6.0 Noise and Vibration

6.1 Introduction

6.1.1 This chapter of the ES has been prepared by WYG and assesses the likely significant environmental effects from the Proposed Development with regard to noise and vibration.

6.1.2 The chapter sets out the methodology followed in undertaking the assessment and provides a review of the baseline features and resources of the Site and surrounding area. A separate Noise Technical Report to this chapter is found in Appendix 6.1.

6.1.3 The effects of the Proposed Development at existing receptors have been established. Where relevant, mitigation measures are proposed to minimise adverse effects of the Proposed Development during both the construction and operational phases of the scheme. The likely residual effects of the Proposed Development are then stated.

6.2 Methodology and Scope

Policy Background

National Planning Policy

National Planning Policy Framework (2019)

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

6.2.2 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;"

6.2.3 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."

Noise Policy Statement for England

6.2.4 The Noise Policy Statement for England (NPSE) was published on 15 March 2010. It sets out the long-term vision of government noise policy, to "*promote good health and a good quality of life through the management of noise within the context of Government policy on sustainable development*".

6.2.5 The long-term vision is supported by the following 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.*"

6.2.6 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.

6.2.7 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."

6.2.8 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 considering 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.

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

Planning Policy Guidance: Noise (2014)

6.2.10 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.

6.2.11 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."*

6.2.12 With respect to noise, Planning Practice Guidance: Noise (PPG) provides a summary of the effects of noise exposure which is set out in Table 6.1:

Table 6.1 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
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

6.2.13 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*."

6.2.14 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

6.2.15 The Doncaster Council Core Strategy (2011 - 2028) has one Policy relevant to noise. Policy CS1 (Quality of Life) states:

E) '*Protect local amenity and are well-designed, being: attractive; fit for purpose; locally distinctive; and; capable of achieving nationally recognised environmental, anti-crime and design standards.*'

Guidance and Standards

<u>BS 4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'</u>

6.2.16 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).

6.2.17 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."

The subjective method adopted includes the character corrections set out in Table 6.2.

Table 6.2: BS4142:2014+A1:2019 Noise 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

BS 8233: (2014) – "Sound and noise reduction for buildings – Code of Practice"

6.2.18 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.

6.2.19 The guidance provided in section 7.7 of BS8233 provides recommended internal ambient noise levels for resting, dining and sleeping within residential dwellings. Table 6.3 provides detail of the levels given in the standard.

Table 6.3 BS8233: 2014 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Rooms	35 $L_{Aeq,16hour}$	-
Dining	Dining Room Area	30 $L_{Aeq,16hour}$	-
Sleeping (Daytime resting)	Bedroom	35 $L_{Aeq,16hour}$	30 $L_{Aeq,8hour}$
Study and Work Requiring Concentration	Staff/Meeting Room, Training Room Executive Office	35-45 $L_{Aeq,8hour}$	-

6.2.20 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 to 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].

6.2.21 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

6.2.22 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

6.2.23 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

6.2.24 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."

Institute of Environmental Management & Assessment (IEMA) "Guidelines for Environmental Noise Impact Assessment" (October 2014)

6.2.25 *"The guidelines provide key principles of noise impact assessment and are applicable to all development proposals where noise effects are likely to occur."* Specific support on how noise impact assessment fits within the Environmental Impact Assessment process (EIA) and approaches to derive the significance of effect of a Proposed Development are provided. It is considered that this assessment conforms with the principles outlined in this recent guidance.

Road Traffic Noise

6.2.26 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.

6.2.27 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).

6.2.28 For the ERF 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.

6.2.29 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.

6.2.30 Traffic data for the CRTN assessment presented in this chapter is based on the figures contained within the Transport Assessment (TA), Appendix 2.2. 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.

6.2.31 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: 2009 +A1:2014 - "Code of practice for noise and vibration control on construction and open sites"

6.2.32 This gives "basic information and procedures for noise and vibration control". As part of a Construction Environmental Management Plan (CEMP) which will be submitted prior to commencement of each relevant phase of the development the recommendations presented within this standard will be used to reduce the potential effect of noise on local residential properties from activity on-site during the construction phase.

Ground Vibration

6.2.33 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.

6.2.34 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.

6.2.35 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.

6.2.36 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.

6.2.37 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.

6.2.38 BS5228-2:2009 Annex B Table B.1 gives guidance on the effects of vibration levels, which is summarised in Table 6.4.

Table 6.4: 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.

6.2.39 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

6.2.40 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.

6.2.41 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.

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

Scoping Assessment Stage

6.2.43 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.

6.2.44 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.

