

PEAK acoustics



Noise Impact Assessment

Client: David Byatt

Site: The Huntsman, The Green, Stoke-on-Trent

Reference No. JP2710213NR

Revision: 0.0

Date of Issue: 02/03/2022

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Executive Summary

A Noise Impact Assessment has been undertaken at The Huntsman, The Green, Stoke-on-Trent to assess the noise breakout from the large wooden outbuilding in relation to a retrospective planning application. The pubs licensed operating hours are from 11:00 – 01:00, with the view that this is a permanent structure, operating hours in the outbuilding will be the same.

A BS4142 assessment was also undertaken in relation to the AC Condenser Units on the rear of the outbuilding.

Measurements of the prevailing background noise climate were undertaken from 17th – 18th February 2022 at a location representative of the identified Noise Sensitive Receptors (NSRs).

The nearest or most-affected Noise Sensitive Receptors (NSRs) were identified as the residential dwellings directly behind the wooden outbuilding. The closest habitable room windows of this property will be considered as specific reception points in calculations.

Using the measured background noise survey data, a representative night-time background sound level of **46 dB L_{A90}** was derived for the assessment.

Guidance taken from the Institute of Acoustics 'Good Practice Guide on the Control of Noise from Pubs and Clubs' March 2003, the University of Salford's 'Report for the department of Environment, Food and Rural Affairs' March 2005 and elements of BS4142:2014 as well as the application comments from Staffordshire Moorlands District Council have been utilised to create four assessment methodologies.

- Assessment Methodology 1: 100dB pink noise breakout vs background noise level (L_{A90}) 1m outside habitable rooms.
- Assessment Methodology 2: 85dB Normal use noise breakout vs background noise level (L_{A90}) 1m outside habitable rooms.
- Assessment Methodology 3: 85dB noise breakout vs NR25 curve within habitable rooms.
- Assessment Methodology 4: BS4142 Assessment of external AC Units.

Methodology 1 found the noise level to be up to **14 dB** above the measured background sound level. This methodology was conducted as an absolute worst-case scenario, in reality internal sound levels are very unlikely to reach these levels.

Methodology 2 of noise breakout indicated a *Low Impact* at the NSR location, with Specific Sound Levels up to **6 dB** below the representative background sound levels and **2 dB** below when the canvas side was completely open, whilst acknowledging relevant context, corresponding to achievement of 'NOEL – No Observed Effect Level' in the NPSE.

Methodology 3 found that when comparing the noise breakout to NR25 curve that levels at 500Hz 1KHz and 2KHz are marginally over the accepted criteria. Due to these values being only slightly over and the reviewing relevant, context these values are deemed acceptable.

Methodology 4 BS4142 assessment of the AC plant equipment indicated an *Adverse Impact* at the NSR. Rating Levels were up to **9 dB** above the night-time background sound level.

Mitigation in the form of moving the AC Condenser Units to the east side of the outbuilding were calculated using 'SoundPLAN' and ISO-9613-2. Rating Levels at the NSR were calculated to be up to **3 dB** below the night-time background sound level indicating the potential for a *Low Impact* and corresponding to achievement of 'NOEL – No Observed Effect Level' in the NPSE.

An assessment was then modelled with the AC Units running in the mitigation position with the wooden outbuilding breakout in use at 85 dB with the canvas side completely open (typical of a busy summers evening).

This assessment indicated a *Low/Adverse Impact* with rating levels up to **4 dB** above the night-time background sound level.

It is important to note the assessment accounts for all AC plant equipment operating at continuous maximum output simultaneously. In reality, only a small number of units will operate at a low capacity for short periods when required. It also assumes the outbuilding at full capacity and with background music turned up fairly loud.

The assessment in this report therefore accounts for both a worst-case and unlikely scenario, noise emissions in practice are likely to be considerably lower.

At the time of testing the wooden outbuilding is deemed as 'incomplete' as the rear wall had not been finished, a window in the rear wall had not been fitted, insulation in the roof had not been fitted and the boundary wall between the outbuilding and the next-door residential dwelling had not been completed. This report will model the outbuilding as if these works have been completed. It has been relayed by the client that these works are underway.

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1. Introduction

- 1.1 A Noise Impact Assessment has been undertaken at The Huntsman, The Green, Stoke-on-Trent hereby referred to as 'the site', to assess the noise breakout from the large wooden outbuilding in relation to a retrospective planning application.

- 1.2 The hours of operation of the Huntsman Pub are as follows:

- **Monday – Sunday: 11:00 – 01:00**

It is understood that the outbuilding will be classed as a permanent structure so that 'indoor' licencing times will be the same as the main pub, although after conversations with the client, activity in the outbuilding and pub in general normally conclude earlier than 01:00.

- 1.3 Breakout measurements will be conducted to test the building envelope sound insulation using a dodecahedron speaker and amplified pink noise. Sound pressure levels of 1/3 octave will be measured internally and externally at various positions. Using this data, the sound insulation of the building envelope will be calculated and thus the noise breakout towards the nearest NSR.
- 1.4 This data will then be compared to measurements sourced from 'ANSI - Calculation of Speech Transmission Index in rooms' February 2014 and background music measurements taken by Peak Acoustics at other representative sites and utilised within the assessment to model the potential noise breakout using industry standard acoustic modelling software 'SoundPLAN'.
- 1.5 A separate BS4142 assessment was also undertaken in relation to the AC Condenser Units on the rear of the outbuilding.
- 1.6 Details of the equipment being used on site have been listed below:
- *1 No. Denon DRA-800H Hi-Fi Amplifier*
 - *4 No. wall mounted speakers (6-inch drivers)*
 - *2 No. PUHZ-P125VHA3.UK External AC Units*
 - *2 No. PCA-RP100KA Internal AC Units*
- 1.7 The Loudspeaker units are installed on fixed wall mounted brackets on the north and south facades. The Amplifier / Volume Control Unit is positioned on the south facade behind the pizza oven.
- 1.8 The external AC Units are mounted on the brick wall on the south boundary of the site. The internal AC Units are located on the east side of the outbuilding mounted to the roof.
- 1.9 An assessment of the noise breakout is to be undertaken to determine whether local residents are likely to suffer a loss of amenity as a result of noise from the general use of the outbuilding. Mitigation will be given should any potential loss of amenity be indicated.

2. Planning Policy & Guidance

- 2.1 Guidance for the assessment of noise affecting new residential development is given in the National Policy Framework (NPPF). Section 15 of the NPPF states:

“174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

E) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of...noise pollution.”

Section 185 further states:

“Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- 1. Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- 2. Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.”*

Section 187 states:

“Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed.”

- 2.2 To avoid and mitigate adverse noise effects on health arising from and impacting on new development, the NPPF makes reference to NPSE. The Noise Policy Statement for England (NPSE) was published in March 2010 and covers all forms of noise other than occupational noise. For the purposes of this report, “Neighbourhood Noise” is most relevant as NPSE defined at paragraph 2.5.

“neighbourhood noise which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street.”

- 2.3 The Noise Policy Statement for England (NPSE) states the following aims in paragraph 2.2.

NOEL – No Observed Effect Level.

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level.

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level.

This is the level above which significant adverse effects on health and quality of life occur.

3. Assessment Criteria

- 3.1 Staffordshire Moorlands District Council have requested that the noise impact assessment be undertaken to ensure that the amenity of the area is not significantly affected and to protect the health and wellbeing of nearby residents. Application comments state;

“For a proposal such as this we would expect the impact of entertainment noise (music, speech, soundtrack etc.), low frequency noise (LFN), plant noise (air con, chillers etc), delivery noise and importantly customer noise to have been assessed by a suitably qualified acoustician and present for consideration by the Planning Authority. Breakout noise through this wooden structure could cause significant noise to neighbouring properties.

Any approved noise scheme and measurements should pay due regard to British Standard BS8233: Sound insulation and noise reduction for buildings (Code of Practice), BS4142:2014 Methods for rating and assessing industrial or commercial sound and Noise from Pubs and Clubs (Final Report), DEFRA 2005 and Noise Policy Statement.”

- 3.2 Guidance taken from the Institute of Acoustics ‘Good Practice Guide on the Control of Noise from Pubs and Clubs’ March 2003 and the University of Salford’s ‘Report for the department of Environment, Food and Rural Affairs’ March 2005 consider two main measurement and assessment methodologies;

- 3.3 Absolute Criteria;

“using A-weighted target values for music intrusion within residential properties, generally based on World Health Organisation values. However, it is generally considered inappropriate to use only A-weighted target levels for music noise intrusion, because the impact of the bass elements of the noise.”

“A relatively common application of absolute criteria is to use Noise Rating Curves to provide a target level in design work.”

- 3.4 Relative Criteria;

“Developers should show that noise from the place of entertainment shall not be audible inside habitable rooms of the new development. Inaudibility shall be defined as: Zero increase in the LAeq,1 min (music playing) over the background LA90 (music off) and Zero increase in the L10,T vs L90,T exceedance in each 1/3 octave”

- 3.5 A common standard for the assessment of industrial and commercial sound is '**BS4142 – Methods for rating and assessing industrial and commercial sound**'. The industrial noise assessment method in BS4142 is based on the difference between the measured 'background sound level' (L_{A90}), and the 'Rating Level' of the industrial source, at a noise sensitive location (NSR).

An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level whilst considering the following:

"A Sound Rating Level at or below the background noise level is indicative of Low Impact;

A Sound Rating Level that exceeds the background noise level by around +5dB is likely an indication of Adverse Impact, depending on the context;

A Sound Rating Level that exceeds the background noise level by around +10dB is likely an indication of Significant Adverse Impact, depending on the context;"

BS4142 further states:

"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 negligible impact, depending on the context."

Achievement of a *Low Impact* in accordance with BS4142 can be deemed to correspond to '*NOEL – No Observed Effect Level*' in the NPSE, as detailed above in Paragraph 2.3 above.

- 3.6 Although Section 1.3 of BS4142 states that the assessment of people and recreational activities is beyond the scope of the British Standard, the methods are still deemed a useful tool for the assessment.
- 3.7 A combination of these methods will be utilised for the assessment to ensure any potential loss of amenity to local residents will be indicated and to comply with the comments set out by Staffordshire Moorlands District Council;
- Assessment Methodology 1: 100dB pink noise breakout vs background noise level (L_{A90}) 1m outside habitable rooms;

We will conduct a test of the building envelope sound insulation using a dodecahedron speaker and amplified pink noise. Sound pressure levels of 1/3 octave will be measured internally and externally at various positions. Using this data, the sound insulation of the building envelope will be calculated and thus the noise breakout towards the nearest NSR. This will then be compared against the measured background noise level.

