The Co-operative

Tamar House
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St Budeaux
Plymouth
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Plant Noise
Impact Assessment Report

On behalf of

Project Reference: 92077 | Revision: - | Date: 7th February 2024

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Document Information

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	Name	Qualifications	Initials	Date
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For and on behalf of Noise Solutions Ltd				

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Appendices

1.0 Introduction

1.1. Noise Solutions Ltd (NSL) has been commissioned by Epta UK to provide a noise impact assessment of noise emissions from replacement plant serving an existing Co-operative store located in Tamar House along Victoria Road in Plymouth.

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 residential property and assessed against Plymouth City Council's typical 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 occupies the ground floor and part of the first floor of a mixed-use building at the junction between Victoria Road and Trelawney Avenue.

2.2. New replacement air conditioning (AC) plant will be installed externally on the of the store. The AC units will operate only when the store is open between 06:00 and 22:00 hours.

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**.

3.0 Nearest noise-sensitive receptors

3.1. The area surrounding the site is mixed residential and commercial in nature.

3.2. The nearest noise sensitive receptor will be the residential flats along Victoria Road (Reference R1) at a distance of approximately 22 metres from the proposed plant and the house along Trelawney Avenue (Reference R2) at a distance of approximately 23 metres from the proposed plant.

4.0 Existing noise climate

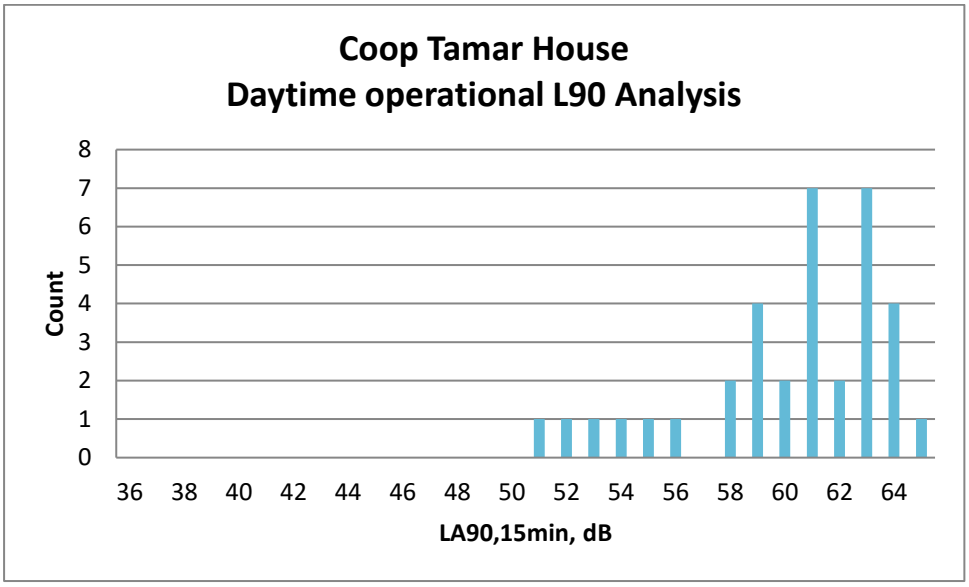
4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate.

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 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 operational (07.00 – 22.00 hours)	64-74	78-101	67-71	51-65
Night-time operational (06.00 – 07.00 hours)	64-69	80-88	67-72	47-61
Night-time (23.00 – 07.00 hours)	48-69	68-91	39-68	36-50

