NORTH LINCOLNSHIRE GREEN ENERGY PARK

Planning Act 2008

Infrastructure Planning (Applications Prescribed Forms and Procedure) Regulations 2009

APFP Reg. 5(2)(a)

Infrastructure (Environmental Impact Assessment) Regulations 2017

North Lincolnshire Green Energy Park

Volume 6

Environmental Statement

6.2.7 Noise

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Acronyms and Abbreviations

Name	Description
AAWT	Annual Average Weekday Traffic
ACC	Air Cooled Condensers
BNL	Basic Noise Level
BPM	Best Practicable Means
BS	British Standard
CEMP	Construction Environmental Management Plan
CoCP	Code of Construction Practice
CoPA	Control of Pollution Act
CRN	Calculation of Railway Noise
CRTN	Calculation of Road Traffic Noise
DCO	Development Consent Order
DHPWN	District Heat and Private Wire Network
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
ERF	Energy Recovery Facility
ERM	Environmental Resources Management
ES	Environmental Statement
HGV	Heavy Goods Vehicle
IPC	Infrastructure Planning Commission
LOAEL	Lowest Observed Adverse Effect Level
NIA	Noise Important rea
NLC	North Lincolnshire Council
NLGEP	North Lincolnshire Green Energy Park
NOAEL	No Observed Adverse Effect Level
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NPSE	Noise Policy Statement for England
NSIP	Nationally Significant Infrastructure Project
NSR	Noise Sensitive Receptor
PEIR	Preliminary Environmental Information Report
PPG	Planning Practice Guidance
PPV	Peak Particle Velocity
RDF	Refuse Derived Fuel
SOAEL	Significant Observed Adverse Effect Level

Name	Description
TRL	Transport Research Laboratory
UAEL	Unacceptable Adverse Effect Level

1. INTRODUCTION

1.1.1.1 This chapter presents the results of the assessment of noise and vibration from the construction, operation and decommissioning of the Project.

1.1.1.2 The assessment takes into account local and national policy, guidance and regulations in identifying likely significant effects.

1.1.1.3 This chapter describes the methodologies which have been followed in quantifying the existing baseline conditions, the potential effects from the Project, the mitigation measures included to address any likely significant adverse effects and the potential residual effects following mitigation. The potential for cumulative impacts is considered in Chapter 18 (**Document Reference 6.2.18**).

2. POLICY CONTEXT, LEGISLATION, GUIDANCE AND STANDARDS

2.1.1.1 The noise and vibration assessment has been carried out in the context of the noise policy, and planning policy and guidance in England. This section sets out how the approach taken meets these requirements.

2.1.1.2 The Overarching National Policy Statement (NPS) for Energy (EN-1)[1] and National Policy Statement for Renewable Energy Infrastructure (EN-3)[2] contain the relevant policies for noise from developments which have been referred to in this assessment. Other policy and guidance may also be important and relevant and includes the Noise Policy Statement for England 2010[3] (NPSE), the National Planning Policy Framework 2021 (NPPF), and the Government's planning guidance on noise (PPGN)[4]. This assessment has also been prepared in accordance with the Infrastructure Planning (IP) Environmental Impact Assessment (EIA) Regulations 2017 (as amended).

2.2 National Policy Statements for Energy

2.2.1.1 Section 5.11 of the Overarching National Policy Statement (NPS) for Energy (EN-1) refers to the Government's policy on noise within the Noise Policy Statement for England (discussed further below) and sets out requirements for noise and vibration assessment for Nationally Significant Infrastructure Projects (NSIP), such as the Project.

2.2.1.2 NPS EN-1 provides advice on decision-making guidance and states:

2.2.1.3 "The Project should demonstrate good design through selection of the quietest cost effective plant available; containment of noise within buildings wherever possible; optimisation of plant layout to minimise noise emissions; and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission." (See paragraph 5.11.8)

2.2.1.4 Section 7 describes the impact avoidance measures identified relevant to the Project.

2.2.1.5 Table 1 provides a summary of the NPS advice regarding noise and vibration and how each has been considered in this chapter.

[1] Overarching National Policy Statement (NPS) for Energy (EN-1), Department of Energy and Climate Change, 2011.

[2] National Policy Statement for Renewable Energy Infrastructure (EN-3), Department of Energy and Climate Change, 2011.

[3] Department for Environment, Food and Rural Affairs (Defra) (2010), Noise Policy Statement for England, Defra.

[4] Department for Communities and Local Government (DCLG) (2014), Planning Practice Guidance – Noise.

Table 1: Description of where the Assessment Meets the Requirements of NPS - EN1 and EN3

Summary of NPS	Consideration within chapter
NPS-EN1	
Paragraph 5.11.4 states: "Where noise impacts are likely to arise from the proposed development, the applicant should include the following in the noise assessment: A description of the noise generating aspects of the development proposal leading to noise impacts, including the identification of any distinctive, tonal, impulsive or low frequency characteristics of the noise; Identification of noise sensitive premises and noise sensitive areas that may be affected; The characteristics of the existing noise environment; A prediction of how the noise environment will change with the proposed development; In the shorter term such as during the construction period; In the longer term during the operating life of the infrastructure; At particular times of the day, evening and night as appropriate; An assessment of the effect of predicted changes in the noise; and Measures to be employed in mitigating noise. The nature and extent of the noise assessment should be proportionate to the likely noise impact."	Descriptions of noise generating aspects of the Project, together with assessment of construction and operational noise and vibration impacts are presented in Sections 4 and 8. Noise Sensitive Receptors (NSR) including proximity of any Noise Important Areas (NIA) are identified in Table 12 and Figure 1 in Appendix A. Information relating to the existing noise environment is presented in Section 6. The mitigation of construction and operational noise is discussed in Section 7 and residual effects are discussed in Section 9
Paragraph 5.11.5 states: "The noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation, should also be considered."	Potential construction and operational related road and rail-traffic noise effects have been assessed in Sections 8.3, 8.4, 8.6 and 8.7. The operation of the wharf has been assessed in Section 8.5.
Paragraph 5.11.6 states: "Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance. Further information on the assessment of particular noise sources may be contained in the technology-specific NPSs. In particular, for…electricity networks (EN-5) there is assessment guidance for specific features of those technologies. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards and other guidance which also give examples of mitigation strategies."	Potential operational noise effects on human NSRs are presented in Section 8. The appropriate standards that have been used to assess the noise are described in Section 5.

Summary of NPS	Consideration within chapter
Paragraph 5.11.7 states: "The applicant should consult EA and Natural England (NE), as necessary and in particular with regard to the assessment of noise on protected species or other wildlife. The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be taken into account."	Potential effects of noise on biodiversity and nature conservation are considered in Chapter 10: Ecology and Nature Conservation (**Document Reference 6.2.10**).
NPS-EN3	
Paragraph 2.4.2 States "Proposals for renewable energy infrastructure should demonstrate good design in respect of landscape and visual amenity, and in the design of the Project to mitigate impacts such as noise and effects on ecology."	Potential effects of noise on biodiversity and nature conservation are considered in Chapter 10: Ecology and Nature Conservation (**Document Reference 6.2.10**). Potential effects in terms of landscape and visual impact are considered in Chapter 11:Landscape and Visual Impact (**Document Reference 6.2.11**).
Paragraph 2.5.25 states "If the existing access is inadequate and the applicant has proposed new infrastructure, the IPC will need to be satisfied that the impacts of the new infrastructure are acceptable as set out in Section 5.13 of EN-1"	Potential construction and operational related road and rail-traffic noise effects have been assessed in Sections 8.3, 8.4, 8.5.1.12 and 8.7. The operation of the wharf has been assessed in Section 8.5.
Paragraph 2.5.53 states "Generic noise and vibration impacts are covered in detail in Section 5.11 of EN-1. In addition, there are specific considerations that apply to biomass and EfW generating stations as set out below. Sources of noise and vibration may include: delivery and movement of fuel and materials; processing waste for fuel at EfW generating stations; the gas and steam turbines that operate continuously during normal operation; and external noise sources such as externally-sited air-cooled condensers that operate continuously during normal operation."	The potential effects of the operation of the facility are considered in Section 8 taking into account the features that are specific to EfW generating stations.
Paragraph 2.5.54 states "The ES should include a noise assessment of the impacts on amenity in case of excessive noise from the Project as described in Section 5.11 in EN-1"	The potential effects on the operation of the facility are considered in Section 8.
Paragraph 2.5.55 states "The IPC should consider the noise and vibration impacts according to Section 5.11 in EN-1. It should be satisfied that noise and vibration will be adequately mitigated through requirements attached to	The mitigation of construction and operational noise is discussed in Section 7 and residual effects are discussed in Section 9.

Summary of NPS	Consideration within chapter
the consent. The IPC will need to take into consideration the extent to which operational noise will be separately controlled by the EA." Paragraph 2.5.56 states "The IPC should not grant development consent unless it is satisfied that the proposals will meet the aims set out in paragraph 5.11.9 in EN-1".	
Paragraph 2.5.57 states "As described in EN-1, the primary mitigation for noise for biomass and EfW generating stations is through good design to enclose plant and machinery in noise-reducing buildings, wherever possible, and to minimise the potential for operations to create noise. Noise from gas turbines should be mitigated by attenuation of exhausts to reduce any risk of low-frequency noise transmission." Paragraph 2.5.58 states "Noise from features including sorting and transport of material during operation of biomass or EfW generating stations is unavoidable. Similarly, noise from apparatus external to the main generating station may be unavoidable. This can be mitigated through careful plant selection"	Descriptions of noise generating aspects of the Proposed Development, together with assessment of construction and operational noise and vibration impacts are presented in Sections 4 and 8.

2.3 Noise Policy Statement for England

2.3.1.1 The NPS is the policy against which the Project will be assessed, however, other national and local policy and guidance can form important and relevant considerations, but in the event of any inconsistency, the NPS takes precedence.

2.3.1.2 The aims of the NPSE are, "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."

2.3.1.3 The explanatory note to NPSE introduces the following concepts:

- Lowest Observed Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

2.4 Planning Guidance on Noise

2.4.1.1 The PPGN provides more in-depth guidance to the NPPF. It introduces the additional concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level). A summary of the guidance on effect levels from the PPGN is provided in Table 2.

Table 2: PPGN Guidance on Noise Adverse Effect Levels

Response	Examples of outcomes	Increasing effect level	Action
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up the volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum

Response	Examples of outcomes	Increasing effect level	Action
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. 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
Unaccptable Adverse Effect Level			
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

2.4.1.2 The Infrastructure EIA Regulations 2017 require the identification of 'likely significant effects'. Where, in terms of government noise policy, the predicted noise or vibration indicates a significant adverse effect on health and quality of life (i.e. the level exceeds the relevant SOAEL), then the assessment will identify a likely significant adverse effect. In line with the aims of the NPSE, the assessment also considers situations where the predicted noise or vibration level is above LOAEL but below SOAEL.

2.4.1.3 North Lincolnshire Council's (NLC) Planning for Renewable Energy Development Supplementary Planning Document (2011)[5] focuses on the noise from windfarms in Policy 8, which is not relevant to the Project. However, Policy 10 requires that

> *'In preparing proposals for renewable energy development, developers should address the cumulative impact that the scheme could have on North Lincolnshire, taking into account operational and approved developments, any extensions to operational or approved proposals, and other proposals being advanced through the planning system. Any assessments should address cumulative visual and landscape impacts, as well as hydrology, hydrogeology, ecology, traffic and transport, aviation and radar, noise, recreation and local amenity impacts.'*

2.4.1.4 The cumulative impacts are discussed in Chapter 18 (**Document Reference 6.2.18**).

2.4.1.5 Other guidance, standards and regulations relevant to this assessment are listed below:

[5] Planning for Renewable Energy Development Spatial Planning Regeneration and Planning North Lincolnshire Council, 2011.

- BS 5228: ‘Code of Practice for noise and vibration control on construction and open sites’ (parts 1 Noise and 2 Vibration);
- BS 4142: ‘Methods for rating and assessing industrial and commercial sound’;
- BS 8233 ‘Guidance on sound insulation and noise reduction for buildings’ defines criteria for noise levels in and around buildings’;
- ‘Design Manual for Roads and Bridges (DMRB): LA 111 - Noise and Vibration’; and
- The Noise Insulation (Railway and Other Guided Systems) Regulations 1996.

2.4.1.6 The way in which these documents are used when assessing noise and vibration from the Project is set out in Section 5.

3. CONSULTATION

3.1.1.1 Table 3 and Table 4 below respectively present excerpts from the scoping opinion received from the Planning Inspectorate and consultation responses on the PEIR specific to the Noise and Vibration assessment. The tables describe how each response has been or will be addressed by the Project, and, as appropriate where more information can be found in the ES.

Table 3: Scoping Consultation Responses

PINS ID	Issue	Inspectorate's comments	Response / Action	Reference within this document
8.7.1.2	Proposed to be scoped out: Noise and vibration impacts from operational railway usage	The Applicant proposes to scope out this matter on the basis that noise and vibration from railway usage is "expected to decay below appropriate threshold" over 30m from the railway line, and that no sensitive receptors are within 30m of the railway line. The Inspectorate does not consider sufficient evidence has been provided within the Scoping Report to support this assumption, and therefore does not agree that this matter can be scoped out of the ES.	Noise effects from the railway have been assessed. Supporting evidence has been included to demonstrate that significant vibration effects are unlikely.	See Section 8.1.2.
8.3	Baseline	Noise monitoring should be carried out to a recognised standard, such as BS7445-1:2003 with detailed survey and conditions data presented. Paragraphs 8.3.1.2 and 8.3.1.3 states that only the village of Amcotts, Neap House, and Flixborough will have noise surveys conducted, but the actual location of the noise monitoring has not been stated. The ES should include the grid references and a figure(s) depicting the noise monitoring locations. In addition, considering the extent of the Proposed Development's order limits, the ES should provide robust justification for how three locations accurately represent the baseline noise level across the entire study area, taking into account, the proposed order limits come into close	Baseline noise monitoring has been carried out in accordance with BS7445-1:2003 at 10 locations. Noise levels were logged continuously for approximately 10 days at five locations around the site, with attended measurements carried out at a further five locations. The monitoring locations were chosen in consultation with North Lincolnshire Council to represent the nearest noise sensitive receptors to all of the Project elements including the wharf and the District Heat Private Wire Network (DHPWN). Baseline traffic information is provided.	The noise monitoring locations are shown in Figure 1 of Appendix A. The results of the baseline monitoring are summarised in Section 6, whilst full details are provided in Appendix B.

PINS ID	Issue	Inspectorate's comments	Response / Action	Reference within this document
		proximity to human receptors in Scunthorpe, Dragonby and receptors close to the proposed road work activities on the M181 and A1077. Furthermore, noise impacts from the wharf and river activities may impact settlements upstream of the Proposed Development such as Burton Upon Stather. Therefore, the noise impact from river traffic should also be considered when determining the noise monitoring locations. The baseline information regarding the number of river traffic, road and railway traffic should be provided within the ES.		Baseline traffic information is discussed in the relevant sections of the methodology (Section 5) or assessment (Section 8).
8.4.2.1	Construction impacts	The ES should also assess the noise impacts associated with the construction of the wharf, increased river and rail traffic if applicable, earthworks, demolition where necessary, and any construction impacts associated with underground utility works including gas and electricity cables/ pipes and above ground installations. If generators are required to power construction compounds or similar construction sites, the generator noise should also be considered within the assessment.	These identified potential impacts during construction have been assessed, however, construction to extend the wharf is not now required.	See Section 8.1 for the construction assessment. For consideration of public rights of way and public open spaces, see Section 5.2.3.9
8.4.2.2	Construction impacts	In addition to the receptors listed in Scoping Report Paragraph 8.4.2.2 the ES should assess the noise impact from construction activities on locally designated ecological sites and any Public Right of Ways (PRoWs) and bridleways that are situated in proximity to the Proposed Development.	Effects on locally designated ecological sites are considered in Chapter 10: Ecology and Nature Conservation. PRoWs/ bridleways have been considered. However, as they are, by their nature, transitory in use, users are unlikely to be significantly affected by construction noise and vibration and these receptors as described in Section 5.2.3.9.	Chapter 10: Ecology and Nature Conservation (**Document Reference 6.2.10**)

PINS ID	Issue	Inspectorate's comments	Response / Action	Reference within this document
8.4.3	Operational impacts	Noise impacts associated with increased Heavy Good Vehicles travelling to and from the Proposed Development should be considered within the ES.	Operational traffic noise on the wider road network, including HGV movements has been assessed.	The operational road traffic noise assessment may be found in Section 7
8. 5.1.1; and 8.5.1.2	Spatial scope of construction impacts	The ES should include the 'scoping calculation' and any assumptions/ limitations used in the calculation to conclude that construction noise is expected to fall below 65dB 600m from the construction site. If the railway is to be operating during the construction phase of the Proposed Development, noise and vibration associated with the increase in rail traffic should be assessed in the ES. Scoping Opinion for North Lincolnshire Green Energy Park 25 ID Ref Other points Inspectorate's comments. The spatial scope should incorporate any areas that are likely to be impacted by an increase in instruction [Sic] traffic. Vibrational impacts on archaeological assets within the construction area should be assessed and appropriate cross references in the ES between the Cultural Heritage and Noise and Vibration assessments should be made. Note: it has been assumed that the term 'instruction' should read ' construction' when responding to this comment.	The assumptions regarding the spatial extent of construction effects carried out for the scoping report have been refined in the construction assessment in this ES. All significant assumptions/ limitations used in the assessment are reported in the ES. The railway will be open to assist in the supply of building materials and has been assessed in the ES. The work that has been carried out since the PEIR has shown that there are no historic buildings near the proposed site works, with the nearest being in Flixborough village or in Amcotts on the other side of the river. Therefore, no vibration effects on archaeological assets are expected.	The construction assessment may be found in Section 8.1
8.6	Temporal Scope	The ES should provide clarity over the temporal nature of noise impacts *that* will be assessed. The ES should consider defining short term, medium term, long term, and permanent noise impacts and effects.	Potential effects during the operational phase are identified as long term and have been assessed against recognised standards which are appropriate for long-term operational activities. The construction assessment deals	

PINS ID	Issue	Inspectorate's comments	Response / Action	Reference within this document
			with short and medium term impacts, again using appropriate criteria. The duration of impacts is discussed in the construction assessment	
N/A	Assessment methodology	The Scoping Report lists relevant noise assessment methodologies but omits a description of the actual assessment methodology to be applied. The ES should provide a detailed description of the assessment methodology which should include: ■ the criteria used to determine the sensitivity of receptor and the locations of all sensitive receptors (human and ecological); and ■ the criteria used to determine the magnitude of impact, including defined Significant Observed Adverse Effect Level (SOAEL) and the Lowest Observed Adverse Effect Level (LOAEL). To aid the readers understanding of the assessment, the ES should provide figure(s) presenting the locations of all ecological and human receptors impacted by construction and operation noise, and a figure(s) that shows which receptors are likely to be impacted by noise levels above the SOAEL value. The ES should also provide clarification on how the significance of effect will be determined.	Details of the method and criteria adopted for the assessment are set out in the methodology section. Figures showing the location of sensitive receptors and predicted noise from on-site operational activities have been included.	Section 5 Appendix A
N/A	Mitigation	The ES should provide a description of any mitigation measures required to minimise noise impacts on human and ecological receptors. The efficacy of the measures should be stated as well as how the measures will be secured through the DCO or other legal mechanism.	Mitigation measures that the Project is committed to implementing are set out in this report. Construction phase mitigation will be secured through implementation of a Construction Environmental Management Plan (CEMP) that will be developed in detail by the construction contractor (see also Code of Construction Practice, CoCP, **Document Reference 6.3.7**)	Section 7 Section 1

PINS ID	Issue	Inspectorate's comments	Response / Action	Reference within this document
				CoCP (Annex 7) (**Document Reference 6.3.7**)

3.1.1.2 Table 4 below sets out the key stakeholder comments from the pre-application statutory consultation specific to noise. The table describes how each response has been or will be addressed by the Project. Responses have been included when they are directly relevant to the Infrastructure EIA Regulations 2017, have required a technical clarification and / or further impact assessment. The full set of responses is contained in the Consultation Report (**Document Reference: 7.1 Appendix I-1**).

3.1.1.3 The consultee types for the purposes of statutory consultation under the Planning Act 2008 are as follows:

- s42(a) is with prescribed consultees;
- s42(b) is with local authorities;
- s44 is with consultees with an interest in land; and
- s47 is with the local community.

Table 4: PEIR Consultation Responses

Consultee Type	Consultee	Comments	Response / Action	Reference within this document
S42(a)	Burton upon Stather Parish Council	The new access road will create more noise and pollution, for the village of Flixborough.	The new access road has been designed so that all vehicle traffic to the site will approach from the south, off Ferry Road West (B1216), thus avoiding the need for traffic to pass through Flixborough Village. As such, it is not anticipated that Flixborough will experience any increase in noise or pollution from traffic associated with the project.	Section 4

Consultee Type	Consultee	Comments	Response / Action	Reference within this document
S42(b)	North Lincolnshire Council	In addition to the standards and guidance listed in the assessment, reference and consideration should also be made to the following guidance: World Health Organisation Environmental Noise Guidelines for the European Region (2018) World Health Organisation Guidelines for Community Noise (1999) World Health Organisation Night Noise Guidelines for Europe (2009) It is noted that reference has been made to WHO guidance in Section 5.3.3.3 but at no other section.	These documents have been considered where they are relevant to the assessment criteria for the types of noise sources that are being considered. Further details can be found in Chapter 7: Noise of the Environmental Statement (**Document Reference 6.2.7).**	Section 2
S42(b)	North Lincolnshire Council	North Lincolnshire Council are of the view that the cumulative operational rating levels according to BS4142 should not exceed background levels, so that noise levels in the area do not creep up. It is noted that at Section 9.2 it is stated that opportunities for further mitigation will be explored to reduce predicted noise effects which will be reported in the ES.	It is noted that BS4142 states that 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. Avoiding an exceedance of background noise would result in a “Low” level of impact depending on the context. Predicted noise from the Project will be reduced to as low a level relative to background as is reasonably practical. S4142 also suggests that “adverse” impacts occur when exceedances of around 5 dB are predicted, and likely “significant” impacts are not predicted until exceedances reach around 10 dB. These conclusions depend on the context of the sound as discussed in BS4142, and it is this overall consideration which has been used to assess the potential for significant impacts	Section 8

Consultee Type	Consultee	Comments	Response / Action	Reference within this document
			in Chapter 7: Noise of the ES **(Document Reference 6.2.7**).	
S42(b)	North Lincolnshire Council	Section 7.3.1.1 states that a noise management plan will be formulated for control of deliveries. However there is no mention of the control of any other noise sources in this section.	An operational noise management plan will be formulated and agreed with NLC and will cover all noise sources that will require active management of the noise emissions. This is a requirement under Schedule 2 of the DCO.	N / A
S42(b)	North Lincolnshire Council	Section 7.2.1.2 states the lead contractors will obtain prior consent from NLC under Section 61 of the CoPA for the proposed construction work. The consent application will set out BPM measures to minimise construction noise and vibration, including control of working hours, and provide a further assessment of construction noise and vibration, including confirmation of receptor based mitigation provision. The LPA would prefer that a Requirement is applied to any consent granted requiring the submission of a Construction Environmental Management Plan (CEMP) which includes all the above items, to be agreed with the local planning authority. Furthermore, it would be helpful for an outline CEMP to be included as part of the application.	In response to this request, the commitment to apply for consent under Section 61 of the Control of Pollution Act (CoPA) has been replaced with a commitment to submit a CEMP which will be developed by the appointed contractor and agreed with the local planning authority. The main noise management and noise monitoring requirements are described in the CoCP in Annex 7 of the ES (**Document Reference 6.3.7**).	Code of Construction Practice (CoCP) (**Document Reference 6.3.7**).
S47	Local Community	A positive development for the area assuming safety and noise/smell not a problem	We have assessed noise in Chapter 7: Noise of the ES (**Document Reference 6.2.7**). The predicted residual noise effects of construction noise are predicted to be of moderate significance at most. In general, most impacts are on a small number of receptors, or over very short periods of time such as is likely for the night works to connect the reopened railway with the	Section 8

Consultee Type	Consultee	Comments	Response / Action	Reference within this document
			existing mainline railway or the transitory works associated with the DHPWN. Significant effects are also likely if the work on the main construction areas needs to be undertaken during the evening at the same intensity as during the day. However, the current information suggests that work outside of core daytime hours would be discussed with NLC to establish which works could be performed with a low likelihood of significant effects. No significant effect is predicted on any road link which is used by construction traffic, or as a result of the use of the railway during the construction period. During operation, the Project has the potential to result in daytime noise impacts at the closest residential receptors to the site. At worst, these include moderate noise impacts during the day at receptors close to Ingelnook in Amcotts, during a loading or unloading event at the railhead. At all other receptors, the predicted effects are considered minor or not significant when the context of the noise is taken into account. Noise from the Project will not be the only form of industrial noise heard at the nearest properties, and this should lessen its perceived impact, as the new noise will sit within an industrial noise soundscape. The predicted noise levels are also either below or not noticeably above the target level for daytime external amenity space. At night there will be no loading or unloading activities and the fixed plant will not result in more than minor noise impacts at any	

Consultee Type	Consultee	Comments	Response / Action	Reference within this document
			receptor. At worst, the predicted noise levels are a range of external noise levels 40–45 dB, LAeq at night that provides a good standard for sleep within the building. We will continue to develop the design and operational procedures and where there is the opportunity to do so we will examine practicable means of further reducing noise levels from operating plant and equipment. A noise monitoring programme will also be developed as part of the commitments to develop and agree an operational noise management plan with NLC. This is a requirement under Schedule 2 of the DCO. Odour will be managed through the design of the ERF and the baled RDF is delivered in sealed containers. These containers are unloaded and taken directly into the Tipping Hall. Here the container is opened, and the baled RDF placed into the waste bunker ready for processing. The Tipping Hall is within a sealed building with shutter doors. Air from the tipping hall is drawn through the combustion process meaning that any odour from the RDF is taken through the process and destroyed.	
S47	Local Community	Noise? What about the increased noise from rail, road and river traffic. Amcotts already suffers from excessive noise from existing facilities on the flixborough site from road and river traffic, so how are you going to be able to mitigate this increase when it can not be achieved consistently as it is.	We have assessed noise in Chapter 7: Noise of the ES (**Document Reference 6.2.7**). This includes noise from rail, road and river transport and potential impacts at Amcotts. We will mitigate noise during operations primarily through the design of the Project. Plant machinery will be enclosed within buildings designed to contain noise. We will design the site to avoid vehicle reversing	Section 8

Consultee Type	Consultee	Comments	Response / Action	Reference within this document
			wherever practical and minimise the use of reversing alarms across the site. The wharfside crane and machinery will be fitted with noise mitigation such as insulation and silencers to further reduce noise levels. An operational noise management plan will be formulated and agreed with NLC, as a requirement under Schedule 2 of the DCO, which seeks to minimise noise levels at the nearest sensitive receptors and pursues continuous improvement in reducing noise levels from the periodic unloading operations at the wharf and the railhead. The plan will include reviewing available technology coming onto the market in terms of procuring intrinsically low noise equipment. We will monitor compliance with the predicted noise levels from the selected equipment and report the results to environmental health officers at North Lincolnshire Council.	
S47	Local Community	Concerned about noise and smell from the site due Close proximity of residential areas.	We have assessed in Chapter 7: Noise of the ES (**Document Reference 6.2.7**). The predicted residual noise effects of construction noise are predicted to be of moderate significance at most. In general most impacts are on a small number of receptors, or over very short periods of time such as is likely for the night works to connect the reopened railway with the existing mainline railway or the transitory works associated with the DHPWN. Significant effects are also likely if the work on the main construction areas needs to be undertaken during the evening at the same intensity as during the day. However, the	Section 8

Consultee Type	Consultee	Comments	Response / Action	Reference within this document
			current information suggests that work outside of core daytime hours would be discussed with NLC to establish which works could be performed with a low likelihood of significant effects. No significant effect is predicted on any road link which is used by construction traffic, or as a result of the use of the railway during the construction period. During operation, the Project has the potential to result in daytime noise impacts at the closest residential receptors to the site. At worst, these include moderate noise impacts during the day at receptors close to Ingelnook in Amcotts during a loading or unloading event at the railhead. At all other the predicted effects are considered minor or not significant when the context of the noise is taken into account. Noise from the Project would not be the only form of industrial noise heard at the nearest properties, and this should lessen its perceived impact, as the new noise will sit within an industrial noise soundscape. The predicted noise levels are also either below or not noticeably above the target level for daytime external amenity space. At night there will be no loading or unloading activities and the fixed plant will not result in more than minor noise impacts at any receptor. At worst, the predicted noise levels are a range of external noise levels 40 – 45 dB, LAeq at night that provides a good standard for sleep within the building. We will continue to develop the design and operational procedures and where there is the opportunity to do so we will examine	

Consultee Type	Consultee	Comments	Response / Action	Reference within this document
			practicable means of further reducing noise levels from operating plant and equipment. A noise monitoring programme will also be developed as part of the commitments to develop and agree an operational noise management plan with NLC. This is a requirement under Schedule 2 of the DCO. Odour will be managed through the design of the ERF and the baled Refuse Derived Fuel (RDF) is delivered in sealed containers. These containers are unloaded and taken directly into the Tipping Hall. Here the container is opened, and the baled RDF placed into the waste bunker ready for processing. The Tipping Hall is within a sealed building with shutter doors. Air from the Tipping Hall is drawn through the combustion process meaning that any odour from the RDF is taken through the process and destroyed.	

