

Noise Impact Assessment:

**Proposed Extension to
Wood Chip Preparation Building & Silos**

At

**Kronospan Manufacturing Facility
Off Holyhead Road
Chirk
Wrexham**

for

**Axis
Acting on behalf of
Kronospan Ltd**

**Consultant: D.R. Kettlewell MSc MIOA MAE I.Eng
Report No.: R22.0606/DRK
Date: 24th June 2022**

Undertaken by:

Noise & Vibration Consultants Ltd

**Member of Institute of Acoustics
Member of Association of Noise Consultants
Member of Academy of Experts**

**Report undertaken & checked by:
D R Kettlewell MSc MIOA MAE I.Eng – Principal Consultant:**



Date: 24th June 2022

Summary

1. This noise assessment is prepared for Kronospan Ltd in support of a planning application made by Kronospan Limited (hereafter referred to as Kronospan) for the development of Extension to the Wood Chip Preparation Building and Silos (referred to as the 'Proposed Development') at the Kronospan Works site off Holyhead Road, Chirk, Wrexham.
2. The assessment establishes any potential noise impact on nearest sensitive receptors (NSRs) resultant from the operation of the Proposed Development.
3. The assessment also assesses the cumulative effect of the operation of the Proposed Development with other consented development at Kronospan since the original baseline survey in 2011 as agreed with Wrexham County Borough Council (WCBC).
4. In terms of noise associated with the operation of the Proposed Development, the following noise sources have been considered:
 - Extension to the Wood Chip Building
 - Movement of Filter Boxes and an additional Filter Box
 - New Silos and Conveyors for Silos
5. Previous noise assessments relating to the Kronospan site have been referencing the 2011 baseline survey at the nearest receptor boundaries so that ongoing development can ensure background residual levels do not 'creep'. The existing baseline position has however been recently re-established from monitoring of noise levels undertaken over approximately one week at nine fixed positions commencing during August 2021. The historic baseline from 2011 previously referenced, has therefore been updated. It is important to note that this includes a significant amount of improvement in Site radiated noise levels due to the replacement of older plant and further noise control measures on existing plant that has taken place.

Noise Criteria

6. BS4142: 2014+A1:2019 is relevant to fixed industrial noise sources and is therefore the most relevant standard for the Proposed Development noise assessment.

Noise from the Site

7. The impact of site activity noise at the nearest residential properties around the site has been assessed.
8. Empirical noise levels measured on Site from the existing Wood Chip Preparation Building and Filter Boxes have been referenced to enable the prediction of noise 'break-out' from the existing building and the proposed extended building and associated plant to be determined.

9. Noise levels have been predicted based on ISO9613-2 methodology using computer-based software and appropriate input settings.
10. The study benefits from previous noise surveys of new plant that has been installed on site undertaken for previous planning applications, which provides an update to assumed noise data for inclusion in this assessment.

Conclusions

11. Following detailed calculations and consideration of appropriate and relevant standards, we have concluded the following:
 - (i) The Proposed Development predictions in terms of contributory noise levels at NSRs are shown to be between 15dB and 31dB L_{Aeq} during daytime and night-time periods at nearest sensitive receptors.
 - (ii) The background sound levels at night-time (i.e. lowest likely) for comparison vary between 30dB and 51dB L_{A90} with residual L_{Aeq} levels typically between 37dB and 54dB.
 - (iii) The positive effect of the installed new plant since 2011 and overall improvement in site noise levels is shown in the results of the latest baseline survey, indicating a reduction in background noise levels at all receptor positions.
 - (iv) The Proposed Development is not expected to generate any unusual noise characteristics perceptible at nearest sensitive receptors as the measurement of existing similar plant on Site has shown no tonal characteristics.
 - (v) The results show that the Proposed Development would not result in any background noise 'creep' in accordance with H3 Horizontal Guidance Note for Noise Part 2: Noise Assessment and Control and BAT.
 - (vi) The magnitude of impact from the Proposed Development during daytime or night-time is shown to be a **low impact** (i.e. according to BS 4142: 2014+A1:2019).
 - (vii) The magnitude of impact from the cumulative effects of the site in operation during daytime or night-time is shown to be a **low impact or below an adverse impact** (i.e. according to BS 4142: 2014+A1:2019).
 - (viii) Noise levels to the northeast and northwest directions show a reduction in noise levels from the Wood Chip Preparation associated plant due to the screening effects from the proposed silos, removal of roller doors at ground level and the lowering of filter boxes from mezzanine level to ground level.

- (ix) The noise from the operation of the Proposed Development would result in noise levels complying with all relevant standards for noise at the nearest sensitive receptors.
 - (x) There would be no increase expected in road traffic movements as a result of the Proposed Development and therefore no impacts on road traffic noise would occur.
12. In terms of construction noise, best practice would be applied in accordance with BS5228-1:2009+A1:2014 'Code of practice for control of noise and vibration on construction and open sites' to ensure that reasonable site generated noise is minimised. Construction noise is not considered to generate any significant impacts.

CONTENTS

Section	Page Number
1. Introduction	1
2. Site Description	3
3. Noise Guidance & Criteria	7
4. Baseline Survey	12
5. Noise Level Predictions	15
6. Noise Mitigation	20
7. Conclusions	21

References

Figures 1 - 4

Appendix 1	Basic Acoustic Terminology
Appendix 2	Measured Noise Levels
Appendix 3	Noise Mapping
Appendix 4	Input Data for ISO 9613 Noise Model
Appendix 5	Consultants' Experience & Qualifications

1.0 INTRODUCTION

- 1.1 At the request of Axis acting on behalf of Kronospan Ltd, Noise & Vibration Consultants Limited ("NVC") was commissioned to carry out a noise impact assessment.
- 1.2 This noise assessment is prepared for Kronospan Ltd in support of a planning application made by Kronospan Limited (hereafter referred to as Kronospan) for the development of an Engineering Stores (referred to as the Proposed Development).
- 1.3 The development would be undertaken at the Kronospan manufacturing facility on the industrial site that forms part of Maesgwyn Farm off Holyhead Road, Chirk, Wrexham.
- 1.4 The assessment establishes any potential noise impact on existing residential properties resultant from the operation of the Proposed Development. It considers the noise contribution from the new facility to establish whether there is likely to be any increase in ambient noise levels and complies with relevant guidance and standards.
- 1.5 Where appropriate, Noise & Vibration Consultants Ltd will provide recommendations for noise amelioration measures to reduce the effect of noise on any existing dwellings to an acceptable level.

Assessment Aims and Objectives

- 1.6 The aim of the noise assessment is to provide information for the planning application in relation to the impact of noise from the development on existing residential receptors. This includes the provision of the following:
 - Provides information on the established noise climate at sensitive receptors.
 - Provides information on the predicted noise from the Proposed Development at the nearest sensitive receptors and compares the existing and new facility in respect of its noise contribution to the baseline noise climate.
 - Provides information on noise levels from permitted plant that has now been installed and operating from previous approved planning applications, which has been used to update the cumulative effects.
 - Provides information on the cumulative impact of the residual noise levels (with the Proposed Development) and impact of permitted or proposed development (post 2011 baseline survey) at the nearest sensitive receptors.
 - Where appropriate, provides advice in respect of noise mitigation measures necessary to meet appropriate noise guidance and standards.
- 1.7 The above potential noise impacts are considered in the context of the existing background noise at site, which is predominantly influenced by local road traffic noise.

Survey Work

- 1.8 Previous noise assessments relating to the Kronospan site have been referencing the 2011 baseline survey at the nearest receptor boundaries so that ongoing development can ensure background residual levels do not 'creep'. The existing baseline position has however been recently re-established from monitoring of noise levels undertaken over approximately one week at nine fixed positions commencing during August 2021. The historic baseline from 2011 previously referenced, has therefore been updated. It is important to note that this includes a significant amount of improvement in Site radiated noise levels due to the replacement of older plant and further noise control measures on existing plant that has taken place.

Sources of Information

1.9 Information used in this assessment has been obtained from the following sources:

- Ordnance Survey maps of the local area;
- general layout and elevations of the Proposed Development;
- British Standards BS 4142: 2014+A1:2019, BS 7445: 2003, BS 8233: 2014; BS5228-1:2009+A1:2014;
- World Health Organisation: 'Guidelines for Community Noise' - April 1999;
- 'Night Noise Guidelines for Europe' WHO 2009
- Technical Advice Note ("TAN") 11, 'Noise' – 1997;
- Technical Guidance Note IPPC H3;
- ISO 9613-2: 1996 Acoustics – Attenuation of Sound During Propagation Outdoors;
- NVC Report R16.0204/DRK dated 12th February 2016 for RCF Facility;
- NVC Report R16.0705/DRK dated 21st July 2016 for Chip Wash Pre-heating Plant;
- NVC Report R16.0401/DRK dated 5th April 2016 for proposed building extension for MF Press & relocation of MF Ventilation System;
- NVC Report R15.0903/DRK dated 4th September 2015 for Gas Engine CHP Facility;
- NVC Report R17.0306/DRK dated 8th April 2017 for Wood Chip Preparation Facility;
- NVC Report R17.0506/1/DRK dated 12th June 2018 for OSB Manufacturing Facility;
- NVC Report R21.0502/DRK dated 7th May 2021 for new Warehouse Facility;
- NVC Report R22.0103/DRK dated 23rd February 2022 for Covered Loading Yard;
- NVC Report R22.0305/DRK dated 23rd March 2022 for the Engineering Stores; and
- Brucha Composite Wall & Roof Panel WP-F & WP-D specification and technical brochure.

1.10 Appendix 1 provides details of technical terms described in layman terms for ease of reference. There is also a table showing typical everyday noise levels to assist in understanding the subjective level of noise in terms of decibels.

2.0 SITE DESCRIPTION

2.1 Introduction

- 2.1.1 The location for the development is within the existing Kronospan manufacturing site. The Kronospan site is located on land adjacent to Holyhead Road (the B5070), Chirk and covers a total area of approximately 40 hectares.
- 2.1.2 The Kronospan site comprises a number of large industrial process buildings including air emissions stacks, storage areas for raw materials, warehouse buildings for manufactured products, offices and car parking. The development would be located adjacent to the main manufacturing and finishing buildings.
- 2.1.3 The Proposed Development would be located in the area adjacent to the Log Yard Material Handling Silos and extending to the north of the existing Wood Chip Preparation Building on the Kronospan Site.
- 2.1.4 Elevations and a plan view of the Proposed Development are provided on Drawing no. 7000/706/B and 9000/88/C.
- 2.1.5 The site covers an area of circa 40ha, with circa 14ha of this developed with industrial buildings and plant. A number of industrial process facilities are located mainly to the west of the site, these facilities are used to process, sort and dry the raw wood materials used in the manufacture of MDF/particle board and include a number of tall structures including stacks that emit process emissions to the atmosphere.
- 2.1.6 A number of other process buildings are located in the northern half of the site including: a sawmill; formalin plant and the secondary product manufacturing facility (Kronoplus) which produces laminate flooring and worktops.
- 2.1.7 The site car park, reception building, weighbridge and main site offices are located in the south-eastern corner of the site to the south of the MDF/chipboard finishing buildings.
- 2.1.8 The western perimeter of the Kronospan site is formed by the Shrewsbury to Chester railway. Improved railway siding facilities have been constructed within the Kronospan site to enable an increased volume of timber to be imported by rail. The Llangollen Canal is located to the west of the railway line. Water is abstracted from the canal for use in the manufacturing process. The eastern perimeter of the site is formed by Holyhead Road (B5070). An earth bund, planted with trees, has been developed along the eastern perimeter of the site in order to reduce the visibility of the site operations from neighbouring properties on Holyhead Road.
- 2.1.9 A sewerage pumping station and one property, owned by Kronospan, are located to the immediate north of the site. To the immediate south of the site is the Mondelez factory and the Chirk recreational ground.
- 2.1.10 The main residential area of Chirk is located to the east of the site with residential properties lining the majority of the eastern side of Holyhead Road. Chirk town centre is located approximately 500m to the southeast of the site.
- 2.1.11 The wider area beyond the urban settlement of Chirk is dominated by agricultural fields and woodland. Chirk Castle and its grounds are located to the west of the site, beyond the Llangollen Canal.

