ACOUSTIC CONSULTANTS LTD

Noise Impact Assessment

Proposed Steel Fabrication Building, Woolley Green

Reference: 10271/SL

Client:
Laurence Ovens

Document Control

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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise, acoustic, and vibration aspects as included in this report. We provide advice only in relation to noise, vibration and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and, on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

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1. Introduction

Laurence Ovens appointed Acoustic Consultants Limited to undertake a noise impact assessment for the proposed relocation of a steel fabrication operation in Woolley Green, Bradford-on-Avon.

This report provides a noise assessment of the proposed relocated steel fabrication site at Woolley Green on the nearest existing noise sensitive receivers (NSRs). The existing site was approved on 3rd February 2022 (Application Reference PL/2021/11393). Condition 2 of the planning approval states:

> *"The development hereby permitted shall be carried out in accordance with the following approved plans:*
>
> *Noise Report, Site Location Plan 2783-03, Barn A elevation and floor plans 2783-04, Barn B elevation and floor plan 2783-05 and proposed site plan 2783-06 – all received 2 December 2021; and supporting statement received 15 January 2022."*

The noise report referred to in the planning condition was produced by Acoustic Consultants Limited in 2021 (ACL Reference 9303/SL). The Supporting Statement acknowledges that "*Section 6.1 of the [noise impact assessment] states that roller shutter must be closed when working internally to address noise breakout".*

We understand that the steel fabricators have not operated as required and as advised in the original noise impact assessment with roller shutter doors closed since relocating from their old premises in Whaddon to the current site in Woolley Green. Subsequently, noise complaints have been received from neighbouring dwellings to the east which are directly overlooked by the open roller shutter doors.

The client has advised it is not feasible for the site to operate with doors closed and therefore it is proposed to construct a new steel fabrication building to the west, which is approximately 100 metres further from the dwellings and orientated with the open doors facing away from the nearest dwellings in order to reduce the noise impact.

The noise impact assessment has been undertaken in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG) and British Standard 4142:2014+A1:2019 (BS4142).

The noise impact assessment is for the industrial unit only and not for the proposed dwellings. The proposed dwellings however are considered in the BS4142 assessment.

The author of this report is a Member of the Institute of Acoustics (MIOA) with seven years' experience in the field and the report has been checked by a Member of the Institute of Acoustics (MIOA) and director of the company with over sixteen years' experience.

2. The Site and Proposals

The site is located at Woolley Green, Bradford-on-Avon. It is proposed to relocate the approved steel fabrication premises (Application Reference PL/2021/11393) to a new site approximately 100 metres to the west to reduce the impact of its operation on nearby dwellings.

The existing site, which was an agricultural barn fit out for steel fabrication, directly overlooks a number of dwellings to the east. The original noise impact assessment for the approved scheme concluded that the site must operate with the roller shutter doors on its eastern façade closed in order to prevent an adverse impact. The site has not been able to operate with the closed doors and, as such, has received complaints from neighbours to the east.

The proposals would see a new commercial use building constructed on a patch of farmland (approximately 100 metres to the east of the existing site) with the access doors to be orientated to face west, where the nearest dwelling is located approximately 400 metres away. The steel fabricator tenants at the existing site would be relocated to the new site and the existing barn building to be demolished to accommodate 3No. new detached dwellings.

The proposed operational hours are understood to be Monday to Friday (07:00 – 18:00 hours) and Saturday mornings (07:00 – 12:00 hours).

A noise survey was undertaken at the existing Woolley Green site during which site staff demonstrated the various equipment involved in the operation. The equipment comprises various handheld tool, fixed machinery and mobile plant such as grinders, welders, bandsaws, a punch machine, a mag drill, paint shop tools, an extraction fan and telehandler. Steel is transported internally by the telehandler, where it is processed to create bespoke items which may then be spray painted by an affiliated paint shop.

The existing site sees steel transported between the fabrication and paint shop areas by the telehandler. The proposals include both fabrication and paint shop zones within the same building.

As follows are shown the proposed site layout (showing the position of the relocated steel fabrication unit and proposed dwellings) and internal layout of the proposed steel fabrication and paint shop building:

Figure 1: Proposed site layout

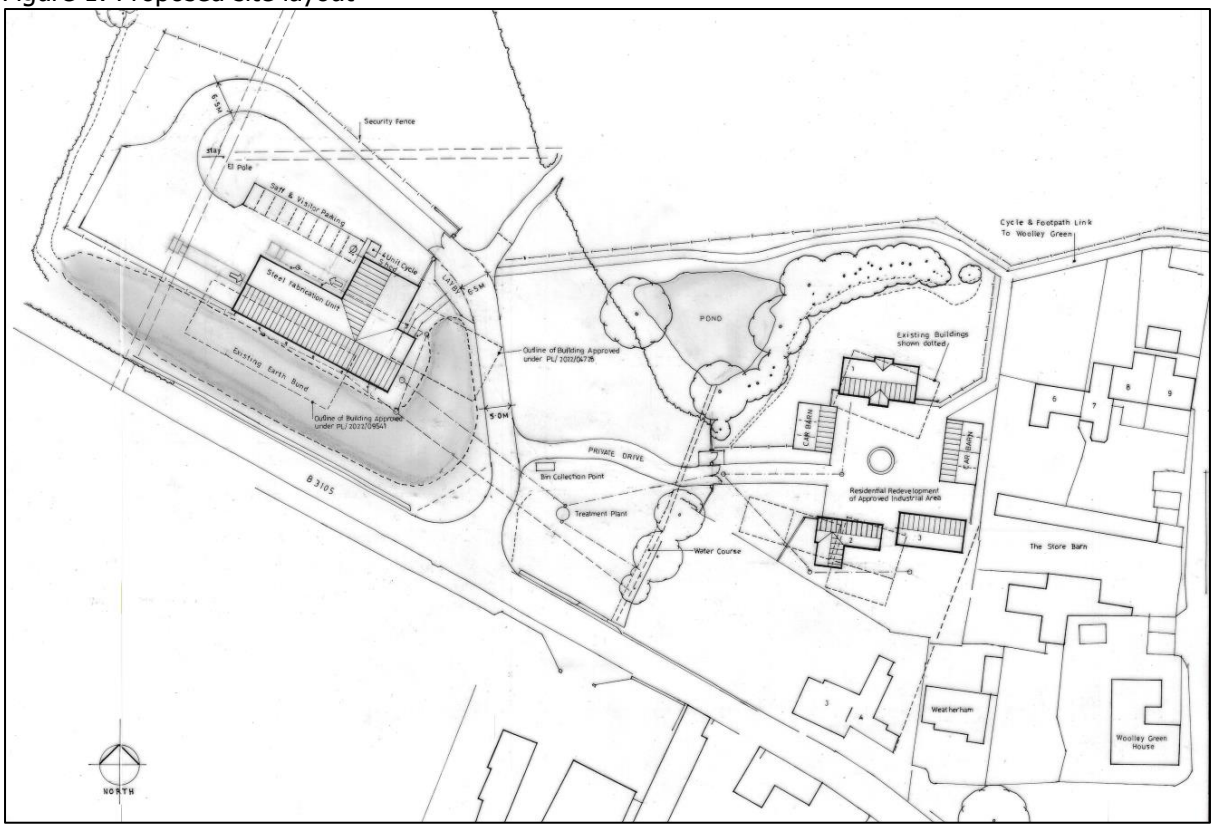
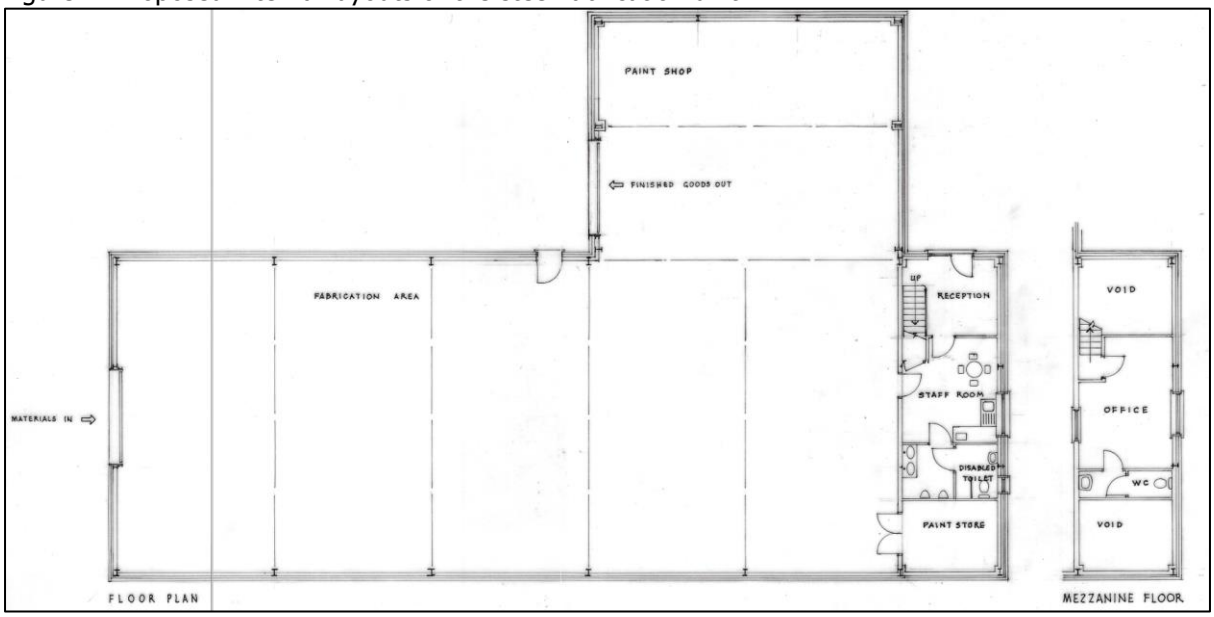


Figure 2: Proposed internal layouts of the steel fabrication unit



3. Planning and Noise

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in July 2021. Section 15 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning. Paragraph 174 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 soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 185 states:

"185. 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:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation. "

The document does not prescribe any assessment methodology or criteria to assess the adverse effect of noise, and refers you to the NPSE.

3.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion and applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long-term vision of Government noise policy. This long-term vision is supported by three noise policy aims which are as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

avoid significant adverse impacts on health and quality of life;
mitigate and minimise adverse impacts on health and quality of life; and
where possible, contribute to the improvement of health and quality of life."

The NPSE introduces the concept of "Significant adverse" and "Adverse" impacts of noise which relate to the noise policy aims. These are applied as follows:

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. With regard to where there is potential for noise impact it states the following in relation to the second noise policy aim:

"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."

The NPSE does not provide any assessment criteria for the noted effect levels and each case must be considered on its own merits. The NPSE does, however, emphasise that in dealing with noise, Local Planning Authorities are required to take a balanced approach in considering the benefits of development against any adverse effects which arise. Paragraph 2.18 of the NPSE is particularly relevant in this respect and states:

"There is a need to integrate consideration of the economic and social benefits of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other related factors."

The planning need is outside the scope of noise and acoustics and will need to be addressed by others.

3.3. National Planning Practice Guidance, Noise

The National Planning Practice Guidance (NPPG) on noise, referred to here, is based on the current version (July 2019) as provided on the Planning Guidance Website. It states that *"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."*

The document provides generic guidance on how to determine the impact of noise and what factors could be a concern. It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation. Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE. The table is duplicated on the following page.

Table 1: NPPG Noise – Perception of Effect Levels

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise.	Significant Observed Adverse Effect	Avoid

Response	Examples of Outcomes	Increasing Effect Level	Action
	Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.		
Present and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

The table does not provide any objective assessment which equates to the noted effect levels.

The NPPG identifies that where noise is audible it is not necessarily intrusive. The effect and impact on people is based primarily on the level of noise.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum when taken into account against all other planning considerations.

Section 4 of this report identifies guidance which is considered to provide noise criteria equivalent to effect levels below the Lowest Observed Adverse Effect Level. This is where the perception of noise is "not noticeable" or "noticeable but not intrusive" as indicated in Table 1 above.

4. Assessment Methodology

For industrial and commercial noise, the most relevant guidance is provided within British Standard 4142:2014+A1:2019. It was agreed with the local authority to apply the methodology of BS4142 for this noise impact assessment.

