

Blacks Head PH
High Street
Upper Tean
ST10 4DY

**Plant Noise
Impact Assessment**

On behalf of



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Executive Summary

Noise Solutions Limited has been appointed to provide a noise impact assessment for new plant to be installed for the proposed Co-operative store, formerly the Blacks Head Public House in Upper Tean.

A new refrigeration pack, an associated gas cooler and two air conditioning (AC) units will be installed within a service area at the rear (west) of the store.

The assessment shows that the noise from the proposed plant, with the attenuation measures described in this report, will result in no worse than a “low impact” when assessed using the method described in BS 4142:2014, and should therefore be acceptable to the local authority.

1.0 Introduction

- 1.1. Noise Solutions Ltd (NSL) has been commissioned by SEP Properties Ltd to provide a noise impact assessment for new plant serving the proposed convenience store (formerly the Blacks Head Public House) in Upper Tean.
- 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. Noise levels from the plant have been predicted at the nearest noise-sensitive receptors and assessed against the local authority's usual requirements and recognised standards.
- 1.4. A glossary of acoustic terminology is given in [Appendix A](#).

2.0 Details of development proposals

- 2.1. The Blacks Head Public House occupies a building sited on the High Street in Upper Tean. Plant is to be located externally within a service area at the rear (west) of the store.
- 2.2. The proposed plant layout is shown in [Appendix D](#). Plant noise data is given in [Appendix E](#).
- 2.3. A pack, an associated gas cooler and two AC units will be installed within the service area to the west of the store. A suitable acoustic barrier has been proposed for the refrigeration pack and suitable acoustic enclosures have been proposed for the AC units. Wall lining has also been proposed for the proposed plant items.
- 2.4. The proposed AC units will operate only during the daytime period (07.00 – 23.00 hours) when the proposed store is open. The proposed refrigeration plant may potentially operate at any time of the day or night, although equipment duties will generally be lower at night when demands on the system are reduced.
- 2.5. A site plan showing the site and surrounding area, the nearest noise sensitive properties 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 predominantly residential in nature. It is understood that there are plans to develop the first floor of the building into residential flats. The nearest residential property to the plant is a flat sited on the first floor directly above the external plant area (Receptor R1). The closest windows are approximately 3m from the nearest plant.

- 3.2. Directly adjacent to the plant area is 13 High Street (Receptor R2) which overlooks part of the plant area but is screened to the proposed gas cooler due to building geometry. The closest window of this property is approximately 6m from the nearest plant item.

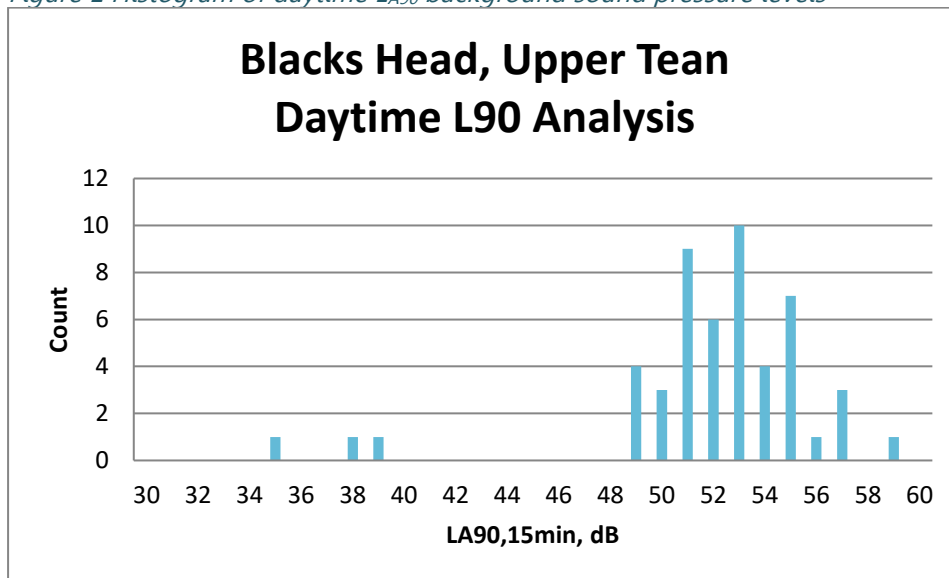
4.0 Existing noise climate

- 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 (07.00 – 23.00 hours)	62-72	77-99	67-75	35-59
Night-time (23.00 – 07.00 hours)	39-69	65-89	37-73	31-48

