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Noise Impact Assessment For Planning Application & Environmental Permit For Proposed Energy Recovery Centre

At

Sandalls Stone Road Doncaster

For

BH EnergyGap

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Report No.: R20.0505/DRK

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NOISE & VIBRATION ASSESSMENT

1.0 INTRODUCTION

1.1 This report presents the findings of an updated noise and vibration assessment undertaken to support a planning application and an Environmental Permit ("EP") application for the construction and operation of an Energy Recovery Facility ("ERF") at Sandal Stones Road, Doncaster (herein referred to as the Proposed Development).

1.2 Planning permission for the development of an energy recovery facility on the site (17/00923/TIPA) was granted by Doncaster Council in 2018 (herein referred to as the Consented Development). As a result of a proposed change in technology and changes in the layout of the plant a new planning application is being submitted. This assessment considers the revised proposals to support an update to the Environmental Statement (ES) and an EP.

1.3 This report assesses the likely significant environmental effects from the Proposed Development with regard to noise and vibration. It describes the methods used to assess the effects, the baseline conditions that currently exist and potential future baseline in the vicinity of the Site and the potentially affected noise sensitive receptors. The assessment also sets out direct and indirect likely significant effects arising from the construction and operation of the Proposed Development and provides details of any additional mitigation measures required beyond those which have been incorporated into the design.

1.4 The assessment includes a:

- description of the existing sound environment;
- outline of the likely evolution of the future baseline sound levels;
- identification of construction and operation activities that may cause noise and vibration effects;
- predictions of noise levels during the operation phase upon the nearest Noise Sensitive Receptors (NSRs);
- details of potential cumulative effects where noise from other potential developments may also affect the same NSRs; and
- likely residual significant effects taking account additional mitigation.

1.5 Potential noise effects are considered in the context of the predicted background sound levels at nearest sensitive receptors, which at this location are likely to be influenced by road and other existing industrial activities.

1.6 Appendix 1 of this report provides details of technical terms used within the chapter. There is also a chart showing typical everyday noise levels to assist in understanding the subjective level of noise in terms of decibels (dB).

Competence

1.7 The author of this chapter has over 35 years' experience in the field of industrial and environmental acoustics with a Masters' Degree in Acoustics and is a Member of the Institute of Acoustics, Member of the Association of Noise Consultants, Member of the Academy of Experts and an Incorporated Engineer.

2.0 LEGISLATION, POLICY AND GUIDANCE

National Planning Policy

The National Planning Policy Framework (February 2019)

2.1 Chapter 15 of the National Planning Policy Framework (NPPF) relates to 'Conserving and enhancing the natural environment'.

2.2 Paragraph 170 e) refers directly to noise and states that:

"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;"

2.3 Paragraph 180 also states:

"180. 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[60];
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."

2.4 The Noise Policy Statement for England (NPSE) was published in March 2010. It specifies the following long-term vision and aims:

"*Noise Policy Vision: Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.*

This long-term vision is supported by the following aims:

Noise Policy Aims

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."*

2.5 The NPSE introduced three concepts to the assessment of noise, as follows:

NOEL – No Observed Effect Level
This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable 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.

2.6 The above categories are undefined in terms of noise levels and for the SOAEL the NPSE indicates that the noise level will vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research is therefore required to establish what may represent a SOAEL. It is acknowledged in the NPSE that not stating specific SOAEL levels provides policy flexibility until there is further evidence and guidance.

2.7 The NPSE indicates how the LOAEL and SOAEL relate to the three aims listed above. The first aim of NPSE requires that:

"significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development."

2.8 The second aim of the NPSE (mitigating and minimising adverse impacts on health and quality of life) refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate adverse effects on health and quality of life whilst also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur, as there may be situations where there is a limit to the effect of mitigation to try and minimise impacts, due to other essential operational requirements.

2.9 The third aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development.

Planning Practice Guidance

2.10 On March 6th, 2014, the Government published the National Planning Practice Guidance ("NPPG") on noise, which provides further information in respect of new developments which may be sensitive to the prevailing noise environment.

2.11 The NPPG refers to the NPPF and NPSE documents and under the heading 'How to determine the noise impact?' it states:

"Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved."*

2.12 With respect to noise, Planning Practice Guidance: Noise (PPG) provides a summary of the effects of noise exposure which is set out in Table 2.1:

Table 2.1 Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No Specific Measures Required
Noticeable 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 (NOEL)	No Specific Measures Required

Perception	Examples of Outcomes	Increasing Effect Level	Action
Lowest Observed Adverse Effect Level (LOAEL)			
Noticeable 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; closing windows for some of the time because of the noise. Potential for non-awakening 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 (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. 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.	Significant Observed Adverse Effect	Avoid
Noticeable 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 Observed Adverse Effect	Prevent

2.13 The guidance, however, stops short of providing specific technical information in the form of noise limits or criteria. This is consistent with the approach of the NSPE which stated, "*it is not possible to have a single objective based measure that defines 'significant effect levels' that is applicable to all sources of noise in all situations*."

2.14 As such there remains the requirement to establish relevant criteria based on currently available guidance documents and standards such as British Standards BS 4142 and BS 5228. This is described further below.

Local Planning Policy

2.15 Table 2.2 provides a summary of local planning policies that make reference to noise.

Table 2.2: Summary of Local Planning Policies

Guidance	Relevance to Assessment
Doncaster Council Core Strategy (2011 - 2028) Policy CS1 (Quality of Life	Refers to the protection of local amenity and capable of achieving nationally recognised environmental standards.

Guidance and Standards

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

2.15 BS4142: 2014+A1:2019 is based on the measurement of background sound using L_{A90} noise measurements, compared to source noise levels measured in L_{Aeq} units. Once any corrections have been applied for source noise tonality, distinct impulses etc., the difference between these two measurements (i.e. known as the 'rating' level) determines the impact magnitude.

- Typically, the greater the 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 (although this can be dependent 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 (although this can be dependent on the context).

2.16 In order to establish the rating level, corrections for the noise character need to be taken into consideration. The Standard states that when considering the perceptibility:

"Consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention."

2.17 The subjective method adopted includes the character corrections set out in Table 2.3.

Table 2.3: BS4142: 2014+A1:2019 Character Corrections

Level of Perceptibility	Correction for Tonal Character dB	Correction for Impulsivity dB	Correction for Intermittency dB	Correction for `Other Character' dB
Not perceptible	0	0	0	0
Just perceptible	+2	+3	0	0
Clearly perceptible	+4	+6	+3*	+3*
Highly perceptible	+6	+9	+3*	+3*

*Standard defines this should be readily distinctive against the residual acoustic environment, it is interpreted therefore to be either clearly or highly perceptible as a character.
If characteristics likely to affect perception and response are present in the specific sound, within the same reference period, then the applicable corrections ought normally to be added arithmetically. However, if any single feature is dominant to the exclusion of the others then it might be appropriate to apply a reduced or even zero correction for the minor characteristics

BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings'

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

2.19 The guidance provided in section 7.7 of BS8233 provides recommended internal ambient noise levels for resting, dining and sleeping within residential dwellings. Table 2.4 provides detail of the levels given in the standard.

Table 2.4: 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 $L_{Aeq,8hours}$
Study and work requiring concentration	Staff/Meeting Room, Training Room Executive Office	35-45dB $L_{Aeq8hours}$ 35-45dB $L_{Aeq8hours}$	

2.20 This standard would be appropriate to apply to existing or proposed residential development. The Site noise contribution should be within the proposed internal noise levels, which would include the following noise limits:

- Living room areas: <=35dB $L_{Aeq,16hours}$ (0700-2300 hours) [equivalent to an external level of approximately 65dB $L_{Aeq,16hours}$ based on typical standard double- glazed units in the closed position and approximately 50dB $L_{Aeq,16hours}$ in the open position].
- Bedrooms: <=30dB $L_{Aeq,8\ hours}$ (2300-0700 hours) [equivalent to an external level of approximately 60dB $L_{Aeq,8hours}$ based on typical standard double-glazed units in the closed position and approximately 45dB $L_{Aeq,8hours}$ in the open position].
- Offices: 35dB – 45dB $L_{Aeq,\ 8hours}$ [equivalent to an external level of approximately 65dB to 75dB $L_{Aeq,\ 8hours}$ based on typical standard double-glazed units in the closed position].

2.21 The above internal bedroom limits would comply with sleep disturbance criteria defined by WHO. The WHO night noise guidelines for Europe refers to sleep disturbance limit of 42dB-45dB L_{Amax} for regular peak events within bedrooms (which is approximately 57dB-60dB L_{Amax} external to the bedroom window in the open position).

World Health Organisation Guidelines for Community Noise: April 1999

2.22 This document provides further updated information on noise and its effects on the community. Within the document for noise '*In Dwellings'* it states that *'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 the maximum desirable sound level for new development."*

World Health Organisation (2009) – Night noise guidelines for Europe

2.23 The WHO regional office for Europe set up a working group of experts to provide scientific advice to the Member States for the development of future legislation and policy action in the area of assessment and control of night noise exposure. Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night,outside}$ as defined in the Environmental Noise Directive (2002/49/EC), an $L_{night,outside}$ of 40dB should be the target of the night noise guidance (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 the countries where the NNG cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach.

World Health Organisation `Environmental Noise Guidelines for the European Region': 2018

2.24 The objective of the `Environmental Noise Guidelines for the European Region' is stated in the Executive Summary of the report:

"The main purpose of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway and aircraft) noise, wind turbine noise and leisure noise. Leisure noise in this context refers to all noise sources that people are exposed to due to leisure activities, such as attending nightclubs, pubs, fitness classes, live sporting events, concerts or live music venues and listening to loud music through personnel listening devices. The guidelines focus on the WHO European Region and provide policy guidance to Member States that is compatible with the noise indicators used on the European Union's END."

Integrated Pollution Prevention and Control (IPPC) - Technical Guidance Note IPPC H3 Part 2 – Noise Assessment & Control

2.25 Integrated Pollution Prevention and Control (IPPC) is a regulatory system that employs an integrated approach to control the environmental impacts of certain industrial activities. It involves determining the appropriate controls for industry to protect the environment through a single permitting process. To gain a Permit, operators have to show that they have systematically developed proposals to apply the 'Best Available Techniques' (BAT) and meet certain other requirements, taking account of relevant local factors.

2.26 In terms of noise specifically, the use of BAT has to be considered and balanced within the wider context of other releases to different media (air, land and water) and taking issues such as usage of energy and raw materials into account. Noise cannot therefore be considered in isolation from other impacts on the environment.

2.27 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 to 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.

2.28 Consequently, the aim of BAT should be to ensure that there is no reasonable cause for annoyance to persons beyond the installation boundary.

2.29 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*' (i.e. creeping ambient L_{Aeq}), which is the gradual increase in sound levels as industry expands and areas develop.

2.30 The indicative requirements apply to both new and existing activities but it is 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 are expected to meet BAT from the outset and to demonstrate that noise reduction or prevention has been built into the process design. For most existing plant, especially where there are no existing noise limits, the focus is on good practice (BAT) and the need to ensure that there is no reasonable cause for annoyance. In assessing any noise impact, it is more normal to monitor existing levels and apply corrections and calculations, rather than rely on predictions.

2.31 The guidance makes reference to BS4142:1997, BS8233:1999 and WHO guidance for absolute levels for protection of community annoyance. The two British Standards have been updated since the guidance was published and the latest versions have been considered in this assessment.

Road Traffic Noise

2.32 No guidance exists for assessing increased traffic noise on existing roads as a result of traffic generated by new developments. However, any change in noise levels along affected roads would be relevant to subsequent planning applications.

2.33 The standard index used in the UK for describing road traffic noise is LA10, which is the 'A' weighted sound level in dB exceeded for 10% of the assessment period (ref. LA 111 Terms and Definitions). Daytime noise is assessed using the 18-hour LA10, following the methodology given in the Department of Transport's Calculation of Road Traffic Noise (CRTN).

2.34 For the operational phase of the Proposed Development it is proposed that the majority of HGV movements would be restricted to a 12-hour daytime period. Therefore, an assessment has been undertaken on the impact of road traffic in relation to the increase in noise level based on a 12-hour average using an LA10 index. In respect to impacts, a 12-hour period would present a worst case compared with the use of an 18-hour time frame and is therefore considered to represent a robust assessment.

2.35 For road traffic noise, the CRTN calculation method can be used to predict noise levels from the movement of traffic along adjacent roads. Post-development predicted noise levels at sensitive receptors can be compared with predicted noise without the Proposed Extension, to establish any likely significant increase in overall traffic noise.

2.36 Traffic data for the CRTN assessment presented in this chapter is based on the figures contained within the Transport Assessment (TA), Chapter 15, Appendix 2.2 of the planning application. The TA sets out existing and predicted traffic data for the assessment year based on established growth factors and known committed developments. In this regard the impact of road traffic noise is inherently a cumulative assessment.

2.37 According to CRTN where the traffic flow volumes are very low (i.e. where traffic flows below 50 vehicles per hour or 1000 vehicles per 18 hours) then the CRTN methodology is unreliable (ref. paragraph 30 of CRTN). For the assessment of on-site traffic, ISO9613-2 calculation methodology using a 'line source' to represent moving vehicles with appropriate speed and empirical sound power levels obtained from other similar sites in the UK has been used.

BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites

2.38 This scope of the standard that is relevant to construction noise is clarified as follows:

`This part of BS5228 gives recommendations for basic methods of noise control relating to construction and open sites where work activities/operations generate significant noise levels, including industry-specific guidance. The legislative background to noise control is described

and recommendations are given regarding procedures for the establishment of effective liaison between developers, site operators and local authorities. This part of BS5228 provides guidance concerning methods of predicting and measuring noise and assessing its impact on those exposed to it.' [Reference: BS5228-1-A1: 2014 page 1, section 1]

2.39 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 control of vibration and recommendations for controlling vibration at source and management controls (e.g. liaison with communities, supervision, preparation and choice of plant etc.).