The methods described in the British Standard use outdoor sound levels to assess the likely effects of sound upon people who might be inside or outside a dwelling or other premises used for residential purposes.

The initial estimate principle is that of establishing the 'difference' between the 'rating level' and the 'background sound level'. The 'rating level' is the 'specific sound level' of the source over a period of one hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours). Clause 9 entitled 'Rating Level' states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level."

An acoustic character correction should be added to the 'specific sound level' if it exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies, dependent on the prominence of the character of the sound source at the assessment location. In *Clause 11 of the Standard, entitled 'Assessment of the Impacts', it states:*

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9), and consider the following.

- *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."*

Based on the initial assessment outcomes of BS4142, and depending on context, it is our opinion that the NOEL, LOAEL and SOAEL levels stated in the Noise Policy Statement for England would generally fall within the following categories when considered in conjunction with the effect levels of the NPPG Noise.

Table 2: BS4142 Difference in Relation to Effect Levels

BS4142 Assessment Difference	Corresponding Effect Level*	Action*
≤-10 dB	No Observed Effect	No specific measures required
-9.9 dB to 0 dB	No Observed Adverse Effect	No specific measures required
	Lowest Observed Adverse Effect Level	
0.1 dB to 5 dB	Observed Adverse Effect	Mitigate and reduce to a minimum
	Significant Observed Adverse Effect Level	
5.1 dB to 10 dB	Significant Observed Adverse Effect	Avoid
≥10.1 dB	Unacceptable Adverse Effect	Prevent

* BS4142 states that "where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration". Therefore, the assessment levels and effect levels above are not definitive and can be modified due to context.

It should be noted that the numerical outcome only represents the initial estimate of impact, as stated in the first paragraph of Clause 11, and that contextual matters should be considered before determining what the potential impact is. This paragraph states:

> *The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. 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.*
>
> *Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9).*
>
> *NOTE 1 More than one assessment might be appropriate.*

The second part of Clause 11 sets out three contextual matters that should be taken into account once the initial numerical estimate has been determined. It is important to note that the three listed is not exhaustive and all pertinent factors should be considered.

5. Noise Monitoring

Partially attended long-term noise monitoring exercise was undertaken at the site between Thursday 18th May 2023 to Tuesday 23rd May 2023 to establish baseline noise levels at locations representative of both the existing and proposed receivers.

Attended noise measurements was also taken at the existing site with the Environmental Health Officer present on 18th May 2023 to determine noise levels of the individual processes involved with the steel fabrication operation.

5.1. Monitoring Equipment

Sound Pressure Levels were measured using a sound level analyser with half-inch condenser microphone, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 entitled "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards. This equipment was checked and calibrated as noted below.

Table 3: Monitoring Equipment

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, NTI, XL2	A2A-13561-E0	17/11/2021	39498
Pre-Amp, NTI, MA220	7606	17/11/2021	39498
Microphone, NTI, MC230A	A17955	17/11/2021	39497
Calibrator, Larson Davis, CAL200	15064	08/12/2022	42729
SLM, NTI, XL2	A2A-20250-E0	22/03/2022	34610
Pre-Amp, NTI, MA220	10592	22/03/2022	34610
Microphone, NTI, MC230A	A22596	22/03/2022	34609
Calibrator, Larson Davis, CAL200	19741	04/04/2023	43930

The measuring systems were checked for calibration before and after the tests. No drift exceeding 0.1 dB was detected.

5.2. Weather Conditions

Table 4: Weather Conditions During Survey

Date	Wind Speed (m/s)	Prevailing Wind Direction	Air Temperature (°C)	Precipitation (time/hrs)	Cloud Cover (%)
18/05/2023	1-4	W	10-18	-	25
19/05/2023	2-4	S	9-17	-	-
20/05/2023	4-5	NE	7-18	-	-
21/05/2023	4-5	NE	7-19	-	-
22/05/2023	3-5	S	10-20	-	-
23/05/2023	2-4	NE	9-18	-	75

5.3. Monitoring Procedure

5.3.1. Baseline Noise Survey

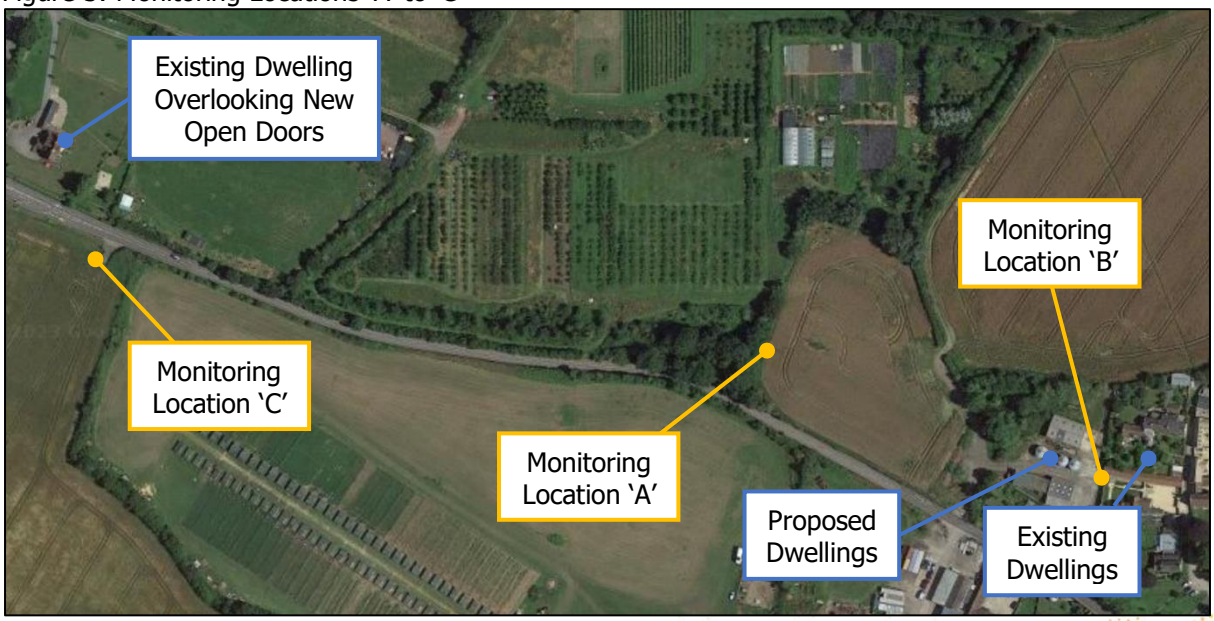
A partially attended long-term baseline noise survey was undertaken at Monitoring Location 'A' to determine noise levels representative of the dwellings to west, which overlook the open doorways of the proposed relocated steel fabrication site. The sound level meter was elevated on a tripod at a height of approximately 2 metres above ground in a free-field position, set back from the road at a comparable distance to the dwelling to the east which overlooks the proposed open doors. The noise climate was determined primarily by road traffic noise along the B3105 with occasional noise audible from the existing steel fabrication site (though not frequently enough to influence the background sound level).

A partially attended long-term baseline noise survey was undertaken at Monitoring Location 'B' to determine noise levels representative of the proposed and existing dwellings to the east. The sound level meter was elevated on a tripod at a height of approximately 2 metres above ground in a façade position. The noise climate was determined by site noise at the existing steel fabricators and road traffic on the B3105. The lowest measured background sound level will nonetheless be used to account for the effect of existing site noise, as agreed with the local authority.

Simultaneous attended measurements were taken at Monitoring Location 'C' for comparison with the long term data at Monitoring Location 'A'. This exercise was intended to verify that the long term measurements at Location 'A' were representative of the noise climate at Location 'C' adjacent to the worst-case dwelling to the west.

The monitoring locations are marked on the satellite image of the site and surrounding area below:

Figure 3: Monitoring Locations 'A' to 'C'



5.3.2. **Operational Noise Measurements**

Operational noise measurements were undertaken at the existing site alongside the Environmental Health Officer on 18th May 2023. One sound level meter was installed in a reverberant position while site staff walked the consultant through the building, describing each piece of equipment (i.e. frequency of use, duration of use, quantity etc) and demonstrating the noise generated by its operation. Attended measurements were taken of each piece of equipment using a second sound level meter, typically in a nearfield position at 1.5 metres.

Attended measurements were taken in both the main fabrication building and paint shop. These associated operations are proposed to move to the new site together and operate within one building.

There is also a smaller scale fabrication operation located in a small unit on the existing site, which is not associated with the proposals and will not be moving to the new site. We understand this is informally let to a one-man operation and that the noise complaints relate to the use of the larger fabrication site. The local authority requested that the noise of the smaller operation was considered in the measurements. Therefore, attended measurements were undertaken for all equipment in this unit on 23rd May 2023; this data is not applicable to the modelling for the proposed site in this noise impact assessment but is appended to the report for the local authority's information (see Appendix 2).

Measurements within the steel fabrication unit considered handheld grinders, welding machinery, "9-inch" grinders, a punching machine, a mag drill, centre pop tools, an angle band saw, flipping/moving of steel beams and the site radio. The main band saw was faulty at the time of survey (18th and 23rd May 2023) and could not be measured. Site staff advised that both band saws generate similar noise levels.

The main bandsaw was also measured by Acoustic Consultants Limited at the old premises in Whaddon on 12th November 2021 for the previous noise impact assessment (ACL Reference 9303/SL). The measurement was taken under reverberant conditions. This reverberant data will be applied in the modelling for the proposed site in lieu of being able to take new measurements of the bandsaw during the 2023 visit.

Upon arrival to site, it was observed that the movement of steel beams can generate significant impulsive noise. Site staff commented that the noise of a beam being manoeuvred can vary dependent on its size, weight etc. The turning of a large steel beam was demonstrated by site staff using the telehandler to flip it over on the metal work surface and this was described as representative.

Measurements were also taken externally of the telehandler both driving and reversing in a straight line at a distance of 4 metres in a façade position. The noise of the reverse alarm was barely perceptible over the noise of the engine at this distance. The "pass by" level of the telehandler will be calibrated in the modelling based on the measured data and applied as a moving point source within a known area externally.

Site staff advised that the dropping of beams doesn't typically occur externally as the stored beams are collected from outside and transported internally where fabrication and painting occurs. As the new site will house both the fabrication and paint shop areas within the same building, there are anticipated to be fewer external telehandler movements compared to the existing operation, where steel must be transported between the two buildings.

The sound level meter left in the reverberant position was collected later in the day to be moved to one of the environmental positions after site staff had returned to work. Reverberant noise was therefore captured during typical working conditions which can be considered for context in the assessment although a reverberant noise level will be calculated based on individual measurements as agreed with the Environmental Health Officer.