- Assessment Methodology 2: 85dB Normal use noise breakout vs background noise level (L_{A90}) 1m outside habitable rooms;

Data collected from Assessment Methodology 1 will be used in using industry standard acoustic modelling software 'SoundPLAN' to model the wooden outbuilding and calculate the noise breakout towards the nearest NSR at an internal level of 85 dB. This will then be compared against the measured background noise level.

An internal sound level of 85 dB has been assumed after onsite observations as an approximate maximum of 80 people can be seated at any one time in the outbuilding as well as 4 small speakers providing background music with no audible low frequency response.

- Assessment Methodology 3: 85dB noise breakout vs NR25 curve within habitable rooms.

The same internal sound source as used in Methodology 2 will then be compared to the NR25 curve within the nearest habitable room of the NSR. This assessment will account for the frequency response breaking out of the wooden outbuilding.

- Assessment Methodology 4: BS4142 of AC Units;

Noise propagation from the proposed plant equipment will be calculated using 'SoundPLAN' and ISO-9613-2. Rating Levels at the worst affected NSR for operation of the AC plant equipment will be calculated in accordance to BS4142 and mitigation will be given should any potential loss of amenity be indicated.

- 3.8 An environmental noise survey to measure background sound levels representative of the nearest noise sensitive receptors (NSR's) will be taken. Measurements will be carried out in accordance with the provisions of BS7445 '*Description and Measurement of Environmental Noise*'. The measurements made will include both dBA and octave band noise levels including L_{eq} , L_{max} , and L_{90} parameters.

4. Site Location

- 4.1 The site is located on the west side of Cheadle, Stoke-on-Trent. Directly north of the site is Delphouse Road (A521) followed by residential dwellings on Brookhouse Road. To the East through to the south-west are several industrial and commercial sites many of which have external plant equipment and industrial processes occurring outside. On the south boundary of the site are residential dwellings No. 3 – 7 Draycott Cross Road which have been denoted NSR 1. Directly west of the site is Draycott Cross Road with ArB Tree care opposite.
- 4.2 The site, proposed noise source and receptor locations are shown in Figure 1 below:

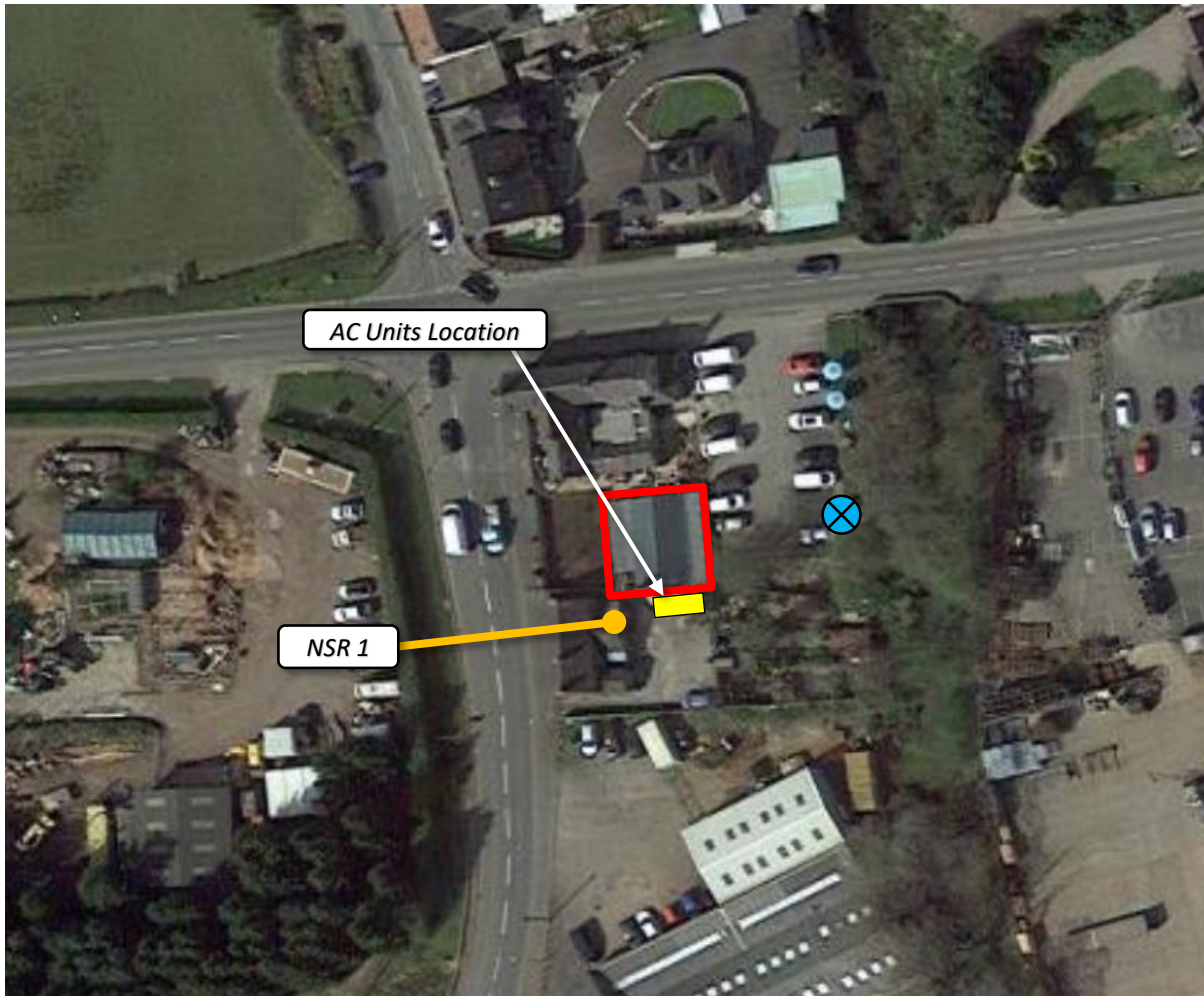


Figure 1: Site, Source & NSR Locations - <https://earth.google.com>

- | | |
|--|---|
|  Site Boundary (Approx.) |  AC Units Location (Approx.) |
|  Noise Sensitive Receptors (NSRs) |  Background Monitoring Location M1 (Approx.) |

5. Noise Sensitive Receptors

- 5.1 The nearest or most-affected Noise Sensitive Receptors (NSRs) has been identified as the residential buildings on the south boundary of the site No. 3 – 7 Draycott Cross Road.
- 5.2 The closest habitable room windows of this property will be considered as specific reception points in calculations.
- 5.3 The NSR locations and reception points are shown in an aerial image (**Figure 1**) on Page 10.

6. Background Noise Survey

- 6.1 An unattended background noise survey was conducted at position M1 over a period of approximately 24 hours from 17th – 18th February 2022. Measurements of $L_{Aeq,T}$ and $L_{A90,T}$ were logged in 5-minute intervals in accordance with BS7445 - 'Description and Measurement of Environmental Noise'.
- 6.2 At position M1 shown in Figure 1, the microphone was placed approximately 1.7m from local ground level and away from nearby reflective surfaces. Position M1 is located at the southern boundary of the site closest to NSR 1 at the edge of the car park.
- 6.3 As the wooden outbuilding was in use during the assessment period and high wind speeds were recorded, measurements from a previous noise impact assessment conducted by Peak Acoustics **Ref: JP2204216NR** at Brookhouse Way, Cheadle, ST10 1SR (approximately 500 meters away) has been utilised to compare the representative background noise data. The noise climate at these positions were deemed representative of the noise climates at the identified noise sensitive receptor.
- 6.4 The noise climate at the monitoring position was dominated by road noise from the adjacent road Delphouse Road (A521).
- 6.5 Measurements were obtained using Class 1 instrumentation. Full equipment details are given in **Appendix B**.
- 6.6 Equipment was calibrated before and after use and no significant drift occurred during measurements. Up to date calibration certification can be provided upon request. Full calibration details are provided in **Appendix D**.
- 6.7 Daytime temperatures during the survey were noted as between 6-7°C with high wind speeds being recorded, typically between 7.5 – 10 m/s; Detailed meteorological information can be found in **Appendix C**.

7. Background Sound Levels

- 7.1 The day and night-time background sound levels from measurement M1 are summarised below.

Measurement	Date(s)	Period	L _{Aeq,T}	L _{A90, T}
M1	17 th – 18 th February 2022	Daytime (07:00 – 23:00) (aggregated period)	61	59
	17 th – 18 th February 2022	Night-time (23:00 – 07:00)	57	47

Table 1: Background Noise Survey Results

- 7.2 Measurements from a previous Noise Impact Assessment conducted by Peak Acoustics Ref: **JP2204216NR** at Brookhouse Way, Cheadle, ST10 1SR (approximately 500 meters away) have been utilised within the assessment to compare the recorded background sound levels due to the outbuilding being in use and high winds being recorded during the assessment period.

- 7.3 The day and night-time background sound levels from that report are summarised below.

Measurement	Date(s)	Period	L _{Aeq,T}	L _{A90, T}
M1	20 th – 21 st October	Daytime (07:00 – 23:00) (Aggregate Period)	51	47
	20 th – 21 st October	Night-time (23:00 – 07:00)	52	37

Table 2: JP2204216NR Background Noise Survey Results

- 7.4 Using the measured background noise survey data, the lowest night-time background sound level of **46dB L_{A90}**, measured on the 18th of February 2022 will be used for the assessment. This is deemed acceptable when comparing the two measurements sets due to the site location next to Delphouse Road (A521).

- 7.5 A full-time history of the survey data is shown in **Appendix E**.

8. Source Noise Levels

- 8.1 Methodology 1 uses a dodecahedron speaker placed in the centre of the room emitting amplified pink noise at a measured level of 100dB at 1 meter away from the speaker.
- 8.2 Internal and external measurements were taken, and a summary of measurements made are as follows:

Measurement Location	Octave Centre Frequency Band (Hz)								
	63	125	250	500	1K	2K	4K	8K	dBA
External Measurements 1 Meter from Facade									
1	62.2	68.5	68.4	66.3	58.6	56	47.7	34.9	66.2
2	69	75.2	76.6	72.5	65.5	60.9	52.7	36.3	72.9
3	75.3	85.8	87.7	83.4	75.2	70.9	61.1	42	83.5
4	75.6	83.7	84.4	81	74	70.1	60.4	42.8	81.1
5	67.5	78.2	77.8	73	67	66.6	58.6	43.1	74.7
6	67.5	73	74.1	68.5	64.9	65.9	53.7	35.5	71.8
Internal Measurements									
7	82.2	98.6	98.2	98.8	95.3	94.9	89.6	73.7	101.1
8	80.3	90.1	93	93.6	90.6	92.4	87.9	75.1	97.4
9	77.7	92.8	92.9	93.4	90.9	93.4	88.5	75.2	98
10	78.1	90.8	93.2	95.4	91.9	93.4	89	76	99.1
11	79.6	93.7	95.8	96.2	92.4	93.5	89.5	76	97.4
External Measurements 5 Meters from Facade									
13	63.4	68	67.1	63.3	57.3	55.2	48.3	35.2	64.4
14	74.4	83.5	82.3	84.8	69.4	66.1	57.4	40.6	77.4
15	65.1	66.7	66.1	59.6	60.6	59.5	53.5	42	65.6

Table 3: Internal and External Noise Source Results at 100dB

- 8.3 Internal and external measurement locations can be found in **Appendix H**.
- 8.4 Using the collected data, transmission loss for each of the walls and ceiling was calculated and used in industry standard acoustic modelling software 'SoundPLAN' to model the noise breakout of the wooden outbuilding.
- 8.5 'SoundPLAN' was then used to model the internal source noise for Assessment Methodology 2: 85dB normal use noise breakout, and 3: 85dB noise breakout vs NR25 curve within habitable rooms. The assumed internal sound pressure level is given below.