Ground Vibration

2.40 Most of the available data relating to the effects of ground vibration on buildings have been obtained during tests using explosives. From these studies, two regimes of building damage have evolved, those of structural damage involving major failures of whole or parts of buildings and architectural damage involving cracking plaster or other brittle materials.

2.41 Recent International and British Standards define and categorise building damage under three main headings:

a) Cosmetic - the formation of hairline cracks on drywall surfaces or the growth of existing cracks in plaster or drywall surfaces. In addition, the formation of hairline cracks in mortar joints of brick / concrete block construction.
b) Minor - the formation of large cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks.
c) Major - damage to structural elements of the building, cracks in support columns, loosening of joints, splaying of masonry cracks, etc.

2.42 An investigation into the effects of induced vibration undertaken by the British Standards Institution (BSI) has culminated in BS7385:1993; Part 2 which gives guide values to prevent cosmetic damage to property of 15 to 20mms-1 between 4Hz and 15Hz, whilst above 40 Hz the guide value is 50mms-1. The Standard gives guidance on the levels of vibration (i.e. peak particle velocity in mms-1) above which building structures could be damaged. Strains imposed on a building by ground motion will tend to be greater if lower frequencies (in Hz) predominate.

2.43 The BSI suggests reducing these figures by a factor of 50% for continuous vibration, for example from rail traffic, thus the values become 7.5-10mms-1 at 4-15Hz, and 25.0mms-1 at 40Hz and above.

2.44 With regard to the threshold of cosmetic damage, for continuous vibration such as road or rail traffic, levels below 5.0mms-1 are unlikely to be significant. For a given level of vibration the risk of damage decreases as the frequency of that vibration increases.

2.45 BS5228-2:2009 Annex B Table B.1 gives guidance on the effects of vibration levels, which is summarised in Table 2.5.

Table 2.5: Guidance on Effects of Vibration Levels

Vibration Level $mm.s^{-1}$	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments.
1.0	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10	Vibration is likely to be tolerable for any more than a very brief exposure to this level.

2.46 In terms of response limits of buildings BS5228-2:2009 (Annex B, Table B.2) refers to BS7385-1 and BS7385-2 and sets out guide values for transient vibration for cosmetic damage, which gives a low frequency limit of 15mm/sec (4Hz) increasing to 20mm/sec at 15Hz for residential or light commercial buildings. For reinforced or framed structures the limit is 50mm/sec at 4Hz and above.

Vibration Nuisance

2.47 The human body is very sensitive to vibration and therefore can result in subjective concern being expressed at energy levels well below the threshold of damage.

2.48 Guidance on the human response to vibration in buildings is found in British Standard BS 6472-1:2008. Weighting curves relating to human response to vibration of buildings are presented within this chapter. Estimates are given on the probability of adverse comment, which might be expected, from human beings experiencing vibration in buildings. This is based on a vibration dose value (VDV), assessed from frequency weighted vibration measurements and based on a 16-hour day and 8-hour night period as set out in BS6472-1:2008.

2.49 For the purposes of assessing the potential to cause nuisance the guidance in BS6472-1:2008 has been used.

Consultation

2.50 A request for a scoping opinion was issued to Doncaster Council on 10th March 2020. Reference to the previous noise assessment was made in respect of established baseline sound levels.

2.51 A scoping response was received from the Principal Planning Officer at Doncaster Council in respect of the scoping report on noise. This states that “An updated noise assessment will be required and should be carried out in accordance with the details contained within the submitted document. The locations proposed for acoustic levels are agreed. However, I would stress that sound levels should not be taken during the current lockdown as it is not a representative climate.” Therefore, it has been agreed with the Doncaster Council that the background and residual sound levels undertaken in 2016 for the previous ES noise chapter would be acceptable to reference as being representative for the purposes of this assessment.

3.0 ASSESSMENT METHODOLOGY

3.1 Noise Predictions

3.1.1 In terms of noise predictions this assessment has used the calculation method based upon ISO9613-2, which is an internationally recognised methodology, which takes into account source distance, screening effects, operating time and direction in relation to the nearest sensitive receptor. The noise model includes suitable calculation method settings and assumes that all relevant plant is operational to ensure the highest likely noise levels are assessed. Appendix 3 and 4 of this report provide further detail of the noise model settings and assumptions made in respect of noise levels from the Proposed Development.

3.1.2 The plant noise levels assumed within this assessment have been based on actual noise levels measured at other similar sites in the UK and from advice provide from a number of technology providers who are involved in the detailed design of such developments.

3.2 Level and Significance of Effect

3.2.1 The level of an effect is a function of the sensitivity or importance of the receiver, or receptor, and the scale or magnitude of the effect. In the case of this assessment the level of the effect has been determined by reference to existing guidance and standards outlined below.

3.2.2 The receptors identified for the assessment include:

- Residents of existing houses adjacent to the Site who could experience site construction noise during daytime periods;
- Residents of existing houses adjacent to the Site who could experience site operational noise during daytime and night-time periods; and
- Residents of existing houses who could experience additional road noise during the construction and operation of the Proposed Development.

Magnitude of Effect

Construction Noise

3.2.3 For residents of houses that could be exposed to construction noise, BS5228:2009+A1:2014 is considered to be the appropriate standard. This standard does not prescribe limits but requires ‘best practicable means’ (“BPM”) to be employed to control noise generation. The criterion therefore is that BPM should be employed, and conditions implemented for example to restrict construction noise to non-sensitive hours.

3.2.4 The construction impact semantic scale, set out in Table 2.6 below, is based on the ABC method of assessment described in Annex E.3.2 of BS5228, which sets out threshold values depending upon the ambient noise at receptors, which have been determined from the baseline sound survey.

3.2.5 According to the guidance found within the DMRB LA 111, the lowest observable adverse effect level (LOAEL) and significant observable adverse effect level (SOAEL) for noise sensitive receptors during construction are shown in Table 3.1.

Table 3.1: Construction Time Period - LOAEL and SOAEL

Time period	LOAEL	SOAEL	Threshold level $LAeq_{1hr}$ dB
Day (0700-1900 hours Weekday and 0700-1200 Saturdays)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS5228-1:2009+A1:2014 Section E3.2 and Table E.1 BS 5228-1:2009+A1:2014	65-75
Night (2300-0700 hours)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS5228-1:2009+A1:2014 Section E3.2 and Table E.1 BS 5228-1:2009+A1:2014	45-55
Evening and weekends (time periods not covered above)	Baseline noise levels $L_{Aeq,T}$	Threshold level determined as per BS5228-1:2009+A1:2014 Section E3.2 and Table E.1 BS 5228-1:2009+A1:2014	55-65

3.2.6 The magnitude of impact for construction noise is outlined in Table 2.7 (as defined in DMRB LA 111).

Table 3.2: Magnitude of Impact for Construction Noise

Magnitude of impact	Construction noise level
Negligible	Below LOAEL
Minor (Slight)	Above or equal to LOAEL and below SOAEL
Moderate	Above or equal to SOAEL and below SOAEL +5dB
Major (Substantial/Severe)	Above or equal to SOAEL +5Db

Construction Road Traffic Noise

3.2.7 According the LA 111 guidelines, the magnitude of impact at noise sensitive receptors from construction traffic is set out in Table 3.3.

Table 3.3: Magnitude of Impact for Construction Road Traffic Noise

Magnitude of impact	Increase in basic noise level of closest public road used for construction traffic (dB)
Negligible	Less than 1.0
Minor (Slight)	Greater than or equal to 1.0 and less than 3.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Major (Substantial/Severe)	Greater than or equal to 5.0

Note: Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:
1) 10 or more days or nights in any 15 consecutive days or nights;
2) a total number of days exceeding 40 in any 6 consecutive months.

Construction Phase – Vibration

3.2.8 For construction phase vibration the LOAEL and SOAEL is set out in DMRB LA 111 and provided in Table 3.4.

Table 3.4: Construction Vibration LOAELs and SOAELs

Time period	LOAEL	SOAEL
All time periods	0.3mm/sec PPV	1.0mm PPV

3.2.9 The magnitude of impact for construction vibration is therefore determined in accordance with Table 3.5, as defined in DMRB LA 111.

Table 3.5: Magnitude of Impact for Construction Vibration

Magnitude	Vibration level
Negligible	Below LOAEL
Minor (Slight)	Above or equal to LOAEL and below SOAEL
Moderate	Above or equal to SOAEL and below 10mm/s PPV
Major (Substantial/Severe)	Above or equal to 10mm/s PPV

Note: Construction vibration shall constitute a likely significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

1) 10 or more days or nights in any 15 consecutive days or nights; or
2) a total number of days exceeding 40 in any 6 consecutive months.

Operational Noise

3.2.10 In order to enable the assessment of the Proposed Development in terms of LOAEL and SOAEL, Table 3.6 presents equivalent noise levels and associated actions with the impact magnitude identified. It shows the proposed impact magnitude methodology considering the guidance contained within BS4142: 2014+A1:2019 for fixed and mobile plant noise (e.g. fans, turbines and on-site HGV movements etc.), road traffic noise impacts according to DMRB LA111 and IEMA Guidelines for Environmental Noise Impact Assessment'. The IEMA guidelines set out an example of how changes in noise level may be assessed in terms of residual LAeq. This assists in determining the impact of Site operational noise relative to the context of the noise climate.

Table 3.6: Method for Assessing the Magnitude of the Impact

PPG Effect Level	Impact	Assessment	Noise Level Criteria	Action/ Justification
No Observed Adverse Effect Level (NOAEL)	Negligible	Road Traffic Noise (L_{A10}) Off-site HGV movements (L_{Aeq})	Change in noise is: < 1 dB	Magnitude of Change is Negligible (DMRB LA111)
		Fixed Plant & on-site vehicle movements	Noise Rating Level ($L_{Aeq,T}$) is at or below background noise level ($L_{A90,T}$)	BS 4142 (2019) indication of low impact
		Absolute Noise Levels (Depending on context) Fixed Plant On-site HGV movements	Noise levels are below: *Bedrooms: 30 dB$L_{Aeq,8hours}$* *Living Rooms: 35 dB$L_{Aeq,16hours}$*	Within BS8233 / WHO guideline criteria
Lowest Observed Adverse Effect Level (LOAEL)	Slight	Road Traffic Noise (L_{A10}) Off-site HGV movements (L_{Aeq})	Change in noise is: 1 < dB < 3	Magnitude of Change is Minor (DMRB LA111)
		Fixed Plant & on-site vehicle movements	Noise Rating Level ($L_{Aeq,T}$) between 1dB – 4dB above the background noise level ($L_{A90,T}$).	BS 4142 (2019) indication of low impact
		Absolute Noise Levels (Depending on context) Fixed Plant On-site HGV movements	Noise levels are below: *Bedrooms: 30 dB$L_{Aeq,8hours}$* *Living Rooms: 35 dB$L_{Aeq,16hours}$*	Within BS8233 / WHO upper guideline criteria
Significant Observed Adverse Effect Level (SOAEL)	Moderate	Road Traffic Noise (L_{A10}) Off-site HGV movements (L_{Aeq})	Change in noise is: 3 < dB < 5	Magnitude of Change is Moderate (DMRB LA111)
		Fixed Plant & on-site vehicle movements	Noise Rating Level ($L_{Aeq,T}$) 5dB to 9dB above the background noise level ($L_{A90,T}$).	BS 4142 (2019) indication of adverse impact

PPG Effect Level	Impact	Assessment	Noise Level Criteria	Action/ Justification
		Absolute Noise Levels (Depending on context) Fixed Plant On-site HGV movements	Noise levels are exceeded: Bedrooms: 30 $dBL_{Aeq,8hours}$ Living Rooms: 35 $dBL_{Aeq,16hours}$	Mitigate and reduce to a achieve: Bedrooms: 30 $dBL_{Aeq,8hours}$ Living Rooms: 35 $dBL_{Aeq,16hours}$
Unacceptable Observed Adverse Effect Level (UOAEL)	Substantial	Road Traffic Noise (L_{A10}) Off-site HGV movements (L_{Aeq})	Change in noise is: > 5 dB	Magnitude of Change is Major (DMRB LA111)
		Fixed Plant & on-site vehicle movements	Noise Rating Level ($L_{Aeq,T}$) 10 dB or greater above the background noise level ($L_{A90,T}$).	BS 4142 (2019) indication of significant adverse impact
		Absolute Noise Levels (Depending on context) Fixed Plant On-site HGV movements	Internal noise levels exceed: Bedrooms: 51 $dBL_{Aeq,8hours}$ Living Rooms: 57 $dBL_{Aeq,16hours}$	Mitigate and reduce to a achieve: Bedrooms: 30 $dBL_{Aeq,8hours}$ Living Rooms: 35 $dBL_{Aeq,16hours}$ External Amenity Space: 55 $BL_{Aeq,16hours}$

3.2.11 Whilst the noise descriptors and categories presented in Table 3.6 have been established through reference to relevant guidance documents, there a number of other factors which need to be taken into account when assessing the noise impact of the Proposed Development. Therefore, a flexible approach to these categories has been adopted in the context of how specific impacts interact with the identified sensitive receptors. Where there is a departure from defining the impact based on how the predicted noise levels are compared with the noise criteria and impact descriptor, this is justified accordingly. With regard to proposed fixed plant, where there is an exceedance of the background noise level by between 5 to 9dB, this will be classified as a moderate impact.

Road Traffic Noise

3.2.12 To assess the likely impact on NSRs from noise due to increased traffic on the local road network associated with the Proposed Development, noise calculations have been undertaken using CRTN methodology and traffic flow information for the Proposed Development.

3.2.13 The DMRB LA 111 provides guidance on the magnitude of change in terms of road traffic noise. The procedure for assessing noise impacts advises the use of a LA_{10} measurement index based on a daytime 18-hour time period (i.e. 0600 to 2400 hours) and night-time period (i.e. 0000-0600 hours). Further assessment of the impact would be required where changes of 1dB(A) or more are expected in the short-term and changes of 3dB(A) in the long term.

