

Sainsbury's Local
Brunel House
Station Road
Reading
RG1 1LG

**Plant Noise
Impact Assessment**

On behalf of

Sainsbury's

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For and on behalf of Noise Solutions Ltd				

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1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned by Sainsbury's to provide a noise impact assessment for plant serving a proposed Sainsbury's store located at Brunel House on Station Road in 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. Plant noise levels have been predicted at the nearest noise-sensitive premises and assessed against the requirements of Condition 4 of the Decision Notice (PL/24/0762).
- 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 store is to occupy the ground and basement floor a multi-storey commercial building located on Station Road, Reading.
- 2.2. The plant is to comprise of a gas cooler, a pack, and 3No air conditioning (AC) units.
- 2.3. It is understood that the proposed refrigeration plant (gas cooler and pack) is to be located in an internal plant room on the northern side of the store. Airflow will be maintained to the plant room via a louvre, which is to be fitted with atmospheric-side attenuation internally.
- 2.4. The proposed AC units are to be located externally within a basement undercroft.
- 2.5. All proposed plant and associated pipework/ductwork is to be fitted with suitably rated anti-vibration mounts in order to minimise structure-borne sound transmission to adjoining properties.
- 2.6. The proposed refrigeration plant will potentially operate 24 hours a day, although it should be noted that these units operate as required to meet demand and generally at a reduced capacity at night. The ACUs will only operate during the daytime period.

3.0 Nearest noise sensitive receptors

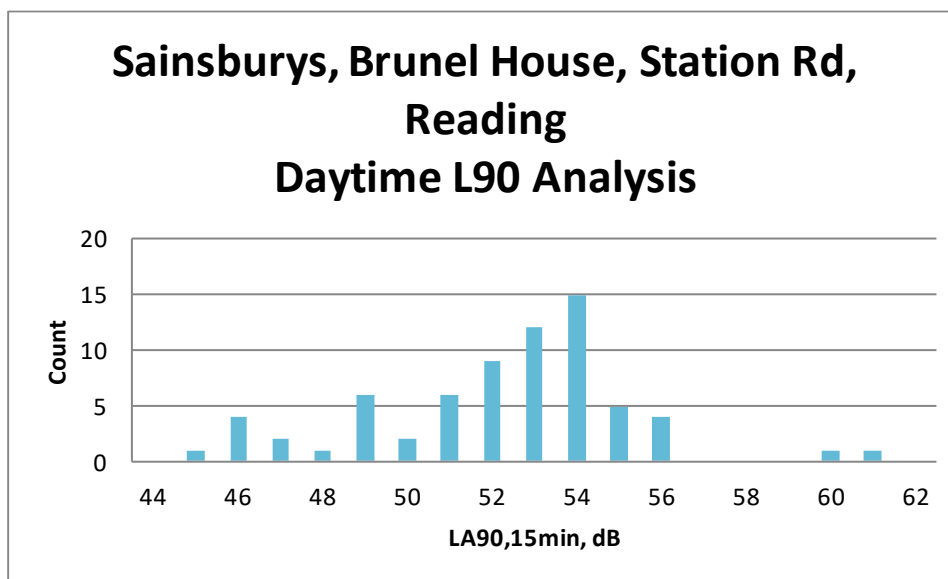
- 3.1. The nearest noise sensitive premises are residential flats (Receptor R1) and serviced apartments (Receptor R2) located to the rear of the site. Windows of these properties are around 11m away from the proposed louvres with direct line of sight.
- 3.2. Additionally, there are offices above (Receptor R3) the proposed store, approximately 3m from the plant room louvres.
- 3.3. A site plan showing the site and surrounding area, the nearest noise sensitive properties and noise monitoring location used in this assessment is presented in [Appendix B](#).

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 *Summary of survey results*

Measurement period	Range of recorded sound pressure levels (dB)			
	L _{Aeq} (15mins)	L _{AFmax} (15mins)	L _{A10} (15mins)	L _{A90} (15mins)
Daytime (07.00 – 23.00 hours)	53-70	67-94	57-75	45-61
Night-time (23.00 – 07.00 hours)	42-60	57-83	42-60	37-48

Figure 1 Histogram of daytime L_{A90} background sound pressure levels



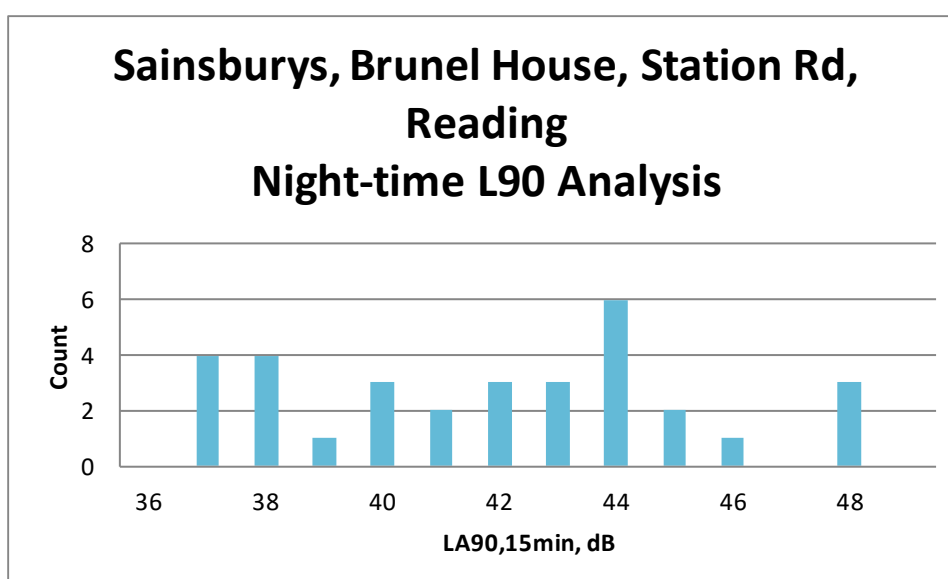
- 4.3. Further statistical analysis has been carried out on the data, and the mean and median values are shown in Table 2 below.

