptor R2 – St Mary's Butts

Unit	Distance				Directivity	Screening	Result
	L _{pA}	at / m	m	dB			
CU1	55	1	30	-30	+3	-5	23
CU2	55	1	31	-30	+3	-5	23
CU3	55	1	32	-30	+3	-5	23
CU4	35	10	33	-10	+3	-5	23
CU5	35	10	34	-11	+3	-5	22

Supply Air AHU

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	In-duct L _w	80	87	80	78	73	72	69	66	80
System losses		-6	-2	0	0	0	0	0	0	
Atmospheric side attenuator		-5	-9	-16	-25	-31	-28	-22	-15	
Sound power level leaving terminal		69	76	64	53	42	44	47	51	62

Receptor R1 – 83 Broad Street

Directivity correction	(90,45)	-1	0	-1	-1	-6	-9	-9	-9	
Distance correction	15m	-32	-32	-32	-32	-32	-32	-32	-32	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant at Receptor R1	L_p	31	39	26	15	-1	-2	1	5	24

Receptor R2 – St Mary's Butts

Directivity correction	(90,45)	-1	0	-1	-1	-6	-9	-9	-9	
Distance correction	28m	-37	-37	-37	-37	-37	-37	-37	-37	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant at Receptor R2	L_p	26	34	21	10	-6	-7	-4	0	19

Supply Fan AHU Breakout

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	L _w	80	83	74	59	54	51	47	44	70

Receptor R1 – 83 Broad Street

Distance correction	16m	-32	-32	-32	-32	-32	-32	-32	-32	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant at Receptor R1	L_p	43	46	37	22	17	14	10	7	33

Receptor R2 – St Mary's Butts

Distance correction	25m	-36	-36	-36	-36	-36	-36	-36	-36	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant at Receptor R2	L_p	39	42	33	18	13	10	6	3	29

Kitchen Extract Exhaust

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	In-duct L _w	117	97	91	88	84	81	76	70	94
System losses		-9	-4	-1	-2	-3	-4	-3	-3	
Atmospheric side attenuator		-6	-12	-24	-34	-40	-33	-26	-17	
Sound power level leaving terminal		102	81	66	52	41	44	47	50	76

Receptor R1 – 83 Broad Street

Directivity correction	(90,45)	-1	0	-1	-1	-6	-9	-9	-9	
Distance correction	17m	-33	-33	-33	-33	-33	-33	-33	-33	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant at Receptor R1	L_p	63	43	27	13	-3	-3	0	3	37

Receptor R2 – St Mary's Butts

Directivity correction	(90,45)	-1	0	-1	-1	-6	-9	-9	-9	
Distance correction	25m	-36	-36	-36	-36	-36	-36	-36	-36	
Screening correction		0	0	0	0	0	0	0	0	
Resultant at Receptor R2	L_p	65	45	29	15	-1	-1	2	5	39

Kitchen Extract Fan Breakout

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	L _w	100	82	76	69	65	64	60	56	77
Acoustic Enclosure losses		-15	-15	-15	-15	-15	-15	-15	-15	
Attenuated source noise level		85	67	61	54	50	49	45	41	62

Receptor R1 – 83 Broad Street

Distance correction	16m	-32	-32	-32	-32	-32	-32	-32	-32	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant at Receptor R1	L_p	48	30	24	17	13	12	8	4	25

Receptor R2 – St Mary's Butts

Distance correction	24m	-36	-36	-36	-36	-36	-36	-36	-36	
Screening correction		0	0	0	0	0	0	0	0	
Resultant at Receptor R2	L_p	49	31	25	18	14	13	9	5	26

General Extract Exhaust

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	In-duct L _w	74	78	72	64	65	63	60	53	71
System losses		-13	-9	-5	-1	0	0	0	0	
Sound power level leaving terminal		61	69	67	63	65	63	60	53	70

Receptor R1 – 83 Broad Street

Directivity correction	(45,45)	0	1	1	2	2	2	2	2	
Distance correction	16m	-32	-32	-32	-32	-32	-32	-32	-32	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant at Receptor R1	L_p	24	33	31	28	30	28	25	18	34

Receptor R2 – St Mary's Butts

Directivity correction	(45,135)	-2	-2	-4	-7	-10	-10	-10	-10	
Distance correction	23m	-35	-35	-35	-35	-35	-35	-35	-35	
Screening correction		0	0	0	0	0	0	0	0	
Resultant at Receptor R2	L_p	24	32	28	21	20	18	15	8	26

General Extract Fan Breakout

Description	Notes.	Sound level (dB) at octave band centre frequencies (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Source noise level (unattenuated)	L _w	56	45	51	47	45	42	39	30	50

Receptor R1 – 83 Broad Street

Distance correction	16m	-32	-32	-32	-32	-32	-32	-32	-32	
Screening correction		-5	-5	-5	-5	-5	-5	-5	-5	
Resultant at Receptor R1	L_p	19	8	14	10	8	5	2	-7	13

Receptor R2 – St Mary's Butts

Distance correction	23m	-35	-35	-35	-35	-35	-35	-35	-35	
Screening correction		0	0	0	0	0	0	0	0	
Resultant at Receptor R2	L_p	21	10	16	12	10	7	4	-5	15

Appendix F Proposed plant layout

Roof plant area

