Mallard Pass
Solar Farm

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Chapter 10: Noise and Vibration

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10.0 Noise and Vibration

10.1 Introduction

10.1.1 This chapter of the ES presents the approach and findings of the assessment of potential impacts of noise and vibration from the Proposed Development on sensitive receptors.

10.1.2 This ES chapter is supported by the following appendices [**EN010127/APP/6.2**]:

a. ***Appendix 10.1***: Legislation and Planning Policy Relevant to Noise and Vibration.

b. ***Appendix 10.2***: Noise and Vibration Assessment Methodology.

c. ***Appendix 10.3***: Consultation Record and Reponses Relevant to Noise and Vibration.

d. ***Appendix 10.4***: Baseline Noise Survey.

e. ***Appendix 10.5***: Noise Modelling.

10.1.3 This ES chapter is supported by the following Figure [**EN010127/APP/6.3**]:

a. ***Figure 10.1:*** Noise Monitoring Locations

10.1.4 The chapter summarises the assessment methodology (which is detailed in **Appendix 10.2**) and provides a review of the baseline conditions in the vicinity of the Proposed Development and surrounding area as well as Embedded Mitigation measures. The chapter then presents the results of the assessment and the impact of the Proposed Development on the baseline environment in order to determine the anticipated magnitude of impact and significance of effect. Additional Mitigation measures are presented to minimise the impacts of the Proposed Development during the construction, operation and

decommissioning phases. Consideration is also given to Residual Effects and Cumulative Effects.

10.1.5 The relevant legislation, policy and guidance pertinent to the noise and vibration assessment is provided in ***Appendix 10.1***.

10.1.6 The noise and vibration assessment follows the general approach to undertaking EIA as detailed in ***Chapter 2: Overview of the EIA process*** of the ES [**EN010127/APP/6.1**], albeit it has been adapted to take account of relevant industry guidelines and best practice (see ***Appendix 10.1***). The approach to the assessment of the sensitivity of receptors, magnitude of impacts and the significance of effects in relation to noise and vibration is described in ***Appendix 10.2***.

10.1.7 A summary of the consultation undertaken, setting out relevant matters raised by the stakeholders and a description of how and where these have been addressed is provided in ***Appendix 10.3***. This includes consideration of the scoping responses and how this was addressed in the assessment.

10.1.8 Noise and vibration will be generated by construction and decommissioning as noise and vibration could arise from onsite activities, such as the construction of the access tracks, installation of PV Arrays and the Onsite Substation, installation of the Grid Connection Cable and associated infrastructure. The movement of construction traffic, both onsite and travelling on public roads, to and from the Order Limits also represents a potential source of noise and vibration for consideration.

10.1.9 During the operation of the Proposed Development, the main potential source of noise would be associated with electrical and mechanical plant, both the equipment located within the PV Arrays and the Onsite Substation. The noise and vibration from operational traffic is unlikely to

be significant[1] and have been scoped out as agreed with the Planning Inspectorate (PINS) (see ***Appendix 10.3***).

10.2 Assessment Methodology and Significance Criteria

10.2.1 Noise and vibration from construction and decommissioning activities within the Solar PV Site have been assessed with the guidance of BS 5228 Parts 1 and 2 [**Ref 10-1**]. ***Appendix 10.2*** details magnitude of impact thresholds based on for construction noise and vibration based on BS 5228 guidance. Although the thresholds are based on absolute levels, they were determined with regards to the rural nature of area. As advised in BS 5228 guidance, the duration of the impacts needs to be considered and shorter-term localised activities (i.e. less than one month) can result in reduced impacts. Conversely, work outside of standard weekday daytime periods, in particular at night-time, is considered against more stringent thresholds.

10.2.2 The noise impacts of construction-related traffic passing to and from the Solar PV Site along local surrounding roads has been determined in accordance with the guidance of the Design Manual for Roads and Bridges (DMRB) [**Ref 10-2**]. For receptors located along the likely access route, the relative change of traffic noise levels created by this increased traffic during construction is evaluated and compared with relevant change thresholds from the DMRB.

10.2.3 Operational noise from plant within the Solar PV Site and Onsite Substation is assessed based on the guidance in BS 4142 [**Ref 10-3**]. This assessment is based on rated noise levels (L_{Ar}), which account for the character of the noise, which is compared to typical baseline

[1] The anticipated operational trip generation is set out in Chapter 9, Transport and Access, to further support this.

background noise levels at the receptors, subject to a lower cut-off of 35 dB L_{Ar}.

10.2.4 In line with relevant guidance (set out in ***Appendix 10.1***), the assessment focuses on residential receptors which were considered to have a high sensitivity to noise. Dwellings within 500 m of the Solar PV Site, or 800 m from the Onsite Substation, are considered (see **Appendix 10.2**).

10.2.5 In order to provide a precautionary assessment and following consultation, the assessment also considers potential impacts on users of Public Rights of Way (PRoWs), despite the transient nature of any exposure to noise and vibration impacts. PRoWs which passed closest to the Solar PV Site (within 100 m) were considered. Operational noise for PRoW receptors is compared to a threshold of significant effect at 55 dB L_{Aeq} (on a precautionary basis) based on guidance including that of BS 8233 [**Ref 10-4**].

10.2.6 All residential receptors are of high sensitivity. PRoWs are considered to have a medium sensitivity due to the transient and recreational nature of the use of these paths. The relationship applied between magnitude of impact and sensitivity to determine the level of significance is provided in Table 3 of **Appendix 10.2**, which is reproduced below as **Table 10-1**. Moderate and major effects (in bold) are considered to be significant within the meaning of the EIA Regulations.