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



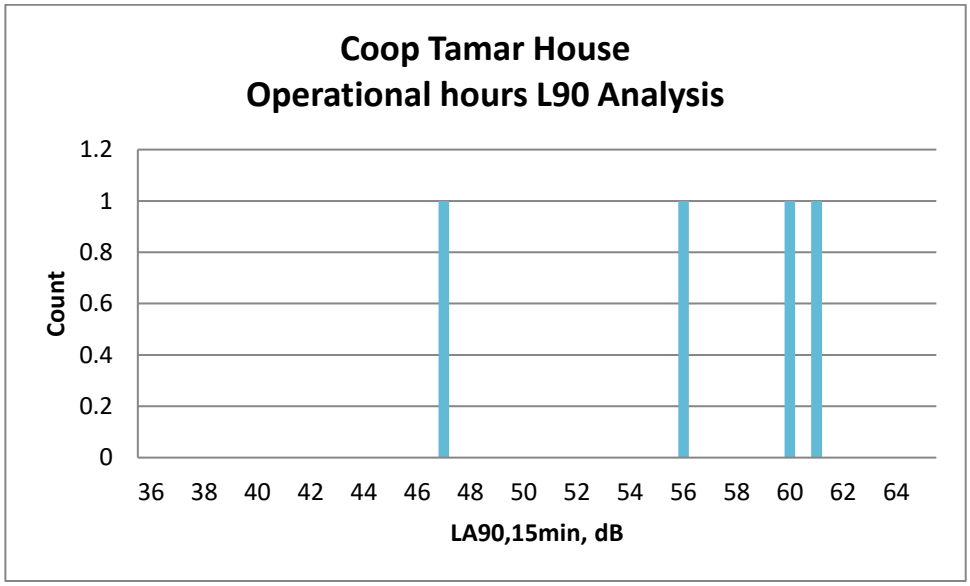
4.3. Further statistical analysis has been carried out on the data; the mean, modal and median values are shown in Table 2 below.

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

dB, L_{A90} daytime period	
mean	60
modal	63
median	61

4.4. From the histogram analysis, 54dB has been selected to be a robust representation of the background noise level during the daytime period.

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



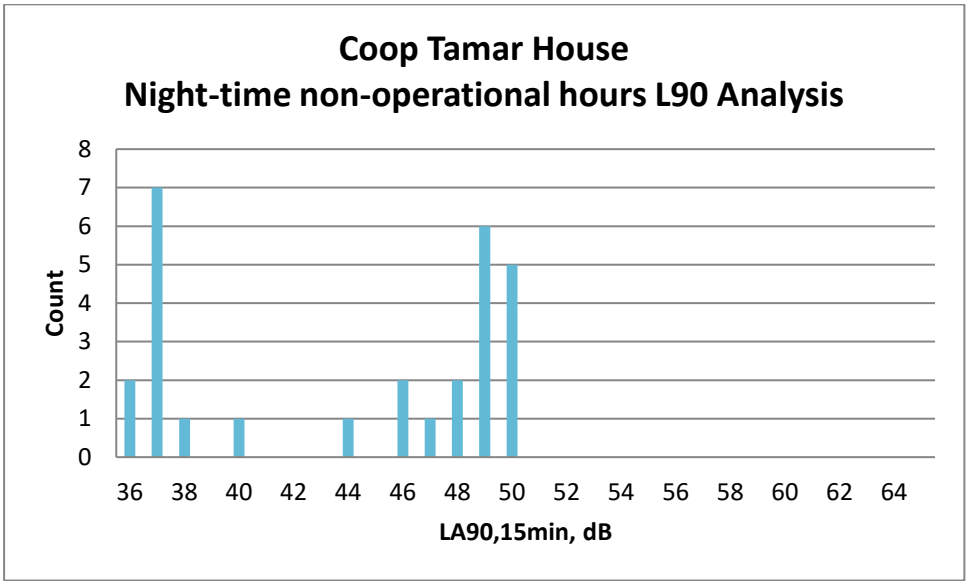
4.5. Further statistical analysis has been carried out on the data; the mean, modal and median values are shown in Table 3 below.

Table 3 Statistical analysis of $L_{A90,15min}$ levels during the night-time operational period

dB, L_{A90} night-time period	
mean	56
modal	56
median	58

4.6. Again, from the histogram analysis, 56dB has been selected to be a robust representation of the background sound level during the night-time operational period.

