Acoustic Assessment Report

31st May 2018 Peter Clark

1. INTRODUCTION

1.1 MidCounties Co-operative (MCC) have owned and operated a supermarket and food-store, off Market Square, in Newent, Gloucestershire for a number of years. The store is to be extended to cater for additional food retail demand at the store and an extension added. The proposed extension will house chilled and frozen food display and storage units which require additional mechanical plant to be located externally. A full planning application is to be submitted for the proposed extension and as such a noise impact assessment is required to support the application. As a part of the pre-application consultation process, the local planning authority (Forest of Dean District Council) have raised concerns over noise issues that may arise from the installation of the additional mechanical plant. The requirement for additional delivery vehicles arriving/departing the site is also to be considered in terms of potential noise impact *and this is considered in Section 4 of this report.* The existing store and extension are located on land off Market Square in Newent. There are a number of residential properties nearby which are considered in the assessment, the rear gardens of those in Broad Street, Market Square and Culver Street (to the North) will be closest to the extension itself, whilst properties in Freeman's Orchard (to the South) are near to the existing mechanical plant. All plant and equipment which serves the existing store is located on the flat roof, behind the existing mansard. The mansard provides an effective shield for all neighbouring

properties. The additional refrigeration plant and equipment proposed will be located on the existing flat roof, adjacent to the existing plant.

1.2 The assessment has been carried out in accordance with national guidance documents and shows that the proposed external plant and equipment can operate without detrimental effect on existing noise levels in the immediate locality. The site location is given in Figure 1 below:

Figure 1: Site Location (© Google Maps)

2.0 NOISE MEASUREMENTS

2.1 Environmental noise measurements were carried out from Friday 18th May to Wednesday 23rd May 2018. Sound level measurement equipment was installed in three locations at the site (a) near the delivery yard entrance close to the neighbouring residential property (Club Cottage), (b) at the western perimeter of the delivery yard, close to the rear of properties in Culver Street and (c) in the South-West corner of the site, close to properties in Freeman's Orchard. Respective noise monitoring locations are shown in Figure 1 above. The equipment was used to continuously log noise levels over the five day period. The measurement equipment is listed below in Table 1.

Table 1. Environmental Noise Measurement Instrumentation

No.	Description
1.	3 off Larson Davis Model 812 Sound Level Meter.
2.	3 off Larson Davis Model 2541 1/2" Diameter Condenser Microphone.
3.	Larson Davis Model CAL200 Sound Level Meter Calibrator.

2.2 All acoustic equipment conforms to the relevant parts of BS EN 60651:1994 (equivalent to BS 5969:1981) for the requirements of Type 1 acoustic accuracy. Additionally, the relevant equipment conforms to the specifications contained within BS EN 60804:1994 (equivalent to BS 6698:1976) for integrating sound level meters. The measurements were carried out in accordance with BS7445.

2.3 In order to verify the correct operation of the equipment on site, an acoustic calibrator was applied during the course of the measurements. A maximum change of 0.1 dB(A) was noted, this can be considered as an insignificant change. The calibrator complies with the specifications of IEC 942:2003. The instrumentation was previously factory calibrated in January 2018.

2.4 Fast meter response was used for all measurements carried out during the course of the survey.

2.5 Noise levels are expressed in terms of continuous equivalent noise levels (L_{Aeq}) over an appropriate time period. The use of L_{Aeq} allows non-steady and non-continuous noise to be assessed and compared to the existing noise climate. L_{Aeq} is referred to as the ambient noise level. In addition to this background noise levels have also been measured and are expressed as L_{A90}. A full explanation of terminology commonly used in the measurement and assessment of noise levels is given in Appendix B at the end of this report.

3.0 RESULTS & ASSESSMENT

3.1 Noise level measurements were carried out at 15 minute intervals during the survey period. Ambient (L_{Aeq}) and background (L_{A90}) noise levels were measured. Average noise levels for the day-time (07:00 to 19:00 hrs), evening time period (19:00 to 23:00 hrs) and night time period (23:00 to 07:00 hrs) have been determined. The results are summarised in Tables 2.1, 2.2 and 2.3 below.

Table 2.1: Summary Results – North (Location 1)

	Day	Evening	Night
L_{A90}	44.9	38.8	30.8
L_{Aeq}	59.5	55.9	48.6

Table 2.2: Summary Results – West (Location 2)

	Day	Evening	Night
L_{A90}	47.0	36.2	28.5
L_{Aeq}	56.1	54.6	55.7

Table 2.3: Summary Results – South (Location 3)

	Day	Evening	Night
L_{A90}	41.4	33.4	26.0
L_{Aeq}	51.2	49.3	46.4

3.2 The area surrounding the existing food-store is generally quiet, with some occasional noise associated with delivery vehicles arriving/departing the store. Noise from the existing mechanical plant was not audible during site visits. For the majority of the survey period, winds were light and there was little or no rain. A full listing of 15 minute interval data, for all measurement locations, is given in the graphs at the end of this report (Figure A1.1, A1.2 and A1.3). Photographs showing the location of the three noise monitors are shown in Figures A2.1, A2.2 and A2.3.

3.3 In addition to this, the noise data graphs show that noise levels in the area do vary throughout day and night-time periods. This is to be expected. To determine appropriate background noise levels for the assessment,

statistical analyses of the data measured at each location has been carried out. As the fixed plant may run 24 hours per day, both day-time and night-time periods are addressed. The resulting noise level histograms are given in Figures A3.1, A3.2 and A3.3 for each of the three measurement locations respectively. These histograms show that an appropriate day-time background level ($L_{A90,15min}$) to be used in the assessment is 41 dB for areas to the north, 39 dB to the west and 35 dB to the south. Corresponding night-time levels are 29 dB, 26 dB and 25 dB.

3.4 The noise assessment for this application should be made in accordance with BS4142: 2014[1]. Using this method, the resulting noise associated with the proposed plant and equipment is compared to the existing background noise level (L_{A90}). The night time is the critical period in terms of noise assessment. The methodology given in [1] also takes account of potential impulsive and/or tonal characteristic for noise (by weighting the noise level by an additional factor dB). The assessment method describes the "magnitude of impacts" by subtracting the measured background noise level from the rating (or noise associated with the new plant) level such that:

- *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*

[1] British Standard BS4142: 2014 ""Methods for Rating Industrial and Commercial Sound" is the most appropriate and current method for determining acceptability etc associated with new industrial plant and equipment in these applications.

impact or a significant adverse impact.

