

NOISE IMPACT ASSESSMENT SPALDING SOLAR FARM

VERSION 1.0

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1 INTRODUCTION

Metrica Environmental Consulting Ltd ('Metrica') has been commissioned by Envams ('the Client') to undertake a Noise Impact Assessment for the proposed Spalding Solar Farm ('the Development'), located on land to the south of the Pilgrim's UK facility in Spalding ('the Site').

The Development layout is presented in Appendix 1.

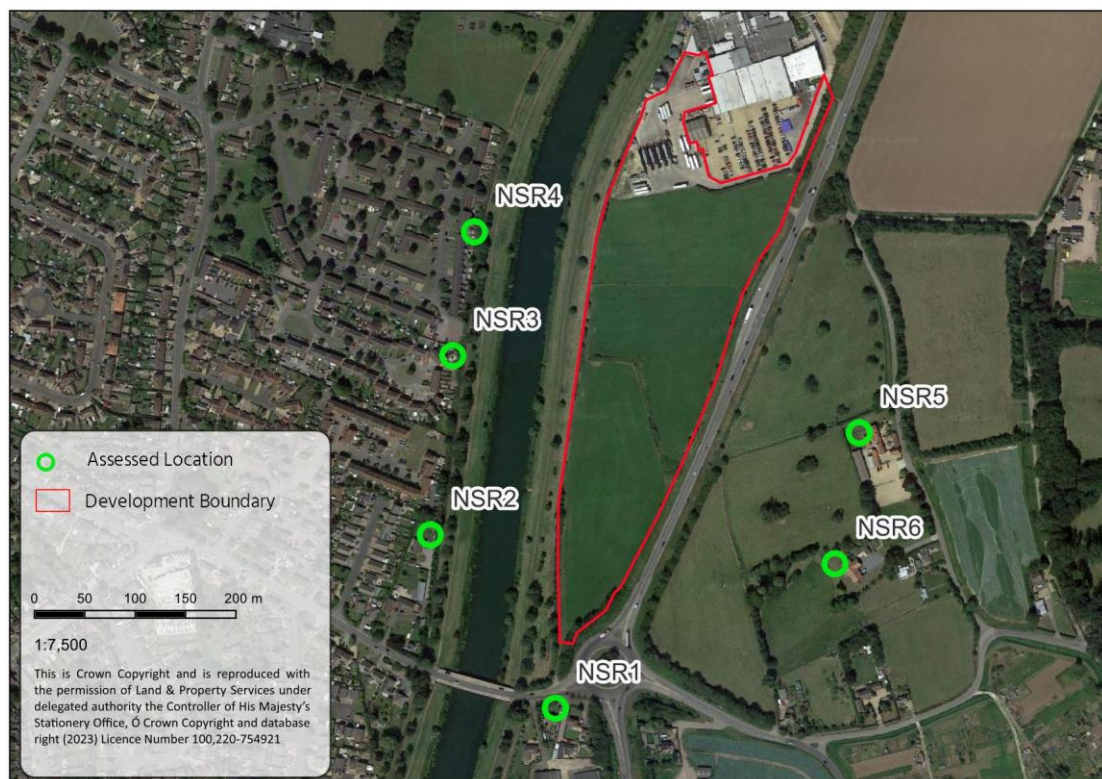
2 DEVELOPMENT OVERVIEW

The Development consists of a south-facing ground-mounted solar array; noise emitting plant is limited to a number of string inverters and a single transformer (See Section 4 for details).

The Development is bounded by agricultural land and the A16 to the east, the Pilgrim's UK manufacturing facility to the north, and residential properties to the west, which are separated from the Site by the Coronation Channel (a tributary of the River Welland). The nearest noise sensitive receptors (NSRs) are located approximately 150 m from the nearest noise emitting plant.

Figure 1 below shows the Development and assessed NSRs.

Figure 1: NSR Locations



3 GUIDANCE

The following guidance and standards are pertinent to the assessment:

- ◆ The National Planning Policy Framework (NPPF);
- ◆ The Noise Policy Statement for England (NPSE);
- ◆ BS 4142:2014 +A1:2019 Method for rating and assessing industrial and commercial sound ('BS 4142'); and
- ◆ NR Curves – ISO 1996-1:2016 (en) *Acoustics – Description, measurement, and assessment of environmental noise – Part 1: Basic quantities and assessment procedures*.

3.1 THE NATIONAL PLANNING POLICY FRAMEWORK

The NPPF sets out the Government's planning policies for England, providing a framework within which local policies can be developed. The key principle of the NPPF is a presumption in favour of sustainable development. With regards to noise, the NPPF states that sustainable development can be achieved by:

- ◆ Avoiding noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- ◆ Mitigating and reducing to a minimum potential adverse impacts resulting from noise from new development, including through the use of conditions; and
- ◆ Identifying and protecting areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

3.2 THE NOISE POLICY STATEMENT FOR ENGLAND

The NPSE sets out the purpose of noise policy, together with the Government's Noise Policy Vision and Aims, consistent with the NPPF.