6.3 Assessment Methodology

6.3.1 The assessment has been based on a widely used and accepted 'significance matrix assessment approach' which is based on the characteristics of the impact (magnitude and nature) and the sensitivity of the receptor. This allows the relative significance of effects to be determined on a scale and ultimately the likely significant effects to be determined, as explained in the following subsections.

6.3.2 The study area comprises the Site and surrounding area which is defined by the extent of the traffic assessment.

Noise Predictions

6.3.3 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 6.1 provides further detail of the noise model settings and assumptions made in respect of plant noise levels.

6.3.4 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 provided from a number of technology providers who are involved in the detailed design of such developments.

Level and Significance of Effect

6.3.5 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.

6.3.6 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 Generating Station.

Magnitude of Effect

Construction Noise

6.3.7 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.

6.3.8 The construction impact semantic scale, set out in Table 6.5 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.

6.3.9 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 6.5.

Table 6.5 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

6.3.10 The magnitude of impact for construction noise is outlined in Table 6.6 (as defined in DMRB LA 111).

Table 6.6 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)	Above or equal to SOAEL +5dB

Construction Road Traffic Noise

6.3.11 According the LA 111 guidelines, the magnitude of impact at noise sensitive receptors from construction traffic is set out in Table 6.7.

Table 6.7 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)	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

6.3.12 For construction phase vibration the LOAEL and SOAEL is set out in DMRB LA 111 and provided in Table 6.8.

Table 6.8: Construction Vibration LOAEL's and SOAEL's

Time Period	LOAEL	SOAEL
All Time Periods	0.3mm/sec PPV	1.0mm/sec PPV

6.3.13 The magnitude of impact for construction vibration is therefore determined in accordance with Table 6.9, as defined in DMRB LA 111.

Table 6.9 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)	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

6.3.14 In order to enable the assessment of the Proposed Development in terms of LOAEL and SOAEL, Table 6.10 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 6.10 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

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 below: *Bedrooms: 30 dBL$_{Aeq,8hours}$* *Living Rooms: 35 dBL$_{Aeq,16hours}$*	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
		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$_{Aeq,16hours}$

6.3.15 Whilst the noise descriptors and categories presented in Table 6.10 have been established through reference to relevant guidance documents, there are numerous other factors which need to be taken into account when assessing the noise impact. Therefore, a flexible approach to these categories will be undertaken in the context of how specific impacts associated with the Proposed Development 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 building services 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

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

6.3.17 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.

6.3.18 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 6.11 for the short term and 6.12 for the long term.

Table 6.11 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 6.12 Magnitude of Change – Road Traffic Noise- Long Term

Short term magnitude	Short 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

6.3.19 Key receptors to noise generally include individual or groups of residential properties, hospitals and schools. Table 6.13 provides methodology for assessing sensitivity relative to the receptor type and tranquillity of the associated area.

6.3.20 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 6.13 relate to CPRE tranquillity ratings with Zone 1 being an area with the 'least- tranquil' and Zone 10 being 'most-tranquil'.

Table 6.13 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)

Effect Significance

6.3.21 Table 6.14 shows how the interaction of magnitude and sensitivity results in the significance of an environmental effect.

Table 6.14 Significance of Effects Matrix

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

6.3.22 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.

6.3.23 For the purposes of this ES, an effect identified as being of Intermediate significance or greater, based on the descriptors presented in Table 6.14 is considered to be significant in EIA terms. Where a departure from this approach has been taken this is justified accordingly.

Limitations of the Assessment

6.3.24 Specific details regarding construction works are not currently available as the Contractor 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.

6.3.25 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. However, this is considered to be a robust assessment as baseline levels are unlikely to have changed significantly.

6.4 Baseline Environment

Existing baseline

6.4.1 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.

6.4.2 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

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

Table 6.15 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

6.4.4 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 6.13.

6.4.5 The nearest commercial receptors (i.e. offices associated with industrial units) are represented below in Table 6.16.

Table 6.16 Existing Commercial Receptor Locations

NSR Ref.	Description	Approximate Distance to Source (m)	Grid Reference X Y
C1	Aggreko	70	460889 407168

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

6.4.1 A baseline monitoring survey was undertaken at seven locations from Thursday 18th August 2016 to Tuesday 24th August 2016. 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 6.1.

6.4.2 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 6.17 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

6.4.3 The results of the baseline measurements conducted during the survey are summarised in Table 6.18. 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 6.18 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

Future baseline

6.4.4 It is anticipated that the future baseline will be similar to the existing conditions.

6.5 Assessment of Effects

Incorporated Mitigation

Construction Phase

6.5.1 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 Contractor to develop and implement.