Figure 3 Histogram of night-time non-operational hours L_{A90} background sound pressure levels



4.7. Further statistical analysis has been carried out on the data; the mean, modal and median values are shown in Table 4 below.

Table 4 Statistical analysis of $L_{A90,15min}$ levels during the night-time non-operational period

dB, L_{A90} night-time period	
mean	44
modal	37
median	47

4.8. Again, from the histogram analysis, 37dB has been selected to be a robust representation of the background sound level during the night-time period.

4.9. Therefore, the following values are considered to be the lowest existing background sound pressure levels at nearby noise sensitive premises:

- 54dB L_{A90} during the daytime operational period; and
- 56dB L_{A90} during the night-time operational period; and
- 37dB L_{A90} during the night-time non-operational period.

5.0 Plant noise design criteria

Plymouth City Council

5.1. From previous NSL projects, Gregg Portass from Plymouth City Council was contacted in order to obtain the typical requirements of the council in relation to the level of noise emitted from fixed plant. His response is as follows:

"I would attempt to meet BS8233 room levels (bedroom/living room depending upon the timeframe) taking into account façade corrections and mitigation of standard windows.

However I am aware that this may not be achievable/the background level may not allow for this to be reached. As such as a secondary I would be trying to achieve 5dB below background if possible."

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+A1:2019 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.

Summary of criteria

5.12. Plymouth City Council usually requires than the BS 4142:2014+A1:2019 rating level is no higher than 5dB below the existing background sound level. The proposed plant noise limits are therefore as shown in Table 5:

Table 5 Proposed plant rating level limits at nearest residential receptors

Receptor	Period	Plant rating level (dB)
Residential	Daytime operational (07.00 – 22.00 hours)	49
	Night-time operational (06.00 – 07.00 hours)	51
	Night-time non-operational (23.00 – 06.00 hours)	32

6.0 Plant noise impact assessment

6.1. It should be noted that the proposed ventilation plant will operate during operational hours only and is not anticipated to exhibit any tonal or impulsive characteristics provided it is well maintained. All proposed external plant will be inverter driven and, therefore, will gently ramp up and down depending on the demands on the various systems. To provide a robust assessment, a 3dB acoustic feature correction as described in BS 4142:2014+A1:2019 for the possible presence of "*...characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment...*".

6.2. Plant rating levels have been predicted at the nearest noise sensitive receptors. The assessment has taken account of the distance between the plant and the nearest receptors, orientations, screening, reflections and other propagation effects.

6.3. Table 6 summarises the results of the assessment outside the nearest noise-sensitive dwellings. 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 calculations are presented in **Appendix E**.

Table 6Assessment of plant rating levels

Receptor	Period	Predicted plant rating level at receptor, L_{Aeq} (dB)	Proposed design criterion (dB)	Difference (dB)
R1 (Residential)	Daytime operational (07.00 – 22.00 hours)	45	49	-4
	Night-time operational (06.00 – 07.00 hours)	45	51	-6
	Night-time non-operational (23.00 – 06.00 hours)	-	32	-
R2 (Residential)	Daytime operational (07.00 – 22.00 hours)	40	49	-9
	Night-time operational (06.00 – 07.00 hours)	40	51	-11
	Night-time non-operational (23.00 – 06.00 hours)	-	32	-

Assessment of uncertainties

6.4. 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 Epta UK to provide a noise impact assessment of noise emissions from replacement plant serving an existing Co-operative store located in Tamar House along Victoria Road in Plymouth.