Access

2.1.12 The site is accessed via a T-junction with Holyhead Road (B5070) which runs in a north south direction to the east of the site. The B5070 meets the A5 approximately 1.5km to the north of the site via a roundabout junction, known as Whitehurst Roundabout. Approximately 1km to the east of this roundabout the A5 forms a junction with the A483. The A483/A5 provide links north to Chester, west to Llangollen and south to Shrewsbury. To the south of the site access the B5070 leads to the A5 via Chirk town centre, this route is restricted to non-HGV traffic.

2.1.13 The existing railhead and sidings within the site are used to import timber for the manufacturing process.

2.2 Recent Approved Planning Applications

2.2.1 Kronospan have received planning permission for the following developments after the 2011 baseline study:

- (a) RCF Facility Planning Ref: P/2016/0219 (NVC report ref. R16.0204/DRK)
- (b) Biomass facility (P/2012/0165 & P/2013/0824)
- (c) Chip Wash Pre-heating Plant (NVC report ref. R16.0705/DRK)
- (d) Gas Engine CHP Facility (P/20015/0728) (NVC Report R15.0903/DRK)
- (e) Wood Chip Preparation Building and WESP Chip Dryer (P/2017/0416)

2.2.2 In addition to the above Wrexham BC refused planning permission for an extension to the melamine facing press hall (P/2016/0336). Kronospan however lodged an appeal against the decision and the appeal was upheld (Appeal Ref. 3165368).

2.2.3 The OSB Manufacturing Facility was refused planning permission, Kronospan however lodged an appeal against the decision and the appeal was upheld (Appeal Ref. APP/H6955/A/19/3227571).

2.2.4 Development of a new Warehouse (P/2021/0725), which is located in the north-eastern corner of the Site, has been submitted to WCBC and has been given planning permission.

2.2.5 The development of a Covered Loading Yard is proposed in the area where the existing reception building is located, which has been submitted to WCBC and is pending a planning decision.

2.2.6 The development of the Engineering Stores at the southern boundary of the Site, has been submitted and awaiting validation and a planning decision.

2.2.7 The development of the Wood Chip Preparation Building extension and Silos including the approved developments (including the appeal developments and proposed development) has been considered as part of this assessment.

2.2.8 We understand that the consented (Appeal Ref. 3193142) Raw Board Store is unlikely to be built and the Wood Flaker Facility (P/2017/0699) relates to new plant that is replacing old and therefore these not considered in this assessment.

2.3 General Environs

2.3.1 The main source of existing noise affecting nearest property positions relates to the movement of local road traffic and industrial activities.

2.4 Baseline Sound Monitoring Positions

- 2.4.1 The original baseline sound monitoring was undertaken in April 2011 at agreed monitoring positions following consultation with WCBC Public Protection Officer to determine typical ambient L_{Aeq} and background L_{A90} levels in the vicinity of the nearest dwelling boundaries during daytime and night-time periods. This included operational noise associated with the Kronospan site at the time prior to the development of the Biomass facility.
- 2.4.2 Figure 1 attached shows the site position and Figure 3 the site position relative to the receptor locations.
- 2.4.3 An update to the baseline sound levels have been undertaken in July/August 2021, which is detailed in section 4.0.
- 2.4.4 The static monitoring positions provide broadband noise data of the existing noise climate around the site at the nearest residential properties.

Nearest Sensitive Receptors

- 2.4.5 Figure 2 attached shows the layout of the site and building elevations. The nearest sensitive receptors to the development are located northeast of the Proposed Development (i.e. positions 2 to 3a below).

Position 1: Position 1 is located northeast of the development area along Linden Avenue. The receptor position is approximately 860 metres to the development building and silos.

Position 2: Position 2 is located northeast of the Wood Chip Preparation Building at Wern. The closest receptor in this direction is approximately 560 metres from the Proposed Development.

Position 3: Position 3 is northeast of the development area at the junction of the Holyhead Road and West View. The approximate distance from the new Engineering Stores to this receptor is approximately 500 metres.

Position 3a: Position 3a is northeast of the development area on George Street, which connects to West View and then Holyhead Road. The approximate distance from the Proposed Development to this receptor is approximately 550 metres.

Position 4: Position 4 is southeast of the site entrance at Maes-y-Waun at a distance of approximately 680 metres from the development area. The site boundary earth mound screen provides some degree of screening from the development in this direction.

Position 5: Position 5 is in a south easterly direction at Shepherds Lane at approximately 1020 metres from the development area.

Position 6: Position 6 is at the front entrance of the Mondelez factory to the south of the Kronospan site. The distance from this location to the nearest building is approximately 740 metres.

Position 7: Position 7 is along the access road to the Canalwood Industrial Estate and approximately 460 metres southwest of the development area.

Position 8: Position 8 is adjacent to a small cluster of properties off the Llwyn-y-cil Road, at approximately 675 metres southwest to west of the development area.

Position 9: This monitoring position is opposite the Castle back gates on high ground at approximately 890 metres to the northwest of the development area.

- 2.4.6 Positions 1 to 5 and 8 to 9 are representative of the nearest sensitive residential properties to the development and are therefore classified as receptors of high sensitivity. Position 6 and 7 are industrial sites and as such are of low sensitivity.

2.5 Site Activities

- 2.5.1 The Proposed Development comprises the development of an extension to the existing Wood Chip Preparation Building and associated filters and silos and is formed of the following:

- 10m extension to the north of the existing Wood Chip Preparation Building to a similar height.
- Movement of 3 existing filter boxes from mezzanine platform level to ground floor level in front of the new extension.
- One new filter box to be positioned adjacent to the existing units at ground floor level.
- 3 new material silos with associated conveyor systems located in front of the new extension.
- 2 new large raw material silos with associated conveyor systems.

Refer to Figure 1 for information on the location of the Proposed Development.

- 2.5.2 It is intended that the above facility would operate continuously during day and night-time periods.

3.0 NOISE GUIDANCE AND CRITERIA

3.1 General Planning Guidance

3.1.1 Within the introduction of Technical Advice Note (Wales) 11: 1997 'Noise' it states:

"This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business."

3.1.2 Technical Advice Note 11 (TAN 11) provides the following information:

- It indicates how noise issues should be handled in development plans and development control;
- outlines ways of mitigating the adverse impact of noise;
- provides specific guidance on noisy and noise-sensitive development;
- introduces the use of noise exposure categories; and
- gives guidance on the use of planning conditions relating to noise.

3.1.3 The guidance introduces the concept of Noise Exposure Categories (NEC), which have been derived to assist local planning authorities in their consideration of planning applications for residential development near transport-related noise sources. The NEC procedure is only applicable for the introduction of a new residential development into an area with an existing noise source. At Annex 1, guidance is given for various types of noise sources, which includes road traffic, aircraft and railways.

3.1.4 For reference, the recommended noise exposure categories for new dwellings near existing sources are shown below in Table 3.1. Note that these noise categories are based upon measurements taken in an open site (i.e. without any noise attenuating features in place).

3.1.5 The level at the boundary of NEC A and NEC B is based on guidance provided by the World Health Organisation (WHO) health criteria from 1980, which states that *"general daytime outdoor noise levels of less than 55dB(A) Leq are desirable to prevent any significant community annoyance"*.

3.1.6 The night-time noise level at the boundary of NEC A and NEC B is also based upon the WHO health criteria, stating *"based on limited data available, a level of less than 35dB(A) is recommended to preserve the restorative process of sleep"*.

3.1.7 Table 3.1 below provides an interpretation of the NEC categories in terms of granting planning permission.

Table 3.1 NEC Categories

NEC Category	Description	Noise Range L _{Aeq,T} dB
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.	<55dB(A) daytime (16hr) <45dB(A) night-time (8hr) Road, rail and mixed sources
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.	55-63dB(A) daytime (16hr) 45-57dB(A) night-time (8hr) Road and mixed sources

C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.	63-72dB(A) daytime (16hr) 57-66dB(A) night-time (8hr) Road and mixed sources
---	---	--

3.1.8 In applying these noise exposure categories, it states:

“Different indices have been used to describe noise from different sources, and limits have been set over different time periods. This has caused confusion, and this advice follows the move towards consistency advocated in BS 7445: 1991 by expressing all noises of $L_{Aeq,T}$. The recommended time periods are 0700-2300 and 2300-0700.”

3.1.9 Within the general guidance it states “where there is a clear need for new residential development in an already noisy area some or all NECs might be increased by up to 3dB(A) above the recommended levels. In other cases, a reduction of up to 3dB(A) may be justified.”

3.1.10 For noisy industrial developments, the guidance refers to BS 4142 – ‘Methods for rating and assessing industrial and commercial sound’.

3.2 Noise Standards and Guidance

BS4142: 2014+A1:2019 ‘Methods for rating and assessing industrial and commercial sound’

3.2.1 BS 4142: 2014+A1:2019 ‘Methods for rating and assessing industrial and commercial sound’ is based on the measurement of background sound using L_{A90} noise measurements, compared to source noise levels measured in L_{Aeq} units. The differential between the two measurements; once any corrections have been applied for source noise tonality, distinct impulses etc. (i.e. the ‘rating’ level); determines the impact magnitude.

- 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.

3.2.2 In terms of establishing the rating level, corrections for the noise character has to be taken into consideration. These include tonality, impulsivity and intermittency characteristics.

BS 8233: 2014 ‘Guidance on sound insulation and noise reduction for buildings’

3.2.3 The British Standard BS8233 provides additional guidance on noise levels within buildings. These are based on the WHO recommendations and the criteria given in BS8233 for unoccupied spaces within residential properties.

3.2.4 The guidance provided in section 7.7 of BS8233 provides recommended internal ambient noise levels for resting, dining and sleeping within residential dwellings. Table 3.2 provides detail of the levels given in the standard.

Table 3.2: BS8233: 2014 Indoor ambient noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hours}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hours}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hours}$	30 dB $L_{Aeq,8hours}$

- 3.2.5 For a partially open window the standard refers to a reduction of approximately 15dB. This would therefore indicate a noise level outside the window of approximately 50dB $L_{Aeq,16hours}$ for living rooms during daytime and 45dB $L_{Aeq,8hours}$ during night-time outside bedrooms.

World Health Organisation (WHO) Guidelines for Community Noise: April 1999

- 3.2.6 This document provides further updated information on noise and its effects on the community. Within the document for noise 'In Dwellings', it states that "The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference". For bedrooms, the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for single sound events. Lower noise levels may be disturbing depending upon the nature of the noise source. At night-time, outside sound levels about 1 metre from the facades of living spaces should not exceed 45dB L_{Aeq} , so that people may sleep with bedroom windows open. This value was obtained by assuming that the noise reduction from outside to inside with the window open is 15dB. To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35dB L_{Aeq} . To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq} . Where it is practical and feasible, the lower outdoor sound level should be considered to represent the maximum desirable sound level for new development.
- 3.2.7 In 2009, the WHO published 'Night Noise Guidelines for Europe', which it describes as an extension to the WHO 'Guidelines for community noise' (1999). It concludes that "Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night,outside}$ as defined in the Environmental Noise Directive (2002/48/EC), an $L_{night,outside}$ of 40dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. $L_{night,outside}$ value of 55dB is recommended as an interim target for those countries where the NNG cannot be achieved in the short-term for various reasons, and where policy-makers choose to adopt a stepwise approach."

BS 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites'

- 3.2.8 BS 5228 refers to "the need for the protection against noise and vibration of persons living and working in the vicinity of, and those working on, construction and open sites. It recommends procedures for noise and vibration control in respect of construction operations and aims to assist architects, contractors and site operatives, designers, developers, engineers, local authority environmental health officers and planners."
- 3.2.9 Part 1 deals with noise in terms of background legislation and gives recommendations for basic methods of noise control relating to construction and open sites where significant noise levels may be generated. The guidance is aimed at giving advice on achieving 'best practice' in controlling noise and vibration from construction and open

sites. There is an example of noise limits given in Annex E, which sets out cut-off limits between 65dB(A) and 75dB(A) or 5dB(A) above the ambient noise, whichever is the greater. Part 2 of BS 5228 deals specifically with vibration control and provide the legislative background to the assessment of vibration and recommendations for controlling vibration at source and management controls (e.g. liaison with communities, supervision, preparation and choice of plant etc.).

