



8. NOISE AND VIBRATION

8.1 INTRODUCTION

- 8.1.1 This chapter presents an assessment of the likely significant environmental effects of the Proposed Solar Farm with regard to noise. It describes the methods used to assess the effects, the baseline conditions that currently exist and the potential future baseline in the vicinity of the Site and the potentially affected noise sensitive receptors. The chapter also sets out direct and indirect likely significant effects arising from the construction and operation of the proposed development and provides details of the mitigation measures required.
- 8.1.2 The assessment includes the consideration of:
- information on existing baseline sound level climate;
 - information on the noise levels from site noise sources;
 - information and predictions on the noise impact on nearest Noise Sensitive Receptors (NSRs) from plant operations;
 - information and predictions on the noise and vibration impact on NSRs from construction activities;
 - information on the cumulative impact of other permitted site activities on Site or in the local area; and
 - where appropriate, information on noise mitigation measures to comply with current noise standards and guidance.
- 8.1.3 The above potential noise impacts are considered in the context of the existing background noise at the site, which is generally affected by distant road traffic movements, aircraft noise from RAF Valley, farm animals and birdsong.
- 8.1.4 **Appendix 8.1** to this ES provides details of technical terms within the chapter, for ease of reference. There is also a chart showing typical everyday noise levels to assist in understanding the subjective level of noise in terms of decibels.
- 8.1.5 The associated plant will consist of the following:
- Photovoltaic panels and associated supporting frames and ground mounting;
 - Inverters (mounted within prefabricated containers);
 - Transformer stations (housed in prefabricated containers);
 - Cabling linking inverters and transformer stations to the substation;
 - Perimeter fencing and CCTV (invisible infra-red illumination at night, only pointing into the site);
 - DNO Substation;
 - Client Substation;
 - Internal service roads;
 - Scheme of landscaping;
 - Temporary Compound & set down area.

Proposed Development

- 8.1.6 A full description of the proposed development is provided in Chapter 3. The location of the Proposed Development (the Site) is shown on **Drawing LOC1001/1/01**.
- 8.1.7 Solar Farms are an inherently quiet installation as there are no moving parts. Noise is generated from the associated plant to convert the DC current to AC at the correct voltage involves the use of inverters and transformers.
- 8.1.8 Transformers are not particularly noisy plant and generate a low level 'hum' at relatively close distances driven by the mains frequency. The inverters would be

located within purpose-built containers. By its nature the proposed development will only be operational during daylight hours, however during peak generation during the summer months (i.e. under conditions of high temperatures) there may be occasional periods when the operation of the inverters and transformers occurs just after sun rise (i.e. earliest sunrise in the year being around 0500 to 0600 hours), but this would not be at full capacity and noise levels would be less than used in the assessment. The assessment for the sunrise scenario is therefore a robust view of impacts at NSRs.

8.1.9 A baseline noise survey commenced on 17th April 2020 for a week in the vicinity of the Proposed Development to determine existing representative background and residual sound levels. The aim of the sound survey was to:

- identify the existing baseline sound levels for use as a reference for background and residual sound levels in the assessment of impacts related to the operation of the Proposed Development;
- enable the assessment baseline to be established and understand the effects of existing developments on the future baseline; and
- characterise the nearest NSRs or noise sensitive sites.

8.1.10 The methodology and approach to the sound survey and assessment included the following:

- establishing the nearest NSRs;
- evaluation of present and assessment background and ambient sound levels;
- evaluation of noise sources from the Proposed Development in terms of typical operating levels;
- assessment of specific noise sources in relation to appropriate guidance and standards (e.g. TAN11, BS5228:2009+A1:2014+A1:2019);
- evaluation of construction noise and vibration sources relative to nearest receptors; and
- identification of any noise control necessary where noise generated from the Proposed Development has been identified as exceeding relevant guidance and standards.

Consultation

8.1.11 The noise assessment has benefited from pre-application discussions with the IACC's Environmental Health Officer and submissions relating to the scoping exercise. During the consultation process, the assessment methodology, baseline monitoring positions and relevant standards and guidance were agreed. The pre-application discussion is presented in the report included in **Appendix 8.1** to this ES.

Future Baseline

8.1.12 The site has been assessed against the current baseline which includes all relevant established permitted noise sources. We therefore consider that this represents a good indication of the likely future baseline for the assessment of impact.

Competence

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

8.2 CONTEXT

Introduction

- 8.2.1 The ambient environmental noise at any location will vary according to the activities in progress around the location. In the vicinity of a busy motorway, for example, the noise level will remain fairly constant due to the relatively steady noise input from road traffic, whereas the noise level close to a source of high noise over short periods, such as an airport, will vary over a much wider range. It is therefore necessary to consider how to quantify the existing noise levels in an area in order to accurately assess the acceptability of the introduction of a new noise source.

Planning Policy

- 8.2.2 To establish the impact of the Proposed Development in respect of noise on existing or proposed residential receptors it is necessary to consider the relevant noise guidance, standards and policy for an industrial development. The following section examines the guidance and establishes the methodology to be adopted for assessing noise impacts. It also outlines the key planning policy and guidance that relates to the assessment of residential amenity and protection of residents from general environmental and industrial noise sources.

- 8.2.3 Future Wales' *Policy 18 – Renewable and Low Carbon Energy Developments of National Significance* provides 'in principle' support for renewable energy projects provided that there are no unacceptable adverse impacts by way of noise.

Technical Advice Note (Wales) 11 (TAN11) 'Noise': 1997

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

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

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

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

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

- 8.2.7 For reference, the recommended noise exposure categories for new dwellings near existing sources are shown below in **Table 8.1**. Note that these noise categories are based upon measurements taken in an open site (i.e. without any proposed noise attenuating features in place).

- 8.2.8 The level at the boundary of NEC A and NEC B is based on guidance provided by the World Health Organisation (WHO) health criteria from 1980, which states that “*general daytime outdoor noise levels of less than 55dB(A) Leq are desirable to prevent any significant community annoyance*”.
- 8.2.9 The night-time noise level at the boundary of NEC A and NEC B is also based upon the WHO health criteria, stating “based on limited data available, a level of less than 35dB(A) is recommended to preserve the restorative process of sleep”.
- 8.2.10 **Table 8.1** below provides an interpretation of the NEC categories in terms of granting planning permission.

Table 8.1: NEC Categories

NEC Category	Description	Noise Range LAeq,T dB
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.	<55dB(A) daytime (16hr) <45dB(A) night-time (8hr) Road, rail and mixed sources
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.	55-63dB(A) daytime (16hr) 45-59dB(A) night-time (8hr) Road, rail and mixed sources

- 8.2.11 For noisy industrial development, the guidance refers to BS 4142 - ‘Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas’ (updated in 2021).
- [BS4142: 2014+A1:2019 ‘Methods for rating and assessing industrial and commercial sound’](#)
- 8.2.12 BS4142: 2014+A1:2019 ‘Methods for rating and assessing industrial and commercial sound’ is based on the measurement of background sound using LA90 noise measurements, compared to source noise levels measured in LAeq units. Once any corrections have been applied for source noise tonality, distinct impulses etc., the difference between these two measurements (i.e. known as the ‘rating’ level) determines the impact magnitude. Typically, the greater the difference, the greater the magnitude of the impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact (although this can be dependent on the context).
 - A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
 - The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact (although this can be dependent on the context).
- 8.2.13 In order to establish the rating level, corrections for the noise character need to be taken into consideration. The Standard states that when considering the

perceptibility:

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

8.2.14 The subjective method adopted includes the following character corrections:

Table 8.2: BS4142: 2014 Character Corrections

Level of Perceptibility	Correction for tonal character dB	Correction for impulsivity dB	Correction for intermittency dB	Correction for 'other character' dB
Not perceptible	0	0	0	0
Just perceptible	+2	+3	0	0
Clearly perceptible	+4	+6	+3*	+3*
Highly perceptible	+6	+9	+3*	+3*

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

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

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

8.2.16 The guidance provided in section 7.7 of BS8233 provides recommended internal ambient noise levels for resting, dining and sleeping within residential dwellings. **Table 8.3** provides detail of the levels given in the standard.

Table 8.3: BS8233:2014 Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hours}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hours}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hours}$	30 dB $L_{Aeq,8hours}$
Study and work requiring concentration	Staff/Meeting Room, Training Room Executive Office	35-45dB $L_{Aeq8hours}$ 35-45dB $L_{Aeq8hours}$	

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

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

in the closed position and approximately 45dB $L_{Aeq,8hours}$ in the open position].

- Offices: 35dB to 45dB $L_{Aeq, 8hours}$ [equivalent to an external level of approximately 65dB to 75dB $L_{Aeq, 8hours}$ based on typical standard double-glazed units in the closed position].