Table 10-1: Significance of Effects

Magnitude of Impact	**Residential receptors**	**PRoW Receptors**
High	**Major**	**Moderate**
Medium	**Moderate**	Minor

Magnitude of Impact	Residential receptors	PRoW Receptors
Low	Minor	Minor
Negligible	Negligible	Negligible

10.3 Consultation

10.3.1 As part of the pre-application process, consultation has been undertaken with Rutland County Council (RCC) Public Protection Section and South Kesteven District Council (SKDC) Environmental Health Services to agree the scope of the baseline noise survey and assessment methodology.

10.3.2 Further detail of the consultation undertaken, including how the Scoping Opinion has been addressed are set out in **Appendix 10.3,** which confirms that the assessment approach used is robust and in line with good practice.

10.4 Legislation, Planning Policy and Guidance

10.4.1 This noise assessment has been undertaken with regard to the following documents:

a. Legislation

   i. The Environmental Protection Act 1990 (Her Majesty's Stationery Office (HMSO), 1990) [**Ref 10-5**].

   ii. Control of Pollution Act (CoPA) 1974 (HMSO, 1974) [**Ref 10-6].**

b. National Planning Policy Statements

   i. Overarching National Policy Statement for Energy (EN-1) [**Ref 10-7**].

ii. National Policy Statement for Renewable Energy Infrastructure (EN-3) [**Ref 10-8**].

iii. Draft Overarching National Policy Statement for Energy (EN-1) [**Ref 10-9**].

iv. Draft National Policy Statement for Renewable Energy Infrastructure (EN-3) [**Ref 10-10**].

c. National Planning Policy

i. Noise Policy Statement for England (NPSE) [**Ref 10-11**].

ii. National Planning Policy Framework (NPPF) [**Ref 10-12**].

d. Local Planning Policy

i. Rutland Local Development Framework: Core Strategy (Adopted July 2011) [**Ref 10-14**].

ii. South Kesteven Local Plan 2011- 2036 (January 2020) [**Ref 10-15**].

e. Guidance

i. British Standard 5228 (2014) 'Code of practice for noise and vibration control on construction and open sites' [**Ref 10-1**].

ii. Design Manual for Roads and Bridges (DMRB) [**Ref 10-2**].

iii. British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound [**Ref 10-3**].

iv. Planning Practice Guidance – Noise [**Ref 10-13**].

v. Calculation of Road Traffic Noise [**Ref 10-16**].

vi. ISO 9613-2 Attenuation of sound during propagation outdoors, Part 2: General method of calculation [**Ref 10-17**].

10.4.2 Further detail on these policies and guidance of relevance to this chapter is provided in ***Appendix 10.1 and 10.2*** [**EN010127/APP/6.2**].

10.5 Assumptions and Limitations

10.5.1 The baseline noise survey was undertaken in January and February 2022 when there were no significant restrictions associated with the COVID-19 pandemic in place. It was therefore expected that the pandemic would have had either no substantial influence on human activity and road traffic levels and therefore background noise, or that levels would only be marginally lower than normal therefore resulting in a more conservative assessment. This was agreed in consultation with local authorities as discussed in **Appendix 10.3**. The weather during the survey was representative and it was not undertaken during holiday periods.

10.5.2 The assessment of construction of the Proposed Development has considered the general description of the activities set out in **Chapter 5**. In all cases, construction activities assumed were those likely to be the worst-case in terms of noise generation, including percussive piling of PV Module mounts and earth works within the Solar PV Site (Works Area 1). For the same reasons, use of Horizontal Directional Drilling (HDD) was assumed for the cable crossing of the East Coast Mainline Railway/West Glen River (see ***Chapter 5: Project Description*** of this ES and ***Figure 5.8***), as well to cross below ground utility infrastructure within the Solar PV Site (no closer than 500m from any dwellings). Other cable work would use an open trench construction technique, which generates less noise and does not require out-of-hours work and therefore is associated with reduced effects.

10.5.3 In the absence of details on the construction and decommissioning activities at this stage, reasonable worst-case working locations were considered, within each of the relevant Works Area, based on each activity occurring at the closest point in that area to the noise-sensitive locations.

10.5.4 Typical noise emissions of construction plant items were derived from BS 5228-1 [**Ref 10-1**] (see ***Appendix 10.5***), on a precautionary basis. These were used to predict the average sound pressure level for the daily construction working period over different phases of the construction and decommissioning for different receptors, assuming a high amount of activity and based on the period where these would occur closest to each receptor to provide a worst-case scenario.

10.5.5 The assessment of the noise impact of construction traffic was based on the assumptions set out in both ***Chapter 5: Project Description*** and ***Chapter 9: Transport and Access***, with a daily peak of 54 two-way HGV trips and 105 two-way LGV trips, as well as the traffic routing and future baseline traffic values (for 2026) derived in ***Chapter 9: Transport and Access***.

10.5.6 As set out in ***Chapter 5: Project Description*** of this ES, the final plant specification and equipment layout within Works Area 1 (the Solar PV Area) is not yet determined, The assessment is therefore based on a worst-case assumption that Central Container Inverters are used (as opposed to String Inverters distributed around the Solar PV Site) as this is considered likely to result in the highest potential noise levels at neighbouring properties based on experience of similar developments and the modelling shown in **Appendix 10.5**. The emissions levels assumed for these central inverters is considered robust and does not assume any noise mitigation. The potential noise from Single Axis Tracker (SAT) motors has also been considered as a worst-case.

10.5.7 This plant will mainly operate during the daytime, in which background noise levels tended to be more elevated; however, during the summer months, daylight periods may extend to early morning periods (05:00 to 07:00) and evening periods (18:00 to 23:00). Therefore, as a worst-case, the plant noise from the Proposed Development has been

considered against these quieter periods. Also, the plant has been assumed to operate at full duty (with its maximum level of noise emission) during this period. This is a worst-case assumption as evening/night periods will tend to experience lower temperatures, and therefore plant components providing cooling are likely to operate at reduced duty and be quieter than assumed during these periods.

