

The Co-operative
105-111 Winchester Rd
Chandler's Ford
Eastleigh
SO53 2GH

**Plant Noise
Impact Assessment**

On behalf of



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For and on behalf of Noise Solutions Ltd				

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01	15 th June 2023	Revised plantroom drawing	JL	NAC
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Contents

1.0	Introduction	1
2.0	Details of development proposals.....	1
3.0	Nearest noise-sensitive receptors.....	1
4.0	Existing noise climate	2
5.0	Plant noise design criteria	4
	Eastleigh Borough Council	4
	BS 4142:2014 Methods for rating and assessing industrial and commercial sound.....	4
	Summary of criteria	5
6.0	Plant noise impact assessment.....	6
	Assessment of uncertainties	7
7.0	Summary	8

Appendices

Appendix A	Acoustic terminology
Appendix B	Photograph of site showing areas of interest
Appendix C	Environmental sound survey
Appendix D	Noise data of proposed plant
Appendix E	Proposed site and plant layout
Appendix F	Noise level predictions

1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned by Henry Riley LLP to provide a noise impact assessment of replacement plant serving the Co-operative store located on Winchester Road at Chandler's Ford, Eastleigh.
- 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. Details of the survey are given in section 4.0.
- 1.3. Noise levels from the proposed plant have been predicted at the nearest noise-sensitive receptor and assessed against the local authority'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 Co-operative store will occupy a unit within the commercial building located on Winchester Road in Chandler's Ford, Eastleigh. New refrigeration and air conditioning (AC) plant will be located within an internal plantroom with louvres terminating along the north façade of the building.
- 2.2. The AC plant will operate only when the store is open; the refrigeration plant will operate at all times but will typically run at reduced duty at night.
- 2.3. A site plan showing the site and surrounding area and the noise monitoring location used in this assessment is presented in [Appendix B](#). A layout drawing for the site and plantroom is given in [Appendix E](#). Manufacturer plant noise data is given in [Appendix D](#).

3.0 Nearest noise-sensitive receptors

- 3.1. The surrounding area is a mixture of commercial and residential units.
- 3.2. The nearest and potentially most affected noise sensitive receptor to the plantroom louvres will be the flats (Receptor R1) above the commercial units east of the site. These windows will be approximately 20m from intake and discharge louvres.
- 3.3. There are also houses (Receptor R2) west of the site on Brownhill Road, with windows approximately 25m from the plantroom louvres.

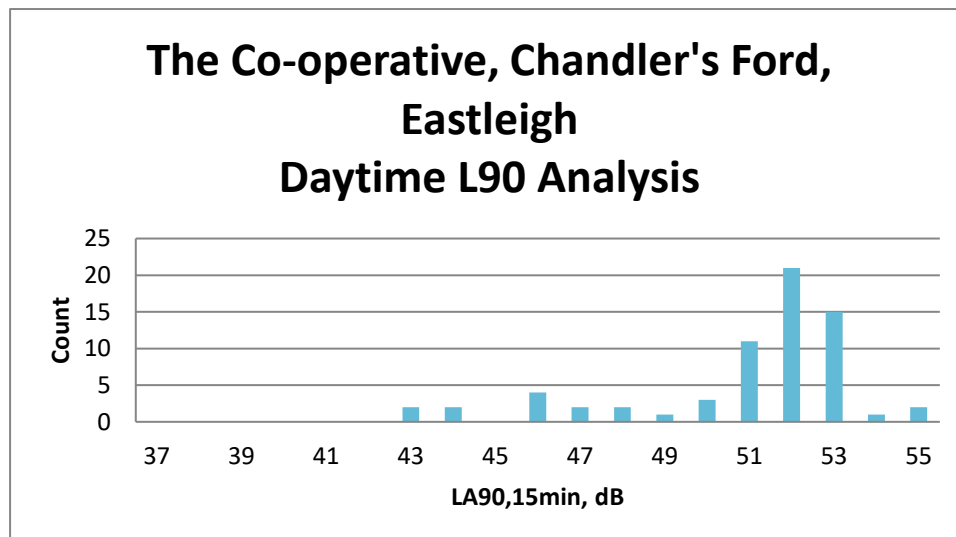
4.0 Existing noise climate

- 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 initial intention was to install the noise monitor on the road adjacent to the Fryern arcade, however no suitable and secure spot could be found for the monitor. An alternate location had to be selected that offered a comparable noise environment, which was to position the monitor on Brownhill Road.
- 4.3. 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 C](#).