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

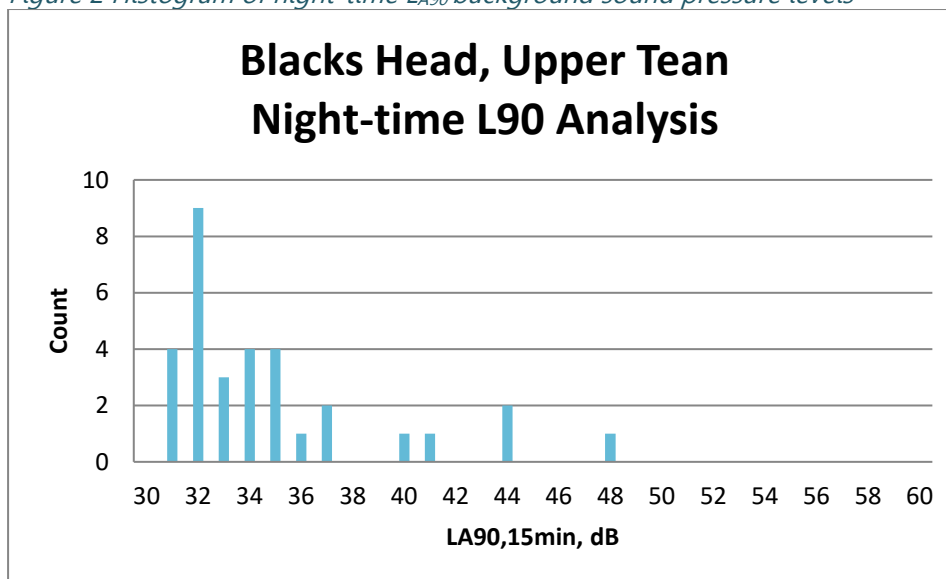


- 4.3. Additional statistical analysis has been undertaken. As shown in Table 2, the mean, median, and modal values have been calculated:

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

dB, L_{A90} daytime period	
Mean	52
Mode	53
Median	53

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



- 4.4. Additional statistical analysis has been undertaken. As shown in Table 3, the mean, median, and modal values have been calculated:

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

dB, L_{A90} night-time period	
Mean	35
Mode	32
Median	33

- 4.5. Based on the histogram analyses above, the following values have been considered as representative of the existing background sound pressure levels at nearby noise sensitive premises:

- 49dB L_{A90} during the daytime period; and

- 31dB LA90 during the night-time period.

- 4.6. The above values have been selected to be representative of periods when road traffic was at a minimum and background sound levels are therefore due to more-distant noise sources also affecting the residential property closest to the plant area.

5.0 Plant noise design criteria

Staffordshire Moorlands District Council

- 5.1. The below is taken from a planning condition involving noise for a similar site in the jurisdiction of Staffordshire Moorlands District Council.

The machinery, plant or equipment including installed or operated in connection with the carrying out of this permission shall be so enclosed and/or attenuated that the noise generated by the operation of the machinery shall not increase the background noise levels during the day time expressed as LA90 [1hour] (day time 07:00-23:00 hours) and/or (b) LA90 [15 mins] during night time (night time 23:00-07:00 hours) at any adjoining noise sensitive locations or premises in separate occupation above that prevailing when the machinery is not operating. Noise measurements for the purpose of this condition shall be pursuant to BS 4142:2014. The details and location of any plant or machinery to be installed under this permission should be submitted to and approved of in writing by the Local Planning

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

- 5.1. 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”.
- 5.2. 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.
- 5.3. 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.

- 5.4. 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."*
- 5.5. 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."*
- 5.6. 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.*
- 5.7. 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."*
- 5.8. 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."*
- 5.9. 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."

- 5.10. 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.

Low background noise levels

- 5.11. Due to the exceptionally low background levels, it is deemed appropriate to limit the night-time noise level to 30dB. An external noise level of 30dB will result in an internal noise level of 15dB(A) within bedrooms with windows partially open. This is well below the levels normally produced by domestic refrigerators etc.

Proposed criteria

- 5.12. In order to take into account potential cumulative effects, the following noise emissions criteria are proposed for use in this assessment.