10.5.8 Noise modelling is also undertaken on a conservative basis which does not account for the screening of noise provided by the PV Modules themselves, which are largely solid and would in practice block some of the plant noise during the operational phase. In addition, although some of the plant may be located in enclosures, their sound reduction is omitted for the purpose of this assessment in the absence of detailed information on the acoustic performance of the enclosures and therefore presents a worst-case scenario.

10.5.9 The noise modelling first considers such inverter plant and SAT plant located at the closest distance to sensitive receptors consistent with the design principles set out in the Design and Access Statement [**EN010127/APP/7.3**]: a minimum separation distance of 250m and 50m from residential properties and PRoWs respectively.

10.5.10 The assessment has also considered the potential noise emissions from the Onsite Substation based on the closest separation distance from Works Area 2 and the nearest residential properties. This assumed robust levels of noise emissions based on a large transformer and associated power regulation equipment without assuming any noise mitigation measures or screening (see **Appendix 10.5**).

10.5.11 To consider total noise levels from the combination of these plant sources spread across the Order limits, a model of all the inverters

shown on the illustrative layout [**EN010127/APP/6.3**] in combination with the Onsite Substation was also undertaken.

10.6 Baseline Conditions

Sensitive Receptors

10.6.1 Residential properties are considered to be highly sensitive to noise and vibration based on the guidance and policy set out in ***Appendix 10.1***. Commercial and industrial receptors are considered to have a low or negligible sensitivity to noise and vibration. Some of these commercial and industrial receptors are present in the industrial estate south of Essendine, but given this reduced sensitivity and that more sensitive receptors are located at similar or closer distance to the sources of noise considered, a detailed assessment of these receptors is scoped out and they are not considered further in this chapter.

10.6.2 PRoW receptors will at times include users of these paths for recreational purposes. Due to their transient nature of passage and nature of their use, based on professional judgement and relevant guidance, recreational users of PRoW are considered to have a medium sensitivity to noise and vibration (see ***Appendix 10.1***).

Current Baseline

10.6.3 A baseline noise survey was undertaken in January and February 2022 to characterise the noise environment for locations potentially affected by operational noise effects following consultation with the local planning authorities. The survey and results are detailed in ***Appendix 10.4***. The survey was undertaken in line with guidance outlined in British Standard (BS) 4142 '*Methods for rating and assessing industrial and commercial sound*' (British Standards Institution (BSI), 2014, amended 2019) in consultation with the Environmental Health Departments of South Kesteven District Council (SKDC), Rutland County Council (RCC) and

Lincolnshire County Council (LCC) as set out in ***Appendix 10.3***. Characterisation of baseline through measurements was not required for properties potentially affected by construction traffic as the assessment is based on relative changes in traffic levels for properties along the access route.

10.6.4 Noise measurements were undertaken in mid-January and late February 2022, with a combination of unattended measurements at 4 fixed locations for a period of several days each, and short-term sample monitoring at 9 locations around the Order limits. The monitoring locations were determined to be representative of the noise-sensitive properties identified neighbouring the Order limits, in consultation with the relevant local authorities. The survey was undertaken during typical weekday and weekend periods in suitable weather conditions.

10.6.5 The baseline noise environment was observed to be varied but typical of the rural location of the Order limits, with a range of natural noise sources and a varying influence of road traffic. Although occasional train movements were audible at times, they tended not to influence the background noise environment due to their infrequent and brief nature.

10.6.6 The background noise survey results are analysed in ***Appendix 10.4*** in accordance with BS 4142 guidance. This shows that, at properties neighbouring the Order limits:

a. Properties exposed to traffic from local roads in the day-time could experience levels of 35 to 40 dB LA90, but levels reduced to quieter levels of around 31 dB during the evening periods of the day-time;

b. At properties more distant from local roads, quieter levels were also typical during the day-time (and not just evenings);

c. During the night-time, levels reduced below 30 dB (typically 26 dB LA90).

d. Locations exposed to higher traffic noise on the A6121 experienced higher noise levels, at least 6 dB higher.

10.6.7 The resulting derived typical noise levels are summarised in Table 3 in **Appendix 10.4**.

Future Baseline

10.6.8 Without the implementation of the Proposed Development, the future baseline is considered to be generally similar to that described above, as no other committed developments were identified as likely to significantly affect the baseline noise environment for the noise-sensitive receptors considered.

10.7 Embedded Mitigation

Construction

10.7.1 When considering the potential effects of the Proposed Development, the relevant embedded mitigation measures are described within ***Chapter 5: Project Description*** of this ES. These include core construction hours of 07:00 – 19:00 Monday to Saturday for working and HGV movements. The following activities will also be excluded on Saturday afternoons (13:00 to 19:00):

a. works likely to generate substantial levels of noise (including earthworks, trench construction and any piling);

b. HGV deliveries and movements.

10.7.2 This is considered in further detail in the Outline Construction Environmental Management Plan (oCEMP) [**EN010127/APP/7.7.6].** The management of construction traffic is also described in ***Chapter 9: Highways and Access***, including the measures implemented through the Outline Construction Traffic Management Plan (oCTMP).

10.7.3 The only exception to the general working hours restrictions would be HDD which could be required in some cases to continue outside of the assumed day-time construction hours (i.e. evening, Sundays, Bank Holidays or at night). HDD locations for below ground utility crossings within the Solar PV Site would be located at least 500m from the nearest residential property.

10.7.4 The oCEMP also includes standard good practice measures such as use of Best Practical Means to reduce disturbance associated with noise and vibration during construction as far as reasonably practicable, with reference to relevant guidance in BS 5228.

Operation

10.7.5 The overall design of the work areas included in the Proposed Development has been developed to generally maximise where possible the distance between areas where noise-generating plant may be located from noise-sensitive receptors: in particular this is the case for the location of the Onsite Substation, as well as the Solar PV Areas within the Order Limits.