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	L _{Aeq} (15mins)	L _{Amax} (15mins)	L _{A10} (15mins)	L _{A90} (15mins)
Daytime (07.00 – 23.00 hours)	50-69	70-103	51-68	43-55
Night-time (23.00 – 07.00 hours)	42-59	59-79	43-60	37-51

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



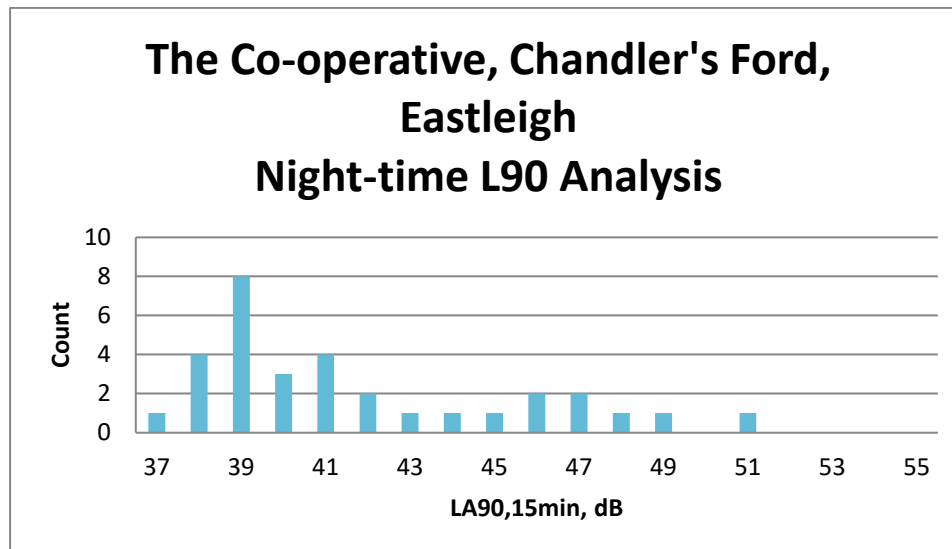
- 4.4. Further statistical analysis has been carried out on the data; the mean, modal and median values are shown in Table 2 below.

Table 2 Statistical analysis of LA90,15min levels during the daytime period

dB, L _{A90} daytime period	
mean	51
modal	52
median	52

- 4.5. From review of the time history chart, 43dB has been selected to match Eastleigh Borough Council's criteria (see section 5.1.).

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



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

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

dB, L _{A90} night-time period	
mean	42
modal	39
median	40

- 4.7. Again, from the time history chart, 37dB has been selected to match Eastleigh Borough Council's criteria (see section 5.1.) .Therefore, the following values are considered representative of the existing background sound pressure levels at nearby noise sensitive premises:

- 43dB L_{A90} during the daytime period; and
- 37dB L_{A90} during the night-time period.

5.0 Plant noise design criteria

Eastleigh Borough Council

- 5.1. Eastleigh Borough Council's noise limit requirements are worded as follows:

Prior to commencement of the development, details shall be submitted to and approved in writing by the Council, of the external sound level emitted from plant/ machinery/ equipment and mitigation measures as appropriate. The measures shall ensure that the external sound level (Rating Level) emitted from plant, machinery/ equipment will be lower than the lowest existing background sound level by at least 10dBA to prevent any adverse impact. The assessment shall be made in accordance with BS4142:2014 at the nearest and/or most affected noise sensitive premises, with all machinery operating together at maximum capacity. A post-installation noise assessment shall be carried out where required to confirm compliance with the sound criteria and additional steps to mitigate noise shall be taken, as necessary. Approved details shall be implemented prior to occupation of the development and thereafter be permanently retained.