5.4. Measurement Data

5.4.1. Baseline Noise Levels

As follows are shown in chart format the measured maximum, equivalent and background sound levels at Monitoring Locations 'A' and 'B' over the full survey duration:

Chart 1: Long term survey data at Monitoring Location 'A'

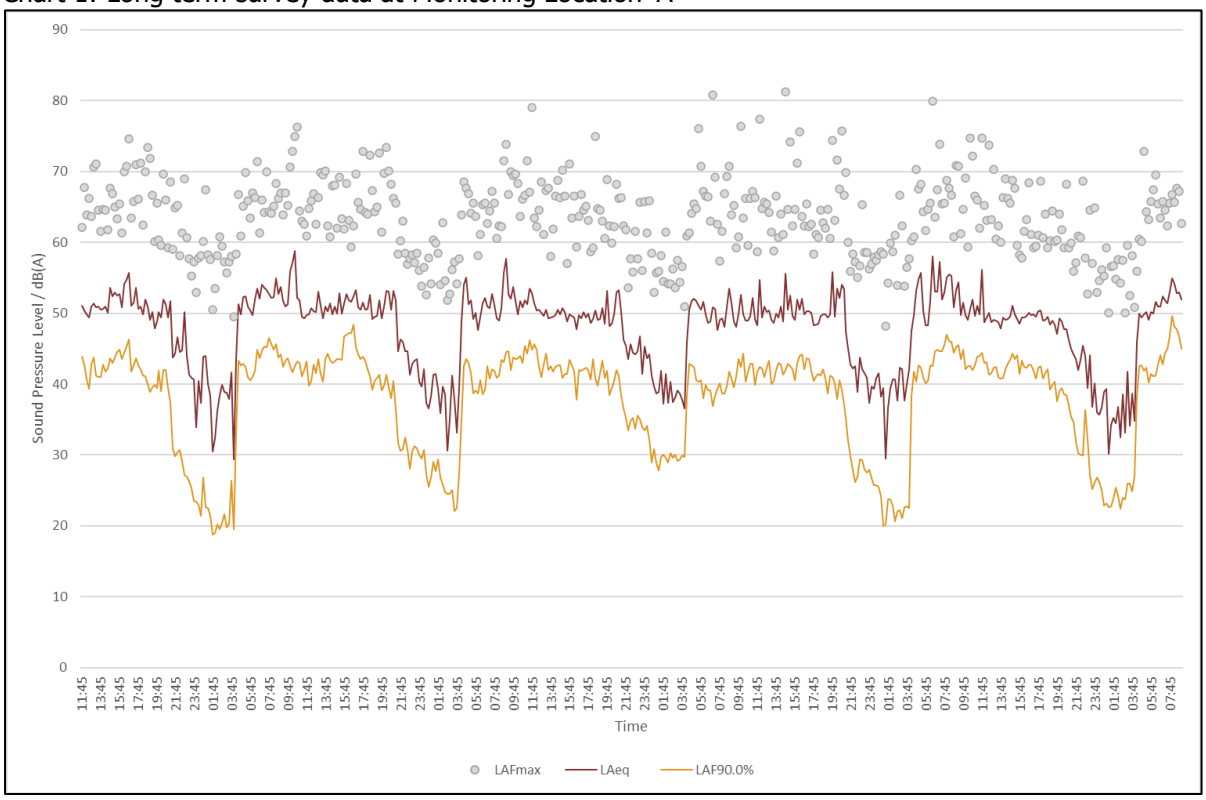
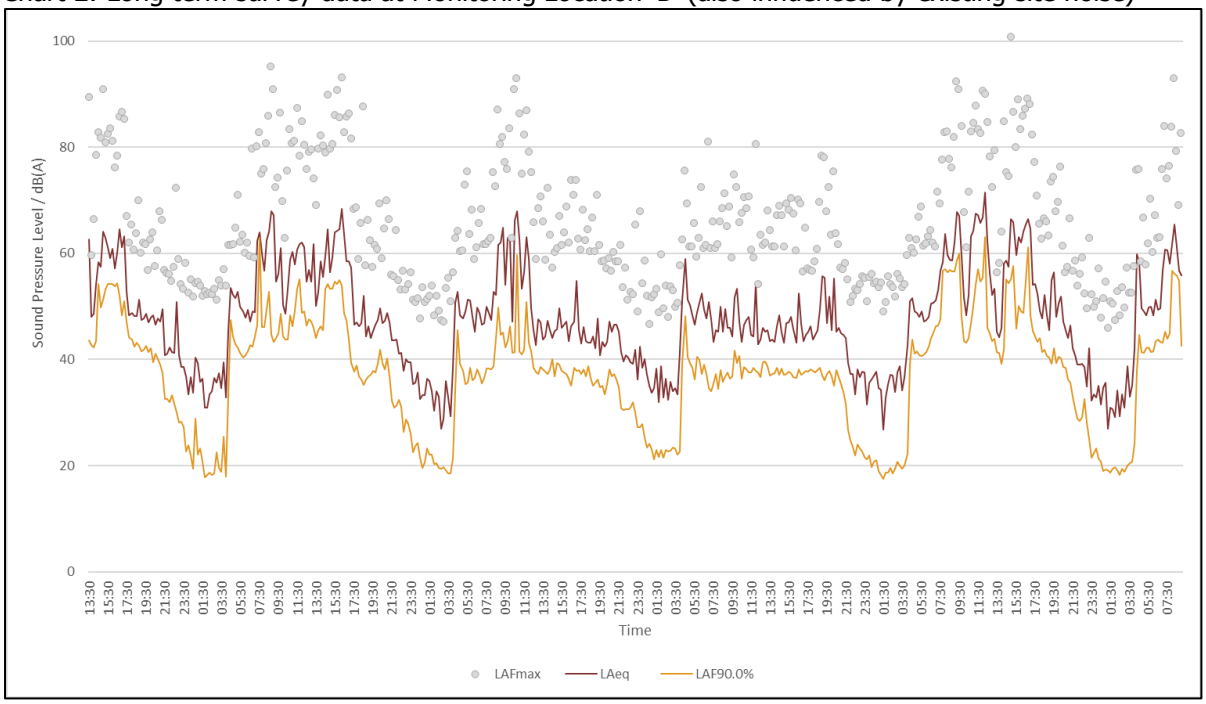


Chart 2: Long term survey data at Monitoring Location 'B' (also influenced by existing site noise)



The full survey data is shown in tabular format (equivalent and background sound levels) in Appendix 2 of this report for the local authority's information.

The simultaneous data measured at Monitoring Locations 'A' and 'C' verified that the background sound level at 'C' was of a similar order but slightly higher than at 'A'. Therefore, the long term background sound data measured at Monitoring Location 'A' a is considered representative of the dwellings to the west. The attended simultaneous survey data is also included in Appendix 2 of this report.

British Standard 4142:2014 states *"the objective* [in determining representative background sound levels] *is not simply to ascertain a lowest measured background sound level but to quantify what is typical during particular time periods."* It has been agreed with the local authority to use the lowest background sound level measured at both locations, in the interest of a robust assessment (and also to account for the fact that the existing site may have affected the background sound level at Monitoring Location 'B' in some cases).

On this basis, the design background sound level is 38 dB $L_{A90,1hour}$ at the dwellings to the east (existing and proposed) and 41 dB $L_{A90,1hour}$ at the dwellings to the west. These were the lowest measured background sound levels during the proposed operational hours at each location.

The statistical analysis of the measured baseline noise levels during proposed operational hours is summarised below for each monitoring location:

Table 5: Background and residual sound levels established over proposed operational hours

Assessment Location	Background Sound Level / $L_{A90,1hour}$ dB*		Residual Sound Level / $L_{Aeq,1hour}$ dB*	
	Range	Modal	Range	Average
Location 'A'/Dwellings to West	**41**-48	43	**49**-57	52
Location 'B'/Dwellings to East	**38**-57	47	**48**-67	60

*Lowest measured to be applied as agreed with the Environmental Health Officer

5.4.2. Operational Noise Levels

As follows are summarised the measurements of each item of equipment or process as demonstrated to us by the site staff and commentary on the use:

Table 6: Attended measurement data from 2023 Woolley Green survey

Source	Measurement Distance (m)	Measured Equivalent Noise Level (dBA)*	Notes
Grinder	1.5	93	Frequently used, 30 minutes usage per worst hour, 4 grinder tools on site.
Welder	1.5	85	Can be continuous over an hour over busy periods. Up to 4 people welding at a time.
9-inch Grinder	1.5	93	Infrequent usage, only for specific jobs.
Punch Machine	1.5	80	Infrequently used but can be consistent over an hour when needed.
Mag Drill	1.5	85	Similar use as the punch machine but used more frequently.
Radio	1.5	71	Constantly on in the background.
Band Saw & Compressor	1.5	83	Used infrequently to cut angles. Compressor only runs until there is enough compressed air in the system to power the saw. Reportedly similar in noise levels to the main band saw.
Centre Pop	1.5	89	Impulse to form guide holes pre-drilling. If needed, approx. 6 per beam but not a continuous noise like the powered equipment.
Steel beam flip	6	92†	Impulse of steel beam being turned using a telehandler and winches.
Paint Shop Extract (external)	3	85	Runs continuously when needed to remove fumes from the paint shop. Measurement taken adjacent to a channel between two buildings, where the existing grille is located (i.e. lots of reflections).
Paint Spray Gun & Extract (internal)	1.5	85	Assumed continuous over an hour when busy.
Bandsaw (2021)	Reverberant	85	Measured under reverberant conditions in 2021 as the equipment was not in working order during the 2023 survey. Understood the bandsaw is not frequently used but may be used constantly over an hour when needed for certain jobs.

*Spectral data is appended to this report in Appendix 2
†Maximum noise level

The reverberant sound level captured while the meter continued to run after staff returned to normal work is as follows:

Table 7: Measured reverberant sound level during normal operation

Location	Sound Pressure Level per Octave Band, $L_{eq,25min}$ (dB)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Current steel fabrication building	61	66	70	74	79	81	79	76	86

6. Noise Modelling

The noise emission of the proposed operation has been modelled in the proprietary noise modelling software Cadna:A by DataKustik. The modelling software calculates sound levels based on the inputted sound emission values, source and receiver locations, and primarily distance, barrier and ground attenuation. Calculations are undertaken using the General Method of Calculation from ISO 9613-2.

6.1. Design Operational Noise Levels

The British Standard 4142:2014 assessment requires an assessment of the worst-case typical operation over a one hour period (during daytime hours). Reverberant levels were measured during normal operation during the survey but the local authority advised that the source-specific measurements should be recombined to calculate a worst-case reverberant level based on a worst-case combination of sources.

In order to calculate a worst-case combination of equipment, the maximum number of site operatives must first be known. It is understood the current site typically employs four people within the steel fabricators in addition to one person running the paint shop. Based on the relative floor area of the new site, we would anticipate the new site could increase its capacity to cover six employees in the steel fabricators plus a paint shop operative.

Grinding tools were observed to be the worst-case piece of equipment in terms of noise, during the site visit. It was discussed that there could be up to four people using grinders at once and that each grinder, at worst, would be used for approximately 30 minutes in an hour. The Environmental Health Officer expressed that four grinders operating at once would likely constitute the worst-case hour. The main grinder tools and the 9-inch grinder tool used infrequently to cut notches in metal were very similar in terms of A-weighted broadband levels, although the 9-inch grinder had slightly more energy in the low frequency range. Therefore, we have considered 3 of the regular grinding tools and one 9-inch grinder, each time corrected to operate for 30-minutes over an hour, in our representative reverberant level.

To account for potential upscaling of the operation, with additional future employees, we have allowed for a further person operating a welder over 30 minutes within an hour and another operating the main bandsaw over the full hour. As the latter was not possible to demonstrate during the 2023 survey, the reverberant level measured in 2021 will be added to the calculated reverberant level of other sources.

We have also considered the site radio and paint shop equipment to operate over the full hour.

The reverberation time of the proposed steel fabrication and paint shop building has been calculated for the reverberant calculation. The total floor area considered is 462m^2 and the volume of the space is considered to be 3005m^3.

The absorption over the walls is considered to α = 0.1 across the frequency spectrum, which is considered representative of reflective walls with equipment and various machinery located around the perimeter, based on our experience.

The absorption of the roof is considered to be α = 0.2 across the spectrum, which is a factor considered representative of profile sheet metal finishes.

Absorption coefficients for concrete (i.e. almost fully reflective) are considered for the floor and a factor for sound being lost through the open shutter doors is also considered.

On the basis of the above, the reverberation time is predicted to be between 2 to 3 seconds in all octave bands with a T_{mf} (mid-frequency reverberation time) of 2.7 seconds using the Sabine formula.

Assuming source locations distributed across the floor area in worst-case reasonable positions, the reverberant level due to the four grinders, welder, radio and paint shop equipment (time corrected as described above) was calculated as follows:

Table 8: Calculated reverberant sound level of worst-case assumed operation

Location	Sound Pressure Level per Octave Band, $L_{eq,1hour}$ (dB)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Steel Fabrication and Paint Shop Building	71	77	76	75	78	84	88	85	91

The reverberant level of the bandsaw measured in 2021 was then recombined with the calculated reverberant level above. Based on the relative dimensions of the old Whaddon site and the new Woolley Green site, assuming similar absorptive properties for all surfaces, the total area of absorption at the new, larger site would be larger and therefore the reverberant level lower. On this basis, considering the reverberant level measured of the bandsaw in 2021 is a worst-case assumption.