Table 2 Statistical analysis of $L_{A90,15min}$ levels during the daytime period

dB, L_{A90} daytime period	
mean	52
modal	54
median	53

- 4.4. In order to be robust, 48dB has been selected to be representative of the background noise level during the daytime period.

Figure 2 Histogram of night-time L_{A90} background sound pressure levels



- 4.5. Further statistical analysis has been carried out on the data and the mean and median values are shown in Table 3 below.

Table 3 Statistical analysis of LA90,15min levels during the night-time period

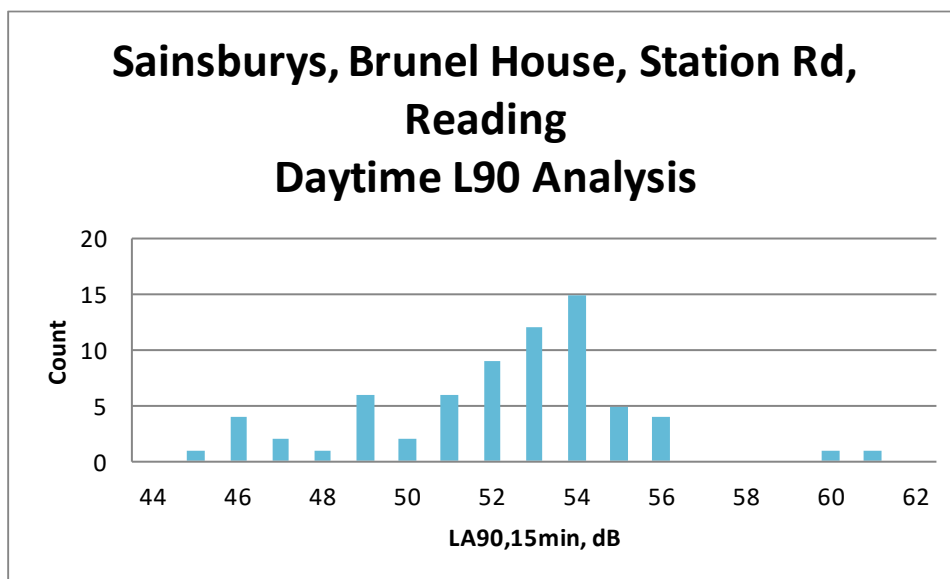
dB, LA90 night-time period	
mean	42
modal	44
median	42

- 4.6. In order to be robust, 38dB has been selected to be representative of the background sound level during the night-time period.
- 4.7. Therefore, the following values are considered representative of the existing background sound pressure levels at nearby noise sensitive premises:
- 48dB LA90 during the daytime period; and
 - 38dB LA90 during the night-time period.
- 4.8. below. The full set of measurement results and details of the survey methodology are presented in [Appendix C](#).

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	LAeq(15mins)	LAfmax(15mins)	LA10(15mins)	LA90(15mins)
Daytime (07.00 – 23.00 hours)	53-70	67-94	57-75	45-61
Night-time (23.00 – 07.00 hours)	42-60	57-83	42-60	37-48

Figure 1 Histogram of daytime L_{A90} background sound pressure levels



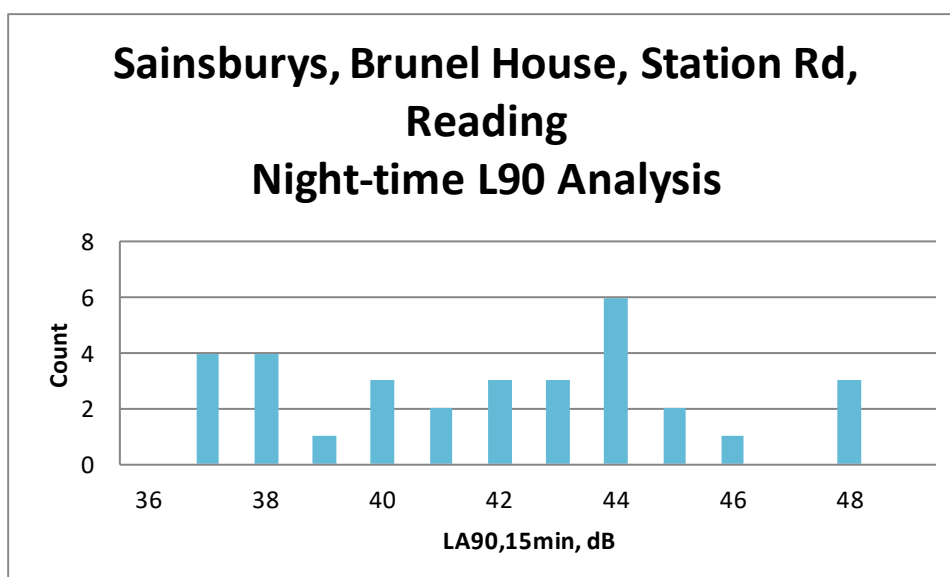
- 4.9. Further statistical analysis has been carried out on the data, and the mean and median values are shown in Table 2 below.

Table 2 Statistical analysis of $L_{A90,15min}$ levels during the daytime period

dB, L_{A90} daytime period	
mean	52
modal	54
median	53

- 4.10. In order to be robust, 48dB has been selected to be representative of the background noise level during the daytime period.

Figure 2 Histogram of night-time L_{A90} background sound pressure levels



- 4.11. Further statistical analysis has been carried out on the data and the mean and median values are shown in Table 3 below.

Table 3 Statistical analysis of LA90,15min levels during the night-time period

dB, LA90 night-time period	
mean	42
modal	44
median	42

- 4.12. In order to be robust, 38dB has been selected to be representative of the background sound level during the night-time period.
- 4.13. Therefore, the following values are considered representative of the existing background sound pressure levels at nearby noise sensitive premises:
- 48dB LA90 during the daytime period; and
 - 38dB LA90 during the night-time period.