H3 Horizontal Guidance Note for Noise Part 2: Noise Assessment and Control

- 3.2.10 The assessment of noise will consider the guidance found within the Environment In terms of noise specifically, the use of BAT will have to be considered and balanced within the wider context of other releases to different media (air, land and water) and taking into account issues such as usage of energy and raw materials.
- 3.2.11 Noise cannot therefore be considered in isolation from other impacts on the environment.
- 3.2.12 The definition of pollution includes “emissions which may be harmful to human health or the quality of the environment, cause offence to human senses or impair or interfere with amenities and other legitimate uses of the environment”. BAT is therefore likely to be similar, in practice, to the requirements of the Statutory Nuisance legislation which requires the use of “best practicable means” to prevent or minimise noise nuisance. In the case of noise, “offence of any human senses” may be judged by the likelihood of complaints. However, the lack of complaint should not necessarily imply the absence of a noise problem. In some cases it may be possible, and desirable, to reduce noise emissions still further at reasonable costs and this may therefore be BAT for noise emissions.
- 3.2.13 Consequently, the aim of BAT should be to ensure that there is no reasonable cause for annoyance to persons beyond the installation boundary.
- 3.2.14 In summary, the aim of BAT should be to achieve the following:
- Underpinning of good practice, a basic level of which the operator should employ for the control of noise including adequate maintenance of any parts of plant or equipment whose deterioration may give rise to increases in noise. For example, this would include bearings, air handling plant, the building fabric as well as specific noise attenuation measures associated with plant, equipment or machinery.
 - Noise levels should not be loud enough to give reasonable cause for annoyance for persons in the vicinity, which is a more appropriate environmental standard than that of Statutory Nuisance and is normally the aim of most planning or other conditions applied by Local Authorities.
 - Prevention of “*creeping background*”, which is the gradual increase in background sound levels (i.e. L_{Aeq}) as industry expands and areas develop.
- 3.2.15 The indicative requirements apply to both new and existing activities, but it will be more difficult to justify departures from them in the case of new activities. Indeed, because the requirements for noise are likely to be strongly influenced by the local environmental conditions, new installations will be expected to meet BAT from the outset and to demonstrate that noise reduction or prevention has been built into the design process.

- 3.2.16 For new plant clear targets may be needed to ensure that noise emissions do not contribute to a creeping background sound level. In the case of new plant sound levels should be predicted and modelled. Monitoring for compliance may be required and this monitoring may result in the need for additional noise reduction measures.

Noise Assessment Criteria

Noise Assessment Methodology

- 3.2.17 In order to determine the noise contribution relative to the residual noise climate we have produced a noise model that reflects the Proposed Development for comparison.
- 3.2.18 The results of the noise model will assist in determining whether the Proposed Development will increase the noise level contribution at the sensitive receptors. The noise contribution would also be assessed against BS4142: 2014+A1:2019 for further impact analysis.

Fixed Plant Noise

- 3.2.19 The assessment for fixed industrial noise has been undertaken with reference to BS 4142: 2014+A1:2019. The standard indicates that if the level difference between the representative background sound level and the site rating noise is zero or lower than background then the impact will be low. Where rating level is around 5dB above background then the impact would be adverse.
- 3.2.20 Following consultation with Wrexham County Borough Council's EHO, it was agreed that the design of any new facilities would need to demonstrate that BAT had been implemented. The design of the new development should aim to prevent existing noise from 'creeping', which was based on the 2011 baseline survey results.
- 3.2.21 The calculation method used in this study is based upon ISO 9613: 2, noise propagation model, which takes into account source position, screening effects, distance and direction in relation to the nearest receptor. Noise predictions have been undertaken using CadnaA noise modelling software.
- 3.2.22 The assessment has used the empirical data obtained from the Kronospan site to calculate the expected resultant noise contribution at the nearest property boundary locations during daytime and night-time operations (worst case impact will be during the night-time period).
- 3.2.23 The assessment is based on measured plant noise levels as outlined in Appendix 2. The noise control measures are intended to reduce noise impacts relative to the nearest receptor so that noise from the development does not increase existing noise levels.

4.0 BASELINE SURVEY

4.1 Introduction

- 4.1.1 The results of noise measurements recorded for the purpose of establishing typical ambient and background noise levels at NSR positions, are summarised below in Tables 4.2 and 4.3.

4.2 Results

Subjective Results

- 4.2.1 Observations were made during night-time periods on 30th July 2021 and during daytime periods on 27th July and 3rd August 2021. Notes made during these periods indicated the following subjective observations:

Table 4.1: Subjective Observations

NSR Position	Description of Position
P1: No.2 Linden Avenue	During daytime periods no site noise was audible and the noise climate was formed in general by occasional local road traffic movements, more constant distant road traffic noise and birdsong with occasional high-level aircraft. During night-time periods, noise from site off Linden Avenue was barely audible with no tonal or impulse noise character detected.
P2: No. 3 Wern	During daytime periods local road traffic noise dominates the noise climate from Holyhead Road. Short periods between traffic movements indicate very low-level steady background site noise but no character detected. During night time there was intermittent road traffic movement and a low-level steady 'air movement' type noise but no perceptible tonal or impulse character detected.
P3: No. 23 George Street	Noise from site was not audible at the rear garden at this location during daytime periods and distant road traffic noise was audible and birdsong with occasional high level short-term aircraft. At the previous West View spot roaming location noise from Holyhead Road was dominant. During night-time periods at positions at similar distance from Holyhead Road a low-level steady 'air movement' type noise was just audible but no noise character evident. Road traffic movements occur occasionally.
P4: Chirk Court	This position is adjacent to and a similar distance from Holyhead Road which dominates the daytime noise climate due to vehicle movements here and no site noise audible above road traffic. Similar to P2 during night-time there is intermittent road traffic movement and a low-level steady 'air movement' type noise but no perceptible tonal or impulse character detected.
P5: No.2 Hadley Close	This position is at distance from the Site and as such during daytime periods noise was barely perceptible and mainly formed by local and distant road traffic noise. During night-time periods, there is a very low steady 'air movement' type noise but no perceptible tonal or impulse character and local road traffic occurs occasionally.
P6: Tall Trees, Station Avenue	This position is relatively close to the Mondelez factory and as such during daytime and night-time the noise climate is dominated by a steady 'air movement' type noise which appears to be from a relatively close source, which may be associated with the Mondelez plant. Occasional local road traffic movements occur during daytime and occasionally during night-time. The source of 'air movement' noise does not present any perceptible tonal or impulse noise character.
P7: Canalwood Industrial Estate	At this location the monitoring position is towards the entrance of the access road into the estate. Noise from Mondelez and Kronospan and occasional passenger train movement is audible and during night-time periods noise from parked HGVs with engines running can be audible. The low-level air noise and a low frequency pulse type noise was perceptible but appeared to be a relatively local source, which wasn't identifiable.
P8: Manatton, Llwyn-y-cil Road	At positions off Llwyn-y-cil Road daytime and night-time noise is formed in general by a distant low-level steady 'air noise' which does not present any tonal or impulse noise character. Local road traffic movements and birdsong form other general noise sources during daytime and occasional vehicle movements during night-time.
P9: New Hall Farm, Castle Gates	At the elevated position to the northwest at New Hall Farm the daytime and night-time noise climate is generally formed by distant, steady 'air movement' type noise which does not indicate any tonal or impulse noise. Other noise sources include local farm animal noise, bird noise and local road traffic movements.

Objective Results

- 4.2.2 The summary of results of the noise monitoring are provided below in Tables 4.2 and 4.3.

Site Baseline Noise Survey

- 4.2.3 The results of the monitoring over approximately one week at the nine monitoring positions during daytime is provided below in Table 4.2 and for the night-time period in Table 4.3.

Table 4.2: Average Daytime Position Noise Measurements (0700-2300 hours)

Location	Survey Dates	LAeq dB	Representative LA90 dB	LAmx dB
P1. Linden Avenue	Tue 27/07/21 to Mon 02/08/21	46	36-37	47-86
P2. Wern	Tue 27/07/21 to Tue 03/08/21	57	45-48	63-91
P3a. George Street	Tue 27/07/21 to Mon 02/08/21	40	33-35	43-80
P4. Maes-y-Waun	Tue 27/07/21 to Tue 03/08/21	59	49	68-92
P5. Hadley Close	Tue 27/07/21 to Mon 02/08/21	47	41-42	47-86
P6. Station Avenue	Tue 27/07/21 to Mon 02/08/21	49	45-46	48-84
P7. Canalwood Industrial Estate	Tue 27/07/21 to Tue 03/08/21	54	51-54	44-92
P8. Lylwn-y-cil Road	Tue 27/07/21 to Tue 03/08/21	46	39-40	42-75
P9. Opposite Castle back gates	Tue 27/07/21 to Mon 02/08/21	48	38	40-99

Table 4.3: Night-time Fixed Noise Measurements (2300-0700 hours)

Location	Time	LAeq dB	Representative LA90 dB	LAmx dB
P1. Linden Avenue	Tue 27/07/21 to Mon 02/08/21	41	34	40-81
P2. Wern	Tue 27/07/21 to Tue 03/08/21	52	38-41	54-80
P3a. George Street	Tue 27/07/21 to Mon 02/08/21	37	30-31	34-62
P4. Maes-y-Waun	Tue 27/07/21 to Tue 03/08/21	53	46-47	49-93
P5. Hadley Close	Tue 27/07/21 to Mon 02/08/21	47	39-40	41-82
P6. Station Avenue	Tue 27/07/21 to Mon 02/08/21	47	45	47-67
P7. Canalwood Industrial Estate	Tue 27/07/21 to Tue 03/08/21	54	49-51	54-80
P8. Lylwn-y-cil Road	Tue 27/07/21 to Tue 03/08/21	45	38-39	39-75
P9. Opposite Castle back gates	Tue 27/07/21 to Mon 02/08/21	47	34-36	54-80

Representative Background Level

- 4.2.4 Section 8 of BS4142:2014+A1:2019 sets out the parameters for establishing the representative background level. The standard provides an example of statistical analysis that might provide a suitable method using the most commonly occurring value.

4.2.5 The data set obtained during the July and August monitoring period has been statistically analysed and the results provided below in Tables 4.4 and 4.5. This includes values for median, mean and most common place figures (including rain and without rain affected data).

Table 4.4: Statistical Analysis of Data Set (including rain affected periods)

With Rain	Position 1 Linden Avenue		Position 2 Wern		Position 3 George Street		Position 4 Maes-y-waun		Position 5 Hadley Close		Position 6 Station Av. (Mondelez)		Position 7 Canalwood Ind Est		Position 8 Lwyn-y-cil Road		Position 9 Castle Gates	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Total number of values	401	192	451	224	373	192	450	224	423	192	411	192	459	224	442	224	376	176
Number of excluded values	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of binned values	401	192	451	224	373	192	450	224	423	192	411	192	459	224	442	224	376	176
Minimum	31	28	36	31	27	24	42	41	33	31	43	43	42	46	34	33	30	30
25% Percentile	36	31.25	45	38	33	29	47	45	39	38	45	45	49	49	38	37	36	34
Median	37	35	48	41	35	31	49	46	41	40	46	45	51	51	40	38	38	36
75% Percentile	41	38	51	45	37	34	51	48	44	42	47	46	54	53	41	40	41	38
Maximum	48	51	58	52	43	40	58	53	50	53	52	57	56	55	51	60	46	54
Most Commonplace	36	30	45	38	33	30	49	47	41	39	45	45	54	49	39	39	38	34
Mean	38.08	35.13	47.49	41.34	34.98	31.83	49.32	46.46	41.15	39.77	46.09	45.74	51.27	50.87	39.97	39.10	38.23	37.40
Std. Deviation	3.13	4.10	4.16	4.77	3.22	3.61	2.63	2.34	3.35	2.90	1.68	1.65	2.58	2.44	2.53	4.23	3.35	4.88
Std. Error of Mean	0.16	0.30	0.20	0.32	0.17	0.26	0.12	0.16	0.16	0.21	0.08	0.12	0.12	0.16	0.12	0.28	0.17	0.37
Lower 95% CI of mean	37.78	34.54	47.11	40.72	34.65	31.32	49.08	46.15	40.83	39.36	45.92	45.50	51.03	50.55	39.74	38.55	37.89	36.67
Upper 95% CI of mean	38.39	35.71	47.88	41.97	35.31	32.35	49.56	46.77	41.47	40.18	46.25	45.97	51.51	51.19	40.21	39.66	38.57	38.12