The reverberant level of the bandsaw and combined design reverberant level are therefore as follows:

Table 9: Measured 2021 reverberant bandsaw and calculated cumulative worst-case reverberant level

Source	Sound Pressure Level per Octave Band, $L_{eq,1hour}$ (dB)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Reverberant Bandsaw (2021)	57	68	70	70	72	83	75	68	85
Cumulative Design Reverberant Level	71	77	77	76	79	87	88	85	92

The calculated worst-case single figure reverberant level is 92 dB(A). This is significantly greater than measured during typical operation in 2021 and 2023 (81 dBA and 86 dBA respectively) and as such is considered worst-case in the interest of a robust assessment.

6.2. Noise Mitigation

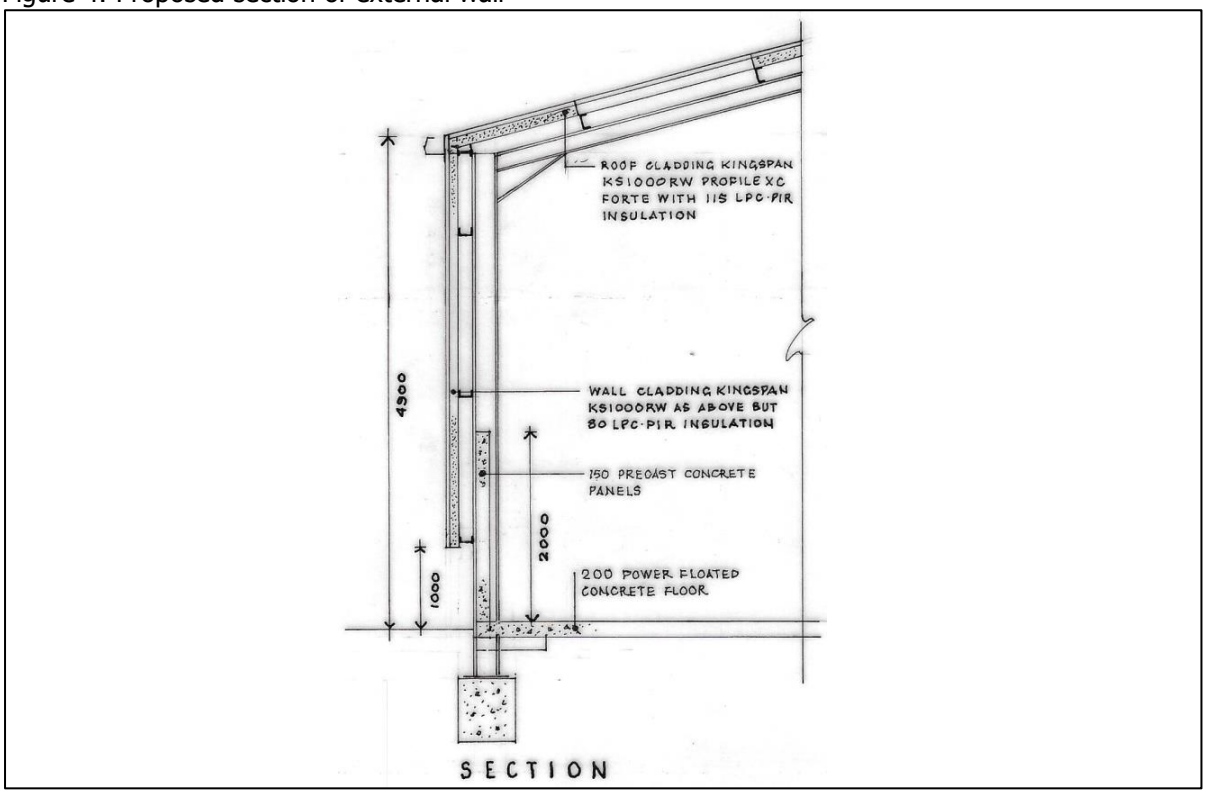
The proposed site is orientated with the open roller shut doors facing west where the nearest dwelling is approximately 400 metres away. The building fabric should be designed to mitigate noise breakout through the east facing façades which could affect the existing and proposed dwellings to the east.

6.2.1. Building Façade Construction

It is proposed to construct the building façade of the steel fabricators and paint shop with 150-millimetre precast concrete panels up to a height of 2 metres and Kingspan KS1000RW 80-millimetre PIR insulation forming the upper section of the walls (total height 4.9 metres).

This is shown in the section drawing reproduced below (Ashley Design drawing number 2783-16 dated April 2023):

Figure 4: Proposed section of external wall



In order to control noise emission through the building façade, we recommend that the Kingspan cladding is lined internally such that the partition comprises:

- 80-millimetre Kingspan KS1000RW composite wall panel.
- 100-millimetre galvanised steel stud at 600-millimetre centres.
- 15-millimetre plasterboard (surface mass 10 kg/m^2).

The above lining system essentially follows Detail 3W in the Kingspan Acoustic Performance Guide and is expected to achieve the following sound reduction indices:

Table 10: Required minimum sound reduction indices of Kingspan walls (lined internally)

Construction	Sound Reduction Index 'R' per Octave Band (dB)							R_w
	63	125	250	500	1k	2k	4k	
Recommended Kingspan lining – Detail 3W	14	17	31	40	48	46	63	**41**

The assumed performance of the lower part of the walls is as follows (150-millimetre precast concrete, assumed density of 2340 kg/m^3):

Table 11: Required minimum sound reduction indices of 150-millimetre concrete walls

Construction	Sound Reduction Index 'R' per Octave Band (dB)							R_w
	63	125	250	500	1k	2k	4k	
150mm precast concrete (2340 kg/m^3)	42	44	42	49	57	63	68	**54**

The modelling considers the sound insulation performances above for the respective areas of concrete and Kingspan walls.

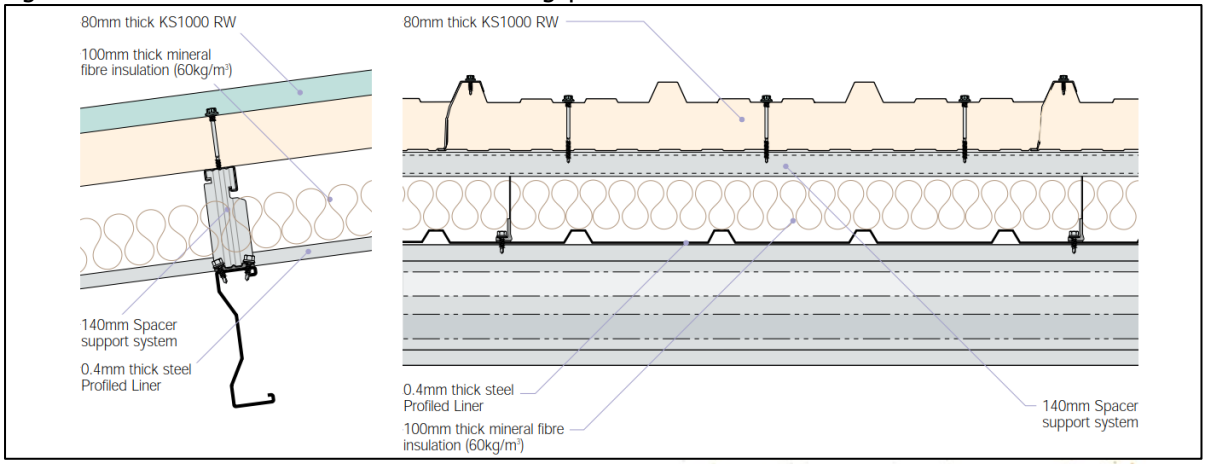
6.2.2. Roof Construction

It is proposed to construct the roof using Kingspan composite roof panels (115-millimetre KS1000RW XL Forte profile) as shown in Figure 4 above. This is understood to be a metal sandwich product with a pre-decorated underside.

On the basis this comprises a metal sheet fixed either side of the PIR insulation, the expected acoustic performance would be approximately 27 dB R_w which is not considered sufficient to attenuate noise breaking out through the roof.

Therefore, in order to control noise emission through the roof, we recommend that the roof meets the following KS1000RW construction detail contained in Appendix B of the Kingspan Acoustic Performance Guide (Detail 8R):

Figure 5: Roof construction detail 8R from Kingspan Acoustic Performance Guide



At the Woolley Green site, this would therefore comprise:

- Kingspan KS1000RW 115-millimetre composite roof panel.
- 140-millimetre spacer support system.
- 100-millimetre mineral fibre insulation (60 kg/m^3).
- 0.4-millimetre steel profiled liner.

The acoustic test results for the recommended 8R Kingspan detail states the following sound reduction indices:

Table 12: Required minimum sound reduction indices of roof

Construction	Sound Reduction Index 'R' per Octave Band (dB)							R_w
	63	125	250	500	1k	2k	4k	
8R – KS1000 RW/80 + I + L	-*	20	36	48	50	66	70	**46**

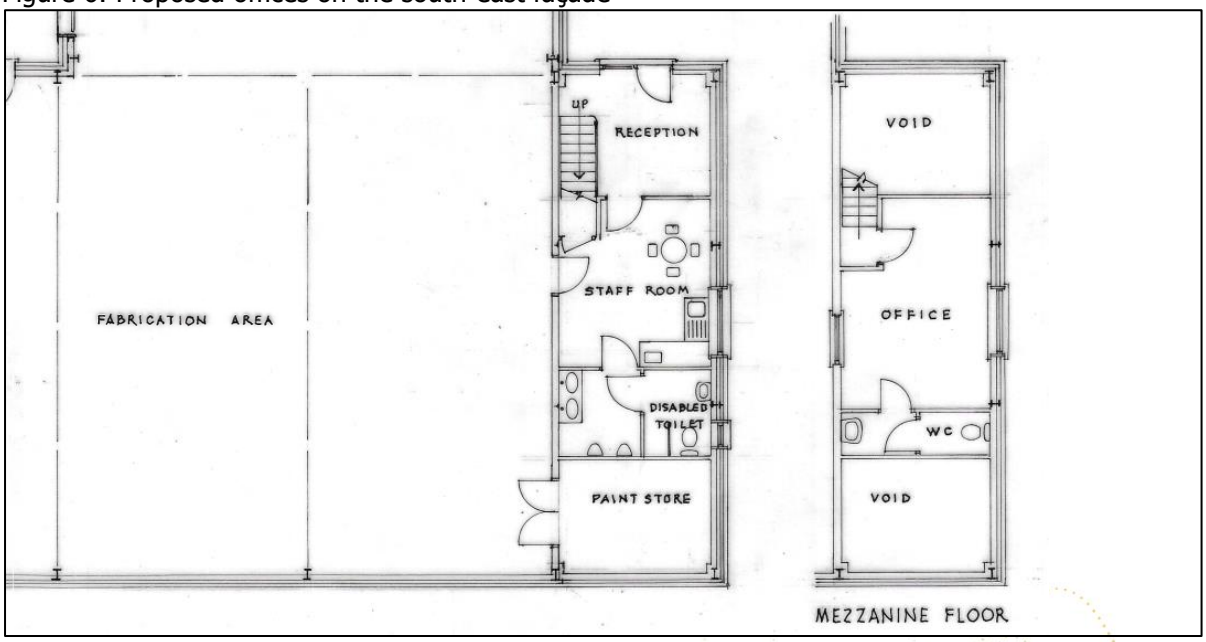
*The Kingspan document doesn't provide any performance at 63 Hz for the 8R detail. We have worked on the basis of a sound reduction index of 13 dB at 63 Hz based on the INSUL data for unlined KS1000RW rigid insulation, which is considered a worst-case assumption. In any case, noise generated by the proposed operation is most significant in the mid- to high-frequency range.

Any alternative roof system must achieve, at a minimum, the above sound reduction indices as stated in the manufacturer's acoustic data.

6.2.3. Window Constructions

No windows are located on within the steel fabrication and paint shop work areas. However, the adjoining offices do contain windows; these could be openable for ventilation as required but should be kept shut when internal doors linking the fabrication area and offices are open in order to mitigate noise breakout via the south-east façade facing the proposed dwellings when the fabrication area is in use.

Figure 6: Proposed offices on the south-east façade



Our modelling considers reverberant noise from the fabrication operation radiating from closed windows on the south-east façade. The noise levels considered to be emitted from the office areas are the same as the determined for the main fabrication area and paint shop, which is a worst-case assumption.