3.2.14 DMRB LA 111 defines the short term and long-term scenarios are considered to represent the situation when a new road opens (short term) and 15 years after a road opens (long term). The magnitude of change criteria are set out in Table 3.7 for the short term and 3.8 for the long term.

Table 3.7: Magnitude of Change – Road Traffic Noise- Short Term

Short term magnitude	Short term noise change (dB $L_{A10,18hr}$ or L_{night})
Negligible	Less than 1.0
Minor (Slight)	1.0 to 2.9
Moderate	3.0 to 4.9
Major (Substantial/Severe)	Greater than or equal to 5.0

Table 3.8: Magnitude of Change – Road Traffic Noise- Long Term

Long term magnitude	Long term noise change (dB $L_{A10,18hr}$ or L_{night})
Negligible	Less than 3.0
Minor (Slight)	3.0 to 4.9
Moderate	5.0 to 9.9
Major (Substantial/Severe)	Greater than or equal to 10.0

Receptor Sensitivity

3.2.15 Key receptors to noise generally include individual or groups of residential properties, hospitals and schools. Table 3.9 provides methodology for assessing sensitivity relative to the receptor type and tranquillity of the associated area.

3.2.16 In accordance with the NPPF, the tranquillity of the Site and surrounding area has also been considered. The tranquillity assessment has been based on the mapping data published by Campaign to Protect Rural England (CPRE). The CPRE data present the results of a semi-quantitative assessment. Tranquillity scores are calculated by determining a location's proximity to perceived positive and negative features such as natural landscape, hearing birdsong or streams, and roads, aircraft and built-up areas. The calculations make a simple distinction between major and minor roads and do not consider detailed, measured noise levels. Tranquillity scores, particularly close to major roads may be affected by the presence of subjective, positive features that 'outweigh' the negative score attributable to the major road or other features such as aircraft movements. For the purpose of this assessment, the sensitivity of the area in terms of its tranquillity has been classified. The Zones specified in Table 3.9 relate to CPRE tranquillity ratings with Zone 1 being an area with the 'least- tranquil' and Zone 10 being 'most-tranquil' and have been applied within this assessment.

Table 3.9: Methodology for Assessing Sensitivity of Noise and Vibration

Sensitivity	Example of Receptor
High	Residential properties (Permanent tenants) and schools and hospitals CPRE rated tranquillity (Zones 8 - 10)
Medium	CPRE rated tranquillity (Zones 4 – 7)
Low	CPRE rated tranquillity (Zones 1 - 3)

Level of Effect

3.2.17 Based upon the assessment of impact magnitude and the sensitivity of individual receptors, the matrix shown in Table 3.10 has been developed in order to provide an indication of the possible level of effect for each predicted noise impact. Given that there are many factors which may affect the level of the effect of an impact, not least, the character of the noise and timescales over which the noise operates, the overall level of effect must be assessed on an individual basis using professional judgement and experience. Therefore, whilst the matrix provides a useful indication of the likely significance it cannot be applied in all situations.

Table 3.10: Significance of Effect Matrix

Sensitivity of Receptor	Magnitude of Impact			
	Substantial magnitude	Moderate magnitude	Slight magnitude	Negligible magnitude
High	Major	Intermediate	Minor	Neutral

Sensitivity of Receptor	Magnitude of Impact			
	Substantial magnitude	**Moderate magnitude**	**Slight magnitude**	**Negligible magnitude**
Medium	Intermediate	Intermediate – Minor	Minor – Neutral	Neutral
Low	Intermediate - Minor	Minor	Neutral	Neutral

3.2.18 Where an increase in noise level is predicted, the resulting effect is described as being adverse; where a decrease in noise level is predicted the resulting effect is classed as being beneficial.

3.2.19 Where a level of effect is defined as Intermediate or greater, the effect is likely to be considered as significant.

Limitations

3.2.20 Specific details regarding construction works are not currently available as the technology provider who would finalise the detailed design work has not yet been commissioned. Therefore, the assessment undertaken has been based on the previous experience or professional judgement of the assessor with regard to similar types of development.

3.2.21 As agreed with the LPA, in view of the current restrictions on movement due to Covid 19, the baseline data established in 2016 has been referenced for the purpose of establishing impacts relative to baseline and residual sound levels. This is however, considered to be a robust assessment as baseline levels are unlikely to have changed significantly.

4.0 BASELINE

4.1 Data Sources

4.1.1 The following sources of data have been used in order to support and undertake analysis of baseline levels and noise predictions:

a) Baseline sound data from a survey undertaken in August 2016 by WYG for the planning submission for the ES presented in 2018.
b) Baseline sound data from a survey undertaken in July 2018 by WYG to provide further information for the planning submission for the Consented Development.
c) Empirical noise level data for external plant and reverberant sound pressure levels for plant operating within specific buildings from library data obtained by NVC Ltd at a number of waste incineration plants in the UK and from empirical data provided by a number of technology providers who have designed, built and measured noise levels from this type of plant and facility.

4.2 Baseline Survey

4.2.1 Based on a site visit undertaken in August 2016, the noise climate at the Site and surrounding area is influenced primarily by road traffic from Doncaster Road and noise from industrial premises which are located around the Site. During periods of reduced traffic flow, steam venting from the Ardagh Glass production facility was a principal source of noise.

4.2.2 The nearest sensitive receptors (NSRs) are residential properties on Doncaster Road which are located over 350m to the south east of the site. Other residential areas are located at further distances to the north west, north east and south of the Site. These receptors are of **high** sensitivity. The commercial receptors (i.e. offices) are located adjacent to the site.

4.2.3 For the purpose of this assessment, the following receptors have been considered.

Table 4.1: Existing Residential Receptor Locations

NSR Ref.	Description	Approximate Distance to Source (m)	Grid Reference X Y
R1	Low Farm	1730	459149 407936
R2	250 Barnaby Dun Road	560	460757 406523
R3	185 Doncaster Road	380	461081 406943
R4	13 The Boulevard	450	461183 406859
R5	151 Doncaster Road	460	461224 407087
R6	1-15 Marsden Gardens	710	461087 407788
R7	21 Fountains Close	760	461159 407810
R8	4 Nunnington Way	730	461066 407830
R9	Manor House, Clay Lane W	210	460499 406952
R10	Rose Cottage, Clay Lane W	310	460455 406844

4.2.4 The tranquillity of the site and surrounding area falls into Campaign to Protect Rural England (CPRE) Zones 2-3 which are of **low** sensitivity for non-residential receptors. For residential receptors it is assumed these are of high sensitivity in accordance with Table 3.9.

4.2.5 The nearest commercial receptors (i.e. offices associated with industrial units) are represented below in Table 4.2.

Table 4.2: Existing Commercial Receptor Locations

NSR Ref.	Description	Approximate Distance to Source (m)	Grid Reference X Y
C1	Aggreko	70	460889 407168
C2	Don Valley Engineering Co	65	460835 407127
C3	Senior & Dickson Ltd	30	460729 407045

4.2.6 A baseline monitoring survey was undertaken at seven locations from Thursday 18th August 2016 to Tuesday 24th August 2016 by WYG Consultants. Attended short term measurements were undertaken at five locations during the day, evening, and night-time periods with two additional locations being measured unattended over a 137-hour period. The survey was further supplemented by inclusion of three additional short term attended locations and one long term unattended measurement from the Thursday 5th July 2018 to Saturday 7th July 2018. Noise monitoring locations are shown on Figure 1.

4.2.7 Measurements were taken in general accordance with BS 7445-1:2003 The Description and Measurement of Environmental Noise: Guide to quantities and procedures. Weather conditions during the survey period were observed as being dry with scattered showers. Anemometer readings confirmed that wind speeds were less than 5 ms-1 at all times during the survey with a variable wind direction.

Table 4.3: Noise Monitoring Locations

Ref	Description	Grid Reference X	Y
LT1	Wooded area in close proximity to The Boulevard.	461079.0	406908.3
LT2	Off Sandall Lane adjacent to entrance to West Green Drive.	461285.8	407797.3
LT3	Opposite Manor House Clay Ln W Edenthrope	460532.2	406932.9
ST1	Corner of Barnby Dun Road facing Doncaster Road.	460740.4	406497.4
ST2	Doncaster Road.	461206.5	407072.8
ST3	Sandall Stone Road, boundary of proposed site.	460777.0	407117.4
ST4	Sandall Lane facing West Green Drive	461259.4	407795.3
ST5	To the south of Low Farm	459186.5	407937.5
ST6	Adjacent to Senior and Dickson Limited	460744.8	407038.3
ST7	Manor House Clay Ln W	460513.4	406957.3
ST8	Rose Cottage Clay Ln W	460438.5	406853.0

4.2.8 The results of the baseline measurements conducted during the survey are summarised in Table 4.4. For the LT locations, the presented $L_{Aeq,T}$ and $L_{A10,T}$ are average noise levels whilst the L_{A90} is the modal noise level of each 5 minute measurement over the stated survey period.

Table 4.4: Results of Baseline Noise Monitoring Survey

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Week Day 07:00 - 23:00	58 Hours	18/08/2016 - 24/08/2016 17:01 – 10:21	LT1	58	88	60	53
Week Night 23:00 – 07:00	32 Hours	18/08/2016 - 24/08/2016 23:00 - 07:00		52	82	52	43
Weekend Day 07:00 - 23:00	32 Hours	20/08/2016 - 21/08/2016 07:00 - 23:00		60	80	62	54
Weekend Night 23:00 – 07:00	16 Hours	20/08/2016 - 21/08/2016 23:00 - 07:00		52	74	55	44

Period	Duration (T)	Monitoring Date and Times	Location	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)	$L_{A10,T}$ (dB)	$L_{A90,T}$ (dB)
Week Day 07:00 - 23:00	58 Hours	18/08/2016 - 24/08/2016 16:39 – 10:09	LT2	60	99	59	50
Week Night 23:00 – 07:00	32 Hours	18/08/2016 - 24/08/2016 23:00 - 07:00		54	89	47	36
Weekend Day 07:00 - 23:00	32 Hours	20/08/2016 - 21/08/2016 07:00 - 23:00		58	95	56	43
Weekend Night 23:00 – 07:00	16 Hours	20/08/2016 - 21/08/2016 23:00 - 07:00		52	87	45	40
Period	**Duration (T)**	**Monitoring Date and Times**	**Location**	**$L_{Aeq,T}$ (dB)**	**$L_{Amax,T}$ (dB)**	**$L_{A10,T}$ (dB)**	**$L_{A90,T}$ (dB)**
Week Day 07:00 - 23:00	20 hours	05/07/2018 – 06/07/2018 18:50 – 23:00	LT3	61	94	60	50
Week Night 23:00 – 07:00	8 hours	05/07/2018 – 06/07/2018 23:05 – 23:55		57	90	55	50
Weekend Night 23:00 – 07:00	4 hours	07/07/2018 – 07/07/2018 00:00 – 04:15		54	80	52	50
Day 07:00 - 19:00	30 Mins	23/08/2016 14:17-14.47	ST1	64	79	67	55
	30 Mins	23/08/2016 14:56-15:26	ST2	78	81	74	58
	15 Mins	23/08/2016 15:33	ST3	60	76	64	48
	15 Mins	23/08/2016 15:54	ST4	62	81	67	48
	15 Mins	23/08/2016 16:21	ST5	41	60	44	36
	60 Mins	06/07/2018 10:13	ST6	62	84	66	46
	60 Mins	04/07/2018 14:47 & 06/07/2018 11:23	ST7	62	80-85	62	51
	60 Mins	04/07/2018 15:19 06/07/2018 11:56	ST8	64	83-87	65	50
Evening 19:00 – 23:00	60 Mins	05/07/2019 19:00 05/07/2018 20:11	ST7	55	84	52	48
	60 Mins	05/07/2018 19:38 05/07/2018 20:46	ST8	54	75	55	52
Night 23:00 - 07:00	15 Mins	23/08/2016 23:16	ST1	60	75	64	48
	30 Mins	23/08/2016 23:38	ST2	60	82	61	41
	15 Mins	24/08/2016 00:16	ST3	47	73	47	46
	15 Mins	24/08/2016 00:37	ST4	51	74	44	38
	15 Mins	24/08/2016 01:04	ST5	34	62	34	30
	60 Mins	05/07/2018 23:35 & 00:42	ST7	54	83	51	48
	60 Mins	05/07/2018 23:00 & 00:07	ST8	54	78	54	51

4.2.9 The representative existing measured background noise level for each receptor has been established from a statistical analysis of the LT noise survey data and a review of the short term (ST) noise survey data. Figures 4.1 to 4.6 present the statistical analysis of the LT data.