10.7.6 In addition, a series of design principles have been set out in the ***Design and Access Statement*** [**EN010127/APP.7.3**] for the Proposed Development meaning that central inverters (if used) will be located at a minimum distance of 250m and 50m from residential properties and PRoWs respectively. This has therefore been assumed as the basis for the assessment.

Decommission

10.7.7 For the decommissioning phase, similar mitigation measures as for the construction phase have been included in the Outline Decommissioning Environmental Management Plan (oDEMP) [**EN010127/APP/7.8]**. This

means that similar restrictions on working hours and good practice measures would be used.

10.8 Potential Effects

10.8.1 This section describes the potential noise and vibration effects during the construction, operation and decommissioning phases of the Proposed Development, accounting for the above embedded measures.

Construction

Construction Noise

10.8.2 Potential worst-case levels of noise (over the working day) associated with different construction activities occurring at different distances from potential receptors are calculated in Table 2 of ***Appendix 10.5***. The assessment in **Table 10-2** considers construction activities in Works Areas 1, 2, 3 and 5 on the basis that works are ongoing at the closest point[2] to the nearest sensitive receptors within each of the respective Works Area. The nearest identified receptors and corresponding range of worst-case construction noise levels are set out in **Table 10-2**. Please note that these predicted levels correspond to times when the construction activities are closest to the receptors considered.

[2] Table 9 of **Appendix 10.5** sets out the separation distances from Works Area 1 to the residential receptors.

Table 10-2: Worst-case construction noise levels for key activities

Works Area	Activity	Closest distances	Closest residential receptors	Predicted noise levels $L_{Aeq,T}$
1	Earth-works	60-130 m	Vale Farm, Wood Farm Cottages, Green Lane Farm, Sunny Acres, North Lodge House.	60-67 dB
1	Solar array mounts (percussive piling)			65-73 dB
2	Onsite Substation construction	> 500 m	North Lodge House / North Lodge Farm, Ryhall	< 53 dB
3	Grid Connection Cable (trench work)			< 45 dB
5	Temporary site compound construction	210-220 m	Barber's Hill House, Vale Farm	60-61 dB

10.8.3 Works on the solar array mounts within 130 m or earthworks within 65 m correspond to worst-case noise levels of more than 65 dB which could result in a medium magnitude of impact, based on the magnitude criteria of Table 1 in ***Appendix 10.2***, if the work was sustained over a longer-term period of 1 month or more. However, the duration of the work should also be taken into account according to BS 5228 guidance.

10.8.4 Based on the nature of the works, these activities would rapidly move from the closest point and would be undertaken at increased distances of more than 130 m within a short period[3] (substantially less than one month): this would then equate to predicted levels below 65 dB L_{Aeq}. When accounting for the duration of the worst-case impacts, and the reduced magnitude of impact when work would be undertaken further away and based on the guidance in BS 5228 and professional judgement, these activities are considered to represent at most a **low magnitude of impact**.

10.8.5 For residential receptors located even further away, more than 400m from Works Area 1 where piling works may occur, with worst-case levels below 55 dB, the impact would be **negligible**.

10.8.6 Predicted noise levels for Site Compound construction correspond to a **low** magnitude of impact at most. Works required to build the Onsite Substation (Works Area 2) and trench work to install the Grid Connection Cable (Works Area 3) have predicted levels corresponding to a **negligible** magnitude of impact.

10.8.7 Road improvement works are required in several area (within Works Area 6). These will be localised and of short duration, similar to road

[3] The portion of Works Area 1 located within 130 m from noise-sensitive receptors represent less than 1% of the total area, and therefore any works undertaken in that area will represent a small fraction of the total works programme.

maintenance works. Whilst this may generate audible levels of noise at the nearest noise-sensitive properties, it is considered based on professional judgement that this is unlikely to be associated with additional significant effects. Similarly, cable trench work (Works Area 4, excluding HDD which is considered separately below) would be of very short duration, similar to utility connection roadworks. This would in both cases correspond to a **low** magnitude of impact at most.

10.8.8 Therefore, the construction activities assessed above represent a **negligible to low magnitude of impact** on residential receptors (**high sensitivity**), which corresponds to a **negligible to minor** significance of effect which is **Not Significant**.

10.8.9 However, some of the cable laying works may involve use of HDD, which could be required to continue outside of the assumed general day-time construction hours (i.e. evenings, Sundays, Bank Holidays or at night). The closest residential receptors are located approximately 500 m from the areas where HDD may potentially be used: worst-case noise levels of 50 dB L_{Aeq} are predicted in these cases. This includes North Lodge Farm or Banthorpe Lodge (cable crossing of the East Coast Mainline Railway/West Glen River) and Church Farm/Grange Farm Cottage for the below ground utility crossings within the Solar PV Site.

10.8.10 Other properties on the outskirts of Essendine (such as those on Glen Crescent) could be around 700 m from the works, and therefore potentially exposed to levels between 45 and 47 dB $L_{Aeq.}$ These predicted levels would represent a negligible or low magnitude of impact for daytime or evening work. However, if HDD drilling persists during the night-time, this would represent a **medium magnitude of impact** on residential receptors (**high sensitivity**) which would result in a **moderate adverse** significance of effect which is **Significant**.

10.8.11 Other noise-sensitive receptors considered are 900 m or more away from the proposed HDD works with associated levels of 45 dB or less which would be associated with a **low magnitude of impact** which would result in a **minor adverse** significance of effect even for night-time work, which is **Not Significant.**

10.8.12 Some sections of PRoW pass at their closest point around 20 m from Works Area 1 where the noisiest construction works (such as piling) may occur. Therefore, PRoW users could experience worst-case noise levels in excess of 75 dB L_{Aeq} assuming that a PRoW user was to pass by the Solar PV Site during the time when construction works (localised in that particular part of the Solar PV Site) occur at a distance of 20 m: this has a low probability of occurring. Furthermore, the construction noise criteria of ***Appendix 10.2*** relate to noise levels averaged over the working day: PRoW users would therefore experience average levels below 75 dB L_{Aeq}, even under worst-case assumptions, as they pass the Solar PV Site. This would represent at most a **medium magnitude of impact** on the PRoW receptors (**medium sensitivity**) which would result in a **minor adverse** significance of effect which is **Not Significant**.