4. ASSESSMENT PARAMETERS

4.1 Introduction

4.1.1.1 The following elements of the Project have the potential to result in likely significant noise and/or vibration effects and have been considered in this assessment.

4.2 Construction

4.2.1.1 Likely significant noise and vibration effects during the construction of the Project may occur as a result of:

- noise and vibration from the use of construction plant;
- increases in road traffic noise; and
- noise from railway vehicles.

4.2.1.2 The following activities have been assessed as being the key likely sources of noise and vibration impacts during construction.

4.2.1.3 Major construction activities (during day and evening) associated with the main buildings in the northern part of the Energy Park Land[6] which are close to residential receptors:

- Energy Recovery Facility (ERF);
- carbon capture utilisation and storage facility;
- a water treatment facility;
- feedstock storage;
- offices and visitor centre;
- modifications to the existing riverside Wharf (potential installation of a new gantry crane);
- battery storage;
- plastic recycling facility (PRF);
- concrete block manufacturing facility; and
- incinerator bottom ash (IBA) and flue gas treatment residue (FGTr) handling treatment facility (RHTF).

4.2.1.4 Construction activities (during day and evening) associated with the main buildings in the southern part of the Energy Park Land which are close to residential receptors:

- hydrogen production and storage facility;
- back up hydrogen heat and power generation;
- Above Ground Installation (AGI) infrastructure; and

[6] Demolition of the existing buildings has not been considered separately, but initial information suggests that the noise levels produced would be similar to the main construction activities listed.

- electric vehicle (EV) and hydrogen (H_2) refuelling station.

4.2.1.5 The railway may be used to move materials such as engineering fill, arisings removals and concrete as well as for deliveries of construction material such as steelwork and insulation. Up to two deliveries per day has been assumed as a likely worst case, with no deliveries expected to be required at night.

4.2.1.6 Activities that will need to include some work during the evening and night are as follows:

- a new railhead and reinstatement of an existing railway line that links Flixborough Wharf to Dragonby Sidings (which is assumed to require limited night-time work at the tie-in of the railway to the existing operational railway close to Dragonby).
- installation of a district heat and private wire network (DHPWN) which will include laying pipes and cables along or within roads, and which will require work to be carried out at night in some locations to avoid traffic congestion, based on consultation with the NLC. The only area where this is required close to residential properties is where the pipe will need to be laid across Holyroad Drive at the Skippingdale Roundabout which is on the other side of the road from residential properties in Betony Close on the Charnwood Park Estate.

4.2.1.7 Other activities are likely to be minor in terms of their potential to cause significant effects due to the likely limited durations of activities outside individual properties and have not been considered in detail in this ES. The effects are also generally expected to be less noisy than the activities for which predictions have been undertaken and the activities to be no closer to the properties. The following activities fall into this category:

- an access road and upgraded road system; and
- service diversions.

4.2.1.8 Other potential likely significant effects during construction may arise as a result of increases in road traffic. Noise level changes as a result of traffic flow changes along the construction routes are considered in this assessment.

4.3 Operation

4.3.1.1 Likely significant noise and vibration effects during the operation of the Project (i.e. in the long term) may occur as a result of:

- continuous noise from fixed plant (e.g. equipment within the Boiler and Flue Gas Treatment System, the Turbine Hall, the stack and external cooling equipment) and on-site vehicle movements;
- Intermittment loading or unloading operations during the day at the Wharf and railhead;
- railway vehicles; and

- increases in road traffic noise off-site.

4.3.1.2 As described in Section 5, the assessment of noise from on-site activities follows the methodology in BS 4142. Noise from the following activities has been modelled and included in the daytime and night-time assessment:

- fixed plant;
- on-site HGV movements;
- a container vessel being unloaded at the Wharf;
- a train being unloaded at the railhead; and
- a vessel at the Wharf overnight[7].

4.3.1.3 Details of the noise modelling inputs are provided in Appendix C.

4.3.1.4 It is considered unlikely that a train will enter or leave the site whilst a train is being unloaded at the railhead.

4.3.1.5 The potential for increases in off-site road/rail noise do not fall within the scope of the BS 4142 assessment and have therefore been assessed separately. The methodology for assessing noise from these events is set out in Section 5.

4.3.1.6 A train service frequency of one train every 4 hours has been assumed for the daytime period. Each train is assumed to comprise:

- one locomotive (Class 66 assumed as these locomotives make up the majority of the UK fleet)
- 78 freight vehicles, assumed to be 4 axle disc braked vehicles.

4.3.1.7 The train is assumed to travel at a speed of 8 km/hr on-site, close to the railhead and at the eastern end, close to the Dragonby sidings. An average speed of 8 km/hr has also been assumed for the off-site train noise calculation to account for the fact that the train driver will need to stop the train in order to operate level crossing gates as the train passes between the sidings and the site. The locomotive is assumed to be on full power throughout.

4.3.1.8 The track is assumed to be continuously welded rail.

4.3.1.9 Forecast road traffic flows during construction and operation have been provided by the Traffic and Transport team. Detailed flow data is set out in the Traffic and Transport Chapter (**Document Reference 6.2.13**).

[7] Noise emitted from a stationary vessel running power generation system is considered in this scenario. The noise from vessels using the river to access the Wharf is considered in Section 5.3.5.

5. ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

5.1 Introduction

5.1.1.1 This section sets out the methodology and criteria which have been used to assess the significance of noise and vibration effects during the construction, operation and decommissioning of the Project. Potential cumulative noise effects during construction and operation are considered in Chapter 18, Cumulative Effects Assessment (**Document Reference 6.2.18**).

5.2 Construction

5.2.1 Introduction

5.2.1.1 As set out in Section 4.1, likely significant noise and vibration effects during the construction of the Project may occur as a result of:

- the use of construction plant;
- increases in road traffic noise; and
- trains using the railway.

5.2.1.2 The methodology and criteria used to assess noise and vibration during construction are set out in the following subsections.

5.2.2 Construction (Noise from Construction Plant)

5.2.2.1 Construction noise has been assessed using BS 5228-1[8], with reference to the 'ABC method'. The ABC method defines thresholds at building facades on the basis of existing noise levels as set out in Table 5.

5.2.2.2 Where the forecast construction noise exceeds the relevant threshold, this is an indicator of a potentially significant effect and has been adopted as the LOAEL assessment criteria.

5.2.2.3 For daytime, the widely used threshold of 75 dB L_{Aeq} (category C) being exceeded for one month or more has been taken to be the SOAEL for construction noise. The threshold was originally set to avoid interference with normal speech indoors, with windows closed (Wilson, 1963). The daytime SOAEL and the corresponding SOAELs for the evening and night periods (shown in Table 5), indicate likely significant effects on health and quality of life at a receptor, assuming construction noise is dominant and of sufficient duration.

[8] BS5228-1:2009+A1:2014 (Code of practice for noise and vibration control on construction and open sites – noise) (British Standards Institute, 2014a)

Table 5: Airborne Sound from Construction – Impact Criteria at Residential Receptors

Period	Assessment Category dB $L_{Aeq, T}$		
	A	B	C (SOAEL)
Day: T=12hr, Weekdays, 07:00-19:00, T=6hr, Saturday, 07:00-13:00	>65	>70	>75
Evenings and weekends: T=period time stated below, Weekdays 19:00–23:00, Saturdays 13:00-23:00, Sundays 07:00-23:00	>55	>60	>65
Night: T=8 hr, Every day 23:00-07:00	>45	>50	>55

Notes:
All sound levels are defined at the façade of the receptor.
Assessment Category A: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are less than these values.
Assessment Category B: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are the same as category A values.
Assessment Category C: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are higher than category A values.

5.2.2.4 Where predicted noise levels are above LOAEL thresholds, but below the SOAEL, other factors have been taken into a ccount in determining whether, in EIA terms, the effect could be significant, such as the duration of the activity causing the noise impact. This process is summarised in Table 6.

Table 6: Magnitude and Significance of Construction Noise Effects

Exceedance of criteria, dB	Magnitude of predicted impact		Significance of effect
5 or more below the criteria	Negligible	Factors which may influence significance of effects, e.g. duration of construction activity	Negligible
> 5 below, up to the criteria	Small		Minor
Up to 5 dB above the criteria	Medium		Moderate
> 5 above the criteria	Large		Major

5.2.2.5 For buildings with openable windows, which are primarily for office use, the guidance in BS 8233 has been used. BS 8233 provides design guidance on noise levels for a variety of room types. For offices BS 8233 provides a range of noise levels, $L_{Aeq,T}$ between 35 dB(A) and 50 dB(A). These noise levels apply inside the building. Assuming a partially open window, equivalent external noise levels would be 45 - 50 dB(A) to 60 - 65 dB(A). An example of this type of office building is Concord House on Bessemer Way, which is close to a roundabout and other commercial and industrial noise sources. In this context it is reasonable to adopt the higher noise

criteria in this range. Furthermore, where the receptor is affected by short term works such as the DHPWN, which are only likely to be outside a building for a period of weeks, it has been assumed reasonable that building occupants would keep windows closed, and so noise levels that are approximately 10 dB higher would be unlikely to cause significant disturbance inside the building. Noise levels of up to 70 dB LAeq, at 1 m from the building façade) have been adopted as a small magnitude impact, with medium and large magnitude impacts 5 dB and 10 dB higher respectively.

5.2.2.6 Observations of the buildings at Flixborough Industrial Estate that are closest to the site suggests that they are industrial by nature and are not likely to be affected by noise from the Project. This also applies to buildings on Bessemer Way which are close to the DHPWN works. However, there is the potential that some of the buildings may contain noise sensitive offices. Since these buildings will be subject to high noise levels from existing commercial activities in the area on a reasonably regular basis, they are likely to be less sensitive to noise than buidings which are primarily used as offices and a higher criterion of 75 dB L_{Aeq} has been adopted as an indication of the noise level at which significant noise effects would occur. However, the significance of noise levels above this level would depend on the use of the buildings and locations of offices within them. Since this detail is not available at this stage, a precautionary assessment has been undertaken assuming that some parts of the buildings could be noise sensitive.

5.2.3 Construction (Groundborne Vibration from Construction Plant)

5.2.3.1 The primary cause of community concern relating to vibration during construction generally relates to building damage from both construction and operational sources of vibration, although, the human body can perceive vibration at levels which are substantially lower than those required to cause building damage.

5.2.3.2 Damage to buildings associated solely with ground-borne vibration is not common and although vibration may be noticeable, there is little evidence to suggest that it produces cosmetic damage such as cracks in plaster unless the magnitude of the vibration is excessively large. The most likely effect, where elevated levels of vibration do occur during the construction phase, is associated with perceptibility and disturbance.

5.2.3.3 BS 5228-2 indicates that the threshold of human perception to vibration is between approximately 0.15 and 0.3 mm/s peak particle velocity (PPV).

5.2.3.4 A criterion of 1 mm/s PPV has been selected as the assessment criterion to control the impact of construction vibration for residential properties. Vibration at this level is described in BS5228 as being likely to cause complaint, but that it can be tolerated if prior warning and explanation has been given to residents. Vibration above this magnitude has been taken as indicating a medium impact which would be the start of potentially significant disturbance (the LOAEL). The criteria for assessing the

magnitude of vibration impacts are presented in Table 7. Large adverse impacts are identified if PPV values are greater than 10 mm/s (the SOAEL) which is consistent with vibration being intolerable for any more than a very brief exposure within a building.

5.2.3.5 The criteria are presented in terms of PPV as it is the simplest indicator for both perceptibility and building damage. Levels would need to be exceeded persistently rather than from a one-off occurrence which would be unlikely to cause significant disturbance.

Table 7: Magnitude and Significance of Construction Vibration

Vibration Magnitude (PPV in mm/s)	Magnitude of predicted impact		Significance of effect
< 0.3	Negligible	Factors which may influence significance of effects, e.g. duration of construction activity	Negligible
> 0.3 to <1	Small		Minor
> 1 up to 10	Medium		Moderate
> 10	Large		Major

5.2.3.6 Again, it is worth noting that the purpose of the construction vibration criteria is to control the impact of construction vibration as far as is reasonably practicable and is based on the likelihood of the vibration being perceptible and causing disturbance, rather than causing damage to property.

5.2.3.7 Hence, although vibration levels in excess of 1 mm/s PPV would be considered a Medium Adverse impact in respect of the likelihood of disturbance, they would not be considered to lead to significant effects in terms of the potential for building damage, which would require levels of at least 15 mm/s PPV to result in minor cosmetic damage in light / unreinforced buildings.

5.2.3.8 Occupants of industrial or commercial buildings are expected to be far less sensitive to vibration than residential properties. The guidance in BS 5228 suggests that vibration magnitudes of 10 mm/s PPV might be likely to be intolerable for any more than a brief exposure to this level in most building environments. This level of vibration is unlikely to be generated beyond the boundary of a construction site. Given that the site is adjacent to lower sensitivity industrial or commercial buildings, it is assumed that impacts above SOAEL are not likely during construction.

5.2.3.9 Public rights of way and public open spaces are, by their nature, transitory in use. Therefore, users are unlikely to be significantly affected by construction noise and vibration and these receptors have been scoped out of further assessment

5.2.4 Construction (Road Traffic Noise)

5.2.4.1 Construction traffic has been assessed as negligible for noise changes less than 1 dB(A), and minor for changes between 1.0 and 2.9 dB, with moderate changes between 3.0 and 4.9 dB and major changes above 4.9 dB based on the guidance in the DMRB. If construction traffic noise is above the minor impact, the effect would be considered significant if it lasted for at least 10 or more days or nights in any 15 consecutive days or nights.

5.2.5 Construction (Railway Noise)

5.2.5.1 Since there are no trains currently using the track that will be re-opened as part of the Project, it has not been relevant to consider noise changes in rail traffic in the same way as for road traffic noise compared to existing noise levels. Therefore, the predicted noise levels from the railway have been compared to the noise criteria in Table 5.

5.3 Operation

5.3.1 Introduction

5.3.1.1 This section sets out the assessment methodology and significance criteria for the assessment of operational noise and vibration.

5.3.1.2 Section 4.3 sets out the activities which have been assessed. The assessment methodology for each of these activities is set out in the following sub sections.

5.3.2 Fixed plant, On-Site Vehicle Movements and Noise from Unloading Operations

5.3.2.1 This section describes the methodology and criteria used to assess noise from the following activities:

- fixed plant;
- on-site vehicle movements; and
- noise from unloading operations at the port and railhead.

5.3.2.2 Details of the noise modelling inputs are provided in Appendix C.

5.3.2.3 Significant sources of vibration are not expected from these activities during operation and an assessment of vibration effects has therefore been scoped out.

5.3.2.4 BS4142 sets out guidance used for the assessment of sound of an industrial and/or commercial nature. The current version of the standard is applicable to investigating complaints; assessing sound from proposed, new, modified or additional sources of sound; and for assessing sound at proposed new dwellings or premises used for residential purposes. The methods described in BS 4142 use outdoor sound levels to assess the

likely effects of sound on people who might be inside or outside a dwelling used for residential purposes.

5.3.2.5 A key aspect of the BS 4142 (BSI, 2014c) assessment procedure is a comparison between the background sound level in the vicinity of residential locations and the rating level of the sound source under consideration. The relevant parameters in this instance are as follows:

- Background sound level – $L_{A90,T}$ – defined in the Standard as the "A-weighted sound pressure level that is exceeded by the residual sound for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels";
- Specific sound level – L_s ($L_{Aeq,Tr}$) – the "equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr"; and
- Rating level – $L_{Ar,Tr}$ – the "specific sound level plus any adjustment made for the characteristic features of the sound".

5.3.2.6 BS 4142: 2014 (BSI, 2014c) allows for corrections to be applied based upon the presence or expected presence of the following:

- tonality: up to +6 dB penalty;
- impulsivity: up to +9 dB penalty (this can be summed with tonality penalty); and
- other sound characteristics (neither tonal nor impulsive but still distinctive): +3 dB penalty.

5.3.2.7 An assessment of likely significant noise effects from the operation of the Project has been carried out following the methodology in BS 4142. Table 8 summarises the criteria for the magnitude and significance of potential effects adopted in this assessment as well as the LOAEL and SOAEL values.

Table 8: Criteria defining the magnitude and significance of potential effects from fixed plant, and on-site vehicle movements

Noise Rating level [1], $L_{Ar,Tr}$	BS 4142 Extract Regarding the Initial Assessment	Magnitude	Factors which may affect Significance (from BS 4142)	Significance of Noise
<= background [2]	The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.	Negligible	Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including: The absolute level of sound. The character and level of the residual sound compared to the character and level of the specific sound. The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.	No adverse effect
> background [2] up to background [2] + 5dB		Small		Above LOAEL, but below SOAEL
> background [2] + 5dB up to background [2] + 10dB	A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.	Medium		
> background [2] + 10dB	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context	Large		Significant – above SOAEL

1. *Rating Level, LAr,Tr according to BS 4142. The specific sound level corrected to allow for certain distinctive acoustic features.*
2. *Background Sound Level according to BS 4142. The measured L90 level in the absence of the specific level.*

5.3.2.8 The BS 4142 assessment method set out above applies to residential receptors. In order to assess noise effects on non-residential office premises within the Flixborough Industrial Estate, the guidance in BS 8233 has been used. BS 8233 provides design guidance on noise levels for a variety of room types. For offices BS 8233 provides a range of noise levels, $L_{Aeq,T}$ between 35 dB(A) and 50 dB(A). These noise levels apply inside the building. Assuming a partially open window, equivalent external noise levels would be 45 - 50 dB(A) to 60 - 65 dB(A). In the context of this industrial estate, which includes a number of existing noise generating activities, noise levels above 60 dB(A) have been adopted as a small magnitude impact, with medium and large magnitude impacts 5 dB and 10 dB higher respectively.

5.3.2.9 The prediction of noise levels has been carried out to inform the assessment using a computer software package. For this purpose, the widely recognised software package SoundPLAN has been used, implementing the prediction method set out in ISO 9613-2.

5.3.2.10 Ground topography as well as the main buildings close to the site of the Project have been included in the model. The area of hardstanding surrounding the site as well as the river are assumed to be acoustically hard, reflective surfaces. Elsewhere the ground is assumed to be partly absorbent.

5.3.2.11 The assessment has been based on data provided by the Project engineering team, which is set out in Appendix C.

5.3.3 Noise from Railway Vehicles

5.3.3.1 Noise from railway vehicles has been predicted according to the Calculation of Railway Noise (CRN)[9] methodology.

5.3.3.2 Criteria with which to assess the significance of potential effects as a result of noise from railway vehicles have been derived.

5.3.3.3 Threshold levels relating to the LOAEL and SOAEL are summarised in Table 9. Where predicted noise levels are above the LOAEL, the change in noise is considered. The significance of changes in noise from rail vehicles, in EIA terms, is set out in Table 10.

[9] Calculation of Road Traffic Noise. Department or Transport Welsh Office. HMSO 1998

Table 9: Threshold Assessment Criteria for Noise from Railway Vehicles

Time of day	Lowest Observed Adverse Effect Level LOAEL	Significant Observed Adverse Effect Level SOAEL
Day (07:00 – 23:00) dB $L_{pAeq, 16hr}$	50 dB (1)	65 dB (3)
Night (23:00 – 07:00) $L_{pAeq, 8hr}$	40 dB (2)	55 dB (4)

1. The WHO Guidelines for Community Noise[10] identifies guideline values to assess typical community annoyance with 50 or 55 L_{pAeq} (outdoor noise level), representing 'daytime levels below which a majority of the adult population will be protected from becoming moderately or seriously annoyed, respectively.'
2. In the WHO's Night Noise Guidelines for Europe the night noise guideline, 40 $L_{pAeq,2300-0700}$ outdoors, is set explicitly at the lowest observable adverse effect level (LOAEL). However, it is noted that railway vehicles will not use the railway at night and so this criterion is not used in the assessment.
3. Consistent with the daytime trigger level in the UK Noise Insulation (Railways and other guided systems) Regulations[11]
4. For night-time, following NPPG, where the noise from railway vehicles outside a dwelling exceeds the Interim Target defined by the WHO Night Noise Guidelines for Europe[12], residents are considered to be significantly affected by the resulting noise inside their dwelling. However, it is noted that railway vehicles will not use the railway at night and so this criterion is not used in the assessment.

Table 10: Noise Change Assessment Criteria for Noise from Railway Vehicles

Noise change significance	Noise level change dB $L_{pAeq, T}$ T = either 16hr day or 8hr night
Negligible	$\geqslant$ 0 dB and < 3 dB
Minor	$\geqslant$ 3 dB and < 5 dB
Moderate	$\geqslant$ 5 dB and < 10 dB
Major	$\geqslant$ 10 dB

5.3.4 Vibration from Railway Vehicles

5.3.4.1 Vibration from railway vehicles has been shown to fall below the level at which a significant effect would be expected to occur at a distance of approximately 10 m[13]. As the nearest sensitive receptors to the railway (in Flixborough), are situated at a distance of approximately 70 m, significant vibration effects are considered unlikely and have been scoped out of further assessment.

5.3.5 Noise from Increases in Vessels Using the River

5.3.5.1 The number of vessels currently using the river to access the port is approximately one per day. Although this number may increase by up to 2 vessels per day, the level of noise from each vessel is likely to be similar to

[10] World Health Organization (1999) Guidelines for Community Noise. World Health Organization, Geneva

[11] Statutory Instrument 1996 No. 428. The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996. HMSO

[12] World Health Organization, Night Noise Guidelines for Europe, 2010

[13] The Chiltern Railways (Bicester to Oxford Improvements) Order Environmental Statement: Volume 2, Assessment of Impacts. December 2009.

that at present and will last only briefly as it passes individual NSRs. Vessels are expected to be infrequently underway at night (approximately one per month). As the increase in the number of pass by' is expected to be small and mostly during the daytime, significant noise effects at nearby NSRs are considered unlikely and have been scoped out of further assessment.

5.4 Road Traffic Noise

5.4.1.1 Road traffic noise off-site may increase due to construction traffic involving HGVs and other vehicles accessing the site and during operation from staff, deliveries and maintenance vehicles.

5.4.1.2 18-hour (06:00 – 24:00) Annual Average Weekday Traffic (AAWT) data have been provided by the Traffic and Transport assessment 'with' and 'without' the Project, in order to determine if any existing roads are predicted to be subject to a potentially significant change in 18-hour traffic flows. Basic Noise Level (BNL) calculations have been undertaken to predict the change in noise level between the 'with' and 'without' scenarios.

5.4.1.3 Increases in road traffic noise have been assessed by considering the increase in traffic flows during construction and operation, following the prediction methodology in the Calculation of Road Traffic Noise (CRTN)[14] to calculate a basic noise level at 10 m from the nearest kerb. In the case of the new Access Road which will be further from the nearest receptor at Neap House than the existing road, the effect of increasing the distance and the change in traffic flow has been taken into account when calculating the potential for noise changes.

5.4.1.4 CRTN's low flow calculation procedures have been used where the 18h flow is below 4,000 vehicles but above or equal to 1,000. For flows below 1,000 vehicles, the method set out in The Noise Advisory Council document[15] has been used.

5.4.1.5 CRTN provides speed data for different types of road, which have been used, except where observed speed data were available.

5.4.1.6 Predicted road traffic noise level changes of greater than 3 dB(A) are identified as a potentially significant effect. This corresponds to the smallest change in environmental noise that is noticeable under normal conditions.

5.4.1.7 It is generally accepted that a 3 dB change in noise level is the smallest increase generally audible in environmental conditions. This level has therefore been adopted as the LOAEL. In EIA terms, in line with the guidance in the DMRB[(3)], 3 dB has been identified as the smallest change in noise from construction traffic considered an impact above negligible, and changes of above 5 dB have been considered moderate and therefore

[14] Calculation of Road Traffic Noise. Department or Transport Welsh Office. HMSO 1998

[15] The Noise Advisory Council, "A guide to measurement and prediction of the equivalent continuous sound level Leq," HMSO, London, 1978

leading to significant effects. The magnitude and significance of traffic noise is summarised in Table 11.

Table 11: Magnitude and Significance of Construction Traffic Noise

Change in road traffic noise, dB	Magnitude of predicted impact		Significance of effect
< 3	Negligible	Factors which may influence significance of effects, e.g. duration of construction activity	Negligible (not significant)
> 3 up to 5	Small		Minor (not significant)
> 5 up to 10	Medium		Moderate
> 10	Large		Major

6. BASELINE AND RECEPTORS

6.1.1.1 The area around the site of the Project contains the villages of Amcotts (to the west) and Flixborough (to the east) and isolated properties; Flixborough Grange to the north and Park Ings Farm to the south. Further to the southeast lies Scunthorpe, at a distance of approximately 1.8 km and the village of Dragonby to the east (approximately 4.2 km away).

6.1.1.2 Baseline noise monitoring was carried out between 12th and the 22nd April 2021, to quantify the noise environment at locations close to the Project. The noise monitoring locations are shown in Figure 1 in Appendix A.

6.1.1.3 Details of the baseline survey methodology and results are presented in Appendix B. It is noted that for the operational noise assessment that baseline is derived in terms of measuring the actual baseline at any one location which may vary through the night and day. However, for assessment purposes what is actually adopted tends to be at the lower end of the range of measured values. Also, the use of the L_{A90} parameter, as required by the operational assessment method rather than L_{Aeq} noise levels which are used for construction assessment, results in lower baseline noise levels for the same noise environment and as such represents a reasonable worst case assessment. A summary of the baseline sound levels adopted for each NSR is presented in Table 12.