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

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

8.2.19 This document provides further updated information on noise and its effects on the community. Within the document, for noise 'In Dwellings', it states that "*The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference*". For bedrooms, the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for single sound events. Lower noise levels may be disturbing depending upon the nature of the noise source. At night-time, outside sound levels about 1 metre from the facades of living spaces should not exceed 45dB L_{Aeq} , so that people may sleep with bedroom windows open. This value was obtained by assuming that the noise reduction from outside to inside with the window open is 15dB. To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35dB L_{Aeq} . To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB L_{Aeq} . Where it is practical and feasible, the lower outdoor sound level should be considered to represent the maximum desirable sound level for new development.

World Health Organisation (WHO) - Night noise guidelines for Europe: 2009

8.2.20 The WHO regional office for Europe set up a working group of experts to provide scientific advice to the Member States for the development of future legislation and policy action in the area of assessment and control of night noise exposure. Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night,outside}$ as defined in the Environmental Noise Directive (2002/49/EC), an $L_{night,outside}$ of 40dB should be the target of the night noise guidance (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. $L_{night,outside}$ value of 55dB is recommended as an interim target for the countries where the NNG cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach.

World Health Organisation (WHO) – Environmental Noise Guidelines for the European Region: 2018

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

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

8.2.22 The document provides recommendations for road traffic, railway, aircraft, wind turbine and leisure noise based on a strong or conditional recommendation.

8.2.23 In terms of road traffic noise, where NSRs are predominantly affected by road traffic the 'strong' recommendation for protection of residential receptors is as follows:

“For average noise exposure, the DGG strongly recommends reducing noise levels produced by road traffic below 53 decibels (dB) Lden, as road traffic noise above this level is associated with adverse health effects. For night noise exposure, the DGG strongly recommends reducing noise levels produced by road traffic during night time below 45dB Lden, as night-time road traffic noise above this level is associated with adverse effects on sleep.”

Road Traffic Noise

8.2.24 No guidance exists to assess increased traffic noise on existing roads from new developments. However, any change in noise levels along affected roads would be relevant to subsequent planning applications.

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

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

8.2.27 For road traffic noise, the CRTN calculation method can be used to predict noise levels from the movement of traffic along adjacent roads. Construction predicted noise levels at sensitive receptors can be compared with predicted noise without the Proposed Development, to establish any likely significant increase in overall traffic noise. Traffic data for the CRTN assessment presented in this chapter is based on the figures contained within the Transport Statement (TS) which accompanies the planning application documentation.

8.2.28 The TS sets out predicted traffic data for the assessment year based on established growth factors and known committed developments. In this regard the impact of road traffic noise is inherently a cumulative assessment.

8.2.29 According to CRTN where the traffic flow volumes are very low (i.e. where traffic flows below 50 vehicles per hour or 1,000 vehicles per 18 hours) then the CRTN methodology is unreliable (ref. paragraph 30 of CRTN). For the assessment of on-site traffic, we have therefore applied ISO9613-2 calculation methodology using a 'line source' to represent moving vehicles with appropriate speed and empirical sound power levels obtained from other similar sites in the UK.

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

8.2.30 BS5228 refers to: "the need for the protection against noise and vibration of persons living and working in the vicinity of, and those working on, construction and open sites. It recommends procedures for noise and vibration control in respect of construction operations and aims to assist architects, contractors and site operatives, designers, developers, engineers, local authority environmental health officers and planners."

8.2.31 BS5228 Part 1 deals with noise in terms of background legislation and gives recommendations for basic methods of noise control relating to construction and open sites where significant noise levels may be generated. The guidance is aimed at giving advice on achieving 'best practice' in controlling noise and vibration from construction and open sites. There is an example of noise limits given in Annex E, which sets out cut-off limits between 65dB(A) and 75dB(A) or 5dB(A) above the ambient noise, whichever is the greater. Part 2 of BS 5228 deals specifically with vibration control and provide the legislative background to the control of vibration and recommendations for controlling vibration at source and management controls (e.g. liaison with communities, supervision, preparation and choice of plant etc.).

Future Baseline

8.2.32 The site has been assessed against the current baseline which includes all relevant established permitted noise sources. We therefore consider that this would represent a good indication of the likely future baseline for the assessment of impact.

Guidance on Ground Vibration

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

8.2.34 Architectural, sometimes called cosmetic, damage is thought to be more annoying than dangerous and would start to occur at lower levels of vibration than structural damage. Recent International and BS define and categorise building damage under three main headings:

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

loosening of joints, splaying of masonry cracks, etc.

- 8.2.35 An investigation into the effects of induced vibration undertaken by the British Standards Institution has culminated in BS7385:1993; Part 2 which gives guide values to prevent cosmetic damage to property of 15 to 20mms⁻¹ between 4Hz and 15Hz, whilst above 40 Hz the guide value is 50mms⁻¹. The BSI suggests reducing these figures by a factor of 50% for continuous vibration, for example from rail traffic, thus the values become 7.5-10mms⁻¹ at 4-15Hz, and 25.0mms⁻¹ at 40Hz and above.
- 8.2.36 With regard to the threshold of cosmetic damage, for continuous vibration such as road or rail traffic, levels below 5.0mms⁻¹ are unlikely to be significant. For a given level of vibration the risk of damage decreases as the frequency of that vibration increases.
- 8.2.37 BS5228-2:2009 Annex B gives guidance on the effects of vibration levels, which is summarised below in **Table 8.4**.

Table 8.4: Guidance on Effects of Vibration Levels

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

Vibration Nuisance

- 8.2.38 The fact that the human body is very sensitive to vibration can result in subjective concern being expressed at energy levels well below the threshold of damage.
- 8.2.39 Guidance on the human response to vibration in buildings may be found in British Standard BS 6472- 1:2008. Weighting curves related to human response to vibration of buildings are presented within this document. Estimates are given on the probability of adverse comment, which might be expected, from human beings experiencing vibration in buildings. This is based on a vibration dose value (VDV), assessed from frequency weighted vibration measurements and based on a 16-hour day.

8.3 ASSESSMENT APPROACH

- 8.3.1 To establish the impact of the proposed development in relation to noise on existing residential areas, it is necessary to consider the relevant noise guidance, standards and policy for the relevant development. The following information examines the guidance and establishes the methodology to be adopted for assessing noise impacts.
- 8.3.2 Information used in this assessment has been obtained from the following sources:
- Ordnance Survey maps of the local area;
 - Site plans of working areas;
 - BS5228-1:2009+A1:2014 Code of Practice for noise and vibration control on

- construction and open sites – Noise;
- Department of Transport ‘Calculation of Road Traffic Noise’: 1988;
- Design Manual for Roads and Bridges, LA111 Noise and Vibration: November 2019;
- ISO 9613-2: 1996 Acoustics – Attenuation of Sound During Propagation Outdoors;
- BS7385:1993, Part 2; Evaluation and measurement for vibration in buildings. Guide to damage levels from ground borne vibration;
- BS6472: 2008 ‘Guide to the evaluation of human exposure to vibration in buildings’;
- New Zealand Transport Agency research paper entitled ‘Ground Vibration from Road Construction’ in May 2012;
- BS 4142: 2014 +A1:2019 ‘Methods for rating and assessing industrial and commercial sound’; and
- BS8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’

Environmental Effects Assessment - Noise Predictions

8.3.3 In terms of noise predictions, this assessment has used the calculation method based upon ISO9613-2, which is an internationally recognised methodology, which takes into account source distance, screening effects, operating time and direction in relation to the nearest NSR. The noise model includes suitable calculation method settings and assumes that all relevant plant is operational to ensure the highest likely noise levels are assessed. Section 8.5 provides further detail of the noise model settings and assumptions made in respect of plant noise levels.

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

Environmental Effects Assessment Evaluation

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

8.3.6 Four types of receptor have been identified:

- Residents of existing houses adjacent to the Site who could experience site construction noise during daytime periods.
- Residents of existing houses adjacent to the Site who could experience site operational noise during daytime and early morning periods.
- Residents of existing houses who could experience additional road noise from the construction of the Site.
- Ecological sensitive sites, which may have wildlife receptors.

Construction Noise

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

- 8.3.8 The construction impact semantic scale, set out in **Table 8.5**, is based on the ABC method of assessment described in Annex E of BS5228, which sets out threshold values depending upon the ambient noise at receptors, which have been defined from the baseline sound survey.
- 8.3.9 According to the guidance found within the DMRB LA 111, the lowest observable adverse effect level (LOAEL) and significant observable adverse effect level (SOAEL) for noise sensitive receptors during construction are shown in **Table 8.5**.