5.0 Plant noise design criteria

Reading Borough Council

- 5.1. Condition 4 of the Decision Notice (PL/24/0762) states:

No mechanical plant shall be installed until a noise assessment of the proposed mechanical plant has been submitted and approved by the Local Planning Authority. The assessment shall be carried out for in accordance with BS4142:2014 methodology. The predicted specific sound level (LAeq,TR) (with reference to BS:4142) as measured at a point 1 metre external to the nearest noise-sensitive façade shall be at least 10dB below the pre-existing background sound level, LA90,T when all plant/equipment (or any part of it) is in operation. The predicted rating level, LAr,Tr (specific sound level plus any adjustment for the characteristic features of the sound) as measured at a point 1 metre external to the nearest noise-sensitive façade (habitable window of a dwelling) shall not exceed the pre-existing background sound level, LA90,T when all plant/equipment (or any part of it) is in operation. The plant shall thereafter only be installed in accordance with the assessment and shall thereafter be maintained so that it operates to the same standard.

BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

- 5.2. BS 4142:2014+A1:2019 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".
- 5.3. The procedure contained in BS 4142:2014+A1:2019 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.
- 5.4. 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.
- 5.5. 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."
- 5.6. 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."
- 5.7. 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.*

- 5.8. 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."
- 5.9. 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."
- 5.10. 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."

- 5.11. BS 4142:2014+A1:2019 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.

Commercial premises

- 5.12. Typically, local authorities do not consider office spaces to be as sensitive to noise as residential properties and, therefore, emissions criteria are generally relaxed at these locations.
- 5.13. It is considered appropriate to control plant noise levels to meet the recommended internal noise levels provided in BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings' for indoor amenity within office spaces. The standard states a range of noise levels for various spaces used for 'study and work requiring concentration' between 35 and 50dB L_{Aeq} .
- 5.14. BS8233 gives general guidance on the expected sound insulation performance of a given building façade, with details of how various elements can affect the overall performance. Concerning windows, it states that:

If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15dB.

- 5.15. This implies that should windows on a noise affected façade be openable, a sound insulation value of 15dB should be applied to the whole façade to an internal room being assessed. It should be noted that a sound insulation performance of much greater than 15dB is expected for non-openable standard double-glazed windows. However, in order to assess the worst-case scenario, this report assumes that windows may be opened if desired.

- 5.16. Based on the above and assuming a worst-case internal criterion of 35dB L_{Aeq}, cumulative plant noise levels at the façade of the nearest commercial premises should not exceed 50dB L_{Aeq}.

Proposed criteria

- 5.17. It should be noted that the proposed plant is not anticipated to exhibit any tonal or impulsive characteristics provided it is well maintained. All proposed plant will be inverter driven and, therefore, will gently ramp up and down depending on the demands on the various systems. The plant is also not expected to contain any significant low frequency tones, as stated in BS 4142:2014:2014. At worst, a penalty of 3dB as described in BS 4142:2014 could be applied for the possible presence of "...characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment...". Therefore, the more stringent criterion given in Condition 4 relating to specific noise levels has been adopted for this assessment.

Table 4 Plant noise emissions limits at the nearest noise sensitive receptors

Receptor	Period	Cumulative specific plant noise level, dB(A)
Residential	Daytime (07.00 – 23.00 hours)	38
	Night-time (23.00 – 07.00 hours)	28
Commercial	Daytime (07.00 – 23.00 hours)	50
	Night-time (23.00 – 07.00 hours)	--

- 5.18. The above limits have not been approved by the local authority at this stage.

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 directivity, distance and screening between the sources and receivers, and the plant room attenuators shown in Table 5.

Table 5 Proposed atmospheric side attenuators to plant room ventilation louvres

Attenuator	Insertion losses dB, at octave band centre frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Intake	12	27	44	45	45	45	45	45
Discharge	12	27	44	45	45	45	45	45

- 6.2. The predictions have been based on the AC and refrigeration plant operating at full capacity during the daytime. Only the refrigeration units have been considered during the night-time period.
- 6.3. Table 6 summarises the results of the assessment at the nearest noise sensitive receptors. 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 F](#).

Table 6 Assessment of predicted noise levels at the nearest noise sensitive receptors

Receptor	Period	Predicted noise rating level at receptor, L_{Aeq} (dB)	Criterion (dB)	Difference
R1 (residential)	Daytime (07.00 - 23.00 hours)	31	38	-7
	Night-time (23.00 - 07.00 hours)	28	28	0
R2 (residential)	Daytime (07.00 - 23.00 hours)	36	38	-2
	Night-time (23.00 - 07.00 hours)	27	28	-1
R3 (commercial)	Daytime (07.00 - 23.00 hours)	39	50	-11
	Night-time (23.00 - 07.00 hours)	36	--	--

- 6.4. The noise level predictions demonstrate that cumulative noise emissions from the proposed plant will comply with the proposed limits at the nearest noise sensitive properties, inclusive of the proposed attenuators fitted to the plant room louvers.

Context and uncertainties

- 6.5. 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 residential windows will be lower due to screening and distance attenuation.
 - The noise level predictions are based on the proposed equipment running at maximum daytime/night-time duty. The plant will not run in this manner at all times (for example, when

demands for heating/cooling are lower) and, therefore, this is a robust assessment.

6.6. 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.