Table 12: Baseline Sound Levels

Receptor Location	Construction Baseline $L_{Aeq,period}$ dB / (Adopted 'ABC' Category [1])			Operational Baseline RBSL $L_{A90, period}$ dB [2]	
	Day	Evening	Night	Day	Night
1 Flixborough Grange	51 (A)	- [3]	- [3]	34	34
2 The Forge, Flixborough	48 (A)	- [3]	- [3]	34	35
3 Charmaine, Amcotts	53 (A)	- [3]	- [3]	41	37
4 Park Ings Farm	50 (A)	- [3]	- [3]	37	40
5 Inglenook, Amcotts	36 (A)	- [3]	- [3]	34	34
6 Willowmead Close	49 (A)	- [3]	- [3]	39	37
7 Neap House [7]	36 (A)	- [3]	- [3]	34	34
8 Betony Close [8]	49 (A)	- [3]	- [3]	- [5]	- [5]
9 29 High Street, Dragonby	50 (A)	46 (A)	46 (B)	- [5]	- [5]
10 Bolsover Road	52 (A)	- [3]	- [3]	- [5]	- [5]
11 Normanby Road	66 (B) [6]	- [4]	- [4]	- [5]	- [5]

1. *'ABC' category as defined in BS 5228 (see Section 5.2.2).*
2. *Representative baseline sound level according to BS 4142 (see Section 5.3.2).*
3. *Construction works are not expected to be required during the evening and night-time in general, but the exceptions to this and the approach to assessing the construction noise impacts, including assumptions made regarding baseline categories, are discussed in Section 8.1.*
4. *Construction baseline not measured at this location.*
5. *Significant operational noise effects from the Project are not expected at this NSR.*

6. *Measurement carried out at a distance of 6.71 m from curb edge. The construction category has been adjusted for individual NSRs on their distance from Normanby Road.*
7. *Baseline measurement carried out nearby at R5 (Inglenook, Amcotts) have been adopted here as representative. Baseline levels are likely to be conservative as this receptor is closer to industrial works off Gunness Lane and the A1077.*
8. *Baseline measurements carried out nearby at R6 (Willowmead Close) have been adopted here as representative. This results in the lowest (most stringent) construction noise criterion being adopted.*

7. MITIGATION

7.1.1.1 This section describes the mitigation measures considered in the assessment to date as reported in this ES. This includes mitigation that is integral to the design of the Project and good practice mitigation measures that the Project is committed to adopting. The mitigation measures committed to by the Project are described in this ES and the significance of the residual environmental effects reported take into account adoption of these measures.

7.2 Construction

7.2.1.1 The good practice mitigation measures will be in accordance with the following:

- BPM (Best Practicable Means) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA), will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties and other sensitive receptors.
- As part of BPM, mitigation measures will be applied in the following order:

- noise and vibration control at source: for example, the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on-site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings;
- screening: for example, local screening of equipment or perimeter hoarding or the use of temporary stockpiles; and
- where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the CEMP, options for suitable receptor-based mitigation will be reviewed and offered at qualifying properties.

7.2.1.2 Lead contractors will develop and submit a Construction Environmental Management Plan (CEMP) for agreement with the local planning authority. The CEMP will set out BPM measures to minimise construction noise and vibration, including control of working hours, and provide a further assessment of construction noise and vibration. The approved measures will be set out in detail by the Contractor in the CEMP (refer to CoCP, **Document Reference 6.3.7)** and Schedule 2 of the draft DCO (**Document Reference 2.1**).

7.2.1.3 Contractors will undertake and report monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to, and be reviewed by the Applicant and made available to North Lincolnshire Council.

7.2.1.4 Contractors will be required to comply with the terms of the CEMP and appropriate action will be taken by the nominated undertaker as required to ensure compliance.

7.2.1.5 The likely programme of the works has been investigated and the results of the refined noise predictions are included in this ES. The PEIR considered the potential need for receptor-based mitigation. However, since the works have moved further from the receptors and the need for night-work has been minimised, the work carried out for the ES has confirmed that it is possible to avoid the need for receptor-based mitigation by reducing noise at source.

7.2.1.6 Construction traffic routes will be chosen to avoid routing lorries through villages and past NSRs on minor roads as far as possible.

7.3 Operation

7.3.1.1 A noise management plan (as required under Schedule 2 of the draft DCO (**Document Reference 2.1**) will be formulated in order to keep delivery noise (e.g. use of tonal reversing alarms, doors opening/closing etc.) to an acceptable minimum. The details of the assumed acoustic performance of enclosures and the assumed noise levels of plant and equipment in this assessment has been specified in Appendix C. They have been based on the experience of the design team in terms of the lowest realistic noise levels that are likely to be achieved. The external plant at the Wharf and the Railhead have been based on typical noise levels for this type of plant including measurements at Flixborough and Immingham of plant which was operated, where appropriate, with at-source mitigation such as exhaust silencers and enclosed engine compartments.

7.3.1.2 During the review of potential mitigation measures in this assessment the possibility of including noise barriers on site was considered. In particular a barrier along the western side of the railhead to screen the noise from rail loading and unloading operations was considered. However, concerns regarding potential increases in flood levels during flood events were identified, and a flood risk modelling study was carried out to confirm the effects of building a barrier. The assessment demonstrated that with a noise barrier installed the flood risk increases to areas outside the Order Limits. This includes an increase in flood levels up to approximately 100mm observed within Flixborough Industrial Estate during the modelled future overtopping event, and an increase in flood level in Amcotts village during a breach event. For these reasons a noise barrier has not been proposed to mitigate noise.

7.3.1.3 As noted in Section 2 (Table 1), the IPC (now Secretary of State) should be satisfied that noise and vibration will be adequately mitigated through requirements attached to the consent. The Secretary of State will also need to take into consideration the extent to which operational noise will be separately controlled by the EA. Any requirements imposed on the Project as part of the Environmental Permit issued by the EA would be additional or complementary to the DCO consent. Therefore, they would not lessen the need to comply with commitments made in the DCO.

8. ASSESSMENT OF LIKELY EFFECTS

8.1 Construction (Noise from Construction Plant)

8.1.1 Main Site Works

8.1.1.1 The criteria used to assess noise impacts are discussed in Section 5. The noise and vibration levels are assessed using criteria based on BS5228 which also includes a method of predicting construction noise and example noise and vibration source levels for construction plant. The plant teams assumed to correspond to the main phases of the construction work are detailed in Appendix C. These assumptions have been developed with the project engineers to represent a reasonable worst case. Except where specifically discussed below the predicted noise levels are based on the assumption that the noise sources are at the closest point to the receptor on the site i.e. the site boundary, which is also a worst case assumption.

8.1.1.2 Most of the construction work is anticipated to be carried out during the day for the main buildings in the northern and southern parts of the Energy Park Land. Based on the baseline noise levels, daytime construction noise levels have been assessed against a criterion using Category A from BS5228 (65 dB $L_{Aeq, 12\ hrs}$). Some evening works may be required, and again the Category A noise criterion has been adopted (55 dB $L_{Aeq, hrs}$) at the affected receptors.

8.1.1.3 Table 13 summarises the results of noise predictions on residential NSRs from the construction of the main buildings in the northern part of the Energy Park Land described in Section 4.2.1.3 and shows the impact magnitude.

8.1.1.4 Table 14 summarises the results of noise predictions on residential NSRs from the construction of the main buildings in the southern part of the Energy Park Land (hydrogen facilities) as described in Section 4.2.1.4 and shows the impact magnitude. The predicted noise levels resulting from the construction of the access road are likely to be lower than during building construction at the closest receptor Neap House, and are therefore represented by the predicted noise levels in Table 14.

8.1.1.5 The effects of the demolition of existing buildings and construction of the main works at non-residential receptors at the Flixborough Industrial Estate are likely to vary depending on the phase of work and the proximity of the plant. This will also depend on existing glazing and the locations and noise sensitivity of offices within these buildings. The nearest buildings are approximately 37m from the likely location of the major works. Based on a precautionary worst-case assessment a noisy phase of demolition (e.g. using a breaker with a sound power of 120 dB(A)) at 37m could lead to major noise impacts. However, these are predicted to drop to the criterion of 75 dB L_{Aeq} at about 100m so the noise would not be above the criterion during all phases of the works.

8.1.1.6 A more typical construction activity such as bored piling (sound power 111 dB(A)) is predicted to meet the criterion of 75 dB L_{Aeq} even if operating at the closest point to the nearest neighbouring building. Taking into account the potential for disturbance, but bearing in mind that the noise levels will not be at their highest every day, the impact has been assessed as being moderate. The closest building to the works will be the Coffee Stop Café (formerly Milly's Café) which is located immediately adjacent, but outside the Order Limits. Assuming the café remains open during the works it would be likely to be subject to construction noise at times. However, the context of the Café should be considered in that it is located in an industrial estate, which has been subjet to noise from heavy vehicles routinely as well as demolition noise in the area as major changes have taken place at the industrial estate. Noise levels experienced by users inside the Café would be lower than outside, and it has been assumed that due to its industrial setting it is insensitive to noise.

8.1.2 Railhead and Railway

8.1.2.1 The effects of construction of the new railhead and reinstatement of an existing railway line that links Flixborough Wharf to Dragonby Sidings have been assessed taking into account the potential for both daytime and night-time work. Based on experience of similar projects, it is assumed that this requires limited night-time work at the tie-in to the existing operational railway close to Dragonby.

8.1.2.2 The predicted daytime noise levels have been compared to Category A from BS5228 during the day and during the evening, but at Dragonby the night-time baseline noise levels indicated that a noise criterion of 50 dB rather than 45 dB should be adopted (Category B). Experience of similar projects suggests that this type of tie-in work is often limited to a short duration (potentially a few nights). The work is predicted to cause noise levels up to 66 dB L_{Aeq} at the nearest properties to the work in Dragonby, which corresponds to a large magnitude impact at night, but due to the short duration, will not result in a significant effect (i.e. not more than of minor significance).

8.1.2.3 Predictions suggest that during the day, the railway works along the rail corridor are likely to give rise to similar noise levels resulting in medium magnitude impacts at Dragonby and at the Forge in Flixborough which are similar distances from the track, but due to the limited duration adjacent to each receptor, no significant effects are predicted.

8.1.3 District Heating and Private Wire Network (DHPWN)

8.1.3.1 Installation of the Northern and Southern DHPWN will include laying pipes and ducts across open ground and along and across or under roads and railway lines. It is likely to require work to be carried out at night in some locations to avoid traffic congestion based on consultation with North Lincolnshire Council. One area along the Northern DHPWN has been identified where night work is likely to be required close to residential properties i.e. Betony Close on the Charnwood Park Estate, where the

pipe will need to be laid across Holyroad Drive at the Skippingdale Roundabout.

8.1.3.2 It may be practicable to employ directional drilling to install them underneath roads and where road crossings are required, which would avoid the need for night-time work. However, a worst case assumption has been adopted assuming that trenching is required, which would be conducted during a road closure at night. Therefore the techniques assumed to be used in this assessment are breaking out of road surfaces, and excavation of a trench. Discussions have been undertaken with NLC to consider the timing of the works, with a preference for conducting works during the day as with other street works. The impacts have been assessed in this EIA based on worse case assumptions, but selection of the most appropriate mitigation measures will be carried out in the CEMP once details of exact construction plant/methods and durations are available.

8.1.3.3 If a trench is excavated it may require support by installing sheet piles, however, for this type of installation it is not normally necessary to drive the piles into the ground, and they can often be installed by non-impactive means such as pushing them in with an excavator bucket.

8.1.3.4 The pipe will be laid in lengths as the trench is prepared, and it is expected that works will progress at an approximate rate of 75 to 100 m per week along Normanby Road. Where the pipe crosses the Skippingdale roundabout, the works are expected to last for around a week.

8.1.3.5 The daytime noise levels from trenching for most of the DHPWN route are not expected to be significant given the presence of high levels of road traffic noise where the pipes are laid along busy roads such as Ferry Road West and Phoenix Parkway. As discussed above, the duration of any high noise levels would be limited, as the works will progress at approximately 75 to 100 m per week, so individual receptors are not likely to be subject to high noise levels for more than a few weeks.

8.1.3.6 The distance from the works at the Skippingdale Roundabout to houses in Betony Close is approximately 85 m, and based on the noisiest potential phase of works (cutting and breaking out the road surface), the analysis carried out suggests that noise impacts would be likely. However, it is noted that these would not be continuous during the construction period and, given the short duration of the works, these have been rated as being of moderate significance (i.e. a significant effect). Mitigation will be considered during detailed design of the works to further mitigate the noise levels if practicable, but at this stage a worst-case assessment has been made.

8.1.3.7 The PEIR reported the potential noise and vibration effects of the works which are required for the Northern DHPWN along Normanby Road. At the time of the PEIR it was envisaged that night works would be required along Normanby road to reduce traffic disruption. However, subsequent discussion with NLC has indicated that the works along Normanby Road

can be carried out during the day, and so this has been used as a basis of the assessment.

8.1.3.8 It was also noted that the PEIR considered a version of the Project in which the Northern DHPWN extended into Scunthorpe town centre, but since that time the extent of the Northern DHPWN has been reduced and the current proposals extend no further south than the junction with Warren Road. Removal of this section of the Northern DHPWN will reduce the number of properties that are exposed to noise and vibration during the construction phase significantly from that initially considered and reported in the PEIR.

8.1.3.9 A further change since the PEIR is that an alternative route option is proposed in which the Northern DHPWN route avoids Normanby Road altogether. This route option follows Pheonix Way and crosses onto Mannaberg Way, and then turns southwards onto Bessemer Way passing an office building at this junction (Concord House) which is approximately 28 m from the works. Other buildings along this route are industrial or commercial in nature, and are not expected to be noise sensitive except for potential office spaces within the buildings which are discussed below. Once the route reaches Warren Road it turns westwards along Warren Road until it meets Normanby Road where it ends.

8.1.3.10 It is possible that the start and end points of the two route options on Warren Road may vary depending on future connection decisions. However, the receptors on Warren Road have not been considered as noise sensitive as they are generally commercial in nature, and so the exact start and end point would not affect the conclusions of the noise assessment.

8.1.3.11 For the first route option (Option A) (southwards along Normanby Road), the works will be constructed on the eastern side of the road on the carriageway approximately 17 m at the nearest point to the closest housing in Normanby Road. This is further than was assumed in the PEIR which leads to lower predicted noise levels. Noise predictions have been carried out to reflect the likely progression of the works assuming the works consist of three phases described as road breaking, pipe work and road surfacing. Since not all plant will be located at the closest point to the receptor at the same time, and plant will progress along the road with each construction activity passing an individual receptor in turn, the three phases have been modelled as rectangular area noise sources in the noise model. The noise level has then been calculated at the nearest receptor assuming the plant moves past at the expected rate of progress.

8.1.3.12 The calculations suggest the following maximum noise levels (dB L_{Aeq} façade) as each activity passes the closest receptor:

- Road breaking 83 dB;
- Pipe work 79 dB; and
- Road surfacing 79 dB.

8.1.3.13 The high baseline noise levels at this location suggest a noise criterion based on Category B (from BS 5228 see Table 12). The predicted daytime noise levels are above the noise criterion of 75 dB $L_{Aeq, 12hr}$ for a large magnitude impact. Therefore, the noise levels are predicted to cause large noise impacts when directly opposite a receptor with noise levels between 4 to 8 dB above the large magnitude criterion.

8.1.3.14 However, the significance of the noise effect is derived by taking into account factors such as the short duration of the works. Noise levels are expected to be above the Category B criterion for a maximum of up to three weeks (after which the noise impacts would be small magnitude). The short duration of this noise impact has been taken into account and overall the significance of the work has been considered to be moderate.

8.1.3.15 Mitigation will be considered during detailed design of the works to further mitigate the noise levels including careful routing of the pipeline to minimise impacts, careful timing of the works to avoid sensitive times, the use of temporary noise barriers and low noise plant. It is noted that the above conclusions are based on an analysis of the noisiest plant at the closest likely location to the receptors (i.e. a worst case), and that as the plant moves past the receptor this noise level will reduce rapidly.

8.1.3.16 For the alternative route of the Northern DHPWN via Bessemer Way (Option B), the works would pass the closest noise sensitive receptor (the office bulding at Concord House at the junction of Bessemer Way and Mannaberg Way) which is approximately 28 m from the work as discussed above. The predicted noise levels are lower at this building. Since this is a non-residential office building the criteria applied to residential buildings are not directly applicable, and the criteria for an office with windows closed has been applied (70 dB LAeq – façade).

8.1.3.17 The calculations suggest the following maximum noise levels (dB L_{Aeq} façade) as each activity passes Concord House:

- Road breaking 80 dB;
- Pipe work 77 dB; and
- Road surfacing 76 dB.

8.1.3.18 The predicted noise levels exceed the noise criterion by 6 to 10 dB, and are of large magnitude as they pass. However, the significance of the noise effect is derived by taking into account factors such as the short duration of the works. The short duration of this noise impact has been taken into account and overall the significance of the work has been considered to be moderate.

8.1.3.19 Whilst there are several other commercial buildings along this route that appear to also contain some office space facing Bessemer Way, they are linked to relatively noisy industrial or commercial uses (e.g. steel fabrication, piling contractors, glazing factories and motor related trades), and are not expected to be as noise sensitive as Concord House. A noise criterion of 75 dB L_{Aeq} has been applied at these locations. These would be

located at approximately 17 m to the DHPWN works. Predicted noise levels would be up to 3 dB higher than at Concord House, which indicates noise levels potentially up to 8 dB above the criterion and, therefore, large impact magnitudes. However, the significance of the noise effect is derived by taking into account factors such as the short duration of the works. The predicted noise levels are above the noise criterion for approximately two to three weeks, and the significance has been considered to be moderate on this basis.

8.1.3.20 This option is not likely to significantly affect the residential receptors on Normanby Road for any sustained periods and, therefore, the effect on these receptors is assessed to be not significant.

Table 13: Predicted Noise Levels for Construction of the Buildings in the Northern Part of the Energy Park Land dB $L_{Aeq, T}$ (Façade)

NSR	Predicted Noise Level			Criterion dB LOAEL			Exceedance			Impact Magnitude		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening [1]	Night
1 Flixborough Grange	50	50	-	65	55	45	-15	-5	-	Negligible	Small	-
2 The Forge, Flixborough	52	52	-	65	55	45	-13	-3	-	Negligible	Small	-
3 Charmaine, Amcotts	62	62	-	65	55	45	-3	7	-	Small	Large	-
4 Park Ings Farm	58	58	-	65	55	45	-7	3	-	Negligible	Medium	-
5 Inglenook, Amcotts	59	59	-	65	55	45	-6	4	-	Negligible	Medium	-
6 Willowmead Close	51	51	-	65	55	45	-14	-4	-	Negligible	Small	-
7 Neap House	56	56	-	65	55	45	-9	1	-	Negligible	Medium	-

1. *Significant effects are also likely if the work on the main construction areas needs to be undertaken during the evening at the same intensity as during the day. However, the current information suggests that work outside of core daytime hours would be discussed with NLC.*

Table 14 Predicted Noise Levels for Construction of the Buildings to the South of the Energy Park Land dB $L_{Aeq, T}$ (Façade)

NSR	Predicted Noise Level			Criterion dB LOAEL			Exceedance			Impact Magnitude		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening [1]	Night
1 Flixborough Grange	44	44	-	65	55	45	-21	-11	-	Negligible	Negligible	-
2 The Forge, Flixborough	46	46	-	65	55	45	-19	-9	-	Negligible	Negligible	-
3 Charmaine, Amcotts	51	51	-	65	55	45	-15	-5	-	Negligible	Small	-
4 Park Ings Farm	52	52	-	65	55	45	-13	-3	-	Negligible	Small	-
5 Inglenook, Amcotts	55	55	-	65	55	45	-10	0	-	Negligible	Small	-
6 Willowmead Close	61	61	-	65	55	45	-4	6	-	Small	Large	-
7 Neap House[2]	62	62	-	65	55	45	-3	7	-	Small	Large	-

1. *Significant effects are also likely if the work on the main construction areas needs to be undertaken during the evening at the same intensity as during the day. However, the current information suggests that work outside of core daytime hours would be discussed with NLC.*
2. *This predicted noise level also provides an approximation of noise from the new access road on this receptor as the works will be a similar distance but potentially less plant than during building construction. The road construction plant will also move away from receptor over time which will lessen overall noise impact.*

8.1.3.21 The results of the analysis of construction noise impacts show that likely significant effects are likely from the works associated with installation of the Northern DHPWN, and for the main works for buildings in the northern and southern parts of the Energy Park Land when evening works are required to be carried out.

8.2 Construction (Groundborne Vibration from Construction Plant)

8.2.1.1 Vibration is only likely to have a significant effect within 100 m for key activities such as driven piling or use of vibratory compactors, so in most cases the effects will be below moderate as the main building activities are considerably further from the site than this i.e. not significant.

8.2.1.2 Vibration generating equipment will be required during road breaking and other activities during trenching and compaction associated with the installation of the Northern DHPWN, and this will take place close to properties in Normanby Road. The commercial properties on Bessemer Way are not expected to any closer than this, and are likely to be less sensitive to vibration than residential buildings. There is no established method of predicting vibration from road breaking, however, the effects (based on measuring vibration from similar activity) are generally noted as being localised and less widespread than the noise from this activity. ERM's existing database of measurements showed that the use of two large hand held breakers excavating well-compacted cement bound material and hard mudstone gave rise to 2.6 mm/s PPV at 2 m from the activity. A single large breaker also gave rise to 3.3 mm/s at 2 m. The references in BS5228 (see below) allow for a prediction methodology for percussive piling, which has similar characteristics to breaking. The PPV varies according to $r^{-1.3}$ where r is the slant distance to the toe of the pile. Using this to approximate the vibration level at 17 m, which is the minimum distance likely to the receptors on Normanby Road, the estimated level of vibration would be approximately 0.2 mm/s, which might be just perceptible and a negligible magnitude impact resulting in an effect which is not significant. It is noted that the vibration inside the building would be likely to be lower than predicted externally, and therefore the above assessment is considered to be a worst-case.

8.2.1.3 Vibration levels from vibratory compaction are expected to be the most significant with vibration generating equipment. The groundborne vibration potentially generated by construction activities has been calculated using the guidance in Transport Research Laboratory (TRL) Report 429, and guidance in BS5228 - 2:2009 (+A1: 2014). These sources of guidance primarily define empirical prediction methods for various construction activities in terms of the resultant peak particle velocity (PPV).

8.2.1.4 Using the above method the steady state vibration from a vibratory roller (based on a single drum roller, maximum amplitude 0.4 mm, drum width 1.5m) at 17 m would be approximately 0.9 mm/s (for 95% confidence that this level would not be exceeded). This is below the criterion and indicates a small magnitude impact. The duration of the impact is expected to be

limited to typically a few days outside each receptor for this type of work. It also does not exceed SOAEL and is therefore predicted to be an effect of minor significance.

8.3 Construction (Road Traffic Noise)

8.3.1.1 The traffic flow forecasts during construction have been used to predict the noise changes in terms of the Basic Noise Level (BNL) at 10 m from the roads used by construction traffic using the method in CRTN. The routes adopted include:

- Stather Road (West) / new link road;
- Ferry Road West (between New Link Road and A1077);
- A1077 (South);
- the M181 (south of A18); and
- the M181 (north of M180).

8.3.1.2 The changes in traffic indicated that noise increases would be less than 1 dB(A) as a result of the construction traffic. This would result in a negligible noise impact which is not significant.

8.4 Construction (Offsite Railway Noise)

8.4.1.1 No trains are expected to be required at night. Noise is predicted to be below the construction criteria of 65 dB(A) and is therefore considered not significant.

8.5 Operation (Fixed Plant, On-Site Vehicle Movements and Noise From Unloading Operations)

8.5.1 Initial Estimates of Impacts in Accordance with BS 4142

8.5.1.1 The criteria used to assess noise impacts are discussed in Section 5. First, an initial estimate of the impact is made using the BS 4142 method. Following this, the context is considered for each NSR in turn using the guidance in BS 4142 to determine the effect significance. At this stage in the noise assessment process, quite well-developed source data are available for the ERF and other processing plant but are still under development for other aspects of operation including railhead and wharfside unloading activity, requiring some reasonable worst-case assumptions. However, the level of information available has increased and has enabled the noise impact assessment to be updated since the PEIR was undertaken.

8.5.1.2 Predicted noise levels during operation are presented for the day and night for the following scenarios:

8.5.1.3 Scenario1 (daytime) – Unloading RDF at the Wharf:

- 1 vessel (same as or similar to that currently used at the Wharf);

- loading or unloading RDF equipment;
- vehicle movements carrying RDF between the Wharf and tipping hall (on-site);
- fixed process buildings[16];
- concrete block export by road (and reagent and plastic waste delivery); and
- HGV movements; road deliveries, plastic export and hydrogen bus refuelling.

8.5.1.4 Scenario 2 (daytime) Unloading Aggregate at the Wharf:

- 1 vessel (same as or similar to that currently used at the Wharf);
- fixed process buildings;
- equipment for loading or unloading aggregate (sand)/concrete blocks;
- vehicle movements carrying aggregate between the Wharf and concrete block manufacturing facility (on-site);
- concrete block export by road (and reagent and plastic waste delivery); and
- HGV movements; road deliveries, plastic export and hydrogen bus refuelling.

8.5.1.5 Scenario 3 (daytime) Unloading RDF at Railhead:

- 1 train at railhead[17];
- loading or unloading RDF equipment;
- vehicle movements carrying RDF between railhead and tipping hall (on-site);
- fixed process buildings;
- concrete block export by road (and reagent and plastic waste delivery); and
- HGV movements; road deliveries, plastic export and hydrogen bus refuelling.

8.5.1.6 Scenario 4 (daytime) Unloading Aggregate at Railhead :

- 1 train at railhead[18];
- equipment for loading or unloading aggregate (sand);
- vehicle movements carrying aggregate between railhead and concrete processing area (on-site);

[16] This includes all the generation and production process buildings that effectively operate constantly throught the day and night, but excludes gas venting at the AGI which will be for safety reasons only and will not form part of normal operation and will only occur during rare occurances. Noise from this source will be mitigated appropriately to avoid significant noise impacts at the nearest noise sensitive receptors.

[17] Assumed to be stationary during unloading/loading.

[18] Assumed to move slowly during unloading on low power settings to position carraiges over hopper.

- fixed process buildings;
- concrete block export by road (and reagent and plastic waste delivery); and
- HGV movements; road deliveries, plastic export and hydrogen bus refuelling.

8.5.1.7 Scenario 5 Situation without Unloading (night-time or daytime between the above scenarios):

- 1 vessel at the Wharf;
- fixed process buildings (as per daytime, but without tipping taking place); and
- HGV movements; road deliveries, plastic export and hydrogen bus refuelling (all during day only).

8.5.1.8 Table 15 to Table 19 present predicted noise levels from the ERF and other Project processing plant based on the level of noise mitigation described in Section 7 and presents an initial estimate of impacts at each NSR as required by BS4142. (It is expected that noise levels will be similar during loading or unloading events.) Levels are free-field and at first floor window level. Sound levels at ground floor level will be slightly lower (due to greater ground absorption and screening from the intervening topography). Figure 2 to Figure 6 in Appendix A show a plan of the predicted noise levels.