6.5.2 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 suitable 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.

6.5.3 The CEMP will be implemented during the construction phase. 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.

6.5.4 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

6.5.5 Predicted noise levels from the ERF have been calculated using the noise levels provided within Appendix 6.1. These noise levels are based on library data from similar plant used on other UK sites and include the following assumed inherent 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 95dB(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 6.1.
(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

6.5.6 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.

6.5.7 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 6.15 and 6.16. 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.

6.5.8 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.

6.5.9 The assessment of construction noise is presented in Table 6.19 at residential and commercial receptors to establish which receptors fall below the threshold levels according to Table 6.5, which is based on the BS5228 `ABC' method.

6.5.10 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 6.19 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

All values are sound pressure levels in dB re: $2x\ 10^{-5}$ 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.

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

6.5.12 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.

6.5.13 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 6.5.3. 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

6.5.14 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.

6.5.15 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.

6.5.16 Table 6.20 outlines the highest likely vibration levels that could be experienced during construction at the NSRs (i.e. during Piling activities).

Table 6.20 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

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)
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

6.5.17 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

6.5.18 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

6.5.19 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.

6.5.20 Details of the above plant source noise levels are presented in Appendix 6.1, with a summary of the results and assessment in EIA terms presented below.

Operational Noise

6.5.21 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 6.21 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.

6.5.22 The impacts established in Table 6.21 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 6.6.

Operational Road Traffic Noise

6.5.23 The Transport Assessment considers the assessment opening year (2022) and future year (2030) for the traffic demand relating to the ERF compared to a 'Do-nothing' scenario. Table 6.22 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.

6.5.24 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 6.22.

Table 6.22 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.

6.5.25 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

6.5.26 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.

6.6 Additional Mitigation, Compensation and Enhancement Measures

Construction

6.6.1 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

6.6.2 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 ERF 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 ttypical 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.

6.6.3 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.

6.7 Residual Effects and Conclusions

6.7.1 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.

6.7.2 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.

6.7.3 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.

6.7.4 The following analysis considers the residual effect of the additional mitigation measures on the predicted operational noise levels. Table 6.23 below provides information on the predicted noise levels during daytime and night-time operations from the ERF (07.00 to 23.00).

Table 6.23 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.

6.7.5 The predicted noise levels reflect site attributable noise with the additional noise control measures. According to Table 6.10, 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.

6.8 Assessment Summary and Likely Significant Residual Environmental Effects

Construction

6.8.1 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.

6.8.2 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.

6.8.3 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.

6.8.4 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.

6.8.5 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.

6.8.6 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.

6.9 Cumulative impacts

Construction

6.9.1 It is not known whether there will be any overlap during the construction phase of the Proposed Development with construction work occurring in other committed developments. Should this occur, it is expected that mitigation within each separate consent will ensure significant cumulative effects do not arise.

Operation

6.9.2 No other developments have been assessed with regard to the operational phase.

Table 6.24 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 (BS 4142:2014+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

6.10 References

6.10.1 The Environmental Protection Act 1990 HMSO

6.10.2 Noise Policy Statement for England, March 2010 Defra

6.10.3 The National Planning Policy Framework 2019.

6.10.4 Planning Practice Guidance: Noise 2014

6.10.5 The British Standards Institute, BS 8233: 2014: Sound insulation and noise reduction for buildings – Code of practice.

6.10.6 The World Health Organisation: 1999: Guidelines for community noise.

6.10.7 The design manual for roads and bridges (DMRB): LA 111 Noise and Vibration

6.10.8 BS 4142: 2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'

6.10.9 Institute of Environmental Management & Assessment (IEMA): October 2014 - Guidelines for Environmental Noise Impact Assessment

6.10.10 Doncaster Council Core Strategy (2011 - 2028)

6.10.11 BS 5228: 2009+A1:2014 Noise and Vibration Control on Construction and Open Sites – Part 1: Noise

6.10.12 BS 7445-1:2003 The Description and Measurement of Environmental Noise: Guide to quantities and procedures

6.10.13 http://www.cpre.org.uk/resources/countryside/tranquil-places?start=60

6.10.14 Developing an Intrusion Map of England (August 2007), CPRE

6.10.15 The Department of Transport and the Welsh Office: 1988: Calculation of road traffic noise.

6.10.16 Horizontal Guidance Note, IPPC H3 (Part 2) (Amended June 2004)

6.11 Glossary

6.11.1 Presented within Noise Technical Report in Appendix 6.1.