Table 4.5: Statistical Analysis of Data Set (excluding rain affected periods)

Without Rain	Position 1 Linden Avenue		Position 2 Wern		Position 3 George Street		Position 4 Maes-y-waun		Position 5 Hadley Close		Position 6 Station Av. (Mondelez)		Position 7 Canalwood Ind Est		Position 8 Lwyn-y-cil Road		Position 9 Castle Gates	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Total number of values	387	176	437	208	359	176	418	208	410	176	397	176	445	208	429	208	363	160
Number of excluded values	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of binned values	387	176	437	208	359	176	418	208	410	176	397	176	445	208	429	208	363	160
Minimum	31	28	36	31	27	24	42	41	33	31	43	43	42	46	34	33	30	30
25% Percentile	36	31	45	38	33	29	47	45	39	38	45	45	49	49	38	36	36	34
Median	37	34	48	41	35	31	49	46	41	40	46	45	51	51	40	38	38	36
75% Percentile	41	38	50	45	37	34	51	48	44	41.75	47	46	54	53	41	39	41	38
Maximum	48	42	58	52	43	40	58	52	50	44	51	50	56	55	51	51	46	48
Most Commonplace	36	30	45	38	33	30	49	47	42	39	45	45	54	49	39	39	38	34
Mean	38.05	34.76	47.44	41.36	34.99	31.88	49.31	46.44	41.18	39.62	46.09	45.47	51.34	50.92	39.91	38.37	38.19	36.58
Std. Deviation	3.13	3.76	4.15	4.80	3.18	3.58	2.68	2.30	3.29	2.56	1.67	1.05	2.58	2.51	2.48	2.86	3.38	4.06
Std. Error of Mean	0.16	0.28	0.20	0.33	0.17	0.27	0.13	0.16	0.16	0.19	0.08	0.08	0.12	0.17	0.12	0.20	0.18	0.32
Lower 95% CI of mean	37.74	34.20	47.05	40.70	34.66	31.35	49.06	46.13	40.86	39.24	45.93	45.32	51.10	50.58	39.67	37.98	37.84	35.94
Upper 95% CI of mean	38.37	35.32	47.83	42.01	35.32	32.41	49.57	46.76	41.49	40.00	46.26	45.63	51.58	51.27	40.14	38.76	38.54	37.21

4.2.6 The assumed representative is taken as either median or most commonplace as the background level is affected by wind direction and this provides some flexibility in assessment under different meteorological conditions.

5.0 NOISE LEVEL PREDICTIONS

5.1 Introduction

- 5.1.1 Noise has been defined as sound, which is undesired by the recipient. The effects of noise on the neighbourhood are varied and complicated, including such things as interference with speech communication, disturbance of work, leisure or sleep. A further complicating factor is that in any one neighbourhood some individuals will be more sensitive to noise than others.
- 5.1.2 A measure that is in general use and is recommended internationally for the description of environmental noise is the equivalent continuous noise level or L_{Aeq} parameter.
- 5.1.3 In general, the level of noise in the local environs that arises from a development site will depend on a number of factors. The more significant of which are:-
- (a) The sound power levels (SWL's) or sound pressure levels of the plant or equipment used on site.
 - (b) The periods of operation of the plant on site.
 - (c) The distance between the source noise and the receiving position.
 - (d) The presence or absence of screening effects due to barriers, or ground absorption.
 - (e) Any reflection effects due to the facades of buildings etc.

5.2 Prediction Methodology

Operational Noise

- 5.2.1 For the operational noise of the Proposed Development we have used ISO 9613-2 for the propagation prediction modelling and CadnaA software for producing noise maps of the highest likely generated noise.
- 5.2.2 The methodology takes into account source position, distance, duration of activity, and any screening from local buildings and earth mound screens on site. The noise modelling for the fixed plant assumes that they operate continuously. The prediction calculations therefore provide an indication of the highest likely noise level.
- 5.2.3 Appendix 4 attached provides details of the input data for the noise prediction modelling used within the CadnaA software programme.

5.3 Plant Complement

- 5.3.1 The plant sound pressure levels from which the noise predictions were made are presented in Appendix 2. The plant noise levels are based on empirical data from site noise survey work recorded at the Kronospan site of existing plant.

5.4 Results of Noise Predictions

- 5.4.1 We have used empirical data obtained from Site to maintain the accuracy of the calculations at the nearest property boundary locations during site operations.

Refer to Appendix 3 for noise mapping results.

Noise Assessment

Proposed Operational Noise

- 5.4.2 The proposed operation of the Wood Chip Preparation Building and associated plant and silos, have been considered and calculated using noise prediction modelling software. Noise map 2 in Appendix 3 represents the resultant noise contribution from the proposed development at Kronospan. The results of the modelling are shown in below in Table 5.1 (**including** noise mitigation measures).

Table 5.1: Predicted Noise Contribution from the Proposed Development

Receptor Position	Time Period	Predicted Noise Contribution from Proposed Development L _{Aeq,T} dB	Typical Residual & Background Noise level L _{Aeq} & [L _{A90}] dB	Rating compared to Residual & Background noise L _{Aeq,T} [L _{A90}]	Resultant Increase in residual noise levels due to Wood Chip Prep Building Extension L _{Aeq} dB
1. Linden Avenue	Daytime	19	46 [36-37]	-27 [-17]	0 [0]
	Night-time	19	41 [34]	-22 [-15]	0 [0]
2. Wern	Daytime	25	57 [45-48]	-32 [-20]	0 [0]
	Night-time	25	52 [38-41]	-13 [-27]	0 [0]
3. Holyhead Rd/ West View	Daytime	22	40 [33-35]	-35 [-23]	0 [0]
	Night-time	22	37 [30-31] ¹	-30 [-16]	0 [0]
3a. George Street	Daytime	20	40 [33-35]	-20 [-13]	0 [0]
	Night-time	20	37 [30-31]	-17 [-10]	0 [0]
4. Maes-y-Waun	Daytime	22	59 [49]	-37 [-27]	0 [0]
	Night-time	22	53 [46-47]	-31 [-24]	0 [0]
5. Shepherds Lane	Daytime	15	47 [41-42]	-32 [-26]	0 [0]
	Night-time	15	47 [39-40]	-32 [-24]	0 [0]
6. Cadbury's Entrance	Daytime	21	49 [45-46]	-28 [-24]	0 [0]
	Night-time	21	47 [45]	-26 [-24]	0 [0]
7. Canalwood Industrial Estate	Daytime	23	54 [51-54]	-31 [-28]	0 [0]
	Night-time	23	54 [49-51]	-31 [-26]	0 [0]
8. Llwyn-y-cil Road	Daytime	28	46 [39-40]	-18 [-11]	0 [0]
	Night-time	28	45 [38-39]	-17 [-10]	0 [0]
9. Opposite Chirk Castle back gates	Daytime	31	48 [38]	-17 [-7]	0 [0]
	Night-time	31	47 [34-36]	-16 [-3]	0 [0]

Note: No tonal character likely to be perceptible at receptors due to absolute level and mitigation measures (refer to frequency spectra in Appendix 2). Column 5 is calculated by subtracting column 3 from 4. Column 6 is calculated by logarithmically adding column 3 and column 4 and subtracting column 4 from the answer.

- 5.4.3 The predicted noise levels are for the Proposed Development attributable noise in isolation (with mitigation) and range between 15dB and 31dB L_{Aeq} at residential receptors. The fifth column in Table 5.1 shows the difference between the predicted Proposed Development plant noise and typical background and residual noise at the receptor positions. The Proposed Development is not expected to contain any unusual noise characteristic (refer to empirical frequency spectra in Appendix 2). The rating level in column 5 is therefore in accordance with the methodology found within BS 4142: 2014+A1:2019, which is the most relevant noise criterion. Column 6 in Table 5.1 shows the predicted increase in noise levels relative to the baseline at the receptors as a result of the development.
- 5.4.4 The results shown in Table 5.1 above indicate that the Proposed Development noise levels are between 3dB and 27dB below the baseline background noise at sensitive receptors. In terms of residual noise, the development noise levels are between 16dB and 37dB below residual noise levels. This is a clear indication that the development is acceptable and not significant.
- 5.4.5 In consideration of the comparison of the Proposed Development noise contributory levels and background and residual sound levels, we conclude that the new plant would not cause any background noise 'creep' in accordance with H3 Horizontal Guidance Note for Noise Part 2: Noise Assessment and Control and BAT.

- 5.4.6 The magnitude of the impact during daytime or night-time is shown to be a **low impact** (i.e. according to BS 4142: 2014+A1:2019). It should be noted that the introduction of the extension and silos would provide a reduction in noise levels for the NSRs to the northeast direction from Site (refer to Table 5.2 below).
- 5.4.7 Section 6.0 of this report provides the noise control measures that would be employed to ensure the predicted noise levels are achieved.
- 5.4.8 This assumes that the development includes noise amelioration measures similar to those outlined in Section 6.0. Appendix 3 illustrates the modelled noise impact from the development.
- 5.4.9 Table 5.2 below shows the comparison of noise predictions for the existing wood chip preparation facility and the Proposed Development contribution.

Table 5.2: Comparison of Existing and Proposed Noise Contribution from the Wood Chip Preparation Facility

Receptor Position	Predicted Noise Contribution from Existing Wood Chip Prep Facility LAeq,T dB	Predicted Noise Contribution from Proposed Development LAeq,T dB	Change in noise levels LAeq dB	Typical Residual Noise level LAeq dB Daytime/ Night-time
1. Linden Avenue	25	19	-6	46 41
2. Wern	32	25	-7	57 52
3. Holyhead Rd/ West View	25	22	-3	57 52
3a. George Street	24	20	-4	40 37
4. Maes-y-Waun	20	22	+2	59 53
5. Shepherds Lane	14	15	+1	47 47
6. Cadbury's Entrance	21	21	0	49 47
7. Canalwood Industrial Estate	23	23	0	54 54
8. Lylwn-y-cil Road	28	28	0	46 45
9. Opposite Chirk Castle back gates	34	31	-3	48 47

- 5.4.10 The above table shows that with the Proposed Development with the noise mitigation measures described in Section 6.0 would result in a reduction in noise contributory levels in sensitive directions to the northeast (i.e. -3dB to -7dB). In other directions there would be a marginal increase in noise contribution to the southeast and no change in a southwest direction and reduction to the northwest. The reason for the reduction is due to the screening effects from the silos, removal of roller doors at ground level and the lowering of filter boxes from mezzanine level to ground level.
- 5.4.11 In consideration of the comparison of existing and Proposed Development noise contributory levels we conclude that the new plant would not cause any background noise 'creep' in accordance with H3 Horizontal Guidance Note for Noise Part 2: Noise Assessment and Control and BAT.

Cumulative Impact Assessment

5.4.12 The cumulative assessment takes into account two elements of Site development, which includes planning applications since 2011, which includes:

- a) development that has been granted permission and has been developed, being constructed or proposed to be developed;
- b) development that has been successfully appealed and will be developed

5.4.13 All of the above are termed as a group in this report as '*Cumulative Developments*'. Item b) includes the Raw Board Store Facility and OSB Manufacturing Facility.

5.4.14 The effect of development a) that being the Gas Engines, K8 CHP Biomass, RCF Facility, Chip Wash Pre-heating Plant, MF Press & Ventilation System, new Warehouse, Covered Loading Yard and Engineering Stores development operating together with development b) in terms of the cumulative noise contribution at nearest receptors has been assessed and is presented below in Table 5.3.

5.4.15 The Wood Chip Preparation, Wood Flaker and WESP Chip Dryer facility is effectively a replacement of existing plant and as such is expected to provide an improvement in noise levels and has therefore not been previously included in the cumulative assessment. However, as the Wood Chip Preparation Building Extension development includes some new plant and changes to existing plant, it has been included in the assessment below.

5.4.16 Previous site noise survey work at Kronospan has enabled us to update the noise model for the assumed noise levels for the Gas Engines, RCF Facility, Chip Wash Pre-heating Plant and MF Press & Ventilation System. The following table provides a summary of the updated noise model predictions (refer to noise map 3 in Appendix 3).