Table 15: Scenario1 (Daytime) – Unloading RDF at the Wharf: Initial Estimate of Noise Impacts (Free-field, 1st Floor Level)

NSR	Predicted Rating Level, LAr,Tr (1)	Representative Background Sound Level, LA90,15mins	Difference between Rating Level and Representative Background Sound Level, dB	Impact Magnitude
		Day	Day	
1 Flixborough Grange	35	34	1	Small
2 The Forge, Flixborough	39	34	5	Small
3 Charmaine, Amcotts	51	41	10	Medium
4 Park Ings Farm	38	37	1	Small
5 Inglenook, Amcotts	43	34	9	Medium
6 Willowmead Close	38	39	-1	Negligible
7 Neap House	40	34	6	Medium

1. *An acoustic feature correction has not been applied in this assessment because it is most likely that the need for a correction can be avoided during the detailed design phase.*

Table 16: Scenario 2 (Daytime) Unloading Aggregate at the Wharf: Initial Estimate of Noise Impacts (Free-field, 1st Floor Level)

NSR	Predicted Rating Level, $L_{Ar,Tr}$ (1)	Representative Background Sound Level, $L_{A90,15mins}$	Difference between Rating Level and Representative Background Sound Level, dB	Impact Magnitude
		Day	Day	
1 Flixborough Grange	33	34	-1	Negligible
2 The Forge, Flixborough	38	34	4	Small
3 Charmaine, Amcotts	49	41	8	Medium
4 Park Ings Farm	38	37	1	Small

NSR	Predicted Rating Level, $L_{Ar,Tr}$ (1)	Representative Background Sound Level, $L_{A90,15mins}$	Difference between Rating Level and Representative Background Sound Level, dB	Impact Magnitude
		Day	Day	
5 Inglenook, Amcotts	42	34	8	Medium
6 Willowmead Close	38	39	-1	Negligible
7 Neap House	40	34	6	Medium

1. *An acoustic feature correction has not been applied in this assessment because it is most likely that the need for a correction can be avoided during the detailed design phase.*

Table 17: Scenario 3 (Daytime) Unloading RDF at Railhead: Initial Estimate of Noise Impacts (Free-field, 1st Floor Level)

NSR	Predicted Rating Level, $L_{Ar,Tr}$ (1)	Representative Background Sound Level, $L_{A90,15mins}$	Difference between Rating Level and Representative Background Sound Level, dB	Impact Magnitude
		Day	Day	
1 Flixborough Grange	33	34	-1	Negligible
2 The Forge, Flixborough	38	34	4	Small
3 Charmaine, Amcotts	48	41	7	Medium
4 Park Ings Farm	40	37	3	Small
5 Inglenook, Amcotts	46	34	12	Large
6 Willowmead Close	39	39	0	Negligible
7 Neap House	43	34	9	Medium

1. *An acoustic feature correction has not been applied in this assessment because it is most likely that the need for a correction can be avoided during the detailed design phase.*

Table 18: Scenario 4 (Daytime) Unloading Aggregate at Railhead: Initial Estimate of Noise Impacts (Free-field, 1st Floor Level)

NSR	Predicted Rating Level, $L_{Ar,Tr}$ (1)	Representative Background Sound Level, $L_{A90,15mins}$	Difference between Rating Level and Representative Background Sound Level, dB	Impact Magnitude
		Day	Day	
1 Flixborough Grange	33	34	-1	Negligible
2 The Forge, Flixborough	38	34	4	Small
3 Charmaine, Amcotts	49	41	8	Medium
4 Park Ings Farm	40	37	3	Small
5 Inglenook, Amcotts	46	34	11	Large
6 Willowmead Close	39	39	0	Negligible
7 Neap House	43	34	9	Medium

1. *An acoustic feature correction has not been applied in this assessment because it is most likely that the need for a correction can be avoided during the detailed design phase.*

Table 19: Scenario 5 Situation without Unloading (Night-time or Daytime between the Above Scenarios): Initial Estimate of Noise Impacts (Free-field, 1st Floor Level)

NSR	Predicted Rating Level, $L_{Ar,Tr}$ (1)	Representative Background Sound Level, $L_{A90,15mins}$		Difference between Rating Level and Representative Background Sound Level, dB		Impact Magnitude	
		Day	Night	Day	Night	Day	Night
1 Flixborough Grange	32	34	34	-2	-2	Negligible	Negligible
2 The Forge, Flixborough	37	34	35	3	2	Small	Small
3 Charmaine, Amcotts	42	41	37	1	5	Small	Small

NSR	Predicted Rating Level, $L_{Ar,Tr}$ (1)	Representative Background Sound Level, $L_{A90,15mins}$		Difference between Rating Level and Representative Background Sound Level, dB		Impact Magnitude	
		Day	Night	Day	Night	Day	Night
4 Park Ings Farm	38	37	40	1	-2	Small	Negligible
5 Inglenook, Amcotts	39	34	34	5	5	Small	Small
6 Willowmead Close	37	39	37	-2	0	Negligible	Negligible
7 Neap House	38	34	34	4	4	Small	Small

1. An acoustic feature correction has not been applied in this assessment because it is most likely that the need for a correction can be avoided during the detailed design phase.Consideration of Context and Significance

8.5.1.9 Table 20 describes the likely significance of the effect for each NSR location.

Table 20: Overall Context and Significance Daytime Operations (Scenarios 1 to 4)

NSR	Impact Magnitude (Based on BS4142 Initial Assessment)	Consideration of Context	Effect Significance
1 Flixborough Grange	Day: Negligible to Small Night: Negligible	As the context of the receiving environment is not considered to significantly alter the initial estimate of the impact, noise at this level is unlikely to be significant.	Day: Not significant Night: Not significant
2 The Forge, Flixborough	Day: Small Night: Small	Daytime noise does not exceed the target level for external amenity space (e.g. gardens) of 50 dB, LAeq (2). Noise from the Project would not be the only form of industrial noise heard at this NSR. This should lessen its perceived impact, which will sit within an industrial noise soundscape. Below the range of external noise levels 40 – 45 dB, LAeq at night that provides a good standard for sleep within the building (2).	Day: Minor Night: Minor
3 Charmaine, Amcotts	Day: Small to Medium	Predicted daytime noise levels result in a noise exceedance of LA90 background noise of between 7 to 10 dB when loading or unloading is	Day: Minor

NSR	Impact Magnitude (Based on BS4142 Initial Assessment)	Consideration of Context	Effect Significance
	Night: Small	taking place, which indicates a noise impact between adverse and significant based on the initial assessment in BS4142 depending on context. Between these events an exceedance of 1 dB is predicted which would be below an adverse effect. The noisiest activity (RDF loading and unloading at the Wharf) just exceeds the target level for daytime external amenity space (e.g. gardens) of 50 dB, LAeq (2) by 1 dB which is not a noticeable difference. This activity is only expected typically to occur over a 4 hour period each day. Noise from the Project would not be the only form of industrial noise heard at this NSR. This should lessen its perceived impact, which will sit within an industrial noise soundscape. It is also noted that LAeq noise levels measured at this receptor were often at or above 50 dB, LAeq in the existing situation. Taking the above contextual factors into account the significance has been classed as minor. Night-time noise may result in an exceedance of background noise of 5 dB(A) which indicates the potential start of an adverse impact. However, the predicted noise levels are within the range of external noise levels 40 – 45 dB, LAeq at night that provides a good standard for sleep within the building (2).	Night: Minor
4 Park Ings Farm	Day: Small Night: Negligible	As the context of the receiving environment is not considered to significantly alter the initial estimate of the impact, noise at this level is unlikely to be significant at night and minor during the day.	Day: Minor Night: Not significant
5 Inglenook, Amcotts	Day: Small to Large	Predicted daytime noise levels result in a noise exceedance of LA90 background noise of between 8 to 12 dB when loading or unloading is taking place, which indicates a noise impact between adverse and significant based on the initial assessment in BS4142 depending on context. The highest noise exceedances are during loading/unloading	Day: Moderate

NSR	Impact Magnitude (Based on BS4142 Initial Assessment)	Consideration of Context	Effect Significance
	Night: Small	at the railhead. Between these events an exceedance of 5 dB is predicted which would indicate an adverse effect. Daytime noise does not exceed the target level for external amenity space (e.g. gardens) of 50 dB, LAeq (2). Noise from the Project would not be the only form of industrial noise heard at this NSR. This should lessen its perceived impact, which will sit within an industrial noise soundscape. Taking the above contextual factors into account the significance has been classed as moderate. Night-time noise may result in an exceedance of background noise of 5 dB(A) which indicates the potential for an adverse impact based on the initial assessment in BS4142 depending on context. The predicted noise levels are below the range of external noise levels 40 – 45 dB, LAeq at night that provides a good standard for sleep within the building (2).	Night: Minor
6 Willowmead Close	Day: Negligible Night: Negligible	As the context of the receiving environment is not considered to significantly alter the initial estimate of the impact, noise at this level is unlikely to be significant.	Day: Not significant Night: Not significant
7 Neap House	Day: Small to Medium	Predicted daytime noise levels result in a noise exceedance of LA90 background noise of between 6 to 9 dB when loading or unloading is taking place, which indicates a noise impact between adverse and significant based on the initial assessment in BS4142 depending on context. Between these events an exceedance of 4 dB is predicted which would indicate an adverse effect. (It is noted that these exceedences have been based on limited baseline measurements at Inglenook due to survey access not being available to Neap House, which could have resulted in a conservative assessment as this receptor is closer to industrial works off Gunness Lane and the A1077.) Daytime noise does not exceed the target level for external amenity space (e.g. gardens) of 50 dB, LAeq (2).	Day: Minor

NSR	Impact Magnitude (Based on BS4142 Initial Assessment)	Consideration of Context	Effect Significance
	Night: Small	Noise from the Project would not be the only form of industrial noise heard at the nearest properties, and this should lessen its perceived impact, as the new noise will sit within an industrial noise soundscape. Taking the above contextual factors into account the signifinace has been classed as minor. Below the range of 40 – 45 dB, LAeq that provides a good standard for sleep within the building (2).	Night: Minor

1. *Exceedance of Rating Level over Representative Background Sound Level, dB (Day/Night)*
2. *British Standard 8233[19] provides an internal design target for a bedroom at night of 30 dB $L_{Aeq,23:00-07:00}$, based on preserving a good standard for sleep within the building. The external noise levels that are equivalent to this value are typically 10 to 15 dB higher with windows open so that a reasonable benchmark is between 40 and 45 dB $L_{Aeq,23:00-07:00}$ (free-field). The standard also provides a design target for external areas used for amenity space such as gardens of 50 dB $L_{Aeq,T}$ or 55 dB $L_{Aeq,T}$ in noisier environments.*

[19] BS8233: 2014, Guidance on Sound Insulation and Noise Reduction for Buildings, BSI, 2014.

8.5.1.10 Table 20 presents the results of the assessment of noise from operations on the site. This includes noise from all activities described in Section 4.3, including those associated with loading and unloading activities at the Wharf (including the presence of a vessel) and at the railhead, which occur less frequently.

8.5.1.11 These loading and unloading activities have been modelled since the PEIR was published and are based on the current information regarding how the activities would be carried out. Based on current design information, noise modelling of unloading activities shows the potential for up to moderate significance noise effects when the context of the sound is taken into account. During the modelling process the Applicant has explored solutions to reduce noise from these activities before submission of the ES. These include the use of well maintained, modern plant which will be fitted with at-source noise mitigation such as silencers and acoustic engine enclosures. These measures will be included in the CEMP and controlled in the draft DCO.

8.5.1.12 Free-field noise levels, LAeq,T, of up to 62 dB are predicted at the nearest buildings within the Flixborough Industrial Estate. On a precautionary basis, they are assumed to contain offices and therefore up to small magnitude noise impacts are predicted, resulting in noise effects of minor significance.

8.6 Operation (Noise from Railway Vehicles)

8.6.1.1 Predicted noise from trains using the railway between Dragonby Sidings and the Energy Park Land is presented in Table 21.

Table 21: Predicted Noise from Railway Vehicles

NSR	Predicted Train Noise Level, Day $L_{Aeq,T}$ [(1)] dB (Free-field)	Exceeds LOAEL (yes / no)
1 Flixborough Grange	29	No
2 The Forge, Flixborough	43	No
3 Charmaine, Amcotts	31	No
4 Park Ings Farm	34	No
5 Inglenook, Amcotts	28	No
6 Willowmead Close	26	No
7 Neap House	27	No
8 29 High Street, Dragonby	35	No

1. *A service level of one train every 4 hours has been assumed, and trains are assumed to run during the daytime only. However, this is likely to be a worst case as subsequent modelling has shown that only three trains per day are likely.*

8.6.1.2 Train noise is predicted to be below the L_{Aeq} LOAEL threshold level of 50 dB during the day at all NSRs.

8.7 Operation (Road Traffic Noise)

8.7.1.1 Changes in traffic noise on the road network as a result of the operation of the Project have been predicted based on traffic data for the 'do min' and 'do something' situations (i.e. the situations without the Project and with it) in the year of opening 2028.

8.7.1.2 The year 2028 represents a worst-case comparison as traffic from the Project is expected to remain the same in the future assessment year (2038) whereas non-scheme traffic is expected to grow, lessening the difference.

8.7.1.3 The results are presented in Table 22.

Table 22: Change in Traffic Noise on the Road Network

Link number	Link name	Predicted Increase in Noise Level, dB
1	Bellwin Drive	0.2
2	First Avenue (West)	0.0
3	Stather Road (West)	(1)
4	Stather Road (East)	0.0
5	First Avenue (East)	0.0
6	New Access Road	(1)
7	B1216 Ferry Road West (West)	0.0
8	B1216 Ferry Road West (East)	0.2
9	A1077 (South)	0.6
10	A1077 (North)	0.4
11	Ferry Road West	0.0
12	Holyrood Drive	0.1
13	Lunburg Way	0.0
14	A1077 (North East)	0.3
15	A18 Kingsway (West)	0.2
16	M181	0.3
17	A18 Doncaster Road	0.2
18	A159	0.0
19	A18 Queensway	0.1
20	Ashby Road	0.0
21	A18 Kingsway (East)	0.2
22	Ferry Road West (near Staggered junction)	1.0

As part of the Project, Stather Road (west) will be closed and a new access road built further to the east. Changes in road traffic noise on these road links are discussed below this table.

8.7.1.4 As part of the Project, Stather Road (west), between the roundabout close to Neap House Drain and Bellwin Drive (on the Flixborough industrial estate) will be closed and a new access road built further to the east, between Ferry Road and Bellwin Drive. Traffic currently using this road would be, for the most part, expected to use the new road, leading to a large reduction in noise at NSRs close to this road link, chiefly Neap House.

8.7.1.5 The increased traffic on the new access road is expected to generate higher noise levels compared to the existing Stather Road (west). The increase in noise levels is likely to be approximately 3 dB, due to increases in traffic flows. As the road will be further from the nearest NSRs (Neap House and properties close to the river in Amcotts, e.g. Inglenook), they are expected to experience increases of less than 3 dB, which would not be significant. As mentioned above, a reduction in noise would be expected at Neap House because the relative increase in distance to the new road is large.

8.7.1.6 Noise from traffic on this road at NSRs to the east (NSR 6; Willowmead Close, NSR 4; Park Ings Farm) may increase as a result of increases in traffic flow and from the road moving closer. However, as these NSRs are situated further from the road, this source of noise is expected to be less significant to the overall noise level at these NSRs and increases are likely to be small or negligible and therefore not significant.

8.7.1.7 Predicted noise changes from all other road links are less than 3 dB and therefore not significant.

8.8 Assessment Limitations

8.8.1.1 This section describes the limitations of this assessment and identifies areas where data are not available to address a specific issue in detail. It also discusses the approaches that have been taken to ensure the assessment is robust.

8.8.1.2 Construction noise and vibration have been assessed based on the knowledge of the likely construction activities provided by the engineering team. This information is based on common practice on other similar projects. However, the detailed construction method and planning has not been undertaken and will be developed once a contractor is appointed to undertake the works. Where this is an issue, a robust, but conservative approach has been adopted assuming the highest likely noise emissions from equipment that is likely to be used to construct the Project. Reasonable worst case assumptions regarding the proximity of plant to the nearest noise sensitive receptors has also been made where appropriate.

8.8.1.3 Detailed knowledge of the layout of buildings around the site has not been available at this stage. An example would be the identification of individual potentially noise sensitive offices within the generally industrial buildings at Flixborough Industrial Estate. More detailed confirmation of the locations of any such offices will be carried out during development of the CEMP to

ensure that mitigation is appropriately specified to address any impacts where practicable. The assessment has taken a conservative approach and assumed that all surrounding buildings may house such office space.

8.8.1.4 The detail of the operational plant that will be selected at the site has not been established at this planning stage, and whilst the most realistic data have been used to represent the lowest noise levels that are achieved in practice at existing facilities, it may be that other technology such as quieter vehicles, or low noise fixed equipment becomes available. Changes in technology will be reviewed as part of the development of the Noise Management Plan.

9. CONCLUSIONS AND RESIDUAL EFFECTS

9.1 Construction

9.1.1.1 In order to manage construction noise, construction works will be undertaken in accordance with a CEMP (refer to CoCP, **Document Reference 6.3.7**). The CEMP will set out the key management measures that contractors will be required to adopt and implement. These measures will be developed based on those identified during the EIA process. They will include strategies and control measures for managing the potential environmental effects of construction and limiting disturbance from construction activities as far as reasonably practicable. A CoCP that provides the basis for the CEMP is provided in Annex 7 of the ES (**Documents Reference 6.3.7**).

9.1.1.2 Lead contractors will develop and submit the CEMP for agreement with the local planning authority. The approved measures will be set out in detail by the Contractor in the CEMP. The CEMP will set out detailed BPM measures to minimise construction noise and vibration, including control of working hours, and provide a further assessment of construction noise and vibration if necessary. The approved measures will be set out in detail by the Contractor in the CEMP.

9.1.1.3 The predicted residual effects of construction noise impacts are predicted to be of moderate significance at most. In general most impacts are on a small number of receptors, or over very short periods of time such as is likely for the night works to connect the reopened railway with the existing mainline railway or the transitory works associated with the DHPWN.

9.1.1.4 The effect of noise during demolition and construction at the worksite in Flixborough Industrial Estate has been considered on the neighbouring industrial buildings at Flixborough Industrial estate on a worst-case basis. Taking into account the potential for disturbance, but bearing in mind that the noise levels will not be at their highest every day, the impact has been assessed as being moderate, and will be investigated further during the production of the CEMP with the agreement of NLC once more information is available.

9.1.1.5 At Normanby Road and at Concord House and commercial buildings containing offices on Bessemer Way, noise and vibration from the installation of Northern DHPWN pipework and cables has the potential to lead to impacts of large magnitude. However, these works will be undertaken during the day and over a relatively short period. Therefore, moderate residual noise effects are predicted.

9.1.1.6 The closest receptors in Normanby Road are also likely to be subject to vibration impacts during breaking out of the road surface and vibratory compaction, but these are expected to be of minor significance.

9.1.1.7 If daytime directional drilling cannot be used to cross the Skippingdale Roundabout during works associated with the Northern DHPWN, night

works would be required to lay the DHPWN pipe in an excavated trench. This has the potential to lead to impacts of large magnitude. However, these works will be undertaken over a relatively short period. Therefore, moderate residual noise effects are predicted.

9.1.1.8 Significant effects are also likely if the work on the main construction areas needs to be undertaken during the evening at the same intensity as during the day. However, work outside of core daytime hours would be discussed with NLC to establish which works could be performed with a low likelihood of significant effects.

9.1.1.9 The effect of the further mitigation described above cannot be quantified at this stage because the works have not been designed in detail. In order to take a robust approach the assessment of construction noise assumes that further mitigation will not reduce the noise levels during construction.

9.1.1.10 However, detailed consideration will be given to the need for screening around the main worksites considering if it will be effective taking into account the location of the construction noise equipment including its height above ground. More detailed liaison with commercial building owners to identify if the conservative assumption that noise sensitive offices are located in the nearest buildings, is justified, and therefore that further mitigation is necessary.

9.1.1.11 The potential for further mitigation in the form of mobile barriers around the night-time works at Skippingdale roundabout will also be considered in discussions with NLC. It has not been specified at this stage because the balance between the effectiveness of the mitigation in reducing noise levels, and the extension to the number of night time periods that will be required if barriers are to be located and removed during each nightly period, cannot be calculated.

9.1.1.12 Temporary noise barriers could be located around the working area for the DHPWN at other locations, however the installation of this hoarding would reduce the working width for the installation of the network, making works more difficult. The practicability of this mitigation measure will need to be assessed once a contractor is appointed and the detail programme of works is established.

9.2 Operation

9.2.1.1 The residual effects from the operation of the Project at a small number of NSRs are predicted to be of no greater than moderate significance when the context of the noise impact is considered. This assumes the integral mitigation which is described in Section 7.3. The assumed mitigation in terms of enclosures for the fixed plant and noise levels for equipment have been based on the experience of the design team in terms of the lowest realistic noise levels that are likely to be achieved. External plant at the Wharf and the Railhead have been based on measurements at Flixborough and Immingham of plant which was operated, where appropriate, with at-source mitigation such as exhaust silencers and enclosed engine

compartments. Therefore, this assessment takes into account a high level of mitigation which is currently commercially available and practicable to implement.

9.2.1.2 Opportunities for further mitigation will be explored during detailed design to reduce predicted significant noise effects which have been reported in the ES. However, it should be noted that the mitigation options, including the use of building facades with higher acoustic insertion losses, have been considered with the Project engineering team, and lower noise methods of unloading aggregate from the train which avoid the need for a grab crane have been explored, and these have been included in the assessment. As a result options for further mitigation are not expected to significantly change the predicted noise levels. The use of noise barriers along the railhead and on-site roads has also been considered, however, these have not been included due to concerns regarding the potential obstruction of flood water flows on the site, and would only mitigate noise from unloading trains.

9.2.1.3 A noise-monitoring and management programme will be developed and agreed with NLC, and will be implemented before the development becomes operational. The purpose of the programme will be to demonstrate noise from the operation of the Project is no higher than reported in the ES and where practicable to reduce noise levels below those that have been predicted. This noise monitoring will include:

- measurements of candidate unloading equipment during procurement including during loading/unloading cycles to ensure it does not lead to higher noise levels than assumed in the ES;
- review of test data for fixed equipment and building elements;
- identification of equipment with potentially distinctive noise characteristics from equipment and consideration of alternatives/mitigation based on test data and commissioning measurements;
- regular noise monitoring in Amcotts to establish any activities which result in noise levels above those that are predicted in the ES, including attended noise measurements where it is necessary to identify the contribution of loading and unloading activity noise levels;
- investigation of noise complaints and monitoring as required to identify potential causes and solutions; and
- regular visual monitoring/audit of equipment to identify if noise control equipment (covers/louvres/silencers etc) are in good condition and are being used appropriately to minimise noise levels.

10. REFERENCES

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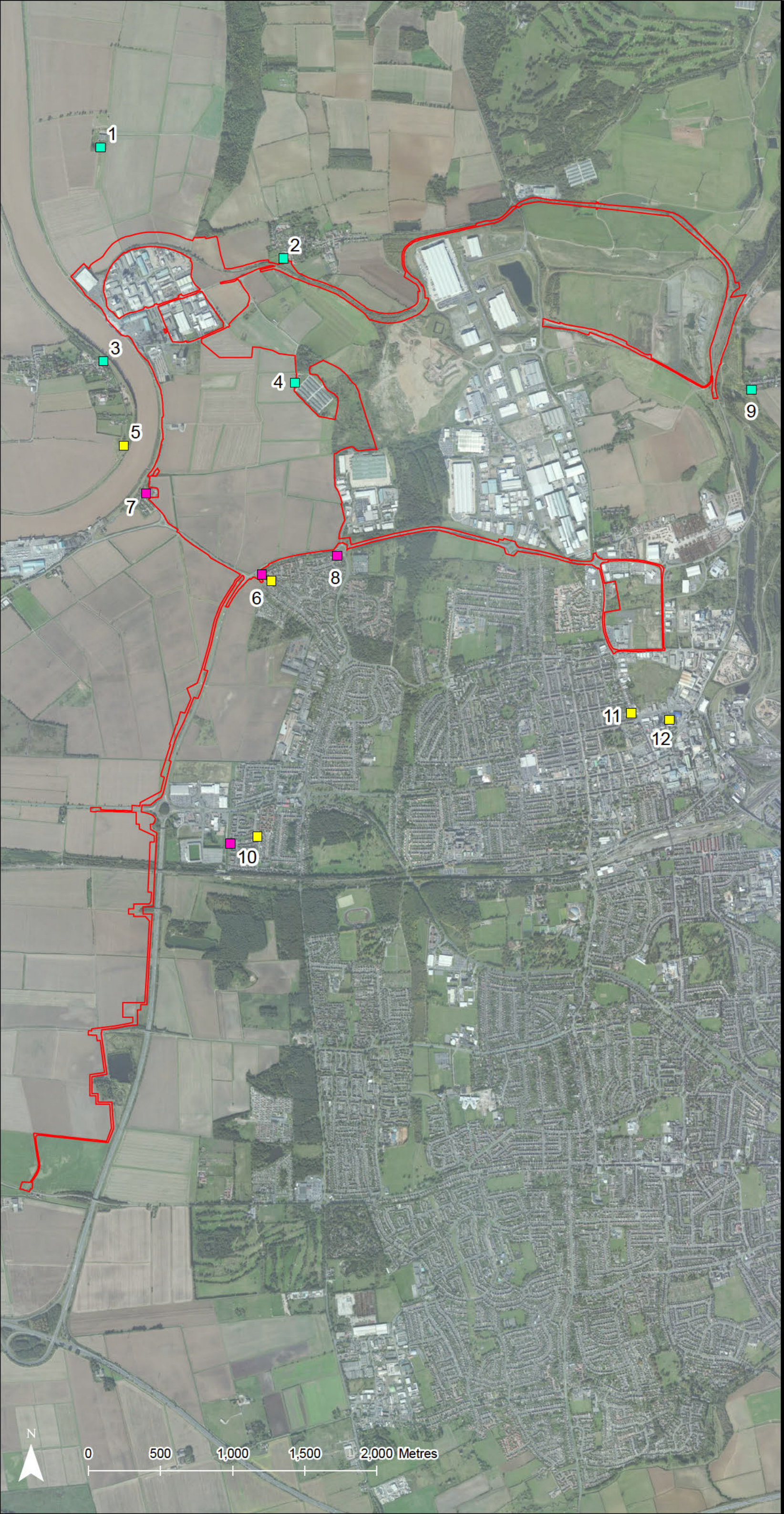
- BS 4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound, British Standards Institute.