The aims of the NPSE require that:

- ◆ Significant adverse effects on health and quality of life are avoided, while taking into account the guiding principles of sustainable development;
- ◆ Adverse impacts on health and quality of life are mitigated or minimised; and
- ◆ Where possible, noise management should seek to improve health and quality of life within the context of Government policy on sustainable development.

Paragraph 2.24 of the NPSE states that in relation to minimising and mitigating adverse impacts:

"...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

3.3 BS 4142:2014

BS 4142:2014 provides a method for rating and assessing noise in order to provide an indication of it's likely impact on nearby noise-sensitive receptors (NSRs).

The 'Specific' noise level at NSRs due to noise from a development (generally predicted using noise modelling software) is rated by applying corrections to account for the acoustic

characteristics of the sound, and an assessment is undertaken based on the level by which the Rating level exceeds the representative background sound level, as follows:

- ◆ A difference of 10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- ◆ A difference of around 5 dB is likely to be an indication of an adverse impact, depending on the context; and
- ◆ Where the rating level does not exceed the background level, this is an indication of the specific sound source having a low impact, depending on context.

3.4 NOISE RATING CURVES

Noise Rating (NR) curves were developed by the International Organisation for Standardisation¹ (ISO) to determine acceptable indoor sound environment for hearing preservation, speech intelligibility, and annoyance. NR curves serve as a standardised way to measure and specify noise within buildings / occupied spaces taking into account the frequency content of the noise, and is widely used by Local Authorities to determine the noise impact associated with electrical plant.

To obtain an NR rating level, the noise spectrum is compared to a series of unweighted (dB) octave-band values. The resulting NR level is that which is entirely above the predicted noise level spectrum. Table 1 below presents the octave band levels for NR20, which is typically used as the most stringent assessment criterion for internal noise within bedrooms during night-time periods.

Table 1: NR Curve Levels for NR 20

NR	Octave Band Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
	Octave Band Noise Level dB(Z)							
NR20	51	39	31	24	20	17	14	13

4 ASSESMENT METHODOLOGY

Given the low level of noise predicted to be experienced at all NSRs due to the Development plant (See Section 6), along with the likely elevated background noise levels in the local area due to existing noise sources (primarily road traffic noise), there is no reasonable prospect of an adverse impact occurring in terms of BS4142. A proportionate, desk-based assessment is therefore considered appropriate in this case, utilising Noise Rating (NR) curves (See Section 3.4 for details).

5 NOISE MODELLING

The Development consists of the following noise sources:

- ◆ 15x String Inverters, located at the end of each row of PV panels; and
- ◆ 1x transformer.

¹ ISO 1996-1:2016(en) *Acoustics – Description, measurement, and assessment of environmental noise – Part 1: Basic quantities and assessment procedures.*

Additional infrastructure includes switchgear / metering equipment. These elements will emit no / negligible levels of noise and therefore have not been considered further as part of this assessment.

5.1 NOISE EMISSION DATA

As the precise plant for the Development has yet to be selected, noise emission data for typical plant has been selected from Metrica's in-house data library, based upon our substantial prior experience of similar developments. This is presented in Table 2. It should be noted that the data relates to unweighted (dBZ) noise levels, as is required to inform an assessment against NR criteria.

Table 2: Equipment Sound Power Levels

	Sound Power Level, dBZ, L _w	Octave Band Centre Frequency, Hz, dBZ							
		63	125	250	500	1000	2000	4000	8000
String Inverter	70	63	62	65	62	58	55	61	51
Transformer	81	78	74	73	71	68	61	56	52

The level of noise emitted by the Development will be related to both the intensity of light incident upon the solar panels and the air temperature. It is therefore anticipated that noise from the Development will be negligible for much of the time, particularly during night-time periods. However, as a worst-case approach, all plant is assumed to be operating simultaneously, at full power, during both daytime and night-time periods.

The actual plant ultimately chosen for installation is yet to be finalised, however these will be selected to comply with any noise limits specified in the Development's planning conditions.

5.2 MODELLING PARAMETERS

The Specific sound level at the nearest NSRs has been calculated in SoundPlan software, using the environmental noise propagation model ISO 9613-2:1996 - Acoustics, 'Attenuation of sound during propagation outdoors – Part 2: General method of calculation'.