3.5 The precise details of proposed plant and equipment planned for the extension are not known at this stage, however it is understood that the Co-op will incorporate similar equipment to that already in use at the site. Additional fixed items of plant which will serve the proposed extension and the refrigeration plant will potentially operate 24 hours per day will comprise one external heat exchanger unit (to serve the additional chiller/freezer display cabinets) and a single external condenser unit (to serve the extended sales area). Noise levels from respective new plant items are given in Figure A4. *BS4142: 2014 also makes reference to acoustic character correction terms that should be applied if the new plant/equipment exhibits tonal and/or impulsive characteristics. None of the proposed equipment exhibits these characteristics and as such no additional correction terms are applicable.* The proposed site layout and location of plant items on the roof is given in Figure A5.

3.6 A computer based modelling package (IMMI) has been used to determine noise levels (using the ISO9613 algorithm). The building geometry and plant locations have been input, the noise model generated and noise levels calculated and displayed in terms of both single point calculation points and a contour map.

3.7 The acoustic model predicts noise levels from the new plant to be 20 dBA in the rear garden of the nearest properties in Culver Street and Freeman's Orchard and 18 dBA at Club Cottage (to the north). <u>These noise levels are very low and would be lower than existing night-time background noise</u>

levels in the area. The noise contour map is plotted in Figure A5 at the end of this report.

3.9 It therefore follows that during the day-time, noise levels will be more than 10 dB below existing background noise levels. At night-time, noise levels are approximately 5 dB below existing background noise levels, and will therefore be virtually inaudible. It should also be noted that at night-time, even with bedroom windows open, windows generally offer a minimum of 10-15 dBA attenuation and as a result internal noise levels would be close to the accepted threshold of human perception.

4.0 DELIVERY VEHICLE NOISE

4.1 As a part of the pre-application consultation process, the local planning authority (Forest of Dean District Council) have raised concerns over noise issues that may arise from additional delivery vehicles arriving/departing the site. The relative size of the proposed sales area extension is small compared to the existing store (approximately 25% increase in total sales area). Discussions with MCC have confirmed that no increase in the number or size of delivery vehicles is expected once the extension is in use. Essentially, the existing size and number of vehicles (around 5 or 6) arriving/departing the site each day will remain unchanged although the volumes of delivery will increase to match demand.

5.0 CONCLUSION

5.1 A noise measurement survey and assessment has been carried out on the external plant and equipment that is to be installed as a part of the proposed extension at the Co-operative Foodstore and Supermarket in Newent, Gloucestershire.

5.2 Predicted noise levels are shown to be very low. During both day-time and night-time periods noise from the new plant will essentially be inaudible at neighbouring properties.

5.3 As the proposed extension will not require an increase in the number and/or type of delivery vehicles, there will be no significant noise impact associated with increased store size.

APPENDIX A: GRAPHS AND FIGURES.

Figure A1.1: Environmental Noise Measurement Data – Location 1: North (Service Yard Entrance) - (Friday 18th to Wednesday 23rd May 2018)

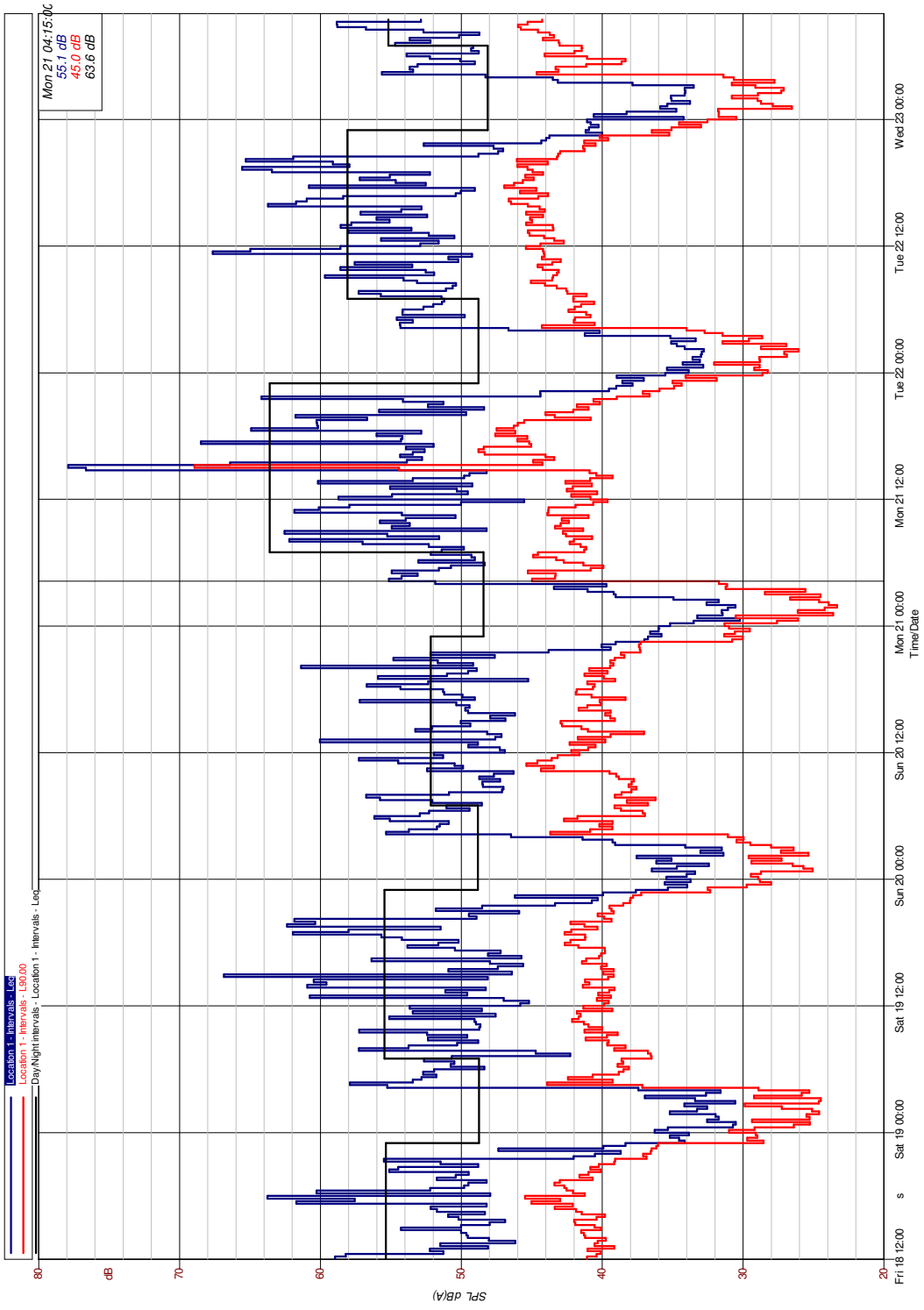


Figure A1.2: Environmental Noise Measurement Data – Location 2: West (Service Yard/Rear of Store) - (Friday 18th to Wednesday 23rd May 2018)