Table 8.5: Construction Time Period – LOAEL and SOAEL

Time Period	LOAEL	SOAEL	Guidance Level L _{Aeq,1hr} dB
Day (0700-1900 hours Weekday and 0700-1200 Saturdays)	Baseline noise levels L _{Aeq,T}	Threshold level determined as per BS5228-1:2009+A1:2014 Section E3.2 and Table E.1 BS 5228-1:2009+A1:2014	65-70
Night (2300-0700 hours)	Baseline noise levels L _{Aeq,T}	Threshold level determined as per BS5228-1:2009+A1:2014 Section E3.2 and Table E.1 BS 5228-1:2009+A1:2014	45-50
Evening and weekends (time periods not covered above)	Baseline noise levels L _{Aeq,T}	Threshold level determined as per BS5228-1:2009+A1:2014 Section E3.2 and Table E.1 BS 5228-1:2009+A1:2014	55-60

- 8.3.10 The magnitude of impact for construction noise is outlined in **Table 8.6** (as defined in DMRB LA 111).

Table 8.6: Impact Magnitude Category: Construction Noise

Magnitude of Impact	Construction Noise Level
Negligible	Below LOAEL
Minor (Slight)	Above or equal to LOAEL and below SOAEL
Moderate	Above or equal to SOAEL and below SOAEL +5dB
Major (Substantial/Severe)	Above or equal to SOAEL +5dB

- 8.3.11 DMRB LA 111 defines the short term and long-term scenarios which are considered to represent the situation when a new road opens (short term) and 15 years after a road opens (long term). The magnitude of change criteria are set out in **Table 8.7** for the short term and **Table 8.8** for the long term.

Table 8.7: Magnitude of Change – Road Traffic Noise- Short Term

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

Table 8.8: Magnitude of Change – Road Traffic Noise- Long Term

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

- 8.3.12 The impact magnitude categories can then be correlated with the receptor sensitivity categories provided in **Table 8.15** to establish a level of effect as defined in **Table 8.16**.

Construction Phase – Road Traffic

- 8.3.13 The magnitude of impact for construction noise is outlined in **Table 8.9** (as defined in DMRB LA 111).

Table 8.9: Impact Magnitude Category: Construction Road Traffic Noise

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

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

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

Construction Phase – Vibration

- 8.3.14 For construction phase vibration the LOAEL and SOAEL is set out in DMRB LA 111 and provided in **Table 8.10**.

Table 8.10: Impact Magnitude Category: Construction Road Traffic Noise

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

8.3.15 The magnitude of impact for construction vibration is therefore determined in accordance with **Table 8.11**, as defined in DMRB LA 111.

Table 8.11: Impact Magnitude Scale: Construction Phase Ground Borne Vibration for Residential Receptors

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

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

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

Operational Noise

8.3.16 **Table 8.12** shows the proposed impact magnitude methodology considering the guidance contained within BS4142: 2014+A1:2019 for fixed noise (e.g. transformer, switchgear and inverters).

Table 8.12: Impact Magnitude Scale – Future Noise Against Existing in Accordance with BS4142:2014 (Operational Phase)

Rating Level Above Background Noise dB(A) as BS4142: 2014+A1:2019	Description of Effect	Impact Magnitude
-10 to 0	No discernible effect on the receptor	Negligible
+0.1 to +4.4	Non-intrusive - Noise impact can be heard but does not cause any change in behaviour or attitude. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Slight
+4.5 to +9.4	Intrusive - Noise impact can be heard and causes small changes in behaviour and/or attitude. Affects the character of the area such that there is a perceived change in the quality of life. Potential for non-awakening sleep disturbance.	Moderate
+9.5 or greater	Disruptive – Causes a material change in behaviour and/or attitude e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty getting to sleep. Quality of life diminished due to change in character of the area.	Substantial
Undefined*	Physically Harmful – Significant changes in behaviour and/or inability to mitigate effect of noise leading to psychological stress or physiological effects e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm	Severe

Note: The 'rating' level is the difference between the noise contribution from Site and the existing background

sound level allowing for any adjustments required for noise characteristics (i.e. tonal, impulsive or intermittent noise character). The Standard advises that rounding of numbers to one decimal place should relate to levels of 0.5dB or above, which is reflected in the table limits. The impact magnitude scales in Tables 8.12 to 8.13 are used in the assessment of operational noise impacts. * The level at which physical harm occurs will be dependent upon a number of site-specific factors, which may include type and character of noise source, location, human sensitivities, duration and receptor expectations etc.

8.3.17 The Institute of Environmental Management and Assessment (IEMA) has provided 'Guidelines for Environmental Noise Impact Assessment'. The guidelines set out an example of how changes in noise level may be assessed in terms of residual LAeq. This assists in determining the impact of Site operational noise relative to the context of the noise climate, which is detailed in **Table 8.13**.

Table 8.13: Impact Magnitude Scale – General Site Noise

Change in Sound Levels LAeq dB	Description of Effect	Impact Magnitude
< +2.9	No discernible effect on the receptor	Negligible
+3.0 to +4.9 (high receptor sensitivity)	Non-intrusive - Noise impact can be heard but does not cause any change in behaviour or attitude. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Slight
+5.0 to +9.9 (high receptor sensitivity)	Intrusive - Noise impact can be heard and causes small changes in behaviour and/or attitude. Affects the character of the area such that there is a perceived change in the quality of life. Potential for non-awakening sleep disturbance.	Moderate
+10 or greater (high receptor sensitivity)	Disruptive – Causes a material change in behaviour and/or attitude e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty getting to sleep. Quality of life diminished due to change in character of the area.	Substantial
Undefined*	Physically Harmful – Significant changes in behaviour and/or inability to mitigate effect of noise leading to psychological stress or physiological effects e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm	Severe

*The level at which physical harm occurs will be dependent upon a number of site-specific factors, which may include type and character of noise source, location, human sensitivities, duration and receptor expectations etc.

8.3.18 The WHO thresholds for night noise exposure indicated by $L_{night, outside}$ as defined in the Environmental Noise Directive (2002/49/EC), relates to a $L_{night, outside}$ level of 40dB to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. **Table 8.14** sets out the semantic scale for absolute levels relating to specific noise thresholds relating to rural areas and sleep disturbance.

Table 8.14: Impact Magnitude Scale – Absolute Noise (Operational Phase) in accordance with WHO guidelines (night-time)

Site Noise Levels LAeq dB 15mins	Subjective Response	Impact Magnitude
<=35	Complaint highly unlikely	Negligible
>35 to <=40	Complaint unlikely	Slight
>40 to 45	Marginal significance	Moderate
>45	Complaint Likely	Substantial
>55	Complaint highly likely	Severe

8.3.19 In order to determine the level of the effect, not only must the magnitude of this impact be determined but also the sensitivity of the receptors to the impact. For this assessment, the categories presented in **Table 8.15** have been adopted.

Table 8.15: Receptor Sensitivity

Receptor Sensitivity	Type of Receptor
High	Dwellings / residential properties including houses, flats, old people's homes, hospitals, caravans
Medium	Schools, churches and open spaces/conservation areas.
Low	Commercial premises including retails and offices etc.
Negligible	Industrial premises including warehouses and distribution etc.

8.3.20 Based upon the assessment of impact magnitude and the sensitivity of individual receptors, the matrix shown in **Table 8.16** has been developed in order to provide an indication of the possible level of effect for each predicted noise impact. Given that there are many factors which may affect the level of the effect of an impact, not least, the character of the noise and timescales over which the noise operates, the overall level of effect must be assessed on an individual basis using professional judgement and experience. Therefore, whilst the matrix provides a useful indication of the likely significance it cannot be applied in all situations.

Table 8.16: Level of Effect Matrix

Impact Magnitude	Receptor Sensitivity		
	High	Medium	Low/Negligible
Severe	Major	Major / Moderate	Moderate / Minor
Substantial	Major / Moderate	Moderate	Minor
Moderate	Moderate	Moderate / Minor	Minor / Neutral
Slight	Minor	Minor / Neutral	Neutral
No Significant Impact (Negligible)	Neutral	Neutral	Neutral

8.3.21 Where a level of effect is defined as Major or Major / Moderate then the effect (Severe

or Substantial magnitude) is likely to be considered significant i.e. an impact that is likely to be a key material factor in the decision-making process.

Survey Techniques

- 8.3.22 The monitoring of environmental noise undertaken during the assessment, has been carried out in terms of monitoring and meteorological conditions in accordance with advice given in BS 7445:2003 'Description and measurement of environmental noise.'