Construction Vibration

10.8.13 Vibration criteria are set out in ***Appendix 10.2***, in terms of Peak Particle Velocity (PPV in mm/s): PPV levels between 0.3 and 1 mm/s are considered to be potentially noticeable to dwellings but correspond to a minor magnitude of impact. Some of the construction activities, such as piling operations, drilling or vibratory rolling techniques, may be used within the Solar PV Site, and can generate perceptible vibration levels in close proximity to their use (within around 100 m). Predicted vibration levels at different distances for these activities are evaluated in ***Appendix 10.5*** based on available guidance in BS 5228-2.

10.8.14 The proposed HDD drilling would be undertaken at least 500 m from the nearest sensitive receptors that the associated vibration levels would be negligible (<0.3 mm/s). Percussive piling within the Solar PV Site will occur at distances of at least 60 m from the nearest receptors: this would generate worst-case PPV levels below 0.3 mm/s which would also correspond to a negligible impact magnitude. Vibratory ground compaction, if used within the Solar PV Site, would generate vibration levels marginally above 0.3 mm/s but below 1 mm/s for works within 60 to 100 m of the nearest residential receptors to Works Area 1 (identified in **Table 10-2**). Therefore, construction vibration is potentially associated with a **low magnitude of impact** on residential receptors (**high sensitivity**) which would result in a **minor adverse** significance of effect which is **Not Significant**.

10.8.15 For PRoW receptors (**medium sensitivity**), ground compaction within 20m (worst-case distance) could lead to higher vibration levels marginally above 1 mm/s. This could result in a **medium magnitude of impact** which would also result in a **minor adverse** significance of effect which is **Not Significant**.

Construction Traffic

10.8.16 The noise impact of construction traffic is assessed in ***Appendix 10.5*** using the methodology set out in Calculation of Road Traffic Noise (CRTN) [**Ref 10-16**] to determine the associated maximum total change in the average day-time traffic noise for locations neighbouring the access route. In all cases, an increase in noise levels of 0.1 dB or less was predicted, which correspond to a negligible magnitude of impact based on the DMRB criteria of Table 1 in ***Appendix 10.2***.

10.8.17 For the primary construction compound access on Essendine Road, a relative increase in traffic is predicted, but the absolute level of traffic remains very low with less than 1000 daily movements. This is below

the threshold at which CRTN calculations can be reliably undertaken and it is therefore not possible to calculate a relative change in noise level. However, based on the predicted noise levels that CRTN suggests for the lowest flow value, it can be deduced that the associated L_{Aeq} for the working day associated with this traffic would be below 65 dB. Based on the absolute noise criteria of Table 1 in ***Appendix 10.2***, this would correspond to a **low magnitude of impact** on residential receptors (**high sensitivity**) which would result in a **minor** significance of effect which is **Not Significant**.

Operation

Onsite Substation

10.8.18 The main potential source of operational noise is the Onsite Substation, which would typically include one large transformer as well as other voltage regulation electrical plant which can generate noise in operation, including noise of a tonal character. As the likely location for this equipment within Works Area 2 is more than 600 m from the nearest noise-sensitive receptors (North Lodge Farm and House or properties in Ryhall), the associated levels of operational noise from this facility would be of less than 30 dB L_{Aeq} at these properties (see Table 6 of ***Appendix 10.5***).

10.8.19 As the noise from the Onsite Substation is likely to include a tonal character which may be clearly audible (as a worst-case), a penalty of +4 dB is applied in accordance with BS 4142 (see ***Appendix 10.5***). This potentially results in rated noise levels of 33 dB L_{Ar} which is similar to typical lowest background noise levels of at least 31 dB L_{A90} experienced at the closest dwellings identified during the daytime, resulting in a low impact. The rated noise level could be more than 5 dB above typical background noise levels of 26 dB L_{A90} experienced during quiet periods at night but would remain low in absolute terms (less than

35 dB L_{Ar}). This would therefore represent a low magnitude of impact on balance for this source in isolation according to the methodology of ***Appendix 10.2*** (in line with the BS4142 standard).

10.8.20 PRoW receptors are more than 800 m from the Onshore Substation and would experience negligible levels of noise from that source. The combination of noise from the Onsite Substation with the other plant considered around the site is considered further below.

Plant associated with Solar PV Site

10.8.21 Other plant which would form part of the Proposed Development comprises the plant associated with the PV Arrays, including inverters, transformers and potentially SAT motors.

10.8.22 As the specific design and technology for the Solar PV Site and the location of the plant are not finalised at this stage, ***Appendix 10.5*** considers potential emissions from representative layouts for different technology options: with or without SAT, both using string or central inverters. This modelling demonstrates that:

a. Central inverter technology corresponds to increased noise levels despite the reduced number of sources, as the inverters are noisier; and

b. The SAT approach leads to potentially higher noise levels: this is not due to the SAT motors, which have negligible noise emissions, but due to the potentially increased number of central inverters required.

10.8.23 The assessment is therefore based on the SAT central inverter technology as a worst-case. The predictions are based on representative robust plant noise information from manufacturers and

worst-case assumptions as summarised above and detailed in ***Appendix 10.5.***

10.8.24 Based on the design principles referenced above, residential receptors will be located at a distance of at least 250m from any central inverter. The modelling results of ***Appendix 10.5*** indicate that this corresponds to noise levels of no more than 30 dB L_{Aeq}. Adding a tonal penalty of +4 dB to account (again as worst-case) for a potential character in the inverter noise means that rated noise levels from inverters would be lower than 35 dB L_{Ar}. This would also represent a low magnitude of impact.