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

- 5.2. 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".
- 5.3. 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.
- 5.4. 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 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

- 5.12. In order to meet the local authority's emissions criterion, the cumulative plant noise rating level of the proposed plant items would need to be controlled to a level that does not exceed 5dB below the representative L_{A90} background sound level at the nearest residential property.

- 5.13. The cumulative noise level for the proposed plant at the nearest residential receptors should not therefore exceed the limits shown in the table below:

Table 4 Proposed plant noise emissions level limits at noise sensitive residential receptors

Period	Cumulative plant noise level, dB(A)
Daytime (07.00 – 23.00 hours)	33
Night-time (23.00 – 07.00 hours)	27

6.0 Plant noise impact assessment

- 6.1. The cumulative plant noise levels at the most affected noise sensitive receptors have been predicted based on manufacturer's noise data for the proposed equipment. The assessment has taken into consideration distance attenuation, screening and directivity.
- 6.2. 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. To be robust, however, a +3dB feature correction as advised in BS 4142:2014 has been applied for the possible presence of "...characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment...".
- 6.3. Noise levels at the receptor have been predicted taking into account ductwork system losses, aperture size, directivity of sound propagation, screening and distance attenuation. Predictions are inclusive of atmospheric-side attenuation fitted to the ventilation systems as detailed in Table 5.

Table 5 Proposed atmospheric side attenuators to ventilation systems

Attenuator	Insertion losses dB, at octave band centre frequencies (Hz)							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Plantroom intake	6	15	28	44	45	45	43	33
Plantroom gas cooler discharge	7	15	31	45	45	45	45	41
Plantroom VRV discharge	6	15	28	44	45	45	43	33

- 6.4. Table 6 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 F](#).

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

Receptor	Period	Predicted rating level at receptor, L_{Aeq} (dB)	Criterion (dB)	Difference
R1	Daytime (07.00 - 23.00 hours)	25	33	-8
	Night-time (23.00 - 07.00 hours)	17	27	-10
R2	Daytime (07.00 - 23.00 hours)	25	33	-8
	Night-time (23.00 - 07.00 hours)	16	27	-11

- 6.5. The assessment shows that noise from the proposed plant will be below the recommended criteria, when attenuated as described, at the most affected noise sensitive receptors and should therefore be acceptable to the local authority.

Assessment of uncertainties

- 6.6. Where possible uncertainty in this assessment has been minimised by taking the following steps:
- The measurement of the background sound levels was undertaken over a period including the quietest times of the day and night.
 - The sound level meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
 - Uncertainty in the calculated impact has been reduced by the use of a well-established calculation method.
 - Care was taken to ensure that the measurement position was representative of the noise climate outside the nearby residential dwellings and not at a position where higher noise levels are present.