Limitations

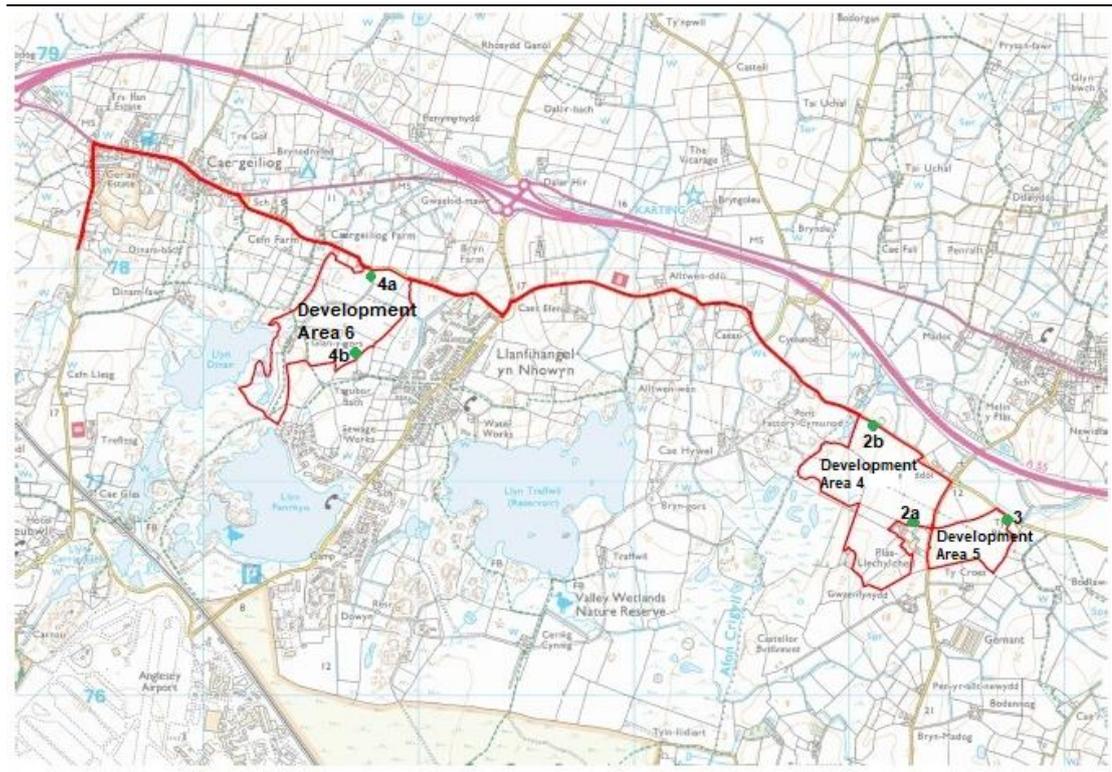
- 8.3.23 The baseline levels measured in April 2020 are potentially lower than normal traffic flow conditions, due to Covid 19 restrictions in place at the time. The A55 is one of the dominant noise sources for the NSRs in the area, therefore this is likely to have slightly reduced residual and background sound levels. With an artificially lower background, this assessment is therefore presented on a worst-case basis. We understand that there were some restrictions on flights to and from RAF Valley at the time of the baseline survey, which may have had some effects on assumed residual LA_{max} and LA_{eq} levels (i.e. baseline levels may have been slightly higher at times under normal flight activities, which would potentially reduce the assumed impacts).

8.4 BASELINE CONDITIONS

Baseline Noise Survey

- 8.4.1 A detailed environmental baseline sound survey was carried out in the vicinity of the nearest NSR positions on 17th April 2020.
- 8.4.2 The main source of existing noise affecting NSR properties relates to the movement of traffic along local and distant roads, intermittent aircraft noise from RAF Valley, farm animals and birdsong.
- 8.4.3 Monitoring locations previously identified in consultation with the Local Authority are referenced to establish the NSRs, which are detailed below:
- Position 2a: South east of DA4 (grid reference 234921 376812)
 - Position 2b: North of DA4 (grid reference 234136 377262)
 - Position 3: Northeast of DA5 (grid reference 234758 376823)
 - Position 4a: North of DA6 (grid reference 231776 377990)
 - Position 4b: East of DA6 (grid reference 231699 377581)
- 8.4.4 The fixed monitoring positions provide broadband noise data of the existing sound climate around the site, at the NSRs. The noise monitoring exercise was carried out over a 7-day period to establish the representative ambient sound climate. Details of the instrumentation used for the survey are detailed in **Appendix 8.2**. The noise monitoring positions are presented in **Figure 8.1**, below.

Figure 8.1: Noise Monitoring Positions



Baseline Sound Survey Results

8.4.5 The results of average noise levels and representative background levels recorded at the fixed monitoring positions are presented below in **Table 8.17** and detailed measurements in **Appendix 8.3**.

Table 8.17: Baseline Levels during Daytime (0700-2300 hours weekday and weekend)

Location (Refer to Figure 8-1)	Average LAeq dB	Average LA10 dB	Average LA90 dB	Representative LA90 dB	LAmix dB Range
2a. Southeast of DA4	54	56	47	47	50-95
2b. North of DA4	57	52	43	43	50-98
3. Northeast of DA5	57	52	43	43	48-98
4a. North of DA6	51	52	38	38	38-88
4b. East of DA6	52	53	40	40	43-94

Note: Representative LA90 based on average or most commonplace value.

Table 8.18: Baseline Levels during 0500-0600 hours (weekday and weekend)

Location# (Refer to Figure 8-1)	Average LAeq dB	Average LA10 dB	Average LA90 dB	Representative LA90 dB	LAmx dB Range
2a. Southeast of DA4	48	50	42	42	50-78
2b. North of DA4	48	49	38	38	50-80
3. Northeast of DA5	47	50	39	39	52-77
4a. North of DA6	55	59	39	38	50-82
4b. East of DA6	56	52	39	39	61-93

Note: Representative LA90 based on average or most commonplace value.

8.4.6 For the operation, based on the results of the background noise survey and the guidance provided within BS4142:2014+A1:2019, the site rating level should not exceed the representative background level. **Table 8.19** provides the assessment of noise criteria relative to the solar farm operations.

Table 8.19: Proposed Noise Criteria at NSRs

NSR (Refer to Figure 8-1)	Grid Reference		Residual LAeq (dB) Daytime (0500-0600hrs)	Daytime Representative Background (0500-0600 hrs) LA90 (dB)	Low Impact According to BS4142:2019 Rating Level LAeq,T (dB)
	X	Y			
Development Areas 4 & 5					
R1. Tyn Rhos	234772	376798	57 (47)	43 (39)	<=47 (<=39)
R2. South Area 5	234527	376519	57 (47)	43 (39)	<=47 (<=39)
R3. Southwest Area 5	243393	376432	57 (47)	43 (39)	<=47 (<=39)
R4. Southwest Area 5	234400	376363	57 (47)	43 (39)	<=47 (<=39)
R5. Gwaenfyndd	234248	376460	57 (47)	43 (39)	<=47 (<=39)
R6. Southwest Area 5	234284	376405	57 (47)	43 (39)	<=47 (<=39)
R7. Plas-Llechylched	234230	376811	54 (48)	47 (42)	<=47 (<=42)
R8. Southeast Area 4	234241	376744	54 (48)	47 (42)	<=47 (<=42)
R9. Southeast Area 4	234295	376702	54 (48)	47 (42)	<=47 (<=42)
R10. Capel Hebron	234411	377070	57 (48)	43 (38)	<=43 (<=38)
R11. North Area 4	234149	377272	57 (48)	43 (38)	<=43 (<=38)
R12. Landowners Bungalow*					
Development Area 6					
R13. Glan-y-gors	231403	377662	52 (56)	40 (39)	<=40 (<=39)
R14. Ysgubor Bach	231716	377511	52 (56)	40 (39)	<=40 (<=39)
R15. Ordd Cerrig Mawr	231872	377499	52 (56)	40 (39)	<=40 (<=39)
R16. Off Dynam Road	232019	377677	52 (56)	40 (39)	<=40 (<=39)
R17. Llanfihangel yn Nhowyn	232118	377798	52 (56)	40 (39)	<=40 (<=39)
R18. Arfryn	232065	377941	51 (55)	38 (38)	<=38 (<=38)

R19. Off Lon Bach	231993 378021	51 (55)	38 (38)	<=38 (<=38)
R20. Caer-Pwll	231722 378032	51 (55)	38 (38)	<=38 (<=38)
R21. Old School House	231626 378076	51 (55)	38 (38)	<=38 (<=38)
R22. Cefn Farm	231497 378043	51 (55)	38 (38)	<=38 (<=38)
R23. Tudor Court	231485 377272	52 (56)	40 (39)	<=40 (<=39)

8.5 SENSITIVE RECEPTORS

8.5.1 Based on relative distance to the Proposed Development from the site boundary fence, the nearest NSRs are provided below:

Development Areas 4 & 5:

- R1. Tyn Rhos north east of Area 5 (circa 40m distance).
- R2. South of Area 5 (approximately 140m distance)
- R3. Southwest Area 5 (circa 190m distance)
- R4. Southwest Area 5 (circa 320m distance)
- R5. Gwaenfyndd southwest of Area 5 (circa 190m distance)
- R6. Southwest Area 5 (approximately 230m distance)
- R7. Plas-Llechylched south east of Area 5 (circa 40m distance)
- R8. Southeast Area 4 (circa 60m distance)
- R9. Southeast Area 4 & west of Area 5 (circa 40m to 100m distance)
- R10. Capel Hebron – group of properties to northeast of Area 4 (circa 30m-40m distance)
- R11. North of Area 4 (circa 30m-40m distance)
- R12. Landowners Bungalow* towards centre of Area 4 (circa 20m distance)