Source	63	125	250	500	1k	2k	4k	8k	dBA
Raised Vocal & Background Music	73	81	81	78	71	67	57	44	85.5

Table 4: Wooden Outbuilding modelled Internal Noise Level

- 8.6 Grid noise maps of Assessment 1 and 2 can be found in **Appendix F**.

9. Specific Sound Levels

9.1 The Specific Sound Level is denoted L_{As} and is the A-weighted, equivalent noise level at the NSR locations. Specific Sound Levels have been calculated for both assessments using industry standard acoustic modelling software 'SoundPLAN'. This software uses ISO-9613-2 - *Attenuation of sound during propagation outdoors* and the model takes into account the following key factors:

- Geometric divergence of sound
- Atmospheric absorption of sound
- Ground absorption
- A light downwind correction toward the NSRs
- Surrounding structures and objects which may reflect or block sound toward the NSRs
- The height of the NSRs (e.g., First, second or third floor reception point)

9.2 The Specific Sound Levels (L_{As}) have been calculated to the receptor locations shown in Figure 1 and described in Section 5. The Specific Sound Levels are tabulated below.

Location	Specific Sound Level, dB L_{As}
NSR 1 (100dB Pink Noise)	60
NSR 1 (85dB Normal use)	40

Table 5: Specific Sound Levels

9.3 The noise model input parameters were as follows:

Parameter	Input
Reflection Order	3
Ground Absorption Factor	G = 0
Air pressure	1013.3 mbar
Relative Humidity	70.0 %
Temperature	10.0°C

Table 6: Calculation Input Parameters

9.4 Noise maps showing external sound propagation is shown in **Appendix F**.

10. Assessment 1 and 2, Specific Sound Levels Vs Background

10.1 The Specific Sound Levels are to be compared to the representative background sound level to determine the noise impact in accordance with BS4142.

A Sound Rating Level at or below the background noise level is indicative of Low Impact;

A Sound Rating Level that exceeds the background noise level by around +5dB is likely an indication of Adverse Impact, depending on the context;

A Sound Rating Level that exceeds the background noise level by around +10dB is likely an indication of Significant Adverse Impact, depending on the context;

10.2 The indicated noise impact at the identified Noise Sensitive Receptors is summarised below:

Location	Rating Level, dB L _{ar}	Background Sound Level, dB L _{A90}	Difference, dB	Noise Impact
NSR 1 (100dB Pink Noise)	60	46	+ 14	Significant Adverse
NSR 1 (85dB normal use)	40	46	- 6	Low Impact
NSR 1 (85dB Canvas side Open)	44	46	- 2	Low Impact

Table 7: Noise Impact

10.3 The noise impact at the receptor position is indicative of a *Significant Adverse Impact* in accordance with BS4142 at 100 dB.

10.4 The noise impact at the receptor position is indicative of a *Low Impact* in accordance with BS4142 at 85 dB.

10.5 It was observed on site that the west side of the outbuilding is comprised of canvas that can be rolled open during warmer seasons and give access to the existing beer garden. The outbuilding was modelled again in 'SoundPLAN' and calculated a Rating Level of **44 dB L_{A90}** at the NSR. The noise impact at the receptor position is indicative of a *Low Impact* in accordance with BS4142.

10.6 This rating level does not include any additional noise from customers in the beer garden as permission has already been granted for this, only the breakout from extra customers in the wooden outbuilding.

10.7 A set of glass doors which is the main entrance into the outbuilding are the only other opening that would increase the noise breakout of the venue. As the doors are the furthest point away from the NSR it is deemed that the noise breakout would be negligible.

10.8 At the time of testing the wooden outbuilding is deemed as 'incomplete' as the rear wall had not been finished, a window in the rear wall had not been fitted, insulation in the roof had not been fitted and the boundary wall between the outbuilding and the next-door residential dwelling had not been finished. This report models the outbuilding as if these works have been completed as it has been relayed by the client that these works are underway.

10.9 As long as the works mentioned above are completed, no mitigation from the wooden outbuilding is deemed necessary.

11. Assessment 3, Specific Sound Levels Vs NR25 Curve

- 11.1 Internal noise levels in the nearest habitable rooms have been calculated from the Specific Sound Level and application of a modest 10 dB reduction through an open window. The calculated internal noise levels have been compared to the limits of NR25 in Table 8 below. This scenario represents the breakout of the wooden outbuilding at 85 dB with the canvas side completely open.

Internal Space/Criteria All Windows / Doors Open	63	125	250	500	1k	2k	4k	8k
Noise Source	73	81	81	78	71	67	57	44
NSR 1 (Receiver)	7.3	21.4	28.6	30.1	25.9	22.7	12.1	-5.6
NR25	55.2	43.7	35.2	29.2	25.0	21.9	19.5	17.7
Difference, dB	-47.9	-22.3	-6.6	+0.9	+0.9	+0.8	-7.4	-23.3

Table 8: Wooden Outbuilding Breakout Vs NR 25 Curve

- 11.2 As can be seen in the table above, the noise levels with the current building design exceed the limits of NR25 at 500Hz, 1 KHz and 2 KHz. As this exceedance is minimal and in practice source noise levels are likely to be much less, this outcome is deemed acceptable with no mitigation being proposed.
- 11.3 Graphs of the NR Curves can be found in **Appendix E**.

12. Assessment 4, BS4142 Assessment of AC Units

- 12.1 External noise generating equipment includes cooling equipment as listed in Table 9 below. The equipment has been installed on the brick wall on the south boundary of the site.

Reference	Description / Location	Operating Hours
AC1	PUHZ-P125VHA3.UK	Anytime (24 Hours)
AC2	PUHZ-P125VHA3.UK	Anytime (24 hours)

Table 9: External AC Plant Equipment

- 12.2 Manufacturer noise data sheets and site arrangement plan are given in **Appendix G**.

13. Specific Sound Levels of AC Units

- 13.1 The Specific Sound Level is denoted L_{A5} and is the A-weighted, equivalent noise level at the NSR location. Specific Sound Levels have been calculated considering all air conditioning units operating cumulatively using industry standard acoustic modelling software 'SoundPLAN'. This software uses ISO-9613-2 - *Attenuation of sound during propagation outdoors*.
- 13.2 The Specific Sound Levels (L_{A5}) have been calculated to the receptor locations shown in Figure 1 and described in Section 5. The Specific Sound Levels are tabulated below.

Location	Specific Sound Level, dB L _{As}
NSR 1 (GF)	52

Table 10: Specific AC Sound Levels

13.3 A noise map showing external sound propagation is shown in **Appendix F**.

14. Rating Levels

14.1 In accordance with BS4142, the Specific Sound Levels may be corrected for characteristics that make the sound more noticeable at the NSR location such as tonality, impulsivity and intermittency. Section 9.2 of BS4142 gives commentary on these characteristics and appropriate penalties:

“Tonality

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. 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.

Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. 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.

Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

NOTE 2 Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.”

- 14.2 The air conditioning equipment serves to control temperatures within the wooden outbuilding and therefore operates when required in response to demand and meteorological conditions. As such, the equipment will operate intermittently; a +3 dB correction for intermittency is therefore to be applied.
- 14.3 Air handling equipment such as this is typically broadband in nature with no noticeable tonal or impulsive characteristics; no other corrections are to be applied.
- 14.4 The resultant Rating levels are summarised below:

Location	Specific Sound Level, dB L_{As}	Total BS4142 Character Corrections	Rating Level, dB L_{Ar}
NSR 1 (1F)	52	+ 3	55

Table 11: Rating Levels

15. Rating Levels Vs Background

- 15.1 The Rating Levels are to be compared to the representative background sound level to determine the noise impact in accordance with BS4142.

A Sound Rating Level at or below the background noise level is indicative of Low Impact;

A Sound Rating Level that exceeds the background noise level by around +5dB is likely an indication of Adverse Impact, depending on the context;

A Sound Rating Level that exceeds the background noise level by around +10dB is likely an indication of Significant Adverse Impact, depending on the context;

- 15.2 The indicated noise impact at the identified Noise Sensitive Receptors is summarised below:

Location	Rating Level, dB L_{Ar}	Background Sound Level, dB L_{A90}	Difference, dB	Noise Impact
NSR 1 (GF)	55	46	+ 9	Adverse Impact

Table 12: Noise Impact

- 15.3 The noise impact at the receptor position is indicative of an *Adverse Impact* in accordance with BS4142.
- 15.4 It is important to note the assessment accounts for all AC plant equipment operating at continuous maximum output simultaneously. In reality, the units will operate at a low capacity for short periods when required. The assessment in this report therefore accounts for both a worst-case and unlikely scenario, noise emissions in practice are likely to be considerably lower.
- 15.5 Mitigation in the form of moving the AC Units to the east side of the wooden outbuilding facing the pub car park is advised and discussed in the next section.