The windows could be formed of a standard double-glazed construction comprising 4-millimetre glass, a 12-millimeter cavity and second pane of 4-millimetre glass. The sound reduction indices typically provided by this construction are as follows:

Table 13: Required minimum sound reduction indices of office glazing

Construction	Sound Reduction Index 'R' (dB) per Octave Band Frequency								R_w
	63	125	250	500	1k	2k	4k	8k	
4/12/4	20	24	20	25	35	38	35	36	**31**

The glazing supplier should confirm that the minimum sound reduction indices above can be achieved at a minimum. We would recommend the same performance is applied to the internal vision panel linking the mezzanine office and fabrication area (for planning purposes, not acoustic design of the office).

6.2.4. Internal Door Constructions

Doors linking the fabrication area and offices should typically be kept closed while fabrication work is ongoing to reduce noise passing into the offices.

We also advise that all internal doors achieve, at a minimum, 30 dB R_w to help reduce sound transmission between the fabrication area and offices, and out the eastern façade towards the proposed and existing dwellings. This is for planning purposes only and not for office design of the offices.

6.2.5. Rooflights

In order to control noise through the roof, the rooflights should be fixed shut and be formed of a double glazing construction to comprise at a minimum 4-millimetre glass, a 12-millimeter cavity and second pane of 4-millimetre glass. Perspex roof lights should not be used.

The sound reduction indices typically provided by this construction are as follows:

Table 14: Required minimum sound reduction indices of rooflights

Construction	Sound Reduction Index 'R' (dB) per Octave Band Frequency								R_w
	63	125	250	500	1k	2k	4k	8k	
4/12/4	20	24	20	25	35	38	35	36	**31**

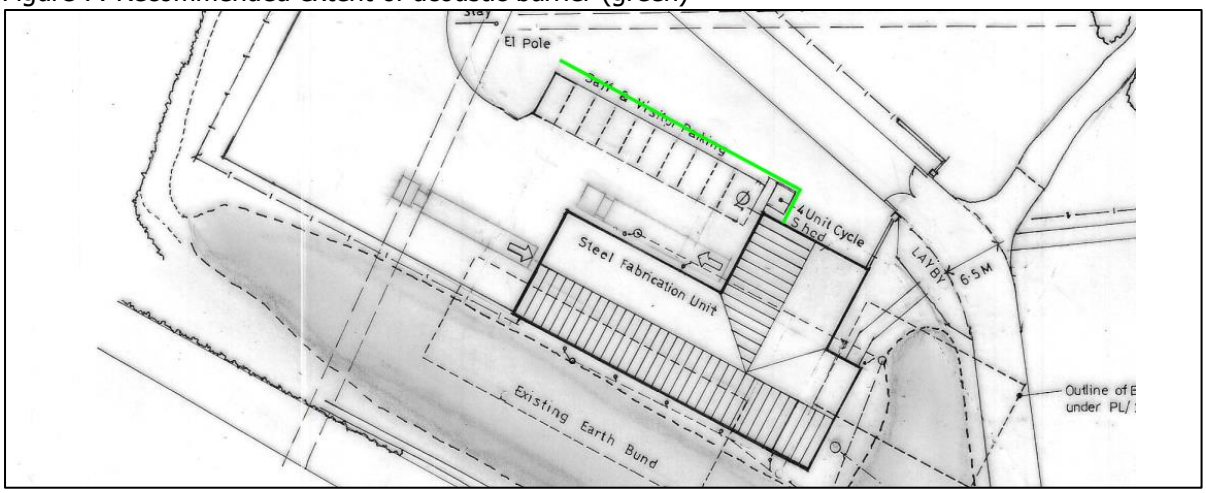
The rooflight/glazing supplier should confirm that the minimum sound reduction indices above can be achieved at a minimum.

6.2.6. **Acoustic Barrier**

In order to mitigate noise of the telehandler manoeuvring about the proposed yard passing around the building to the proposed and existing dwellings to the east, we recommend that a 3-metre-high acoustic barrier is installed along the north-eastern boundary of the yard to wrap around the on-site parking and provide a barrier between the yard and dwellings. The barrier should abut the north-eastern façade of the building with no gaps.

The recommended barrier location is marked on the site plan below in green:

Figure 7: Recommended extent of acoustic barrier (green)



The barrier could be of metal or close boarded timber construction, must have no gaps, extend to a minimum height of 3 metres and have a minimum surface mass of 10 kg/m^2.

6.2.7. **Paint Shop Extract**

The paint shop extraction fan is a new addition to the existing site and was not considered in the 2021 noise impact assessment. The external noise level at 3 metres from the grille was measured during the 2023 survey.

Based on the measured spectrum and considering the extract grille to be located on the north-eastern façade of the paint shop at the new site, the minimum insertion loss required (i.e. additional noise attenuation required to the extract fan) is as follows:

Table 15: Minimum attenuation/insertion loss of attenuator required to paint shop extract

Typical Attenuator Length	**Required Attenuation per Octave Band (dB)**							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
1500mm	9	15	25	45	50	50	43	32

This could typically be achieved with a 1500mm attenuator fitted into the ductwork between the extract fan and atmosphere.

The supplier of the fan and attenuators should verify that their product can achieve the minimum performance above on site, and that noise from the fan will be no greater than 10 dB below the lowest background at the nearest dwelling with the mitigation installed.

It should also be noted that the fan will need to be located within the building and not externally.

6.2.8. Offices Building Services

We have recommended that windows to the office areas are typically kept shut to control the egress of noise which has passed into the office areas via the interconnecting doors and vision panels.

We are not aware what ventilation and cooling requirements the office spaces may require but recommend that any plant associated with the offices is designed to achieve a noise limit of NR55 at 1 metre from the atmospheric grille in order to control noise at the dwellings to the east.

With plant meeting these limits, the predicted sound level at the dwellings to the east is not influenced by office plant over other sources (assuming a single point source on the eastern façade at a height of 3 metres).

6.2.9. Detailing

It was observed during the site visit that noise was escaping unattenuated through many parts of the existing agricultural building used for the steel fabrication process, not only the open roller shutter door. This was primarily through unsealed joins in the sheet metal lining.

The new site will be designed and built specifically for the steel fabrication operation. It must be ensured that the building façade is robustly sealed to ensure there are no weak points through which sound can escape (other than the open doorways, which are orientated away from the most sensitive dwellings).

6.2.10. Noise Management

Upon arrival to site, it was observed that the movement of steel beams can generate significant impulsive noise at times. Site staff commented that the noise of a beam being manoeuvred can vary dependent on its size, weight etc. The turning of a large steel beam was demonstrated by site staff using the telehandler to flip it over on the metal work surface and this was described as representative.

Unattended reverberant noise data and observations made externally suggest that impulsive noise may in some cases be significantly louder than demonstrated.

It is understood it may be difficult to control the level of noise generated when handling large steel beams, but would recommend, as best practice and in addition to the above, that internal noise management policies are implemented to help reduce the frequency and loudness of individual noise events when handling heavy beams.

The 2021 assessment noted that steel beams were carefully lowered on timber battens externally to reduce impulsive noise. This should be continued as best practice and staff should avoid dropping materials externally where possible.

6.3. General Noise Modelling Parameters

The parameters within the Cadna:A model are as follows and are considered reasonable assumptions:

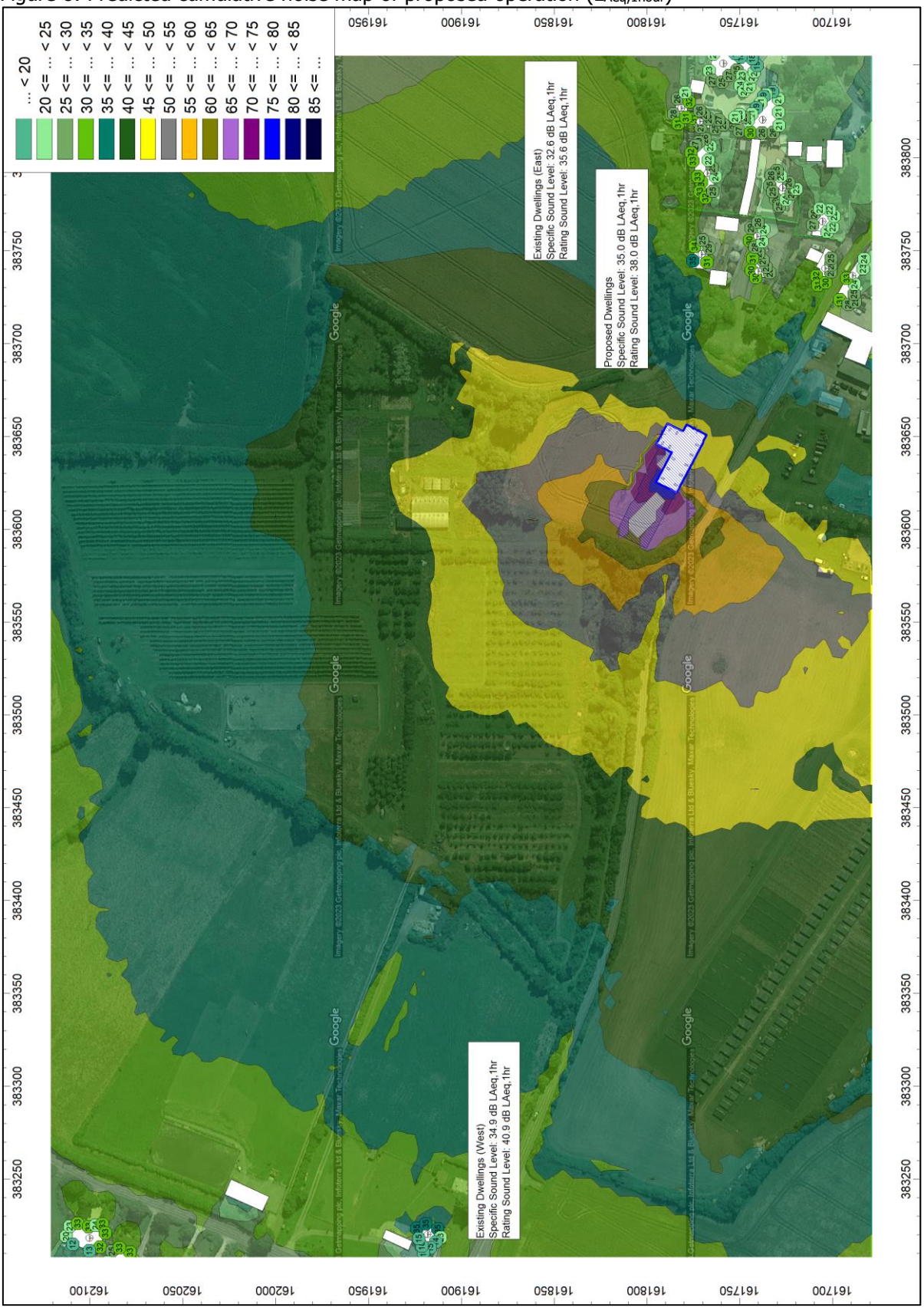
- Building positioning and heights are based on observations made on site and, for the steel fabrication building and proposed 3No. dwellings, the proposed site plans and elevations (Ashley Design drawings 2783-11, 2783-12A, 2783-13A, 2783-14B and 2783-16).
- The order of reflections is 3, and all buildings are considered reflective.
- Areas of hard ground are considered reflective (G = 0.0) and fields/farmland considered absorbent (G = 1.0).
- Existing walls associated with existing dwellings to the east have been modelled as 10 kg/m^2 barriers of one to two metres in height as observed on site.
- The topography of the site has been modelled using Lidar data sourced on the Defra website (2x2m height points).
- The predictions are based on the measured and calculated worst-case operational noise levels set out in Section 6.1 above.
- Noise emission from the proposed steel fabrication and paint shop building has been modelled as area sources using the worst-case reverberant noise levels calculated in Section 6.1 above and the minimum required acoustic performance of each element of the building façade as set out in Section 6.2.
- Noise emission through the open roller shutter doors considers a transmission loss of 0 dB.
- We have worked on the basis that there are no weak points in the workshop façade, other than the open roller shutter doors. The building envelope should otherwise be robustly sealed with the minimum sound insulation performance as set out in Section 6.2.
- External movements of the telehandler have been modelled as a moving point source at a height of 1.5 metres within a horizontal area over the proposed yard as defined in the site layout plans.
- The reverberant internal noise levels have been time corrected to the one hour assessment period as described in Section 6.1.
- The model considers the telehandler operating for 20 minutes over the one-hour assessment period. The client previously advised this is a worst-case assumption. Site staff advised the telehandler is used for approximately 3 hours in total over an 11 hour day.