APPENDIX A FIGURES

May 2022



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 1 Noise Sensitive Receptors & Monitoring Locations

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN0101116
Date	15/03/2022
Drawn by	MTC
Checked by	MF
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	25,001
ArcMap File	\\UKSSMBNAF-

NOISE_ES_SensitveReceptors_MonitoringLocations_A01

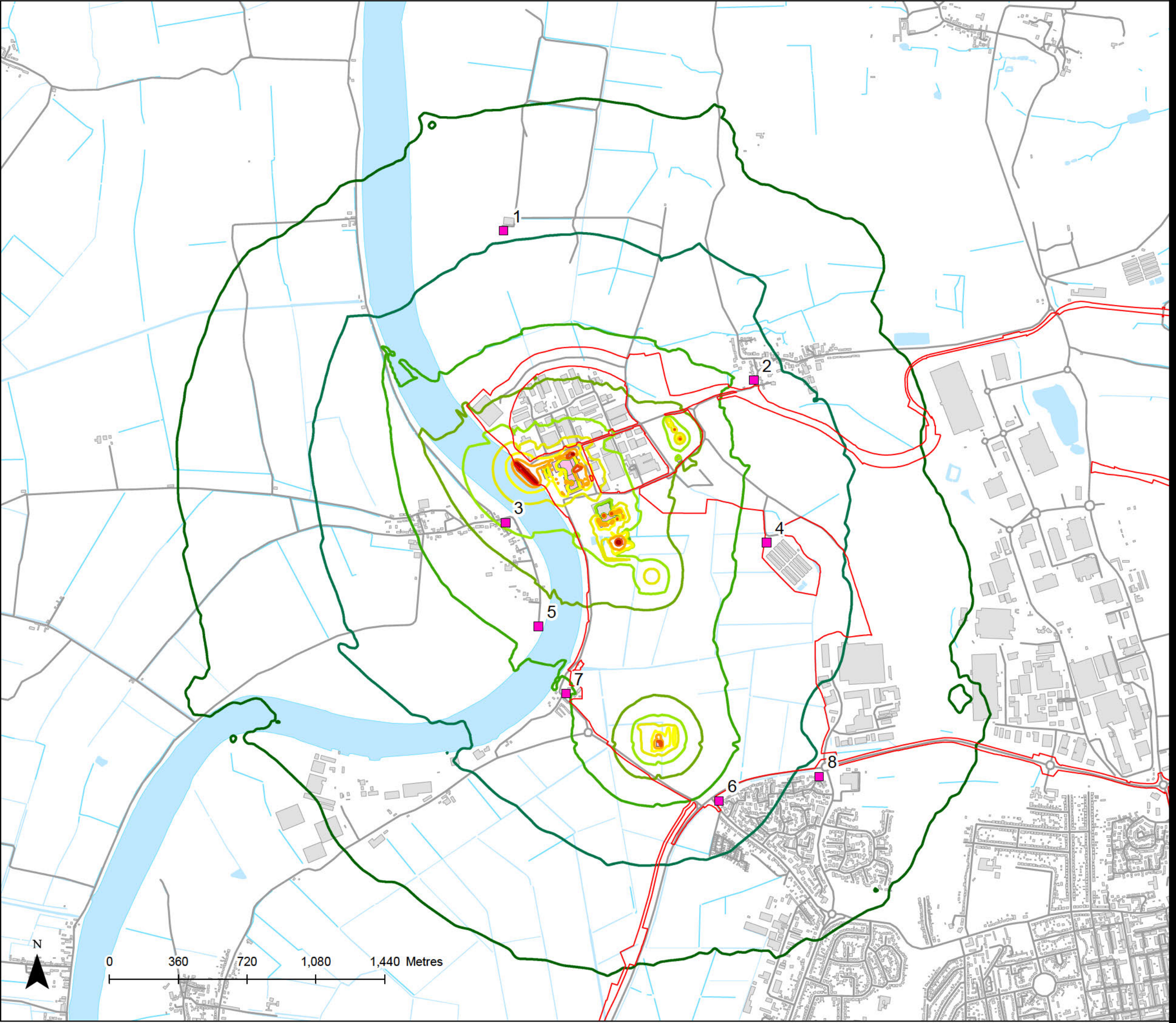
Legend

- Noise Sensitive Receptor / Monitoring Location (Attended noise monitoring)
- Noise Sensitive Receptor / Monitoring Location (Unattended noise monitoring)
- Noise Sensitive Receptor (no monitoring carried out or monitoring carried out nearby)
- Order Limits

Layer Source Information

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DO NOT SCALE THIS DRAWING



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 2 Predicted Noise Levels from Operation of the ERF and Associated Activities (Scenario 1 - Unloading RDF at Quay- Daytime)

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MTC
Checked by	MF
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	18,000
ArcMap File	\\UKSSMBNAF- NOISE_ES_Quay_RDF_Contours_A01

Legend

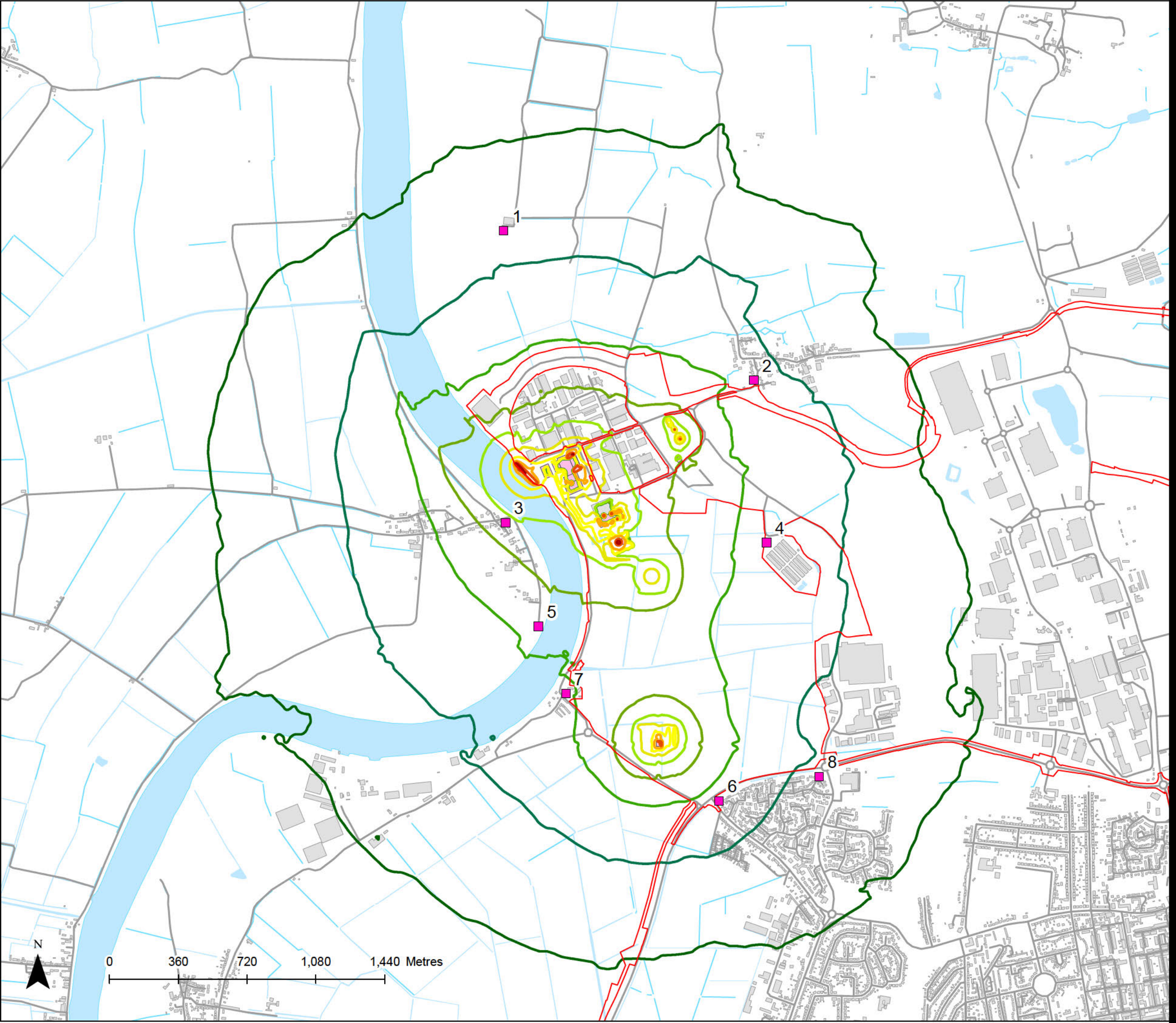
- Noise Sensitive Receptors

Predicted Noise Level, $L_{Aeq,T}$, dB

- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- Order Limits
- Buildings
- Noise Emitting Buildings

Layer Source Information

DO NOT SCALE THIS DRAWING



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ERM

North Lincolnshire Green Energy Park

Title	Figure 3 Predicted Noise Levels from Operation of the ERF and Associated Activities (Scenario 2: - Unloading Aggregate at Quay – Daytime)

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MTC
Checked by	MF
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	18,000
ArcMap File	\\UKSSMBNAF- NOISE_ES_Quay_Aggregate_Contours_A01

Legend

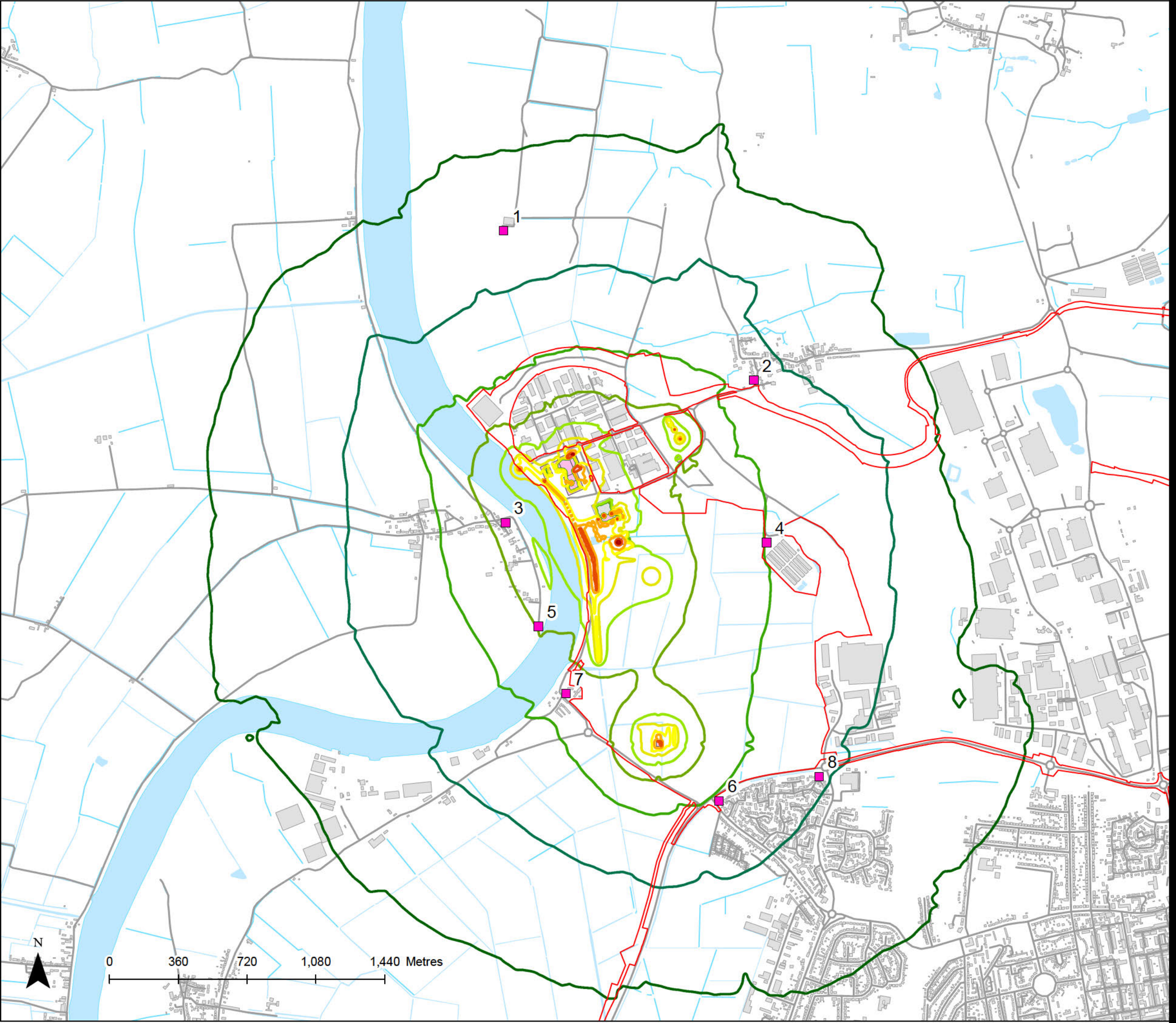
- Noise Sensitive Receptors

Predicted Noise Level, $L_{Aeq,T}$, dB

- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- Order Limits
- Buildings
- Noise Emitting Buildings

Layer Source Information

DO NOT SCALE THIS DRAWING



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 4 Predicted Noise Levels from Operation of the ERF and Associated Activities (Scenario 3 - Unloading RDF at Railhead– Daytime)

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MTC
Checked by	MF
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	18,000
ArcMap File	\\UKSSMBNAF- NOISE_ES_Rail_RDF_Contours_A01

Legend

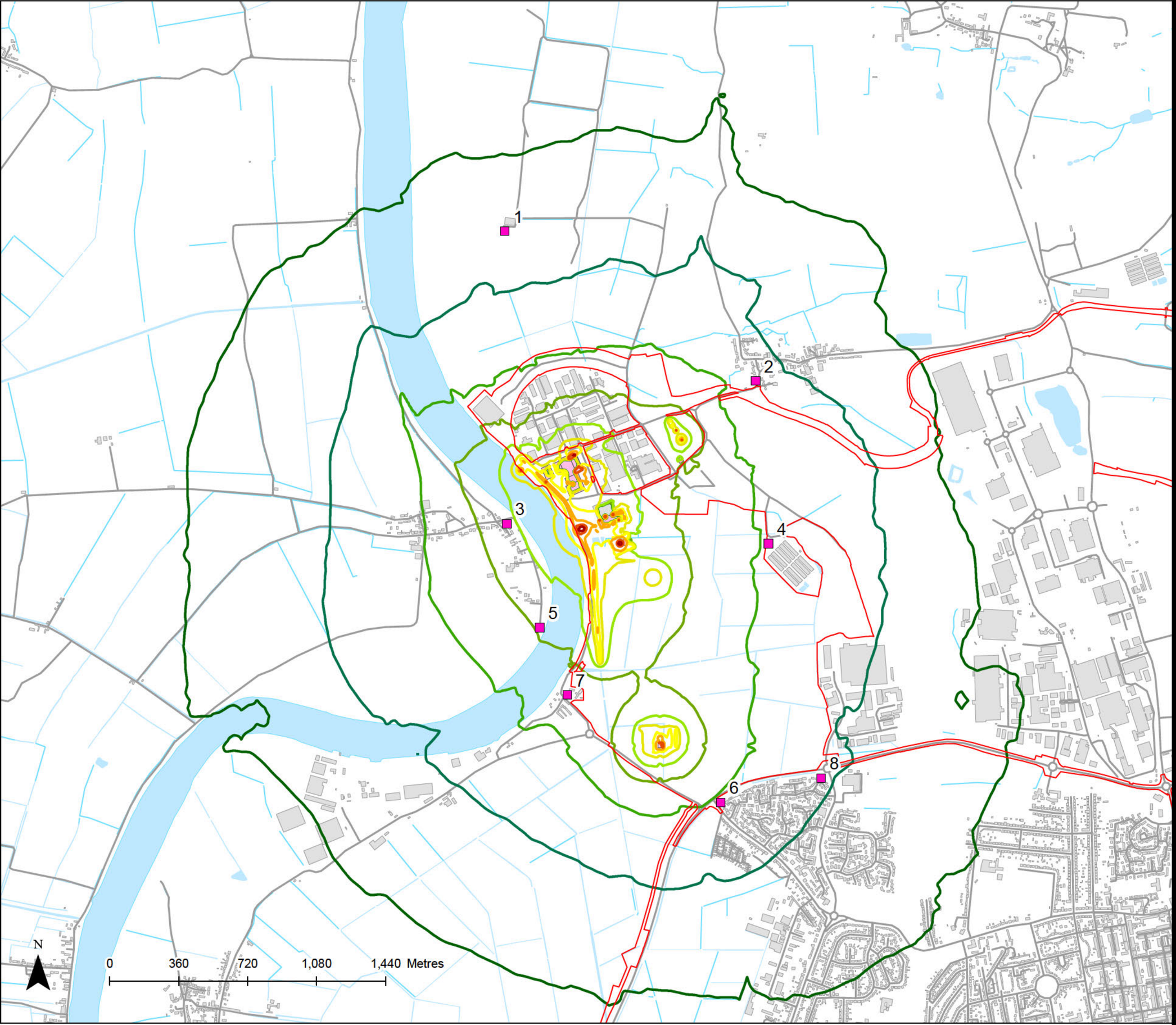
- Noise Sensitive Receptors

Predicted Noise Level, $L_{Aeq,T}$, dB

- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- Order Limits
- Buildings
- Noise Emitting Buildings

Layer Source Information

DO NOT SCALE THIS DRAWING



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 5 Predicted Noise Levels from Operation of the ERF and Associated Activities (Scenario 4 - Unloading Aggregate at Railhead – Daytime)

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MTC
Checked by	MF
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	18,000
ArcMap File	\\UKSSMBNAF- NOISE_ES_Rail_Aggregate_Contours_A01

Legend

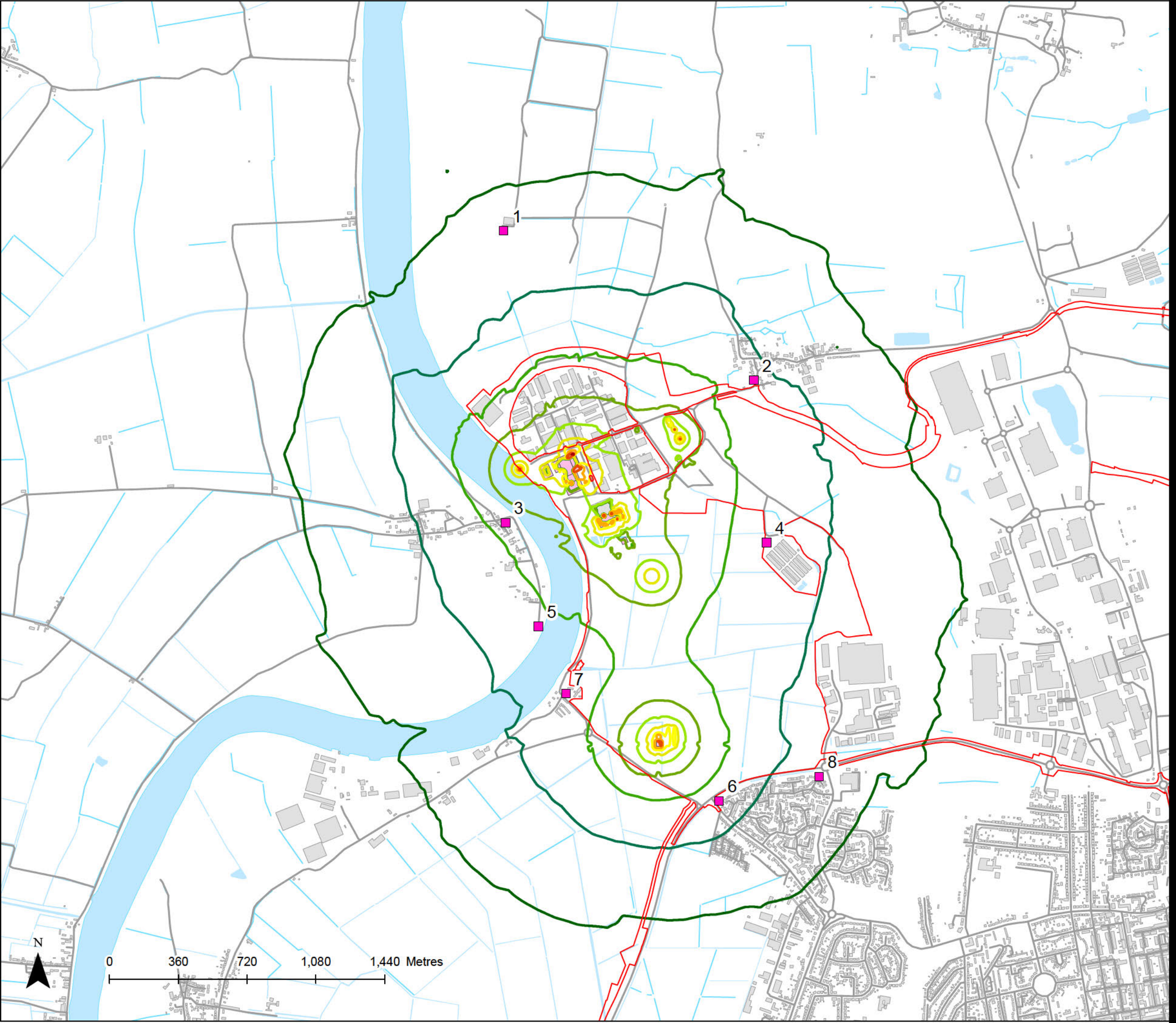
- Noise Sensitive Receptors

Predicted Noise Level, $L_{Aeq,T}$, dB

- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- Order Limits
- Buildings
- Noise Emitting Buildings

Layer Source Information

DO NOT SCALE THIS DRAWING



NORTH LINCOLNSHIRE GREEN ENERGY PARK

ERM

North Lincolnshire Green Energy Park

Title	Figure 6 Predicted Noise Levels From Operation from the ERF and Associated Activities Scenario 5 - Situation without Unloading (Night-time, or Daytime between Scenarios 1 to 4)

Client Information

Client	North Lincolnshire Green Energy Park Ltd
PINS Proj No	EN010116
Date	15/03/2022
Drawn by	MTC
Checked by	MF
Version	P0

Map Information

CRS EPSG	27700
CRS Name	British National Grid
Scale	18,000
ArcMap File	\\UKSSMBNAF- NOISE_ES_Night_Contours_A01

Legend

- Noise Sensitive Receptors

Predicted Noise Level, $L_{Aeq,T}$, dB

- 30
- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- Order Limits
- Buildings
- Noise Emitting Buildings

Layer Source Information

DO NOT SCALE THIS DRAWING

APPENDIX B BASELINE NOISE SURVEY

May 2022

NORTH LINCOLNSHIRE GREEN ENERGY PARK

Planning Act 2008

Infrastructure Planning (Applications Prescribed Forms and Procedure) Regulations 2009

North Lincolnshire Green Energy Park

APPENDIX B BASELINE NOISE SURVEY

Chapter 7 Noise

March 2022

Project No.: EN010116

The business of sustainability

ERM

March 2022

North Lincolnshire Green Energy Park

APPENDIX B BASELINE NOISE SURVEY

Environmental Resources Management

2nd Floor, Exchequer Court
33 St Mary Axe
London EC3A 8AA

[redacted]

CONTENTS

List of Tables

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Acronyms and Abbreviations

Name	Description
dB	Decibel
m	Meters
m/s	Meters per second
RBSL	Representative Background Sound Level
SLM	Sound Level Meters

INTRODUCTION

1.1.1.1 Baseline noise monitoring was carried out between 12th and the 22nd April 2021, to quantify the noise environment at locations close to the Project.

1.1.1.2 This section presents details of the data recorded during the survey and the analysis that has been carried out to derive the Representative Background Sound Level (RBSL) according to BS 4142[1] as well as other key metrics used to describe the baseline noise environment.

1.1.1.3 This appendix is set out as follows:

- Section 0 presents the survey methodology.
- Section 0 presents an overview of the weather data measured over the survey period.
- Section 0 presents the results of the monitoring at Flixborough Grange and the analysis used to derive the RBSL.
- Section 0 presents the results of the monitoring at The Forge, Flixborough and the analysis used to derive the RBSL.
- Section 0 presents the results of the monitoring at Charmaine, Amcotts and the analysis used to derive the RBSL.
- Section 0 presents the results of the monitoring at Park Ings Farm and the analysis used to derive the RBSL.
- Section 0 presents the results of the monitoring at 29 High Street, Dragonby.
- Section 0 presents the results of the attended noise measurements.

METHODOLOGY

2.1 EQUIPMENT AND SETUP

2.1.1.1 Monitoring was carried out using Class 1 sound level meters (attended measurements using a B&K 2250L and five Rion NL-52s set up as noise loggers). A Lufft WS600 weather station was set up at one location (Charmaine, Amcotts), to record weather data throughout the survey period. A Rion WS-15 enhanced windshield with a large diameter windshield and a discrete secondary layer to minimize wind effects at the microphone was used with the five noise loggers.

2.1.1.2 The microphones were set at a height of approximately 1.5 metre (m) above the ground, and all monitoring was carried out in free-field conditions (i.e. at least 3.5 m from the nearest hard reflective surface).

2.1.1.3 The Sound Level Meters (SLM) were calibrated before the survey. Following the survey, the calibration level was checked. No significant drift (i.e. > 0.5

1 BS 4142 2014 Methods for Rating and Assessing Industrial and Commercial Sound, British Standards Institute

decibels (dB)) was noted. Copies of the SLM calibration certificates are available on request.

2.2 DATA RECORDING

2.2.1.1 Noise measurements were carried out at ten locations around the Project. At five of those locations, attended noise measurements were carried out either during the daytime only or during the day and night-time periods. At the remaining five locations a noise meter was installed and left to log 15-minute noise levels continuously for a period of approximately ten days. The noise monitoring locations are shown in Figure 1 in Appendix A.

2.2.1.2 Standard metrics including L_{Aeq}, L_{A90} and $L_{Amax,f}$ were recorded over the 15 minute intervals. In addition, meteorological data such as precipitation, wind speed and direction were continuously logged at one minute intervals at one location; Charmaine, Amcotts.

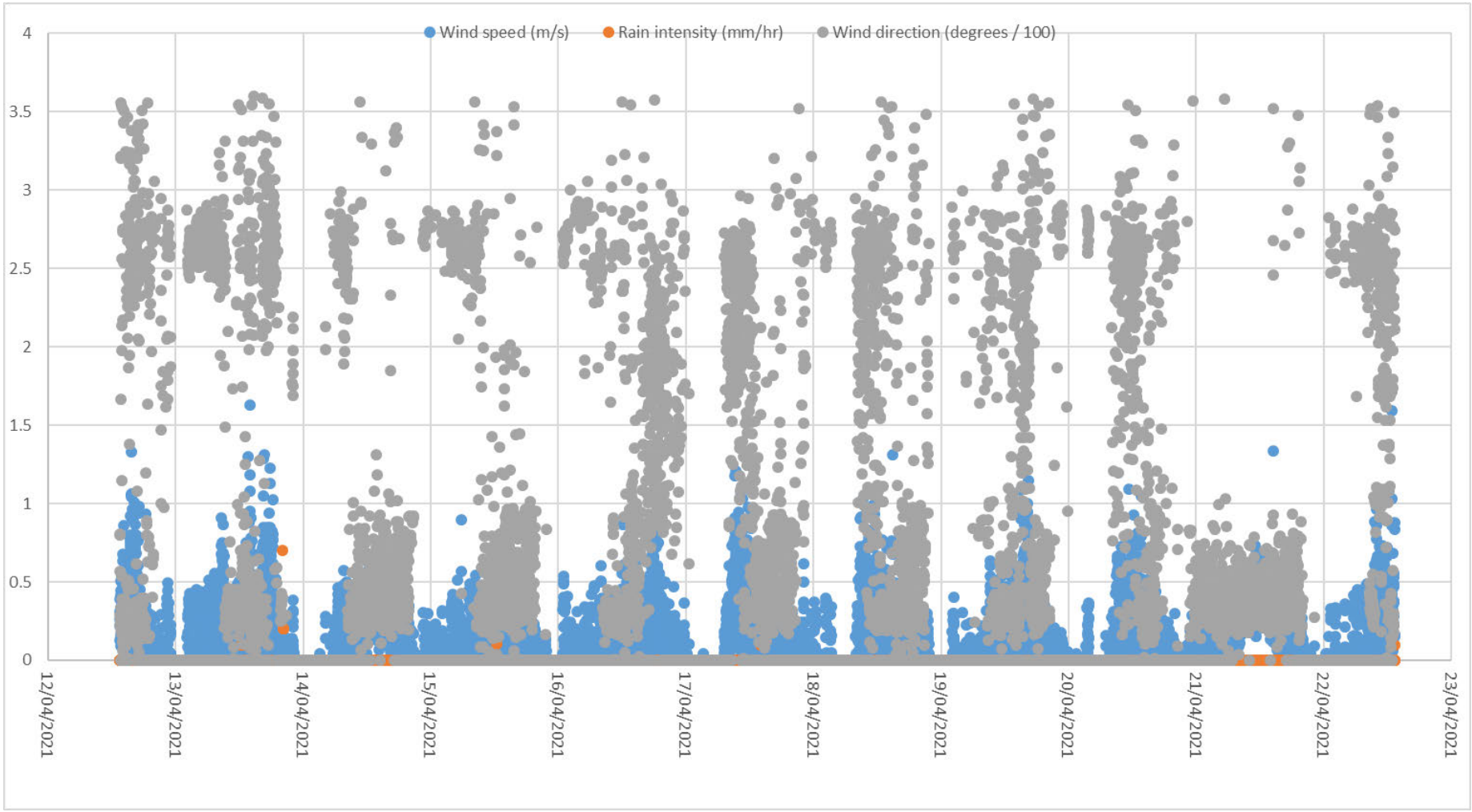
2.2.1.3 To minimise the influence on the measurements from sources of interference such as wind passing over the diaphragm of the microphone or rain falling on the microphone windshield, measurements made during rainfall events and wind speeds of greater than 5 metres per second (m/s) were discarded during data analysis. This follows the guidance given in BS 4142. The highest one minute average wind speed recorded during each 15 minute noise measurement period was used to decide whether to discard noise measurements.