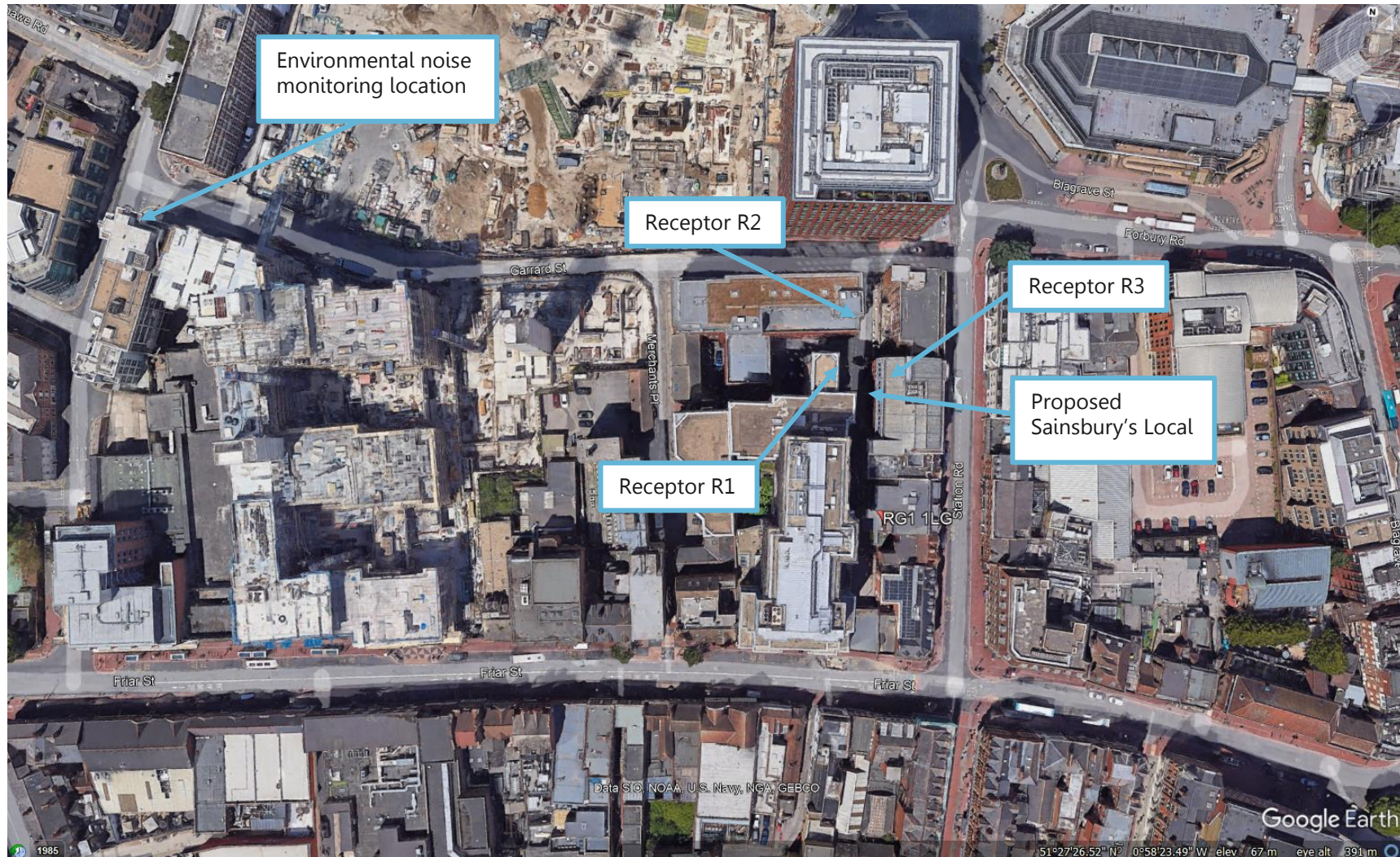
7.0 Summary

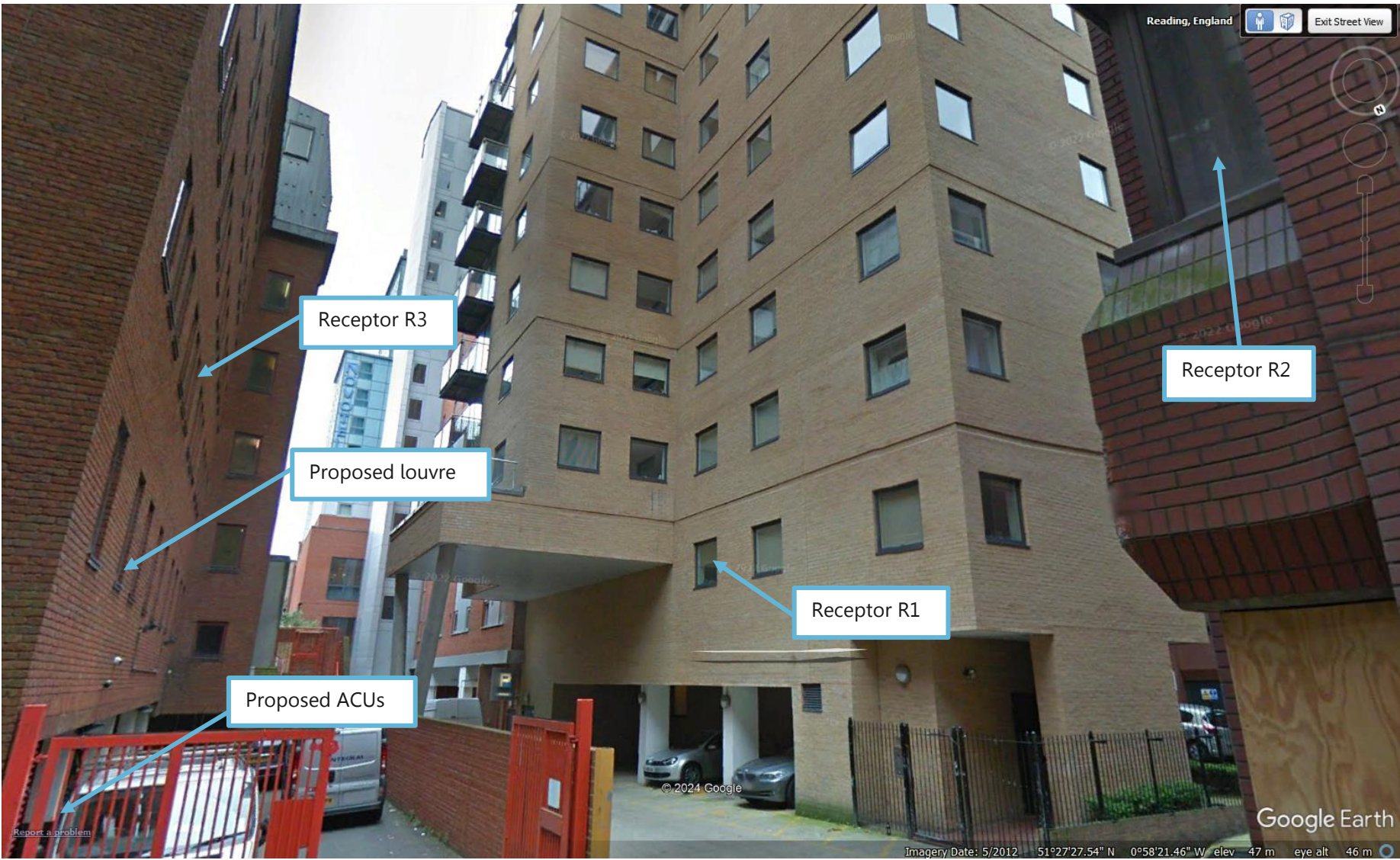
- 7.1. Noise Solutions Ltd (NSL) has been commissioned by Sainsbury's to provide a noise impact assessment for plant serving a proposed Sainsbury's store located at Brunel House on Station Road in Reading.
- 7.2. An environmental sound survey has been undertaken to establish the prevailing background sound pressure levels at a location representative of the sound levels outside the nearest noise sensitive receptor to the site.
- 7.3. Cumulative plant noise emission levels for the plant have been predicted at the most affected noise sensitive receptors and assessed against the requirements of Condition 4 of the planning decision notice.
- 7.4. The noise level predictions demonstrate that cumulative noise emissions from the plant, inclusive of suitable attenuators fitted to the plant room louvres, will comply with the proposed limits at the nearest noise sensitive properties. Noise from fixed plant should not be grounds 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 Aerial Photograph of Site and Areas of Interest