Development Area 6:

- R13. Glan-y-gors southwest of Area 6 (circa 70m distance)
- R14. Ysgubor Bach south of Area 6 (circa 65m distance)
- R15. Ordd Cerrig Mawr southeast of Area 6 (circa 150m distance)
- R16. Off Dynam Road east of Area 6 (circa 120m distance)
- R17. Llanfihangel yn Nhowyn northeast of Area 6 (circa 140m distance)
- R18. Arfryn northeast of Area 6 (circa 75m distance)
- R19. Off Lon Bach northeast of Area 6 (circa 70m distance)
- R20. Caer-Pwll north of Area 6 (circa 40m distance)
- R21. Old School House northwest of Area 6 (circa 40m distance)
- R22. Cefn Farm northwest of Area 6 (circa 60m distance)
- R23. Tudor Court south of Area 6 (circa 260m distance)

*Permitted development but not built, unlikely to be built prior to construction of development

Grid Connection

8.5.2 The proposed point of connection is located at an existing substation to the south of Caergeiliog on the eastern side of Cymyran Road. A customer substation will be located on Development Area (DA) 6 and from here a cable will connect directly into the existing substation on Cymyran Road. DA4 and DA5 will be connected to the customer substation by cabling in the highway and over third-party land.

8.5.3 The indicative cable routes are presented in **drawings LOC1001/01/08 to 12**. The drawings show a `corridor' largely within the highway in which the cable would be laid. The exact alignment of the route is to be confirmed at the detailed design and can be agreed by way of a separate authorization from the Highway Authority. No

upgrade works to the existing substation are required as these have already been implemented by the Distribution Network Operator (DNO). It is proposed that a cable would be laid to the existing sub-station compound boundary, the DNO will then connect the cable in the compound.

8.5.4 As set out in Chapter 3 of this ES, it is the intention for the connection to the Distribution Network will be undertaken by an Independent Connections Provider. These works i.e. the laying of the cable along the cable route, forms part of the planning application.

8.5.5 The assessment considers the potentially significant environmental effects associated with construction / decommissioning and operation of this route.

8.6 PROPOSED DEVELOPMENT

8.6.1 The proposal will comprise the following:

- Photovoltaic (PV) panels to a maximum height of circa 3m;
- Mounting frames - matt finished small section metal structure;
- Scheme of landscaping and biodiversity enhancement;
- Central Inverters (inverters and transformers will be housed together in prefabricated containers to a maximum height of circa 3m), substations (DNO and Customer to a maximum height of circa 3m) and associated cabling (below ground);
- Point of connection;
- Stock fencing up to a height of circa 2m to secure the development areas;
- Infra-red CCTV (CCTV cameras would operate using motion sensors and would be positioned inward only to ensure privacy to neighbouring land and property);
- Temporary set down areas;
- Internal service roads; and
- Site access for the construction, operational and decommissioning phases.

8.6.2 The construction of the solar farm is expected to last approximately 4-6 months and employ up to 150 staff at the peak of the construction period. The TS accompanying the planning application provides details of proposed access arrangements, the anticipated programme, construction vehicle numbers and type, construction worker numbers and the proposed construction hours.

8.7 ASSESSMENT OF EFFECTS

Incorporated Mitigation

8.7.1 Predicted noise levels from the Proposed Development have been calculated using the indicative design layout (see **Drawing No. LOC1001/01/04 to 06**) prepared in conjunction with assumed plant noise levels provided below. These noise levels are based on measured data from similar plant used on other UK Solar Farm sites. Mitigation measures include the following:

- Design of the site to maximise wherever practicable the separation distance from NSR to plant equipment.
- Use of containerised inverter systems. Noise levels from the container and cooling/heating system for the container would be designed to achieve a level not exceeding 65dB(A) @ 1m, if above this level the use of acoustic fencing will be used to achieve this requirement as shown in **drawing LOC1001/01/10**.
- Noise levels from transformers: 65dB LAeq @ 1m sound pressure level (typically 55dB LAeq @ 7m). Smaller inverter transformers produce a noise level between

40dB to 50dB LAeq @ 1m.

- Containerised substation switchgear noise level would be designed not to exceed a noise level of 65dB(A) @ 1m.

Construction/Decommissioning Phase Effects

- 8.7.2 Construction works would involve the movement of soils, piling and the construction of infrastructure and solar panels and associated plant. Excavators, haulage lorries, hydraulic piling, cranes, mobile plant, concrete plant and power tools would all, at some time during the construction programme, be operating on the Site. In addition, ancillary equipment such as small generators, pumps and compressors may also be operating periodically.
- 8.7.3 The above noise sources and their associated activities would vary from day to day, may be in use at different stages of the construction period, and for relatively short durations. The noisiest activities are expected to be generated during soil movement and site set-up during the initial stages of construction and during plant installation when piling rigs, power tools, mobile plant or similar may be in use.
- 8.7.4 The actual noise level produced by construction work would vary at the nearest property boundary at any time depending upon a number of factors including the plant location, duration of operation, hours of operation, intervening topography and type of plant being used (see **Appendix 8.4** for details of the construction plant inventory that has been used to inform the assessment).
- 8.7.5 Empirical field data obtained from plant on site and noise data from library or manufacturer's data have been used to calculate the expected resultant noise contribution at the nearest property boundary locations during daytime and sunrise morning period operations.
- 8.7.6 The results of calculations for vehicle movement, infrastructure, PV installation and general site activities are shown below in **Table 8.20**.
- 8.7.7 Construction works would take place during normal daytime operating hours. The daytime construction activities and associated noise levels are provided in **Table 8.20**, which is based on the ABC method of assessment within BS5228: 2009+A1:2014 (Annex E.3.2.).

Table 8.20: Construction Noise Predictions

NSRs (Refer to Figure 8-1)	Approx. Distance to receptor (m)	Works	Noise Level range at NSRs, LAeq _{1hr} dB	Typical Residual Sound (i.e. existing) LAeq dB	BS5228 Threshold Value LAeq dB Daytime
Area 5: NSRs R1 to R6	45-400 40-400 40-400 40-400 45-400	Piling (mini rig) Site Preparation General site activities Infrastructure PV installation	39-62 44-64 44-64 38-64 44-65	54	65
Area 4: NSRs R6 to 11	35-500 30-500 40-500 30-500 35-500	Piling (mini rig) Site Preparation General site activities Infrastructure PV Installation	37-65 42-67 42-67 40-67 42-68	57	65
Area 6: NSRs R11 to 23	45-450 40-450 40-450 40-450 45-450	Piling (mini rig) Site Preparation General site activities Infrastructure PV Installation	38-62 43-64 43-64 37-64 43-65	51	65

8.7.8 On the basis of the above predictions the increase in noise, as a result of construction, is likely to result in an impact magnitude classification of **negligible to moderate** resulting in a **neutral to moderate adverse** level of effect at receptors, without mitigation.

8.7.9 The application of applying best practice in accordance with BS5228-1:2009+A1:2014 would also assist in minimising impact from construction noise.

Road Traffic Noise - Construction and De-commissioning Phase

8.7.10 The construction of the solar farm is expected to take circa 4-6 months to complete. This would include around 150 staff on site during the peak of the construction phase and between 15 and 105 HGV deliveries per month, which, under peak periods of vehicle movements would only amount to just over 4 HGVs travelling to and from Site during a daytime period. The number of HGVs during an hour period is therefore unlikely to be more than 1 to 2 in any one hour.

8.7.11 The proposed operating hours are:

Monday to Friday 0800 hours to 1800 hours

Saturdays 0800 hours to 1600 hours

8.7.12 Taking into account HGV peak movements to the set down area of Plot 4, car staff movements and additional movement of LGV or smaller HGV vehicles from Area 4 to other Areas, we have assessed the highest likely noise levels at NSRs, which is provided below in **Table 8.21**.