The ISO 9613-2 method predicts the level of sound at a receptor by taking the octave-band sound power level spectrum of the source and applying a number of attenuation factors that determine the resulting rating level at the receptor location. The following parameters were used in the prediction model and are considered to provide a conservative prediction of the noise levels likely to be experienced in practice:

- ◆ Atmospheric conditions of 10°C and 70% relative humidity;
- ◆ A ground factor of G = 1 (soft ground) in all areas except the surface of Coronation Channel, where a ground factor G=0 (hard ground) has been applied;
- ◆ A receiver height of 4 m (approximating first floor window height) for all receivers;
- ◆ All plant operating simultaneously at full capacity;
- ◆ Includes local terrain and buildings;
- ◆ Inverters have been modelled as point sources at a height of 1.5 m; and
- ◆ The transformer has been modelled as a point source at a height of 2 m.

Grid references for the nearest NSRs are provided in Table 3, as presented in Figure 1. On the basis that noise levels are found to be acceptable at these locations, they will also be acceptable at other NSRs located further from the Development.

Table 3: Assessed Receptors

Receptor Name	Easting	Northing
NSR 1	526203	322776
NSR 2	526052	322949
NSR 3	526066	323114
NSR 4	526095	323272
NSR 5	526478	323029
NSR 6	526469	322935

6 NR ASSESSMENT

As NR criteria apply to internal noise levels, this assessment accounts for an open window attenuation of 15 dB, which is taken from research undertaken by Napier University². The research shows that typical attenuation of a slightly open or tilted windows range from 14 dB to 19 dB on average. A conservative 15 dB attenuation has been applied for the purposes of this assessment.

Tables 4 to 9 present the predicted noise level incident upon the worst-case façade of NSRs 1 to 6 at a height of 4 m, the resulting internal noise level, and the headroom between the predicted internal noise levels and the assessment criterion of NR20.

Table 4: NSR 1 - NR Assessment

NSR1	Octave Band Centre Frequency, Hz, dB(Z)							
	63	125	250	500	1000	2000	4000	8000
Predicted Façade Level, dB	24	13	4	6	10	6	6	-19
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	4	-1	-10	-10	-4	-11	-13	-38
Difference to NR20	-47	-40	-41	-34	-24	-28	-27	-51

Table 5: NSR 2 - NR Assessment

NSR1	Octave Band Centre Frequency, Hz, dB(Z)							
	63	125	250	500	1000	2000	4000	8000
Predicted Façade Level, dB	27	18	8	10	14	10	11	-12
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	7	4	-6	-6	0	-7	-8	-31
Difference to NR20	-44	-35	-37	-30	-20	-24	-22	-44

² NANR116: 'Open/Closed Window Research – Sound Insulation Through Ventilated Domestic Windows: Napier University 2007 (Table 5-6, page 65)

Table 6: NSR 3 - NR Assessment

NSR1	Octave Band Centre Frequency, Hz, dB(Z)							
	63	125	250	500	1000	2000	4000	8000
Predicted Façade Level, dB	29	21	11	15	18	13	13	-11
Window Attenuation, dB	-20	-14	-14	-16	-14	-17	-19	-19
Resulting Internal Level	9	7	-3	-2	4	-4	-6	-30
Difference to NR20	-42	-33	-34	-26	-17	-21	-20	-43

Table 7: NSR 4 - NR Assessment

NSR1	Octave Band Centre Frequency, Hz, dB(Z)							
	63	125	250	500	1000	2000	4000	8000
Predicted Façade Level, dB	27	18	8	10	14	9	10	-15
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	7	4	-6	-6	0	-8	-9	-34
Difference to NR20	-44	-35	-37	-30	-20	-25	-23	-47

Table 8: NSR 5 - NR Assessment

NSR1	Octave Band Centre Frequency, Hz, dB(Z)							
	63	125	250	500	1000	2000	4000	8000
Predicted Façade Level, dB	25	14	5	7	10	6	5	-27
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	5	0	-9	-9	-4	-11	-15	-46
Difference to NR20	-46	-39	-40	-33	-24	-28	-29	-59

Table 9: NSR 6 - NR Assessment

NSR1	Octave Band Centre Frequency, Hz, dB(Z)							
	63	125	250	500	1000	2000	4000	8000
Predicted Façade Level, dB	24	13	4	6	9	4	3	-31
Window Attenuation, dB	20	14	14	16	14	17	19	19
Resulting Internal Level	4	-1	-10	-10	-5	-13	-16	-50
Difference to NR20	-47	-40	-41	-34	-25	-30	-30	-63

As can be seen, predictions are comfortably below NR20 at all receptors, with the majority of frequency bands predicted within the nearest NSRs to be below 0 dB.

In addition to the above and in the interest of completeness, Appendix 2 presents a noise contour plot detailing external (A-weighted) L_{eq} levels, showing noise propagation across the local area.

7 CONCLUSION

Metrica was commissioned by Envams to undertake a Noise Impact Assessment in relation to the Spalding Solar Farm development.