Table 4 Proposed plant noise emissions criteria at nearby noise sensitive receptors

Period	Cumulative plant rating level, dB(A)
Daytime (07.00 – 23.00 hours)	39
Night-time (23.00 – 07.00 hours)	30

6.0 Plant noise assessment

- 6.1. The plant noise levels at the nearest noise sensitive receptors have been predicted. The assessment has considered distance losses and surface acoustic reflections from the store building.
- 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. The plant is also not expected to contain any significant low frequency tones, as stated in BS 4142:2014. However, a penalty of 3dB as described 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. Table 3 summarises the results of the assessment at the most affected residential properties. All other nearby receptors benefit from increased distance/screening to the plant. The full set of calculations can be found in [Appendix F](#).

Table 3 Plant noise assessment

Receptor	Period	Plant noise level at receptor, dB L_{Aeq}	Plant noise limit at receptor, dB L_{Aeq}	Excess, dB
R1	Daytime (07.00 – 23.00 hours)	34	39	-5
	Night-time (23.00 – 07.00 hours)	30*	30	0
R2	Daytime (07.00 – 23.00 hours)	32	39	-7
	Night-time (23.00 – 07.00 hours)	27*	30	-3

**Assumes plant will operate at maximum duty during the night-time. The plant will generally run at a reduced duty at night and, therefore, resulting noise levels will typically be lower.*

- 6.4. The assessment shows that noise from the plant is below the proposed criteria, with the mitigation described in this report, and would therefore be below the level at which a “low impact” would be expected when assessed using the methodology in BS 4142:2014. The assessment demonstrates compliance with Staffordshire Moorlands District Council’s requirements and, therefore, the proposals should be acceptable to them in terms of noise.

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 window. The impact on all other nearby residential windows will be lower due to screening and distance attenuation.
 - The assessment has been made with all plant operating at maximum capacity, as this is not always the case, the assessment is an absolute worst-case scenario.
- 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.
- Care was taken to ensure that the measurement positions were representative of the noise climate outside the nearby residential dwellings and not in positions where higher noise levels were present.