Appendix C Environmental sound survey

Details of sound surveys

- C.1 Measurements of the existing background sound levels were undertaken between 12.15 hours on Thursday 23rd May and 13.15 hours on Friday 24th May 2024.
- C.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

- C.3 The representative measurement position was located on a lamppost on Garrard Street, to the west of the proposed Sainsbury's store (location indicated on the site plan in [Appendix B](#)). The location was chosen as environmental noise levels were considered to be similar to those at the nearest receptor while avoiding noise from the existing plant at the store.
- C.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

- C.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	Svantek 977D / 99472	07/02/2024	Factory conformation certificate
Condenser microphone	Microtech MK255 / 26247		
Preamplifier	Svantek SV12L / 144643		
Calibrator	Svantek SV33B / 148015	06/03/2024	Factory conformation certificate

Weather conditions

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

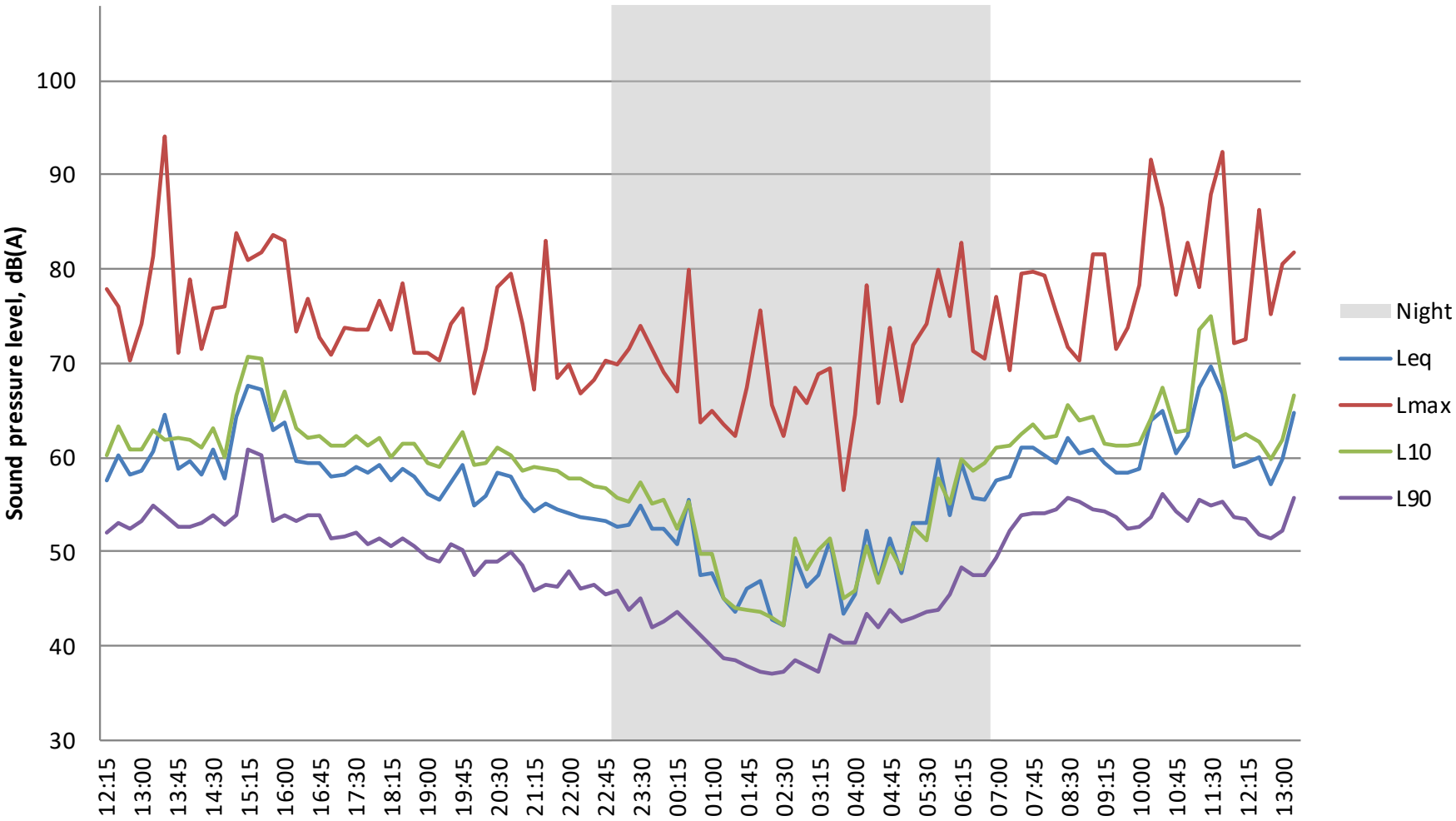
Weather Conditions				
Measurement Location	Date/Time	Description	Beginning of Survey	End of Survey
As indicated on Appendix B	12.15 23 May – 13.15 24 May 2024	Temperature (°C)	16	15
Cloud Cover Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	No	No
		Cloud cover (oktas – see guide)	7	6
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	3	2
		Wind Direction (from)	W	NW
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