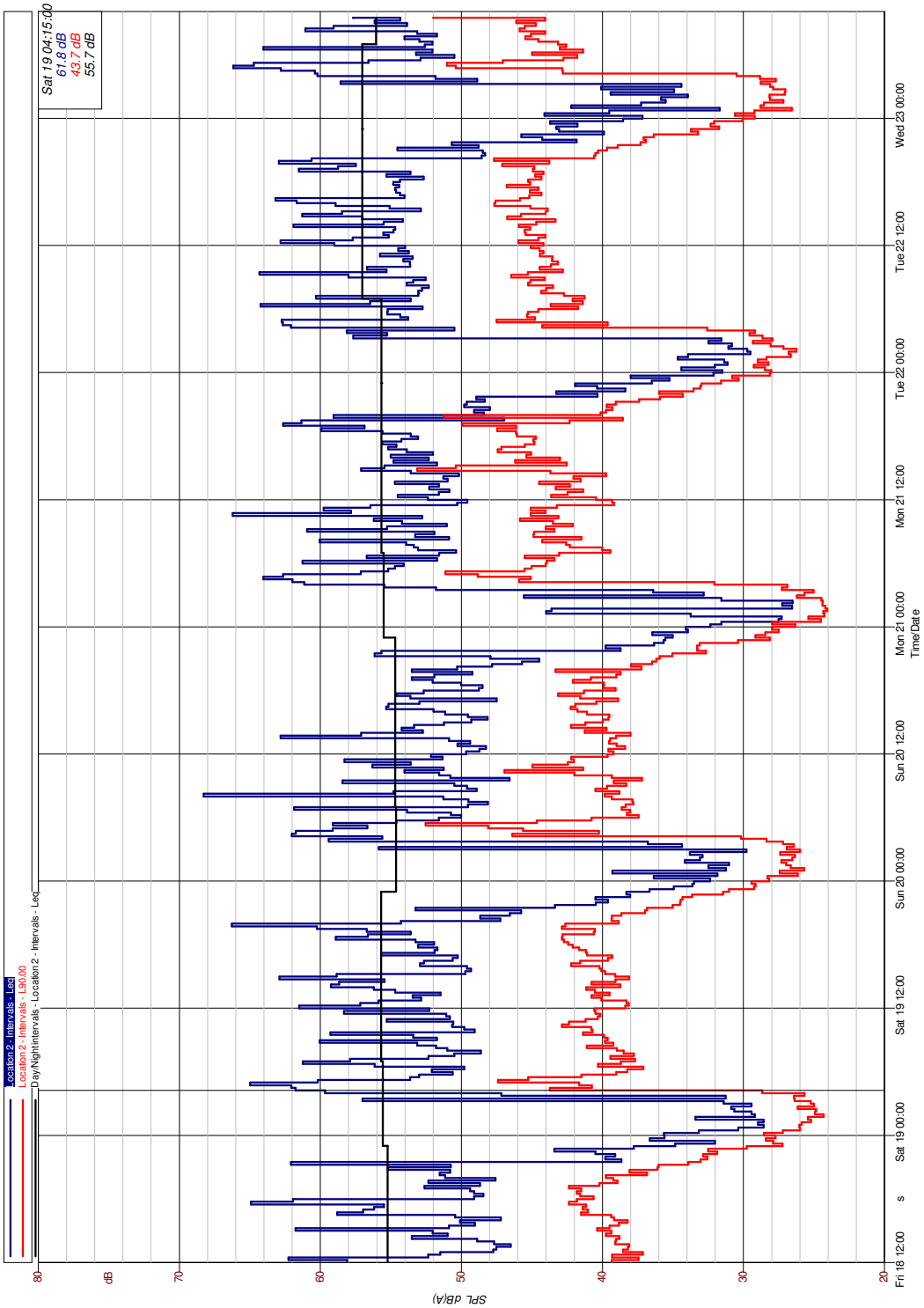


Figure A1.3: Environmental Noise Measurement Data – Location 3: South (Rear Corner of Store) - (Friday 18th to Wednesday 23rd May 2018)