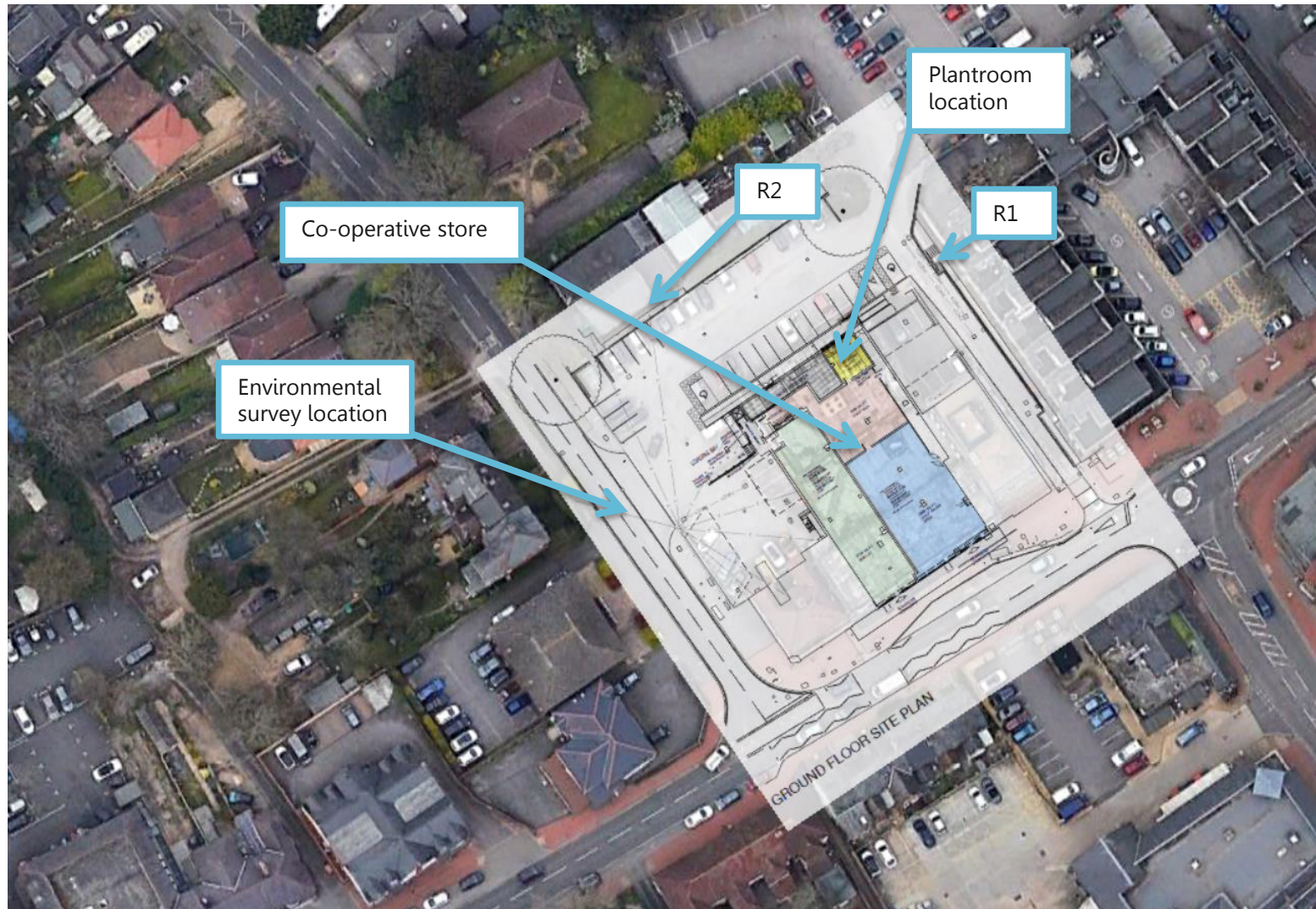
7.0 Summary

- 7.1. Noise Solutions Ltd (NSL) has been commissioned by Henry Riley LLP to provide a noise impact assessment of replacement plant serving the Co-operative store located on Winchester Road at Chandler's Ford, Eastleigh.
- 7.2. An environmental noise survey has been undertaken to establish the existing prevailing noise levels at a location representative of the noise climate outside the nearest noise sensitive receptors to the proposed site.
- 7.3. The cumulative plant noise emission levels for the proposed plant, when attenuated as described, have been predicted at the most potentially affected noise sensitive receptor locations and demonstrated to be in compliance with the requirements of Eastleigh Borough Council. Therefore, noise from 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 exceeded for 90% of the time over the period T. Generally used to describe background noise level.

Appendix B Photograph of site showing areas of interest



Appendix C Environmental sound survey

Details of environmental sound survey

- C.1 Measurements of the existing background sound levels were undertaken between 11.45 hours on Thursday 3rd November and 12.15 hours on Friday 4th November 2022.
- 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 fifteen-minute sample periods for the duration of the survey.