Table 8.21: Predicted Highest Likely Noise Level from Road Traffic Noise during the Construction Phase at NSRs (refer to Appendix 8.6 for noise mapping)

NSR (Refer to Figure 8-1)	Measured Residual LA10dB at NSR (Saturday & Weekday)	Noise contribution from construction traffic LA10,T dB	Cumulative level with site noise & residual LA10,T dB	Level difference LA10,T dB	Impact
Area 5					
R1. Tyn Rhos	48-52	30	48-52	0	Negligible
R2. South Area 5	48-52	31	48-52	+0.1	Negligible
R3. Southwest Area 5	48-52	29	48-52	+0.1	Negligible
R4. Southwest Area 5	48-52	27	48-52	0	Negligible
R5. Gwaenfyndd	48-52	29	48-52	+0.1	Negligible
Area 4					
R6. Southwest Area 5	48-52	28	48-52	0	Negligible
R7. Plas-Llechylched	48-56	38	48-56	0 to +0.4	Negligible
R8. Southeast Area 4	48-56	35	48-56	+0.2	Negligible
R9. Southeast Area 4	48-56	41	49-56	0 to +1	Slight
R10. Capel Hebron	50-52	45-48	51-54.1	+1 to +2.1	Slight
R11. North Area 4	50-52	38	50-53	0 to +0.3	Negligible
Area 6					
R13. Glan-y-gors	45-53	28	45-53	0 to +0.1	Negligible
R14. Ysgubor Bach	45-53	29	45-53	0 to +0.1	Negligible
R15. Ordd Cerrig Mawr	45-53	28	45-53	0 to +0.1	Negligible
R16. Off Dynam Road	45-53	29	45-53	0 to +0.1	Negligible
R17. Llanfihangel yn Nhowyn	45-53	30	45-53	0 to +0.1	Negligible
R18. Arfryn	46-52	37	47-52	0 to +1	Slight
R19. Off Lon Bach	46-52	34	46-52	0 to +0.3	Negligible
R20. Caer-Pwll	46-52	34	46-52	0 to +0.3	Negligible
R21. Old School House	46-52	27	46-52	0 to +0.1	Negligible
R22. Cefn Farm	46-52	29	46-52	0 to +0.1	Negligible
R23. Tudor Court	45-53	23	45-53	0	Negligible

Note: LAeq levels converted to LA10 by adding +3dB

- 8.7.13 The above results show the increase in road traffic noise at NSRs during the construction phase would be between 0dB and +2.5dB LA10_{8hrs/10hrs}. According to **Table 8.9** the increase in road traffic noise would be **negligible to slight** impact and **neutral to minor adverse** level of effect and is therefore not a significant effect.
- 8.7.14 The decommissioning phase is likely to involve similar or fewer vehicle movements in order to remove the plant from site, we would therefore expect impacts and effects to be similar to that concluded for the construction phase.

Operation Phase – Road Traffic Noise

- 8.7.15 Once operational, the solar farm will be unmanned and access for occasional maintenance and inspections will be typically made by light goods vehicles, e.g. vans or 4x4 vehicles. Maintenance will occur roughly once a week. In view of the very limited vehicle movements to and from the Solar Farm site during the operational phase no significant impacts would occur in relation to road traffic noise at NSRs. The impact would therefore be **negligible** and the effect of **neutral** significance.

Construction and Decommissioning of Grid Connection

- 8.7.16 See **drawing LOC1001/01/08 to 12** for cable route details which is largely in the highway. This section assesses the potential construction and decommissioning phase impacts each route would have upon the noise environment.
- 8.7.17 The cable route extends a long distance and the level of noise and vibration would vary depending on the separation distance from the excavation to the NSRs along the route. The cable route includes isolated dwellings and towards the existing substation it would pass through the village of Caergeiliog. The highest level of noise and vibration is likely to occur where the cable route is nearest to NSR's. However, the works would only be carried out over a short duration and would be temporary at each location as the cable is laid and moved along the route. Based on typical noise and vibration levels from plant used in the excavation of roads, infilling and resurfacing of the road or surface during the laying of cables and application of 'best practice' it is anticipated that the highest impact magnitude from noise would be **slight to moderate** and a **minor to moderate** significance effect and **slight to moderate** impact magnitude from vibration and **minor to moderate** significance effect. These effects would **not** be significant in EIA terms as any effects would be short in duration due to the temporary nature of the activity relative to NSRs.
- 8.7.18 In terms of noise generation and impact and in overall terms, and as a temporary and transitional noise source the route would not result in any unacceptable adverse effects and would therefore be acceptable in noise terms.

Decommissioning of Cable Connection

- 8.7.19 At the end of its operational life, it is anticipated that the ducting for the cable connection would be capped off and left in situ unless it is likely to cause problems with farming operations, such that there would be no decommissioning works and therefore no potential significant effects in relation to noise and vibration.

Vibration - Construction & Decommissioning Phase

- 8.7.20 The highest levels of vibration generated by plant is likely to include the following:

- Small hydraulic piling rigs
- Compaction plant
- Loading or unloading of HGVs

- 8.7.21 The distance from nearest residential receptors to any likely use of hydraulic piling rigs, mobile plant and offloading of HGVs is likely to be a minimum distance of 30 to 50 metres based on the NSRs.
- 8.7.22 The New Zealand Transport Agency published a research paper entitled 'Ground Vibration from Road Construction' in May 2012 (refer to **Appendix 8.7**), which includes a table of measured PPV values for different types of plant. The results indicate that vibratory compaction would typically produce a vibration level of 0.3mm/sec at 30m distance. Similarly, the report indicates that the loading of trucks produces a vibration level of 0.2mm.sec PPV at 30m distance and small hydraulic or screw piling rigs produce around 0.1mm.sec to 0.15mm.sec PPV at a similar distance. Predicted vibration levels at separation distances of 30m to 50m would be at or below 0.3mm/sec.
- 8.7.23 Based upon the above information, it is evident that even at the closest approach to existing residential properties, the likely levels of ground-borne vibration would be at or below perceptible levels of vibration (i.e. 0.3mm/s) at all receptors. The results of empirical measurements of vibration from vibratory plant at distances greater than around 30 metres according to BS6472:2008 would indicate that the vibration levels are unlikely to give rise to an 'adverse comment' from a nuisance aspect.
- 8.7.24 It should be noted that the type of equipment, ground conditions and structural form could all affect the resultant level of vibration. At this stage, it has been assumed that the highest likely vibration level scenario occurs (i.e. a conservative estimate of potential effects).
- 8.7.25 The levels of vibration, as a result of the operation of mobile plant or offloading of dump trucks, are likely to result in an impact magnitude classification of **negligible to slight** and a level of effect of **neutral to minor** adverse during general and peak vibration during the construction phase. Similarly, during de-commissioning the use of mobile plant and loading of HGVs to remove plant from site would produce levels of vibration that are at or below the level of perceptibility and therefore no significant effects would occur.

Vibration from Road Traffic

- 8.7.26 Monitoring of ground-borne vibration have been previously undertaken of vehicles travelling along local roads at other sites in the UK. Further detail is provided in **Appendix 8.8** and vibration parameters are presented in **Appendix 8.7**.
- 8.7.27 The results of seismograph monitoring showed that based on a distance of 2m from the kerbside of the road during HGV movements the maximum levels of vibration recorded ranged between 0.2mm/s to 0.5mm/s. This level of vibration is very low (i.e. where 0.3mm/sec is said to be the level below which vibration is imperceptible) and experience has shown that according to BS6472: 2008, even when properties are at this distance, there is normally a 'low probability of adverse comment' over the operating period indicating that nuisance conditions are unlikely.
- 8.7.28 In view of the separation distance to NSRs it is clear that vibration levels would be

imperceptible and therefore produce a negligible impact and neutral effect significance. In terms of BS6472 this would conclude that vibration levels would be well below a 'low probability of adverse comment' and therefore nuisance conditions are highly unlikely to occur.

Operational Noise Effects - Plant Noise

- 8.7.29 The following section provides an assessment of predicted noise levels from the operation of the proposed Solar Farm. The Applicant and their prospective EPC contractor have been progressing the design of the Proposed Development, and this has enabled indicative scheme drawings to be prepared (see **drawings LOC1001/1/04 to 06**). The design of the Site has been developed in sufficient detail to enable an accurate prediction of resultant noise levels at NSRs to be undertaken and provide a good level of confidence in the likely noise contribution and to show that the noise limits can be achieved in practice. Section 8.7.1 provides details of the assumed plant noise levels, which is based on measured data from similar plant used on other UK Solar Farm sites.
- 8.7.30 In terms of the potential noise characteristics of the Solar Farm plant, the following provides the details of the appropriate noise criteria applied in the assessment in accordance with BS4142: 2014+A1:2019.

Tonality

- 8.7.31 In terms of tonality, the plant that is likely to contain this type of characteristic (without mitigation) would be the transformers and any associated cooling fans for the inverter containers at close range positions. However, with proposed mitigation measures and separation distance from NSRs to the plant is likely to be sufficient to prevent any perceptible tonal noise at NSRs. This opinion is supported by results of a number of Solar Farm facility noise surveys in the UK by the author of this chapter. It is therefore assumed that no tonal noise character penalty is required.

Impulsivity

- 8.7.32 In terms of impulsivity, this type of character would not occur with the type of plant being proposed.