Table 5.3: Predicted Noise Contribution from the Consented, Proposed & Appealed development

Receptor Position	Time Period	Cumulative noise level from all consented, appealed & awaiting decision Plant $L_{Aeq,T}$ dB	Cumulative noise level consented, appealed, waiting decision & proposed $L_{Aeq,T}$ dB	Typical Residual & Background Noise level L_{Aeq} & $[L_{A90}]$ dB
1. Linden Avenue	Daytime	32	32	46 [36-37]
	Night-time	32	32	41 [34]
2. Wern	Daytime	35	35	57 [45-48]
	Night-time	35	35	52 [38-41]
3. Holyhead Rd/West View	Daytime	36	36	40 [33-35]
	Night-time	36	36	37 [30-31]
3a. George Street	Daytime	34	34	40 [33-35]
	Night-time	34	34	37 [30-31]
4. Maes-y-Waun	Daytime	37	37	59 [49]
	Night-time	37	37	53 [46-47]
5. Shepherds Lane	Daytime	31	31	47 [41-42]
	Night-time	31	31	47 [39-40]
6. Cadbury's Entrance	Daytime	36	36	49 [45-46]
	Night-time	36	36	47 [45]
7. Canalwood Industrial Estate	Daytime	46	46	54 [51-54]
	Night-time	46	46	54 [49-51]
8. Llwyn-y-cil Road	Daytime	38	38	46 [39-40]
	Night-time	38	38	45 [38-39]
9. Opposite Chirk Castle back gates	Daytime	36	37	48 [38]
	Night-time	36	37	47 [34-36]

Note: Column 3 includes the noise contribution from the Gas Engines, K8 CHP Biomass, RCF Facility, Chip Wash Pre-heating Plant, MF Press & Ventilation System, Proposed new Warehouse, Covered Loading Yard and Engineering Stores.

5.4.17 The above cumulative noise levels associated with consented/appealed/proposed (but not consented) development and the Proposed Development compared with background and residual noise levels are represented below in Table 5.4.

Table 5.4: Predicted Cumulative Noise Contribution from the Proposed Development and Consented/Appealed Development (i.e. CHP Gas Engine facility, Biomass, RCF Facility, Chip Wash Pre-heating, MF Press & Ventilation system & OSB Manufacturing Facility including noise control measures)

Receptor Position	Time Period	Predicted Cumulative Noise Contribution (consented/appealed & proposed) L _{Aeq1hr} dB	Typical Residual & Background Noise level L _{Aeq} & [L _{A90}] dB	Rating compared to background noise L _{Aeq1hr} dB
1. Linden Avenue	Daytime Night-time	32 32	46 [36-37] 41 [34]	-14 [-4 to -5] -9 [-2]
2. Wern	Daytime Night-time	35 35	57 [45-48] 52 [38-41]	-22 [-10 to -13] -17 [-3 to -6]
3. Holyhead Rd/ West View	Daytime Night-time	36 36	57 [45-48] ¹ 52 [38-41] ¹	-21 [-9 to -12] -16 [-2 to -5]
3a. George Street	Daytime Night-time	34 34	40 [33-35] 37 [30-31]	-6 [+1 to -1] -3 [+4 to +3]
4. Maes-y-Waun	Daytime Night-time	37 37	59 [49] 53 [46-47]	-22 [-12] -16 [-9 to -10]
5. Shepherds Lane	Daytime Night-time	31 31	47 [41-42] 47 [39-40]	-16 [-10 to -11] -16 [-8 to -9]
6. Cadbury's Entrance	Daytime Night-time	36 36	49 [45-46] 47 [45]	-13 [-9 to -10] -11 [-9]
7. Canalwood Industrial Estate	Daytime Night-time	46 46	54 [51-54] 54 [49-51]	-8 [-5 to -8] -8 [-3 to -5]
8. Llwyn-y-cil Road	Daytime Night-time	38 38	46 [39-40] 45 [38-39]	-8 [-1 to -2] -7 [0 to -1]
9. Opposite Chirk Castle back gates	Daytime Night-time	37 37	48 [38] 47 [34-36]	-11 [-1] -10 [+3 to +1]

¹Similar to Wern due to proximity to B5070 road.

5.4.18 The results show that the cumulative effect of all plant consented since 2011 compared with the latest baseline background and residual noise.

5.4.19 The magnitude of the impact from cumulative impacts during daytime or night-time is shown to be a **low impact or below an adverse impact** (i.e. according to BS 4142: 2014+A1:2019).

5.4.20 The Proposed Development is not predicted to create any increase in residual sound levels due to the fact that the noise contribution is insignificant.

5.4.21 It is important to note that the Wood Chip Dryer and Wood Chipper & Flaker Facility developments are replacements of older plant and as such would have formed part of the baseline levels recorded in 2011. The positive effect of the installed new plant and overall improvement in noise levels is shown in the results of the latest baseline survey, indicating a reduction in background noise levels at all receptor positions.

Road Traffic Noise

5.4.22 The impact of any increase in road traffic noise generated by the Proposed Development on nearest receptors to the local road network would be insignificant given that there would be no increase in vehicle movements associated with the Proposed Development.

6.0 NOISE MITIGATION

- 6.1 There are a number of different ways in which the new plant noise levels could be reduced, for example, the use of noise control at source and/or the selection of different plant equipment, which may be quieter. The chosen method/s of mitigation should be appropriate to meet the noise criteria and the application of Best Available Techniques (BAT).
- 6.2 The predicted noise levels from the site have been calculated with the following mitigation measures in place to ensure that the resultant noise levels are within appropriate guidance and standards.
- 6.3 Introducing suitable cladding to the building extension that provides adequate noise insulation. The proposed cladding to have an R_w value of 32dB or greater (e.g. Brucha Paneel 100mm DP-F roof composite cladding and Brucha Paneel 100mm WP-F wall composite cladding).
- 6.4 Roller shutter door into the Wood Chip Preparation building to be closed during night-time periods unless temporarily to allow for access for HGVs or mobile plant or in emergency. The roller shutter door to be insulated and operated electrically and regularly maintained.
- 6.5 The proposed bucket elevator ducting and motor drive to be designed to reduce noise levels down to 75dB L_{Aeq} at 1m.
- 6.6 Noise from reverse jet filter nozzles to be reduced to a minimum on existing and proposed filter boxes using silencers and/or lowest practicable operating pressure to reduce impulse noise.

7.0 CONCLUSIONS

General

- 7.1 This noise assessment is prepared for Kronospan Ltd in support of a planning application made by Kronospan for the Wood Chip Preparation Building and associated plant and silos at the Kronospan manufacturing facility on the industrial site that forms part of Maesgwyn Farm off Holyhead Road, Chirk, Wrexham.
- 7.2 The assessment establishes any potential noise impact on nearest sensitive receptors resultant from the operation of the development.
- 7.3 The study benefits from a site noise survey of the existing noise sources to inform the noise model.
- 7.4 The highest likely noise levels have been considered and assessed during the operational phase of the development. Relevant and appropriate noise guidance and standards have been used to determine the noise impact and where appropriate advice provided in terms of mitigation to comply with BAT requirements.
- 7.5 The results of the data analysis and prediction calculations have concluded the following:
- (i) The Proposed Development predictions in terms of contributory noise levels at NSRs are shown to be between 15dB and 31dB L_{Aeq} during daytime and night-time periods at nearest sensitive receptors.
 - (ii) The background sound levels at night-time (i.e. lowest likely) for comparison vary between 30dB and 51dB L_{A90} with residual L_{Aeq} levels typically between 37dB and 54dB.
 - (iii) The positive effect of the installed new plant since 2011 and overall improvement in site noise levels is shown in the results of the latest baseline survey, indicating a reduction in background noise levels at all receptor positions.
 - (iv) The Proposed Development is not expected to generate any unusual noise characteristics perceptible at nearest sensitive receptors as the measurement of existing similar plant on Site has shown no tonal characteristics.
 - (v) The results show that the Proposed Development would not result in any background noise 'creep' in accordance with H3 Horizontal Guidance Note for Noise Part 2: Noise Assessment and Control and BAT.
 - (vi) The magnitude of impact from the Proposed Development during daytime or night-time is shown to be a **low impact** (i.e. according to BS 4142: 2014+A1:2019).
 - (vii) The magnitude of impact from the cumulative effects of the site in operation during daytime or night-time is shown to be a **low impact or below an adverse impact** (i.e. according to BS 4142: 2014+A1:2019).
 - (viii) Noise levels to the northeast and northwest directions show a reduction in noise levels from the Wood Chip Preparation associated plant due to the screening effects from the proposed silos, removal of roller doors at ground level and the lowering of filter boxes from mezzanine level to ground level.

- (ix) The noise from the operation of the Proposed Development would result in noise levels complying with all relevant standards for noise at the nearest sensitive receptors.
- (x) There would be no increase expected in road traffic movements as a result of the Proposed Development and therefore no impacts on road traffic noise would occur.

Noise Mitigation Measures

- 7.6 In terms of applying 'best available techniques' ("BAT") for the control of noise from the Proposed Development we have recommended appropriate development design levels.

Construction Noise

- 7.7 In terms of construction noise, best practice would be applied in accordance with BS5228-1:2009+A1:2014 'Code of practice for control of noise and vibration on construction and open sites' to ensure that reasonable site generated noise is minimised. Construction noise is not considered to generate any significant impacts.

REFERENCES

- BS4142: 2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'
- BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings'
- Guidelines for Community Noise – World Health Organisation: April 1999
- BS7445: 2003- 'Description and measurement of environmental noise'
- ISO 9613-2: 1996 Acoustics – Attenuation of Sound During Propagation Outdoors
- BS5228-1:2009+A1:2014 'Code of practice for control of noise and vibration on construction and open sites'
- Technical Advice Note ("TAN") 11, 'Noise' – 1997.
- Technical Guidance Note IPPC H3.
- Kronospan Environmental Noise Impact Assessment: February 2012.
- 'Night Noise Guidelines for Europe' WHO 2009
- NVC Report R16.0204/DRK dated 12th February 2016 for RCF Facility
- NVC Report R16.0705/DRK dated 21st July 2016 for Chip Wash Pre-heating Plant
- NVC Report R16.0401/DRK dated 5th April 2016 for proposed building extension for MF Press & relocation of MF Ventilation System
- NVC Report R15.0903/DRK dated 4th September 2015 for Gas Engine CHP Facility
- NVC Report R17.0306/DRK dated 8th April 2017 for Wood Chip Preparation Facility
- NVC Report R17.0506/1/DRK dated 12th June 2018 for OSB Manufacturing Facility
- NVC Report R21.0502/DRK dated 7th May 2021 for Development of a Warehouse
- NVC Report R22.0305/DRK dated 23rd March 2022 for the Engineering Stores
- Brucha Composite Wall & Roof Panel WP-F & WP-D specification and technical brochure