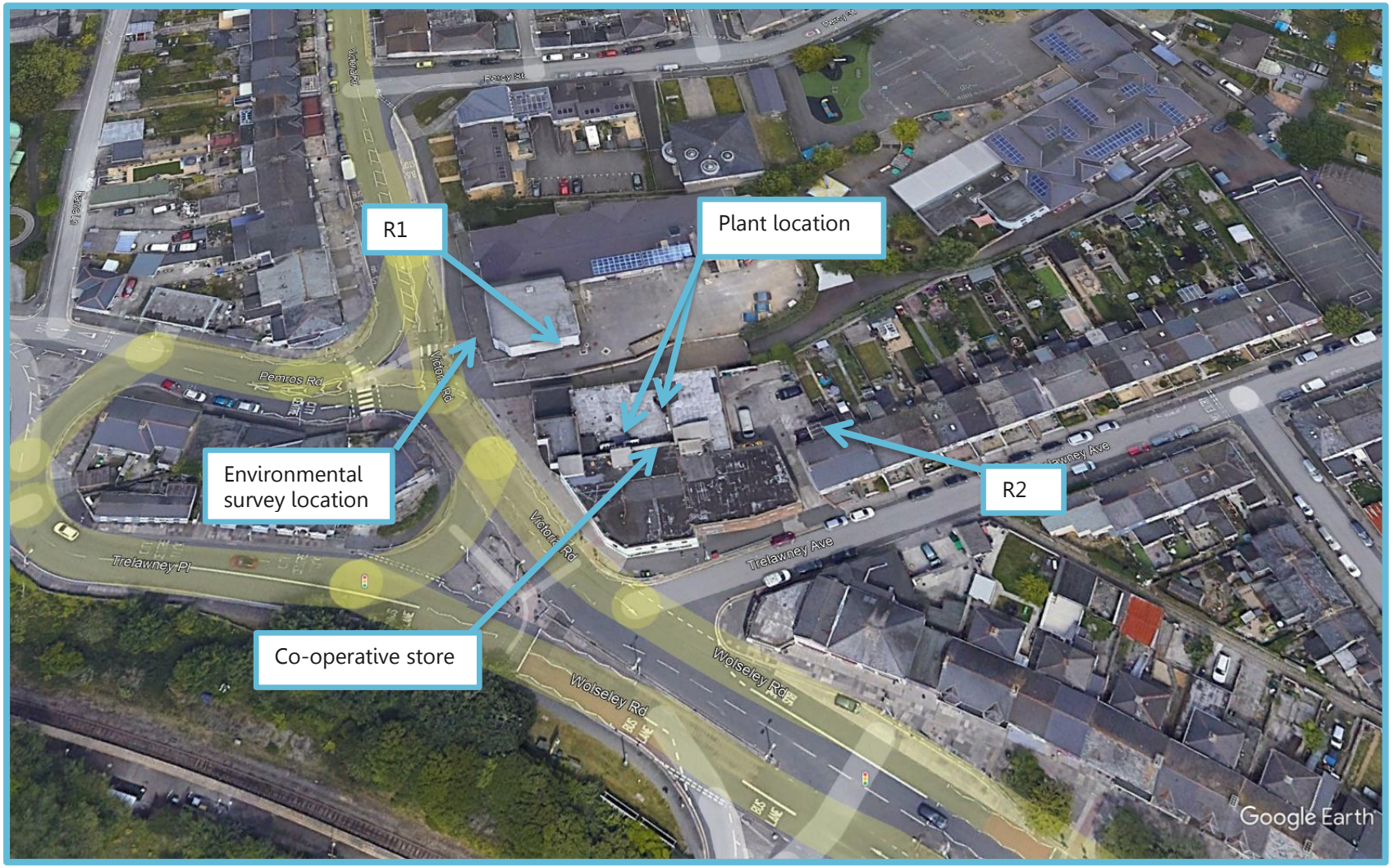
7.2. An environmental noise survey has been undertaken to establish the existing prevailing noise levels at a location representative of the noise climate outside the nearest noise sensitive receptors to the proposed site.