2.2.1.4 The weather during the survey period was largely dry with low wind speeds recorded (> 2 m/s). Consequently, only a very small proportion of the noise measurements had to be discarded.

SURVEY WEATHER

3.1.1.1 Figure 1 below details the measurements of wind and rain recorded during the survey period at Charmaine, Amcotts.

Figure 1: One Minute Logged Weather Data, Charmaine, Amcotts



R1 FLIXBOROUGH GRANGE

4.1.1.1 The charts below present the following information:

- Figure 3 presents the 15 minute noise measurements logged over the survey period for the key noise metrics; L_{Aeq}, $L_{Amax,f}$ and L_{A90}.
- Figure 4 presents the distribution of daytime background $L_{A90,15mins}$ noise levels over the survey period.
- Figure 5 presents the distribution of night-time background $L_{A90,15mins}$ noise levels over the survey period.
- Table 1 and Figure 6 present the period L_{Aeq} noise levels over the day, evening and night-time periods.

4.1.1.2 Notes regarding the noise environment, made at the time the equipment was installed are as follows; significant noise sources include wind turbine noise and occasional aircraft. Distant road traffic is just audible.

Figure 2: Noise Monitoring Setup at Flixborough Grange

Figure 3: Results of the Noise Monitoring at Flixborough Grange

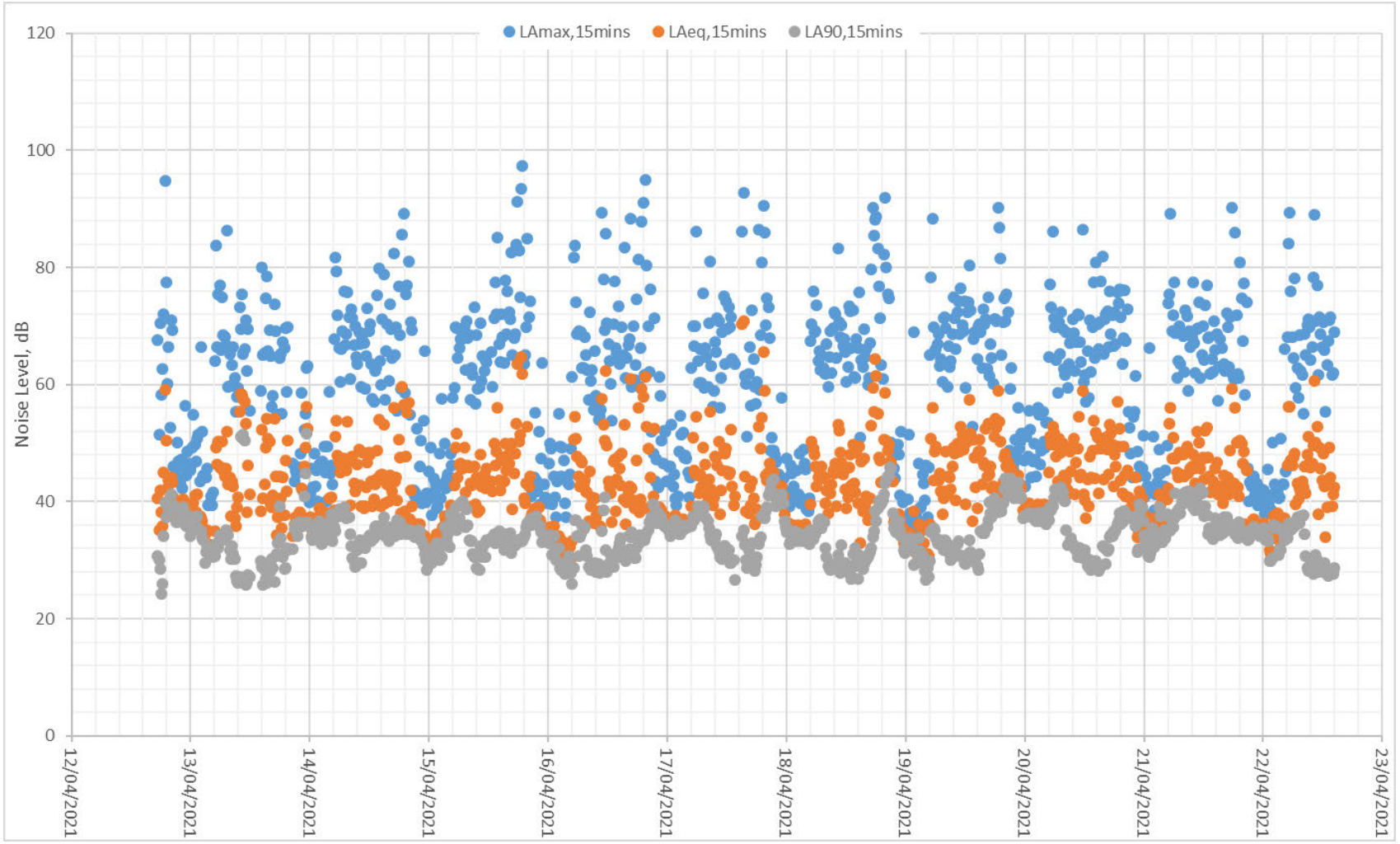
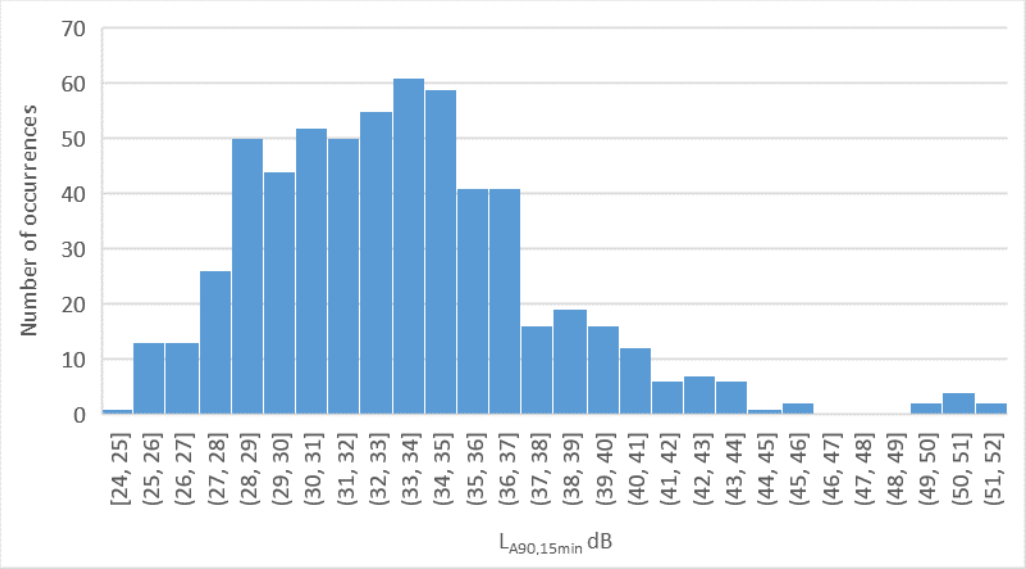
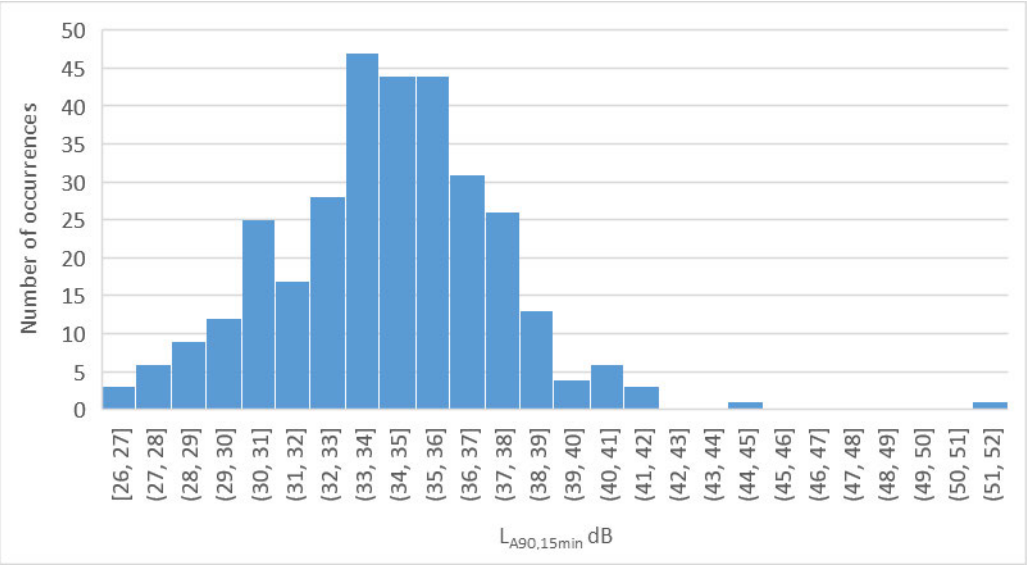


Figure 4: Distribution of Daytime Background $L_{A90,15mins}$ Noise Levels



4.1.1.3 L_{A90} measurements ranged between 25 and 52 dB(A). A peak is evident at the modal value of 34 dB. The 50th percentile value is also 34 dB. A sound level of 34 dB, has therefore been adopted as the RBSL.

Figure 5: Distribution of Night-time Background $L_{A90,15mins}$ Noise Levels

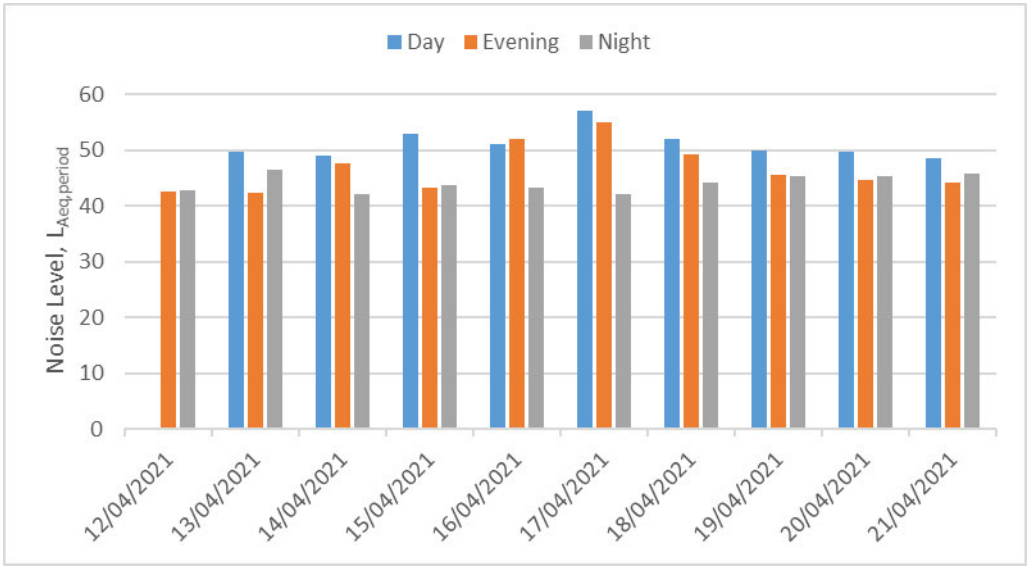


4.1.1.4 L_{A90} measurements ranged between 27 and 52 dB(A). A peak is evident at the modal value of 34 dB. The 50th percentile value is 35 dB. The lower of the two has conservatively values, 34 dB has conservatively been adopted as the RBSL.

Table 1: Period Average Noise Levels

	Noise Level, $L_{Aeq,period}$ dB		
Date	**Day**	**Evening**	**Night**
12/04/2021		43	43
13/04/2021	50	42	47
14/04/2021	49	48	42
15/04/2021	53	43	44
16/04/2021	51	52	43
17/04/2021	57	55	42
18/04/2021	52	49	44
19/04/2021	50	46	45
20/04/2021	50	45	45
21/04/2021	49	44	46
Average	**51**	**47**	**44**

Figure 6: Period Average Noise Levels



R2 THE FORGE, FLIXBOROUGH

5.1.1.1 The charts below present the following information:

- Figure 8 presents the 15 minute noise measurements logged over the survey period for the key noise metrics; L_{Aeq}, $L_{Amax,f}$ and L_{A90}.
- Figure 9 presents the distribution of daytime background $L_{A90,15mins}$ noise levels over the survey period.
- Figure 10 presents the distribution of night-time background $L_{A90,15mins}$ noise levels over the survey period.
- Table 2 and Figure 11 present the period L_{Aeq} noise levels over the day, evening and night-time periods.

5.1.1.2 Notes regarding the noise environment, made at the time the equipment was installed are as follows; significant noise sources include noise from Flixborough industrial estate and occasional cars on the nearby road.

Figure 7: Noise Monitoring Setup at the Forge, Flixborough

Figure 8: Results of the Noise Monitoring at the Forge, Flixborough

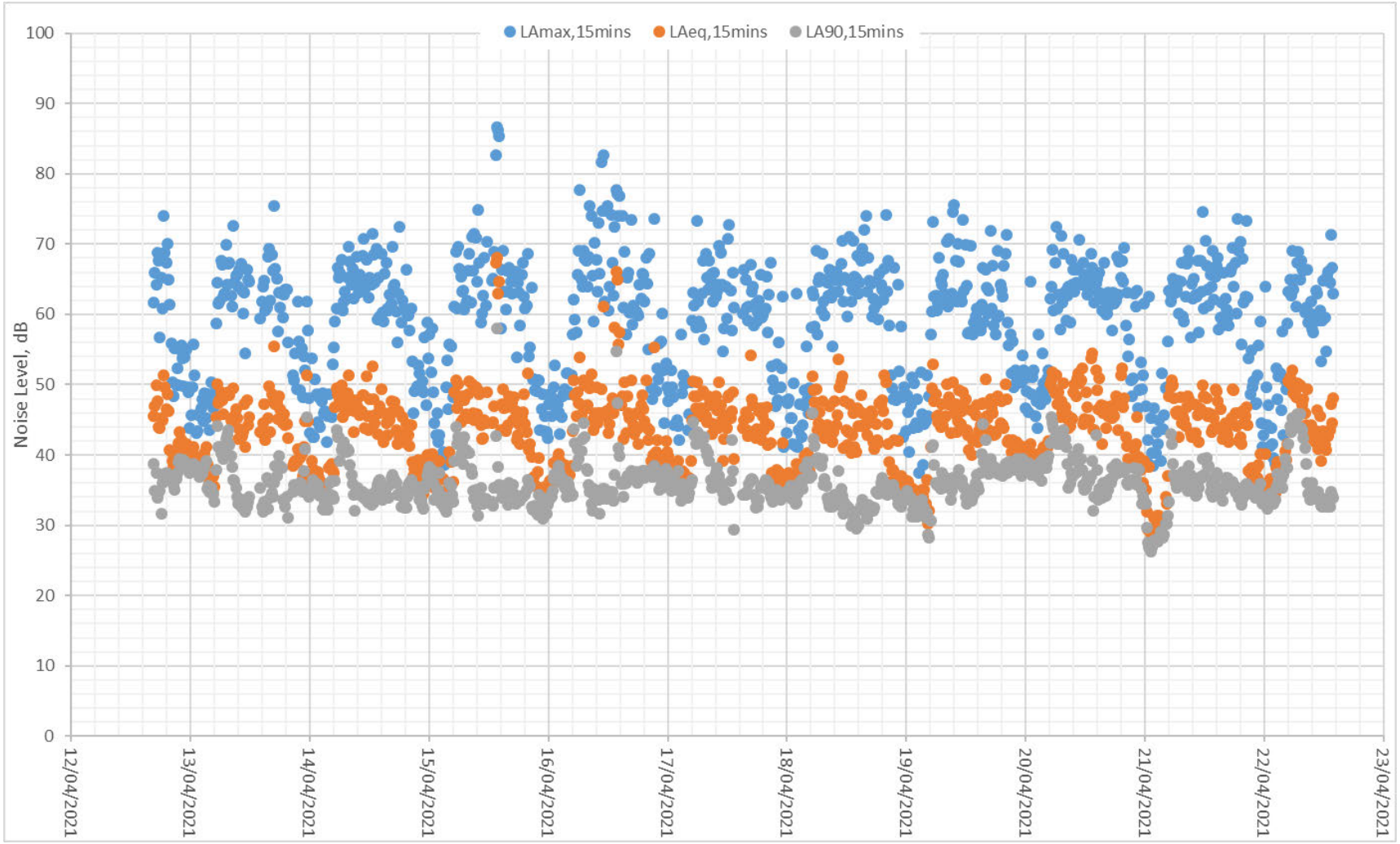
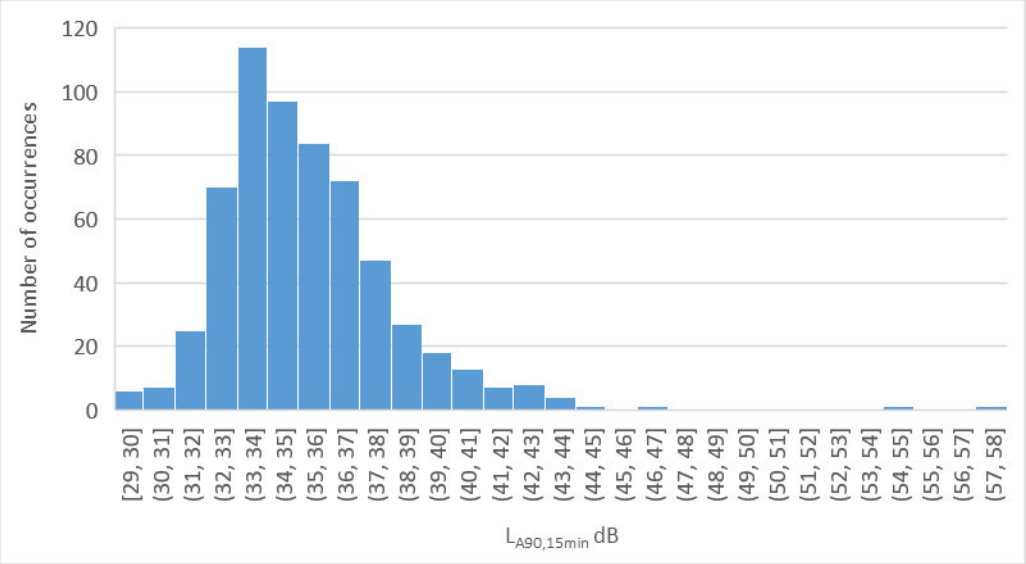
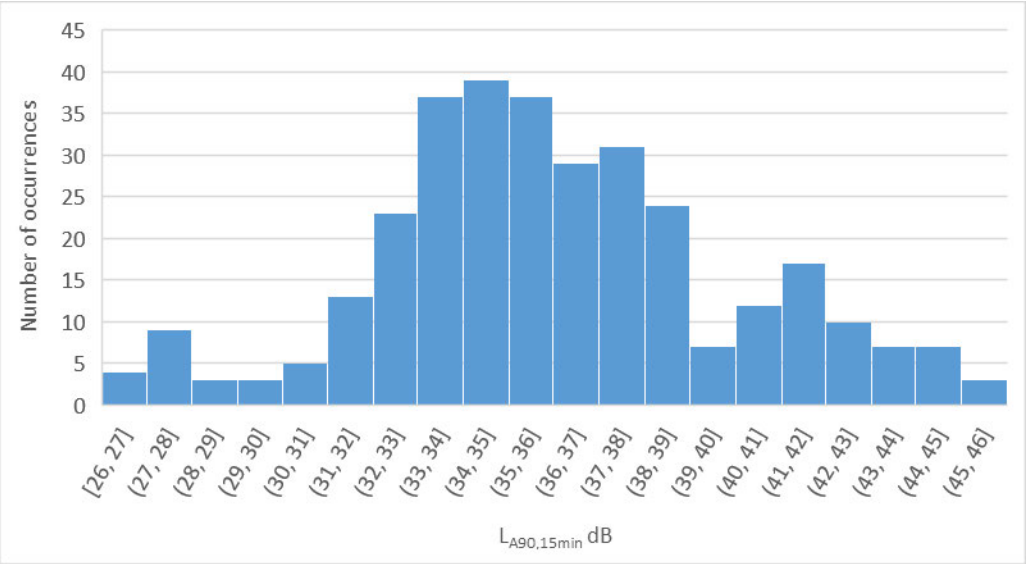


Figure 9: Distribution of Daytime Background $L_{A90,15mins}$ Noise Levels



5.1.1.3 L_{A90} measurements ranged between 30 and 58 dB(A). A peak is evident at the modal value of 34 dB. The 50th percentile value is 36 dB. The lower of the two has conservatively values, 34 dB has conservatively been adopted as the RBSL.

Figure 10: Distribution of Night-time Background $L_{A90,15mins}$ Noise Levels

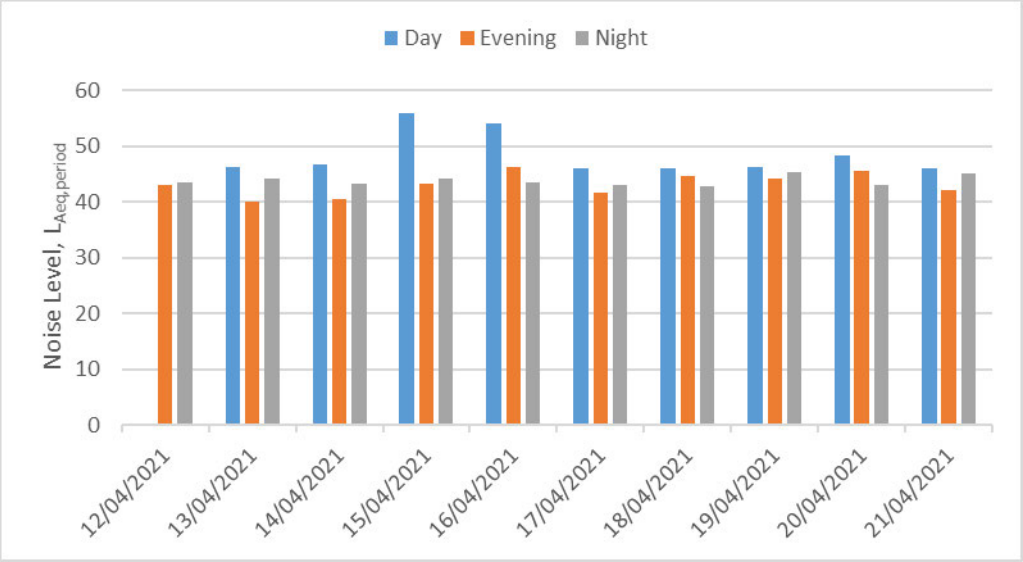


5.1.1.4 L_{A90} measurements ranged between 27 and 46 dB(A). A peak is evident at the modal value of 35 dB. The 50th percentile value is 36 dB. The lower of the two has conservatively values, 35 dB has conservatively been adopted as the RBSL.

Table 2: Period Average Noise Levels

	Noise Level, $L_{Aeq,period}$ dB		
Date	**Day**	**Evening**	**Night**
12/04/2021		43	43
13/04/2021	46	40	44
14/04/2021	47	40	43
15/04/2021	56	43	44
16/04/2021	54	46	43
17/04/2021	46	42	43
18/04/2021	46	45	43
19/04/2021	46	44	45
20/04/2021	48	46	43
21/04/2021	46	42	45
Average	**48**	**43**	**44**

Figure 11: Period Average Noise Levels



R3 CHARMAINE, AMCOTTS

6.1.1.1 The charts below present the following information:

- Figure 13 presents the 15 minute noise measurements logged over the survey period for the key noise metrics; L_{Aeq}, $L_{Amax,f}$ and L_{A90}.
- Figure 14 presents the distribution of daytime background $L_{A90,15mins}$ noise levels over the survey period.
- Figure 15 presents the distribution of night-time background $L_{A90,15mins}$ noise levels over the survey period.
- Table 3 and Figure 16 present the period L_{Aeq} noise levels over the day, evening and night-time periods.

6.1.1.2 Notes regarding the noise environment, made at the time the equipment was installed are as follows; noise from activity on the quay dominates the noise environment. Other significant noise sources include birds.