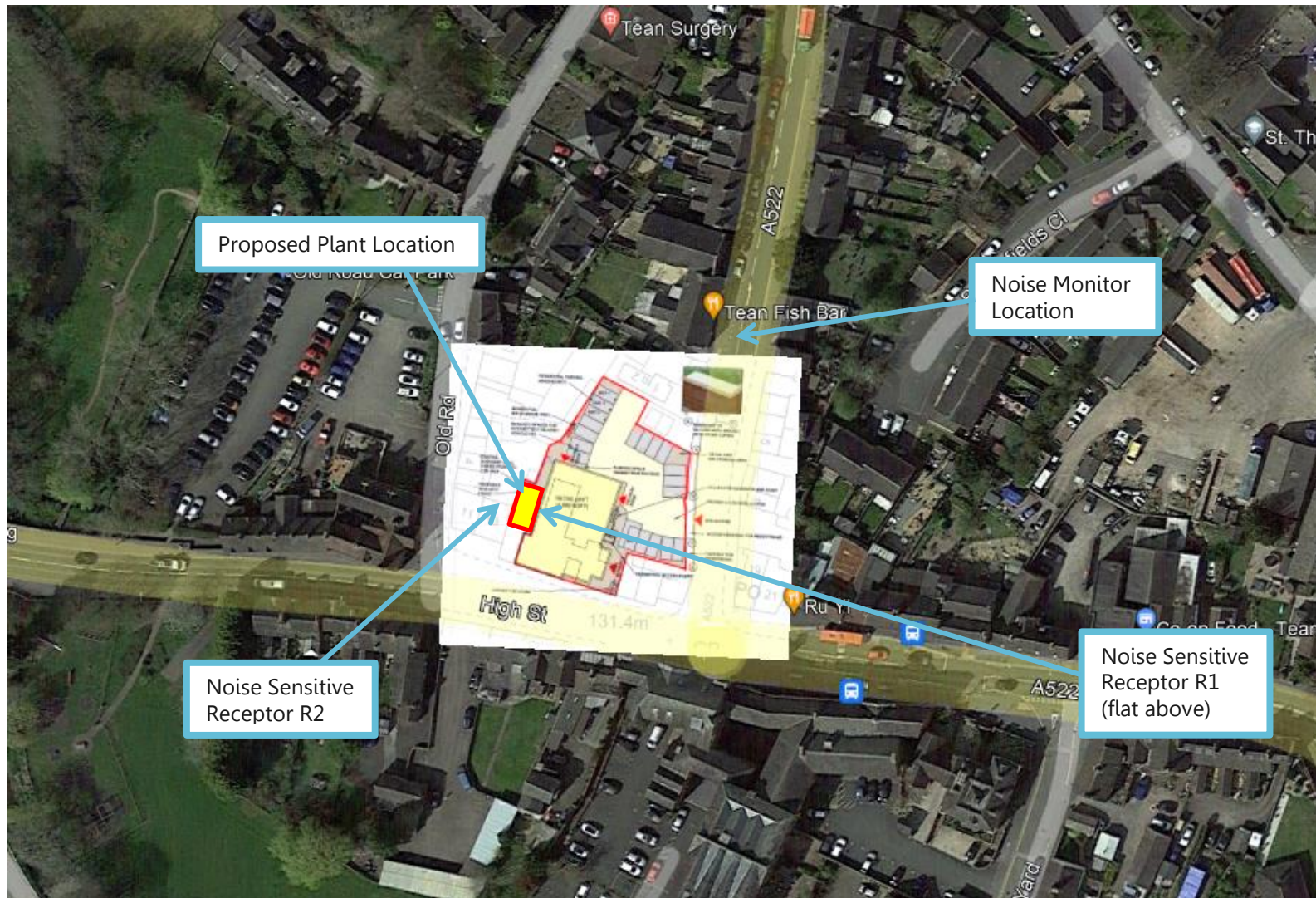
7.0 Summary

- 7.1. Noise Solutions Ltd (NSL) has been commissioned to provide a noise impact assessment on new plant serving the proposed co-operative store to replace the former Blacks Head pub in Upper Tean.
- 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 plant area.
- 7.3. The assessments shows that noise from the proposed plant will comply with recognised Standards and guidance, with the mitigation described within this report, and should therefore be acceptable to the local authority.

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 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 from 16.15 hours on Monday 28th October to 12.30 hours on Tuesday 29th October 2019.
- 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

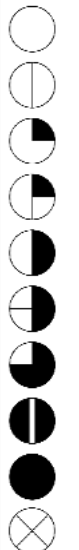
- C.3 The sound level meter was positioned on a lamppost on the A522. The approximate location of the microphone is indicated on the aerial photograph in [Appendix B](#). In accordance with BS 7445-2:1991 '*Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use*', the measurements were undertaken under free-field conditions.
- C.4 The survey location was chosen such that the lowest background noise levels were similar to those at the nearest residential receptors (R1 and R2) but exclude any potential effect of noise from existing plant serving the store.

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.

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Svantek 977 / 36190	25/05/2021	1500077-1
Condenser microphone	ACO Pacific 7052E / 74975		
Preamplifier	Svantek SV12L / 10325		
Calibrator	Svantek SV33A / 73430	08/07/2021	1500622-1