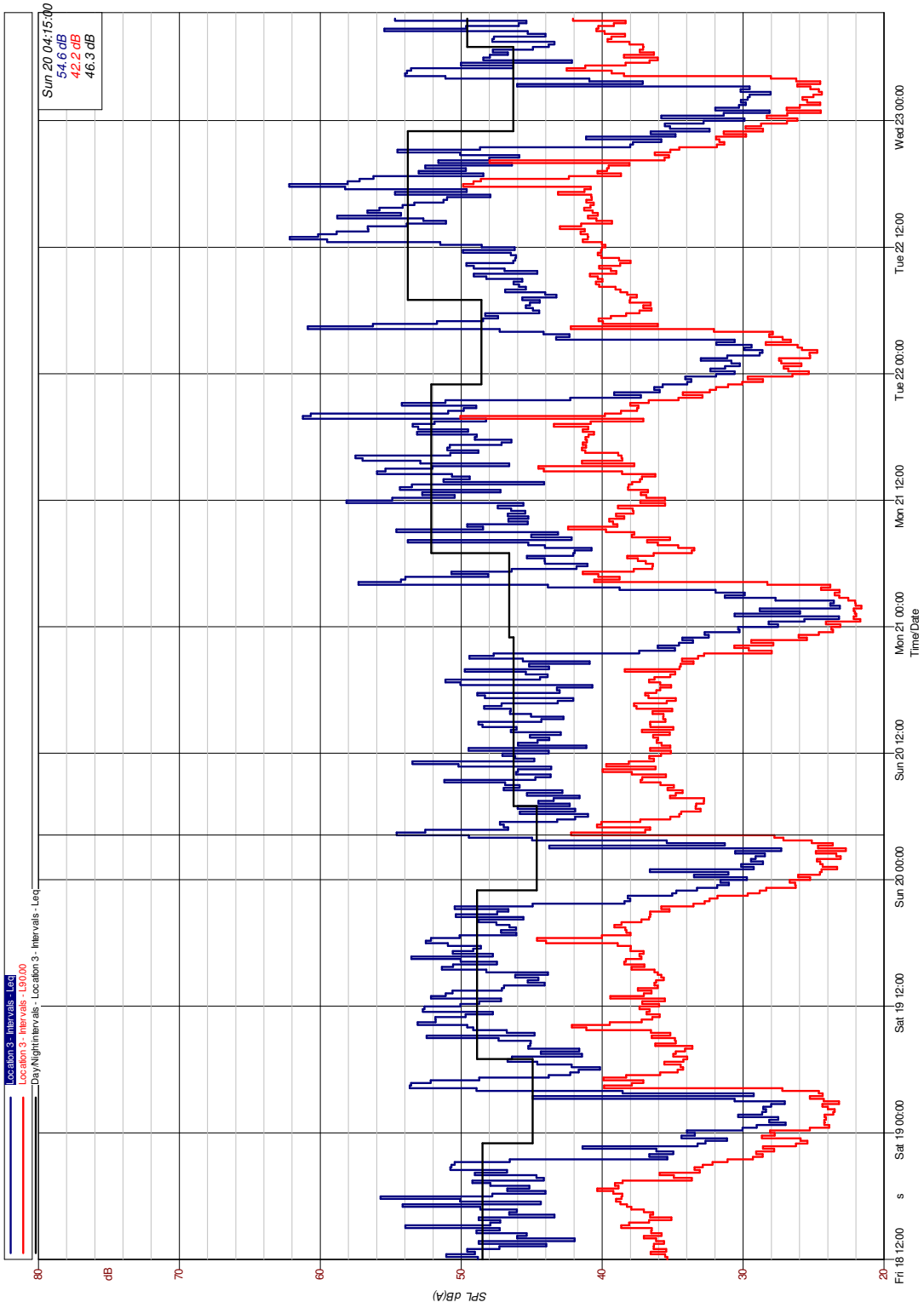


Figure A2.1: Photograph showing noise monitor (Location 1)

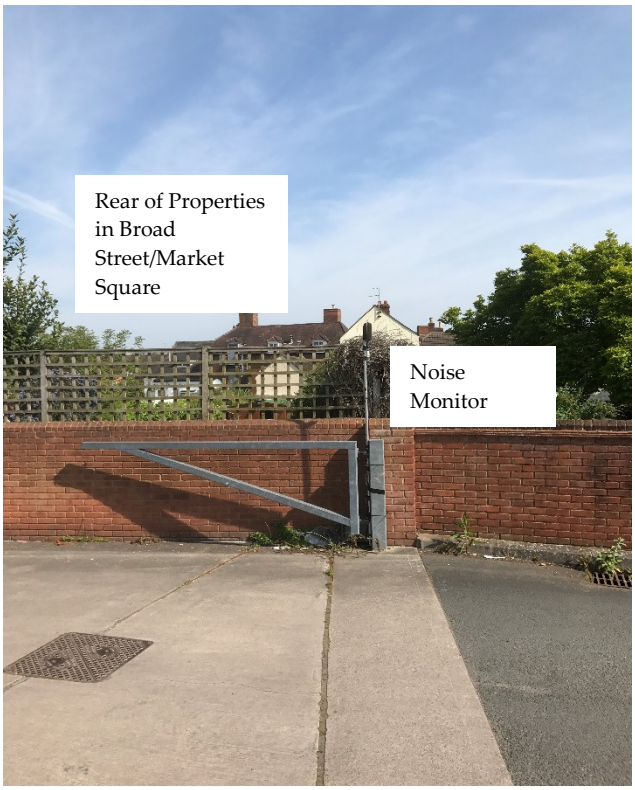
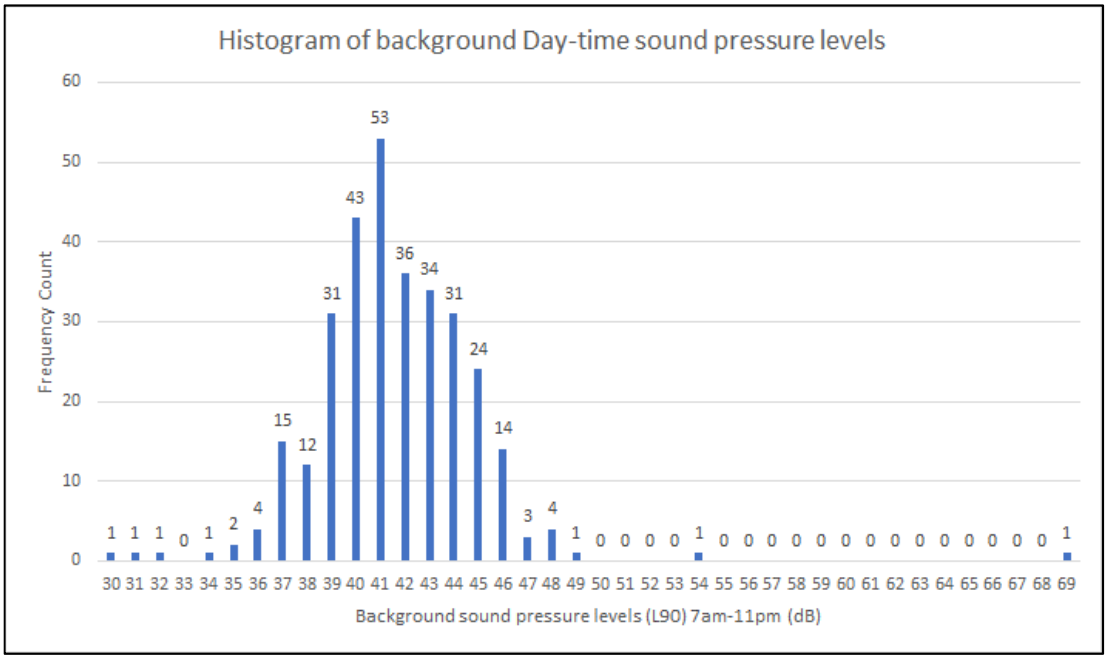