Figure 4.1: LT1 Daytime Background Sound Level

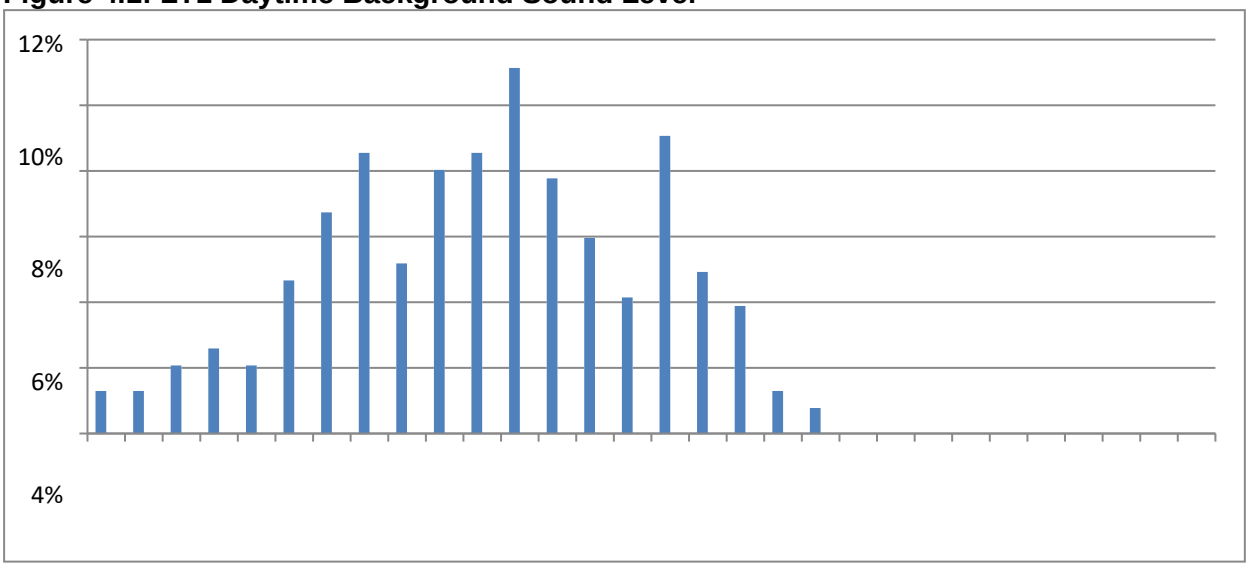


Figure 4.2: LT1 Night-time Background Sound Level

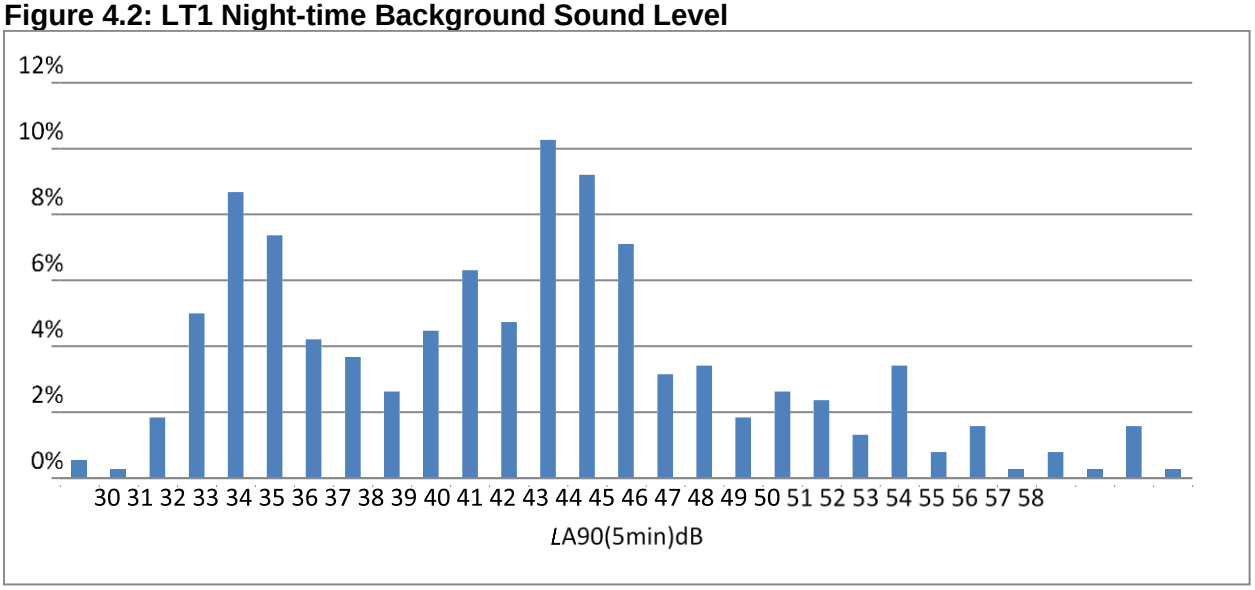


Figure 4.3: LT2 Daytime Background Sound Level

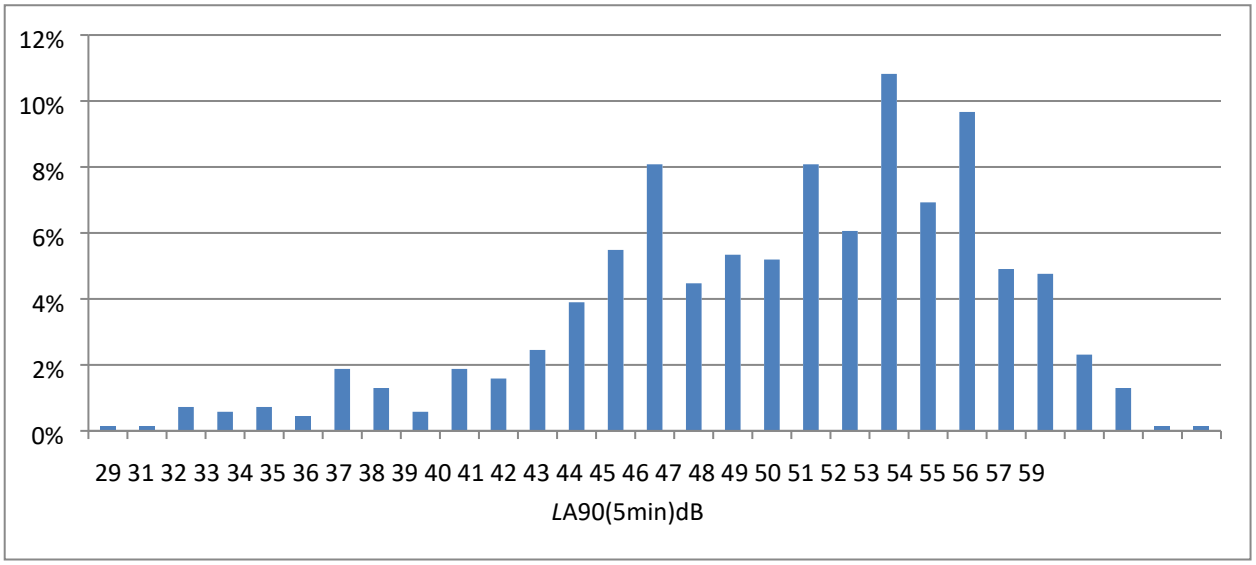


Figure 4.4 LT2 Night-time Background Sound Level

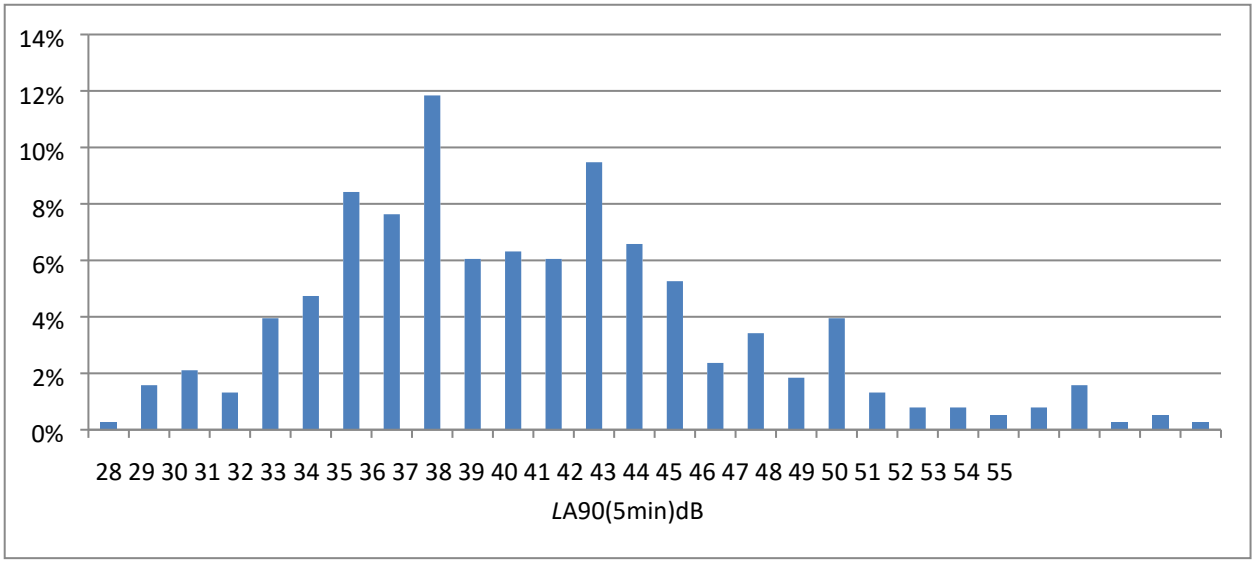


Figure 4.5: LT3 Daytime Background Sound Level

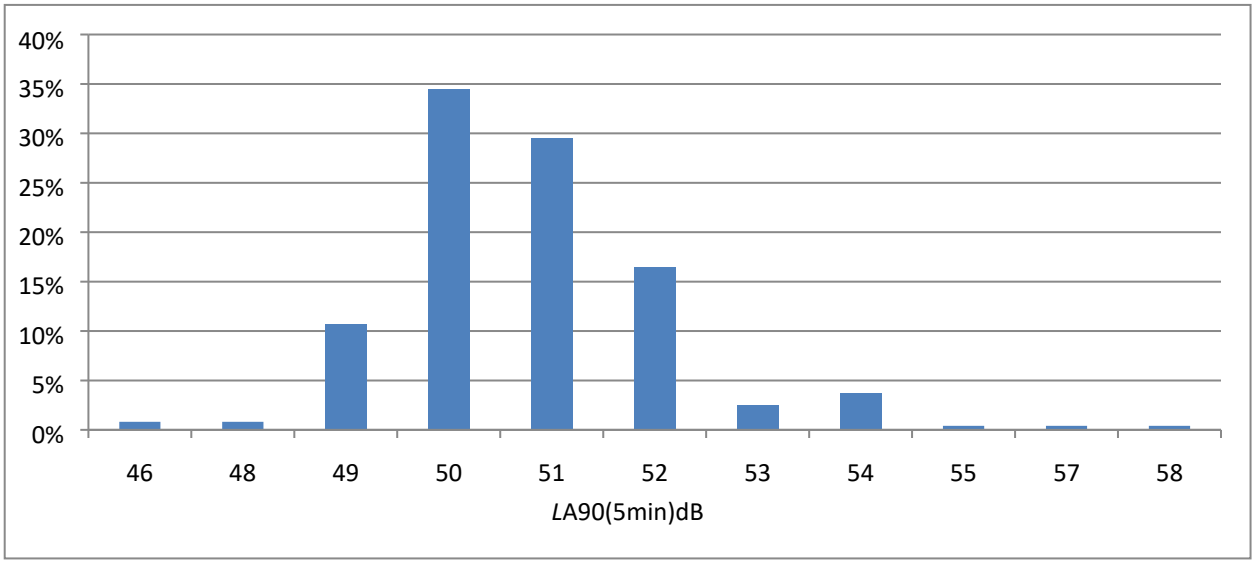
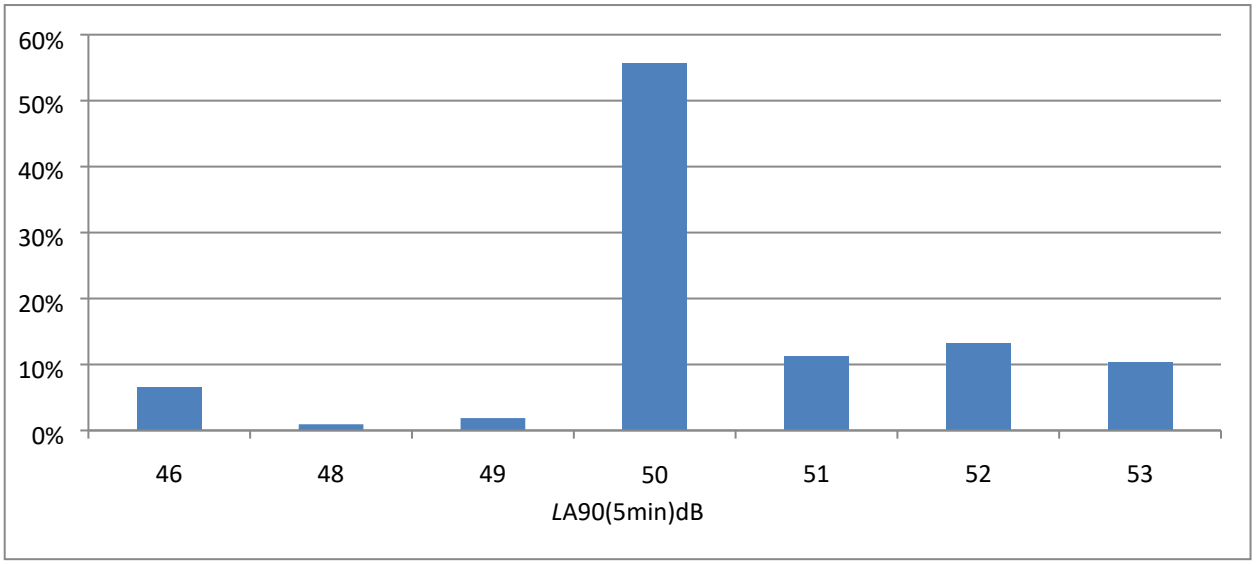


Figure 4.6: LT3 Night-time Background Sound Level



5.0 ASSESSMENT OF EFFECTS

5.1 Construction Phase

5.1.1 No specific details with regard to construction stage design mitigation have been incorporated within the scheme assessed at this stage as this will fall within the remit of the technology provider to develop and implement.

5.1.2 A Construction Environmental Management Plan (CEMP) will be produced prior to the commencement of the construction works by the Contractor. The proposed CEMP will be an appropriate document within which appropriate procedures and methods can be specified to protect noise sensitive receptors. This will include specific method statements identifying methods of working and controls to address the Proposed Development's construction noise effects.