16. Mitigation

- 16.1 Mitigation in the form of moving the AC Units to the east side of the wooden outbuilding has been investigated.
- 16.2 This has been proposed as by moving the AC Unit locations no new NSR's are created, and the wooden outbuilding will be used to shield the current NSR.
- 16.3 The current location of the AC Units is also breaking the boundary lines of the next-door residential property, so relocation of these units is recommended.
- 16.4 The site, proposed AC Unit location and NSR location are shown in Figure 2 below:

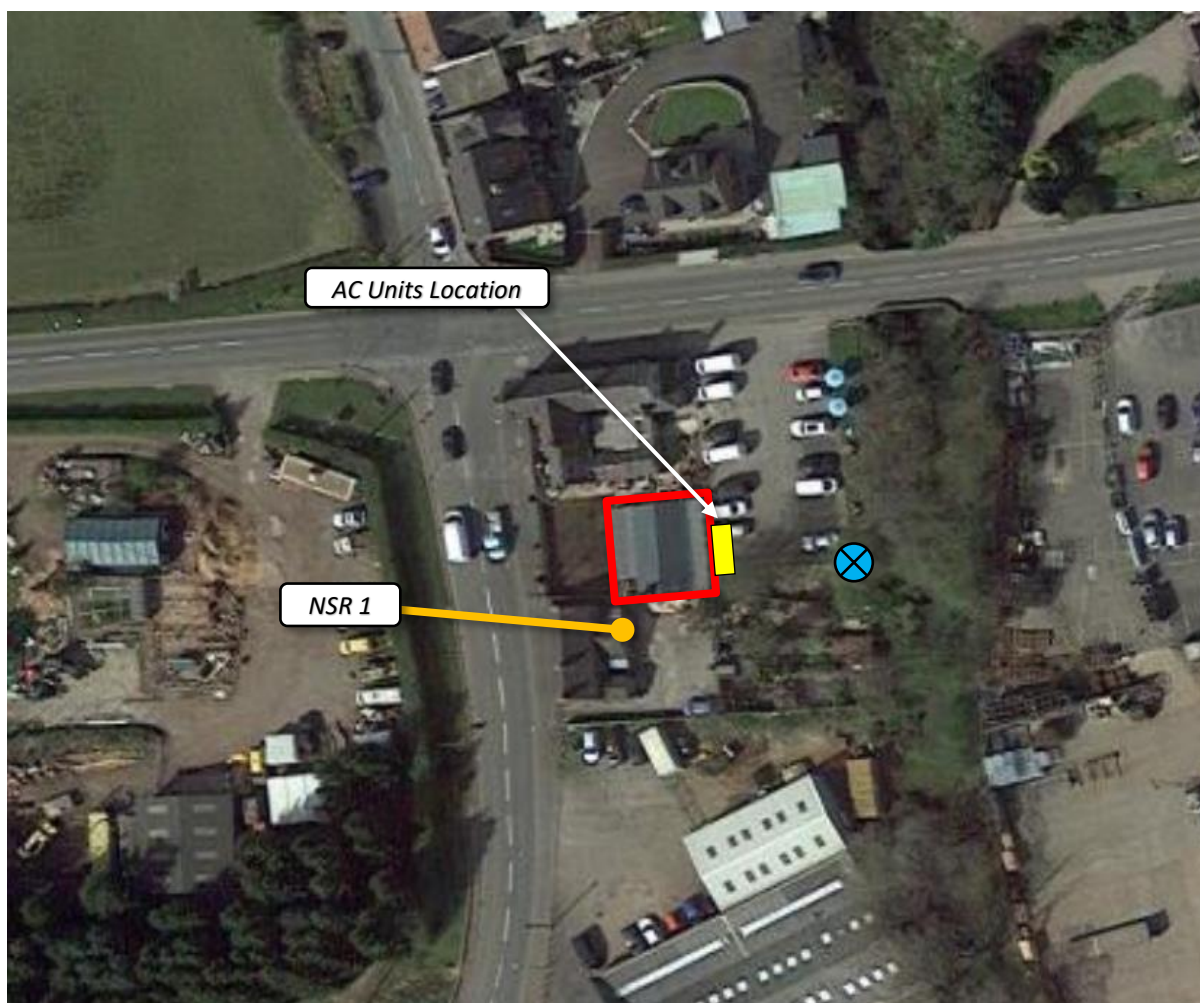


Figure 2: Site & NSR Locations with Source in mitigation position - <https://earth.google.com>

- 16.5 Specific Sound Levels (L_{As}) have been calculated to the receptor locations shown in Figure 2 and described in Section 5. The Specific Sound Levels are tabulated below.

Location	Specific Sound Level, dB L_{As}
NSR 1	40

Table 13: Specific AC Sound Levels (mitigated)

- 16.6 A 3 dB correction for intermittency has again been applied for the potential that the 'on/off' of the units is distinctive against the residual acoustic environment. The resultant Rating Levels are summarised below.

Location	Specific Sound Level, dB L_{As}	Total BS4142 Character Corrections	Rating Level, dB L_{Ar}
NSR 1	40	+ 3	43

Table 13: Rating Levels (mitigated)

- 16.7 The Rating Levels are to be compared to the representative background sound level to determine the noise impact in accordance with BS4142. These are summarised below.

Location	Rating Level, dB L_{Ar}	Background Sound Level, dB L_{A90}	Difference, dB	Noise Impact
NSR 1	43	46	- 3	Low Impact

Table 14: Noise Impact (mitigated)

- 16.8 With the implemented mitigation the noise impact at the NSR is indicative of a *Low Impact* in accordance with BS4142.
- 16.9 The cumulative operation of the outbuilding in use with the canvas side open and the AC Units running in the mitigation position, typical of a busy summers evening, was then modelled in 'SoundPLAN' and calculated a Rating Level of **51 dB L_{A90}** at the NSR. The noise impact at the receptor position is indicative of a *Low/Adverse Impact* in accordance with BS4142.

17. Contextual Factors

- 17.1 It is important to note the assessment accounts for all AC plant equipment operating at continuous maximum output simultaneously. In reality, only a small number of units will operate at a low capacity for short periods when required. The assessment in this report therefore accounts for both a worst-case and unlikely scenario, noise emissions in practice are likely to be considerably lower.
- 17.2 Due to the size and location of the AC Plant equipment, using an acoustic enclosure could prove a costly solution. Moving the units would ensure all residential receptors are protected from adverse impact as well as having the equipment no longer break the boundary line with the next-door residential property.
- 17.3 If the units were to be moved, it would also be recommended (if not already done so) to install the AC Units on anti-vibration mounts as to reduce any structure borne noise transmission.

18. Conclusion

- 18.1 A Noise Impact Assessment has been undertaken at The Huntsman, The Green, Stoke-on-Trent to assess the noise breakout from the large wooden outbuilding in relation to a retrospective planning application.
- 18.2 Measurements of the prevailing background noise climate were undertaken from 17th – 18th February 2022 at a location representative of the identified Noise Sensitive Receptors (NSRs).
- 11.3 The nearest or most-affected Noise Sensitive Receptors (NSRs) were identified as the residential dwellings directly behind the wooden outbuilding. The closest habitable room windows of this property will be considered as specific reception points in calculations.
- 18.4 The measured background noise survey data, a representative night-time background sound level of **46 dB L_{A90}** was derived for the assessment. Assessment methodologies 2, 3 found the noise level to achieve acceptable outcomes in conjunction with the adopted assessment criteria, whilst acknowledging relevant context.
- 18.5 Assessment methodology 4 found noise levels to be up to 9 dB above the relative background sound level. Mitigation in the form of moving the location of the AC plant equipment was investigated and found to reduce the noise levels to 3 dB below the background sound level.

19. Uncertainty

- 19.1 The background monitoring equipment is subject to a 1dB error margin, however calibration before and after measurements allows the drift within the margin to be monitored and thus demonstrates that minimal drift occurred throughout the measurements.
- 19.2 Uncertainty can arise in the prediction of noise propagation from and around flat reflective surfaces, such as the surrounding structures present on site. This has been reduced to a minimum by utilising an acoustic modelling software that uses the validated method, ISO-9613-2, as described in BS4142.

APPENDIX A – Measurement Details

Measurement	Kit	Start Date	Start Time	End Date	End Time
M1	A1	17/02/2022	12:30	18/02/2022	12:25
Sound Test	SKT 5	17/02/2022	10:00	17/02/2022	12:00

APPENDIX B - Equipment Details

Kit	Equipment	Make	Model	Class	Serial Number
A1	Sound Meter	Svantek	958	1	34525
A1	Pre-Amp	Svantek	SV12L	1	32484
A1	Microphone	Microtech Gefell	MK255	1	11561
1	Calibrator	Svantek	SV33A	1	90273
STK 5	Sound Meter	Svantek	977A	1	69273
STK 5	Pre-Amp	Svantek	SV12L	1	71601
STK 5	Microphone	ACO	7052E	1	68217
STK 5	Calibrator	Svantek	SV33A	1	90107

APPENDIX C - Meteorology Details

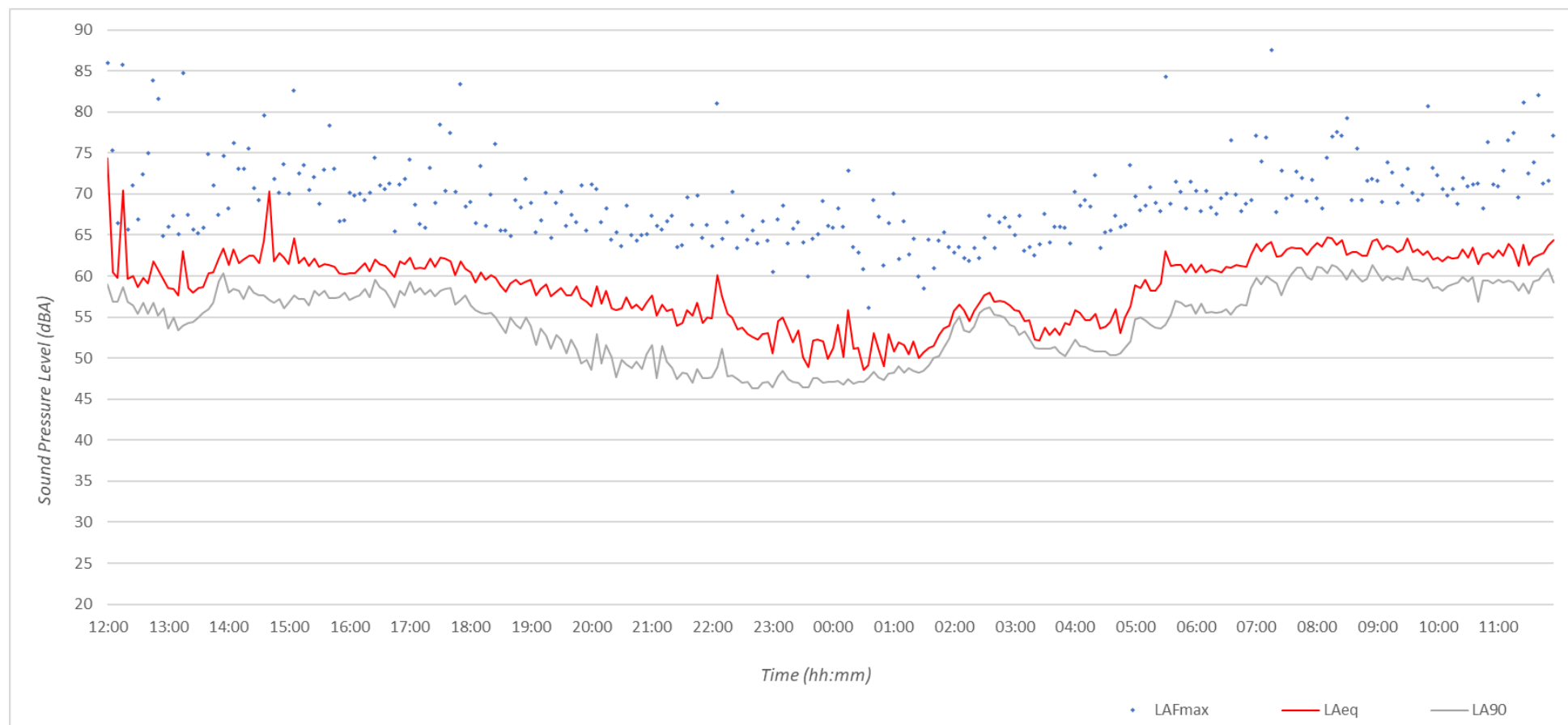
Date	Temp C°	Wind Speed m/s	Wind Direction	Humidity %	Precipitation mm	Cloud Cover (Oktas)
17/02/2022	7	1.8	W	65	3	4/8
18/02/2022	6	5	E	90	19	6/8