Measurement position

- C.3 The representative measurement position was located on a lamp-post on Brownhill Road west of the site. The approximate location of the microphone is indicated on the plan in [Appendix B](#).
- 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

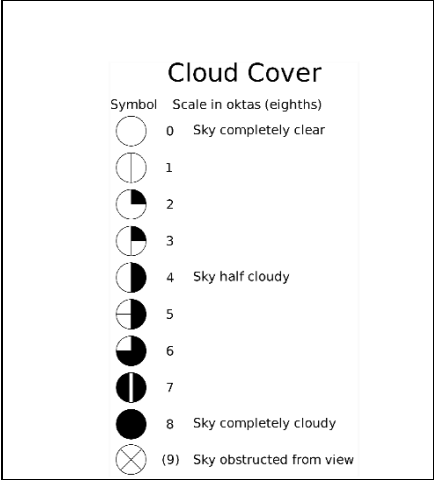
- C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Type 1 Sound level meter	Svantek 971A / 124655	26/07/2022	Factory conformation certificate
Condenser microphone	ACO Pacific 7152 / 84710		
Preamplifier	Svantek SV18A / 126200		
Calibrator	Svantek SV33B / 125706	09/09/2022	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 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	11.45 3 Nov - 12.15 4 Nov 2022	Temperature (°C)	11	12
 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:	Yes	No
		Cloud cover (oktas - see guide)	8	2
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Yes	Yes
		Wind Speed (m/s)	0	<1
		Wind Direction	-	ENE
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

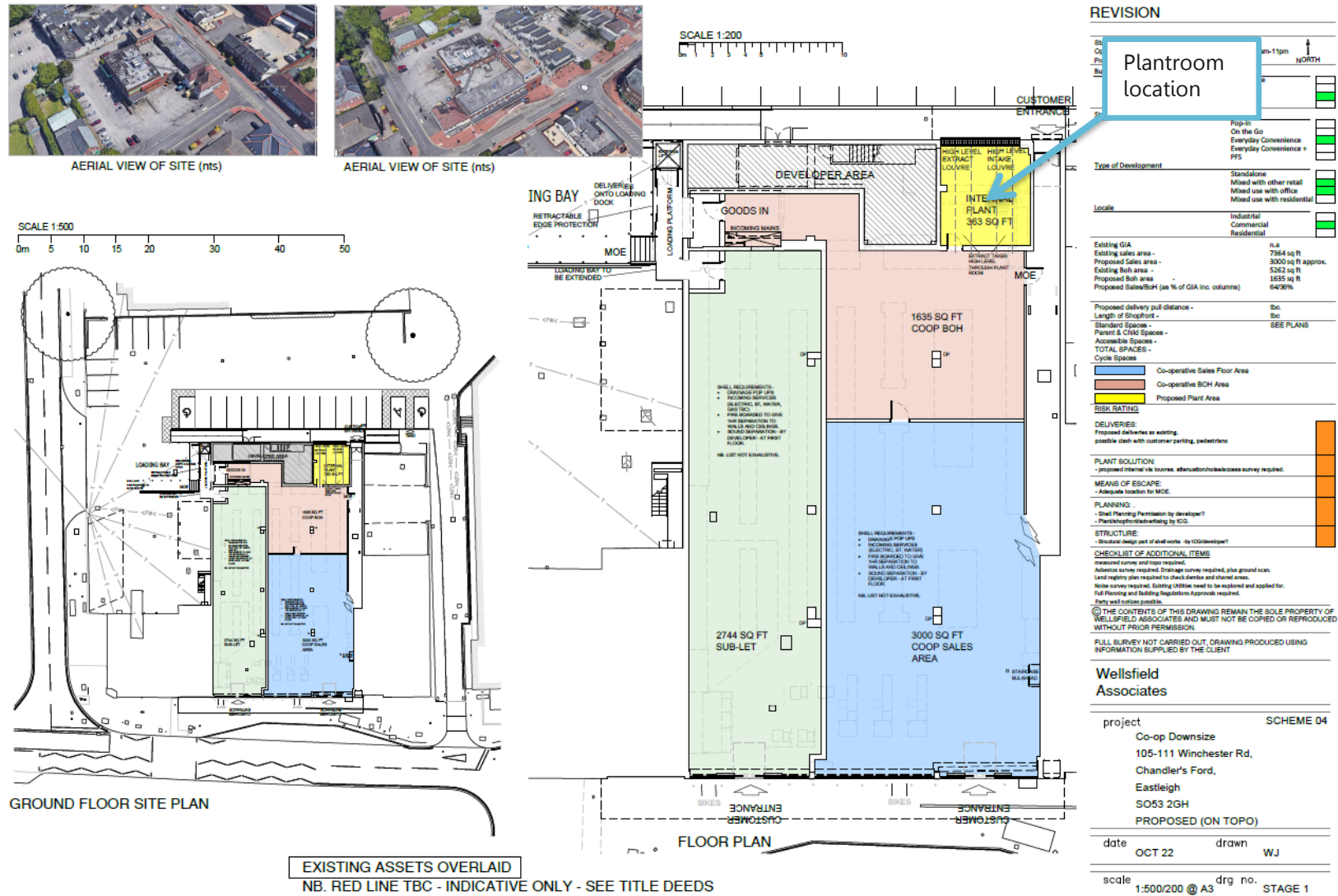
- C.7 The results of the environmental survey are considered to be representative of the background sound pressure levels at the façades of the nearest noise sensitive receptors during the quietest times at which the plant will operate.
- C.8 The predominant noise sources affecting the area at the start include local traffic, aircraft noise, noise from pets(dogs) and pedestrians.
- C.9 The predominant noise sources affecting the area at the end of the survey include traffic noise, and noise from pedestrians.
- C.10 The results of the survey are presented in a time history graph overleaf.