5.1.3 The CEMP will be implemented during the construction phase and will include, as a minimum, unless agreed otherwise in writing by Doncaster Council, a restriction in working hours. In addition, specific mitigation measures specified below have been included as examples of further suitable mitigation measures which should be considered:

- Careful selection of working methods and programme;
- Information provided to local receptors of any likely noisy activity periods or peak vibration events (e.g. piling) will help avoid complaints as experience shows that informing local residents and/or office workers reduces reaction to these activities or events.
- Selection of quietest working equipment available (e.g. hydraulic piling techniques rather than percussive/vibratory piling, electric/battery powered equipment which is generally quieter than petrol/diesel powered equipment);
- Positioning equipment behind physical barriers, i.e. existing features, hoarding, etc., or provision of lined and sealed acoustic covers for equipment that could potentially contribute to a noise nuisance;
- Positioning of noise generating equipment, such as any blending plant in areas which minimise noise as far as practicable;
- Directing noise emissions away from plant including exhausts or engines away from sensitive locations;
- Ensuring that regularly maintained and appropriately silenced equipment is used;
- Shutting down equipment when not in use, i.e. maintain a 'no idling policy';
- Handling all materials in a manner which minimises noise;
- Switch all audible warning systems to the minimum setting required by the Health and Safety Executive;
- Restricting hours of site operation in agreement with the Local Authority. If there is the requirement to undertake work outside of the agreed hours, further consultation should be undertaken with the Local Authority;
- Where processes could give rise to significant levels of noise for sustained periods, noise levels should be monitored regularly by a suitably qualified person. The methodology of any surveys should be agreed with the Local Authority; and
- Employ best practices and follow guidance of BS5228:1999+A1:2014.

5.1.4 The Local Authority is provided with powers under the Control of Pollution Act 1974 to control noise and vibration from construction sites including, if necessary, serving notices under Section 60 to specify working practices.

Operation Phase

5.1.5 Predicted noise levels from the Proposed Development have been calculated using the noise levels provided within Appendix 3 of this report. These noise levels are based on library data from similar plant used on other UK sites and include the following assumed incorporated mitigation measures:

(i) Buildings constructed from single skin cladding (Rw=24dB).
(ii) Air cooled condenser fans operating at an overall sound power level of 102dB(A) (6 fans at 94dBW each fan).
(iii) Fan stack & roof vents designed to a sound power level of 95dBW (84dB $L_{Aeq15mins}$ @ 1m free field) at flue exit point of stack.
(iv) Turbine air cooler fans – overall sound power level of all fans operating designed to a level of 95 dB(A) (i.e. nominally 80dB(A) @ 1m from fans).
(v) Ventilation louvres attenuated using single bank acoustic louvres (Rw 15dB).
(vi) Doors closed except for access to vehicles for offloading and collection unless for maintenance or emergency.
(vii) Doors into Tipping Hall minimum Rw 12dB, doors into Turbine Hall acoustic type (Rw 29dB) and all other doors Rw 18dB.
(viii) Sound power levels of plant as detailed in Appendix 3 of this report.
(ix) Vehicles fitted with non-tonal reversing alarms (i.e. broadband type noise alarms).
(x) Plant designed to ensure that no noise character is perceptible at residential receptor positions (i.e. tonal, impulse or intermittency character)

Construction Phase Effects

Assessment of Effects against Existing Baseline

Plant Noise

5.1.6 The most notable impacts due to increases in noise during construction would occur during periods of earthworks and remediation, construction of site infrastructure and the construction of substructures. In addition to on-site sources, increased noise may be caused by HGV movements travelling to and from the development site during construction.

5.1.7 Exact details regarding the construction techniques and types of plant can only be estimated at present and, therefore, it is difficult to predict accurately the potential magnitude of potential noise effects on noise sensitive receptors. Given the nature of construction works there is the likelihood that during certain periods of the construction phase, noise would be audible at locations which are represented by receptors as identified in Table 3.2 and 3.3. Any impacts would be temporary in nature. The level of noise with be dependent on the on the location of the construction activities on a daily basis and the equipment being used, with noise levels being attenuated as the distance between the source and receptor increases.

5.1.8 Whilst construction / demolition noise impacts are generally sufficiently controlled by adherence to 'Best Practice' techniques and restricted operating hours, an indicative reasonable worst-case noise assessment has been undertaken to assess whether the effects which could be significant may arise. The quantitative assessment undertaken follows the guidance provided within BS 5228 and is based on the use of standard construction plant in the main construction areas within close proximity to the identified receptor locations.

5.1.9 The assessment of construction noise is presented in Table 5.1 at residential receptors fall below the threshold levels according to Table 3.1, which is based on the BS5228 `ABC' method.

5.1.10 The table below presents the findings of a daytime construction noise assessment at noise sensitive properties surrounding the site. Daytime is regarded as weekdays 07:00 – 19:00 and Saturdays 07:00 – 13:00.

Table 5.1: Construction Noise Assessment Results (ABC Method) – Daytime

Nearest Sensitive Receptors	Measured Existing Ambient Noise Level (L_{Aeq})	Predicted Construction Noise	Category	Threshold	Significant Effect
R1	41	32-38	A	65	No
R2	64	41-48	A	65	No
R3	59	44-51	A	65	No
R4	59	42-50	A	65	No
R5	59	42-49	A	65	No
R6	62	39-46	A	65	No
R7	62	39-45	A	65	No
R8	62	39-45	A	65	No
R9	64	47-56	B	70	No
R10	64	45-53	B	70	No
C1	62	51-64	-	70-75*	No
C2	62	55-69	-	70-75*	No
C3	62	56-80	-	70-75*	No-Yes

All values are sound pressure levels in dB re: 2×10^{-5} Pa.
*BS5228-1:2009+A1:2014 applies to residential receptors not commercial therefore a higher threshold level is applied, which is reasonable given the industrial location.

5.1.11 The results indicate that the noise levels at the residential receptors would be below the SOAEL criteria.

5.1.12 Based on the predictions, the resultant noise levels at NSRs, is likely to result in an impact magnitude classification of **negligible**, resulting in a **neutral** level of effect at all residential receptors. At commercial receptors, the threshold levels would only be exceeded at the closest industrial unit office due to potential piling and infrastructure activities when being undertaken at the closest approach to the receptor.

5.1.13 In accordance with Best Practice, examples of noise control measures that will be adopted by the Contractor as part of the CEMP is presented in Section 5.1.3. This would assist in reducing peak noise activity at the closest approach to the receptor to a level not exceeding a significant effect. Based on a `best practice' approach no significant effects in EIA terms are likely.

Construction Vibration Effects

5.1.14 The highest levels of vibration generated by construction plant is likely to include the following:

- Piling rigs;
- Dozers;
- Vibratory rollers and compactors;
- Material offloading onto hard surfaces; and
- Concrete vibratory plant.

5.1.15 BS5228:2009+A1:2014 Part 2 deals with vibration from construction and open sites and provides information on the effects of the levels of vibration, human and structural response, response limits of structures and practical measures to reduce vibration.

5.1.16 Table 5.2 outlines the highest likely vibration levels that could be experienced during construction at the NSRs (i.e. during Piling activities).

Table 5.2: Vibration Levels During Construction

NSR Ref	Approximate distance to NSR (m)	Receptor Sensitivity	Range of highest likely vibration (mm/sec)	Perceptible levels of vibration (mm/sec)	Cosmetic damage vibration limits (mm/sec)
R1	1730	High	0	0.3	5.0
R2	560	High	0 - 0.1	0.3	5.0
R3	380	High	0 - 0.1	0.3	5.0
R4	450	High	0 - 0.1	0.3	5.0
R5	460	High	0 - 0.1	0.3	5.0
R6	710	High	0 - 0.1	0.3	5.0
R7	760	High	0 - 0.1	0.3	5.0
R8	730	High	0 - 0.1	0.3	5.0
R9	210	High	0.1 - <0.3	0.3	5.0
R10	310	High	0 – 0.2	0.3	5.0
C1	110	Low	0.1 to 0.6	0.3	5.0
C2	70	Low	0.2 to 1.0	0.3	5.0
C3	30	Low	0.7 to 3.2	0.3	5.0

5.1.17 The levels of vibration at residential receptors, as a result of construction, without mitigation are likely to result in vibration levels below LOAEL and an impact magnitude classification of **negligible** and a level of effect of **neutral** during general and highest generated vibration. At the nearest commercial receptors, the impact magnitude may be above SOAEL with an impact magnitude of **moderate** and a level of effect of **minor significance**. The control of vibration would form part of the CEMP for the construction phase by the application of `best practice' (e.g. selection of lower vibration piling rig).

Construction Road Traffic Effects

5.1.18 The effect of construction road traffic is not expected to be significant due to the likely number of vehicles onto the local road network and the temporary nature of the source occurring over a relatively short time period. The impacts on residential receptor locations is expected to be **negligible** and a **neutral** level of effect.

Operational Phase Effects

Assessment of Effects against Existing Baseline

Plant Noise

5.1.19 In terms of the potential noise characteristics of the Proposed Development the following provides the details of the appropriate noise criteria applied in the assessment in accordance with BS4142: 2014+A1:2019:

Tonality

5.1.20 In terms of tonality the results of a number of Energy from Waste facility noise surveys at other similar sites operating in the UK show no tonal characteristics associated with the operational noise. The route of the HGVs utilises a one-way system. Vehicles would only reverse when inside the Tipping Hall and mobile plant on site would be fitted with broadband noise type reversing alarms. Fixed plant emitting any significant tonal character at source would be controlled by design or mitigation measures. It is therefore assumed that no tonal noise character penalty is required. For robustness we have allowed for +2dB in the analysis.

Impulsivity

5.1.21 In terms of impulsivity (e.g. noise from pressure relief valves and impacts) empirical on-site noise monitoring of similar sites indicates no audible impulse noise where pressure relief valves and offloading of waste are enclosed within buildings. If any pressure relief valves are mounted external to the building they would be fitted with appropriate silencers. There are safety valves for emergency venting of steam, which are externally mounted on the roof of the Boiler House but these are not normally in operation. For the proposed design we therefore assume that an impulse noise character penalty is not required.

Intermittency

5.1.22 In terms of intermittency the only typical intermittent activity is likely to be noise from daytime HGV movements on-site. These are unlikely to be distinctive at NSRs during daytime periods (due to the influence of local road traffic movements along the local road network).

5.1.23 In conclusion, with the proposed noise mitigation strategies and controls of specific plant selection and design there is no character penalty likely to be required, however for robustness we have allowed for +2dB to the calculated noise contribution for character.

5.1.24 The potential exists for noise from the proposals to impact upon nearby existing sensitive receptors located within proximity to the site. Effects could arise from the following sources:

- On-site noise generating sources associated with the proposed development including fixed plant and HGV movements.
- Off-site HGV movements.
- Off-site vibration from plant operation.

5.1.25 Details of the above plant source noise levels are presented in Appendix 3 of this report, with a summary of the results and assessment in EIA terms presented below.

Operational Noise

5.1.26 Predicted noise rating levels associated with proposed fixed plant and on-site HGV movements has been compared with the established representative background sound level (L_{A90}) at the NSRs. This includes any incorporated mitigation measures. The difference between predicted noise rating level and representative background sound levels at NSRs is presented below.

Table 5.3: Plant Operation Noise Assessment (Incorporated Mitigation Measures)

NSR Ref	Established Baseline Representative Background Sound Levels L_{A90}		Noise Rating[1] Level L_{Aeq}		Difference between background and noise rating level		Impact Magnitude	Significance of Effects
	Daytime	Night-time	Daytime (1hr)	Night-time (15mins)	Daytime	Night-time		
R1	36	30	29	28	-7	-2	Negligible (Day) Negligible (Night)	Neutral Neutral
R2	47	47	38	38	-9	-9	Negligible (Day) Negligible (Night)	Neutral Neutral
R3	44	36	40	39	-4	3	Negligible (Day) Slight (Night)	Neutral Minor
R4	44	36	39	38	-5	2	Negligible (Day) Slight (Night)	Neutral Minor
R5	44	36	39	38	-5	2	Negligible (Day) Slight (Night)	Neutral Minor
R6	44	36	33	33	-11	-3	Negligible (Day) Negligible (Night)	Neutral Neutral
R7	44	36	33	33	-11	-3	Negligible (Day) Negligible (Night)	Neutral Neutral
R8	44	36	34	34	-10	-2	Negligible (Day) Negligible (Night)	Neutral Neutral
R9	50	48	51	50	1	2	Slight (Day) Slight (Night)	Minor Minor
R10	50	48	48	47	-2	-1	Negligible (Day) Negligible (Night)	Neutral Neutral

All values are sound pressure levels in dBA re: 2x 10-5 Pa.
[1] Includes a +2dB penalty for noise character for robustness

5.1.27 The impacts established in Table 5.3 will be permanent and long-term duration. Generally, the operation noise significance is shown to be **negligible** with `worst case' receptor having a **minor adverse** effect. The rating levels at receptors R3, R4, R5 & R9 slightly exceed the background sound level and therefore in accordance with the extant planning permission additional mitigation measures are required, which is detailed in section 4.1.5.

Operational Road Traffic Noise

5.1.28 The Transport Assessment considers the assessment opening year (2022) and future year (2030) for the traffic demand relating to the Proposed Development compared to a 'Do-nothing' scenario. Table 5.4 provides details of the noise impact due to the increased traffic flow along the local road network based on a 12-hour average using the traffic data provided within the Transport Assessment. The assessment of noise associated with an average of 13 off-site HGV movements per hour is presented below. The assessment compares the baseline $L_{A10,T}$ with the predicted $L_{A10,1hour}$ with the contribution of on-site HGV movement.

5.1.29 The predicted noise has been undertaken using the guidance provided within CRTN. The predicted change in noise levels in the short term is presented in Table 5.4.