APPENDIX D - Calibration Details

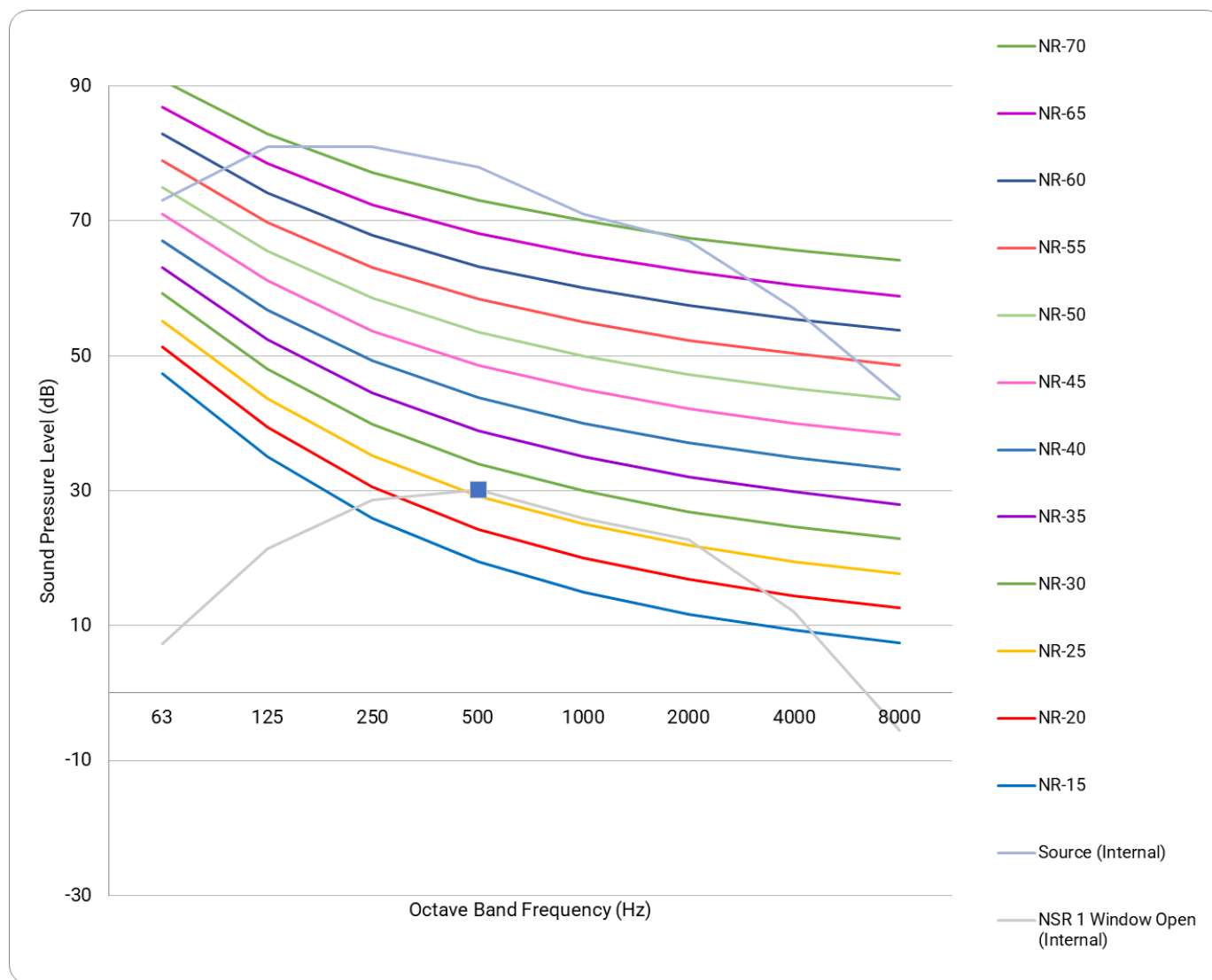
Measurement	Calibrator Ref Level (dB)	Deviation Before (dB)	Deviation After (dB)
M1 (Background)	114.0	1.5	0.1
Sound Test	113.8	-0.44	-1.61