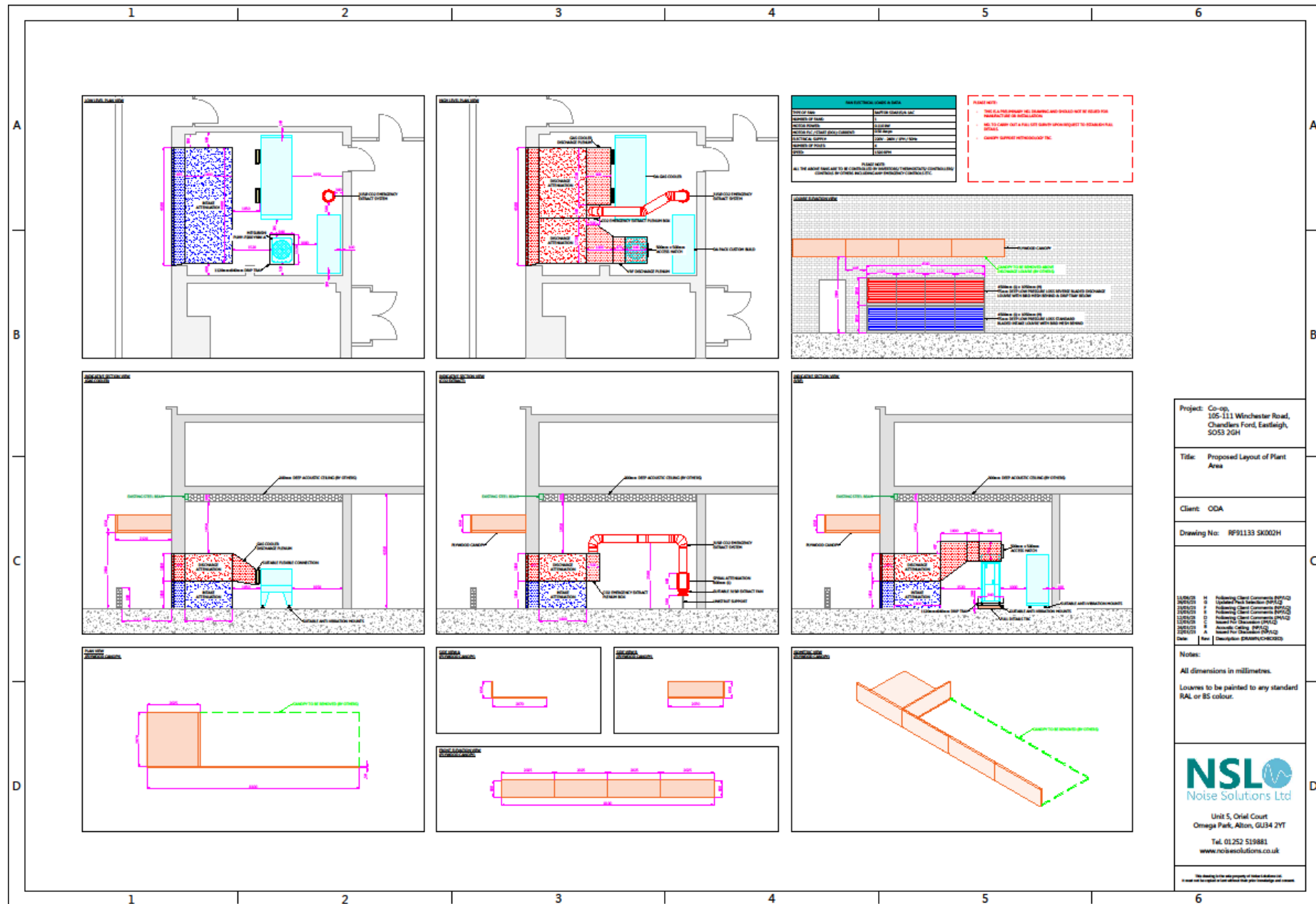
The Co-operative, Chandler's Ford, Eastleigh Thursday 03 - Friday 04 Nov 2022