- Fixed plant (paint shop extract and hypothetical office building services) is considered to operate continuously and modelled as point sources 3 metres high on the north-east paint shop façade and south-east façade respectively).
- The predicted building noise map level at each noise sensitive receiver is taken as the worst-case level per façade.
- The noise map is predicted at ground floor height (1.5 metres).

6.4. Noise Modelling Results

The noise map overleaf shows the cumulative noise emission from the proposed relocated site. As labelled are shown the predicted specific sound level and rating sound level at each group of receivers (see Section 7.3 below for character corrections).

Figure 8: Predicted cumulative noise map of proposed operation ($L_{Aeq,1hour}$)



7. Noise Assessment

7.1. Predicted Specific Sound Level

The cumulative specific sound level is 35 dB $L_{Aeq,1hour}$ at the worst-case proposed dwelling to the east, 33 dB $L_{Aeq,1hour}$ at the worst-case existing dwelling to the east and 35 dB $L_{Aeq,1hour}$ at the worst-case dwelling to the west. This is the level determined at the noise sensitive receivers without any character corrections applied.

7.2. Background Sound Level

It was agreed with the local authority to apply the lowest background sound level measured during the proposed operational hours for existing and proposed receivers to the west and east.

The background sound level determined to be representative of the dwellings to the west was 41 dB $L_{A90,1hour}$.

The background sound level determined to be representative of the dwellings to the east (existing and proposed) was 38 dB $L_{A90,1hour}$.

7.3. Character Correction

Character corrections should be added to the 'specific sound level' if it exhibits any *tonality, impulsivity, other specific characteristics and/or intermittency* at the assessment location. Based on our site visit and modelling, corrections to be applied are as follows:

- *Tonality* –The telehandler measured on site was observed to have a tonal reverse alarm but this was barely perceptible over the engine noise at 4 metres. It is therefore considered that no tonality will be perceptible at the assessment locations and no character correction has been applied.
- *Intermittency* – With the nearest dwellings being shielded from the open doorways and with the dwellings to the west being a considerable distance from, the site (400 metres plus), we do not consider that any intermittency of sources would be perceptible over the residual noise climate at the dwellings. The calculated operational noise levels also assume multiple of the same sources running at once (e.g. four grinders each for 30 minutes over an hour) and subsequently on/off periods would tend to overlap and be less perceptible.
- *Impulsivity* – The operation was observed to be impulsive when heavy steel beams are handled. The level of individual noise events may vary drastically depending on how carefully the steel is manoeuvred and how heavy individual pieces are etc.

Based on our observations and the measured noise data, it is considered maximum noise events may be "just perceptible" at the dwellings to the east which are shielded from the open doorways (+3 dB impulsivity correction) and may, as a worst-case assumption, be "clearly perceptible" at the dwellings 400 metres to the west which face the open doorways (+6 dB impulsivity correction). Discussion on impulsive noise and handling of materials is included above in Section 6.2.10.

- *Other Sound Characteristics* – It is not considered necessary to apply a correction for other sound characteristics, with penalties already having been applied for impulsivity.

Therefore, the British Standard 4142:2014 initial estimate at the most sensitive location is as follows:

Table 16: British Standard 4142:2014 initial estimate

Parameter	**Daytime Assessment (Proposed Operational Hours)**		
	Dwellings to West	**Dwellings to East**	
		Proposed	**Existing**
Background Sound Level, $L_{A90,1hour}$	41 dB	38 dB	
Specific Sound Level, $L_{Aeq,1hour}$	35 dB	35 dB	33 dB
Character Correction	+6 dB	+3 dB	
Rating Level, $L_{Ar,1hour}$	41 dB	38 dB	36 dB
Assessment Difference	0 dB	0 dB	-2 dB

The British Standard 4142:2014 Initial Estimate of Impact results in a worst-case assessment difference of 0 dB both at the dwellings 400 metres away to the east and the existing and proposed dwellings shielded from the open doors to the west.

An assessment difference of 0 dB is an initial indication of a low impact and is considered to fall below the Lowest Observed Adverse Effect Level. The local authority stated that a rating sound level above background (>0 dB assessment difference) would not be acceptable and therefore this requirement is achieved at all receivers.

The above is on the basis of the worst-case assumptions in terms of the calculated internal operational noise level, character corrections applied and design background sound level (lowest measured applied at both assessment locations). These assumptions were made in the interest of a robust assessment and were generally agreed with the Environmental Health Officer during the site visit.

British Standard 4142:2014 states that context must also be considered in all cases. This is addressed below.

7.4. Context of Site

It should be noted that in all instances the context needs to be considered when determining the overall impact.

7.4.1. Absolute Levels

British Standard 4142:2014 states:

> *"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.*
>
> *1) 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. Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse."*

With regard to 'absolute levels', the most relevant guidance is British Standard 8233:2014. Section 7.7.2 Table 4 of the British Standard provides internal ambient noise levels for dwellings. The guideline states that noise levels should not exceed 35 dB $L_{Aeq,16hour}$ within habitable daytime rooms and 50 – 55 dB $L_{Aeq,T}$ within external amenity areas.

The internal level is approximately 15 dB quieter than the external free-field level (as stated by the WHO) allowing for the attenuation of a partially open window. Therefore, based on the predicted rating levels noted above, the typical internal absolute levels are as follows.

Table 17: Comparison with British Standard 8233:2014 at assessment locations

Assessment Location	Predicted External Rating Level dB(A)	Open Window Correction dB(A)	Predicted Internal Level dB(A)	Within BS 8233 Criteria?
Dwellings to West	41	-15	26	YES
Dwellings to East	38		23	YES

The predicted internal rating sound levels are comfortably below the British Standard 8233:2014 internal criterion for daytime rooms within dwellings to the west and east (existing and proposed) assuming windows are partially open for natural ventilation. British Standard 8233:2014 typically applies for anonymous noise only and we acknowledge the site noise does have a specific character. Rating noise levels have been considered and these comfortably achieve the BS8233:2014 daytime criterion of 35 dBA (with character correction) by 9-12 dB.

On this basis and as the assessment difference also falls below 0 dB, the absolute level assessment also suggests that the relocated site will be of a low impact on the existing and proposed receivers in terms of noise.

7.4.2. Residual Noise Climate

British Standard 4142:2014 goes on to state:

> *"2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it."*

We have compared the lowest measured residual noise level, i.e. *the ambient sound at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound,* to the specific sound level and rating level.

This is summarised below:

Table 18: Comparison with residual noise climate at assessment locations

Parameter	Dwellings to West	Dwellings to East
Daytime Residual Sound Level	49 dB $L_{Aeq,1hour}$	48 dB $L_{Aeq,1hour}$
Specific Sound Level	35 dB $L_{Aeq,1hour}$	35 dB $L_{Aeq,1hour}$
Rating Sound Level	41 dB $L_{Ar,1hour}$	38 dB $L_{Ar,1hour}$

As can be seen, the rating sound level (with character) is 8 to 10 dB lower than the lowest measured residual sound at the noise sensitive receivers during the proposed operational hours.

We would consider the site noise may be perceptible but would not be dominant over the residual noise climate. Therefore, we would consider the proposed operational noise to be of a low impact at the noise-sensitive receivers when compared to the residual noise climate.

7.5. Uncertainty

Uncertainty should be considered as part of the British Standard 4142:2014 assessment. Each of the factors of potential uncertainty set out in the document are discussed below.

a) The specific sound of the steel fabrication operation is complex and comprises a number of different potential sources of sound. The uncertainty in the variability of sound from within the steel fabrication building was mitigated by taking individual measurements per source and configuring these based on a worst-case combination to form a theoretical worst-case reverberant level. This approach was discussed and agreed with the local authority prior to and during the site visit. As it forms a worst-case scenario, the approach is considered robust and uncertainty therefore not of concern in terms of the specific sound level.

b) Similarly, it was agreed with the local authority to use the lowest measured background sound level for the assessment. This goes beyond the explicit requirements of a typical BS4142:2014 assessment as the standard states: *"the objective* [in determining representative background sound levels] *is not simply to ascertain a lowest measured background sound level but to quantify what is typical during particular time periods."* Determining a representative background sound level is site specific and, in some cases, may be the lowest measured, in other cases be the modal (or most frequently occurring) or somewhere between the two. Having used the lowest background sound levels therefore represents a robust and conservative approach and the uncertainty here is considered low.

c) In some cases, the specific sound of the existing operation may have influenced the baseline noise survey. The approach of using the lowest measured background sound level also addresses uncertainty surrounding this issue and the lowest is considered to be free of influence from the specific sound.

d) The baseline survey locations were verbally agreed with the local authority before setting up. Simultaneous attended measurement was undertaken at Monitoring Location 'C' to confirm that the long term baseline noise levels at Monitoring Location 'A' were similar or lower than those at the dwellings to the west. Therefore, we consider there to be no uncertainty around the baseline measurement locations.

e) The measurements of individual specific sound sources were generally undertaken close to the source (normally 1.5 metres) within the building. Measurements were taken with a laser measure to ensure there was accuracy in the noted distances. In some cases, reverberant sound may have influenced internal near field measurements but any influence from reverberant sound would result in higher (i.e. worst-case) sound levels being recorded. External measurements were not taken at a significant distance from the sources and intervening ground conditions are not considered to impact the uncertainty of measurement. Therefore, the uncertainty of measurement positions or conditions is considered low.

f & g) The number of measurements and measurement time intervals for specific sound measurements was discussed with the local authority on site and, as the noise generated by the equipment on site was consider stable and continuous, it was agreed that a single 30 second measurement per source was sufficient. On this basis, there is considered to be no uncertainty around the sound levels generated by the equipment as measured during the survey.

h) The baseline survey was undertaken over five days and covers the recommended period suggested by the local authority of "mid-week to Saturday". The measurement period is therefore considered sufficient and uncertainty low.

i) Weather conditions were clement throughout the duration survey as forecast and reported above in this report. There was no precipitation and wind speeds did not exceed 5 m/s. Furthermore, it was agreed that the lowest background sound level would be used and therefore any cases of fluctuating weather would not be expected to influence the lowest measured background sound level over a five day baseline noise survey. On this basis there is no uncertainty around the baseline noise levels as a result of weather.

j) BS4142:2014 states there may be uncertainty due to variability in approach between practitioners. As the methodology was discussed in detail with the Environmental Health Officer via email and on site during the survey, and as there was agreement about the approach taken, it is considered there is little uncertainty here.

k) All figures are rounded to the nearest integer value. This is standard practice as 0.1 dB accuracy is considered imperceptible and we therefore consider there to be no uncertainty around the measurement accuracy. Rounding of data was done at reporting stage, no rounding of data was undertaken during calculation stage and data entered in the Cadna:A model was at 0.1 dB accuracy (this is the finest resolution possible in Cadna:A).

l) The survey data was measured using Class 1 sound level meters with half-inch condenser microphones, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 entitled "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards. Factory calibration details are provided in Section 5.1 above and calibration certificates available on request. The equipment was field calibrated before and after the survey and no drift greater than 0.1 dB was detected. Therefore, there is considered to be no uncertainty around the instrumentation used.

7.6. Summary of British Standard 4142:2014 Assessment

Based on both the initial estimate of impact and contextual assessment, it is considered that the noise impact of the relocated steel fabrication operation could be low at the existing and proposed sensitive dwellings surrounding the proposal site. This is on the basis that the mitigation measures as detailed in Section 6.2 are incorporated into the design of the building and wider site and maintained thereafter. This is also subject to workmanship and careful detailing of the fabrication building envelope and recommended acoustic barrier.

The assessment makes many worst-case assumptions with regard to the specific and background sound levels and therefore is considered to constitute a conservative and robust approach. Any potential uncertainties in the assessment are discussed above in Section 7.5 and uncertainty is considered to be low on the basis of the worst-case assumptions made.