- C.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 setup and collection was dominated by construction works, however, analysis of the survey data suggests the nearby construction site did not operate at night. The noise climate in the absence of construction noise was dominated by road traffic.
- C.8 The results of the survey are presented in a time history graph overleaf.

Sainsburys, Brunel House, Station Rd, Reading

Thursday 23 - Friday 24 May 2024



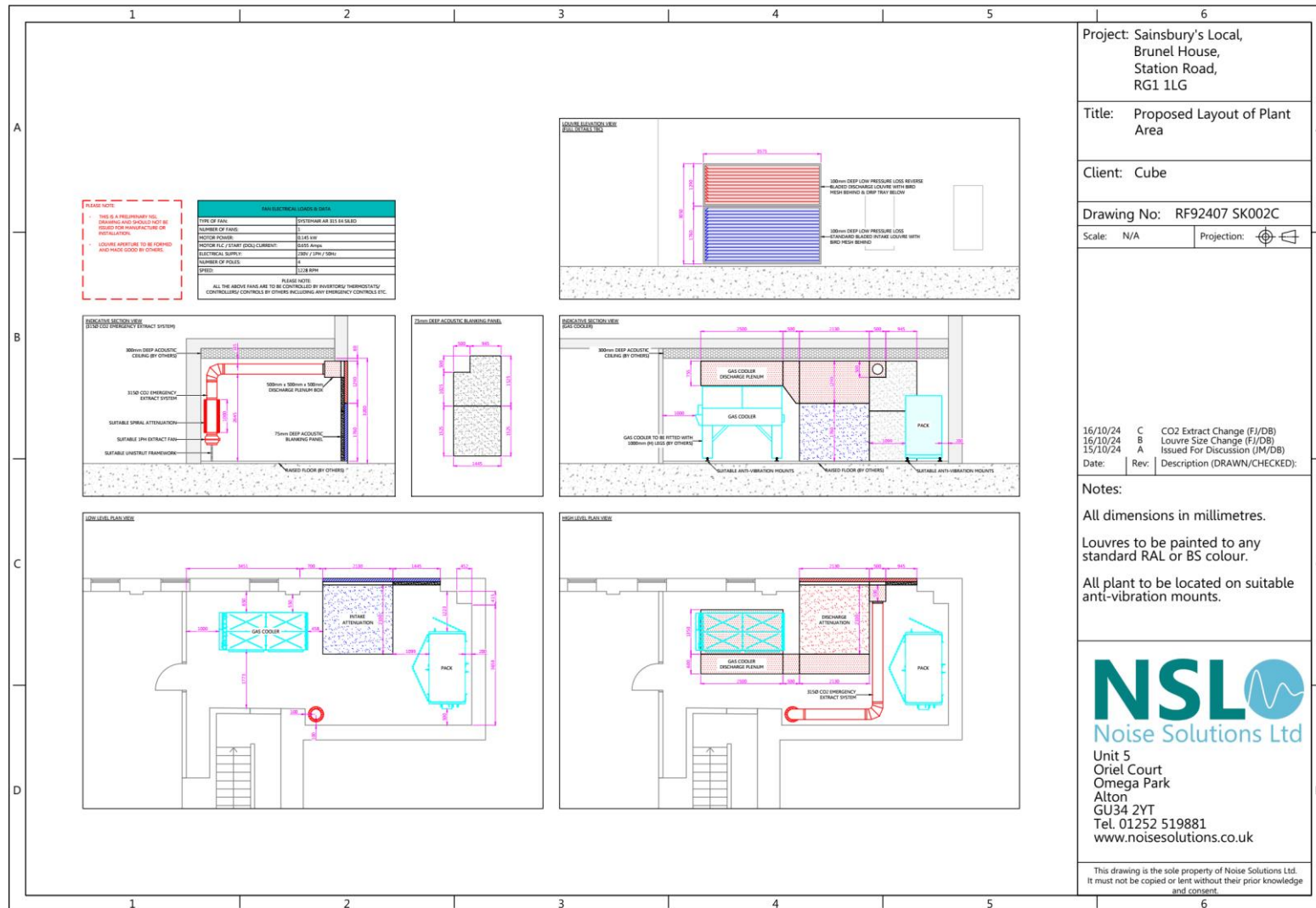
Appendix D Manufacturer noise data

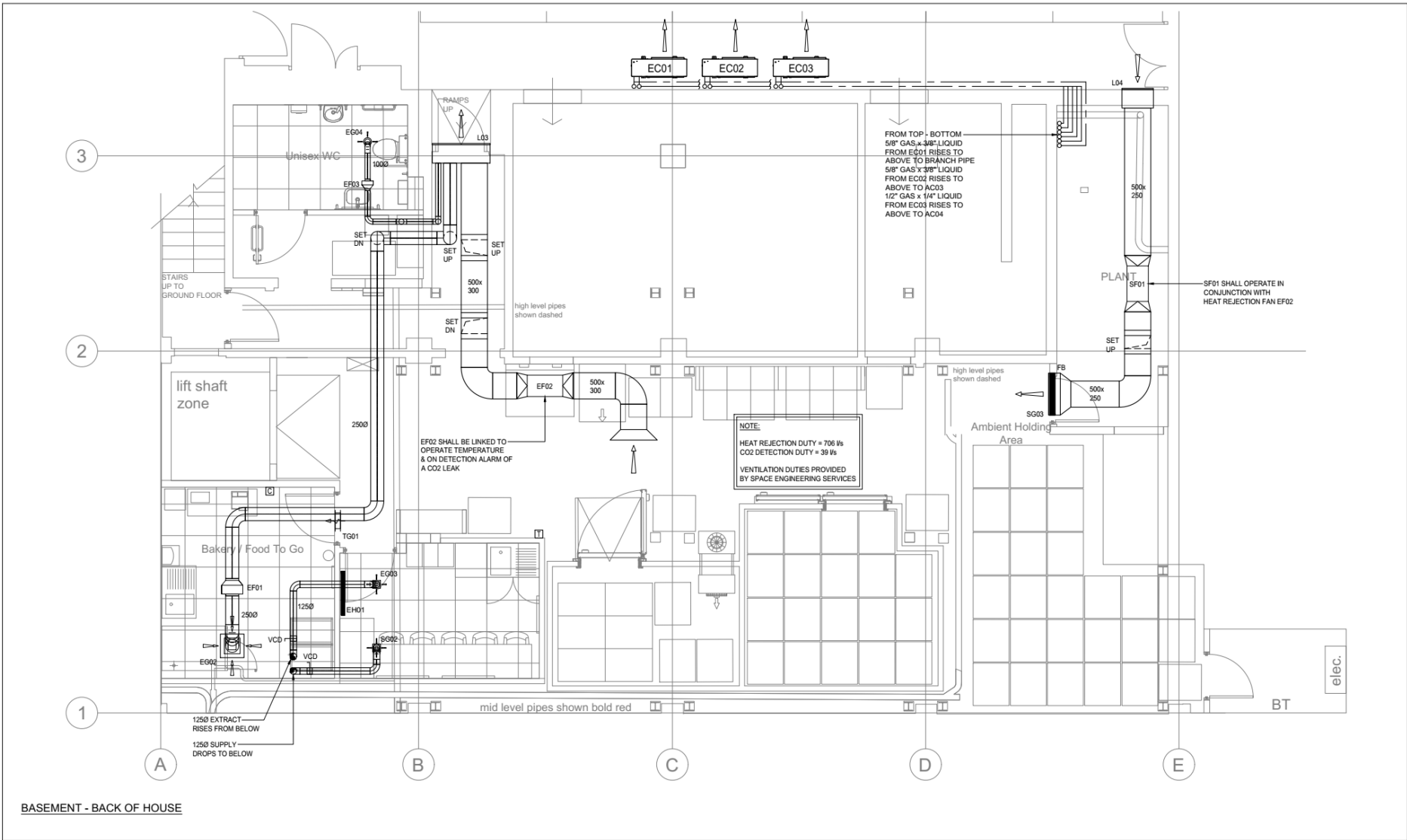
Plant	Model / Unit	No. of units	Manufacturer noise level
EC01	PUZ-ZM140VKA2	1	52dBA @ 1m
EC02	PUZ-ZM71VHA2	1	49dBA @ 1m
EC03	PUZ-ZM35VKA	1	36dBA @ 1m

Plant	Make / Model	No. units	Notes	Operational time	Sound levels, dB, at octave band frequencies (Hz)								
					63	125	250	500	1K	2K	4K	8K	L _{Aeq} (dB)
Gas Cooler	Kelvion GE-MA102G2-HH-OH-063B-AMHE-10FPI	1	Intake L _w *	Day	87	86	82	75	75	73	69	65	81
			Discharge L _w *	Day	90	89	85	78	78	76	72	68	84
			Intake L _w *	Night	84	83	79	72	72	70	66	62	78
			Discharge L _w *	Night	87	86	82	75	75	73	69	65	81
Pack	Bitzer 1x4MTE-7K + 1x4PTE-6K	1	L _w	24/7	82	76	78	73	70	67	63	55	76

*derived from manufacturer's overall octave band sound power level data per fan

**derived from manufacturer's overall octave band sound power level data





Appendix F Noise level predictions

Receptor R1 (residential)

Daytime

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
Plantroom	See Plantroom Calcs Below							31
EC01	52	1	14	-23	3	0	0	32
EC02	49	1	14	-23	3	0	0	29
EC03	46	1	14	-23	3	0	0	26
							CUMULATIVE:	36

Night-time

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
Plantroom	See Plantroom Calcs Below							28
							CUMULATIVE:	28

Receptor R2 (residential)

Daytime

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
Plantroom	See Plantroom Calcs Below							30