Intermittency

- 8.7.33 In terms of intermittency, the plant would tend to operate for long periods when there is sufficient sunlight to power the equipment and therefore this is not expected to be a distinctive character at NSRs.
- 8.7.34 In conclusion, no character penalty is deemed to be necessary or appropriate based on the type of plant being proposed and NVC's subjective observations at other similar sites in the UK.
- 8.7.35 **Table 8.22** below details the predicted noise levels for the operation of the fixed plant all operating together on-site at full load. CadnaA noise modelling software has been used to calculate the resultant maximum noise levels.

Table 8.22: Predicted Highest Likely Noise Level from Solar Farm Operations at NSRs During Daytime Operations: 0700-2300 hours (refer to Appendix 8.6 for noise mapping)

NSR (Refer to Figure 8-1)	Rating ¹ Noise Level from Solar Farm Operations LAeq _{1hr} dB	Representative Background Level LA90 dB (Residual LAeq)	Noise Level Difference Background & Site LAeq _{1hr} dB	Impact Significance	Increase in Residual LAeq dB
DA4 & DA5					
R1. Tyn Rhos	27	43 (57)	-16	Negligible	0
R2. South DA5	28	43 (57)	-15	Negligible	0
R3. Southwest DA5	26	43 (57)	-17	Negligible	0
R4. Southwest DA5	24	43 (57)	-19	Negligible	0
R5. Gwaenfyndd	26	43 (57)	-17	Negligible	0
R6. Southwest DA5	27	43 (57)	-16	Negligible	0
R7. Plas-Llechylched	33	43 (57)	-10	Negligible	0
R8. Southeast DA4	33	43 (57)	-10	Negligible	0
R9. Southeast DA4	35	43 (57)	-8	Negligible	0
R10. Capel Hebron	32	43 (57)	-11	Negligible	0
R11. North DA4	28	43 (57)	-15	Negligible	0
R12. Landowners Bungalow*	40	43 (57)	-3	Negligible	+0.1
DA6					
R13. Glan-y-gors	28	40 (52)	-12	Negligible	0
R14. Ysgubor Bach	29	40 (52)	-11	Negligible	0
R15. Ordd Cerrig Mawr	28	40 (52)	-12	Negligible	0
R16. Off Dynam Road	34	40 (52)	-6	Negligible	+0.1
R17. Llanfihangel yn Nhowyn	31	40 (52)	-9	Negligible	0
R18. Arfryn	29	38 (51)	-9	Negligible	0
R19. Off Lon Bach	30	38 (51)	-8	Negligible	0
R20. Caer-Pwll	31	38 (51)	-7	Negligible	0
R21. Old	31	38 (51)	-7	Negligible	0

NSR (Refer to Figure 8-1)	Rating ¹ Noise Level from Solar Farm Operations LAeq _{1hr} dB	Representative Background Level LA90 dB (Residual LAeq)	Noise Level Difference Background & Site LAeq _{1hr} dB	Impact Significance	Increase in Residual LAeq dB
School House					
R22. Cefn Farm	31	38 (51)	-7	Negligible	0
R23. Tudor Court	23	40 (52)	-17	Negligible	0

¹The solar farm is not expected to produce any noise character due to absolute noise levels compared with residual LAeq levels at NSRs. This residential development has been recently approved under planning ref. C16C132D and belongs to the landowner and is therefore of low sensitivity to noise.

- 8.7.36 The above results show no significant levels of noise predicted for all the plant in operation at full load. The noise levels are well below the noise limit criteria according to BS4142:2014+A1:2019 and would therefore, result in a **negligible** impact magnitude and **neutral** level of effect (refer to **Table 8.12**) and therefore not considered significant in EIA terms.
- 8.7.37 In respect of the increase in residual (LAeq) levels the results show the increase ranges between no change to +0.1dB LAeq (refer to **Table 8.13**) which results in a **negligible** impact and **neutral** level of effect and therefore not significant.

Table 8.23: Predicted Highest Likely Noise Level from Solar Farm Operations at NSRs During Sunrise (i.e. 0500-0600 hours) Operations (refer to Appendix 8.6 for noise mapping)

NSR (Refer to Figure 8-1)	Rating ¹ Noise Level from Solar Farm Operations LAeq _{15mins} dB	Representative Background Level LA90 dB (Residual LAeq)	Noise Level Difference Background & Site LAeq _{15mins} dB	Impact Significance According to BS4142:2019	Increase in Residual LAeq dB
DA4 & DA5					
R1. Tyn Rhos	27	39 (47)	-12	Negligible	0
R2. South Area 5	28	39 (47)	-11	Negligible	+0.1
R3. Southwest Area 5	26	39 (47)	-13	Negligible	0
R4. Southwest Area 5	24	39 (47)	-15	Negligible	0
R5. Gwaenfyndd	26	39 (47)	-13	Negligible	0
R6. Southwest Area 5	27	39 (47)	-12	Negligible	0
R7. Plas-Llechylched	33	42 (48)	-9	Negligible	+0.1
R8. Southeast Area 4	33	42 (48)	-9	Negligible	+0.1

R9. Southeast Area 4	35	42 (48)	-7	Negligible	+0.2
R10. Capel Hebron	32	38 (48)	-6	Negligible	+0.1
R11. North Area 4	28	38 (48)	-10	Negligible	+0.1
R12. Landowners Bungalow*	40	38 (48)	+2	Slight	+0.6
DA6					
R13. Glan-y-gors	28	39 (56)	-11	Negligible	0
R14. Ysgubor Bach	29	39 (56)	-10	Negligible	0
R15. Ordd Cerrig Mawr	28	39 (56)	-11	Negligible	0
R16. Off Dynam Road	34	39 (56)	-5	Negligible	0
R17. Llanfihangel yn Nhowyn	31	39 (56)	-8	Negligible	0
R18. Arfryn	30	38 (55)	-8	Negligible	0
R19. Off Lon Bach	30	38 (55)	-8	Negligible	0
R20. Caer-Pwll	31	38 (55)	-7	Negligible	0
R21. Old School House	31	38 (55)	-7	Negligible	0
R22. Cefn Farm	31	38 (55)	-7	Negligible	0
R23. Tudor Court	23	39 (56)	-16	Negligible	0

¹The solar farm is not expected to produce any noise character due to absolute noise levels compared with residual LAeq levels at NSRs. This residential development has been recently approved under planning ref. 16C132D and belongs to the landowner and is therefore of low sensitivity to noise.

- 8.7.38 The above results show no significant levels of noise predicted for all the plant in operation at full load. The noise levels are well below the noise limit criteria according to BS4142:2014+A1:2019 and would therefore result in a **negligible** impact magnitude and **neutral** level of effect (refer to **Table 8.12**) and therefore not considered significant in EIA terms. The only receptor where the impact is **slight** relates to permitted development (but not yet built) for a residential property on DA4, which belongs to the landowner of the Area and is therefore likely to be less sensitive.
- 8.7.39 In respect of the increase in residual (LAeq) levels the results show the increase ranges between no change to +0.6dB LAeq (refer to **Table 8.13**) which results in a **negligible** impact and **neutral** level of effect and therefore not significant.
- 8.7.40 The calculations use the methodology given in ISO9613-2. Under this methodology the sound power level of the noise source is defined and the attenuation is calculated between its location and the selected receiver, taking account of distance, ground attenuation, screening and the time that a noise source would be operating.
- 8.7.41 The operational phase noise impacts from the Proposed Development are therefore

not considered to represent a significant impact in EIA terms.

Ecological and Heritage Receptors

- 8.7.42 Ecological sensitive areas (i.e. Llynau y Fali Site of Special Scientific Interest (SSSI) and Lyn Dinam Special Area of Conservation (SAC) are located to the southwest of DA6. The Castellor Hut Group (Scheduled Ancient Monument site) is located to the south of DA4. The nearest listed building to the development areas is just north of DA4. The predicted noise levels for the nearest ecological boundary to the Solar Farm is indicated to be between 35m to 70m at the closest approach relative to the SSSI and SAC, between 450m and 650m at closest approach for the Scheduled Ancient Monument and 90m to 330m to the nearest listed building.
- 8.7.43 The predicted noise levels during the construction phase for the SSSI and SAC at the closest boundary positions would vary between 46dB and 67dB LAeq_{1hr} which would be for a temporary and short-term peak period. This compares with typical residual levels of 51-52dB LAeq and in view of intermittent and regular peak noise from jet aircraft in the area and the application of 'best practicable means' and the receptor of medium sensitivity, is not expected to be higher than a **moderate** impact without mitigation and **minor** impact with mitigation and would therefore not produce a significant effect.
- 8.7.44 For the Scheduled Ancient Monument site, the predicted noise levels during the construction phase at the closest boundary positions would vary between 34dB and 42dB LAeq_{1hr} which would be for a temporary and short-term peak noise periods. This compares with typical residual levels of circa 50dB LAeq and in view of intermittent and regular peak noise from jet aircraft in the area and the application of 'best practicable means' and the receptor of medium sensitivity, is not expected to be higher than a **negligible** impact without mitigation and would therefore not produce a significant effect.
- 8.7.45 The site predicted noise level during the temporary construction phase at the closest boundary positions to the Listed Buildings would vary between 40dB and 59dB LAeq_{1hr}, which compares with residual levels of circa 57dB LAeq_{1hr}. With the receptor of high sensitivity (i.e. residential), it is not expected to be higher than a **negligible** impact (without mitigation) and would therefore not produce a significant effect.