The <0 dB assessment difference suggests that noise associated with the proposed relocated site would fall below the Lowest Observed Adverse Effect Level at the existing and proposed dwellings, especially considering the conservation approach taken. Noise associated with the site may just be audible at dwellings but we do not consider this would be dominant over the residual noise (road traffic on the B3105).

It should also be considered that the relocation of the site results in a significant reduction of sound at the existing dwellings to the east compared to the current operation with the roller shutter doors open. Based on our observations on site, the previous noise modelling and the noise modelling of the proposed relocated site, the reduction in sound levels experienced at the existing dwellings to the east is expected to be well in excess of 10 dB. This would be considered to constitute a major positive noise impact on these dwellings in both the short- and long-term.

The proposals both "*improve local environmental conditions"* at the existing dwellings to the east and "*mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development"* through the positioning and orientation of the new fabrication building and through specific noise mitigation measures as set out in this report. On this basis, we consider that the proposals achieve the aims of the National Planning Policy Framework (NPPF) and therefore the requirements of planning in terms of noise.

8. Summary and Conclusions

Laurence Ovens appointed Acoustic Consultants Limited to undertake a noise impact assessment for the proposed relocation of a steel fabrication operation in Woolley Green, Bradford-on-Avon.

This report provides a noise impact assessment of the proposed relocation of the steel fabrication operation. A baseline noise survey was undertaken at the site to establish background sound levels representative of the existing and proposed receivers in the area. Noise measurements were also taken for each piece of equipment associated with the steel fabrication and paint shop operations.

The proposed site has been modelled in the proprietary noise modelling software Cadna:A to predict the resultant noise at the surrounding noise sensitive receivers (existing and proposed). The parameters and assumptions made in the modelling are set out above in this report and these follow a conservative approach as agreed with the local authority. Source noise levels for the modelling have been calculated by combining a worst-case combination of activities as measured on site and as discussed with the local authority during the site visit.

We have set out noise mitigation measures in Section 6.2 of the report, which must be followed in order to achieve the modelled levels at the existing and proposed dwellings. These mitigation measures concern the sound insulation of the building envelope (walls, roof, windows, rooflights), an acoustic barrier to mitigate external noise of the telehandler and attenuation requirements for the paint shop extraction plant. Limits are given for any building services serving the offices, if required.

Based on the noise modelling, survey data, worst-case assumptions and noise mitigation measures as described in this report, a British Standard 4142:2014 assessment has been undertaken for the proposed relocated operation. The assessment difference at all receivers (existing and proposed) is no greater than 0 dB. This is considered to fall below the Lowest Observed Adverse Effect Level, especially considering the conservative approach and worst-case assumptions made. The contextual assessment of absolute sound levels and comparison to the existing residual noise climate supports this conclusion.

The proposals both "*improve local environmental conditions*" at the existing dwellings to the east and "*mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development*" through the positioning and orientation of the new fabrication building and through specific noise mitigation measures as set out in this report.

On this basis, we consider that the proposals achieve the aims of the National Planning Policy Framework (NPPF) and, therefore, the requirements of planning in terms of noise.

9. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure pA – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network.

A-weighted sound pressure level, L_{pA} - quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$L_{pA} = 10 \log_{10} (p_A/p_0)^2$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
p_0 is the reference sound pressure (20 µPa)

Background sound level, $L_{A90,T}$– A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{AeqT} = 10\lg_{10}\left\{(1/T)\int_{t_1}^{t_2}[p_A(t)^2/p_0^2]dt\right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 µPa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example, third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq,Tr}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.

Rating level, $L_{Ar,Tr}$ – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, eVDV – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).

10. Appendix 2 – Full Survey Data

10.1. Baseline Noise Survey

10.1.1. Long Term Noise Data

As follows is shown in tabular format the 1-hour A-weighted equivalent and background sound levels measured at the long term survey positions between 13:00 hours on 18th May 2023 and 09:00 hours on 23rd May 2023. Data highlighted in grey is that which falls outside the proposed operational hours of the steel fabrication operation and therefore not relevant to the assessment.

Table 19: Measured equivalent and background sound levels (long term positions)

Date & Time	Monitoring Location 'A'		Monitoring Location 'B'	
	$L_{Aeq,1hour}$	$L_{A90,1hour}$	$L_{Aeq,1hour}$	$L_{A90,1hour}$
2023-05-18 12:00:00	50.2	41.5	-	-
2023-05-18 13:00:00	50.9	42.0	62.3	43.5
2023-05-18 14:00:00	51.5	42.8	55.9	44.2
2023-05-18 15:00:00	52.6	44.4	62.2	54.1
2023-05-18 16:00:00	54.2	45.3	61.5	54.2
2023-05-18 17:00:00	51.8	42.9	59.6	46.5
2023-05-18 18:00:00	51.0	41.4	49.3	43.3
2023-05-18 19:00:00	49.1	40.0	47.7	42.2
2023-05-18 20:00:00	50.8	41.8	47.7	41.0
2023-05-18 21:00:00	48.5	31.3	46.2	33.7
2023-05-18 22:00:00	47.2	29.2	46.2	31.5
2023-05-18 23:00:00	41.9	25.3	38.9	26.6
2023-05-19 00:00:00	40.4	22.5	37.0	21.5
2023-05-19 01:00:00	40.3	20.0	36.5	19.2
2023-05-19 02:00:00	37.6	19.7	34.2	18.5
2023-05-19 03:00:00	39.6	20.9	37.2	20.8
2023-05-19 04:00:00	48.0	21.6	50.2	20.0
2023-05-19 05:00:00	51.6	42.9	51.1	42.2
2023-05-19 06:00:00	52.0	43.4	48.5	42.3
2023-05-19 07:00:00	53.5	46.4	61.2	46.5
2023-05-19 08:00:00	53.2	45.5	64.4	47.3
2023-05-19 09:00:00	52.0	43.8	62.6	45.3
2023-05-19 10:00:00	56.6	42.9	54.6	44.4
2023-05-19 11:00:00	50.2	42.4	60.4	49.8
2023-05-19 12:00:00	50.3	41.4	59.6	48.1
2023-05-19 13:00:00	51.3	42.2	57.1	45.1
2023-05-19 14:00:00	50.7	43.8	60.8	46.6
2023-05-19 15:00:00	51.2	44.2	62.0	53.8
2023-05-19 16:00:00	52.2	47.6	65.0	50.3

2023-05-19 17:00:00	51.6	44.5	55.2	39.7
2023-05-19 18:00:00	50.9	41.4	48.3	36.7
2023-05-19 19:00:00	50.2	41.1	45.6	38.1
2023-05-19 20:00:00	52.1	40.2	48.0	40.4
2023-05-19 21:00:00	50.3	33.2	46.3	34.4
2023-05-19 22:00:00	44.5	30.0	41.5	29.9
2023-05-19 23:00:00	42.7	30.7	39.0	25.4
2023-05-20 00:00:00	39.5	26.7	35.2	21.1
2023-05-20 01:00:00	40.3	28.3	35.1	21.6
2023-05-20 02:00:00	37.3	25.2	31.8	19.9
2023-05-20 03:00:00	37.9	23.0	32.8	18.9
2023-05-20 04:00:00	52.2	30.1	49.8	24.6
2023-05-20 05:00:00	50.7	41.1	50.1	37.6
2023-05-20 06:00:00	50.5	40.0	48.3	37.8
2023-05-20 07:00:00	51.5	42.6	48.2	37.9
2023-05-20 08:00:00	52.1	42.3	56.6	40.5
2023-05-20 09:00:00	54.7	43.7	62.4	44.1
2023-05-20 10:00:00	51.1	43.8	64.8	43.3
2023-05-20 11:00:00	52.4	45.4	60.5	42.2
2023-05-20 12:00:00	50.6	43.2	53.6	39.5
2023-05-20 13:00:00	49.8	43.0	46.0	38.2
2023-05-20 14:00:00	49.9	42.8	45.7	38.2
2023-05-20 15:00:00	49.9	42.1	47.3	38.7
2023-05-20 16:00:00	49.2	41.2	46.3	37.1
2023-05-20 17:00:00	49.7	42.3	50.0	38.1
2023-05-20 18:00:00	49.4	41.3	43.5	37.1
2023-05-20 19:00:00	50.8	42.3	44.3	35.9
2023-05-20 20:00:00	50.3	40.3	44.9	36.0
2023-05-20 21:00:00	50.0	37.2	45.3	34.3
2023-05-20 22:00:00	44.5	34.3	40.1	30.7
2023-05-20 23:00:00	44.9	34.2	40.6	28.2
2023-05-21 00:00:00	42.6	30.5	38.0	24.9
2023-05-21 01:00:00	39.5	28.8	35.3	21.9
2023-05-21 02:00:00	39.5	29.6	35.9	22.3
2023-05-21 03:00:00	38.4	29.8	34.6	22.9
2023-05-21 04:00:00	48.8	31.7	54.2	26.5
2023-05-21 05:00:00	51.4	42.1	48.7	39.5
2023-05-21 06:00:00	49.9	39.9	50.4	38.9
2023-05-21 07:00:00	49.7	39.5	47.7	36.0
2023-05-21 08:00:00	50.9	40.2	48.0	36.4
2023-05-21 09:00:00	49.8	41.4	48.0	38.0
2023-05-21 10:00:00	50.4	42.1	49.2	38.7
2023-05-21 11:00:00	50.1	42.0	46.4	38.3
2023-05-21 12:00:00	51.8	42.2	49.4	38.0

2023-05-21 13:00:00	49.6	41.8	44.6	38.3
2023-05-21 14:00:00	52.2	42.5	46.2	38.2
2023-05-21 15:00:00	50.6	42.3	46.6	37.6
2023-05-21 16:00:00	51.2	43.7	48.5	37.4
2023-05-21 17:00:00	49.8	42.6	45.0	38.3
2023-05-21 18:00:00	49.2	41.7	46.5	38.3
2023-05-21 19:00:00	52.2	41.3	53.6	37.8
2023-05-21 20:00:00	52.6	40.1	50.4	37.2
2023-05-21 21:00:00	49.1	32.4	43.8	30.7
2023-05-21 22:00:00	42.2	27.5	36.9	23.0
2023-05-21 23:00:00	40.8	28.2	36.4	21.8
2023-05-22 00:00:00	40.5	25.9	36.7	20.5
2023-05-22 01:00:00	37.2	20.8	33.0	18.2
2023-05-22 02:00:00	39.8	22.2	36.0	19.1
2023-05-22 03:00:00	40.9	22.4	37.0	20.1
2023-05-22 04:00:00	49.7	31.0	49.7	33.4
2023-05-22 05:00:00	53.3	42.3	48.3	41.7
2023-05-22 06:00:00	54.3	43.0	49.5	43.3
2023-05-22 07:00:00	54.4	45.2	55.7	47.3
2023-05-22 08:00:00	54.5	46.0	60.7	56.8
2023-05-22 09:00:00	52.6	44.9	65.4	53.3
2023-05-22 10:00:00	50.5	42.5	57.9	44.0
2023-05-22 11:00:00	52.7	44.1	66.4	54.1
2023-05-22 12:00:00	49.3	42.5	67.2	48.5
2023-05-22 13:00:00	48.7	42.0	50.4	42.3
2023-05-22 14:00:00	49.3	42.5	56.9	41.6
2023-05-22 15:00:00	49.8	43.3	63.3	50.5
2023-05-22 16:00:00	49.7	42.8	64.8	51.7
2023-05-22 17:00:00	49.8	42.2	59.5	44.9
2023-05-22 18:00:00	49.5	42.0	49.7	42.2
2023-05-22 19:00:00	48.3	39.5	53.3	40.7
2023-05-22 20:00:00	48.5	39.7	49.5	40.3
2023-05-22 21:00:00	44.9	34.5	43.9	33.5
2023-05-22 22:00:00	43.9	30.7	39.0	29.6
2023-05-22 23:00:00	40.9	26.2	37.7	22.7
2023-05-23 00:00:00	37.0	24.8	33.7	20.8
2023-05-23 01:00:00	35.9	23.2	32.2	19.2
2023-05-23 02:00:00	36.2	23.7	32.2	19.1
2023-05-23 03:00:00	38.3	24.7	35.5	19.9
2023-05-23 04:00:00	47.6	30.0	56.4	30.1
2023-05-23 05:00:00	49.9	42.3	49.4	42.6
2023-05-23 06:00:00	50.9	42.8	49.8	43.5
2023-05-23 07:00:00	52.2	45.1	59.3	44.8
2023-05-23 08:00:00	53.8	48.2	62.3	56.1

10.1.2. Attended Simultaneous Background Sound Levels

As follows are summarised the simultaneous background and equivalent sound levels measured at Monitoring Locations 'A' and 'C':

Table 20: Simultaneous background survey data

Start	End	Monitoring Location 'A'		Monitoring Location 'C'	
		$L_{Aeq,1hour}$	$L_{A90,1hour}$	$L_{Aeq,1hour}$	$L_{A90,1hour}$
12:15 18/05/2023	13:15 18/05/2023	50	42	60	44

Based on the measurement data, the background sound levels at the junction adjacent to the worst-case dwelling to the west are similar or slightly higher than the long term position at Monitoring Location 'A'. Therefore, the long term monitoring data is considered worst-case for a robust assessment.