FIGURES

Figure 1: Location of Proposed Development

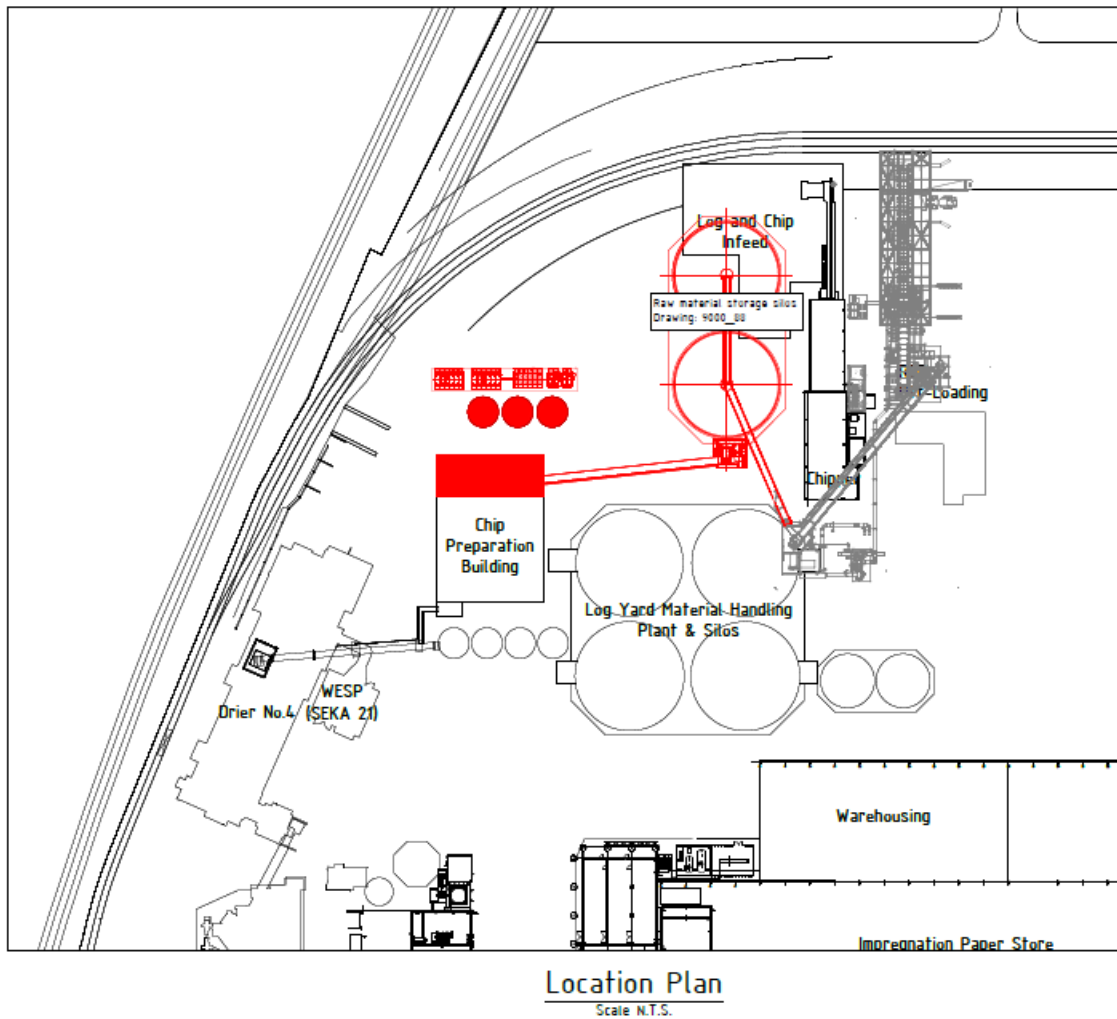


Figure 2: Layout of Proposed Development

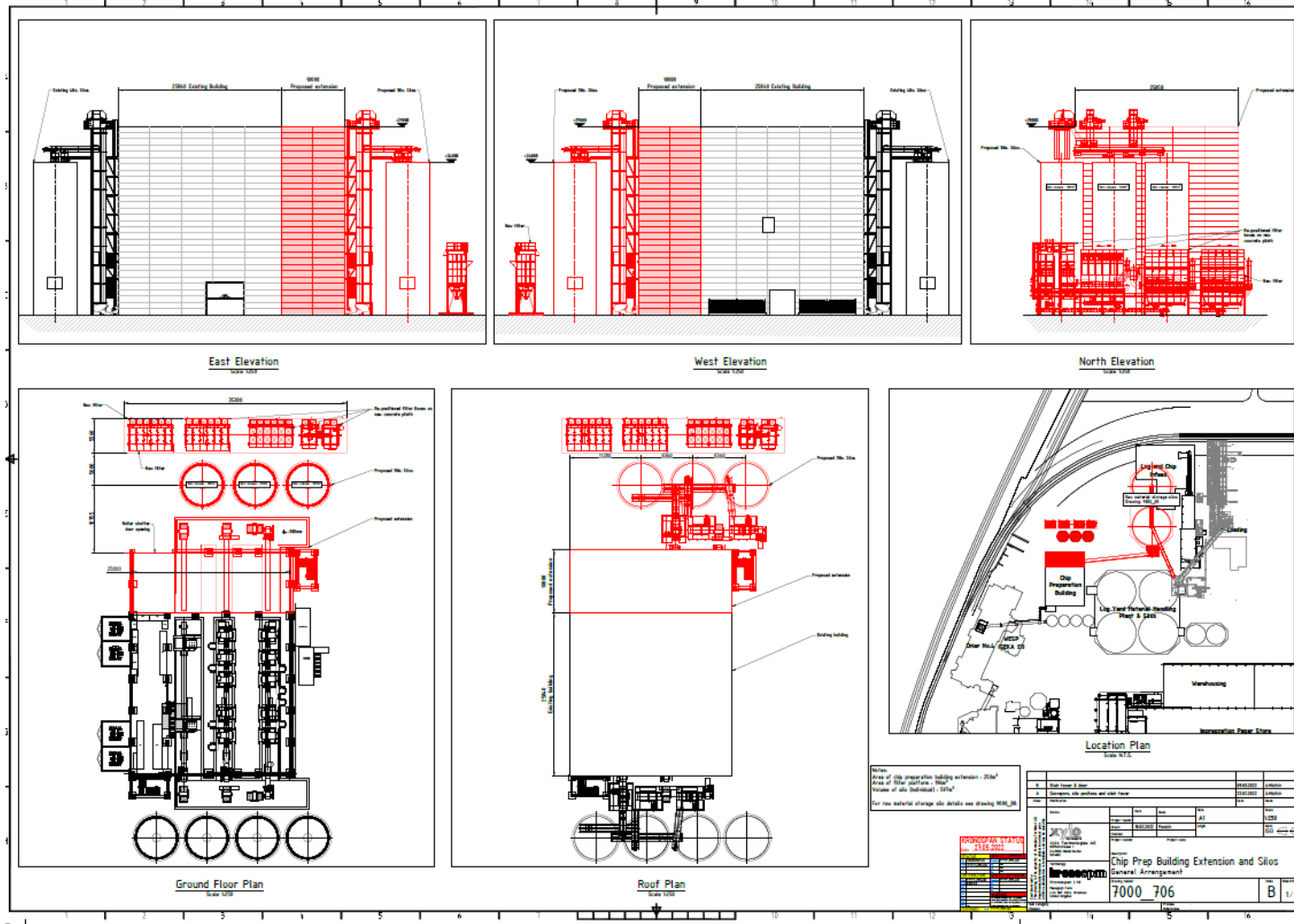
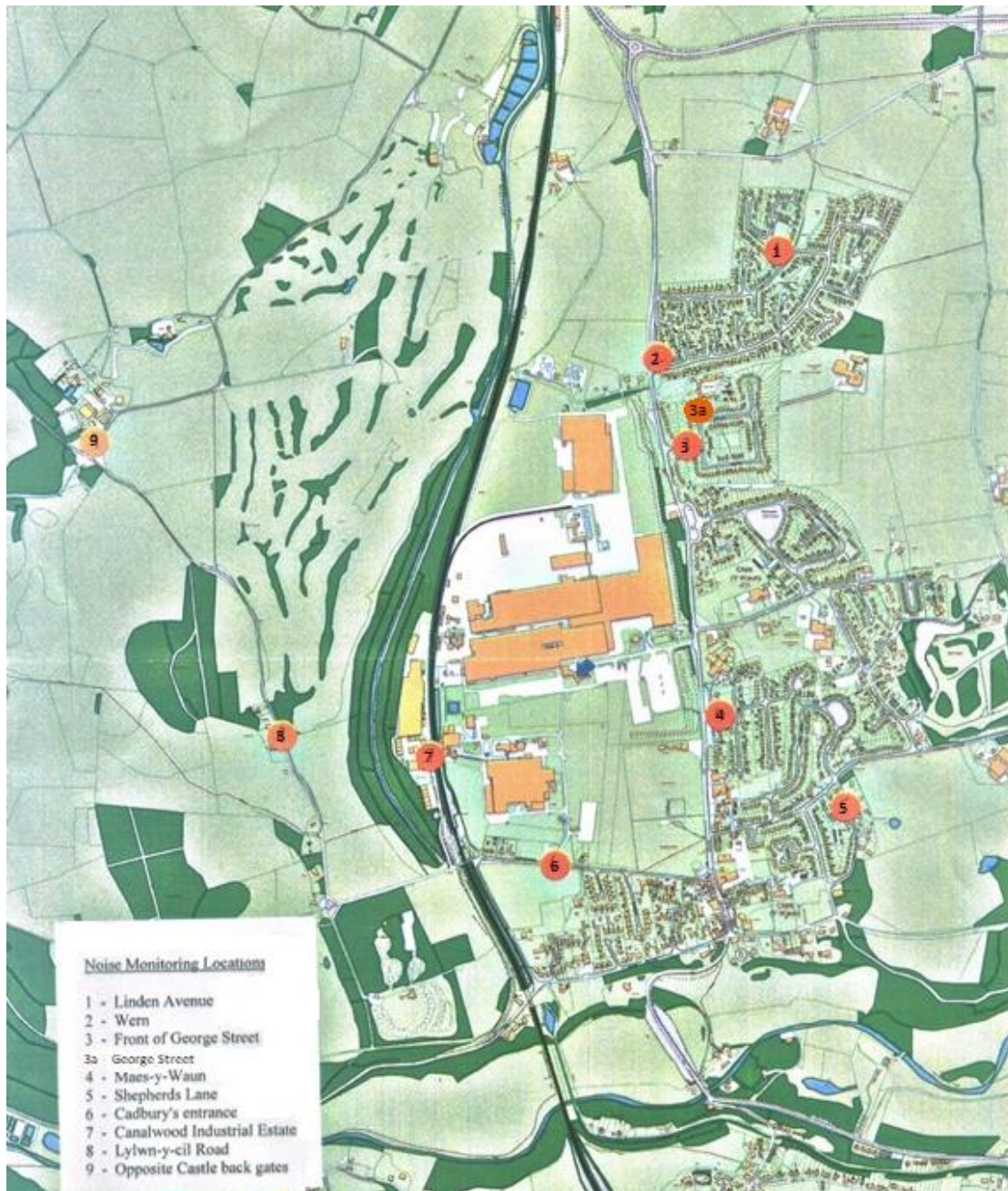


Figure 3: Nearest Sensitive Receptor Location Relative to the Site



Appendix 1

BASIC ACOUSTIC TERMINOLOGY

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

Sound Pressure Level is a measurement of the size of these pressure fluctuations. It is expressed in decibels (dB) on a logarithmic scale. Each 3 dB increase in sound pressure level represents a doubling of the sound energy. The threshold of hearing is approximately 0 dB.

The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hz to 20,000 Hz. Although sound can be of one discrete frequency - a 'pure tone' - most noises are made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same 'subjective' way. This is the basis of the A-weighted sound level dB(A), normally used to assess the effect of noise on people. The dB(A) weighting emphasises or reduces the importance of certain frequencies within the audible range.

Noise Measurement

The measurement of sound pressure level is only really meaningful where the level of noise is constant. In the typical industrial environment noise levels can vary widely and sometimes short duration high levels of noise are interspersed with periods of relative quiet. The most widely used means of 'averaging' the noise over a period of time is the Equivalent Continuous Sound Level. Normally written as L_{Aeq} this value takes into account both the level of noise and the length of time over which it occurs. There are many meters available which are capable of measuring L_{Aeq} by electronic integration over the measurement period.

The L_{Aeq} or A-weighted equivalent continuous noise level is a measure of the total noise energy over a stated time period and includes all the varying noise levels and re-expresses as an 'average', allowing for the length of time for which each noise level was presented.

The L_{An} parameters are defined as the noise levels which are exceeded for n% of the monitoring period, thus, for example, the L_{A90} parameter is the noise level exceeded for 90% of the 15 minute period, i.e. 13.5 minutes. The L_{A50} parameter is the noise level exceeded for 50% of the hourly period, i.e. 30 minutes, etc. The L_{max} parameter is the maximum RMS A-weighted noise level occurring during the measurement period.

The definition in layman's terms is given below for terminology used in the measurement and results obtained during the survey work.

A-weighting: Normal hearing covers the frequency (pitch) range from about 20Hz to 20,000 Hz but sensitivity of the ear is greatest between about 500Hz and 5000Hz. The "A-weighting" is an electrical circuit built into noise meters to mimic this characteristic of the human ear.

Ambient noise: The totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Attenuation: Noise reduction

Background noise: The general quiet periods of ambient noise when the noise source under investigation is not there.

Decibel (dB): The unit of measurement for sound based on a logarithmic scale. 0dB is the threshold of normal hearing; 140dB is the threshold of pain. A change of 1dB is only detectable under controlled laboratory conditions.

dB(A) [decibel A weighted]: Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) serves to distinguish sounds of different frequency (or pitch) in a similar way to how the human ear responds. Measurements in dB(A) broadly agrees with an individual's assessment of loudness. A change of 3dB(A) is the minimum perceptible under normal everyday conditions, and a change of 10dB(A) corresponds roughly to doubling or halving the loudness of sound.

dB(C): [decibel C weighted]: Frequency weighting which does not alter low frequency octave band levels by very much compared to 'A' weighting. Similar to linear reading (i.e. linear does not alter frequency spectra at all)

Frequency (Hz): The number of sound waves to pass a point in one second.