Total Operational noise and conclusions

10.8.25 To assess potential noise from the whole of the equipment within the Solar PV Site, including several central inverters in addition the Onsite Substation, ***Appendix 10.5*** includes modelling results for the indicative solar layout using a central inverter design approach (which represents the worst-case for noise). This indicative design is based on enforcing a minimum buffer distance of 250m and 50m from residential properties and PRoWs respectively. The prediction results (Table 10 in ***Appendix 10.5)*** show that combined noise levels do not exceed a rated level of 35 dB L_{Ar} at almost all residential receptors, even on the basis of the conservative assumptions made (including plant operating at full duty). However, at 2 properties, Wood Farm and North Lodge Farm, predicted levels are 36 dB L_{Ar} which is marginally above this threshold. This is due to the noise from several inverters and the Onsite Substation adding up at these properties.

10.8.26 Table 11 and 12 of ***Appendix 10.5*** details the assessment in line with BS 4142 at all residential properties based on the derived background noise levels and predicted rated noise levels. For day-time periods, the predicted levels are generally either clearly lower (more than 10 dB below) or comparable to (less than 5 dB above) typical lowest

background noise levels, corresponding to a negligible or low impact magnitude respectively. For night-time periods, this is also the case in the majority of situations. At some properties, the predicted rated level are between 5 and 10 dB above the derived night-time background noise levels of 26 dB L_{A90} for these properties; however, as absolute level of the rated noise is low (below 35 dB), this corresponds to a low impact magnitude. Furthermore, the assumption that the inverter plant would operate at full load during quieter periods at night is unlikely to occur, due to low cooling loads, which would reduce noise levels by 7 to 10 dB (based on available manufacturer information).

10.8.27 At Wood Farm and North Lodge Farm, Table 11 of ***Appendix 10.5*** shows a medium magnitude of impact for day-time periods. Despite predicted rated levels being in theory up to 10 dB or more above the derived background levels at night (Table 12) at these properties, given that the absolute level of the noise (a relevant consideration according to BS 4142) is only marginally above the threshold of 35 dB, it is concluded based on professional judgement that this represents a **medium** magnitude of impact.

10.8.28 In conclusion, operational noise from the Onsite Substation and plant associated with the Solar PV Site may represent (as a worst-case) a **medium** magnitude of impact on residential receptors (**high sensitivity**), which would result in a **moderate adverse** significance of effect which is **Significant**. Further mitigation is proposed in **Section 10.5** to reduce this effect in the final design of the Proposed Development.

10.8.29 PRoW receptors are at least 50 m from any central inverters and are located more than 800 m from the Onshore Substation. The modelling results of ***Appendix 10.5*** shows that operational noise levels would not exceed 50 dB L_{Aeq}, which is therefore clearly below a precautionary

threshold of 55 dB L_{Aeq} derived in ***Appendix 10.2***. This means that, although plant noise may be audible for transient users of the PRoW, this will not be at a level likely to create significant disturbance. This would represent a **low** magnitude of impact on these receptors (**medium sensitivity**), which would result in a **minor adverse** significance of effect which is **Not Significant**.

Decommissioning

10.8.30 Decommissioning is likely to involve activities of similar or reduced intensity as for the construction phase and therefore result in comparable noise and vibration effects in the most part; however, HDD or piling are unlikely to be required for this phase, leading to reduced impacts overall.

10.8.31 Breaking up of concrete slabs supporting central inverters and components within the Onsite Substation may be required, but this would occur at least 250 to 500 m from noise-sensitive residential receptors, which according to ***Appendix 10.5***, would result in worst-case noise levels of 53 to 61 dB. This represents a low impact magnitude. Some of this work could occur 50 m from PRoW receptors, which would result in noise levels of 73 dB L_{Aeq}, when passing at the closest point: this would represent a medium magnitude of impact for these receptors.

10.8.32 Decommissioning activities would therefore represent a **low** magnitude of impact on residential receptors (**high sensitivity**) which would result in a **minor adverse** significance of effect which is **Not Significant**. For the PRoW receptors (**medium sensitivity**), the **low to medium** magnitude of impact would result in a **minor adverse** significance of effect which is **Not Significant**.

10.8.33 Vibration associated with decommissioning works is potentially associated with a **low magnitude of impact** on residential receptors (**high sensitivity**) which would result in a **minor adverse** significance of effect which is **Not Significant**. For PRoW receptors (**medium sensitivity**) this low magnitude of impact would also result in a **minor adverse** significance of effect which is **Not Significant.**

10.8.34 Traffic associated with the decommissioning would be similar or lower to that associated with the construction phase and therefore a similar impact would result. This corresponds to a **negligible** magnitude of impact on residential receptors (**high sensitivity**) which would result in a **Negligible** significance of effect which is **Not Significant**.

10.9 Proposed Additional Mitigation

10.9.1 This section discusses mitigation measures identified to reduce the potential significant effects identified, based on the worst-case assumptions made in the above assessment.

Construction

10.9.2 The worst-case noise levels predicted above for HDD work assumed a location for the drilling rig at ground level and not down in a pit and at the closest potential point to the noise-sensitive receptors identified. Furthermore, the assumed noise levels for this activity may not arise in practice based on many factors, including soil condition and type of equipment used. It may also be possible to interrupt drilling at night. Therefore, the suitability of the proposed mitigation measures discussed below (based on a worst-case) will need to be determined at a later stage, in particular once the final locations of the HDD works (if required) and the necessary equipment have been determined.