Table 5.4: Predicted Change in Road Traffic Noise on Local Road Network (2022 & 2030)

Road	Baseline Year	`Do Nothing' $L_{A10,12hrs}$	`Do Something' $L_{A10,12hours}$	Difference	Impact Magnitude	Significance of Effects
Sandall Stones Road	2022 2030	63.3 63.6	64.4 64.7	+1.1 +1.1	Slight	Minor
Barnaby Dun Road East	2022 2030	70.0 70.3	70.3 70.6	+0.3 +0.3	Negligible	Neutral
Doncaster Road	2022 2030	69.4 69.8	69.4 69.8	0 0	Negligible	Neutral
Barnaby Dun Road East (Off Clay Lane Roundabout)	2022 2030	70.4 70.8	70.7 71.0	+0.3 +0.2	Negligible	Neutral
A630 East (Off Clay Lane Roundabout)	2022 2030	70.9 71.2	71.0 71.3	+0.1 +0.1	Negligible	Neutral
Barnaby Dun Road West (Off Clay Lane Roundabout)	2022 2030	67.0 67.4	67.0 67.4	0 0	Negligible	Neutral
A630 West (Off Clay Lane Roundabout)	2022 2030	71.6 71.9	71.7 72.0	+0.1 +0.1	Negligible	Neutral

All values are sound pressure levels in dBA re: 2x 10-5 Pa.

5.1.30 Based on a maximum HGV demand the impact on local roads which include residential development, shows **negligible** impact magnitude and **neutral** level of effect. On Sandall Stones Road, which runs through the industrial estate, shows a **slight** impact magnitude and **minor** level of effect. The results therefore show no significant effects.

Operational Vibration Effects

5.1.31 Experience of monitoring night-time vibration levels at other similar sites, shows that in close proximity to plant (i.e. 1m to 5m) operational vibration levels would be between 0.05mm.sec to 0.1mm/sec. This would produce imperceptible levels at distances of around 10m from the Energy Centre (i.e. below 0.3mm.sec). This would therefore result in a **negligible** impact magnitude and **neutral** level of effect.

5.2 Additional Mitigation

Construction Mitigation

5.2.1 To minimise noise to the nearest commercial receptor, the CEMP would include consideration of hoarding screening of the western boundary, which is adjacent to the receptor to a height of circa 2.5m to 3m and careful consideration of type of piling rig to minimise noise and vibration. Monitoring of vibration could also be undertaken when piling occurs at close approach to the western site boundary external to the commercial receptor building.

Operational Mitigation

5.2.2 Exceedances of rating levels above the background sound level would be reduced by additional mitigation. The incorporated mitigation measures described previously adequately address the needs to avoid, reduce and compensate for many of the potential

effects of the Proposed Development and avoid any significant effects. However, in order to comply with the existing noise condition for the Site and to comply with the requirements of BAT, further noise mitigation would be required. These could include the following additional measures which are all standard commonly applied forms of mitigation applied at other similar facilities operating in the UK.

- IBA, Tipping Hall, Water Treatment, Workshop & Switchroom Buildings constructed from composite cladding or similar to minimum Rw=25dB (e.g. Corus composite panel). Turbine Hall, Boiler, Bunker & FGT Buildings double skin insulated cladding to typical acoustic performance (SRI):

Hz	**31.5**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**Rw**
dB	5	8	17	32	43	48	50	50	40	41

- Air cooled condenser fans operating at an overall sound power level of 100dB(A) (6 fans at 92dBW each fan).
- Fan stack & roof vents designed to a sound power level of 90dBW (79dB $L_{Aeq15mins}$ @ 1m free field) at flue exit point of stack.

5.2.3 There are a number of different ways in which the criteria can be achieved, for example, the use of noise control at source and/or the selection of different plant equipment, which may be quieter, can be investigated. The chosen method(s) of mitigation should be appropriate to meet the noise criteria and the application of BAT. The aforementioned measures are just one combination that would be effective in achieving the requisite noise levels during the daytime and night-time periods.

6.0 RESIDUAL EFFECTS AND CONCLUSIONS

6.1 Residual Effects

6.1.1 During the construction period there would be a variety of noise sources in use at different stages and their associated activities would vary from day to day. The highest noise levels relative to nearest receptors are likely to occur during piling and infrastructure activities. The peak noise activities do not normally occur over long periods of time and best practical means would be employed to control the noise being generated. It is concluded that the increase in construction noise with the implementation of mitigation measures, using best practice, is likely to result in an impact magnitude classification of **negligible** at residential receptors and a **neutral** level of effect. At commercial receptors, using best practice, is likely to result in a **slight** impact and a **minor** level of effect.

6.1.2 The assessment of impact on existing residential areas from any increase in road traffic noise during the daytime operational stage of the Proposed Development shows no significant change in noise levels and therefore there is likely to be a **negligible** magnitude impact at receptors, resulting in a **neutral** level of effect. At commercial receptors, the impact on the local road would be **slight** and a **minor** significance. The effect would not be significant.

6.1.3 In terms of vibration during the construction period, there would be a **negligible** magnitude impact, resulting in a **neutral** level of effect at the nearest residential receptors and well within guidance limits for nuisance and cosmetic damage. The effect would not be significant. At nearest commercial receptors the impact would be **negligible to moderate** impact and **minor** level of effect, which would be minimised by the application of `best practice' control measures resulting in a **negligible to slight** impact and **negligible to minor** level of effect.

6.1.4 The following analysis considers the residual effect of the additional mitigation measures on the predicted operational noise levels. Table 6.1 below provides information on the predicted noise levels during daytime and night-time operations from the Proposed Development.

Table 6.1: Plant Operation Noise Assessment (Additional Mitigation Measures)

NSR Ref	Established Baseline Representative Background Sound Levels L_{A90}		Noise Rating[1] Level L_{Aeq}		Difference between background and noise rating level		Impact Magnitude	Significance of Effects
	Daytime	Night-time	Daytime (1hr)	Night-time (15mins)	Daytime	Night-time		
R1	36	30	27	26	-9	-4	Negligible (Day) Negligible (Night)	Neutral Neutral
R2	47	47	37	36	-10	-11	Negligible (Day) Negligible (Night)	Neutral Neutral
R3	44	36	38	36	-6	0	Negligible (Day) Negligible (Night)	Neutral Neutral
R4	44	36	38	36	-6	0	Negligible (Day) Negligible (Night)	Neutral Neutral
R5	44	36	36	34	-8	-2	Negligible (Day) Negligible (Night)	Neutral Neutral
R6	44	36	29	29	-15	-7	Negligible (Day) Negligible (Night)	Neutral Neutral
R7	44	36	30	29	-14	-7	Negligible (Day) Negligible (Night)	Neutral Neutral
R8	44	36	31	30	-13	-6	Negligible (Day) Negligible (Night)	Neutral Neutral
R9	50	48	50	48	0	0	Negligible (Day) Negligible (Night)	Neutral Neutral
R10	50	48	46	45	-4	-3	Negligible (Day) Negligible (Night)	Neutral Neutral

All values are sound pressure levels in dBA re: 2x 10-5 Pa.

[1] Includes a +2dB penalty for noise character for robustness

6.1.5 The predicted noise levels reflect site attributable noise with the additional noise control measures. According to Table 5.1, the rating level relative to the assessment baseline noise would indicate **negligible** magnitude impact at all receptors. The operational noise impacts from the facility are therefore considered to represent a **neutral** level of effect, and not significant.

6.2 Comparison With Existing Planning Conditions

6.2.1 Planning permission 17/00923/TIPA dated 3rd May 2018 includes a noise condition (condition 02) which states:

"02.During the operations of the development, for the first three years, annual noise monitoring for compliance or at any time as requested by the Local Planning Authority following a complaint, the operator shall submit a noise report to the Local Planning Authority. The noise report shall be conducted by a competent noise consultant whilst the site is in operation and cover daytime/night-time periods. The monitoring positions shall reflect the sensitive receptors as identified in chapter 6 Noise and Vibration (page 6-5) of the White Young Green Environmental Statement Volume dated April 2017. The first report shall be submitted within 3-4 months of the process receiving material (and 12months after to demonstrate that the plant noise does not exceed the existing background levels). Should the actual noise levels not meet the identified background levels at the sensitive receptors location mitigation measures shall be agreed with the Local Planning Authority and implemented within three months of the date of the noise report subject to the source of any increase in noise level being as a result of the operations of the development.
REASON

To protect the amenities of the locality from noise in accordance with Core Strategy Policy CS 14."

6.2.2 The above condition requires that the plant noise does not exceed the existing background levels. As the representative background sound levels have been defined in this assessment then the absolute noise limits can be set out in any new condition. These are presented in Table 6.2:

Table 6.2: Site noise limits at noise sensitive receptors

NSR Ref	Noise Limit LAeq,T	
	Daytime (1 hour)	Night-time (15 mins)
R1	36	30
R2	47	47
R3	44	36
R4	44	36
R5	44	36
R6	44	36
R7	44	36
R8	44	36
R9	50	48
R10	50	48

6.3 Summary & Conclusions

6.3.1 Noise and vibration levels have been considered and assessed during the construction and operational phases of the Proposed Development. Relevant and appropriate noise and vibration guidance and standards have been used to determine the impact. The assessment has been undertaken to inform and guide the design of the Proposed Development, such that any likely noise and vibration impact on existing and potential sensitive receptors is minimised.

6.3.2 To establish any likely impact from noise a robust assessment of baseline sound levels has been considered by undertaking fixed position noise monitoring at seven noise sensitive receptor areas around the Site over long term and short term periods to establish representative background sound levels.

6.3.3 The Environmental Health Team at Doncaster Council has been formally consulted to seek advice and reach agreement in respect of baseline survey methodology, assessment criteria and receptor locations.

6.3.4 In accordance with appropriate standards, best practical means would be employed to control the noise generation during the construction period. Measures may include restriction on operating hours, local screening, broadband noise reversing alarms and careful choice of piling rigs to minimise noise. Such measures would be defined within the Construction Environmental Management Plan.

6.3.5 In relation to the operational phase a number of potential mitigation measures have been proposed to ensure that the resultant operational noise levels are within appropriate guidance and standards. The measures would be based on the employment of Best Available Techniques (BAT) to mitigate any potential peak noise sources.

6.3.6 The assessment shows that there would be no significant impacts during the construction or operation of the Proposed Development following the implementation of appropriate mitigation.

6.3.7 The summary of impact and effect is summarised in Table 6.2.

Table 6.2: Assessment Summary and Residual Environmental Effects (Noise and Vibration)

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Construction							
Construction Noise	Low (commercial) High (residential)	Slight Adverse Negligible	Minor Adverse Neutral	Best practice measures to be implemented as part of a CEMP.	Slight Adverse Negligible	Minor Adverse Neutral	High High
Construction Vibration	Low (commercial) High (residential)	Negligible to Moderate Adverse Negligible	Neutral to Moderate Adverse Neutral	Best practice measures to be implemented as part of a CEMP.	Negligible to Slight Adverse Negligible	Neutral to Minor Adverse Neutral	High High
Operation							
Off Site HGV Movement	Low (commercial) High (residential)	Negligible to Slight Adverse Negligible	Neutral to Minor Adverse Neutral	None	Negligible to Slight Adverse Negligible	Neutral to Minor Adverse Neutral	High High
Operational Noise (BS4142:2014+A1:2019 Assessment)	Low (commercial) High (residential)	Negligible to Slight Adverse Negligible to Slight Adverse	Neutral to Minor Adverse Neutral to Minor Adverse	Noise control to buildings, ACC fans, and stack and roof vents.	Negligible Negligible	Neutral Neutral	High High
Operational Vibration	Low (commercial) High (residential)	Negligible Negligible	Neutral Neutral	None	Negligible Negligible	Neutral Neutral	High High

7.0 REFRENCES

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

(2) BS8233: 2014 ‘Guidance on sound insulation and noise reduction for buildings’

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

(4) World Health Organisation ‘Night Noise Guidelines for Europe’ – 2009;

(5) BS7445: 2003 - Description and measurement of environmental noise.

(6) BS5228-1:2009+A1:2014 ‘Code of Practice for noise and vibration control on construction and open sites’.

(7) BS5228-2: 2009+A1:2019 ‘Code of Practice for noise and vibration control on construction and open sites – Vibration’.

(8) ISO 9613-2: 1996 Acoustics – Attenuation of Sound During Propagation Outdoors.

(9) Design Manual for Roads and Bridges, LA 111 Noise and Vibration – November 2019

(10) National Planning Policy Framework – February 2019

(11) Noise Policy Statement for England (NPSE) – March 2010

(12) Planning Practice Guidance – 6th March 2014 Department for Communities and Local Government (Ref ID: 30-001-20140306)