Appendix D Noise data of proposed plant

Plant Item	Make / Model	Quantity	Operating Hours	Sound level, dB(A)
Gas cooler	3T / HFR-c-124-ECPlug-776-H	1	Daytime and night-time	33@10m (Sound pressure level)
Refrigeration Pack	Hubbard / DT-2A/1D	1	Daytime and night-time	72 (Sound power level)
ACU1	Mitsubishi / PUHY-M200YNW	1	Daytime only	78 (Sound power level)





Appendix F Noise level predictions

Daytime

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	79	73	71	67	63	58	54	47	69
All plant running										
Opening area (m2)	4.73	7	7	7	7	7	7	7	7	
SRI of opening	I.L	-6	-15	-28	-44	-45	-45	-43	-33	
Inside-outside correction		-6	-6	-6	-6	-6	-6	-6	-6	
Lw of opening	Lw	74	58	44	24	19	14	12	15	49
R1										
Directivity correction	(4500,0deg x 1050,90deg)	2	1	1	-4	-7	-7	-7	-7	
Distance correction (m)	20	-34	-34	-34	-34	-34	-34	-34	-34	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R1	Lp @ R1	44	29	14	-11	-19	-24	-26	-23	19
R2										
Directivity correction	(4500,0deg x 1050,50deg)	3	3	4	4	4	4	4	4	
Distance correction (m)	25	-36	-36	-36	-36	-36	-36	-36	-36	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R2	Lp @ R2	44	28	15	-6	-10	-15	-17	-14	19
Discharge										
Gas Cooler Discharge										
Sound power	Lw	70	67	71	61	57	50	46	41	65
End reflection	2.289	-1	0	0	0	0	0	0	0	
SRI of opening	I.L	-7	-15	-31	-45	-45	-45	-45	-41	
Lw of opening		62	52	40	16	12	5	1	0	39
R1										
Directivity correction	(2180,0deg x 1050,90deg)	1	1	1	-4	-7	-7	-7	-7	
Distance correction (m)	20	-34	-34	-34	-34	-34	-34	-34	-34	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R1	Lp @ R1	32	21	9	-19	-26	-33	-37	-38	9
R2										
Directivity correction	(2180,0deg x 1050,50deg)	2	3	3	4	4	4	4	4	
Distance correction (m)	25	-36	-36	-36	-36	-36	-36	-36	-36	
Screening (δ = /m)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R2	Lp @ R2	31	21	10	-13	-17	-24	-28	-29	9
AC Unit Discharge including fan										
Sound power	Lw	82	84	83	85	75	73	69	65	84
End reflection	1.806	-3	-1	0	0	0	0	0	0	
SRI of opening	I.L	-6	-15	-28	-44	-45	-45	-43	-33	
Lw of opening		73	68	55	41	30	28	26	32	54