L_{Aeq}: This is a noise index used to describe the "average" level of a noise that varies with time (T). It allows for the different sensitivities of the human ear to different frequencies (pitch), and averages fluctuating noise levels in a manner, which correlates well with human perceptions of loudness.

L_{A10,T}: This noise index gives an indication of the upper limit or peak levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 10 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A10} reading was say 60dB, then this means that for 1 hour out of 10 the level went above 60dB.

L_{A90,T}: This noise index gives an indication of the lower limit or levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 90 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A90} reading was say 50dB, then this means that for 9 hours out of 10 the level went above 50dB.

L_{Amax}: This is the highest 'A' weighted noise level recorded during a noise measurement period.

Residual noise: The ambient noise remaining at a given position in a given situation when the noise source under investigation is not there.

Specific noise: The noise source under investigation for assessing the likelihood of complaints

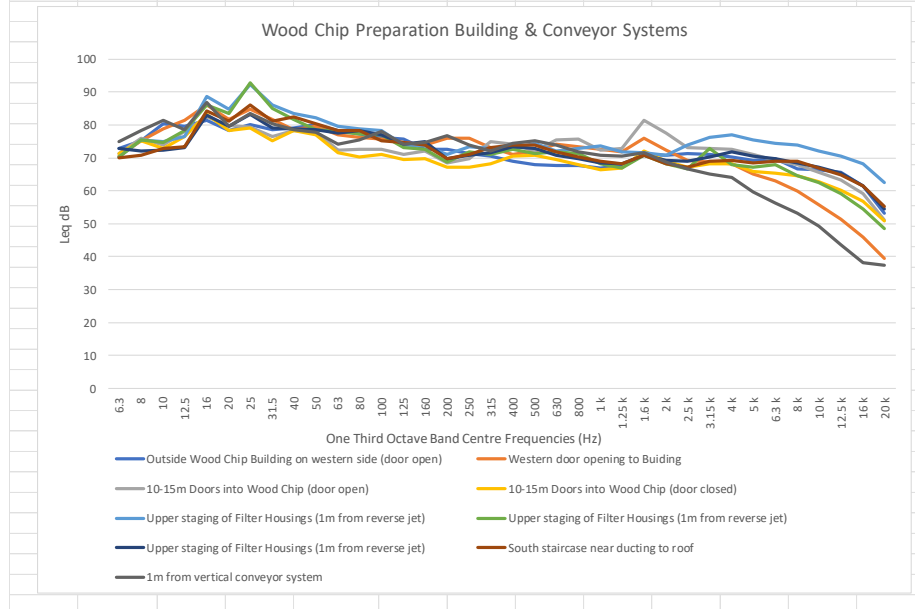
Examples of typical noise levels

Source/Activity	Indicative noise level [dB(A)]
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Busy road at 5km	35-45
Car at 65km/h at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/h at 100m	65
City Traffic at 5m	75-85
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

Appendix 2

Measured Noise Levels for Existing Wood Chip Preparation Facility

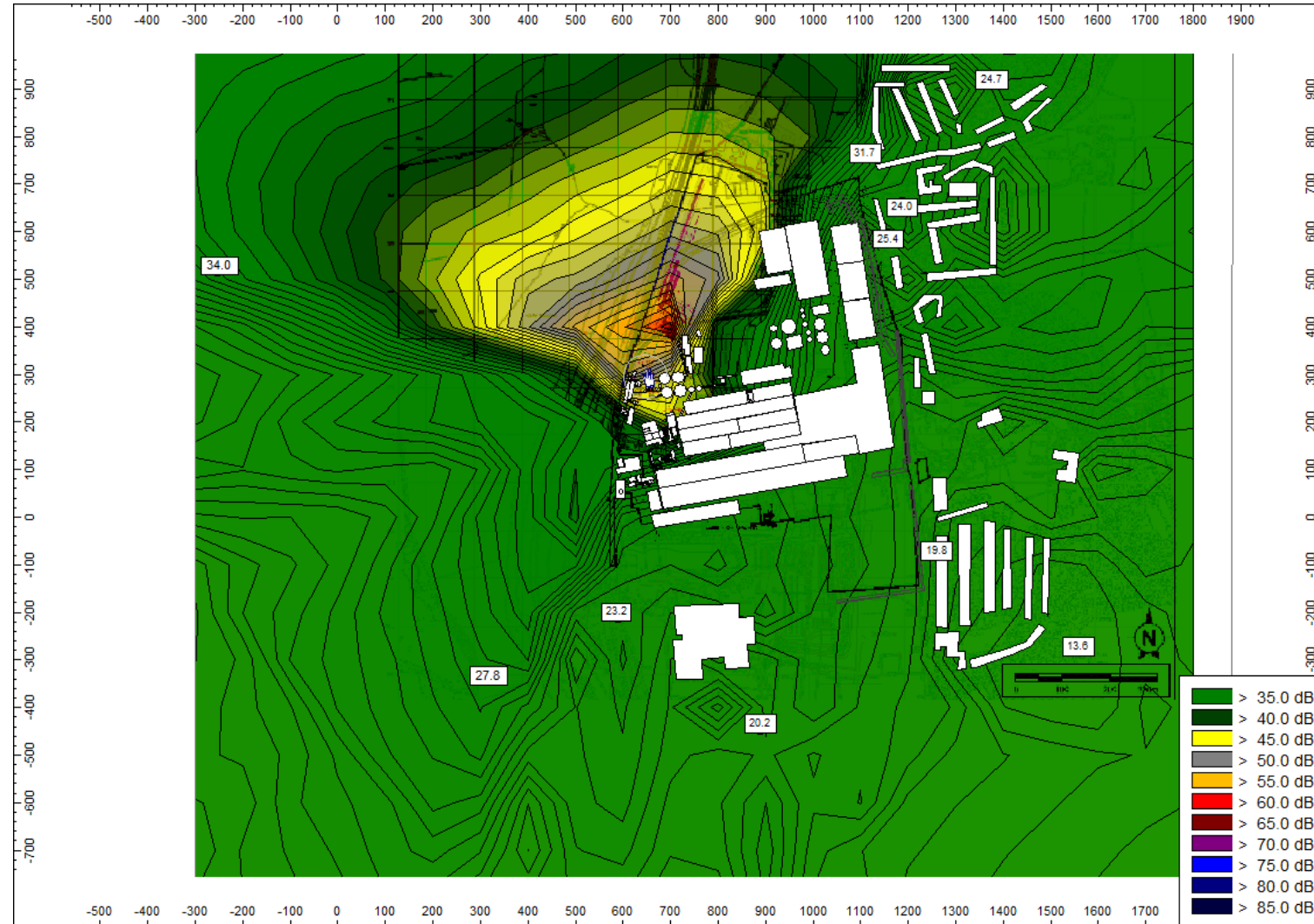
Freq (Hz)	6.3	73	70.6	71.3	71.3	70.3	70.2	72.9	70.1	74.9		
8	75.1	75.2	75.9	75.2	75.5	75.6	72.2	70.9	78.4			
10	80.3	78.8	74	72.9	75	74.6	72.4	72.9	81.4			
12.5	79.6	81.4	78.1	76.5	76.6	78.3	73.2	73.4	78.7			
16	81.4	86.2	82.5	83.2	88.7	86.1	83.1	84.3	86.9			
20	78.3	81.6	79.9	78.3	84.7	83.6	79.7	81.2	79.5			
25	80.1	84.7	79.3	79	92.2	92.7	83.2	86	83.5			
31.5	78.5	81.7	76.4	75.3	86.1	85	79	81.2	80.3			
40	79	78.6	78.2	78.4	83.5	81.7	78.8	82.5	78.6			
50	80.2	79.5	78	77.1	82.3	78.7	78.7	80.4	77.7			
63	78.2	77	72.3	71.6	79.7	78	77.5	78.4	74.1			
80	77.4	76.2	72.6	70.2	78.9	77.3	78.3	78.2	75.6			
100	76.3	75.8	72.6	71	78.2	77.1	77.1	75.1	78			
125	75.7	74.6	71	69.5	74	73.2	74.2	74.8	74.2			
160	72.6	74	72.2	69.8	73.7	72.7	74.9	74	74.6			
200	72.5	75.9	68.4	67.3	71.2	68.8	69.7	69.8	76.8			
250	71.4	76.1	69.8	67.2	73.5	71.9	70.7	71.1	73.8			
315	70.5	73.1	74.9	68.1	72.8	71	71.6	73.2	72.2			
400	69.1	71.1	74.3	70.6	72.8	72.6	73.5	73.8	74.4			
500	67.9	72.2	72.1	70.7	74.5	71.4	72.8	73.9	75.2			
630	67.7	74.3	75.4	69.5	72.2	71.9	70.8	71.9	74			
800	67.8	73.4	75.7	68	72.9	71.3	69.9	70.4	71.8			
1 k	67	72.7	72.3	66.3	73.7	68.1	68.5	68.9	70.7			
1.25 k	67.8	71.8	72.8	66.8	71.8	66.8	68.1	68.1	70.6			
1.6 k	71	76	81.4	72.1	71.6	70.7	70.8	70.8	71.5			
2 k	70.9	72.4	77.6	68.9	70.8	68.2	69.3	68.3	68.8			
2.5 k	71.3	69.3	73.1	67.1	73.9	66.7	68.9	67.1	66.6			
3.15 k	71.2	68.8	72.9	68.1	76.2	72.9	70.2	69	65.2			
4 k	70.2	68.3	72.5	68.1	77.1	68	71.9	69.3	64.2			
5 k	69.2	65.2	71.1	66	75.5	67.2	70.6	68.6	59.8			
6.3 k	69.9	63.1	69.3	65.5	74.5	68	69.8	69.1	56.2			
8 k	66.6	60	67.9	64.6	73.9	64.5	68.6	69.1	53.3			
10 k	66.4	55.9	65.7	62.8	72.2	62.5	67.2	67	49.3			
12.5 k	65.6	51.3	63.4	60.3	70.5	59.1	65.3	64.8	43.7			
16 k	61.4	46	59.1	56.8	68.2	54.5	61.5	61.6	38.3			
20 k	53.3	39.5	51.2	50.8	62.5	48.5	54.4	55.2	37.5			