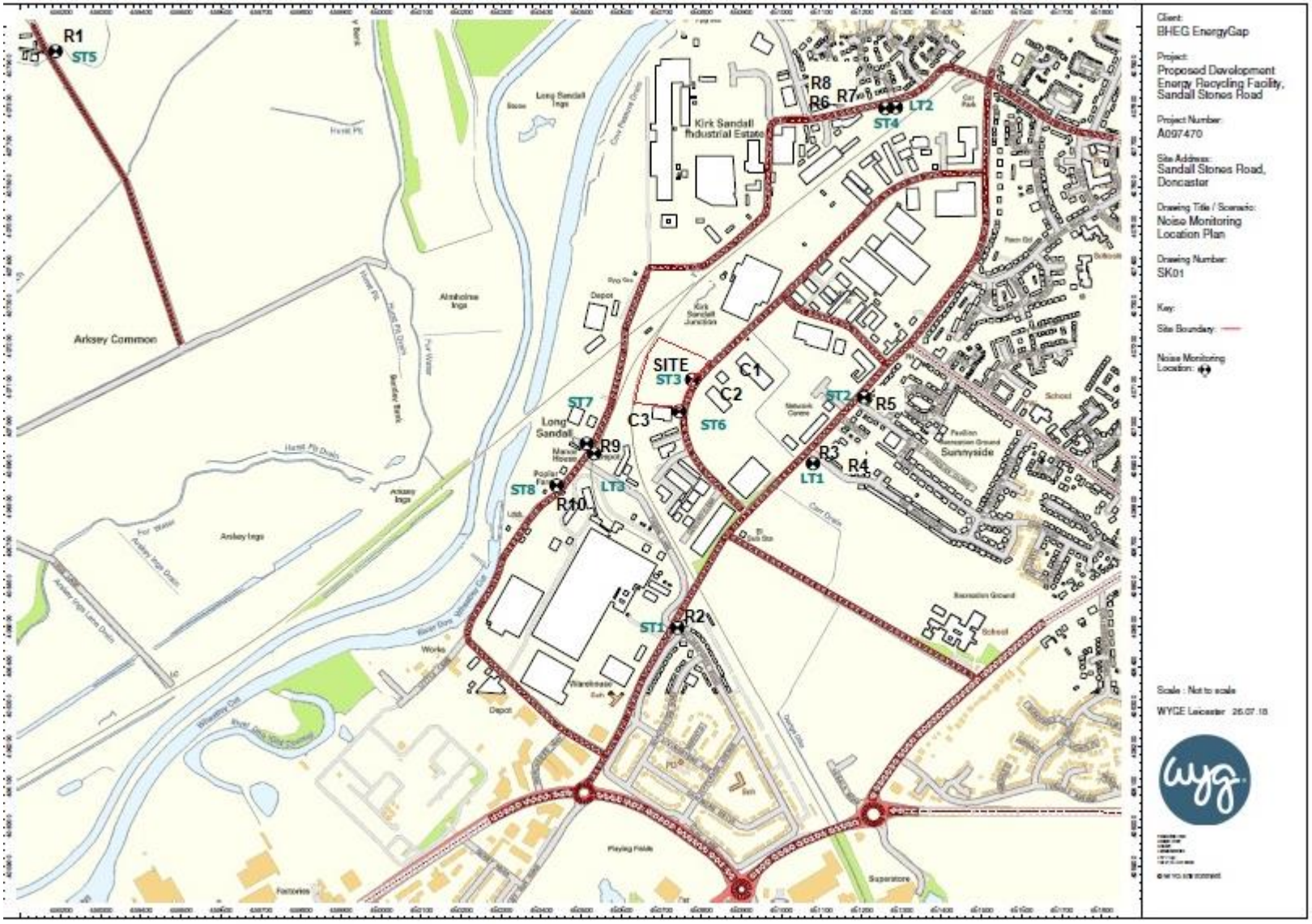
(13) IPPC - Technical Guidance Note IPPC H3 Part 2 – Noise Assessment & Control

(14) BS6472: 2008 `Guide to the evaluation of human exposure to vibration in buildings’

(15) BS7385-1:1993 Evaluation and measurement for vibration in buildings. Guide for measurement of Vibrations and Evaluations of Their Effects on Buildings

(16) BS7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration

Figure 1: Site Location, Monitoring Positions & Receptor Locations



Appendix 1 – Acoustic Terminology and Abbreviations

NOISE

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

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure level. It is because of this wide range that a noise level scale based on logarithms is used in noise measurement. This is the decibel or dB scale.

Audibility of sound covers a range of about 0 to 140 decibels (dB) corresponding to the intensity of the sound pressure level. The ability to recognise a particular sound is dependent on the pitch or frequencies present in the source. Sound pressure measurements taken with a microphone cannot differentiate in the same way as the ear, consequently a correction is applied by the noise measuring instrument in order to correspond more closely to the frequency response of the ear which responds to sounds from 20 Hz to 20000 Hz. This is known as 'A weighting' and written as dB(A).

The use of this unit is internationally accepted and correlates well with subjective annoyance to noise.

The logarithmic basis of noise measurements means that when considering more than one noise source their addition must be undertaken in terms of logarithmic arithmetic. Thus, two noise sources each of 40 dB(A) acting together would not give rise to 40 + 40 = 80 dB(A) but rather 40 + 40 = 43 dB(A). This 3 dB(A) increase represents a doubling in sound energy but would be only just perceptible to a human ear.

The attached chart gives typical noise levels in terms of dB(A) for common situations.

Noise levels can vary with time according to source activity and indices have been developed in order to be able to assign a value to represent a period of noise level variations and to correspond with subjective response.

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.
- **$L_{night,outside}$:** This is the A-weighted long-term average sound level measured outside as defined in ISO 1996-2: 1987, determined over all the night periods of a year.
- **Residual noise:** The ambient noise remaining at a given position in a given situation when the noise source under investigation is not there.
- **Rw** The *weighted sound reduction index* determined using the above *measurement* procedure, but weighted in accordance with the procedures set down in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.
- **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

Construction Plant Inventory

Soil Movements:

Plant Type	Sound Power Level	% Operating Time	Distance Ratio
Dozer	106	100	1.0
Excavator/Loader	103	100	1.0
Dump Truck	107	100	1.0
8 Wheel Tipper	107	100	1.0
Lorry	103	100	1.0

Piling:

Plant Type	Sound Power Level	% Operating Time	Distance Ratio
Piling Rig (percussive)	116	100	1.0
Truck Mixer	107	100	1.0
Concrete Pump	110	100	1.0
Poker Vibrator	106	100	1.0
Lorry	103	100	1.0

General Site Noisy Activities:

Plant Type	Sound Power Level	% Operating Time	Distance Ratio
Excavator	104	100	1.0
HGV	103	100	1.0
Dumper	104	100	1.0
Telehandler	105	100	1.0
Compressor	95	100	n/a
Generator	103	100	n/a
Mobile Crane	98	100	1.0

Infrastructure Construction:

Plant Type	Sound Power Level	% Operating Time	Distance Ratio
Asphalt Melter	103	100	1.0
Asphalt Spreader	96	100	1.0
Road Roller	102	100	1.0
Lorry	103	100	1.0
Poker Vibrator	106	100	n/a
Concrete pump	103	100	n/a
Compressor	95	100	n/a

Building Construction:

Plant Type	Sound Power Level	% Operating Time	Distance Ratio
Excavator	106	100	1.0
Steelwork Erection	108	100	1.0
Concrete Pump	103	100	1.0
Concrete Vibrators	106	100	1.0
HGV	103	100	1.0
Cutting/Grinding	107	100	n/a
Hydraulic Pump	106	100	n/a

Appendix 3

Assumed Noise Levels for Site Plant & Cladding Performance (including additional noise mitigation measures)

Plant Type or Area	Treatment (Cladding Performance Rw) dB	Sound Power (SWL) Sound Pressure Level (SPL) at roof/walls	Assumed % Operating Time	Period of Operation
Bunker (walls/roof)	41 (double skin insulated)	80 (SPL)	100	Daytime/Night-time
Furnace & Boiler Room (walls/roof)	41	85 (SPL)	100	Daytime/Night-time
Tipping Hall (walls/roof)	41	80 (SPL) 70 (SPL)	100 100	Daytime Night-time
Fan Stack (top)	Silencer	90 (SWL)	100	Daytime/Night-time
Flue Gas Treatment (walls/roof)	41	85 (SPL)	100	Daytime/Night-time
Turbine Hall (walls/roof)	41	95 (SPL)	100	Daytime/Night-time
Ash Handling (walls/roof) IBA	25 (composite)	75 (SPL)	100	Daytime/Night-time
Workshop	25	80 (SPL)	100	Daytime/Night-time
Water Treatment	25	80-83 (SPL)	100	Daytime/Night-time
Transformer & Sub-station	- 25	85 (SWL)	100	Daytime/Night-time
HGV	-	103 (SWL)	16 per hour max	Daytime
Ventilation louvres	15dB SRI reduction (single bank acoustic louvres or attenuators)	-	100	Daytime/Night-time
Tipping Hall Doors	Doors (auto action type) Rw 12dB	-	100	Daytime/Night-time
Turbine Access Doors	Turbine Door Rw 29dB	-	100	Daytime/Night-time
Access Doors	Minimum Rw 18dB	-	100	Daytime/Night-time
Mobile Plant	Fitted with non-tonal reversing alarms	-	Variable	Daytime/Night-time
Air Cooled Condenser Fans	Wind Screen above fans	92 (SWL) 6 fans – max overall 100 (SWL)	100	Daytime/Night-time
Turbine Air Cooler Fans	-	95 (SWL) Overall from unit 80 @ 1m (SPL)	100	Daytime/Night-time
Boiler roof vents	Silencer	90 (SWL)	100	Daytime/Night-time
Turbine roof vent	Silencer	90 (SWL)	100	Daytime/Night-time
Safety Valve	Silencer	126 (unsilenced SWL)	Occasional	Daytime (where non Emergency)
Noise Character (i.e. tonal, impulsivity and intermittency)	Design of plant to ensure no perceptible noise character at NSRs	-	100	Daytime/Night-time

Appendix 4

Noise Model Settings

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 Proposed Development 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. CadnaA noise modelling software has been used for the predictions.

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 Proposed Development 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:

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

Receiver height assumed = 4.0m (residential)

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_{atm} = d x α [Where d = 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 10ºC 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. The values for each one-third octave band are given below in table 1.

Table 1: Atmospheric absorption attenuation based on temperature of 10ºC and a relative humidity of 70%

Third Octave Band Centre Frequency (Hz)	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**
Atmospheric Absorption Coefficient (dB/km)	0.0785	0.122	0.186	0.28	0.411	0.584	0.797	1.04
Third Octave Band Centre Frequency (Hz)	**315**	**400**	**500**	**630**	**800**	**1k**	**1.25k**	**1.6k**
Atmospheric Absorption Coefficient (dB/km)	1.31	1.6	1.93	2.33	2.87	3.66	4.86	6.73
Third Octave Band Centre Frequency (Hz)	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**
Atmospheric Absorption Coefficient (dB/km)	9.66	14.3	21.5	32.8	50.2	76.9	117	175

A_{gr} – Ground Effect

Ground Effect for Calcs

G = 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 a mixed ground absorption to NSR as intervening ground is generally formed mainly by grassland and local road network and is therefore appropriate. I have taken the source height as being the height of the relevant section of building and a receiver height of 4 metres for daytime and night-time operations.

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 local screening from industrial and residential buildings around the site.

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.

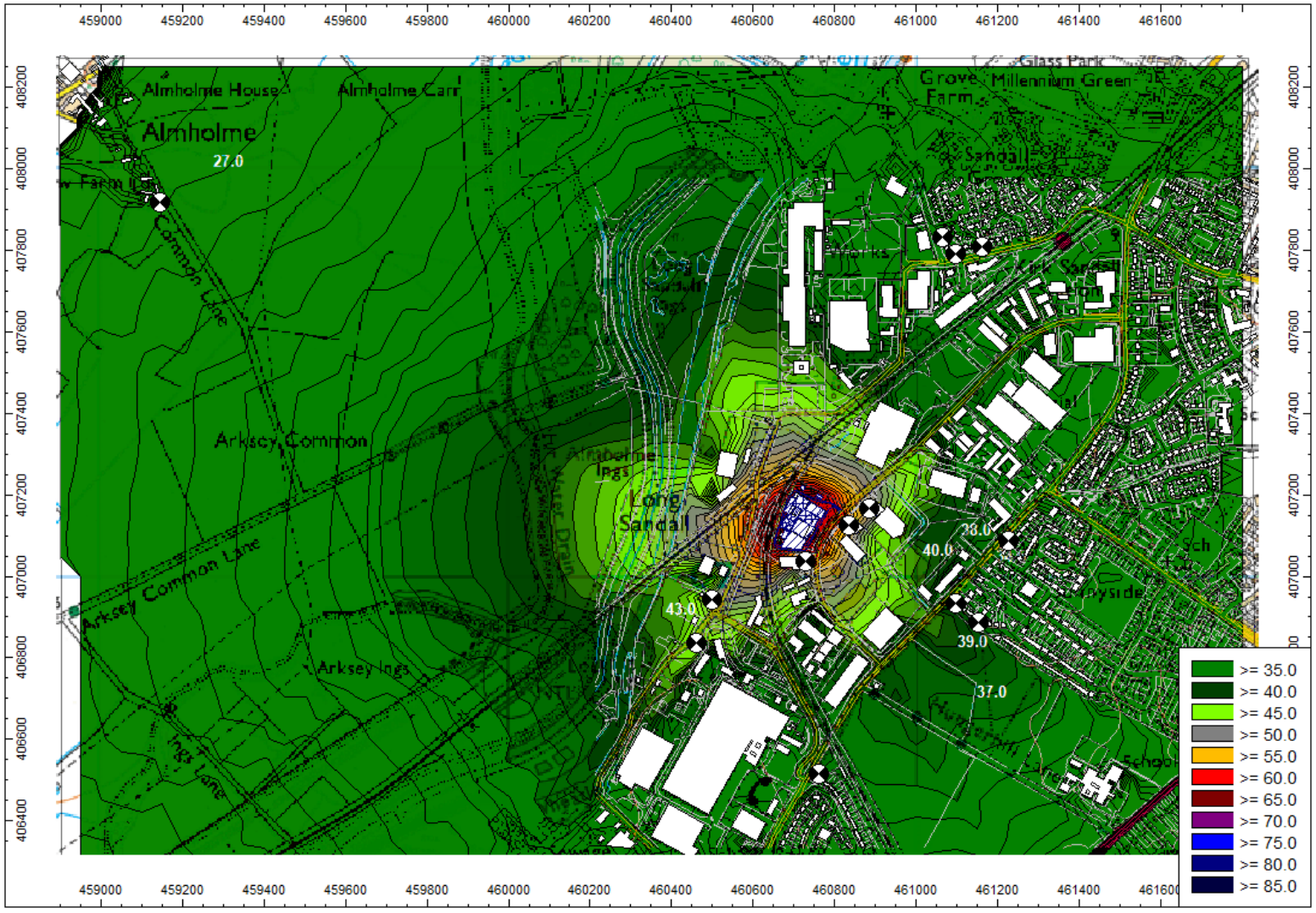
Mobile Plant Noise Sources

The noise model allows for HGV movement around the site (based on a line source). These are accounted for during the daytime operating period based on a maximum of 16 HGV movements in and out per hour.