7.3. The cumulative sound rating levels for the proposed plant have been predicted at the most affect noise sensitive receptor locations and assessed taking into consideration the typical requirements of Plymouth City Council. Therefore, sound 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 s1 and s2 is given by 20 $\log_{10}$ (s1/s2). 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 20μPa. 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 16.45 hours on Wednesday 31st January and 10.30 hours on Thursday 1st February 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 fifteen-minute sample periods for the duration of the survey.

Measurement position

C.3 The representative measurement position was located on a lamp post along Victoria Road. This location is approximately representative of the levels of road traffic noise at the closest receptor. 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

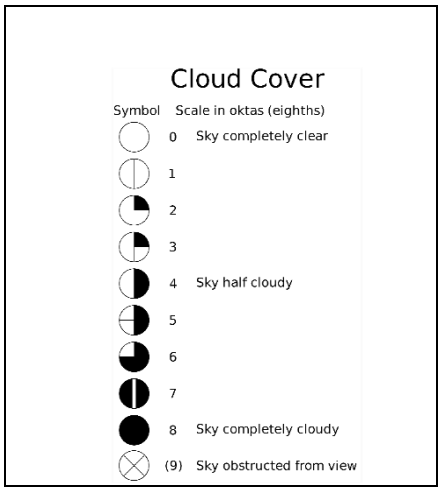
C.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.2 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 977D / 99070	11/05/2023	Factory conformation certificate
Condenser microphone	ACO Pacific 7052E / 81197		
Preamplifier	Svantek SV18A / 130661		
Calibrator	Rion NC-74 / 35094453	06/09/2023	1503192-1