Figure A2.2: Photograph showing noise monitor (Location 2)

Figure A2.2: Photograph showing noise monitor (Location 3)

Figure A3.1 Location 1: Day and Night-time Background Noise Histograms



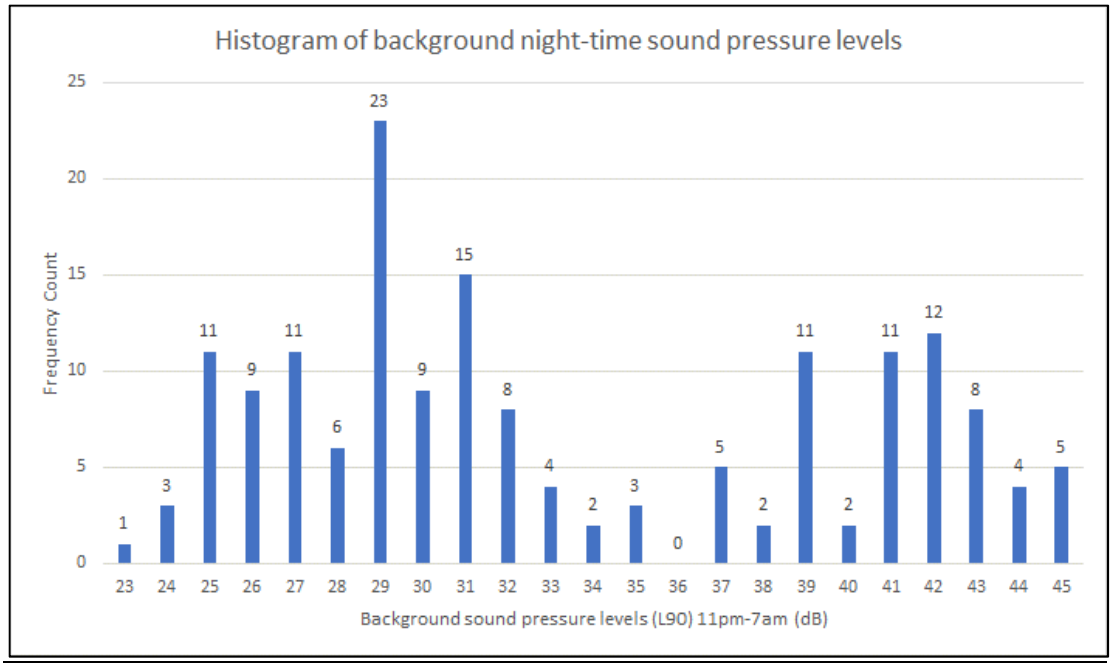
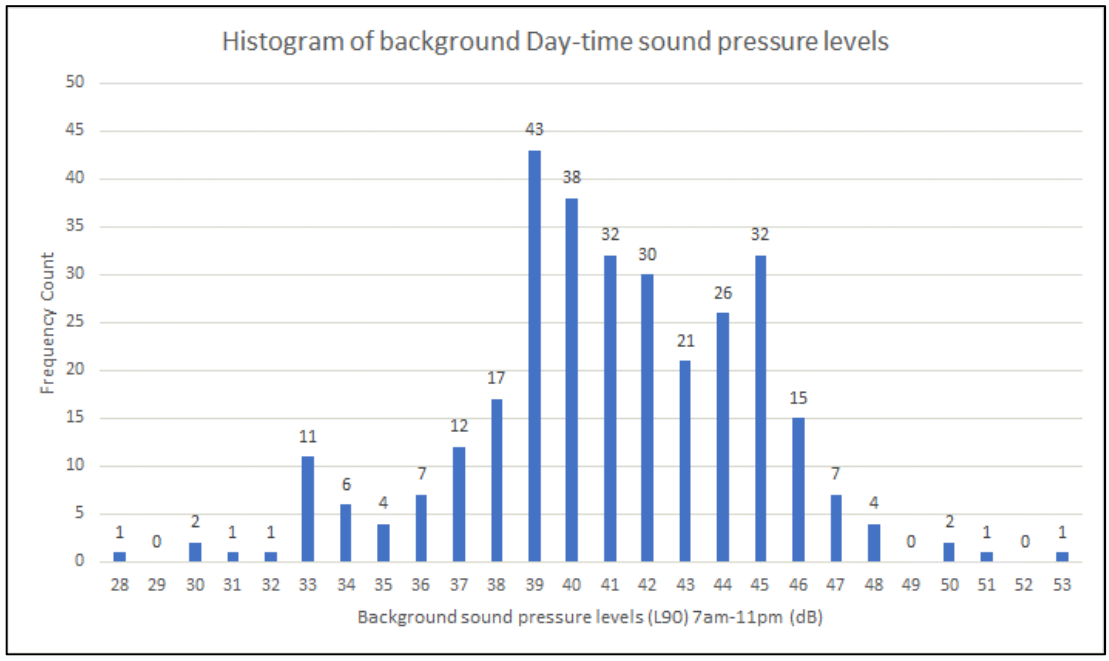