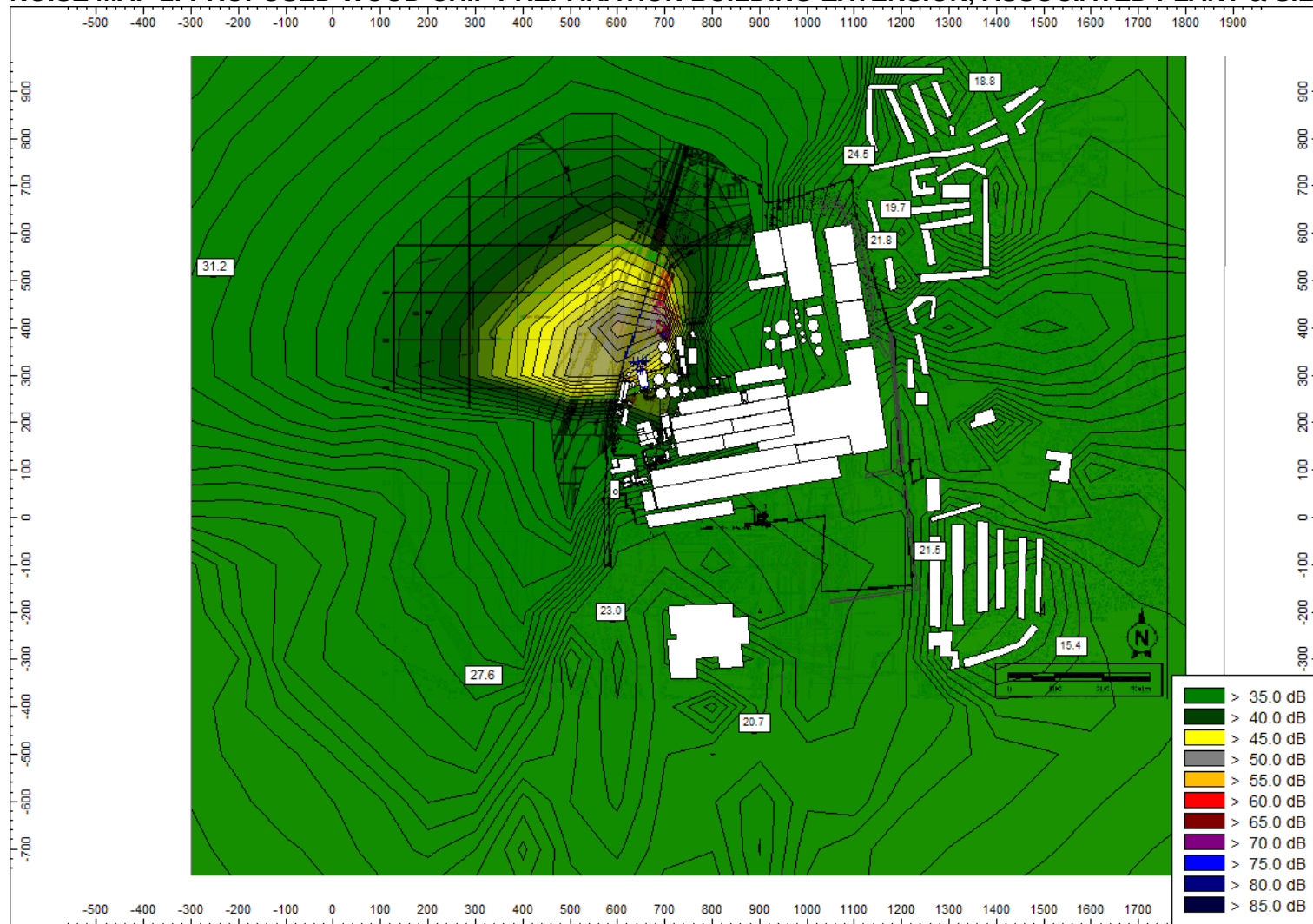
Appendix 3

Noise Mapping

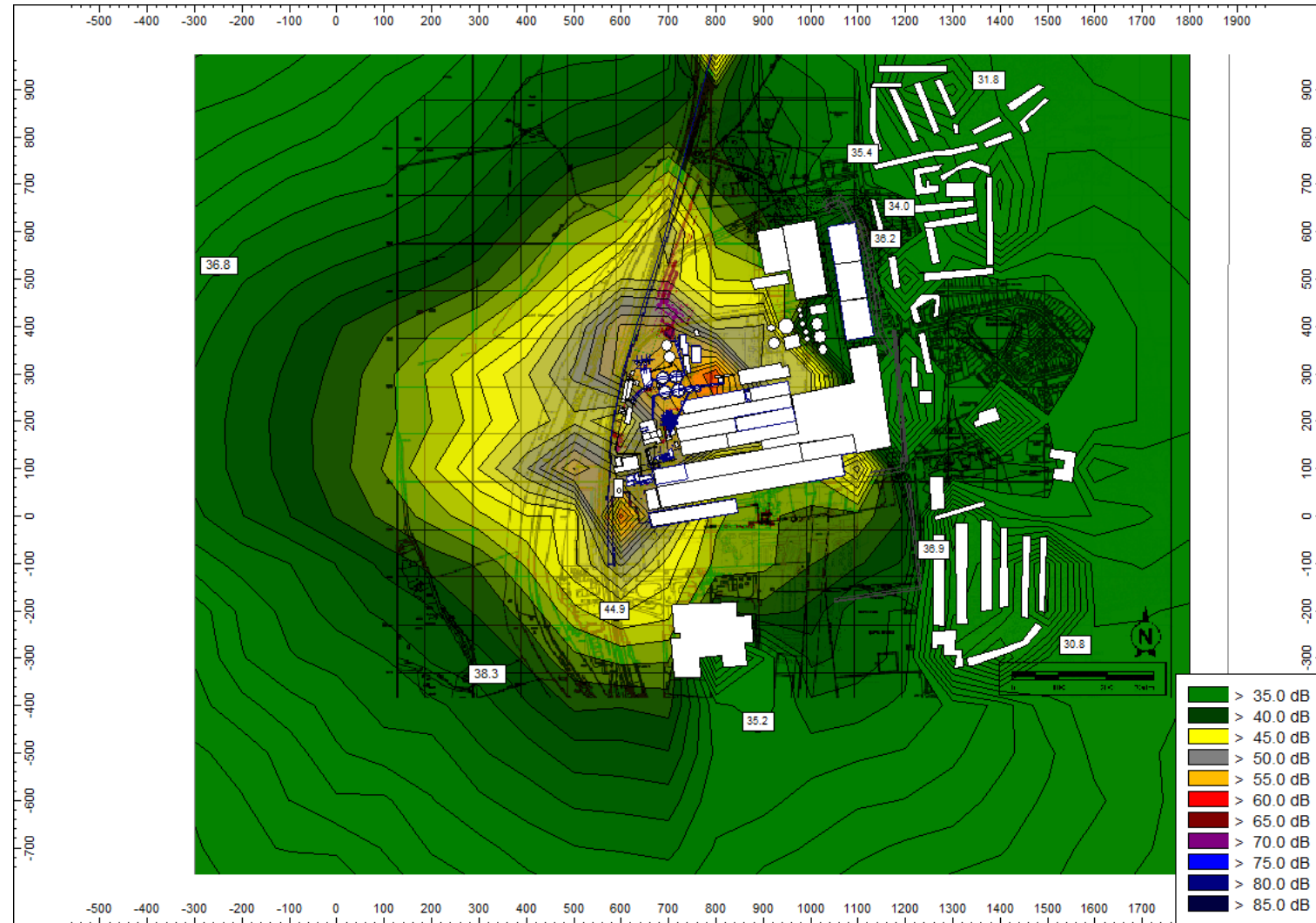
NOISE MAP 1: EXISTING WOOD CHIP PREPARATION BUILDING & ASSOCIATED PLANT



NOISE MAP 2: PROPOSED WOOD CHIP PREPARATION BUILDING EXTENSION, ASSOCIATED PLANT & SILOS



NOISE MAP 3: CUMULATIVE EFFECTS OF CONSENTED/APEALED/PROPOSED PLANT & PROPOSED DEVELOPMENT



Appendix 4

Input Data For ISO 9613 Noise Model

Noise Prediction Model

There are a number of empirical or semi-empirical sound propagation models in common use. One of these is ISO9613-2 which is the International Standard used to predict noise propagation.

The noise levels produced by the Wood Chip Preparation Plant at each of the nearest sensitive receptors has been calculated using a computer model, which is based on ISO 9613, Acoustics – Attenuation of Sound During Propagation Outdoors [1996]. The propagation model described in Part 2 of the standard provides a method for predicting sound pressure levels.

The computer model utilises octave band frequency data of the noise source to assess and predict the noise contribution with the site in full operation.

The ISO propagation model provides a method for calculating the sound pressure level at a specific position by taking the sound power level radiating from the building facades in frequency bands and subtracting a number of attenuation factors according to the following:

Predicted sound pressure level =

$$LW + D - A_{geo} - A_{gr} - A_{bar} - A_{misc}$$

The prediction modelling uses octave band frequency sound power level data calculated in different wall and roof areas of the plant building and corrects the level for the following additional propagation factors and attenuation:

Octave band frequency spectra:

Based on empirical noise measurements recorded at a similar site in the UK when under load conditions. The noise levels at specific face positions are provided below that have been used for the noise model.

D – Directivity Factor

The Directivity Index will depend on the radiating surface and whether it is located in free space, at junction of two surfaces or more and the correction factor changes accordingly. Directivity factor is generally = 2.

A_{geo} - Geometrical Divergence

The geometrical divergence of sound waves accounts for the spherical spreading in the free field from a point source resulting in attenuation depending on distance, which relates to the following correction:

$$A_{geo} = 20 \times \log (d) + 11 \text{ [where } d = \text{distance from the noise source]}$$

Receiver height assumed = 1.5m (castle gate position higher ground assumed), survey of baseline measured at 1.5m above FFL.

A_{atm} - Atmospheric Absorption

When sound energy propagates through the atmosphere it is attenuated as a result of the conversion of the sound energy into heat. The attenuation is dependent upon the relative humidity and the temperature of the air through which the sound energy is travelling. The attenuation is also dependent upon the frequency content of the sound energy with higher levels of attenuation towards higher frequencies.

The attenuation therefore depends upon the distance from the sound source and according to ISO9613 is calculated according to the following formula:

$$A_{\text{atm}} = d \times a \quad [\text{Where } d = \text{distance from the source}]$$

a = atmospheric absorption coefficient in dB/m]

From ISO9613 Part 1 [1996] I have used values of 'a' corresponding to a temperature of 10°C and a relative humidity of 70%. This will give an indication of the lowest likely atmospheric attenuation as examples worked at 20deg C and -5deg C indicate a reduction of around -0.5dB(A) on those values calculated.

A_{gr} – Ground Effect

Ground Effect for Calcs = 0.5 (mixed ground absorption)

The ground effect is a result of the interference of sound reflected by the ground which interferes with the direct sound propagating from the noise source to the receiver. The prediction of the ground effects is relatively complex and is dependent upon a number of factors including ground conditions, source height, receiver height and the propagation height between the source and receiver. The ground conditions are described according to a variable 'G' which varies between 0 for 'hard' ground and 1 for 'soft' ground. Hard ground refers to paving, concrete and any sites with low porosity. Soft ground refers to grassland, trees or other vegetation. I have assumed a ground factor of $G = 0.5$ to represent mixed ground conditions. I have taken the source height as being the height of the relevant section of building and a receiver height of 4 metres.

A_{bar} – Barrier Attenuation

When there is a solid barrier between any noise source and the receiver position the noise level will be reduced. The level of attenuation resulting will depend upon the barrier position, barrier size, receiver position and frequency content relative to the noise source. For the purpose of these calculations, we have included for any local screening from existing buildings.

A_{misc} – Miscellaneous Other Effects

This additional attenuation effect described in ISO9613 allows for the effects of propagation through foliage. I have not taken account of any such effects and in my expert opinion they are unlikely to significantly reduce noise levels below those predicted.

Appendix 5

Consultants Experience & Qualifications

**Consultant: Dean Robert Kettlewell - MSc MIOA MAE I.Eng
(Director - Principal Acoustic Consultant)**

Précis

As Director and Principal Acoustic Consultant with Noise & Vibration Consultants Ltd, Dean has over 35 years background experience in a wide range of issues relating to environmental, industrial and commercial noise and vibration assessment. He currently manages corporate and unit specific contracts for:

- Assessment of Environmental & Industrial Noise
- Environmental Noise Impact Assessments
- Expert Witness representation for Deafness and 'Vibration White Finger' Claims
- Integrated Pollution Prevention and Control (IPPC) Applications
- Industrial Noise Assessment and Control
- Planning Issues for Residential and Commercial Development
- Noise at Work Regulations Assessments
- Building Acoustics and Sound Insulation Tests
- Wind Farm Noise Impact Assessments
- Entertainment Noise Assessment and Control
- Architectural Acoustics
- Specialist knowledge in the Design of Noise Control Systems
- Ground borne vibration measurement and assessment
- Project Management of Noise Control Systems
- Hand-arm Vibration Assessments

Relevant Work Experience

Director & Principal Consultant - Noise & Vibration Consultants Ltd	2001- to date
Senior Acoustic Consultant - Vibrock Limited	1998 - 2001
Associate & Principal Acoustic Consultant - John Savidge & Associates	1994 - 1998
Technical Manager – LBJ Limited (Noise Control Division)	1990 - 1994
Technical Engineer/Technical Manager (1988) - Vibac (Noise Control) Ltd	1982 - 1990

Qualifications and Education

M.Sc. Applied Acoustics (Derby University – Distinction)
HNC Electrical & Electronic Engineering
IOA Diploma in Acoustics & Noise Control
IOA Certificate in Law and Administration
Certificate of Competence in Workplace Noise Assessment
Certificate of Competence in Ground Vibration Monitoring

Affiliations: Member of Institute of Acoustics (MIOA)
Member of Academy of Experts (MAE)
Member of Association of Noise Consultants (ANC)
Incorporated Engineer (I.Eng)