Figure 12: Noise Monitoring Setup at Charmaine, Amcotts

Figure 13: Results of the Noise Monitoring at Charmaine, Amcotts

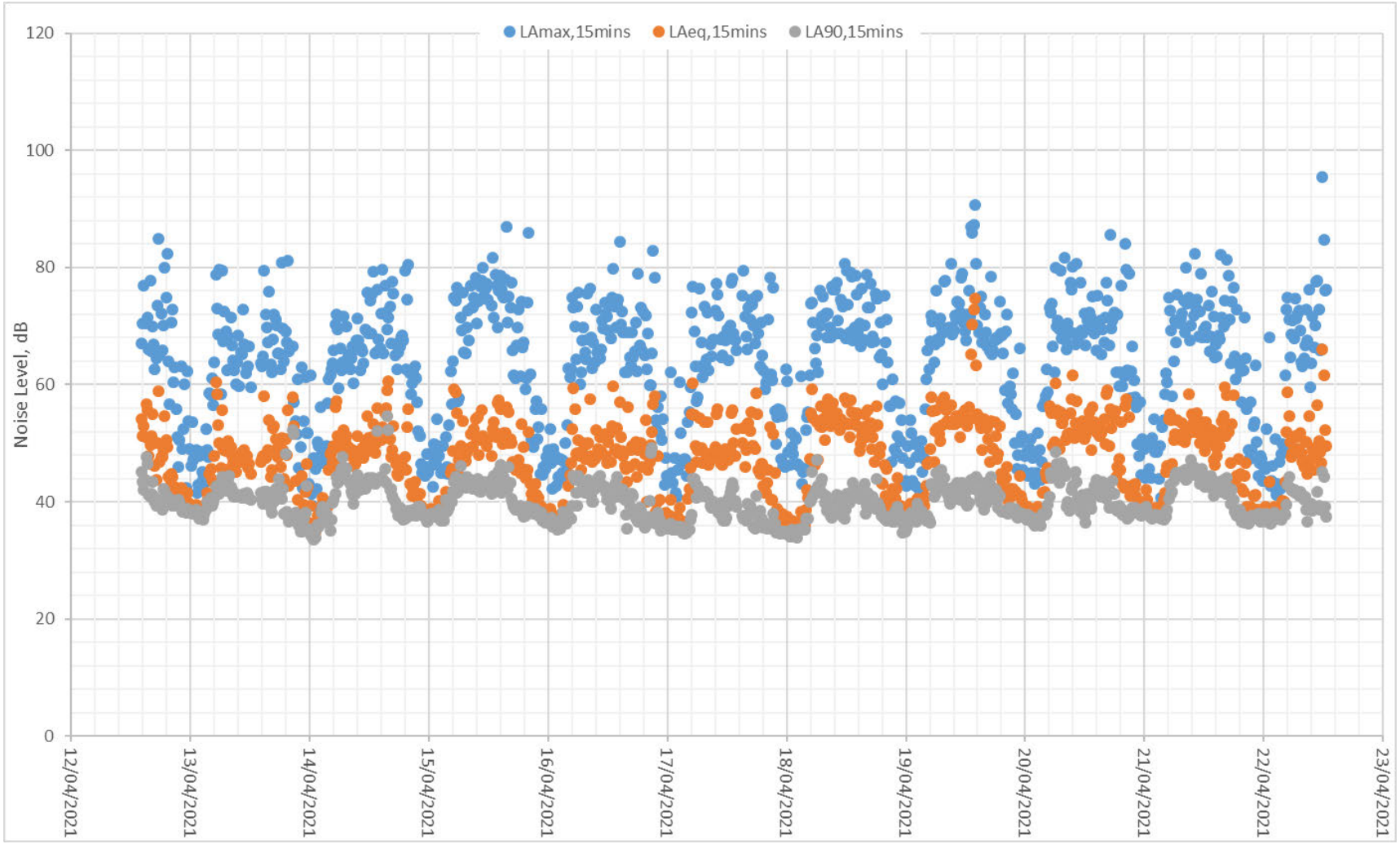
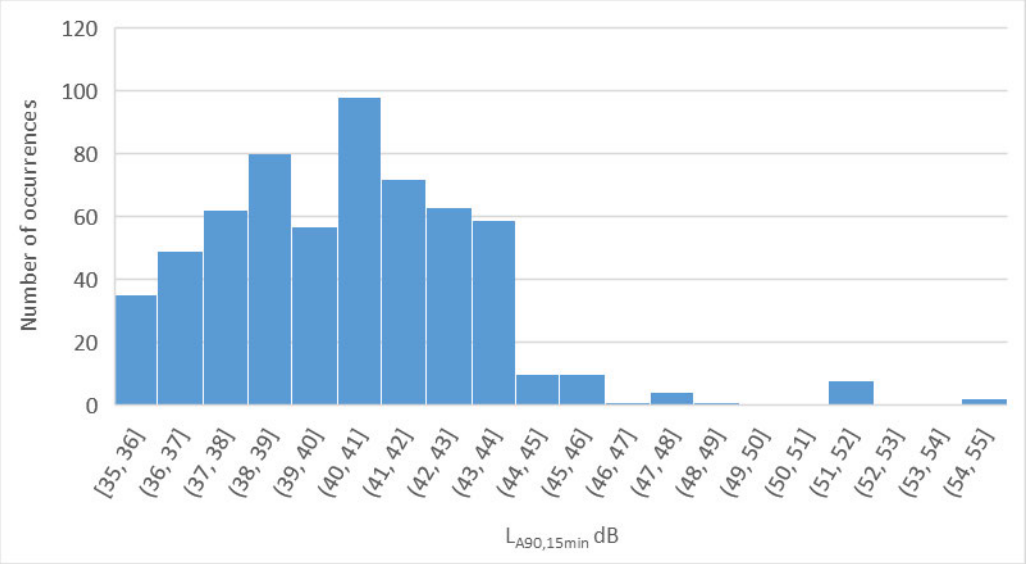
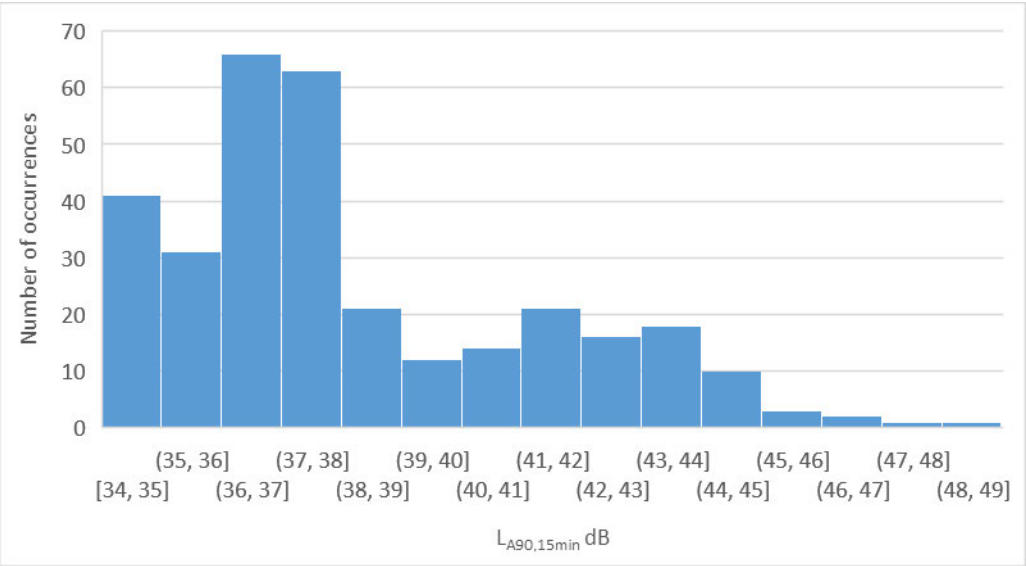


Figure 14: Distribution of Daytime Background $L_{A90,15mins}$ Noise Levels



6.1.1.3 L_{A90} measurements ranged between 36 and 55 dB(A). A peak is evident at the modal value of 41 dB. The 50th percentile value is also 41 dB. 41 dB has therefore been adopted as the RBSL.

Figure 15: Distribution of Night-time Background $L_{A90,15mins}$ Noise Levels

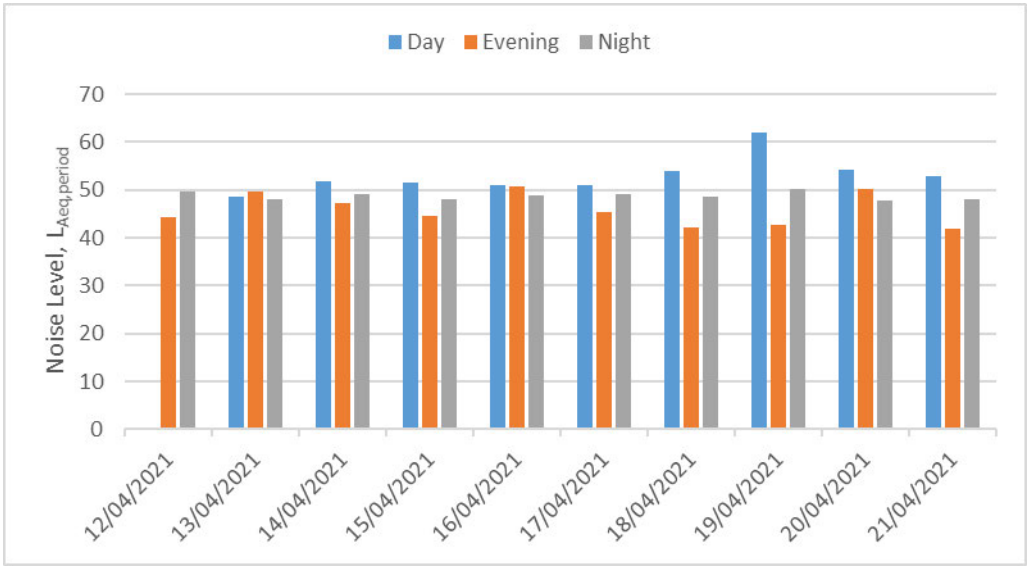


6.1.1.4 L_{A90} measurements ranged between 35 and 49 dB(A). A peak is evident at the modal value of 37 dB. The 50th percentile value is 38 dB. The lower of the two has conservatively values, 37 dB has conservatively been adopted as the RBSL.

Table 3: Period Average Noise Levels

	Noise Level, $L_{Aeq,period}$ dB		
Date	**Day**	**Evening**	**Night**
12/04/2021		44	50
13/04/2021	49	50	48
14/04/2021	52	47	49
15/04/2021	52	45	48
16/04/2021	51	51	49
17/04/2021	51	45	49
18/04/2021	54	42	49
19/04/2021	62	43	50
20/04/2021	54	50	48
21/04/2021	53	42	48
Average	**53**	**46**	**49**

Figure 16: Period Average Noise Levels



R4 PARK INGS FARM

7.1.1.1 The charts below present the following information:

- Figure 18 presents the 15 minute noise measurements logged over the survey period for the key noise metrics; L_{Aeq}, $L_{Amax,f}$ and L_{A90}.
- Figure 19 presents the distribution of daytime background $L_{A90,15mins}$ noise levels over the survey period.
- Figure 20 presents the distribution of night-time background $L_{A90,15mins}$ noise levels over the survey period.

- Table 4 and Figure 21 present the period L_{Aeq} noise levels over the day, evening and night-time periods.

7.1.1.2 Notes regarding the noise environment, made at the time the equipment was installed are as follows; quiet extraction noise from chicken houses dominates. Other sources which may be significant include distant noise from activity on the quay, distance road traffic, birds. The equipment was positioned to avoid significant water noise from a possible water feature in the garden.

Figure 17: Noise Monitoring Setup at Park Ings Farm

Figure 18: Results of the Noise Monitoring at Park Ings Farm

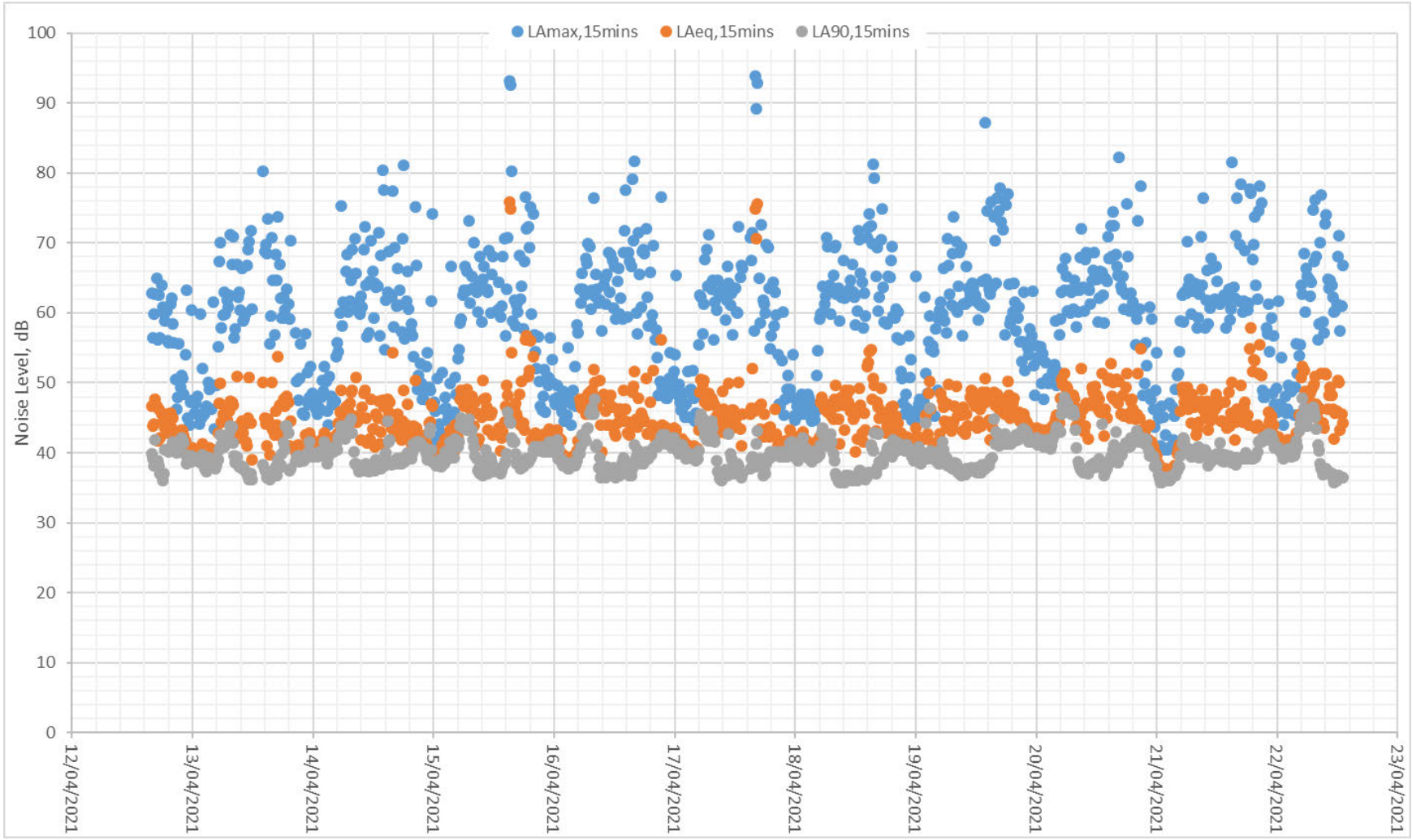
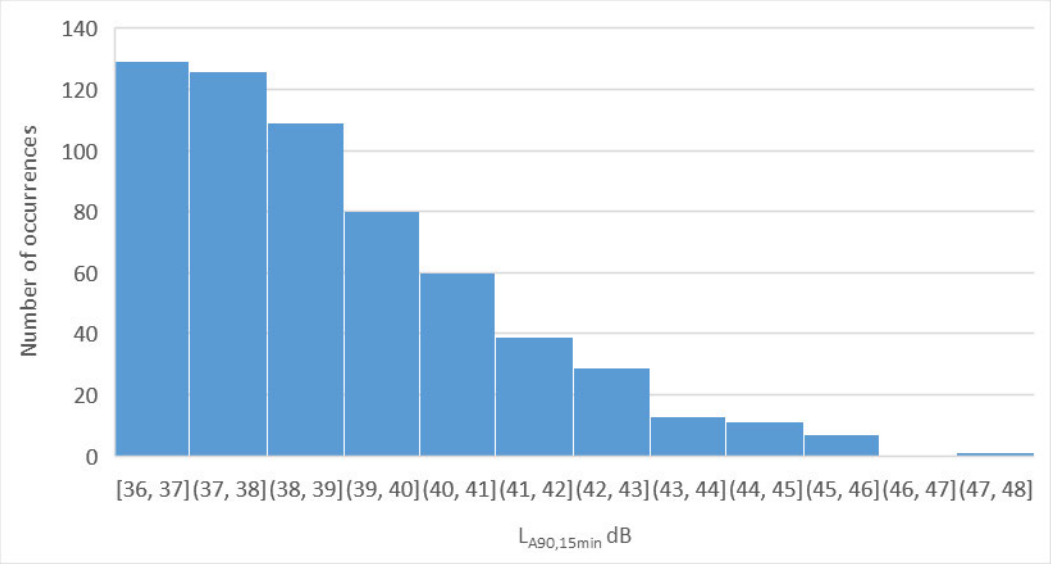
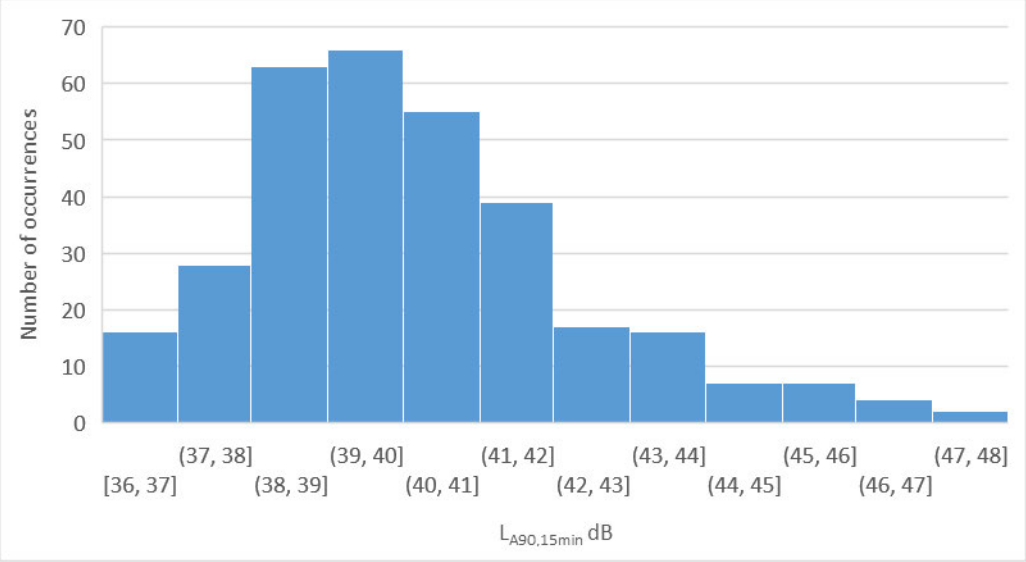


Figure 19: Distribution of Daytime Background $L_{A90,15mins}$ Noise Levels



7.1.1.3 A continuous noise from fixed plant associated with the chicken houses was observed whilst on-site. L_{A90} measurements ranged between 37 and 48 dB(A). A peak is evident at the modal value of 37 dB. The 50th percentile value is 39 dB. The lower of the two has conservatively values, 37 dB has conservatively been adopted as the RBSL.

Figure 20: Distribution of Night-time Background $L_{A90,15mins}$ Noise Levels

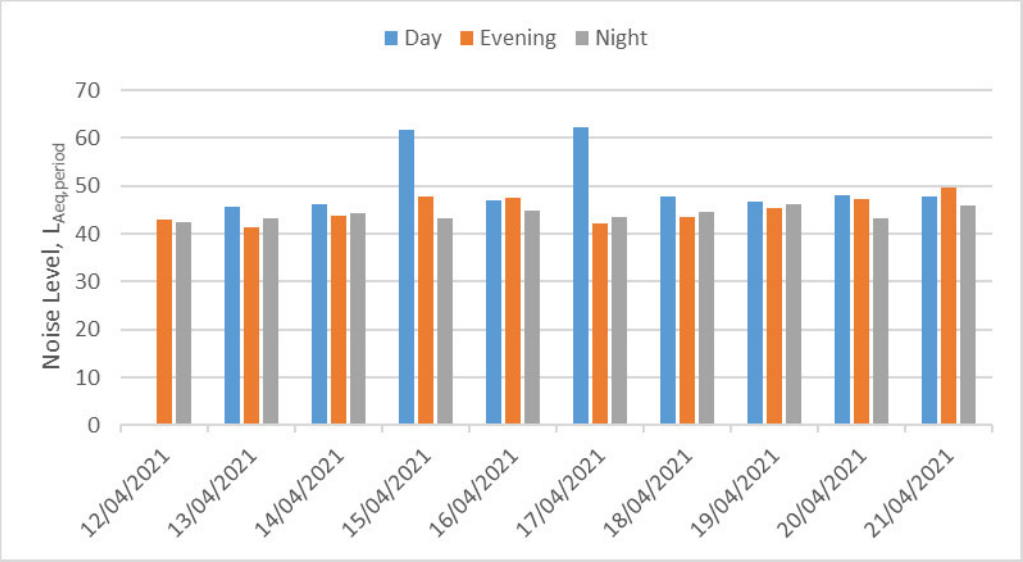


7.1.1.4 It can be seen from Figure 18 that the L_{A90} sound levels are normally slightly elevated during the late evening/night when compared with the daytime. L_{A90} measurements ranged between 37 and 48 dB(A). A peak is evident at the modal value of 40 dB. The 50th percentile value is also 40 dB. This may be as a result of the operating duty of the farm equipment. 40 dB has therefore been adopted as the RBSL.

Table 4: Period Average Noise Levels

	Noise Level, $L_{Aeq,period}$ dB		
Date	**Day**	**Evening**	**Night**
12/04/2021		43	42
13/04/2021	46	41	43
14/04/2021	46	44	44
15/04/2021	62	48	43
16/04/2021	47	47	45
17/04/2021	62	42	43
18/04/2021	48	44	45
19/04/2021	47	45	46
20/04/2021	48	47	43
21/04/2021	48	50	46
Average	**50**	**45**	**44**

Figure 21: Period Average Noise Levels



R8 29 HIGH STREET, DRAGONBY

8.1.1.1 The charts below present the following information:

- Figure 23 presents the 15 minute noise measurements logged over the survey period for the key noise metrics; L_{Aeq}, $L_{Amax,f}$ and L_{A90}.
- Table 5 and Figure 24 present the period L_{Aeq} noise levels over the day, evening and night-time periods.

8.1.1.2 Notes regarding the noise environment, made at the time the equipment was installed are as follows; significant noise sources include birds, occasional neighbouring dog. Distant road traffic is just audible.

Figure 22: Noise Monitoring Setup at 29 High Street, Dragonby

Figure 23: Results of the Noise Monitoring at 29 High Street, Dragonby

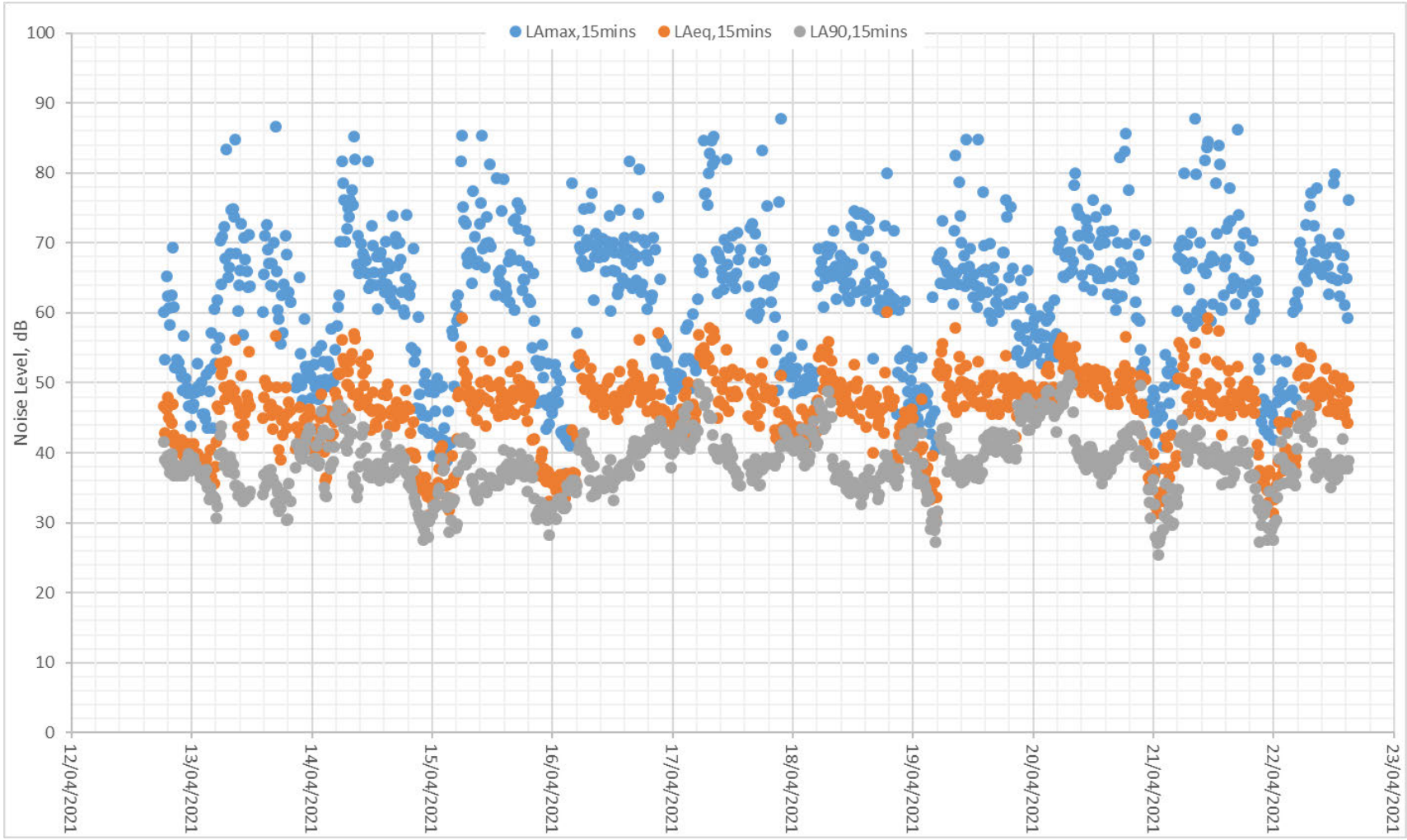
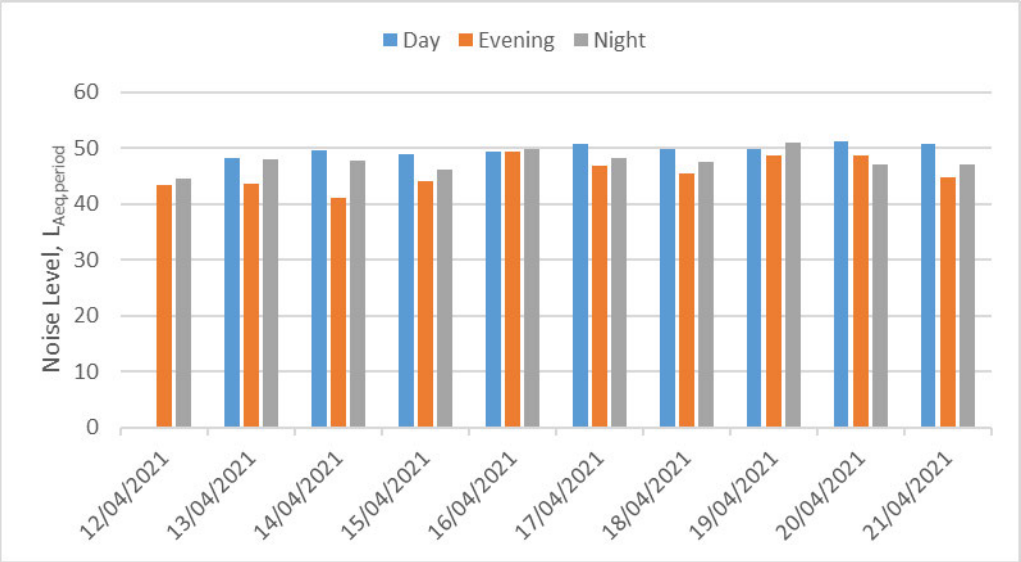


Table 5: Period Average Noise Levels

	Noise Level, $L_{Aeq,period}$ dB		
Date	**Day**	**Evening**	**Night (1)**
12/04/2021		43	43
13/04/2021	48	44	47
14/04/2021	50	41	46
15/04/2021	49	44	43
16/04/2021	49	49	48
17/04/2021	51	47	46
18/04/2021	50	45	45
19/04/2021	50	49	50
20/04/2021	51	49	44
21/04/2021	51	45	44
Average	**50**	**46**	**46**

1) Period L_{Aeq} values at night are likely to have been affected by the dawn chorus. As it only occurs during spring and early summer, and may not coincide with construction works, it is not considered a typical feature of the baseline sound environment. To minimise its effect on the period sound level values, noise measurements half an hour either side of (civil) dawn from each day of the survey have been replaced with data from the preceding hour. This has the effect of reducing the night-time baseline values by between 1 and 3 dB.

Figure 24: Period Average Noise Levels



ATTENDED MEASUREMENTS

9.1.1.1 Table 6 presents the results of the attended measurements. The noise monitoring locations are shown in Figure 1 Appendix A.

9.1.1.2 The weather was dry during all measurements with wind speeds of up to 2 m/s.

Table 6: Attended Noise Measurement Results

Receptor Location	Date	Time	Duration	Noise Level, dB				Description of Noise Environment
				$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$	
5. Inglenook, Amcotts	12/04/2021	13:55	30	36	41	38	34	Quiet location. Distant noise from industrial site to the south just audible (bangs, reversing alarms), distant agricultural noise (incl. tractors), occasional aircraft, single car. Also birds, wind rustling the wheat.
5. Inglenook, Amcotts	12/04/2021	23:00	30	38	46	40	34	Distant road traffic noise dominates. Occasional noise from industry to the south (bangs), distant industrial noise level from elsewhere audible sometimes.
6. Willowmead Close	13/04/2021	11:10	30	49	67	53	39	Significant sources include distant road traffic, occasional cars passing on nearby Ferry Road West and occasional cars passing close by on Willowmead Close. Bird noise and people activity (distant power tools) may also be significant.
6. Willowmead Close	12/04/2021	23:48	30	42	48	45	37	Significant sources include distant road traffic, occasional cars passing on nearby Ferry Road West and a single car pass close on Willowmead Close.
9. Bolsover Road	13/04/2021	10:30	30	52	66	53	44	Distant road traffic dominates the L_{A90} noise level. Occasional cars passing close by on Bolsover Road. Distant noise from fixed plant (possibly from Gallagher Retail Park) may also be significant.