Figure A3.2 Location 2: Day and Night-time Background Noise Histograms



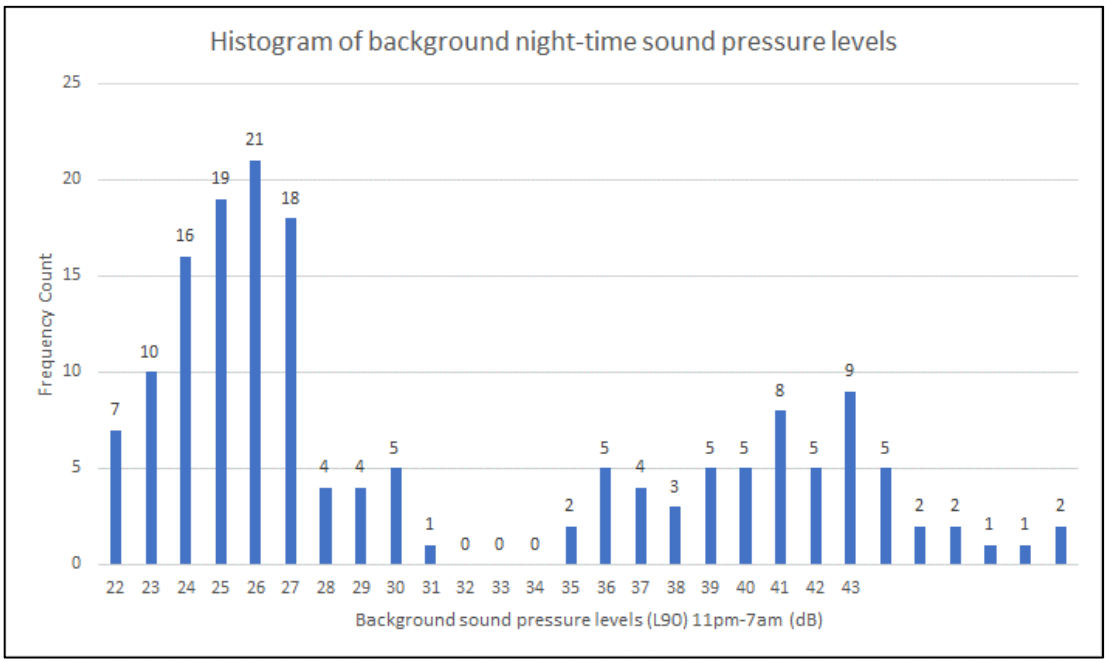
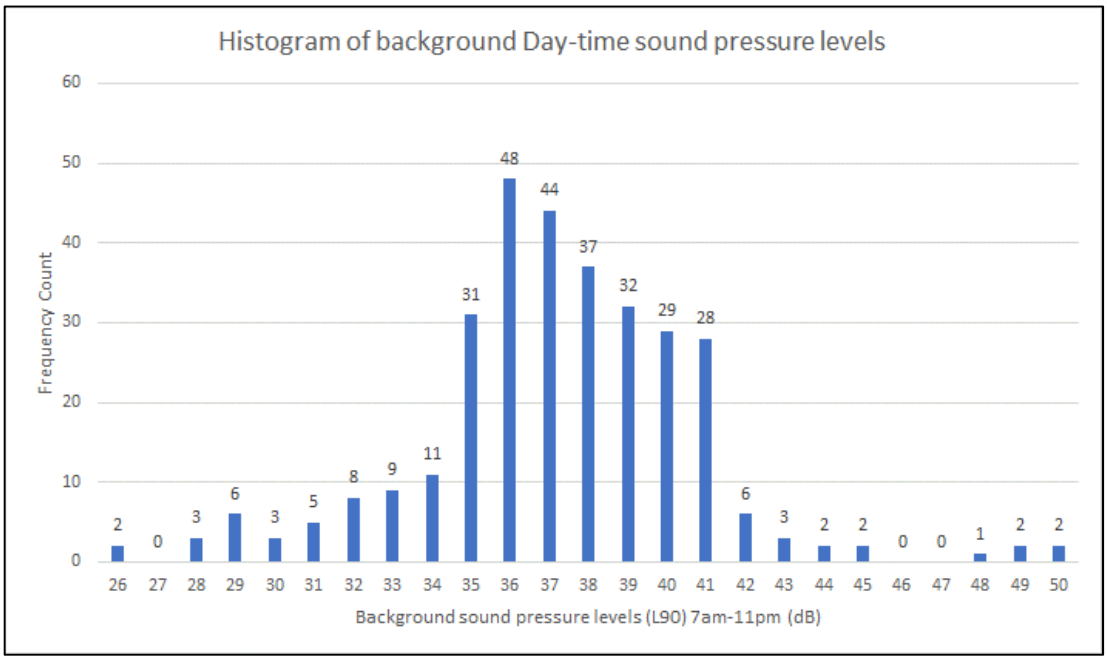


Figure A3.3 Location 3: Day and Night-time Background Noise Histograms



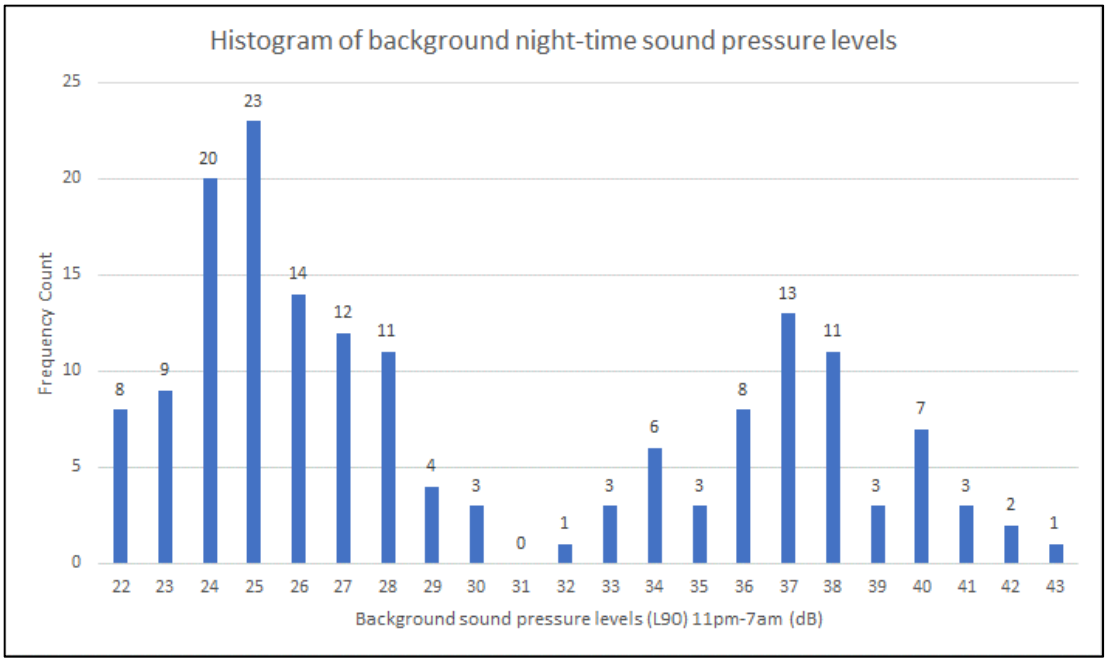


Figure A4: Equipment Noise Datasheets

Heat Exchanger Unit

Sound Pressure Level	dB(A)	46 @ 10 m
Mean Sound Pressure Level	dB(A)	48 @ 10 m
Sound Power Level	dB(A)	80
Sound Spectrum 125 Hz	dB	84
Sound Spectrum 250 Hz	dB	80
Sound Spectrum 500 Hz	dB	75
Sound Spectrum 1 kHz	dB	75
Sound Spectrum 2 kHz	dB	73
Sound Spectrum 4 kHz	dB	68
Sound Spectrum 8 kHz	dB	61