APPENDIX E – Noise Survey Results

Measured Background Sound Levels Time History (M1): 17/02/2022 – 18/02/2022

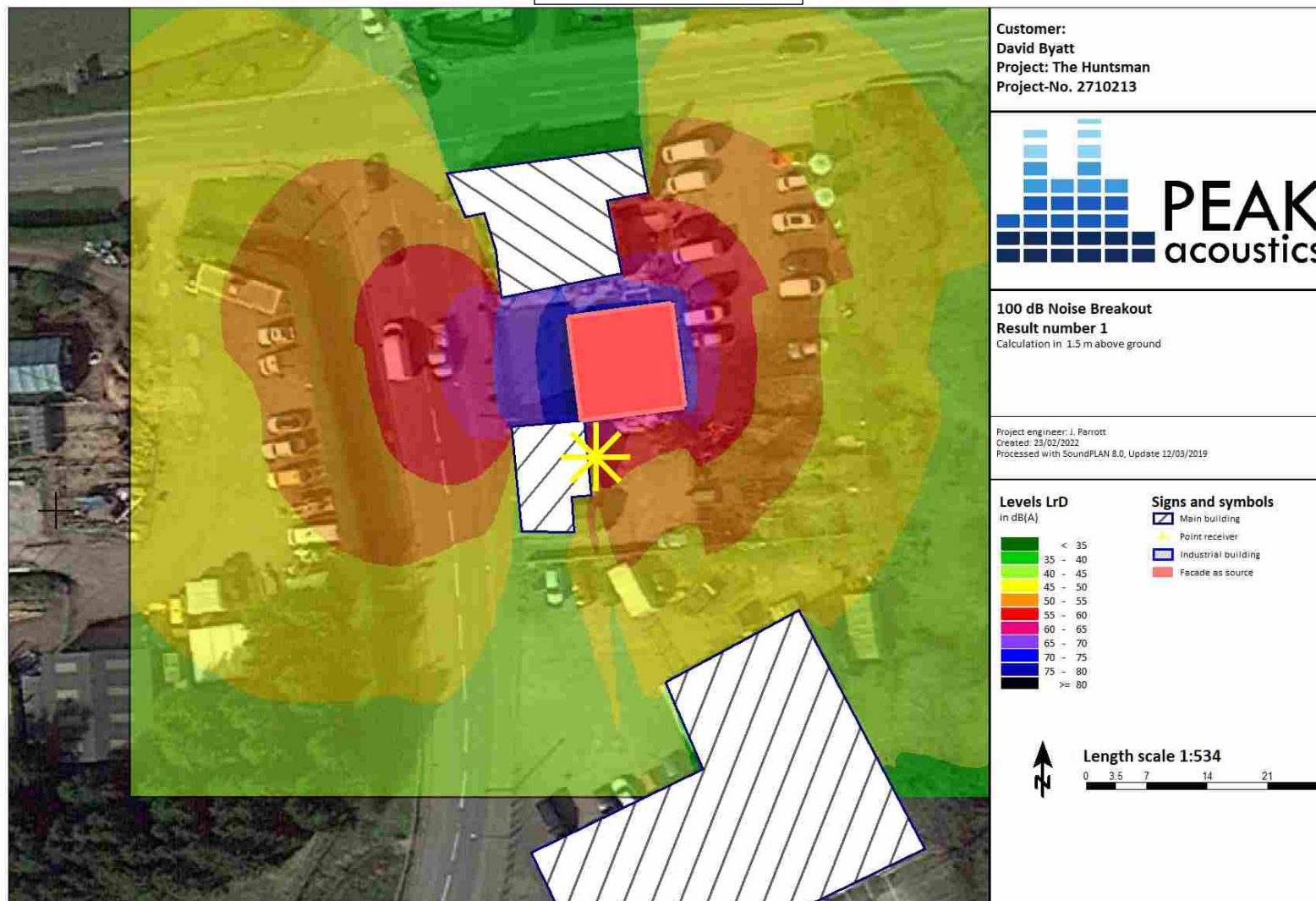


Assessment Source Levels Vs NR Curves



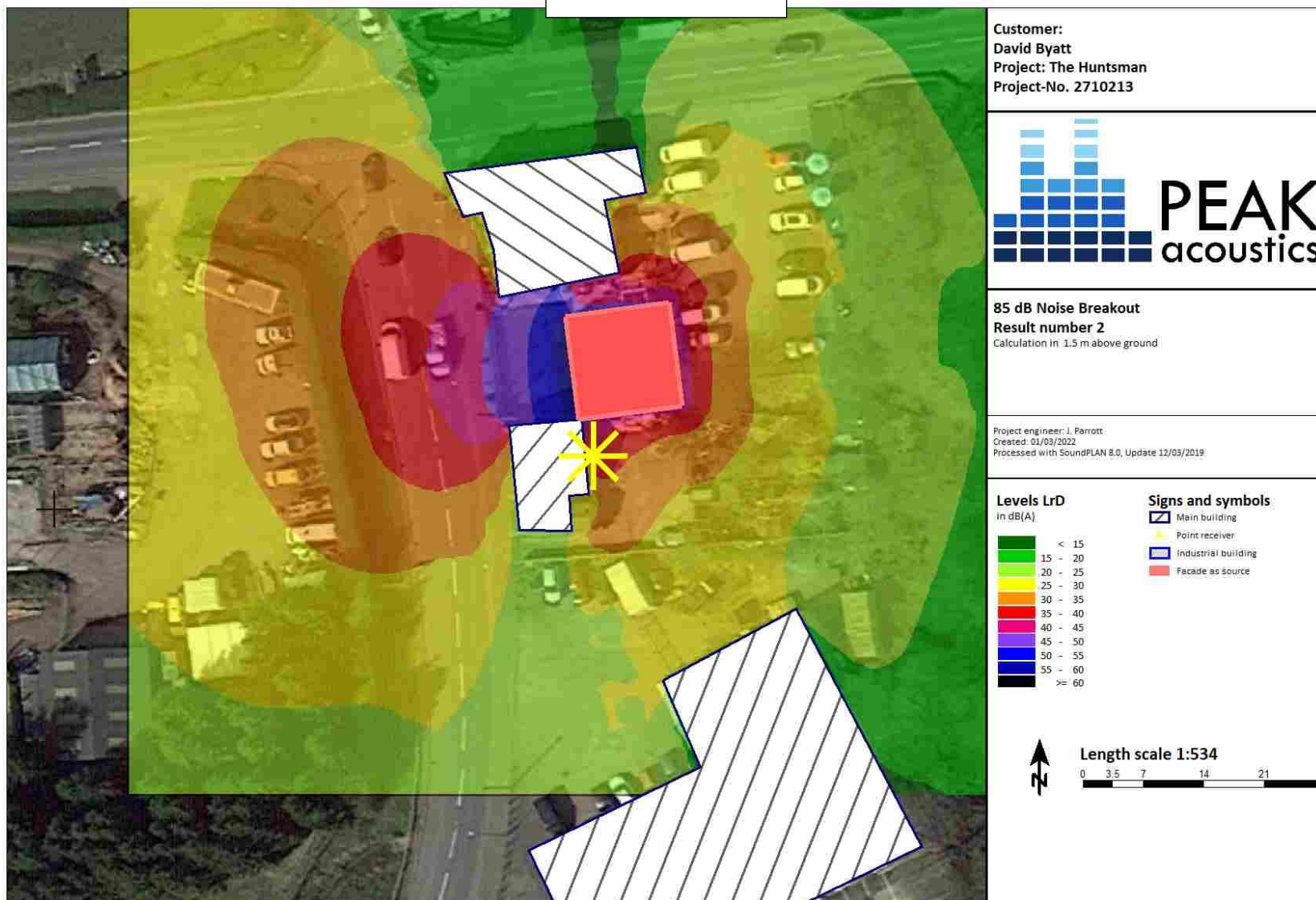
APPENDIX F –Grid Noise Map

100 dB Noise Breakout



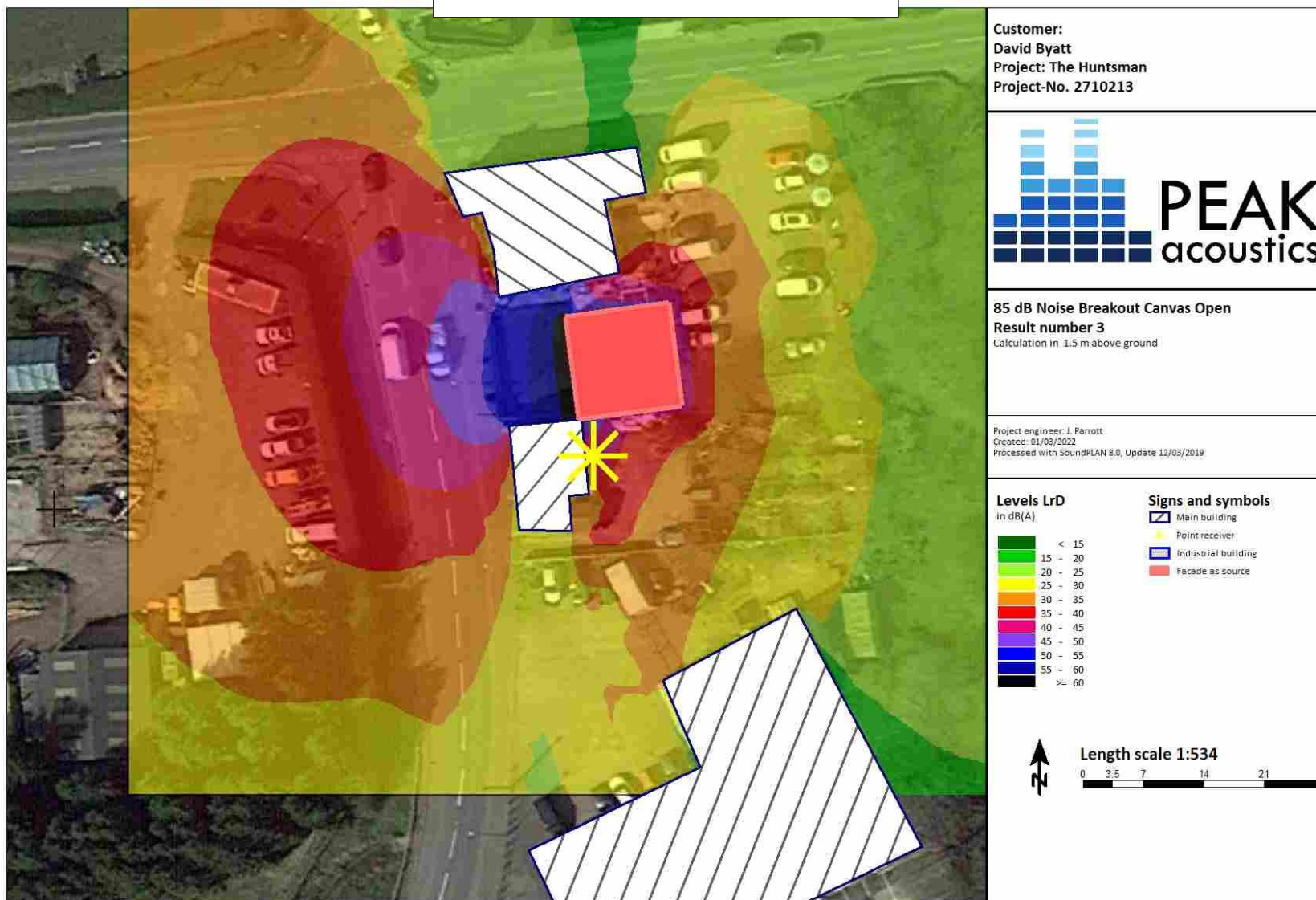
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85 dB Noise Breakout



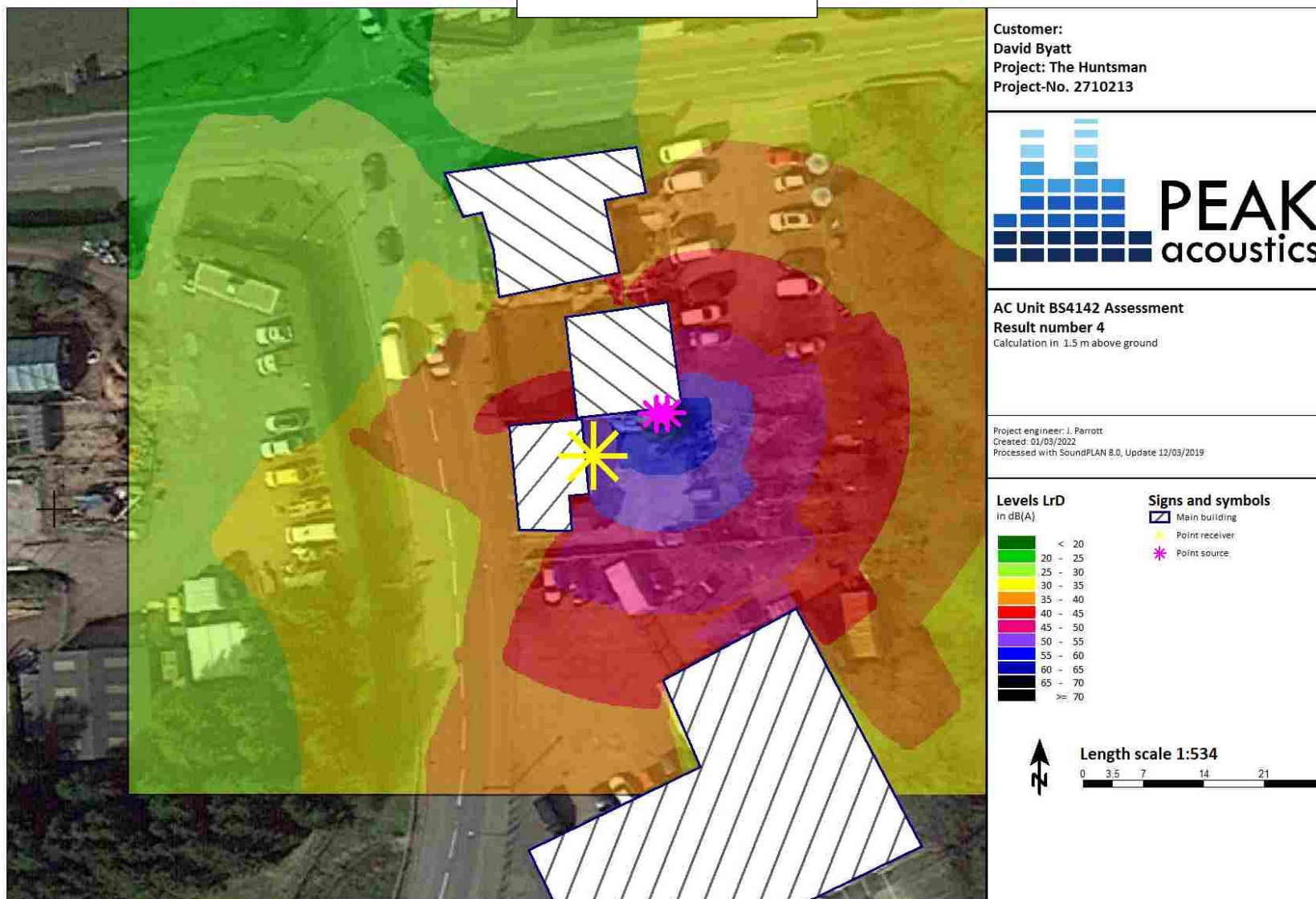
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85 dB Noise Breakout with Canvas Side Open