	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
Receptor R1									
Intake	44	29	14	-11	-19	-24	-26	-23	19
Condenser Discharge	32	21	9	-19	-26	-33	-37	-38	9
VRV Discharge	43	38	25	7	-8	-10	-12	-6	24
Cumulative	47	39	25	7	-7	-10	-12	-6	25
Receptor R2									
Intake	44	28	15	-6	-10	-15	-17	-14	19
Condenser Discharge	31	21	10	-13	-17	-24	-28	-29	9
VRV Discharge	42	38	25	12	1	-1	-3	3	24
Cumulative	46	38	26	12	2	-1	-3	3	25

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	75	70	70	65	61	56	52	46	67
All plant running										
Opening area (m2)	4.7	7	7	7	7	7	7	7	7	
SRI of opening	I.L	-6	-15	-28	-44	-45	-45	-43	-33	
Inside-outside correction		-6	-6	-6	-6	-6	-6	-6	-6	
Lw of opening	Lw	70	55	43	22	17	12	10	13	45
R1										
Directivity correction	(4500,0deg x 1050,90deg)	2	1	1	-4	-7	-7	-7	-7	
Distance correction (m)	20.0	-34	-34	-34	-34	-34	-34	-34	-34	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R1	Lp @ R1	41	26	13	-13	-21	-26	-28	-25	16
R2										
Directivity correction	(4500,0deg x 1050,50deg)	3	3	4	4	4	4	4	4	
Distance correction (m)	25.0	-36	-36	-36	-36	-36	-36	-36	-36	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R2	Lp @ R2	40	25	14	-8	-12	-17	-19	-16	16
Discharge										
Gas Cooler Discharge										
Sound power	Lw	70	67	71	61	57	50	46	41	65
End reflection	2.3	-1	0	0	0	0	0	0	0	
SRI of opening	I.L	-7	-15	-31	-45	-45	-45	-45	-41	
Lw of opening		62	52	40	16	12	5	1	0	39
R1										
Directivity correction	(2180,0deg x 1050,90deg)	1	1	1	-4	-7	-7	-7	-7	
Distance correction (m)	20.0	-34	-34	-34	-34	-34	-34	-34	-34	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R1	Lp @ R1	32	21	9	-19	-26	-33	-37	-38	9
R2										
Directivity correction	(2180,0deg x 1050,50deg)	2	3	3	4	4	4	4	4	
Distance correction (m)	25.0	-36	-36	-36	-36	-36	-36	-36	-36	
Screening ($\delta = /m$)	-	0	0	0	0	0	0	0	0	
Surface Directivity		0	0	0	0	0	0	0	0	
BS4142		3	3	3	3	3	3	3	3	
Resultant at receptor R2	Lp @ R2	31	21	10	-13	-17	-24	-28	-29	9

	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
Receptor R1									
Intake	41	26	13	-13	-21	-26	-28	-25	16
Condenser Discharge	32	21	9	-19	-26	-33	-37	-38	9
Cumulative	41	27	14	-12	-20	-25	-27	-24	17
Receptor R2									
Intake	40	25	14	-8	-12	-17	-19	-16	16
Condenser Discharge	31	21	10	-13	-17	-24	-28	-29	9
Cumulative	40	27	15	-7	-11	-16	-18	-15	16