EC01	52	1	14	-23	3	0	0	32
EC02	49	1	14	-23	3	0	0	29
EC03	46	1	14	-23	3	0	0	26
							CUMULATIVE:	36

Night-time

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
Plantroom	See Plantroom Calcs Below							27
							CUMULATIVE:	27

Receptor R3 (commercial)

Daytime

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
Plantroom	See Plantroom Calcs Below							39
EC01	52	1	7	-17	3	-15	0	23
EC02	49	1	7	-17	3	-15	0	20
EC03	46	1	7	-17	3	-15	0	17
							CUMULATIVE:	39

Night-time

Plant	Plant noise level at source		DISTANCE		DIRECTIVITY	SCREENING	BS4142 Feature Correction (dB)	RESULTANT AT RECEPTOR (dBA)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)		
Plantroom	See Plantroom Calcs Below							36
							CUMULATIVE:	36

Plantroom Day

Description	Notes	Sound level (dB) at octave band centre frequency								LAeq (dB)
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
Plant room										
Intake										
Reverberant level in plant room	Rev Lp	88	86	81	74	74	70	66	62	79
All plant running										
Opening area (m2)	3.75	6	6	6	6	6	6	6	6	
SRI of opening	I.L	-12	-27	-44	-45	-45	-45	-45	-45	
Inside-outside correction		-6	-6	-6	-6	-6	-6	-6	-6	
Lw of opening	Lw	76	59	37	29	28	25	21	17	50
R1										
Directivity correction	(2130,0deg x 1760,0deg)	3	4	5	6	6	6	6	6	
Distance correction (m)	11	-29	-29	-29	-29	-29	-29	-29	-29	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R1	Lp @ R1	50	34	13	6	6	2	-2	-6	25
R2										
Directivity correction	(2130,0deg x 1760,45deg)	2	3	3	4	4	4	4	4	
Distance correction (m)	11	-29	-29	-29	-29	-29	-29	-29	-29	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R2	Lp @ R2	49	33	11	4	4	0	-4	-8	24
R3										
Directivity correction	(2130,0deg x 1760,90deg)	0	0	-4	-7	-7	-7	-7	-7	
Distance correction (m)	4	-20	-20	-20	-20	-20	-20	-20	-20	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R3	Lp @ R3	56	39	13	2	1	-2	-6	-10	30