8.8 PROPOSED MITIGATION

Construction and Decommissioning Phase

- 8.8.1 In accordance with BS 5228, best practice would be employed to control the noise generation. In consideration of applying best practice, the following measures would be proposed, which would form part of a Construction & Environmental Management Plan (CEMP):
- Restricting operation to current permitted hours during the daytime;
 - Regular maintenance of plant;
 - Where required, use of local screening where plant is being used in close proximity to sensitive receptor boundaries or around plant (e.g. within 30m of sensitive boundary) using temporary hoarding; and
 - Site management.
- 8.8.2 It is proposed that a planning condition be included on any permission granted to

ensure that the noise criteria for daytime operations are achieved. This approach has been agreed with IACC.

- 8.8.3 The predicted noise levels from the site have been calculated without any further noise mitigation measures, however the following proposed management control measures applies best available techniques to control airborne noise from site to minimise noise levels at nearest receptors.

Site Management

- 8.8.4 The following measures would assist in minimising radiated noise from site:

- The use of a banksman to help guide deliveries into site;
- Advisory temporary signage on the highway for works in the area;
- Temporary signage along the proposed route from the A55 to ensure deliveries follow agreed routes;
- Provide sufficient parking areas so there is no parking on the highway or block access tracks;
- Vehicles carrying loose material shall be sheeted;
- The use of bowsers/sprays as necessary during dry conditions to prevent dust and the use of wheel cleaning facilities to prevent 'drag out' on the highway as required;
- Secure the site to prevent unauthorised access;
- Regularly monitor the condition of the highway for 'drag out' or damage and rectify as required;
- Contact local residents prior to construction works commencing advising of anticipated duration and a contact number to advise of any issues/concerns; and
- Turning engines off when not in use.
- All mobile plant operating on-site should be designed such that reverse alarm use is minimised.
- Where practicable, the mobile plant should be fitted with broadband noise type alarms (i.e. non 'beeper' type);
- Ensure drivers are instructed to minimise engine revving and avoid un-necessary impact noise;
- Ensure plant is regularly maintained and fitted with efficient exhaust silencers;
- Plant equipment should not have engine covers or hoods removed except for maintenance; and
- Introduce a complaints procedure and/or site liaison contact or committee for local residents so that they can be informed of site progress and to be able to make contact with site.

Vibration

- 8.8.5 The application of 'best practicable means' would ensure that vibration generated during the construction phase would be below the level of perceptibility. This may for example include:

- Selection of vibratory plant to minimise vibration.
- Wherever practicable, ensure distance between NSR and compaction activity is greater than 30m.

Operational Phase

- 8.8.6 The incorporated mitigation measures described previously (refer to section 8.7.1) adequately address the needs to avoid, reduce and compensate for any potential

effects of the Proposed Development in terms of noise and vibration and ensures there are no significant effects.

8.9 CUMULATIVE IMPACTS

8.9.1 Consideration has been given to potential cumulative influences from other environmental topics assessed as part of this EIA and from proposals beyond the application site boundary. The assessment demonstrates that no significant effects will be created during both the construction and operational phases of the proposal therefore no in combination effect will occur. Furthermore, the baseline survey would have captured surrounding land-uses that may influence the local noise climate and as such the assessment demonstrates there would be no significant effects created.

8.9.2 Consideration has also been given to significant planning permissions which have yet to become fully operational within the vicinity of the application site. Details of such schemes are listed in chapter 13 of this ES. The identified schemes that have the greatest potential to create cumulative impacts are located a considerable distance from the application site (greater than 1km) and as such are unlikely to contribute to a significant effect at identified noise sensitive receptors.

8.10 RESIDUAL EFFECTS

Construction and Decommissioning

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

8.10.2 In terms of vibration during the temporary construction period, with the application of 'best practicable means' to control vibration, it is concluded that the impact from vibration with the implementation of mitigation measures would result in a **negligible** magnitude impact and a **neutral** level of effect at the nearest residential receptor and well within guidance limits for nuisance and cosmetic damage. The effect would not be significant.

Road Traffic Noise

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

Operational Noise

8.10.4 The assessment shows that there would be no significant impacts during the

operation of the Proposed Development following the implementation of appropriate mitigation. The incorporated mitigation is provided in section 8.7.1, which includes the use of containerised inverters with suitable attenuation measures and maintaining good separation distance between equipment plant and NSRs. The magnitude of impact during the operational phase at receptors of high sensitivity would be **negligible** resulting in a **neutral** level of effect.

Cumulative Effects

8.10.5 The cumulative effect of other developments in the local area that have planning permission or have not been determined have been considered. It is concluded that there will be no cumulative environmental effects at residential receptors arising from the Proposed Development in combination with the identified developments during either the construction or operational phases.

Cable Route

8.10.6 The effect of the construction work involved in providing a grid connection for the proposed Solar Farm have been considered and based on the highest likely noise and vibration levels from plant required to excavate and infill the trenchwork. It is concluded that the environmental effects arising from the temporary and short-term works would be **negligible to moderate** impact and **negligible to moderate** adverse effect, which is not significant.

8.11 SUMMARY OF PREDICTED EFFECTS

8.11.1 In summary, no significant noise or vibration **effects** have been identified by the noise assessment in relation to construction or operation of the Proposed Development. **Table 8.24** below summarises the predicted residual effects of the construction / decommissioning, and operation of the Proposed Development.

Table 8.24: Residual Impact at Nearest Receptor after Mitigation Measures

Source	Nature of Effect	Time Period	Effect	Impact Magnitude	Proposed Mitigation	Residual Effect	Residual Impact Magnitude
Construction/ Decommissioning noise	Direct & Temporary	Daytime	Neutral to Moderate	Negligible to Moderate	CEMP	Neutral to Minor	Negligible to Slight
Road traffic noise (construction/ decommissioning)	Direct & Temporary	Daytime	Neutral to Minor	Negligible to Slight	Inherent traffic routes	Neutral to Minor	Negligible to Slight
Road traffic noise (operation)	Direct & Permanent	Daytime	Neutral	Negligible	Inherent traffic routes	Neutral	Negligible
Industrial noise (operation)	Direct & Permanent	Daytime	Neutral	Negligible	None required	Neutral	Negligible
		Night	Neutral	Negligible		Neutral	Negligible
Construction/ Decommissioning Vibration	Direct & Temporary	Daytime	Neutral to Minor	Negligible to Slight	CEMP	Neutral	Negligible
Operational Vibration	Direct & Permanent	Daytime	Neutral	Negligible	None required	Neutral	Negligible
		Night	Neutral	Negligible		Neutral	Negligible
Road traffic Vibration	Direct & Permanent	Daytime	Neutral	Negligible	None required	Neutral	Negligible
Cumulative	Direct &	Daytime	Neutral	Negligible	None	Neutral	Negligible

Source	Nature of Effect	Time Period	Effect	Impact Magnitude	Proposed Mitigation	Residual Effect	Residual Impact Magnitude
Effects	Permanent						
Grid Connection	Direct & Temporary	Daytime	Neutral to Moderate	Negligible to Moderate	CEMP	Neutral to Moderate	Negligible to Moderate

8.12 SUMMARY AND CONCLUSIONS

- 8.12.1 Noise and vibration levels have been considered and assessed during the construction / decommissioning and operational phases of the proposed development. Relevant and appropriate noise and vibration guidance and standards have been used to determine the impact. The assessment has been undertaken to inform and guide the design of the Solar Farm, such that any likely noise and vibration impact on existing and potential sensitive receptors is minimised.
- 8.12.2 To establish any likely impact from noise a robust assessment of baseline sound levels has been considered by undertaking fixed position noise monitoring at six noise sensitive receptor areas around the Site. This was carried out over a week period in April 2020 during Covid 19 restrictions to establish the lowest likely representative background levels for robustness.
- 8.12.3 The Environmental Health Team at IACC has been formally consulted to seek advice and reach agreement in respect of baseline survey methodology, assessment methodology and receptor locations.
- 8.12.4 In accordance with appropriate standards, best practical means would be employed to control the noise generation during the construction period. Measures may include restriction on operating hours, sensible routing of equipment to site and careful choice of piling rigs to minimise noise. Such measures would be defined within the Construction Environmental Management Plan.
- 8.12.5 The assessment shows that there would be no significant adverse effects during the construction or operation of the Proposed Development.