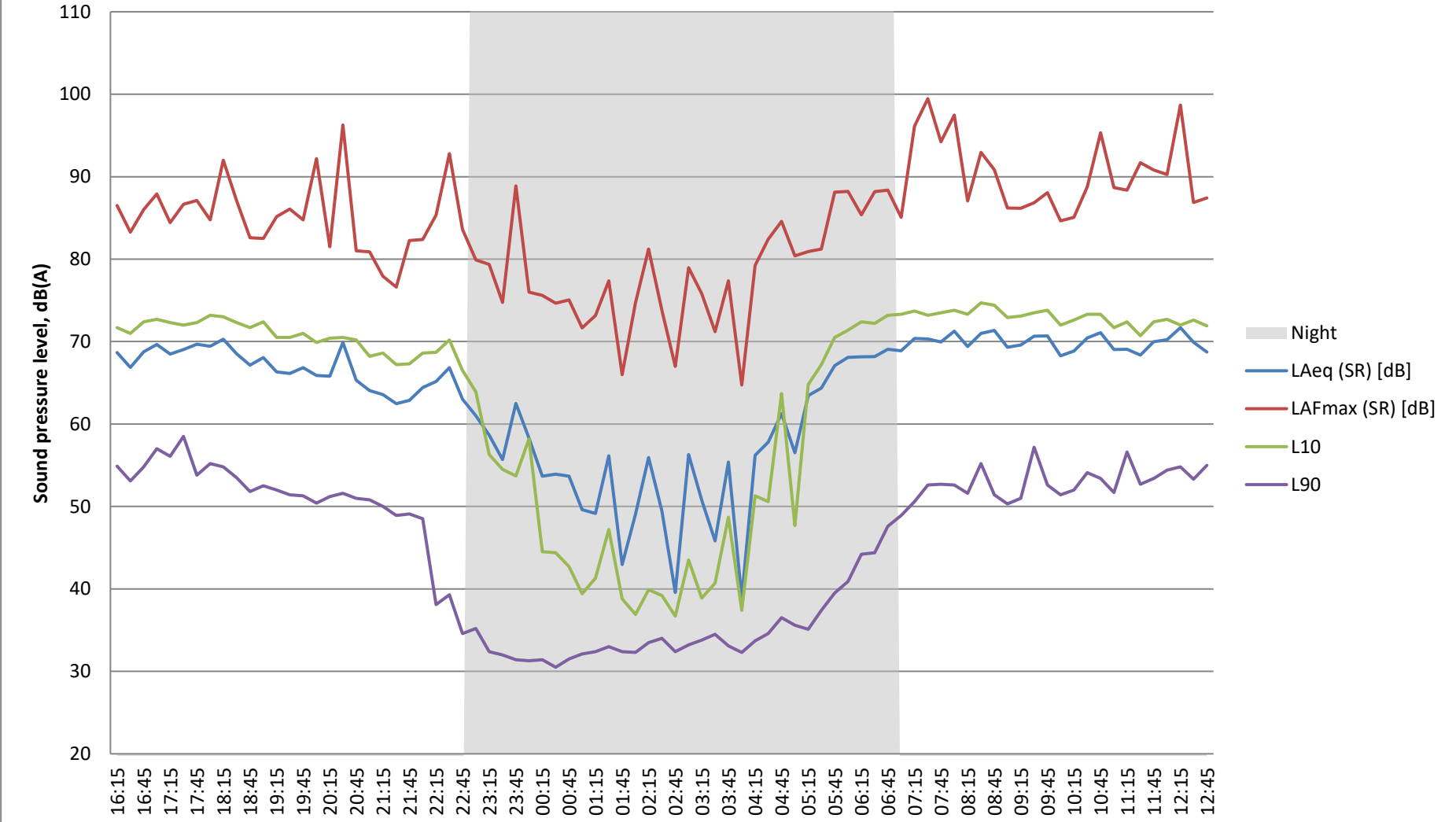
- C.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	Time/Date	Description	Beginning of Survey	End of Survey
As indicated on Appendix B	16.15 28 Oct – 12.30 29 Oct 2019	Temperature (°C)	9	10
Cloud Cover  Symbol Scale in oktas (eighths) 0 Sky completely clear 1 2 3 4 Sky half cloudy 5 6 7 8 Sky completely cloudy (9) Sky obstructed from view		Precipitation:	No	No
		Cloud cover (oktas – see guide)	6	2
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	<1	2.4
		Wind Direction	n/a	E
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	n/a	n/a