An assessment of predicted noise levels was undertaken against a suitably conservative criterion of NR20, as is widely used by Local Authorities to determine the noise impact associated with electrical plant. The assessment shows that predicted internal noise levels are comfortably compliant with NR20, with all plant operating simultaneously and at full power.

The level of noise emitted by the Development will be related to both the intensity of light incident upon the solar panels and the air temperature, meaning that noise levels are likely to be even lower in practice, particularly during night-time periods.

Based on the above, noise due to the operation of the Development has been found to be acceptable.

8 GLOSSARY OF TERMS

Background Noise: The background noise level is the underlying level of noise present at a particular location for the majority (usually 90%) of a period of time.

Decibel (dB): The decibel is the basic unit of noise measurement. It relates to the cyclical changes in pressure created by the sound and operates on a logarithmic scale, ranging upwards from 0 dB. 0 dB is equivalent to the normal threshold of hearing at a frequency of 1000 Hertz (Hz). Each increase of 3 dB on the scale represents a doubling of the Sound Pressure, and is typically the minimum noticeable change in sound level under typical listening conditions.

dB(A): Environmental noise levels are usually discussed in terms of dB(A). This is known as the A-weighted sound pressure level, and indicates that a correction factor has been applied, which corresponds to the human ear's response to sound across the range of audible frequencies. The ear is most sensitive in the middle range of frequencies (around 1000-3000 Hz), and less sensitive at lower and higher frequencies. The A weighted noise level is derived by analysing the level of a sound at a range of frequencies and applying a specific correction factor for each frequency before calculating the overall level. In practice this is carried out automatically within noise measuring equipment by the use of electronic filters, which adjust the frequency response of the instrument to mimic that of the ear.

Frequency: The frequency of a sound is equivalent to its pitch in musical terms. The units of frequency are Hertz (Hz), which represents the number of cycles (vibrations) per second.

$L_{Aeq,t}$: This term is known as the A-weighted equivalent continuous sound pressure level for a period of time, t. It is similar to an average, and represents the sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound in question.

Rating Level: Noise levels which have been corrected for certain acoustic features, as required under BS4142 methodology.

Sound pressure (P): The fluctuations in pressure relative to atmospheric pressure, measured in Pascals (Pa).

Sound pressure level (L_p): Sound pressure measured on the decibel scale, relative to a sound pressure of 2×10^{-5} Pa.

Specific Level: In terms of BS4142 methodology, the specific level is the sound level produced by a source, without corrections for acoustic features.

APPENDIX 1: DEVELOPMENT LAYOUT



- Notes:
1. All dimensions to be confirmed on site prior to installation.
 2. All dimensions are indicative only and in mm unless otherwise specified.
 3. Drawing based on satellite data:
Imagery date: 21/04/23

Reference drawings		
Drawing name	Rev	Date

Legend:	
—	Red-line boundary (RLB)
—	Perimeter fence
—	HV cable route
•	Security column
■	Ring main unit (RMU)
	Gate
	Transformer station
	String Inverter Unit

System description:

DC Power kWp:	1640.76
AC Power kVA:	1,400

No. of modules:	2,904
Module type:	Canadian Solar CS6W 565MS 565Wp
Dimensions:	2278x1134x30 mm

Substructure type:	4 rows of modules in landscape
Modules per string:	Varies
Number of strings:	112
Tilt angle:	25°
Shading angle:	N/A
Azimuth from South:	0°

Inverter model:	DNO Compliant model as available
Inverter power, kVA:	TBC
No. of inverters:	TBC
DC / AC ratio:	TBC

Capacity per area:

Area	Module qt.	Capacity, kWp
N	1320	745.8
S	1584	894.96
TOTAL	2904	1640.76

Proposed location:



Revisions:

Rev	Date	Comments	Drawn	Approved
D	21/04/23	First Issue	MZ	MB
A	02/02/23	Various Changes	MZ	CMA
B	18/02/23	Module, Inverter and Layout Changes	MZ	CMA
C	28/04/23	Module, Inverter and Layout Changes	MZ	CMA

Project: Pilgrim's UK - Spalding
Location: Spalding
PE12 6EP
United Kingdom
52.792581°, -0.128068°
Title: PV Layout

Drawn:	RPP / MZ	Checked:	MB
Scale:	1:1000@A1	Date:	21/04/23
Drawing No:	PILGR-SPALD-100	Rev:	C

APPENDIX 2: NOISE CONTOUR PLOT: dB, LAeq

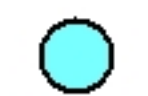


Project: Spalding Solar

Project-No: 0188

Description

Noise Contour Plot @ 1.5m

-  Building
-  Receptor Location
-  Point source

Noise Level dB, LAeq

	20 - 25
	25 - 30
	30 - 35
	35 - 40
	40 - 45
	45 - 50
	> 50