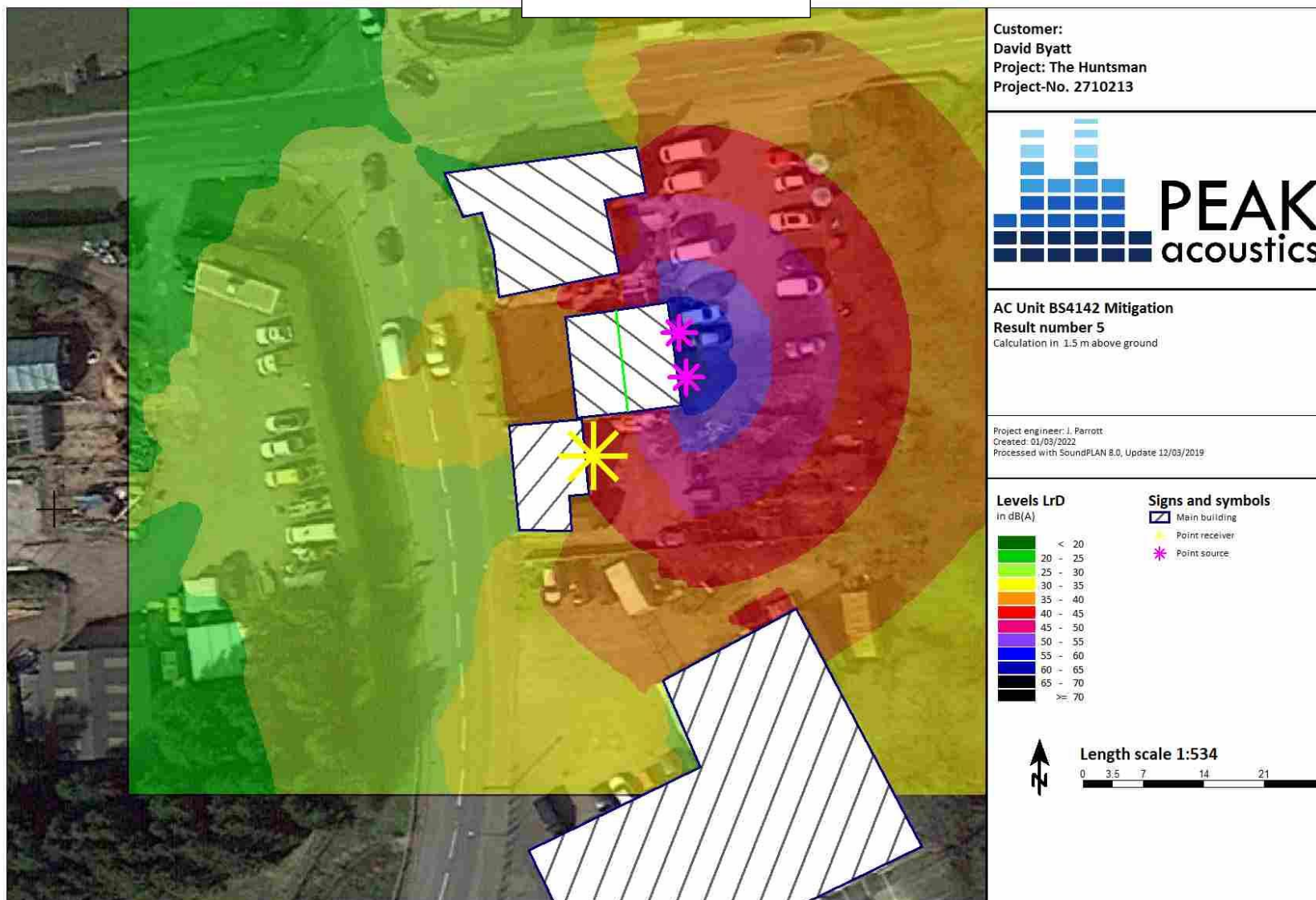
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AC Unit BS4142 Assessment



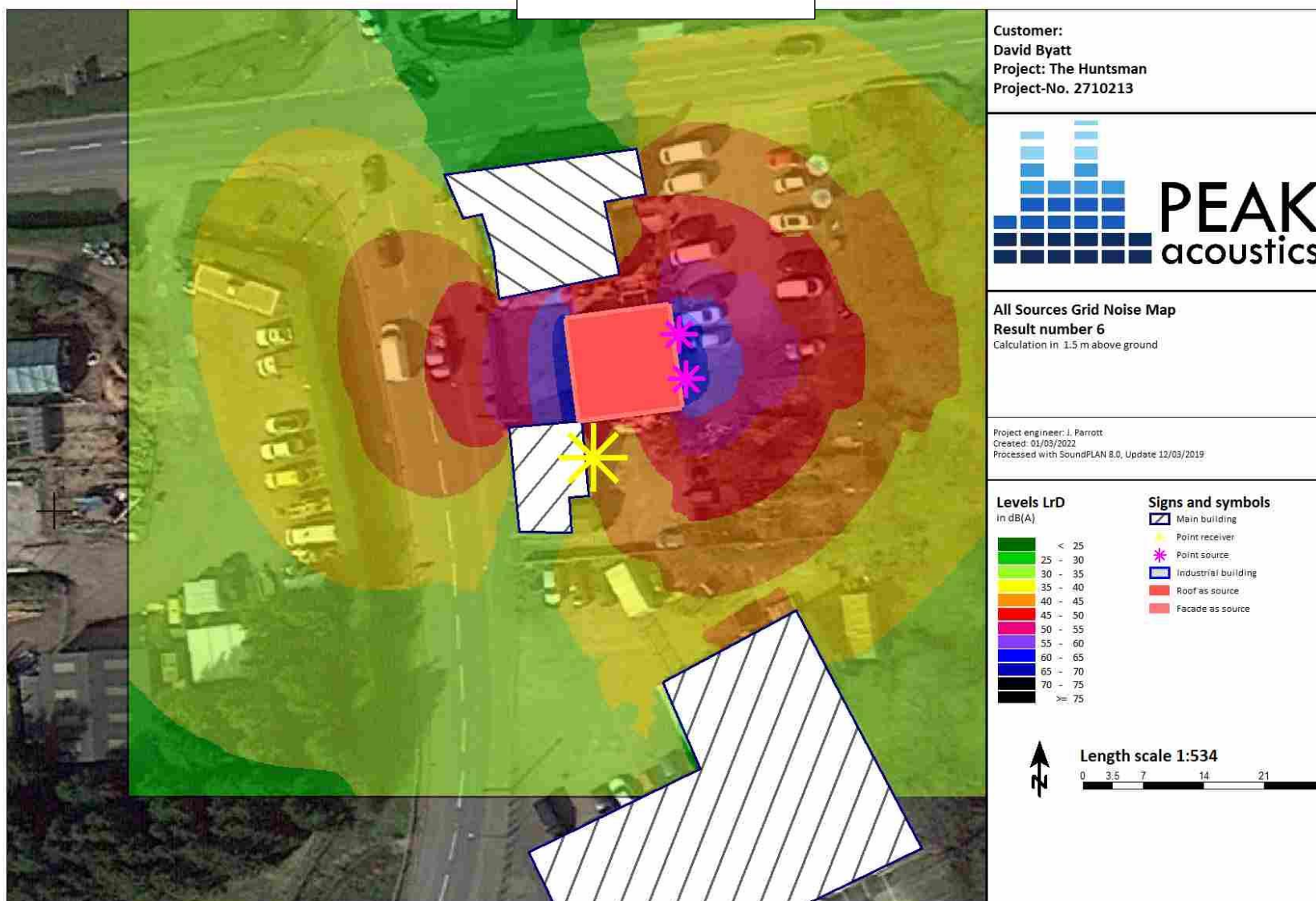
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AC Unit BS4142 Mitigation



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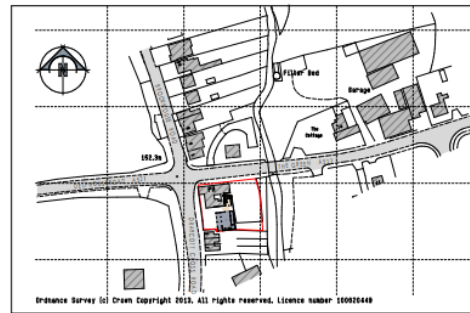
All Sources Grid Noise Map



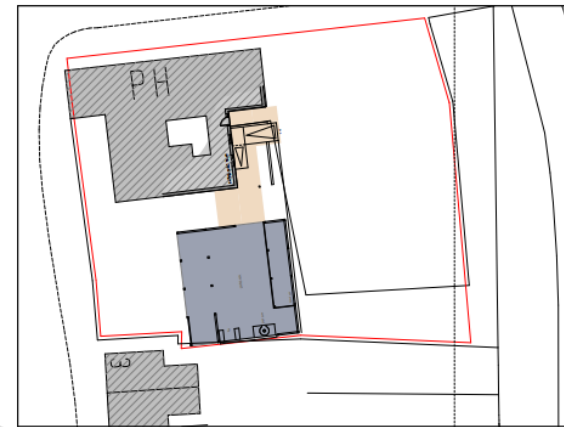
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APPENDIX G – Site Plan & Data Sheets

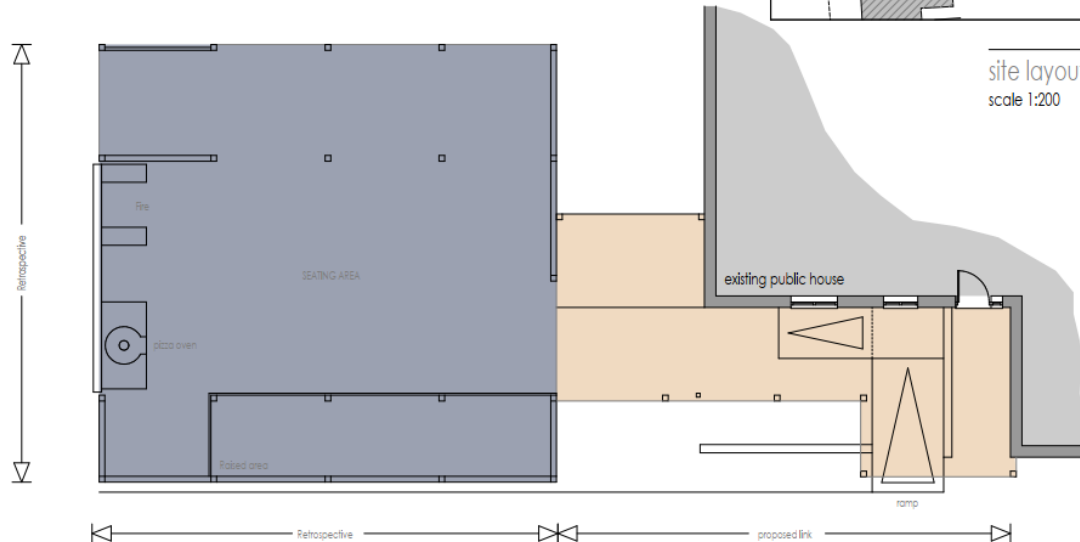
The Huntsman – Public House



site location plan
scale 1:1250



site layout plan
scale 1:200



floor plan
scale 1:50

The Huntsman			
Comments Timber frame outdoor space, to rear beer garden area of the Huntsman Pub Part Retrospective: Part Proposed			
Drawing Title Proposed Conditions Floor Plan & Site Plans			
Date 8 May 2021	Drawn P. J. Parrott	Revised P. J. Parrott	Scale 1:50 @ A1
Drawn P. J. Parrott	Checked P. J. Parrott	Approved P. J. Parrott	Comments S642
Rev No S642-001	Rev Date 08/05/2021	Rev Description Initial Design	Rev Approved P. J. Parrott
Rev No S642-001	Rev Date 08/05/2021	Rev Description Initial Design	Rev Approved P. J. Parrott
Rev No S642-001	Rev Date 08/05/2021	Rev Description Initial Design	Rev Approved P. J. Parrott
Rev No S642-001	Rev Date 08/05/2021	Rev Description Initial Design	Rev Approved P. J. Parrott