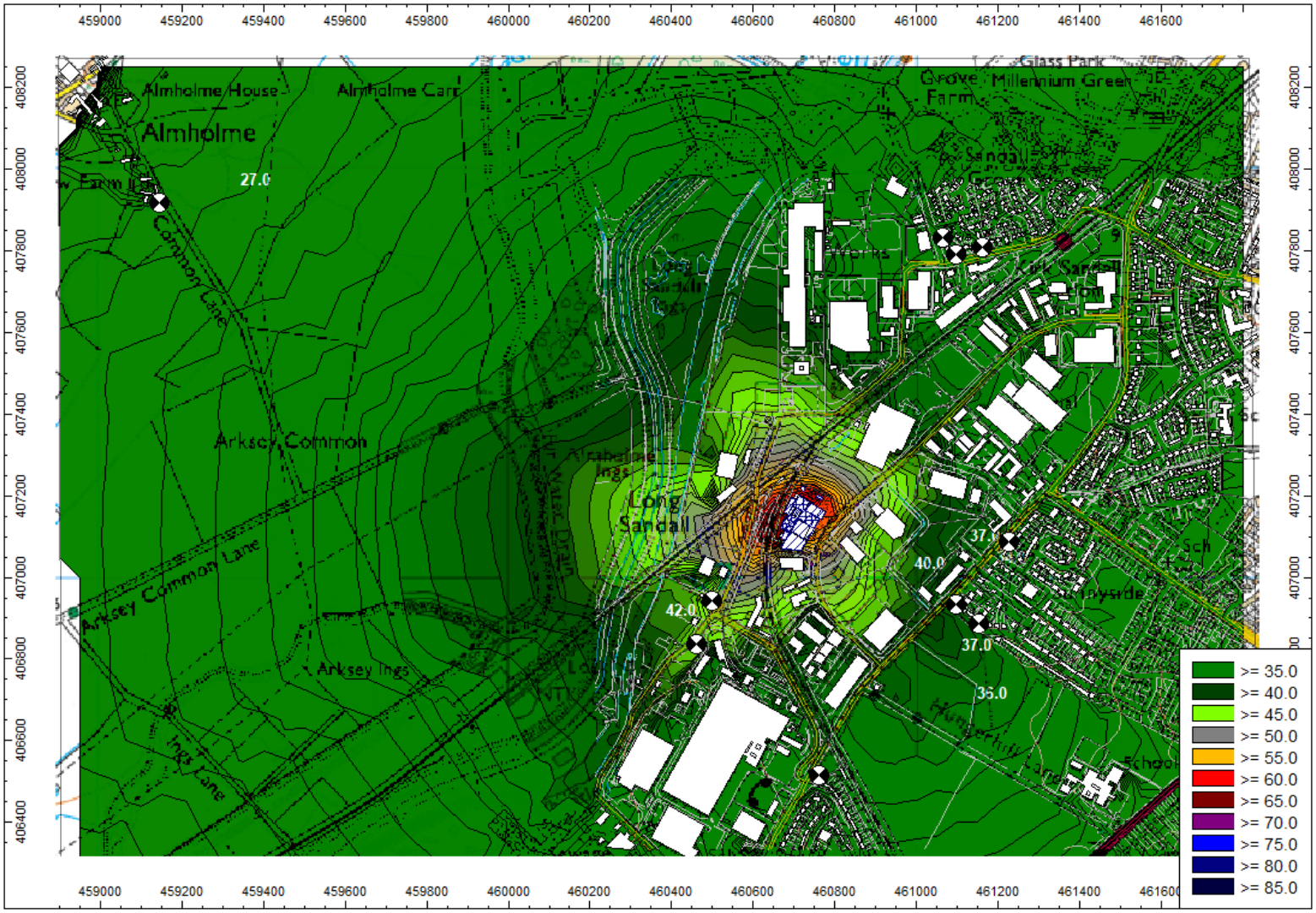
Appendix 5

Noise Mapping Results

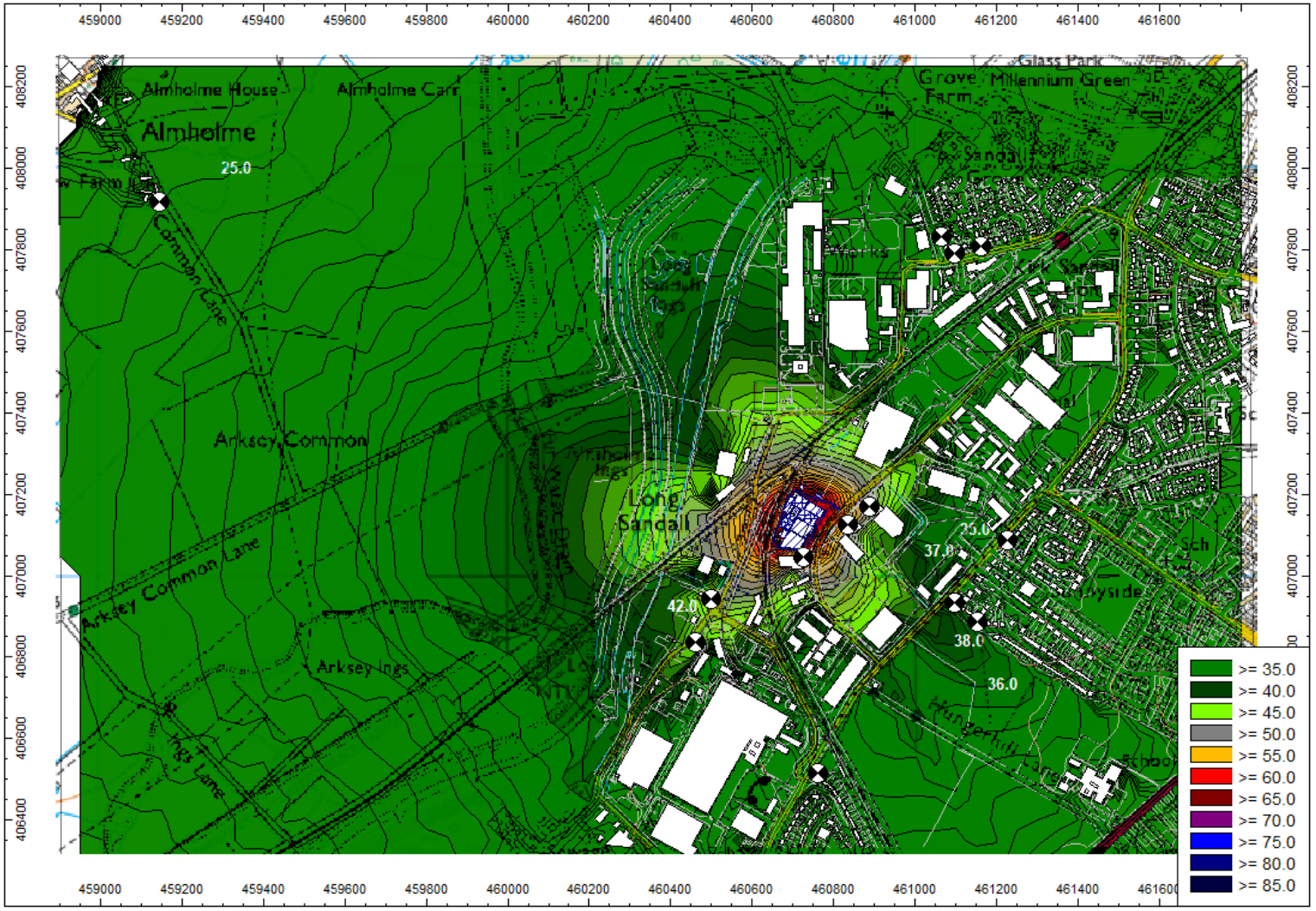
Noise Map 1: Daytime Generating Station Noise Contours (with incorporated noise mitigation)



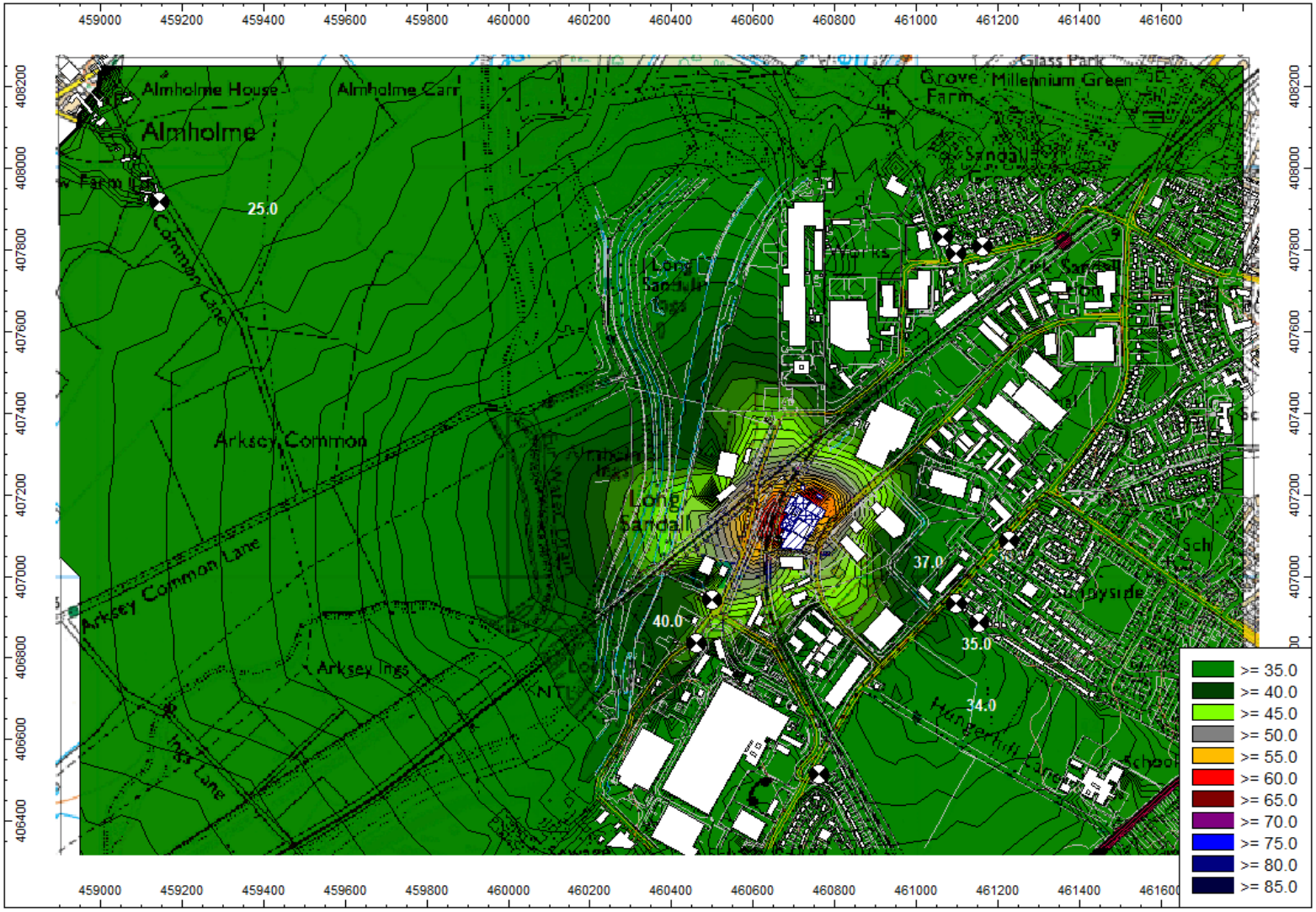
Noise Map 2: Night-time Generating Station Noise Contours (with incorporated noise mitigation)



Noise Map 3: Daytime Generating Station Noise Contours (with additional noise mitigation)



Noise Map 4: Night-time Generating Station Noise Contours (with additional noise mitigation)



Appendix 6

VIBRATION TECHNICAL TERMS

Ground Borne Vibrations

For any source of vibration on or near the surface of the ground, energy propagates away from the source via:

a) Elastic body (or compression) waves – which radiate energy into the ground in all directions
b) Surface (or shear) waves – which carry energy along the ground surface, caused when body waves are reflected back into the ground at the ground-surface interface

Thus, at any point away from that source, the ground motion is the sum of all the wave motions at that point. When wave motion has been generated, the waves will be attenuated as they travel away from the source. The two main mechanisms for attenuation are:

a) Enlargement of the wavefront as the distance from the source increases, and
b) Internal damping of the transmitting medium (the ground)

Ground borne vibration is therefore made up of a combination of different waves, travelling in different directions, at different speeds and at different frequencies. The frequency component of the vibration will affect the rate at which attenuation occurs since the internal damping of the ground is frequency dependent.

Since vibration enters buildings through the foundations, the hard structure of the building is normally affected to a greater degree than by air borne vibration. Often ground borne vibrations are more noticeable when standing or sitting near the middle of suspended wooden floors.

Ground Borne Vibration Measurement Units

Ground borne vibration is caused when the individual particles making up the strata are caused to oscillate by the passage of a pressure wave. The resulting vibration can be summarized in terms of 4 main parameters:

a) **Velocity** – how fast the particles move when they are oscillating. Since the velocity of these particles continually change as the pressure wave passes the most useful value that is often reported is the maximum or peak particle velocity (PPV). PPVs are usually expressed in terms of ms^{-1} or mms^{-1}.

b) **Acceleration** – is the rate at which the particle velocity changes during oscillation. It is usually measured in ms^{-2} mms^{-2} or "g's". 1g is that acceleration imparted to an object by the earth's gravitational pull and is approximately 9.81 ms^{-2}.

c) **Displacement** – is the distance moved by oscillating particles. This is usually very small and measured in mm or even µm.

d) **Frequency** – is the number of oscillations per second which a particle undergoes due to the passage of a vibration wave. It is measured in cycles per second or Hertz (Hz).

The movement of particles induced to oscillate by vibration waves are usually measured in three mutually perpendicular directions to fully describe the vibration intensity, as particles will be oscillating in three dimensions. These are:

a) **Longitudinal** – back and forth particle movement in the same direction that the vibration wave is travelling.

b) **Vertical** – up and down movement perpendicular to the direction the vibration wave is travelling.

c) **Transverse** – left and right particle movement perpendicular to the direction the vibration wave is travelling.