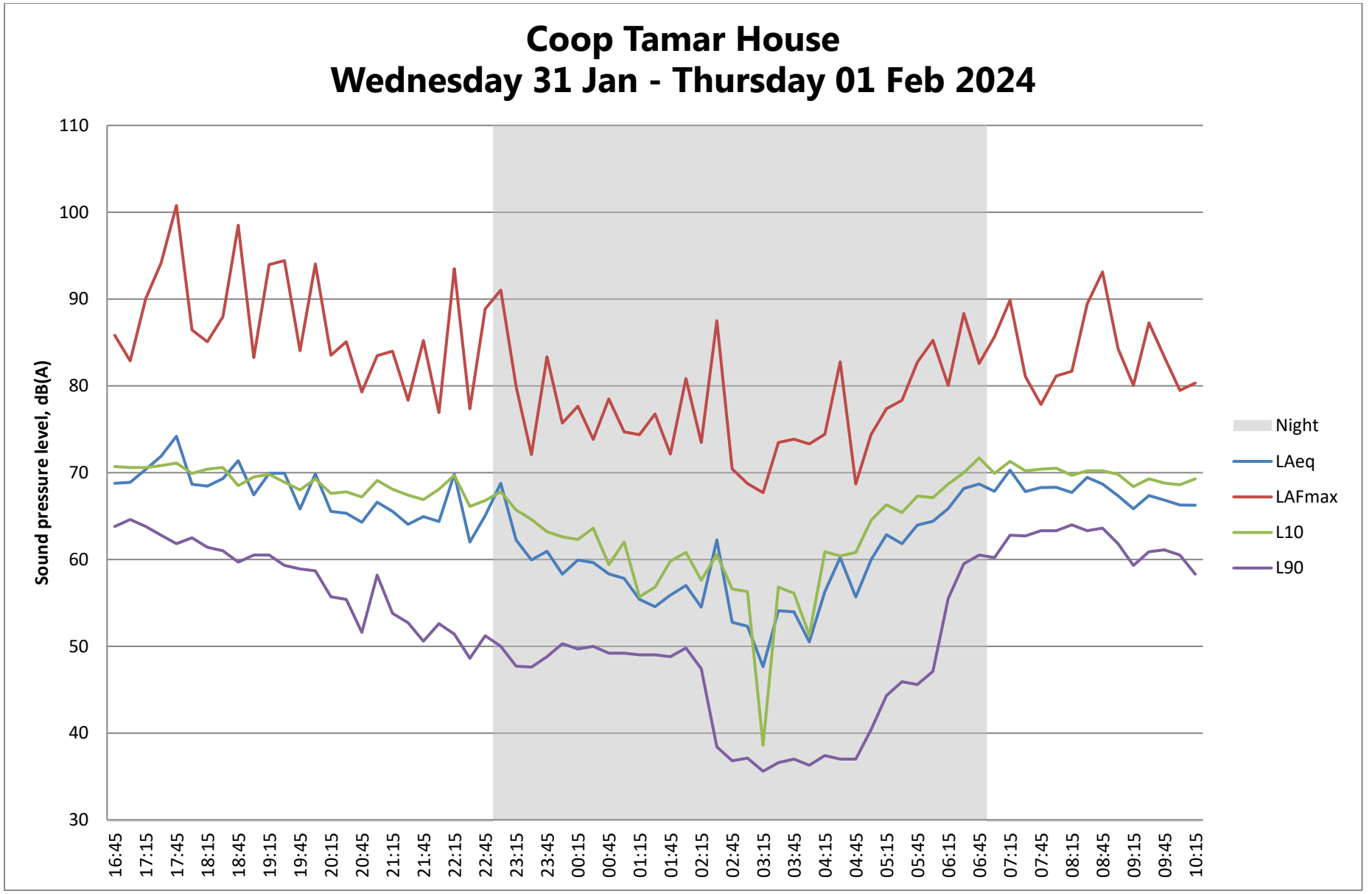
Weather conditions

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	16.45 31/1/24 - 10.30 1/2/24	Temperature (°C)	11	7
		Precipitation:	No	No
		Cloud cover (oktas - see guide)	7	7
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	Yes	Yes
		Wind Speed (m/s)	2	1
		Wind Direction	Easterly	Northerly
		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 predominant noise source affecting the area was distant traffic. The results of the survey are presented in a time history graph overleaf.


Coop Tamar House
Wednesday 31 Jan - Thursday 01 Feb 2024
Sound pressure level, dB(A)
110
100
90
80
70
60
50
40
30
16:45
17:15
17:45
18:15
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19:15
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04:15
04:45
05:15
05:45
06:15
06:45
07:15
07:45
08:15
08:45
09:15
09:45
10:15
Night
LAeq
LAFmax
L10
L90

Appendix D Manufacturer's Noise Data

Plant	Unit/Model	No. of units	Description	Level (dBA)
AC1-3	Mitsubishi/PUZ-ZM250YKA2	3	Sound pressure level at 1m	62
AC4	Mitsubishi/PUZ-ZM100YKA2	1	Sound pressure level at 1m	51

Appendix E Plant noise calculations

Receptor R1 – Operational

Plant	PLANT NOISE LEVEL AT SOURCE		DISTANCE		Directivity	Screening	BS4142 FEATURE	Rating Level at Receptor (dB)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)	Correction (dB)	
AC 1	62	1	24	-28	3	0	+3	40
AC 2	62	1	24	-28	3	0	+3	40
AC 3	62	1	24	-28	3	0	+3	40
AC 4	51	1	22	-27	3	0	+3	30
Combined rating level at receptor								**45**

Receptor R2 – Operational

Plant	PLANT NOISE LEVEL AT SOURCE		DISTANCE		Directivity	Screening	BS4142 FEATURE	Rating Level at Receptor (dB)
	Noise level (dBA)	Distance (m)	Distance (m)	Correction (dB)	Correction (dB)	Correction (dB)	Correction (dB)	
AC 1	62	1	24	-28	3	-5	+3	35
AC 2	62	1	26	-28	3	-5	+3	35
AC 3	62	1	28	-29	3	-5	+3	34
AC 4	51	1	23	-27	3	-5	+3	25
Combined rating level at receptor								**40**

Appendix F Plant layout