Receptor Location	Date	Time	Duration	Noise Level, dB				Description of Noise Environment
				$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$	
10. Normanby Road	13/04/2021	08:39	30	66	73	70	56	Road traffic noise on Normandy Road dominates. Mic located 6.71 m from curb edge.
11. King's Court	13/04/2021	07:55	30	50	60	52	47	Road traffic noise dominates. Other sources which may be significant include; occasional vehicles in carpark (incl. door slams), people talking, occasional noise from retail units (bangs), and distant construction noise (generator, bangs).

Figure 25: R5 Inglenook, Amcotts Noise Monitoring Setup

Figure 26: R6 Willowmead Close Noise Monitoring Setup

Figure 27: R9 Bolsover Road Noise Monitoring Setup

Figure 28: R10 Normanby Road Noise Monitoring Setup

Figure 29: R11 King's Court Noise Monitoring Setup

APPENDIX C MODELLING INPUT DATA AND ASSUMPTIONS

May 2022

NORTH LINCOLNSHIRE GREEN ENERGY PARK

Planning Act 2008

Infrastructure Planning (Applications Prescribed Forms and Procedure) Regulations 2009

North Lincolnshire Green Energy Park

Appendix C – Modelling Data and Assumptions

Chapter 7 Noise

May 2022

PINs No.: EN010116

The business of sustainability

ERM

May 2022

North Lincolnshire Green Energy Park

Appendix C – Modelling Data and Assumptions

Environmental Resources Management

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[redacted]

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Acronyms and Abbreviations

ACC	Autoclaved Aerated Concrete
AGI	Above Ground Installation
BESS	Battery Energy Storage Systems
dB	Decibel
DNO	Distribution Network Operator
ERM	Environmental Resources Management
h	Hour(s)
HGV	Heavy Goods Vehicle
HVAC	Heating, Ventilation and Air Conditioning
Mph	Miles per hour
RBSL	Representative Background Sound Level
RDF	Refuse Derived Fuel

1. INTRODUCTION

1.1.1.1 This Appendix presents the noise level assumptions used to build the noise levels prediction model. There are three aspects to the noise predictions: construction noise, operational noise and vessel noise.

2. CONSTRUCTION PLANT ASSUMPTIONS

2.1.1.1 The construction plant assumptions are detailed in Table 1.

Table 1: Assumed Construction Plant

Activity	L_{Aeq} at 10 m	BS5228 Reference	No of items	% on time	Effective Sound Power Level (LWA)
Main Building Construction					
Dozer	79	C.2.11	1	100	107
Tracked Excavator	76	C.2.5	1	100	104
Dump Truck	78	C.4.2	1	100	106
Wheeled Loader	68	C.2.8	1	100	96
Bored Piling	83	C.3.15	1	100	111
Concrete mixer truck	80	C.4.20	1	100	108
Concrete Pump	78	C.3.25	1	100	106
Wheeled mobile telescopic crane	77	C.4.38	1	100	105
Road Roller	80	C.5.19	1	100	108
Vibratory roller	77	C.5.26	1	100	105
Asphalt paver	77	C.5.31	1	100	105
Combined Effective Sound Power Level					*117*
DHPWN - Breaking out Road and Trenching					
Cutting road surface - backhoe mounted hydraulic breaker	88	C.5.1	1	50	113
Road planer	82	C.5.7	1	10	100
Tracked excavator (trenching activities)	80	C.5.18	1	50	105
Articulated dump truck	81	C.5.16/17	1	50	106
Road Lorry	81	Av C.6.21 & 23	1	10	99
Generator for lighting rig	65	C.4.86	1	30	88
Combined Effective Sound Power Level					*115*
DHPWN – Pipe work					

Activity	L_{Aeq} at 10 m	BS5228 Reference	No of items	% on time	Effective Sound Power Level (LWA)
Angle grinder	80	C.4.93	1	30	103
Diesel generator - from general site activities table	66	C.4.85	1	30	89
Hand-held welder (welding piles)	73	C.3.31	1	30	96
Electric water pump. Assumed not to need a generator to run it.	68	C.5.40	1	100	96
Generator for lighting rig	65	C.4.86	1	30	88
Combined Effective Sound Power Level					*104*
DHPWN - Compactions and road laying					
Articulated dump truck	81	C.5.16/17	1	30	104
Tracked excavator	80	C.5.18	1	30	103
Road Roller	80	C.5.19	1	30	103
Asphalt paver	75	C.5.30	1	30	98
Road Lorry	81	Av C.6.21 & 23	1	10	99
Generator for lighting rig	65	C.4.86	1	30	88
Combined Effective Sound Power Level					*109*
Railway works					
Excavator	76	C.2.5	1	100	104
Generator for lighting rig	65	C.4.86	1	100	93
Dump truck (road going)	78	C.4.2	1	100	106
Combined Effective Sound Power Level					*108*

3. DATA INCLUDED IN THE OPERATIONAL NOISE MODEL

3.1.1.1 Table 2 to Table 12 set out the noise modelling inputs that have been included in the operational noise model for the plant buildings and onsite vehicles. These inputs have been based on data provided by the Project engineering team as well as the assumptions highlighted in the table. No allowance for uncertainty in the data has been included at this stage, however, in many cases, conservative assumptions have been used. (The derivation of the noise model input for the vessels at Flixborough Wharf is presented in Section 4 separately).

Table 2: Equipment Noise Levels Assumed in the Noise Modelling for the ERF Area

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, metre (m) (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Boiler and FGT Hall	External building façade level, L_{WA} of 54 dB / m2 based on: ■ internal reverberant level of 84 dB(A) ■ building cladding designed with 30 dB insertion loss	Building height to 55	n/a	Data provided by Fichtner (1). It has been assumed that the noise level data provided should be interpreted as the reverberant level inside the Boiler and FGT Hall. Assume no external noise sources other than stack.
Stack	87 L_{WA}	120	1	Data provided by Fichtner (1).
Turbine Hall	External building façade level, L_{WA} of 70 dB / m2 based on: ■ internal reverberant level of 90 dB(A) ■ building cladding designed with 20 dB insertion loss	Building height to 25	n/a	Data provided by Fichtner (1). It has been assumed that the noise level data provided should be interpreted as the reverberant level inside the Turbine Hall.
Autoclaved Aerated Concrete (ACC)	ACC clad units, L_{WA} of 64 dB / m2 based on overall L_{WA} of 103 dB, based on: ■ L_{WA} 94 dB per fan (combined level of ACC inlet, L_{WA} 90 dB and ACC, L_{WA} 92 dB levels) ■ 8 fans in total	Cladding height above turbine hall to 48	8 fans	Data provided by Fichtner (1).
Airblast cooling	Lw 90dB(A) per cell	20	4	Data provided by Fichtner

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, metre (m) (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Bunker Hall	External building façade level, L_{WA} of 60 dB / m2 based on: internal reverberant level of 90 dB(A) building cladding designed with 30 dB insertion loss	Building height to 45	n/a	Data provided by Fichtner (1). It has been assumed that the noise level data provided should be interpreted as the reverberant level inside the Bunker Hall. Assume no external noise sources
Tipping Hall / Waste Reception	With roller doors closed, external building façade level, L_{WA} of 60 dB/m^2 day and L_{WA} of 50 dB/m^2 night based on: ■ internal reverberant level of 80 dB(A) during the day, and 70 dB(A) at night ■ insertion loss of 20 dB to simulate typical roller door performance With roller doors open, an additional noise source L_{WA} of 80 dB/m2 is assumed for the opening. Door opening assumed to be 8.5m wide and 7m high.	Building height to 33, with a floor level of 11.	n/a	Data provided by Fichtner (1). It has been assumed that the noise level data provided should be interpreted as the reverberant level inside the Tipping Hall. No tipping will occur at night, and lower internal reverberant level of 70 dB(A) has been assumed to represent constant noise from equipment which operates continuously. Dimensions of tipping hall door estimated from ERF Parameter Plans South Elevation (S3154-8000-0008 Rev.1) It is assumed that doors will remain open for 5 minutes at a time. This results in an emission on-time of 33%

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, metre (m) (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
				using the 15 minute reference time period required by BS 4142. (-4.77dB)
Emergency Diesel Generator	n/a	n/a	1	It is assumed this unit will not normally operate as it is intended for use during power outages. It will be tested regularly, however, it is assumed that this will occur only infrequently (e.g. once a month), and only during the daytime. As a result, it is not expected to result in significant noise effects and will be omitted from the noise model.
Water treatment plant	n/a	n/a		Equipment assumed to be within turbine hall and included in noise assumptions for that building
Transformer	L_{WA} of 85 dB	5	5	Data provided by Fichtner (1). No. equipment items based on NGLEP Overall Site Layout, S3154-8000-0002, Rev.10.

1) by email on 25/02/2021 from Calum Bezer

Table 3: Carbon Capture Plant

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Airblast coolers. 4 cells	L_{WA} 90 dB per cell	27m (2m above building)	4	Data provided by Fichtner
Other equipment (compressors, reactors etc) to be housed in buildings.	External building façade level, L_{WA} of 54 dB / m2 based on: ■ internal reverberant level of 84 dB(A) ■ building cladding designed with 30 dB insertion loss	Building adjoining boiler hall, height to 25m Building to the west, height to 20m	n/a	Data provided by Fichtner

Table 4: Gas AGI, Substation and Electrolyser Building to the East of the ERF Area

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Client / Distribution Network Operator (DNO) Substation Switchgear equipment.	L_{WA} of 85 dB	5	3	Noise data confirmed as suitable by Fichtner. Assumes 3 units located outside with a height of 5 m.
Gas Above Ground Installation (AGI)	External L_{WA} of 93 dB based on: ■ internal reverberant level of 94 dB(A) ■ building cladding designed with 20 dB insertion loss	Building height to 5	n/a	Noise data from previous ERM project. Building dimensions taken from drawing AGI Compound, S3154-8000-0009 Rev.1
Electrolyser building containing compressor	External building façade level, L_{WA} of 69 dB / m^2 based on:	Building height up to 11 m	n/a	Fichtner confirmed assume same as electrolyser building for hydrogen area.

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
	■ internal reverberant level of 89 dB(A) ■ building cladding designed with 20 dB insertion loss			

Table 5: Concrete Block Manufacturing Plant

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Concrete block manufacturing plant building	External building façade level, L_{WA} of 62 dB / m^2 based on: ■ internal reverberant level of 97 dB(A) ■ 5 dB assumed for controlling nosiest internal sources eg through enclosure. Confirmed with Fichtner. ■ building cladding designed with 30 dB insertion loss	Building height to 30m	n/a	Data taken from HSE website for concrete block manufacturing and input from Fichtner. Confirmed as suitable by Fichtner. 5 dB assumed for controlling nosiest internal sources eg through enclosure. Noisy buildings assumed to be: Ash reprocessing ■ FGTr reprocessing ■ Concrete processing ■ Ash maturation building assumed to provide screening
Loading shovel	L_{WA} 99 dB	3	2	100% on time assumed, daytime and night-time operation.

Table 6: Polymer Processing Plant

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Polymer processing building	Internal reverberant level of, L_{Aeq} of 92 dB, based on: ■ total internal L_{WA} 110 dB ■ assumed average absorption coefficient of 0.01 ■ building dimensions (m) estimated from Polymer Processing Facility S3154-8000-0009 Rev.1 of L=120, W=80, H=35 External L_{WA} of 98 dB, based on: ■ provided SRI values, assuming open door area of 8.5m x 7m and 2x conveyor openings of 3m x 3m.	Building height to 35	n/a	Data provided by Fichtner (1). Assumed average absorption coefficient of 0.01 Building dimensions (m) estimated from Polymer Processing Facility S3154-8000-0009 Rev.1 Door opening assumed to be 8.5 m wide and 7 m high, as per Tipping Hall. It is assumed that doors will remain open for 5 minutes at a time. This results in an emission on-time of 33% using the 15 minute reference time period required by BS 4142.
High-level fan extract system	L_{WA} 85 dB	35	2	Data provided by Fichtner (1). 2 items assumed
Storage area / heat exchanger buildings Conveyors	n/a	n/a	n/a	Assumed they're enclosed and not significant noise sources

1) by email on 12/03/2021 from Thomas Mann

Table 7: Hydrogen Production and Battery Storage Area

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Electrolyser building containing compressor	External building façade level, L_{WA} of 69 dB / m^2 based on: ■ internal reverberant level of 89 dB(A) ■ building cladding designed with 20 dB insertion loss	Building height up to 11 m	n/a	Fichtner provided data for compressor of 75 dB@5 m. Assumes reverberant level in electrolyser building is equal to 1 m level of 89 dB Noise data provided by Fichtner
External heating, ventilation and air conditioning (HVAC) equipment for battery storage	Lw 76 dB(A) per unit	3.6 m (assumed to be 1 m above standard 40' container height)	48 (2 per Battery Energy Storage System (BESS))	
Oxygen separators.	Not expected to be a significant source of noise.			
Airblast coolers.	Lw 90dB per cell	2	2	Provided by Fichtner

Table 8: Quay Loading Area – Refuse Derived Fuel (RDF)

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Quayside crawler crane	103.5	4	1 at 100% on time	Ref ERM measurement of Ruston Bucyrus RB61-SC (20T) at Flixborough, in 2021. Daytime operation.
Reach stacker	107.7	3	1 at 50% on time	Based on measurements of a reach stacker (Reach stacker (Linde D4531) at Immingham

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
				port in 2021. Adopted noise level is an average of pass by noise and container handling noise. Includes bangs as they were not significant to the overall measurement. Daytime operation.
Tugmaster	103.6	3	1 at 100% on time	Based on measurements of Terberg vehicle at Immingham port in 2021 performing a mixture of pass-by movements and manoeuvring with a 40 ft trailer. Daytime operation.
Impact noise (gantry crane unloading)	L_{WA} of 96 dB, based on: ■ 116 dB(A) SEL ■ 40 containers per hour (h)	3	1 at 100% on time	Ref ERM Impact noise used from measurements of gantry crane moving containers as measurements carried out of crawler crane at Flixborough were of steel handling, and measured levels were therefore not representative. Daytime operation.
Vehicle movements	L_{WA} of 70.8 dB(A) per metre (m), based on: ■ L_{WA} of 103 dB for Heavy Goods Vehicle (HGV) moving.	3	2	L_{WA} for HGV provided by Fichtner (1) Daytime operation.

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
	■ 78 containers per train, 4h per vessel ■ Containers are moved from railhead stack to ERF continuously at a rate of 19.5 movements per h each way ■ Speed 32 miles per hour (mph)			

1) by email on 25/02/2021 from Calum Bezer

Table 9: Quay Loading Area - Aggregate

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Quayside crawler crane	103.5	4	1 at 100% during daytime operation period	Ref ERM measurement of Ruston Bucyrus RB61-SC (20T) at Flixborough, in 2021. Daytime operation.
Impact noise (gantry crane unloading)	L_{WA} of 96 dB, based on: ■ 116 dB(A) SEL ■ 40 impacts per h	3	1 at 100% during daytime operation period	Ref ERM Impact noise used from measurements of gantry crane moving containers as measurements carried out of crawler crane at Flixborough were of steel handling, and measured levels were therefore not representative. This may be conservative for aggregate unloading if not containerised.

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
				Daytime operation.
Vehicle movements	L_{WA} of 67.2 dB(A) per m, based on: ■ L_{WA} of 103 dB for HGV moving. ■ 100 loads per vessel, 12h per vessel ■ Aggregate is moved continuously throughout the 12 h period at a rate of 8.3 movements per h each way ■ Speed 32 mph	3	2	L_{WA} for HGV provided by Fichtner (1) Daytime operation.

1) by email on 25/02/2021 from Calum Bezer

Table 10: Railway Loading Area - RDF

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Reach stacker	L_{WA} 104.7	3	1 at 50% on time	Based on measurements of a reach stacker (Reach stacker (Linde D4531) at Immingham port in 2021. Adopted noise level is an average of pass by noise and container handling noise. Includes bangs as they were not significant to the overall measurement. Daytime operation.

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Vehicle movements	L_{WA} of 70.8 dB(A) per m, based on: ■ L_{WA} of 103 dB for HGV moving. ■ 78 containers per train, 4h per train ■ Containers are moved from railhead stack to ERF at a rate of 19.5 movements per h each way ■ Speed 32 mph	3	2	L_{WA} for HGV provided by Fichtner (1) Daytime operation.
Train movements on-site	L_w 72.6 dB(A)/m, based on: ■ up to 1 movement in 1 h ■ train comprises 1 class 66 loco on full power plus 78 freight vehicles, travelling at a speed of 8 km/h. CWR, no source enhancements.	4.5	n/a	Project team. Daytime operation.

1) by email on 25/02/2021 from Calum Bezer

Table 11: Railway Loading Area - Aggregate

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Conveyor system	■ Feed Hooper Conveyor drive: L_{WA} 103 dB ■ Conveyor rollers: L_{WA} 85.9 dB/m	5.3	1	BS 5228, C10,23. Daytime operation.
Train movements on-site	Lw 72.6 dB(A)/m, based on: ■ up to 1 movement in 1 h	4.5	n/a	Project team.

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
	■ train comprises 1 class 66 loco on full power plus 78 freight vehicles, travelling at a speed of 8 km/h. CWR, no source enhancements.			Daytime operation.
Vehicle movements	L_{WA} of 70.8 dB(A) per m, based on: ■ L_{WA} of 103 dB for HGV moving. ■ 100 loads per train, 12h per train ■ Vehicles move between railhead and ERF continuously throughout the day at a rate of 8.3 movements per h each way ■ Speed 32 mph	3	1	L_{WA} for HGV provided by Fichtner (1) Daytime operation.

Table 12: Vehicles Common to Daytime Scenarios

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Concrete block export by road	L_{WA} of 63.4 dB(A) per m, based on: ■ L_{WA} of 103 dB for HGV moving. ■ 42 loads per day, over 12h ■ Hourly flow 3.5 ■ Speed 32 mph	2	2	Daytime operation.

Equipment Name / Building	Assumed Noise Source Level	Assumed Source Height, m (above local ground level)	Number of Equipment Items	Reference for data / Assumptions
Reagent	L_{WA} of 51.9 dB(A) per m, based on: ■ L_{WA} of 103 dB for HGV moving. ■ 3 loads per day, over 12h ■ Hourly flow 0.25 ■ Speed 32 mph	2	2	Daytime operation.
Hydrogen buses	L_{WA} of 65.7 dB(A) per m, based on: ■ L_{WA} of 103 dB for HGV moving. ■ 30 loads per day, over 5h ■ Hourly flow 6 ■ Speed 32 mph	2	2	Daytime operation.
Plastic	L_{WA} of 53.7 dB(A) per m, based on: ■ L_{WA} of 103 dB for HGV moving. ■ 4.5 loads per day, over 12h ■ Hourly flow 0.375 ■ Speed 32 mph	2	2	Daytime operation.

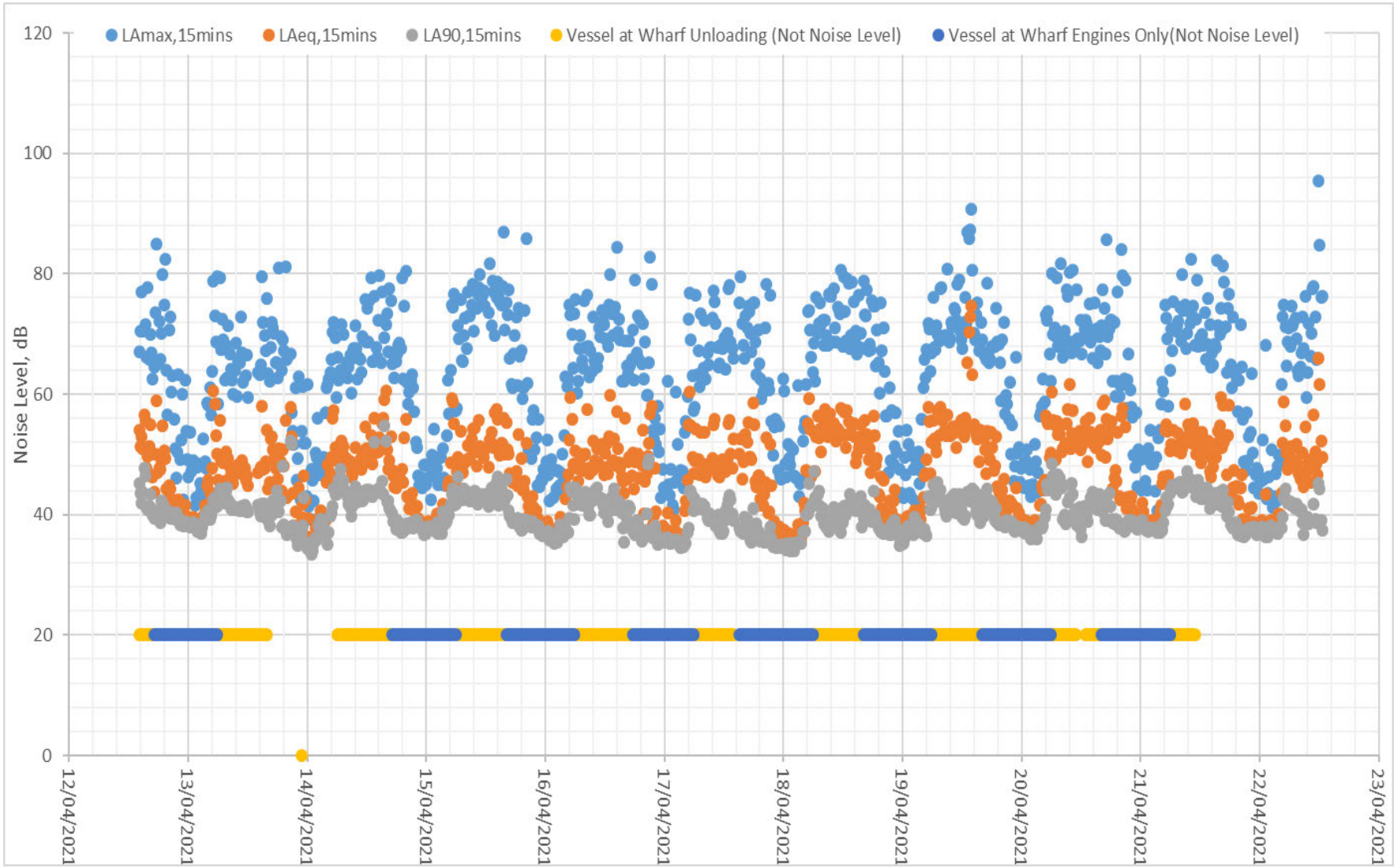
4. VESSEL NOISE

4.1.1.1 The noise level for the vessels in the quay were derived based on measurements made at the nearest receptor when vessels were alongside Flixborough Wharf. The measurements were made at Charmaine in Amcotts during the baseline noise survey and included noise data between the 12th of April 2021 and the 21st April. As noted in the baseline noise, section measurements were undertaken when very light wind speeds were recorded (<0.5 m/s) and therefore no wind vector was assumed to enhancing the noise levels.

4.1.1.2 Records of the unloading times at the quay were used for each vessel, to identify when ships were alongside the quay and when they were unloading. This was used to select periods when the noise levels were most likely to represent the noise from vessels alongside the wharf overnight during operation of the Project. The size of vessels would be similar to those that currently use the wharf and so it was representative of future operations at night (when the power supply systems on the vessels at the quay and the process equipment will be the only activities). Although the majority of the data were for a single vessel at the wharf, it was possible that two vessels may overlap at times. However, records were not sufficiently detailed to determine when this was the case.

4.1.1.3 The noise levels that were recorded, and the times at which vessels were at the quay unloading and not unloading, are shown in Figure 1. The periods when the vessel was at the quay idle are marked in blue lines. The periods when unloading was occurring are shown with yellow lines. The noise levels at these times are shown as scatter plot points. It is noted that daytime unloading activities (of steel) start at 06:00, although full unloading starts at approximately 07:00. Activities finish at various times during the day, but always before 17:00. Therefore, it was possible to see that noise levels decreased when the unloading activity ended and reached a minimum at night.

Figure 1: Log of Times when Vessels were at Flixborough Wharf with Noise Levels Monitored at Charmaine, Amcotts



4.1.1.4 In order to estimate noise levels from the ship, measurements during the night were used. This minimised any local intermittent noise sources, and the L_{A90} parameter was used to identify times at which noise from the ship may be a significant contributor to background the noise levels. Since the noise from the ship would be constant, the minimum L_{A90} noise levels were used to represent the noise from the vessel. The results are shown in Table 13: Minimum Vessel Measurements at Charmaine, Amcotts during the Night–Table 13 .

Table 13: Minimum Vessel Measurements at Charmaine, Amcotts during the Night– dB L_{A90} Free-field

	Date (at Start of Period) and Noise Levels												
Date (in April 2021)	12	13	14	15	16	17	18	19	20	21	Mean	Min	Max
Minimum L_{A90} with Ship in Quay but No Unloading Unless Stated	37	34 (1)	37	35	35	34	35	36	37	36 (2)	36(3)	34	37

1) no ship at wharf – background noise

2) no record of ship movements – excluded from analysis

3) mean value of the minimum L_{A90} values for all nights when a ship was in the wharf has been used.

4.1.1.5 It was noted that during the periods of interest, i.e. when no unloading was taking place, a noise level was recorded consistently between 34 and 37 dB L_{A90} with an average of 36 dB L_{A90}. During the night when these measurements were taken it could be seen that the L_{Aeq} was typically up one decibel higher than the L_{A90}, and therefore an L_{Aeq} equivalent to 37 dB L_{Aeq} has been estimated as the likely noise from the vessel at Charmaine. This is based on the mean minimum measurement when a vessel was known to be in the wharf with a 1 dB conversion factor to convert from L_{A90} to L_{Aeq}. The model has been calibrated at this point to reflect realistic noise levels from vessels.

4.1.1.6 It was noted that other steady noise sources in the area would have contributed to the recorded noise levels, such as from distant industry and roads, and these may lead to an overestimate of noise from the vessels alone. On one night (the 13th to 14th of April), when there were no vessels at the wharf, lower noise levels were recorded at the quietest time of night even down to 34 to 35 dB L_{A90} at times. This suggested that noise levels from the vessels could be several decibels lower than have been adopted in the assessment. This make the approach likely to be conservative.

4.1.1.7 Standard noise propagation algorithms in the noise model are based on ISO 9613-2 which includes a component for downwind propagation which is a worst case. This has been applied to all noise sources except the vessel noise, which has been calibrated to neutral meteorological conditions. Since the baseline was also measured under neutral conditions, the comparison of the measured vessel noise and background noise levels is robust. Allowing the model to add any appropriate downwind correction to the other noise sources means that the comparison is likely to be conservative when compared to neutral baseline conditions.

4.1.1.8 The noise level that was use as the input to the model in order to achieve the measured noise level at Amcotts is show in Table 14.

Table 14: Assumed Vessel Noise

Vessels docked at quay	L_{WA} 95.3 dB	Assumed 10m (approx. exhaust height)	1	From baseline measurements including vessels at existing wharf. Not known if vessels will switch engines off once dock, but assumed engines will run for 1 h, ie 100% on-time for BS 4142 assessment. Daytime and night-time operation.