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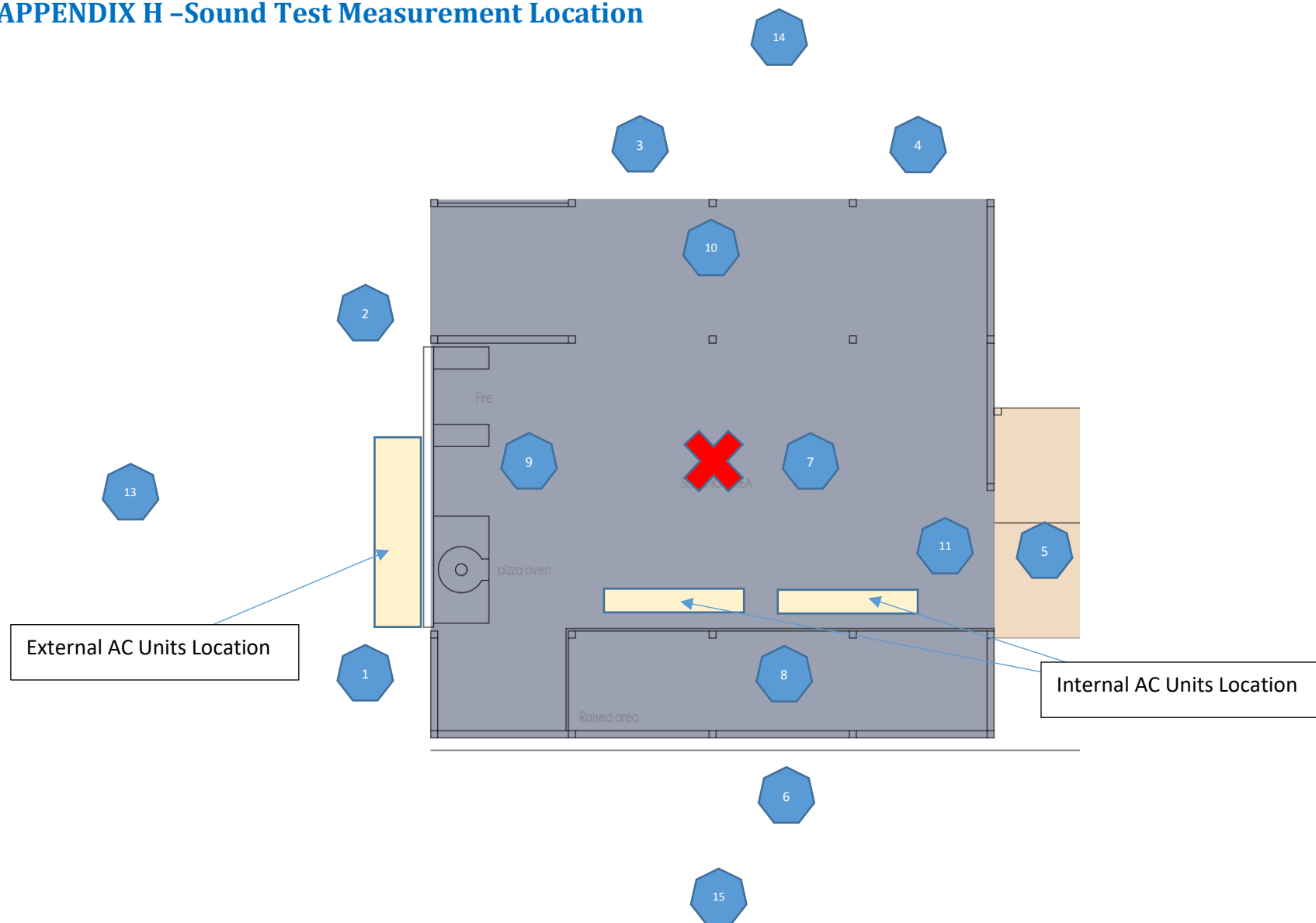
AC Units Technical Specification



Pictures not to scale

OUTDOOR UNIT	Service Ref.			PUHZ-P125VHA2.UK PUHZ-P125VHA2.1.UK PUHZ-P125VHA3.UK PUHZ-P125VHA3R1.UK PUHZ-P125VHA3R2.UK PUHZ-P125VHA3R3.UK		PUHZ-P140VHA2.UK PUHZ-P140VHA2.1.UK PUHZ-P140VHA3.UK PUHZ-P140VHA3R1.UK PUHZ-P140VHA3R2.UK PUHZ-P140VHA3R3.UK		
	Mode			Cooling	Heating	Cooling	Heating	
	Power supply (phase, cycle, voltage)			Single 50Hz, 230V				
	Running current		A	17.37	16.74	22.48	21.31	
	Max. current		A	28		29.5		
	External finish			Munsell 5Y 7/1 / Munsell 3Y 7.8/1.1 (VHA3R1/R2/R3)				
	Refrigerant control			Linear Expansion Valve				
	Compressor			Hermetic				
	Model			TNB306FPGM/TNB306FPGMT (VHA3R3)				
	Motor output		kW	3.4		3.9		
	Starter type			Inverter				
	Protection devices			HP switch				
	Crankcase heater			W	Discharge thermo/Comp. surface thermo (VHA3R2/R3)			
	Heat exchanger			30				
	Fan		Fan (drive) × No.	Plate fin coil				
			Fan motor output	kW	Propeller fan × 2			
		Airflow	m³/min(CFM)	0.060+0.060 100(3,530)				
Defrost method			Reverse cycle					
Noise level		Cooling	dB	51	52			
		Heating	dB	55	56			
Dimensions		W	mm(in.)	950(37-3/8)				
		D	mm(in.)	330+30(13+1-3/16)				
		H	mm(in.)	1,350(53-1/8)				
Weight			kg(lbs)	99(218)				
Refrigerant			R410A					
		Charge	kg(lbs)	4.5(9.9)				
		Oil (Model)	L	0.87(FV50S)				
REFRIGERANT PIPING	Pipe size O.D.		Liquid	mm(in.)	9.52(3/8)			
			Gas	mm(in.)	15.88(5/8)			
	Connection method		Indoor side	Flared				
			Outdoor side	Flared				
	Between the indoor & outdoor unit		Height difference	Max. 30m				
		Piping length	Max. 50m					

APPENDIX H –Sound Test Measurement Location



APPENDIX I – Acoustic Terminology

To aid the understanding of acoustic terminology and the relative difference between noise levels the following background information is provided.

We perceive sound when the ear detects fluctuations in air pressure (sound waves), which are then processed by the brain and perceived as sound. Humans can hear an incredibly wide range of sound intensities ranging from jet engines to fingertips lightly brushing against each other. This range is quantified using a logarithmic scale called the decibel scale (dB). The comfortable range of the decibel scale typically ranges from 0dB (the threshold of hearing) to around 140dB. Here are some examples common environments and their typical noise levels.

Noise Level	Environment
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a moving car
60 to 70 dB(A)	Typical high street
100 to 110 dB(A)	Fire alarm at 1 metre away
140 dB(A)	Threshold of pain

Terminology

dB (decibel) – A unit used to quantify the pressure level of sound. Defined as 20 times the logarithm of the ratio between the root-mean-square pressure of a given sound field and a reference pressure level (2×10^{-5} Pa – threshold of hearing).

$L_{Aeq, T}$ – The equivalent continuous sound pressure level over a stated period. It quantifies a fluctuating sound level over a given period as the equivalent continuous sound level in which the same amount of acoustic energy is contained over. This is A-weighted in order to assess human perception.

L_{A90} – The sound level exceeded 90% of the time. Typically used to describe background noise the L_{90} is regarded as the ‘average minimum level’ and quantifies the common sound level of a fluctuation sound field i.e. the sound level that occurs 90% of the time. Alternatively, L_{10} describes the sound level exceeded 10% of the time and therefore quantifies the ‘average maximum level’ of sound which is often used during the calculation of road traffic noise.

A-Weighting – A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

R_w – The Weighted Sound Reduction Index (R_w) is a number used to rate the effectiveness of a soundproofing system or material.



Let us introduce ourselves

Peak Acoustics formed in 2011, we are a fully accredited specialist consultancy and testing organisation.

We are a diverse team of Acoustic Consultants, Specialist Engineers and Building Compliance Technicians, with a network spanning the UK. We are proud to offer our services nationally, with no job too big or small.

We provide Acoustic Consultancy, Building Compliance Testing and Energy Services.

Additional Services

We offer an extensive range of services in the sectors of Acoustic Consultancy, Building Compliance & Energy Efficiency. We are able to put together custom packages combining multiple services which saves both time and money for you.

Building Compliance

- Sound Insulation Testing
- Air Tightness Testing
- Ventilation Testing
- Water Efficiency Calculations
- Sound Insulation Specification

Energy Efficiency

- SAP Calculations
- EPC's
- SBEM Calculations
- Energy Statements
- Sustainability Statements
- MEES Regulations
- Commercial EPC's

Acoustic Consultancy

- Noise Assessment for planning conditions
- Construction site noise monitoring
- Noise at work assessments
- Noise & Vibration Impact Assessments

Peace of mind

We are accredited and registered by all the relevant major UK authorities to provide the services we offer. Peak Acoustics is UKAS accredited for sound insulation testing, ATTMA registered for Air Leakage Testing. and our Energy team are all Domestic On-Completion Energy Assessors.

Our Added Value

We combine our detailed knowledge of building regulations with our technical understanding of building physics, acoustics and environmental sciences to maximise development quality. Our work ensures appropriate strategies and studies are prepared to demonstrate to local authorities how proposed developments will be of high quality and generate acceptable impact on the surrounding environment.

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