Results

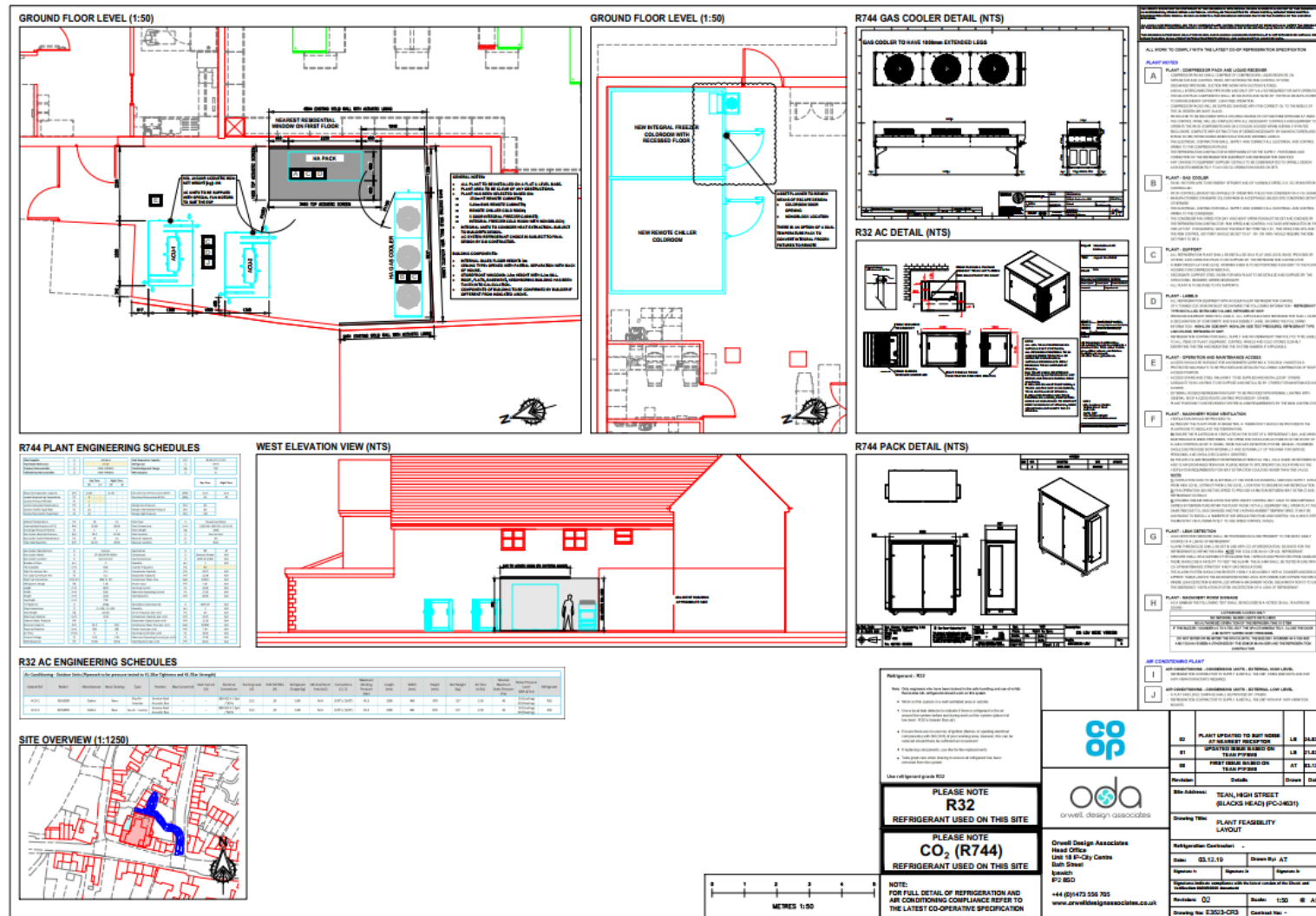
- C.7 The results of the survey are considered to be representative of the background sound pressure levels at the façades of the most affected noise sensitive receptors to the plant area during the quietest times at which the plant will operate. The noise climate at the measurement position was dominated by local road traffic and distant plant noise from the nearby Fish and Chip shop. The results of the survey are presented in a time history graph overleaf.

Blacks Head, Upper Tean Monday 28 - Tuesday 29 Oct 2019



Appendix D

Plant layout



Appendix E Plant noise data

Plant Ref		Operating Hours	Sound pressure level
1 x HA DT1 Gas Cooler	Kelvion	Day and night	22 dBA at 10m
1 x HT Pack	Hubbard	Day and night	20 dBA at 10m
ACU1, ACU2	Mitsubishi	Day	60 dBA at 1m

Appendix F Plant noise calculations

Receptor 1 – Proposed flat above the store

Plant item	Source Sound level (dBA)	Distance		Directivity Correction (dB)*	Screening (dB)**	BS 4142 feature correction (dB)	Plant rating level at receptor L _{Aeq} (dB)
		Distance to Receptor (m)	Correction (dB)				
Pack	20 at 10m	3	10	0	-10	3	23
Gas cooler	22 at 10m	6	4	0	0	3	29
AC1	60 at 1m	6	-16	0	-20	3	27
AC2	60 at 1m	5	-14	0	-20	3	29
Total plant rating level, day							34
Total plant rating level, night							30

**No directivity due to proposed wall lining for plant items*

***Screening included for the pack due to proposed barrier above plant item. Screening included for the AC units due to proposed enclosure.*

Receptor R2 – Bedroom window at 13 High Street

Plant item	Source Sound level (dBA)	Distance		Directivity Correction (dB)*	Screening (dB)**	BS 4142 feature correction (dB)	Plant rating level at receptor L _{Aeq} (dB)
		Distance to Receptor (m)	Correction (dB)				
Pack	20 at 10m	7	4	0	0	3	27
Gas cooler	22 at 10m	8	2	0	-10	3	17
AC1	60 at 1m	7	-17	0	-20	3	26
AC2	60 at 1m	6	-15	0	-20	3	28
Total plant rating level, day							32
Total plant rating level, night							27

**No directivity due to proposed wall lining for plant items*

***Screening included for the gas cooler due to building geometry. Screening included for the AC units due to proposed enclosure.*