Sales Area External Condenser Unit

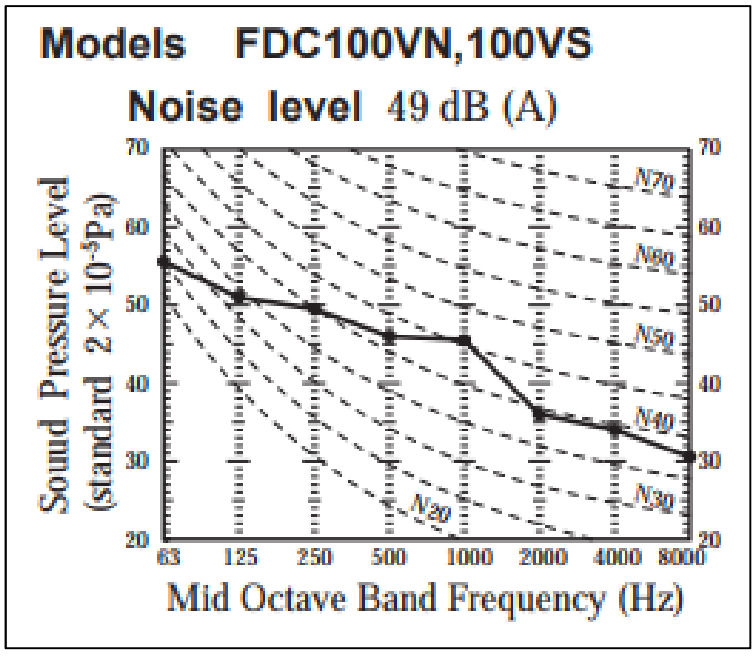


Figure A5: Proposed layout showing new plant and noise monitoring locations

Figure A6: Predicted Noise Level Contour Map (Contours in 3 dBA increments)