10.1.3. Reproduced Baseline Survey Charts

Overleaf are reproduced full page long term baseline survey charts showing maximum sound levels, equivalent sound levels and background sound levels at Monitoring Locations 'A' and 'B'.

Chart 3: Long term survey data at Monitoring Location 'A'

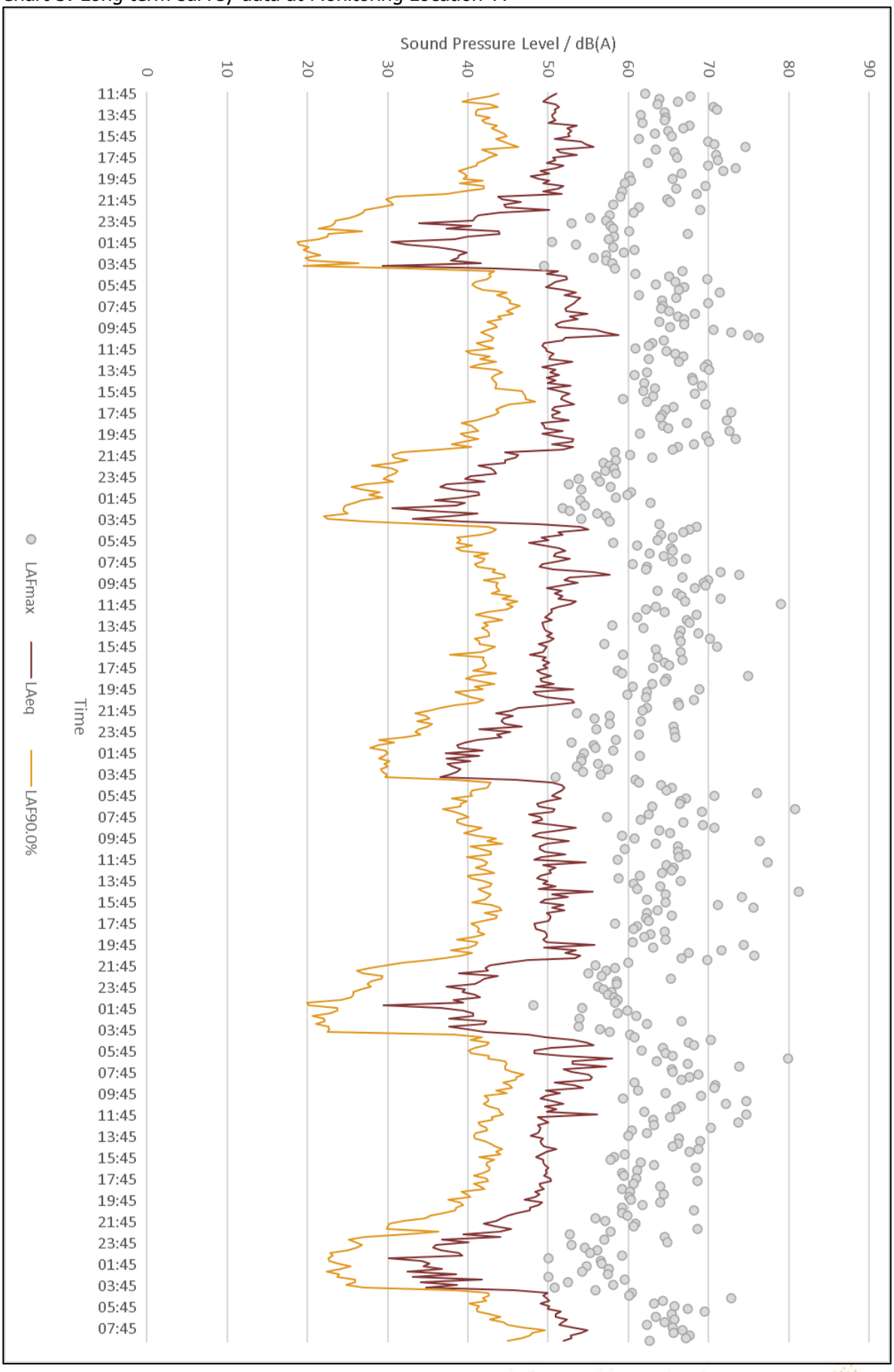
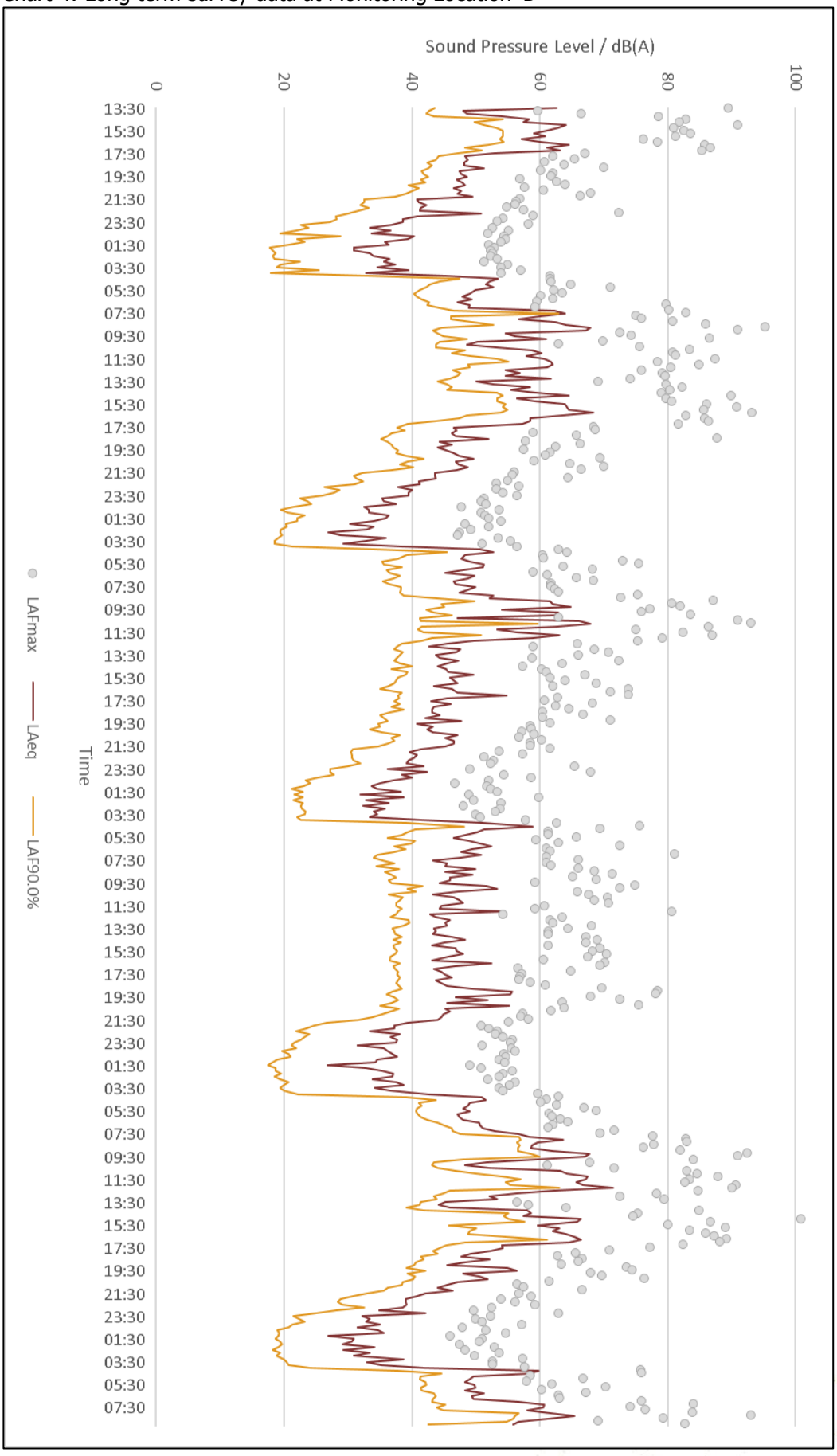


Chart 4: Long term survey data at Monitoring Location 'B'



10.2. Attended Measurement Data

10.2.1. Spectral Equipment Noise

As follows are collated the equivalent noise spectra for the attended survey data set out in Section 5.4.2:

Table 21: Attended measurement data from 2023 Woolley Green survey (spectral)

Source	Distance (m)	Equivalent Sound Level per Octave Band (dB)								dB(A)
		63	125	250	500	1000	2000	4000	8000	
Grinder	1.5	54	67	70	72	75	85	90	87	93
Welder	1.5	58	63	66	68	72	77	81	81	85
9-inch Grinder	1.5	57	66	71	76	83	87	86	88	93
Punch Machine	1.5	63	72	71	73	70	70	74	74	80
Mag Drill	1.5	57	62	64	69	79	81	77	77	85
Radio	1.5	68	77	67	69	65	63	60	56	71
Band Saw & Compressor	1.5	81	77	86	84	84	89	84	77	93
Centre Pop	1.5	59	70	78	83	78	76	86	79	89
Steel beam flip	6	70	82	85	91	88	83	76	65	92*
Paint Shop Extract (external)	1.5	75	83	84	86	79	75	69	60	85
Paint Spray Gun & Extract (internal)	1.5	78	82	83	78	78	80	75	69	85
Bandsaw (2021)	Reverberant	57	68	70	70	72	83	75	68	85

*Maximum sound levels ($L_{max,F}$)

10.2.2. Telehandler Noise Spectrum

The maximum pass-by level of the telehandler was 76.5 dB L_{AFmax} at 4 metres (free-field level).

The pass-by level was calibrated in Cadna:A to determine a sound power level for the telehandler of 99.5 dB(A). This is of a similar order to typical telehandler data given in BS5228 and is considered reasonable for this assessment.

The equivalent noise spectrum of the telehandler measured on-site weighted to achieve this broadband level, as follows:

Table 22: Sound power spectrum of telehandler (to one significant figure)

Source	Sound Power Level per Octave Band (dB)								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Telehandler	97	95	94	96	96	92	87	80	100

10.3. Small Unit Operational Noise

As follows are summarised the individual source measurements taken of equipment in the small unit at the existing site. This is a separate one person operation which is not associated with the application and won't be present at the new site.

Internal measurements were all taken at 1.5 metres from the source under reverberant conditions. The external measurement of the extract fan was taken approximately 3 metres from the grille and the sound level meter was paused when cars passed to prevent their influencing the measurement.

Table 23: Attended measurement data from adjacent small unit (not moving to new site)

Source	Distance (m)	Equivalent Sound Level per Octave Band (dB)								dB(A)
		63	125	250	500	1000	2000	4000	8000	
Drill	1.5	61	69	70	68	65	60	57	54	70
Grinder	1.5	66	67	69	72	77	88	92	91	96
Welder	1.5	58	63	73	69	76	80	83	85	88
Compressor	1.5	58	66	67	74	73	64	56	45	76
Saw	1.5	59	64	67	65	65	63	61	55	70
Extract Fan (Internal)	1.5	58	62	63	59	60	60	54	44	65
Extract Fan (External)	3	53	54	56	51	45	39	33	26	52



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