Discharge										
Condenser Discharge										
Sound power	Lw	93	92	88	81	81	79	75	71	87
End reflection	2.7477	-1	0	0	0	0	0	0	0	
SRI of opening	IL	-12	-27	-44	-45	-45	-45	-45	-45	
Lw of opening		80	65	44	36	36	34	30	26	55
R1										
Directivity correction	(2130,0deg x 1290,0deg)	3	4	5	6	6	6	6	6	
Distance correction (m)	11	-29	-29	-29	-29	-29	-29	-29	-29	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R1	Lp @ R1	54	40	20	13	13	11	7	3	29
R2										
Directivity correction	(2130,0deg x 1290,45deg)	2	3	3	4	4	4	4	4	
Distance correction (m)	11	-29	-29	-29	-29	-29	-29	-29	-29	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R2	Lp @ R2	53	39	18	11	11	9	5	1	29
R3										
Directivity correction	(2130,0deg x 1290,90deg)	1	1	1	-4	-7	-7	-7	-7	
Distance correction (m)	3	-18	-18	-18	-18	-18	-18	-18	-18	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R3	Lp @ R3	63	48	27	15	11	9	5	1	38

SUMMARY

Receptor R1

Intake

Condenser Discharge

VRV Discharge

Cumulative

63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
50	34	13	6	6	2	-2	-6	25
54	40	20	13	13	11	7	3	29
-37	-39	-47	-59	-65	-65	-62	-55	-50
55	41	20	14	14	12	8	4	31

Receptor R2

Intake

Condenser Discharge

VRV Discharge

Cumulative

49	33	11	4	4	0	-4	-8	24
53	39	18	11	11	9	5	1	29
-37	-40	-48	-61	-67	-67	-64	-57	-51
55	40	19	12	12	10	6	2	30

Receptor R3

Intake

Condenser Discharge

VRV Discharge

Cumulative

56	39	13	2	1	-2	-6	-10	30
63	48	27	15	11	9	5	1	38
-34	-37	-47	-64	-74	-74	-71	-64	-50
64	49	27	15	12	10	6	2	39

Plant room night-time

Description	Notes	Sound level (dB) at octave band centre frequency								LAeq (dB)
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
Plant room										
Intake										
Reverberant level in plant room	Rev Lp	85	84	78	72	71	68	64	59	77
All plant running										
Opening area (m2)	3.7	6	6	6	6	6	6	6	6	
SRI of opening	I.L	-12	-27	-44	-45	-45	-45	-45	-45	
Inside-outside correction		-6	-6	-6	-6	-6	-6	-6	-6	
Lw of opening	Lw	73	56	34	27	26	23	19	14	48
R1										
Directivity correction	(2130,0deg x 1760,0deg)	3	4	5	6	6	6	6	6	
Distance correction (m)	11.0	-29	-29	-29	-29	-29	-29	-29	-29	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R1	Lp @ R1	47	32	10	4	3	0	-4	-9	22
R2										
Directivity correction	(2130,0deg x 1760,45deg)	2	3	3	4	4	4	4	4	
Distance correction (m)	11.0	-29	-29	-29	-29	-29	-29	-29	-29	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R2	Lp @ R2	46	30	9	2	1	-2	-6	-11	21
R3										
Directivity correction	(2130,0deg x 1760,90deg)	0	0	-4	-7	-7	-7	-7	-7	
Distance correction (m)	4.0	-20	-20	-20	-20	-20	-20	-20	-20	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R3	Lp @ R3	53	36	10	0	-1	-4	-8	-13	28

Condenser Discharge										
Sound power	Lw	90	89	85	78	78	76	72	68	84
End reflection	2.7	-1	0	0	0	0	0	0	0	
SRI of opening	1.L	-12	-27	-44	-45	-45	-45	-45	-45	
Lw of opening		77	62	41	33	33	31	27	23	52
R1										
Directivity correction	(2130,0deg x 1290,0deg)	3	4	5	6	6	6	6	6	
Distance correction (m)	11.0	-29	-29	-29	-29	-29	-29	-29	-29	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R1	Lp @ R1	51	37	17	10	10	8	4	0	26
R2										
Directivity correction	(2130,0deg x 1290,45deg)	2	3	3	4	4	4	4	4	
Distance correction (m)	11.0	-29	-29	-29	-29	-29	-29	-29	-29	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R2	Lp @ R2	50	36	15	8	8	6	2	-2	26
R3										
Directivity correction	(2130,0deg x 1290,90deg)	1	1	1	-4	-7	-7	-7	-7	
Distance correction (m)	3.0	-18	-18	-18	-18	-18	-18	-18	-18	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		0	0	0	0	0	0	0	0	
Resultant at receptor R3	Lp @ R3	60	45	24	12	8	6	2	-2	35

SUMMARY

Receptor R1

Intake

Condenser Discharge

Cumulative

63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
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47	32	10	4	3	0	-4	-9	22
51	37	17	10	10	8	4	0	26
52	38	18	11	11	9	5	1	28

Receptor R2

Intake

Condenser Discharge

Cumulative

46	30	9	2	1	-2	-6	-11	21
50	36	15	8	8	6	2	-2	26
52	37	16	9	9	7	3	-1	27

Receptor R3

Intake

Condenser Discharge

Cumulative

53	36	10	0	-1	-4	-8	-13	28
60	45	24	12	8	6	2	-2	35
61	46	24	12	9	7	3	-1	36