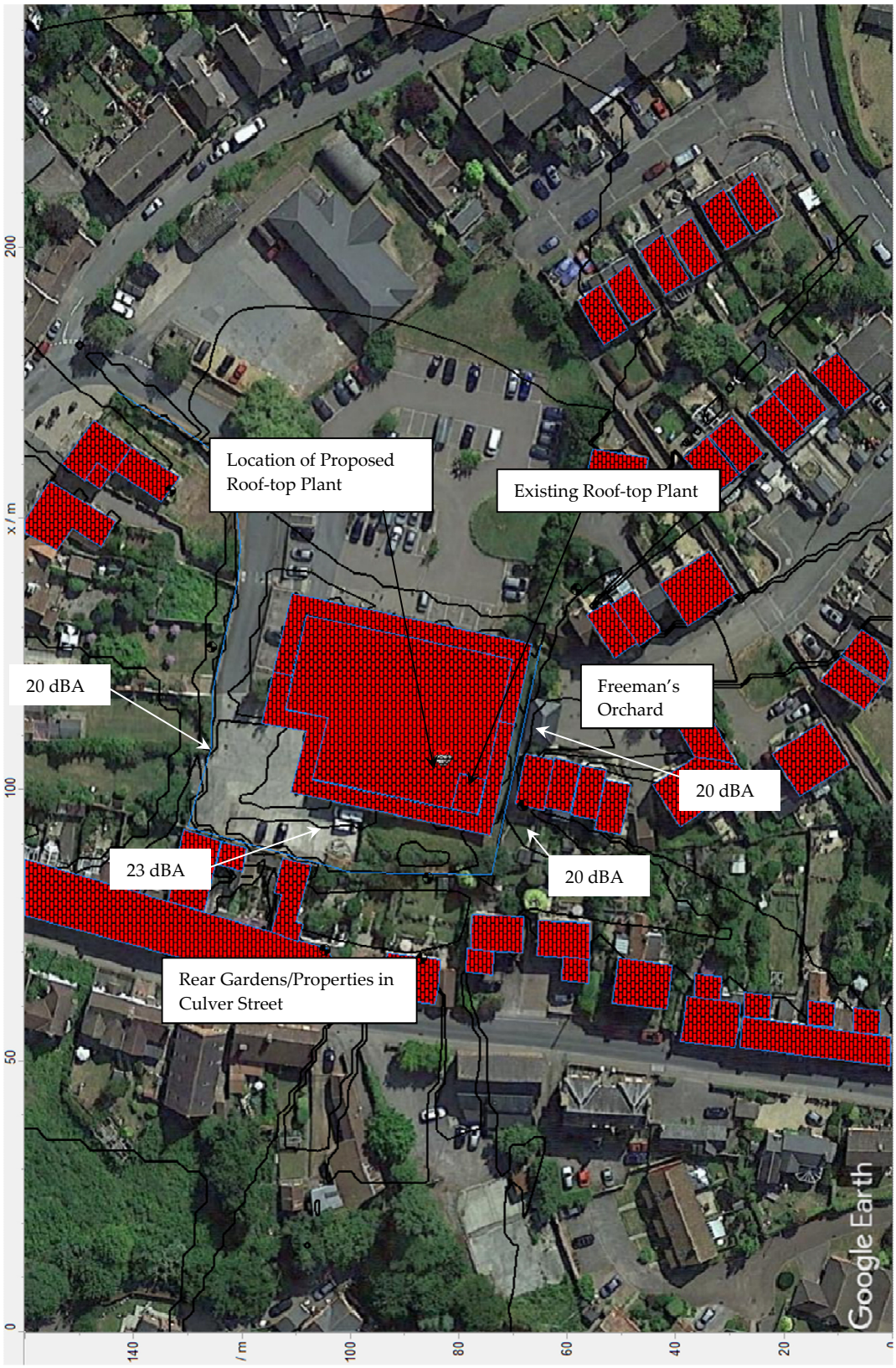


Figure A7: Detailed Acoustic Calculations

Elements	Label		16 Hz	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	L r,A
			L r,i /dB	L r,i /dB	L r,i /dB	L r,i /dB	L r,i /dB	L r,i /dB	L r,i /dB	L r,i /dB	L r,i /dB	L r,i /dB	/dB
IPkt001 »	**Freeman's Orchard**	**Variant 0**	**Setting: Reference setting**										
		x = 97.1 m			y = 68.1 m			z = 9.0 m					
EZQi002 »	RF Unit	-				31.098	23.310	14.150	10.528	6.322	0.933	-7.483	19.651
EZQi003 »	Mitsubishi FDC100VN	-			24.335	14.707	8.865	1.748	-1.819	-13.989	-15.392	-20.858	5.920
	Sum spectrum	A			-1.865	15.097	14.864	11.193	10.774	7.562	2.033	-8.388	19.831
IPkt002 »	**Culver Street**	**Variant 0**	**Setting: Reference setting**										
		x = 69.0 m			y = 86.6 m			z = 4.7 m					
EZQi002 »	RF Unit	-				28.232	22.600	15.475	12.928	7.960	-0.892	-14.449	19.408
EZQi003 »	Mitsubishi FDC100VN	-			20.540	12.231	8.593	3.461	0.910	-12.062	-16.916	-27.477	6.111
	Sum spectrum	A			-5.660	12.240	14.169	12.540	13.193	9.203	0.216	-15.838	19.607
IPkt004 »	**Culver Street Garden**	**Variant 0**	**Setting: Reference setting**										
		x = 83.8 m			y = 85.7 m			z = 4.7 m					
EZQi002 »	RF Unit	-				28.385	20.495	11.735	8.425	3.439	-2.098	-11.057	17.010
EZQi003 »	Mitsubishi FDC100VN	-			22.218	12.408	6.516	-0.243	-3.552	-16.519	-18.054	-24.004	3.788
	Sum spectrum	A			-3.982	12.393	12.065	8.802	8.692	4.683	-0.989	-11.949	17.212
IPkt005 »	**Delivery Road Fence**	**Variant 0**	**Setting: Reference setting**										
		x = 137.1 m			y = 58.1 m			z = 5.8 m					
EZQi002 »	RF Unit	-				26.924	20.877	13.483	10.800	5.710	-3.311	-17.244	17.573
EZQi003 »	Mitsubishi FDC100VN	-			19.322	10.683	6.595	1.172	-1.529	-14.634	-19.682	-30.627	4.001
	Sum spectrum	A			-6.878	10.926	12.436	10.531	11.047	6.950	-2.212	-18.149	17.760
IPkt006 »	**Club Cottage Garden**	**Variant 0**	**Setting: Reference setting**										
		x = 126.4 m			y = 125.3 m			z = 2.8 m					
EZQi002 »	RF Unit	-				21.821	13.910	5.225	1.923	-3.137	-9.251	-20.214	10.444
EZQi003 »	Mitsubishi FDC100VN	-			15.875	5.944	0.035	-6.648	-9.947	-23.014	-25.113	-33.121	-2.644
	Sum spectrum	A			-10.225	5.832	5.484	2.298	2.197	-1.893	-8.140	-21.102	10.653
IPkt007 »	**Closest House North**	**Variant 0**	**Setting: Reference setting**										
		x = 155.2 m			y = 133.1 m			z = 5.3 m					
EZQi002 »	RF Unit	-				24.370	19.638	13.454	11.691	7.110	-2.204	-18.569	17.187
EZQi003 »	Mitsubishi FDC100VN	-			15.839	8.427	5.690	1.501	-0.268	-12.851	-18.158	-31.474	3.943
	Sum spectrum	A			-10.361	8.380	11.210	10.523	11.959	8.354	-1.095	-19.444	17.388

APPENDIX B: GLOSSARY OF NOISE TERMS AND UNITS.

1.0 Noise

1.1 The sounds that we hear are as a result of successive air pressure changes. These air pressure changes are generated by vibrating sources, such as train engines or wheels, and they travel to a receiver, i.e. the human ear, as air pressure waves.

1.2. The human ear is capable of detecting a vast range of air pressures, from the lowest sound intensity that the normal ear can detect (about 10^{-12} watts/m^2) to the highest that can be withstood without physical pain (about 10 watts/m^2). If we were to use a linear scale to represent this range of human sensitivity it would encompass more than a billion units. Clearly this would be an unmanageable scale yielding unwieldy numbers.

1.3. The scale can be compressed by converting it to a logarithmic or Bel scale, the number of Bels being the logarithm to the base 10 of one value to another (as applied by Alexander Graham Bell to measure the intensity of electric currents). The Bel scale gives a compressed range of 0 to 12 units which in practice is a little too compressed. A more practical operating range of 0 to 120 is obtained by multiplying by 10, ie. 10 x Bel, which produces the scale units known as decibels or dB.

1.4. Examples of typical sound intensity levels within the decibel range of 0 to 120 dB are listed below:

Commercial four-engine jet aircraft at 100m	120dB
Riveting of steel plate at 10m	105dB
Pneumatic drill at 10m	90dB
Circular wood saw at 10m	80dB
Heavy road traffic at 10m	75dB

Male speech, average, at 10m	50dB
Whisper at 10m	25dB
Threshold of hearing, 100Hz	0dB

1.5. Due to this logarithmic scale noise levels have to be combined logarithmically rather than arithmetically. For example, two equal sound sources of 70 dB each, when operated simultaneously, do not produce a combined level of 140 dB but instead result in a level of 73 dB, ie. A rise of 3dB for each doubling of sound intensity. Subjectively, a 3dB change does not represent a doubling or halving of loudness; to make a sound appear twice as loud requires an increase in sound pressure level of about 10dB.

1.6. The subjective loudness of noise can be measured by applying a filter or weighting which equates to the frequency response of the human ear. This is referred to as an A-weighting and when applied results in noise levels expressed as dB(A).

1.7. dB(A) noise levels can be measured using a variety of noise indices. The index which correlates best with human response due to machinery noise is the L_{Aeq} this is the A-weighted L_{eq} which is referred to as the 'equivalent continuous noise level' and is a measure of the total sound energy generated by a fluctuating sound signal within a given time period.