10.9.3 HDD activities should be interrupted at night if possible and safe to undertake. If they are required to continue at night, they should be

controlled not to exceed a level of 45 dB L_{Aeq} at the closest neighbouring residential properties. This may be achieved in some cases without the need for further mitigation. As a worst-case, this may require local temporary solid screening of a height and mass providing at least a 5 dB(A) reduction in sound pressure level. This acoustic screening performance would be achieved for example using temporary solid barriers with a height of at least that of the main drilling equipment located in proximity (around 10m or less) of the HDD work area, between the drilling equipment and the nearest noise-sensitive property(ies). The duration of HDD works and night-time noise generation should also be minimised as much as possible. The closest residents to the works shall be notified of the start and completion of the works if undertaken at night-time.

10.9.4 It is also recommended as a good practice measure that, if percussive piling is used for the support structures/foundations for the Mounting Structures, this should be further restricted (when works are undertaken within 400 m of residential properties) to no more than two periods of four hours each with at least one hour of no piling between these four-hour periods and restricted to the hours of 08:00 to 18:00 Monday to Friday and 08:00 to 12:00 on Saturdays.

10.9.5 Although likely impact on PRoW users are not considered significant, it would be beneficial to inform users of the PRoW of any percussive piling or earthworks planned as part of the reporting of information to local residents.

10.9.6 These measures will be implemented through the CEMP to be secured through a requirement of the DCO.

Operation

10.9.7 Additional mitigation is considered to demonstrate that a rated noise limit of 35 dB is achievable at all neighbouring properties on the basis of the assumptions considered above in **Section 10.4.** A 3 dB reduction in the noise emission levels of the inverters is considered straightforward to achieve either through selection of quieter plant units or through standard noise attenuation measures for the fan noise likely dominating the noise emission from this plant.

10.9.8 By applying a 3 dB reduction to the 2 inverters closest to Wood Farm and the 3 inverters closest to North Lodge Farm, Table 13 in ***Appendix 10.5*** demonstrates that noise levels not exceeding 35 dB L_{Ar} can be achieved in all cases even on the basis of a worst-case assumption of central inverter technology.

10.9.9 Selection of the final plant technology approach would be made on the basis of different considerations including noise. The detailed design of the Proposed Development, including final plant locations and selections, will be controlled through a requirement of the DCO. This final design will be determined such that total rated noise levels (L_{Ar}), including the applicable character correction, do not exceed 35 dB at residential properties. This noise limit would apply to the total noise from the Onsite Substation and all solar PV plant (inverters, transformers and other ancillary plant).

Decommissioning

10.9.10 No additional measures are proposed.

10.10 Residual Effects

10.10.1 Following implementation of the above proposed additional mitigation, the present section assesses residual effects: these are summarised in **Table 10-3**.

Construction

10.10.2 HDD work would either not be undertaken during night-time periods or controlled to levels not exceeding 45 dB L_{Aeq} at nearby noise-sensitive locations. This would reduce the previously identified potential medium magnitudes of impact associated with HDD to a low impact magnitude at most.

10.10.3 On this basis the effects of noise and vibration from all construction activities (including associated traffic) would represent in all cases a **negligible to low magnitude of impact** on residential receptors (**high sensitivity**) which would result in **negligible to minor Adverse** significance of effect which is **Not Significant**.

10.10.4 The noise and vibration from construction activities would represent at most a **low to medium magnitude of impact** on the PRoW receptors (**medium sensitivity**) which corresponds to a **minor adverse** significance of effect which is **Not Significant**.

Operation

10.10.5 The proposed mitigation measures would secure a final design of the onsite plant to meet the proposed noise limit of 35 dB L_{Ar} at all residential receptors. The analysis of ***Appendix 10.5,*** and summarised in **Section 10.5** above, demonstrates that the proposed noise limits are achievable in practice using standard noise control measures at source. Table 14 and 15 of ***Appendix 10.5*** details the corresponding assessment in accordance with BS 4142 at all properties which shows that a **negligible to low** impact magnitude is achieved at all properties.

10.10.6 Therefore, operational noise effects would correspond at most to a **negligible to low** magnitude of change for residential receptors (**high sensitivity**), which corresponds to a **negligible to minor adverse** significance of effect which is **Not Significant**. This would also

represent at most a **low** magnitude of impact on PRoW receptors (**medium sensitivity**), which would result in a **minor adverse** significance of effect which is **Not Significant**.

Decommissioning

10.10.7 In the absence of additional mitigation measures, the same conclusions can be reached as in the Potential Effect section. The effects of noise and vibration from decommissioning activities would represent in all cases a **negligible to low magnitude of impact** on residential receptors (**high sensitivity**) which would result in **negligible to minor adverse** significance of effect which is **Not Significant**.

10.10.8 For the PRoW receptors (**medium sensitivity**), a **low to medium magnitude of impact** would result in a **minor Adverse** significance of effect which is **Not Significant**.

10.11 Monitoring Requirements

10.11.1 The oCEMP and oDEMP sets out procedures for setting up and publicising a contact point with the contractor to log, monitor and address any complaints associated with noise during the construction period. A scheme to this effect will be included in the detailed CEMP. Provision of monthly reporting of information to local residents (including PRoW users) to advise of potential noisy works that are due to take place will also be included in the detailed CEMP.

10.11.2 Although no significant residual effect was identified, the oOEMP includes provision for regular inspections and maintenance of the equipment, to limit the risk of malfunctions creating disturbance associated with increased noise emissions. Furthermore, the oOEMP outlines a procedure for monitoring noise levels following any complaint from members of the public to report noise disturbance from the plant within the Solar PV Site.

10.12 Cumulative Effects

10.12.1 The assessment presented above has considered the effects of construction and operational activities associated with the Proposed Development (aside from construction traffic) in a Study Area limited to a zone of around 500 to 800 m from the Solar PV Site (as set out in Appendix 10.2). The cumulative schemes identified are located more than 1.5 km from this area, and therefore no additional cumulative effect would be expected based on professional judgement and the type of activities involved. Furthermore, the cumulative schemes considered would not introduce any noise-sensitive receptors in closer proximity to the Solar PV Site to those already assessed. Therefore there are no cumulative effects identified.

10.12.2 In relation to cumulative traffic, this is considered in ***Chapter 9: Highways and Access*** [**EN010127/APP/6.1**] which does not consider that any increased effect is likely, and this will therefore be the case for noise effects.

10.12.3 The other topics where there is potential for intra-development effects to arise alongside the identified noise and vibration receptors are as follows:

a. Highways and Access (Chapter 9): associated impacts are considered in the present chapter 10;

b. Air Quality (considered in Chapter 15);

c. Ecology and Biodiversity (considered in Chapter 7); and

d. Landscape and Visual (considered in Chapter 6).

10.13 Conclusion

10.13.1 The assessment has identified the potential for noise from some construction activities to lead to potentially significant effects if HDD is

required and remains active at night, but this can be mitigated through either interruption of drilling at night or use of localised solid screening (unless this is not considered required based on the equipment specification and drilling location).

10.13.2 Operational noise from the plant in the Solar PV Site and Onsite Substation will meet suitably low noise limit levels at neighbouring residential properties, based on the design principles which form part of the Proposed Development. This was determined on a conservative, worst-case basis and will be secured in the detailed design by a requirement of the DCO.

10.13.3 Other construction, operation and decommission noise and vibration effects were identified and may be audible / perceptible at times but are such that their effect would be minor or negligible.

10.13.4 Potential effects of noise and vibration on users of PRoWs were also considered but were considered minor at most considering the transient nature of such uses.

10.13.5 This assessment is summarised in **Table 10-3** below.

Table 10-3: Summary of Effects

Description of Effect/Activity	Nature of Effect	Receptor	Value / Sensitivity of Receptor	Embedded Mitigation Measures	Magnitude of Impact	Potential Significance of Effect	Additional Mitigation Measures	Residual Effect Significance	Monitoring Requirement
Construction Phase									
Construction Noise	Adverse, Short-term	Dwellings	High	Restriction of working hours, good practice measures (implemented through CEMP)	Negligible to Medium	Negligible to Moderate: Significant	Control of HDD works at night. Implemented in CEMP	Negligible to Minor: Not Significant	Inform residents of noisy works and investigate complaints.
	Adverse, Short-term	PRoW users	Medium		Low to Medium	Minor: Not Significant	Inform PRoW users of works (part of CEMP).	Minor: Not Significant	Inform residents of noisy works and investigate complaints.
Construction Vibration	Adverse, Short-term	Dwellings	High		Low	Minor: Not significant	None	Minor: Not Significant	None

Description of Effect/Activity	Nature of Effect	Receptor	Value / Sensitivity of Receptor	Embedded Mitigation Measures	Magnitude of Impact	Potential Significance of Effect	Additional Mitigation Measures	Residual Effect Significance	Monitoring Requirement
	Adverse, Short-term	PRoW users	Medium		Low	Minor: Not significant	None	Minor: Not Significant	None
Operational Phase									
Operational Noise	Adverse, Long-term	Dwellings	High	General design of Proposed Development considered noise-sensitive receptors.	Negligible to Medium.	Negligible to Moderate: Significant	Final design, location and selection of electrical plant to meet relevant noise limits (DCO Requirement).	Negligible to Minor: Not Significant	Equipment inspections and provision for monitoring following complaints.
	Adverse, Long-term	PRoW users	Medium		Low	Minor: Not Significant		Minor: Not Significant	Monitoring following complaints
Decommissioning Phase									

Description of Effect/Activity	Nature of Effect	Receptor	Value / Sensitivity of Receptor	Embedded Mitigation Measures	Magnitude of Impact	Potential Significance of Effect	Additional Mitigation Measures	Residual Effect Significance	Monitoring Requirement
Decommissioning Noise and Vibration	Adverse, Short-term	Dwellings	High	Restriction of working hours, good practice measures (oCEMP)	Negligible to Low	Negligible to Minor: Not Significant	None	Negligible to Minor (Non-significant)	Inform residents of noisy works and investigate complaints.
	Adverse, Short-term	PRoW users	Medium		Low to Medium	Minor: Not Significant	Inform PRoW users of works (part of CEMP).	Minor: Not Significant	Inform residents of noisy works and investigate complaints.

10.14 References

Ref 10-1 BSI (2014). BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration.

Ref 10-2 Highways England (2020). Design Manual for Roads and Bridges (DMRB), LA111 Noise and vibration. Revision 2.

Ref 10-3 BSI (2019). BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.

Ref 10-4 BSI (2014) BS 8233, Guidance on sound insulation and noise reduction for buildings, February 2014.

Ref 10-5 HMSO (1990). Environmental Protection Act, Part III.

Ref 10-6 HMSO (1974). Control of Pollution Act, Part III.

Ref 10-7 Overarching National Policy Statement for Energy (EN-1)

Ref 10-8 National Policy Statement for Renewable Energy Infrastructure (EN-3)

Ref 10-9 Draft Overarching National Policy Statement for Energy (EN-1)

Ref 10-10 Draft National Policy Statement for Renewable Energy Infrastructure (EN-3)

Ref 10-11 Department for Environment, Food and Rural Affairs (2010). Noise Policy Statement for England (NPSE).

Ref 10-12 Department for Levelling Up, Housing and Communities (2021). National Planning Policy Framework (NPPF).

Ref 10-13 Department for Levelling Up, Housing and Communities (2014, updated 2019) - Planning Practice Guidance – Noise [Online]. Available: https://www.gov.uk/guidance/noise--2 [accessed: 08/11/2022].

Ref 10-14 Rutland Local Development Framework: Core Strategy (Adopted July 2011)

Ref 10-15 South Kesteven Local Plan 2011- 2036 (January 2020)

Ref 10-16 HMSO Department of Transport (1988). Calculation of Road Traffic Noise (CRTN).

Ref 10-17 International Organization for Standardization (ISO) (1996). ISO 9613 Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation.