Alleston Solar Farm, Pembrokeshire

Transport Assessment

Reference Number: 3.0.4

October 2024

tnei

A specialist energy consultancy

Environmental Noise Impact Assessment

Alleston Solar Farm

Alleston Clean Energy Ltd.

16267-003-R3
03 October 2024

PUBLISHED

Quality Assurance

TNEI Services Ltd, TNEI Africa (PTY) Ltd and TNEI Ireland Ltd operate an Integrated Management System and is registered with The British Assessment Bureau as being compliant with ISO 9001 (Quality), ISO 14001 (Environmental) and ISO 45001 (Health and Safety).

Disclaimer

This document is issued for the sole use of the Customer as detailed on the front page of this document to whom the document is addressed and who entered into a written agreement with TNEI. All other use of this document is strictly prohibited and no other person or entity is permitted to use this report unless it has otherwise been agreed in writing by TNEI. This document must be read in its entirety and statements made within may be based on assumptions or the best information available at the time of producing the document and these may be subject to material change with either actual amounts differing substantially from those used in this document or other assumptions changing significantly. TNEI hereby expressly disclaims any and all liability for the consequences of any such changes. TNEI also accept no liability or responsibility for the consequences of this document being relied upon or being used for anything other than the specific purpose for which it is intended, or containing any error or omission which is due to an error or omission in data used in the document that has been provided by a third party.

This document is protected by copyright and may only be reproduced and circulated in accordance with the Document Classification and associated conditions stipulated or referred to in this document and/or in TNEI's written agreement with the Customer. No part of this document may be disclosed in any public offering memorandum, prospectus or stock exchange listing, circular or announcement without the express and prior written consent of TNEI. A Document Classification permitting the Customer to redistribute this document shall not thereby imply that TNEI has any liability to any recipient other than the Customer.

Any information provided by third parties that is included in this report has not been independently verified by TNEI and as such TNEI accept no responsibility for its accuracy and completeness. The Customer should take appropriate steps to verify this information before placing any reliance on it.

Document Control

Revision	Status	Prepared by	Checked by	Approved by	Date
R0	FIRST ISSUE	EW	GC	GC	10/05/2024
R1	CLIENT COMMENTS	EW	GC	GC	05/06/2024
R2	CLIENT COMMENTS	EH	GC	EW	17/09/2024
R3	FINAL ISSUE	EH	GC	EW	03/10/2024

TNEI Services Ltd
Company Registration Number: 03891836 **VAT Registration Number: 239 0146 20**

Registered Address		
Bainbridge House	7th Floor West One	7th Floor
86-90 London Road	Forth Banks	80 St. Vincent Street
Manchester	Newcastle upon Tyne	Glasgow
M1 2PW	NE1 3PA	G2 5UB
Tel: +44 (0)161 233 4800	Tel: +44 (0)191 211 1400	Tel: +44 (0)141 428 3180

TNEI Ireland Ltd
Registered: 104 Lower Baggot Street, Dublin 2, DO2 Y940
Company Registration Number: 662195 **VAT Registration Number: 3662952IH**

Unit S12, Synergy Centre
TU Dublin Tallaght Campus
Tallaght
D24 A386
Tel: +353 (0)190 36445

TNEI Africa (Pty) Ltd
Registered: Mazars House, Rialto Rd, Grand Moorings Precinct,7441 Century City, South Africa
Company Number: 2016/088929/07

Unit 514 Tyger Lake
Niagara Rd & Tyger Falls Blvd
Bellville, Cape Town
South Africa, 7530

TNEI Inc.
Registered Address: 9319 Robert D/ Snyder Rd. PORTAL Building Mecklenburg County
Charlotte, NC 228223-0001 USA
Certification Number: C202305805696-1

Unit 216 PORTAL Building,
9319 Robert D. Snyder Road
Charlotte, Mecklenburg County,
North Carolina 28223
Tel: +1 (980) 245-4024

Contents

TABLES

APPENDICES

1 Introduction

1.1 Overview

TNEI was commissioned by Alleston Clean Energy Ltd. (henceforth referred to as 'the Client') to undertake an Environmental Noise Impact Assessment (NIA) in support of the Development of National Significance (DNS) planning application for the proposed Alleston Solar Farm development (henceforth referred to as 'the Proposed Development').

The Proposed Development is to be located on land at Alleston Farm, Lower Lamphey Road, Lamphey, Pembrokeshire, Wales, at approximate OS Coordinates 200465, 200113. The Proposed Development site is semi-rural in nature, surrounded immediately by agricultural fields and small areas of woodland, but with a number of residential properties located nearby. The residential dwellings of Pembroke are 190 m north-west of the site whilst the village of Lamphey is located 370 m to the north-eastern corner of the site.

The purpose of the NIA is to:

- Identify the noise sensitive receptors in the vicinity of the Proposed Development;
- Identify the dominant sound sources associated with the operation of the Proposed Development;
- Calculate the likely levels of operational noise at the identified receptors to determine the likely noise impacts associated with the Proposed Development; and
- Indicate any requirements for mitigation measures, if applicable, to provide sufficient levels of protection for all noise sensitive receptors.

For clarity, this NIA does not include an assessment of construction noise. Typically, construction noise for this type of development is temporary in nature and usually dealt with at the post-consent phase when more detail is known about the nature of the works. The adaptation of best practice methods/mitigation measures to appropriately reduce potential construction noise effects is typically addressed at the post-submission stage if required, usually set out within a Construction Environmental Management Plan (CEMP) or similar.

All work undertaken to produce this report has been carried out by members of the TNEI Environment and Engineering Team, all of whom are affiliated with the Institute of Acoustics (IOA). Specifically, the following members of staff have been involved in the project:

- Will Conway, Tech IOA, BSc (Hons): Baseline Sound Level Survey;
- Ewan Watson, AMIOA, BEng (Hons), IOA Postgraduate Diploma in Acoustics and Noise Control: Noise Propagation Modelling, Assessment and Reporting; and,
- Gemma Clark, MIOA/PIEMA, MSc, BSc (Hons), IOA Certificate of Competence in Environmental Noise Measurement: Quality Assurance.

1.2 Nomenclature

Please note the following terms and definitions, which are used throughout this report:

- **Emission** refers to the noise level emitted from a noise source, expressed as either a sound power level or a sound pressure level;
- **Immission** refers to the sound pressure level received at a specific location from a noise source;
- **SWL** indicates the sound power level in decibels (dB);

- **SPL** indicates the sound pressure level in decibels (dB);
- **NML** (Noise Monitoring Location) refers to any location where baseline or specific noise levels have been measured;
- **NSRs** (Noise Sensitive Receptors) are all identified receptors which are sensitive to noise; and;
- **NAL** (Noise Assessment Location) refers to any location where the noise immission levels are calculated and assessed.

In the interests of clarity, a Glossary of Terms is also provided as Appendix A of this report.

All figures referenced within the report can be found in Appendix E.

Unless otherwise stated, all noise levels refer to free field levels i.e. noise levels without influence from any nearby reflective surfaces.

All grid coordinates refer to the Ordnance Survey grid using Eastings and Northings.

2 Project Description

A layout plan of the Proposed Development is included in Appendix B. The Proposed Development is based on a 'decentralised' design, with the solar panels feeding into a number of string inverters that will be installed at the end of the rows of solar panels and distributed across the site. The string inverters connect into a number of Medium Voltage (MV) transformer stations and a single High Voltage (HV) grid transformer, for further export to the grid. The decentralised layout is in contrast to a 'centralised' solar farm design, which requires a single or small number of larger inverters, instead of a large number of string inverters. In terms of operational noise, a decentralised solar farm can consist of hundreds of low-level noise sources, whereas a centralised design contains fewer but louder noise sources.

With due regard to the above, the dominant sound sources identified for consideration within the NIA are as follows:

- 105 of, Sungrow SG320HX/SG350HX Solar String Inverter;
- 6 of, Jiangsu Huapeng 6000 kVA MV Transformer Station; and,
- 1 of, GE 275/13.8/13.8 kV, 140/70/70 MVA HV Transformer.

The sound level output of any auxiliary infrastructure included as part of the Proposed Development, for example, auxiliary transformers, were considered to be insignificant in comparison to the primary sound sources detailed above. Accordingly, no other items of plant were considered within the assessment.

2.1 Study Area

Noise Sensitive Receptors (NSRs) are properties that are sensitive to noise and, therefore, require protection from nearby noise sources. The study area for the assessment of environmental noise is usually defined through the identification of the closest NSRs to the Proposed Development.

The assessment of noise attributable to the Proposed Development considers the nearest NSRs only, on the assumption that if sound levels at the closest receptors are deemed acceptable, then sound levels at NSRs at greater distances from the Proposed Development should also be within acceptable levels. Table 2-1 details all of the NSRs considered within the NIA.

Table 2-1: Nearest Identified NSRs

NSR Descriptor	Comment	Receptor Type
Alleston Farm	Closest receptor located centrally within the boundary of the Proposed Development	Residential
Upper Longstone	Closest receptor located to the west of the Proposed Development	Residential
Lower Lamphey Road	Closest receptors located to the northwest of the Proposed Development	Residential
Warmsley	Closest receptors located to the north of the Proposed Development	Residential

NSR Descriptor	Comment	Receptor Type
Ashton Villa	Closest receptors located to the north of the Proposed Development	Residential
Lamphey	Closest receptors located to the northeast of the Proposed Development	Residential
Rushmore	Closest receptor to the east of the Proposed Development	Residential
Westhill	Closest receptor located to the southeast of the Proposed Development	Residential
Herbertsmoor	Closest Receptor located to the south of the Proposed Development	Residential
Lammaston Farm	Closest receptor located to the southwest of the Proposed Development	Residential

3 Assessment Methodology

3.1 Legislation and Policy Context

3.1.1 National Planning Policy

Planning Policy Wales (PPW) (12th Edition) (2024) [(1)] provides guidance to planning authorities in Wales and sets out the planning policies of the Welsh Government. PPW is the overarching planning policy in Wales but does not provide any specific guidance on how to consider environmental noise. Rather, a series of Technical Advice Notes (TANs) are available that supplement PPW, one of which, (TAN 11) provides advice on how many aspects of noise should be considered in a planning context.

3.1.2 Noise and Soundscape Action Plan 2023–2028

In 2023, the Welsh Government, published the Noise and Soundscape Action Plan 2023–2028 (NSAP) [(2)], which outlines the Welsh public sector's strategic policy direction in relation to noise and soundscape management. Other than for onshore wind developments, the NSAP offers no specific guidance with regards to the consideration of noise from other renewable energy or electrical infrastructure developments, however, Annex E – '*guidance to support decision making'*, references a number of standards that are appropriate for use. These include British Standard (BS) 4142 and BS 8233. The NSAP also refers to TAN 11 as an appropriate advice note in terms of noise, whilst recognising that it is due an update.

3.1.3 Technical Advice Note (TAN) 11: Noise

With regards to the assessment of industrial noise, TAN 11: noise [(3)] refers to both BS 4142[1] and BS 8233 as appropriate standards by which to assess noise.

3.2 Assessment Method

A number of standards and guidelines are available for the assessment of environmental noise from proposed new developments or activities. Typically, assessments are based on a comparison of likely noise levels against either 'context' based limits or a set of fixed limits.

Context based limits are set relative to the existing noise environment and may also consider the characteristics of the noise source(s), whilst fixed limits are usually set regardless of the existing noise environment or type of noise source(s).

3.2.1 'Context' Based Limits (BS 4142:2014 +A1:2019)

BS 4142:2014+A1:2019 *'Methods for Rating and Assessing Industrial and Commercial Sound'* [(4)] is commonly used to assess the potential impacts of new sound sources on nearby residential receptors.

The BS 4142 form of assessment is based on the predicted or measured levels of an assessed sound source compared to the measured background sound levels without the specific sound source present and uses, *"outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident".*

Specifically, the assessment is made by subtracting the measured background sound level from a calculated or measured 'Rating Level'.

[1] Note that the TAN refers to outdated versions of both BS 4142 (1990) and BS 8233 (1987). Both standards have been updated since the publication of the TAN and the most recent versions have been adopted for use in this assessment.

BS 4142 uses the following definitions:

Ambient Sound: Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, both near and far. Described using the metric, $L_{Aeq\ (t)}$.

Specific Sound Level: Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, *Tr*. Described using the metric $L_{Aeq\ (t)}$. Also referred to in this report as the *Immission Level*.

Residual Sound Level: Equivalent continuous A-weighted sound pressure level of the residual sound without the specific sound source(s) present at the assessment location over a given time interval, *T*. Described using the metric $L_{Aeq\ (t)}$.

Background Sound Level: A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, *T*, measured using time weighting *F* and quoted to the nearest whole number of decibels. Described using the metric $L_{A90\ (t)}$.

Rating Level: The Specific Sound Level adjusted for the characteristics of the sound. The Rating Level is calculated by adding a penalty or penalties (if required) to the Specific Sound Level when the sound source contains audible characteristics such as tonal, impulsive or intermittent components. Described using the metric, $L_{Aeq\ (t)}$.

3.2.2 Fixed Guideline Levels (BS 8233:2014)

BS 8233 '*Guidance on sound insulation and noise reduction for buildings*' [5] presents guideline noise levels for daytime and night-time periods for a number of different building types; for residential developments these are based on guidelines issued by the World Health Organisation (WHO). Specifically, the Standard states; *'In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values in Table 4.'* Table 4 is reproduced here as Table 3-1.

Table 3-1: Indoor Ambient Noise Levels for Dwellings (BS 8233:2014 Table 4)

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq\ (16hour)}$	-
Dining	Dining room/area	40 dB $L_{Aeq\ (16hour)}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq\ (16hour)}$	30 dB $L_{Aeq\ (8hour)}$

BS 8223 suggests that an allowance of 10 – 15 dB for the attenuation of a partially open window is reasonable in order to convert between internal and external sound levels and limits. Therefore, an assessment of external noise levels can assume an external noise level limit of 13 dB (considered an appropriate assumed value by TNEI between 10 and 15 dB) above those values detailed within Table 3-1 (i.e. to achieve an internal night-time level of 30 dB $L_{Aeq\ (8hour)}$ with windows open the external sound level must not exceed 43 dB $L_{Aeq\ (8hour)}$).

3.2.3 Assessment Criteria

Considering all of the above, the assessment is made as follows:

- A quantitative assessment is made against the fixed noise guideline levels defined in BS 8233:2014; and,

- A qualitative assessment is undertaken at the nearest residential receptors in accordance with BS 4142, taking into consideration the context of the Proposed Development.

3.3 Calculation Method

3.3.1 Noise Propagation Model (ISO 9613-2:1996)

In order to predict the noise immission levels attributable to the Proposed Development, a noise propagation model was created using the propriety noise modelling software, CadnaA [6]. Within the software, complex models can be produced to simulate the propagation of noise according to a range of international calculation standards.

For this assessment, noise propagation was calculated in accordance with ISO 9613 '*Acoustics – Attenuation of sound during propagation outdoors* [7] using the following input parameters:

- Temperature was assumed to be 10°C and relative humidity as 70%;
- A ground attenuation factor of 1 (soft ground) has been assumed, however each of the solar PV panels has been modelled as a reflective surface; and,
- Receiver heights were set to 4 m.

3.3.2 Uncertainties and Limitations

The noise propagation model was designed to give a good approximation of the specific sound level and the contribution of each individual sound source attributable to the Proposed Development; however, it is expected that measured levels are unlikely to be matched exactly with modelled values and the following limitations in the model should be considered:

- In accordance with ISO 9613, all assessment locations are modelled as downwind of all sound sources and propagation calculations are based on a moderate ground-based temperature inversion, such as commonly occurs at night. These conditions are favourable to noise propagation;
- Table 5 of ISO 9613 estimates overall accuracy for broadband noise predictions of ± 3 dB, with average source to receiver heights <5 m, at distances of up to 1,000 m;
- The predicted barrier attenuation provided by local topography, embankments, walls, buildings and other structures in the intervening ground between source and receiver can only be approximated and not all barrier attenuation will have been accounted for;
- The model assumes that all sound sources, aside from the string inverters during the night-time period, are operating at maximum noise output; and
- The model assumes that all sound sources are operating continuously and simultaneously.

Accordingly, the predicted noise levels are likely to over-predict the actual noise levels that will occur during normal operation.

4 Baseline Sound Level Survey

To inform the BS 4142 assessment, an unattended baseline sound level survey was undertaken at four Noise Monitoring Locations (NMLs) between 23rd November 2023 and 7th December 2023. The noise monitoring equipment measured continuously for the entire duration of the survey, logging in 15-minute averaging periods.

Table 4-1 details the NMLs, which are also shown on Figure 1 (Appendix E). The NMLs were selected to represent the closest NSRs in the vicinity of the Proposed Development and Figure 1 also indicates which of the NMLs have been selected to represent each NSR.

Table 4-1: Baseline Noise Monitoring Locations

NML		Coordinates		Comments
NML01	Within garden of residence on Alleston Farm	200460	200170	Representative of the nearest NSRs located within the centre of the Proposed Development site boundary
NML02	Located within agricultural land to the north of Alleston Farm, approximately 50 m south of Lower Lamphey Road	200467	200503	Representative of the nearest NSRs located to the north and northeast of the Proposed Development
NML03	Located within agricultural land to the west of Alleston Farm, approximately 100 m to the east of Watery Lane	199999	200081	Representative of the nearest NSRs located to the west of the Proposed Development
NML04	Located within agricultural land to the south of Alleston Farm, approximately 500 m to the west of the B4584	200598	199677	Representative of the nearest NSRs located to the south, southeast and southwest of the Proposed Development

All measurements were made with the Sound Level Meters (SLMs) mounted approximately 1.2 m above the ground and as far away from nearby reflective surfaces i.e. building façades, fences etc. as practically possible.

The noise monitoring equipment consisted of four Rion NL-52 SLMs fitted with appropriate environmental wind shields. All noise monitoring equipment (calibrator, SLM and microphones) used for the study is categorised as Class 1, as specified in IEC 61672-1 *'Electroacoustics. Sound level meters. Specifications'* (8). The equipment was calibrated onsite at the beginning and end of each measurement period with no significant deviations noted. Appendix C contains the equipment and laboratory calibration details for the SLMs and Calibrator.

Subjective observations made during the installation and collection of the survey equipment noted the following:

- At NML01, the soundscape consisted of road traffic noise from Lower Lamphey Road to the north, wind induced vegetation noise, barking from dogs on Alleston Farm and a helicopter overhead (installation only).

- At NML02, the soundscape consisted primarily of road traffic noise from Lower Lamphey Road, but wind induced vegetation noise, birdsong, movement of animals in surrounding bushes and faint corona discharge noise from nearby overhead lines was also noted.
- At NML03, the soundscape consisted of distant road traffic noise, wind induced vegetation noise, birdsong, faint corona discharge noise from nearby overhead lines and passing trains.
- At NML04, the soundscape consisted of faint distant traffic noise, lowing of cattle and birdsong.

Meteorological data was collected onsite with a Kestrel portable weather station and a tipping bucket rain gauge, both of which were installed alongside one of the SLMs. All sound level data recorded during (as well as 20 minutes before and 60 minutes after) a recorded precipitation event was removed to reduce the potential influence of raised sound levels from rainfall. The data was also filtered for periods when wind speeds were above 5 m/s, to remove any data when noise levels could be atypically increased due to wind induced noise.

The representative background sound level for each NML was determined with reference to the time history charts, statistical analysis charts and distribution analysis charts included in Appendix C, following the guidance in BS 4142, which states:

'A representative level should account for the range of background sound levels and should not automatically be assumed to be either the minimum or modal value.'

With due consideration of the above, Table 4-2 details the representative background sound levels $L_{A90\,(15mins)}$ at each of the NMLs for the daytime (07:00-23:00) and night-time (23:00-07:00) periods, as defined by BS 4142.

Table 4-2: Representative Background Sound Levels, dB L_{A90}

Noise Monitoring Location (NML)	Daytime $L_{A90(15mins)}$	Night-time $L_{A90(15mins)}$
NML01	35	26
NML02	36	26
NML03	36	26
NML04	31	25

5 Operational Noise Impacts

5.1 Modelling of Individual Sound Sources

The noise model considered all of the sound sources detailed within Section 2.

The following sections describe how each sound source was incorporated into the noise model. All items of plant were modelled as area sources and were assumed to be operating continually with a constant sound level output. The noise level data used within the model, which was provided by the Client, is included within Appendix D.

5.1.1 Sungrow SG350HX Solar String Inverter

The solar string inverters have been modelled as point sources, located at the ends of the solar panel arrays. The client has provided Octave Band Sound Power Level (SWL) data for the unit operating at 100%, which has been used to represent daytime operation, when the inverters are likely to be operating at full capacity. During the night-time, the client has indicated that 30% operating capacity is appropriate, and as such the corresponding SWL data has been used for this value to represent night-time operation.

Table 5-1 and Table 5-2 detail the equivalent SWL (which equates to 84 dBA and 63 dBA for the daytime and night-time periods respectively) values which were applied to each of the point sources used to model the individual solar string inverters.

Table 5-1: Octave Band SWL (dBA) values used to model the Solar String Inverters (Daytime)

	Frequency (Hz)								
Solar String Inverter	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Sungrow SG350HX (Daytime)	56	60	62	65	70	81	74	75	74

Table 5-2: Octave Band SWL (dBA) values used to model the Solar String Inverters (Night-time)

	Frequency (Hz)								
Solar String Inverter	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Sungrow SG350HX (Night-time)	35	39	41	44	49	60	53	54	53

5.1.2 Jiangsu Huapeng 6000 kVA MV Transformer Station

The solar string inverters will be connected to multiple MV transformer station units with an anticipated rating of 6000 kVA. The client has provided noise data for a candidate unit with a broadband SPL value of 70 dBA @ 1 m, which is approximately equivalent to 78 dBA SWL.

No spectral data is available for this candidate; however, typical transformer spectra is well documented and One-Third Octave Band SWL data for a similar unit has been input into the noise

model and transposed to equal a broadband SWL of 78 dBA. Table 5-3 details the resulting SWL used within the noise model and the relevant data sheets are included within Appendix D.

Table 5-3: One-Third Octave Band SWL (dBA) values used to model the MV Transformer Station Units

	Frequency (Hz)								
MV Transformer Station Jiangsu Huapeng 6000 kVA	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
	-	-	-	54	38	45	62	58	68
	200	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**
	64	66	70	67	67	69	68	67	64
	1600	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**
	62	60	58	57	57	55	52	50	48

5.1.3 GE 275/13.8/13.8 kV, 140/70/70 MVA HV Transformer

The MV Transformer Stations will be connected to a single HV Grid Transformer with an anticipated rating of 70 MVA. The client has provided noise data for a candidate unit with a broadband SPL value of 68 dBA @ 2 m (inclusive of cooler noise), which is approximately equivalent to 82 dBA SWL.

As with the MV Transformer Station data, no spectral data is available for this candidate and therefore the same typical transformer One-Third Octave Band spectra has been input into the noise model and transposed to equal a broadband SWL of 82 dBA. Table 5-4 details the resulting SWL used within the noise model and the relevant data sheets are included within Appendix D.

Table 5-4: One-Third Octave Band SWL (dBA) values used to model the HV Grid Transformer

	Frequency (Hz)								
HV Transformer GE 275/13.8/13.8 kV, 140/70/70 MVA	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
	-	-	-	58	42	49	66	62	72
	200	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**
	68	70	74	71	71	73	72	71	68
	1600	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**
	66	64	62	61	61	59	56	54	52

5.2 Calculated Immission Levels

Noise immission levels were calculated at thirteen Noise Assessment Locations (NALs), which were selected to represent the closest NSRs to the Proposed Development, as detailed in Table 2-1. The assessment location at each NAL was set on the side of the property facing the Proposed Development at the curtilage boundary, with noise immission levels calculated for a height of 4 m. In the instance of Alleston Farm, two NALs were chosen to represent either side of the property as noise emitting

plant is located in multiple directions in relation to this receptor. The NALs are detailed in Table 5-5 and shown on Figure 2 in Appendix E.

Table 5-5: Noise Assessment Locations

Noise Assessment Location			
NAL ID	**NAL Descriptor**	**Coordinates**	
NAL01a	Alleston Farm A	200446	200144
NAL01b	Alleston Farm B	200418	200118
NAL02	Upper Longstone	199890	200063
NAL03	Lower Lamphey Road A	199767	200648
NAL04	Warmsly	199986	200556
NAL05	Ashton Villa	200296	200542
NAL06	Lower Lamphey Road B	200742	200546
NAL07	Lamphey A	201250	200304
NAL08	Lamphey B	201300	200079
NAL09	Rushmore	201217	199704
NAL10	Westhill	201106	199612
NAL11	Herbertsmoor	200621	199021
NAL12	Lammaston Farm	200143	199343

The immission levels (Specific Sound Levels) were calculated assuming all items of plant were operating continuously and concurrently. The predicted levels are detailed in Table 5-6 as dB $L_{Aeq(t)}$.

Table 5-6: Predicted Immission Levels, dB $L_{Aeq(t)}$

Noise Assessment Location		Immission Level, dB $L_{Aeq(t)}$	
NAL ID	**NAL Descriptor**	**Daytime**	**Night-time**
NAL01a	Alleston Farm A	35	21
NAL01b	Alleston Farm B	37	22
NAL02	Upper Longstone	35	23
NAL03	Lower Lamphey Road A	28	15

Noise Assessment Location		Immission Level, dB $L_{Aeq(t)}$	
NAL ID	**NAL Descriptor**	**Daytime**	**Night-time**
NAL04	Warmsly	38	21
NAL05	Ashton Villa	36	20
NAL06	Lower Lamphey Road B	36	19
NAL07	Lamphey A	29	13
NAL08	Lamphey B	27	11
NAL09	Rushmore	26	10
NAL10	Westhill	35	21
NAL11	Herbertsmoor	37	22
NAL12	Lammaston Farm	35	23

6 Noise Impact Assessment

6.1 Quantitative Assessment – BS 8233

The assessment against fixed noise levels is made against the most stringent of the guideline levels presented in BS 8233:2014 (detailed in Table 3-1). To determine a set of external limits, 13 dB has been added to the BS 8233 internal levels to allow for the attenuation provided by a partially open window, as detailed in Table 6-1.

Table 6-1: Derived Fixed Level Limits, dB $L_{Aeq(t)}$

Assessment parameter	BS 8233 Guideline Level	Allowance for partially open window attenuation, dB	Equivalent External Level
Daytime 07:00 – 23:00	35 dB $L_{Aeq\ (16\ hours)}$	13	48 dB $L_{Aeq\ (16\ hours)}$
Night-time 23:00 – 07:00	30 dB $L_{Aeq\ (8\ hours)}$	13	43 dB $L_{Aeq\ (8\ hours)}$

Table 6-2 compares the predicted immission levels with the derived noise level limits.

Table 6-2: Quantitative Assessment

Noise Assessment Location		Predicted Level, $L_{Aeq\ (t)}$		Daytime		Night-time	
NAL ID	NAL Descriptor	Daytime	Night-time	Equivalent External Level	Margin dB	Equivalent External Level	Margin dB
NAL01a	Alleston Farm A	35	21	48	-13	43	-22
NAL01b	Alleston Farm B	37	22	48	-11	43	-21
NAL02	Upper Longstone	35	23	48	-13	43	-20
NAL03	Lower Lamphey Road A	28	15	48	-20	43	-28
NAL04	Warmsly	38	21	48	-10	43	-22
NAL05	Ashton Villa	36	20	48	-12	43	-23
NAL06	Lower Lamphey Road B	36	19	48	-12	43	-24
NAL07	Lamphey A	29	13	48	-19	43	-30
NAL08	Lamphey B	27	11	48	-21	43	-32
NAL09	Rushmore	26	10	48	-22	43	-33

Noise Assessment Location		Predicted Level, $L_{Aeq\ (t)}$		Daytime		Night-time	
NAL ID	NAL Descriptor	Daytime	Night-time	Equivalent External Level	Margin dB	Equivalent External Level	Margin dB
NAL10	Westhill	28	12	48	-20	43	-31
NAL11	Herbertsmoor	31	13	48	-17	43	-30
NAL12	Lammaston Farm	32	15	48	-16	43	-28

The predicted immission levels are considerably below the fixed guideline levels for both daytime and night-time assessment periods at all NALs.

6.2 Qualitative Assessment - BS 4142

6.2.1 Rating Level

To assess the immission levels in accordance with BS 4142, the Specific Sound Level must be converted into a Rating Level. The Rating Level allows for character corrections to be added to account for particular characteristics of the sound that may be perceived as more annoying. In particular the Rating Level considers tonality, impulsivity and intermittency of the sound, as well other sound characteristics that are neither tonal, impulsive, or intermittent, but are otherwise readily distinctive against the residual acoustic environment.

6.2.1.1 Tonality

With regards to tonality, BS 4142 states:

'For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible.'

Electrical plant such as power transformers are often inherently tonal at source, typically in the 100 Hz frequency band. BS 4142 corrections, however, are only applied if the noise characteristics are present at the receptor location, not at the source location. Although none of the source data used within the model indicates any tonality, consideration of the predicted one-third octave levels at the identified receptors confirmed that tonality will not be noticeable from any plant. As such, no tonal character correction was applied.

6.2.1.2 Impulsivity

With regards to impulsivity, BS 4142 states:

'A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible.'

Impulsivity is not considered to be a relevant sound characteristic of a Solar Farm as when operational, the noise level will be predictable and consistent.

6.2.1.3 Intermittency

The intermittency of the sound source needs to be considered when it has identifiable on/off conditions with regards to intermittency, BS 4142 states:

'If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.'

As with impulsivity, intermittency is not considered to be a relevant sound characteristic in this case. Once operational, noise levels may fluctuate by a small amount over long periods of time, but no step changes in noise level are anticipated.

6.2.1.4 Other Sound Characteristics

With regards to other sound characteristics, BS 4142 states:

'Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.'

Based on TNEI's understanding and experience of this type of plant, we do not anticipate any additional sound characteristics that would be considered readily distinctive against the residual acoustic environment.

6.2.1.5 Calculation of the Rating Level

With due regard to the above, no character corrections were required. Therefore, the BS 4142 Rating Levels are equal to the Specific Sound Levels presented in Table 5-6.

6.2.2 Assessment of the Impacts

BS 4142, Section 11, requires that the assessment considers the context in which the sound occurs, and as such there is no definitive pass/fail element to the standard. However, as a starting point the standard states:

'Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following…

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.'

Table 6-3 presents a comparison of the Rating Levels to the daytime and night-time background sound levels.

Table 6-3: Margin Above / Below (+/-) Background Sound Level, dB.

Noise Assessment Location		Rating Level, $L_{Aeq\ (t)}$		Daytime		Night-time	
NAL ID	NAL Descriptor	Daytime	Night-time	Background, dB L_{A90} (15mins)	Margin dB	Background, dB L_{A90} (15mins)	Margin dB
NAL01a	Alleston Farm A	35	21	35	0	26	-5
NAL01b	Alleston Farm B	37	22	35	2	26	-4
NAL02	Upper Longstone	35	23	36	-1	26	-3
NAL03	Lower Lamphey Road A	28	15	36	-8	26	-11
NAL04	Warmsly	38	21	36	2	26	-5
NAL05	Ashton Villa	36	20	36	0	26	-6
NAL06	Lower Lamphey Road B	36	19	36	0	26	-7
NAL07	Lamphey A	29	13	36	-7	26	-13
NAL08	Lamphey B	27	11	31	-4	25	-14
NAL09	Rushmore	26	10	31	-5	25	-15
NAL10	Westhill	28	12	31	-3	25	-13
NAL11	Herbertsmoor	31	13	31	0	25	-12
NAL12	Lammaston Farm	32	15	31	1	25	-10

The Rating Level is below or equal to the representative background sound level at all NALs during the daytime with the exception of NALs 01b, 04 and 12, and at all NALs during the night-time periods, which is '*an indication of the specific sound source having a low impact, depending on the context*' according to BS 4142.

The maximum exceedance of the representative background sound level at NALs 01b, 04 and 12 is 2 dB, which is less than the 5 dB exceedance threshold that is *'an indication of an adverse impact, depending on the context.'*

The context in which the assessment was made is as follows:

- The primary noise generation mechanism for all plant associated with the proposed development is related to cooling. The noise model assumes all items of cooling plant (except for the solar string inverters during the night-time) are operating at maximum noise level output. However, for much of its operation, the Proposed Development will be functioning at lower capacities and overall sound output will be reduced.
- Noise immission levels will remain well below the fixed guideline values as detailed in BS 8233 for all receptors and for all time periods.

The consideration of the context does not change the BS 4142 assessment outcome, and the conclusion is that the Proposed Development is not expected to have an adverse impact in terms of noise at any noise sensitive receptor.

7 Discussion and Draft Planning Condition

The assessment considered the likely noise level immission from the Proposed Development based on candidate plant and typical noise control options. Source noise levels of individual items of plant, however, will vary as the final plant specifications and required control measures are determined during a commercial tendering process. Accordingly, the predicted noise levels presented in this report, or the noise levels at source, should not be used to specify particular noise level limits.

Rather, it is more appropriate to consider the noise immissions received at the nearest NSRs with regards to the existing sound levels in the area (as assessed by BS 4142). This allows appropriate levels of protection to be allocated to the nearest receptors, giving comfort to residents and the Local Planning Authority, whilst providing the developer with sufficient flexibility in the design and specification of plant during the tendering process.

Accordingly, the following planning condition to control operational noise effects is proposed:

'Noise from the operation of the Development shall not exceed 5 dB above the background sound levels as measured or calculated at the nearest lawfully existing or consented residential dwellings when measured in accordance with BS 4142:2014+A1:2019.'

8 Summary

In order to predict the noise immission levels of the Proposed Development, TNEI produced a noise propagation model in accordance with ISO 9613 based on candidate plant typical for this type of development. The noise model assumed that all plant, with the exception of the solar string inverters during the night-time period, will be operating at full capacity, continuously and concurrently, however, this is unlikely to occur for the majority of the time. Accordingly, the noise assessment is deemed to be conservative.

A quantitative assessment was undertaken and has concluded that predicted operational noise levels from the Proposed Development would remain comfortably below the fixed guideline levels detailed in BS 8233 for the daytime and night-time assessment periods.

A qualitative assessment was undertaken in accordance with BS 4142, which concluded that during the daytime and night-time, the rating levels from the Proposed Development at all NALs *'does not exceed 5 dB above the background sound level'* which is *'an indication of the specific sound source(s) having a low impact, depending on the context.'*

Accordingly, the NIA concludes, based on the candidate plant considered within the assessment, that operational noise levels from the Proposed Development will not have an adverse noise impact on the nearby noise sensitive receptors.

9 References

1. **Welsh Government.** *Planning Policy Wales.* s.l. : Welsh Government, 2024.

2. —. *Noise and Soundscape Plan for Wales.* s.l. : Welsh Government, 2023.

3. —. *Technical Advice Note (TAN) 11: Noise.* s.l. : Welsh Government, 1997.

4. **British Standards Institute.** *Methods for Rating and Assessing Industrial and Commercial Sound.* UK : BSI, 2014. BS4142:2014 + A1:2019.

5. —. *Guidance on Sound Insulation and Noise Reduction for Buildings.* UK : BSI, 2014. BS8233:2014.

6. **Datakustik GmbH.** CadnaA. 2024.

7. **(ISO), International Organization for Standardization.** *Acoustics – Attenuation of Sound During Propagation Outdoors: Part 2 – General Method of Calculation.* Geneva : (ISO), International Organization for Standardization, 1996. ISO 9613-2:1996.

8. **Commission Electrotechnique Internationale (IEC).** *Electroacoustics - Sound level meters - Part 1: Specifications.* Geneva : IEC, 2013. IEC 61672-1:2013.

Appendix A – Glossary of Terms

Attenuation: the reduction in level of a sound between the source and a receiver due to any combination of effects including: distance, atmospheric absorption, acoustic screening, the presence of a building façade, etc.

Background Sound Level: the sound level rarely fallen below in any given location over any given time period, often classed according to daytime, evening or night-time periods. The LA90 indices (see below) are typically used to represent the background sound level.

Broadband Noise: noise with components over a wide range of frequencies.

Decibel (dB): the ratio between the quietest audible sound and the loudest tolerable sound is a million to one in terms of the change in sound pressure. A logarithmic scale is used in sound level measurements because of this wide range. The scale used is the decibel (dB) scale which extends from 0 to 140 decibels (dB) corresponding to the intensity of the sound level.

dB(A): the ear has the ability to recognise a particular sound depending on its pitch or frequency. Microphones cannot differentiate sound in the same way as the ear, and to counter this weakness the sound measuring instrument applies a correction to correspond more closely to the frequency response of the human ear. The correction factor is called 'A Weighting' and the resulting measurements are written as dB(A). The dB(A) weighting is internationally accepted and has been found to correspond well with people's subjective reaction to sound levels and noise. Some typical subjective changes in sound levels are:

- a change of 3dB(A) is just perceptible;
- a change of 5dB(A) is clearly perceptible; and
- a change of 10dB(A) is twice (or half) as loud.

Directivity: the property of a sound source that causes more sound to be radiated in one direction than another.

Emission: the sound energy emitted by a sound source (e.g. a wind turbine).

Frequency: the pitch of a sound in Hz or kHz. See Hertz.

Ground Effects: the modification of sound at a receiver location due to the interaction of the sound waves with the ground along its propagation path from source to receiver. Described using the term 'G', and ranges between 0 (hard ground), 0.5 (mixed ground) and 1 (soft ground).

Hertz (Hz): sound frequency refers to how quickly the air vibrates, or how close the sound waves are to each other (in cycles per second, or Hertz (Hz)).

Immission: the sound pressure level detected at a given location (e.g. the nearest dwelling).

Noise: unwanted sound.

L_w: is the sound power level. It is a measure of the total sound energy radiated by a sound source and is used to calculate sound levels at a distant location. The *LWA* is the A-weighted sound power level.

L_{eq}: is the equivalent continuous sound level, and is the sound level of a steady sound with the same energy as a fluctuating sound over the same period. It is possible to consider this level as the ambient noise encompassing all noise at a given time. The $L_{Aeq,T}$ is the A-weighted equivalent continuous sound level over a given time period (T).

L_{90}: index represents the sound level exceeded for 90 percent of the measurement period and is used to indicate quieter times during the measurement period. It is often used to measure the background sound level. The $L_{A90,10min}$ is the A-weighted background sound level over a ten-minute measurement sample.

Sound Level Meter: an instrument for measuring sound pressure level.

Sound Pressure Level: a measure of the sound pressure at a point, in decibels.

Tonal Noise: noise which covers a very restricted range of frequencies (e.g., a range of ≤20 Hz). This noise is subjectively more annoying than broadband noise.

Appendix B – Development Information

Site entrance

Field Entrances

Field Entrances

Temporary Construction Compounds

Point of Connection (POC)

33-132kV Substation

Comms tower

Control room

Field Entrances

Perimeter Fence

Site Boundary

Ancient woodland

Streams

Field Entrances

Existing footpath

Footpath suggested rerouting

0m 50m 100m 150m 200m 250m 300m

REFERENCES

SUMMARY NOTES

1. All dimensions are in 'mm' unless otherwise indicated.
2. Any deviations to be recorded and communicated to Statkraft.
3. The following ecological buffers have been applied:
   - 3.1. 10m from hedgerows and ditches (and other watercourses)
   - 3.2. 20m from ponds and woodland
   - 3.3. 15m from mature trees

SYSTEM SUMMARY

GEOGRAPHICAL COORDINATES	51.66454, -4.88828
LAND OWNERSHIP AREA (GROSS)	96.3 ha
FENCED PV AREA	39.9 ha
MAXIMUM GRID EXPORT CAPACITY	30 MW
PV MODULE TYPE	Crystalline
INVERTER TYPE	String
STRUCTURE TYPE	Fixed

LEGEND

- Overhead Line (OHL)
- Perimeter Fence
- Site Boundary
- Telecommunications Line
- Existing Footpath
- Proposed Footpath
- Maintenance Track
- Existing Roads
- Trees
- Hedgerows
- Transformer Station
- PV Structure
- Gates
- Water Bodies
- Connection route
- CCTV Camera
- Weather station
- Transformer station excavation zone

PROPOSAL ONLY

Key Plan
1:16000

HV substation

PV areas

Site Boundary

Statkraft

Main office in UK
19th Floor,
22 Bishopsgate,
London,
EC2N 4BQ

T +44 (0)20 7549 1000

info@statkraft.com
www.statkraft.com

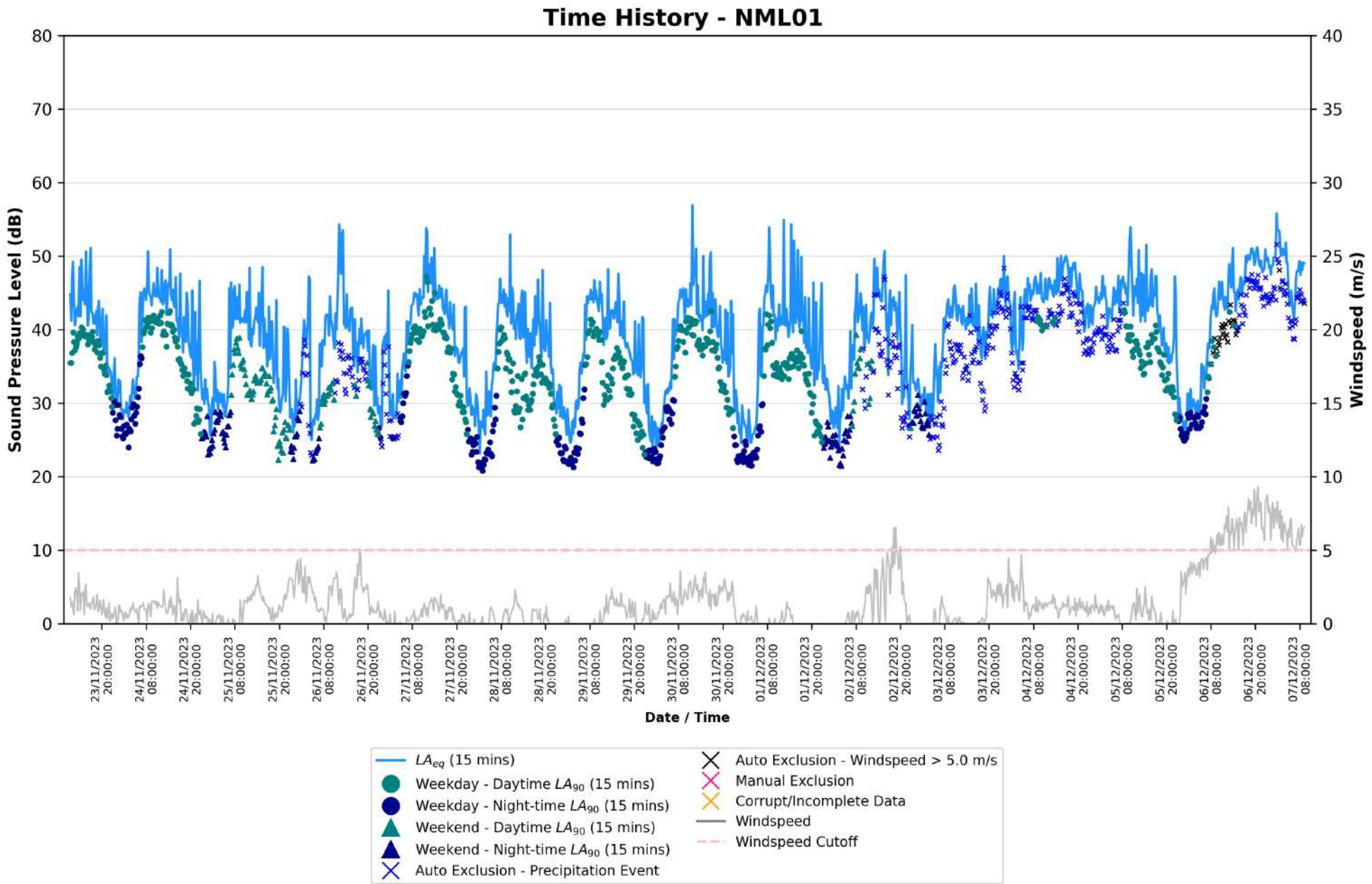
REV	DATE	DESCRIPTION	DRAWN	APPRV
K	23/08/2024	New NGED substation	PPH	AEP
J	19/07/2024	Minor update	PPH	AEP
I	16/07/2024	Major layout update	PPH	AEP
H	28/06/2024	Revised for archaeological data	PPH	AEP
G	03/06/2024	3P10, revised roads + fences	PPH	CRO

General PV Layout — SCALE 1:3000 A1

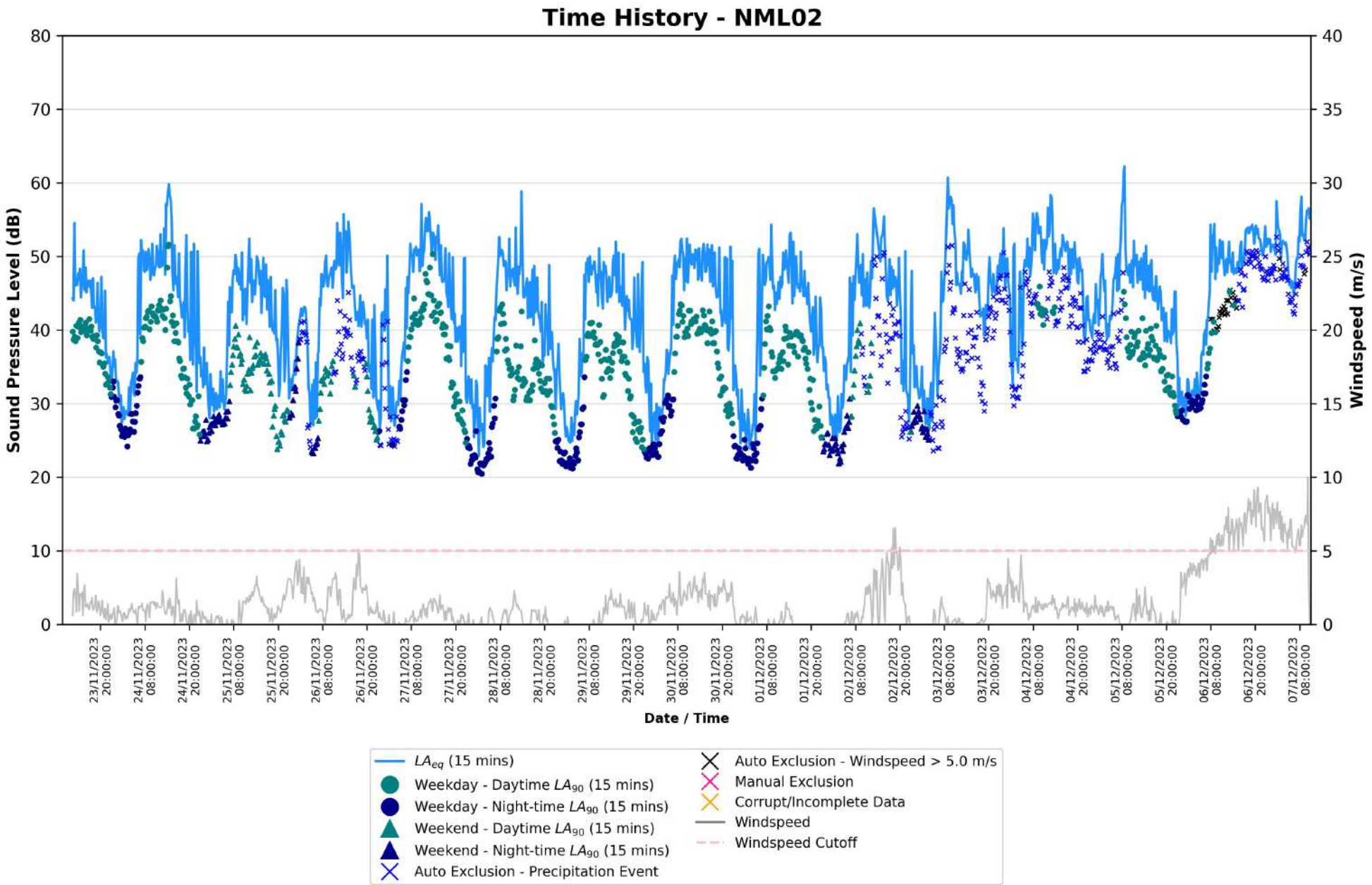
SCUKX-ALLES-000-PVL-100.01K — SHEET 1 of 1

Appendix C – Baseline Survey Information

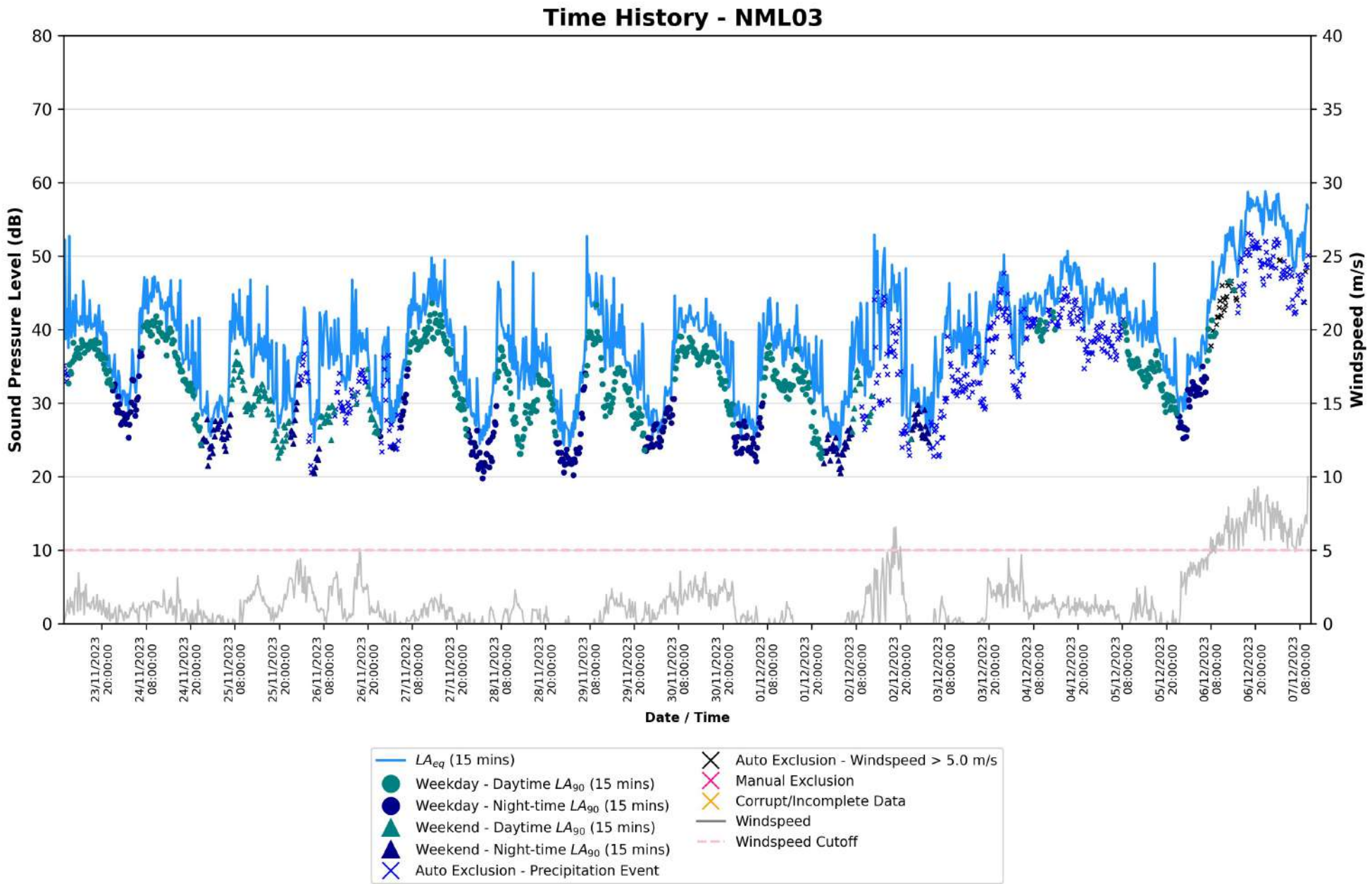
16267 - Alleston Solar Farm - Measured Sound Levels:



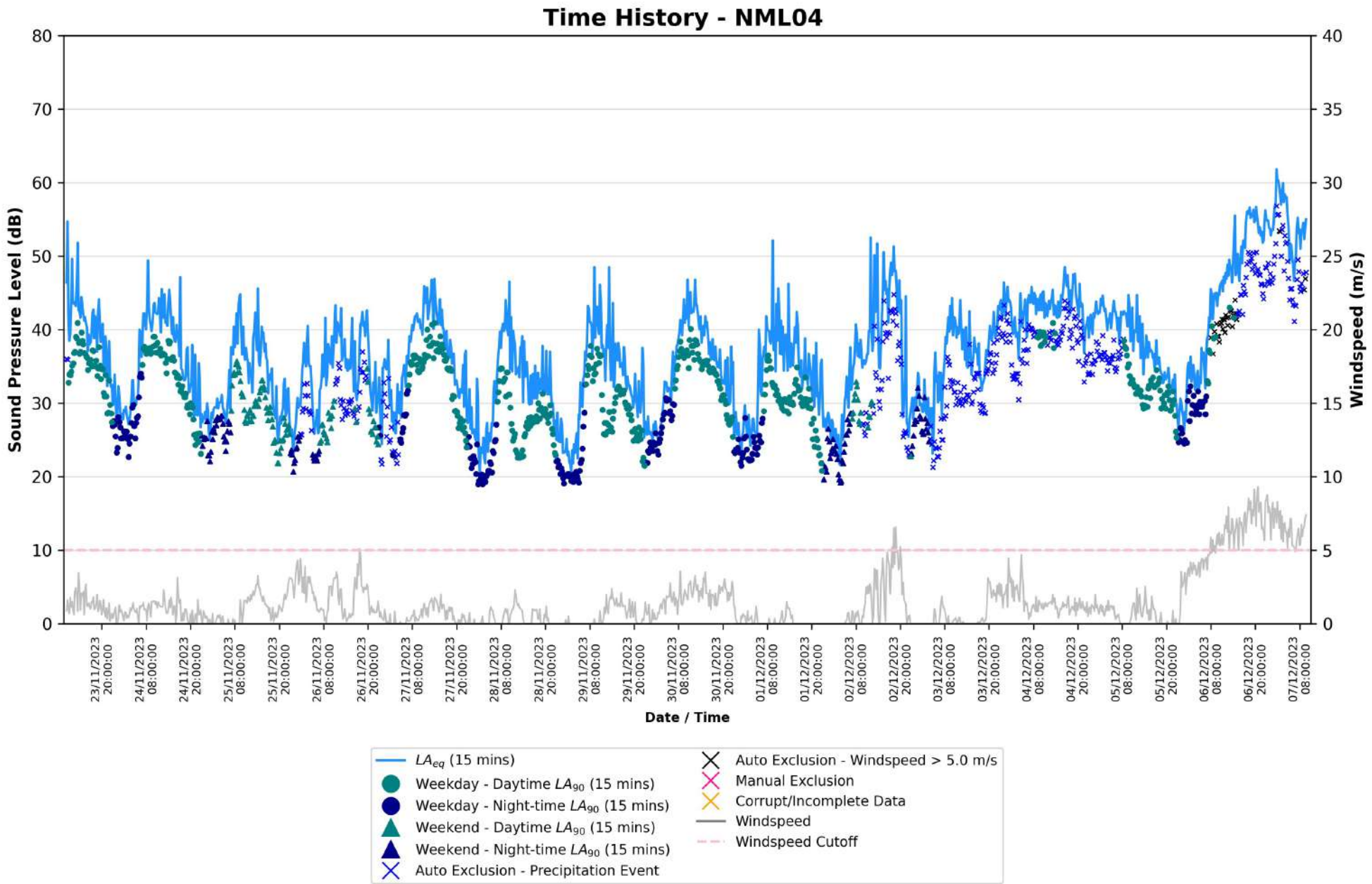
16267 - Alleston Solar Farm - Measured Sound Levels:



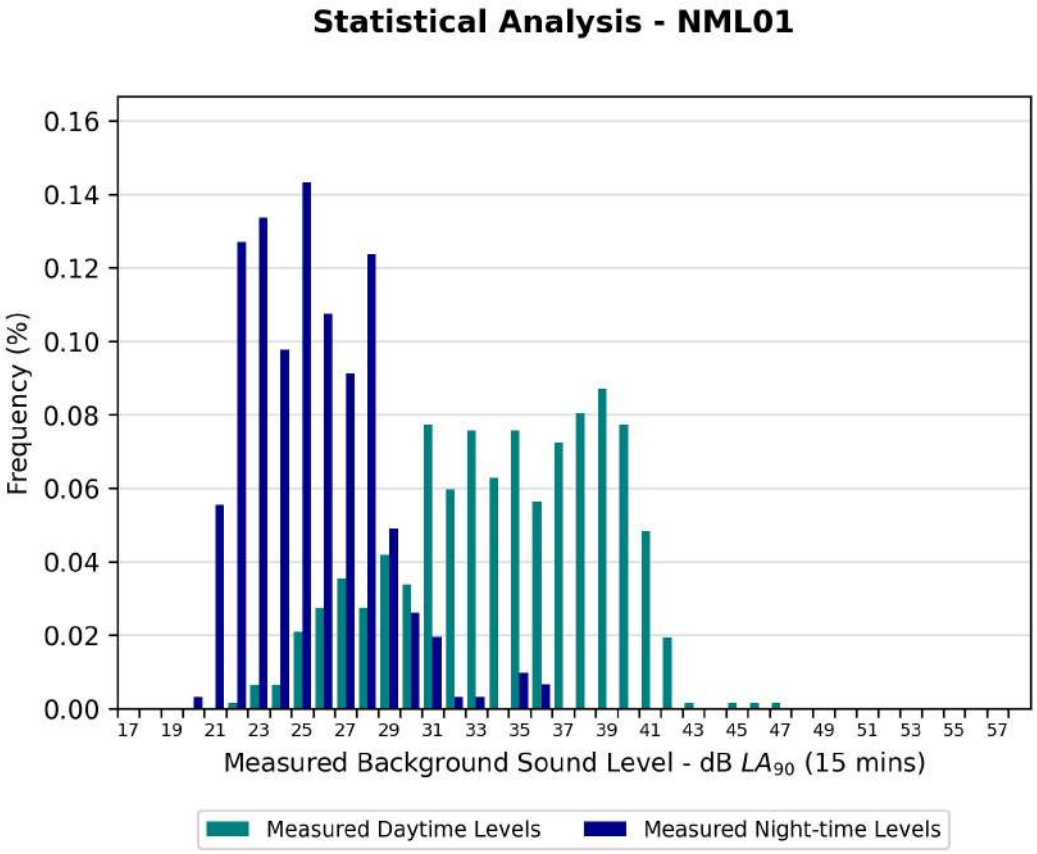
16267 - Alleston Solar Farm - Measured Sound Levels:

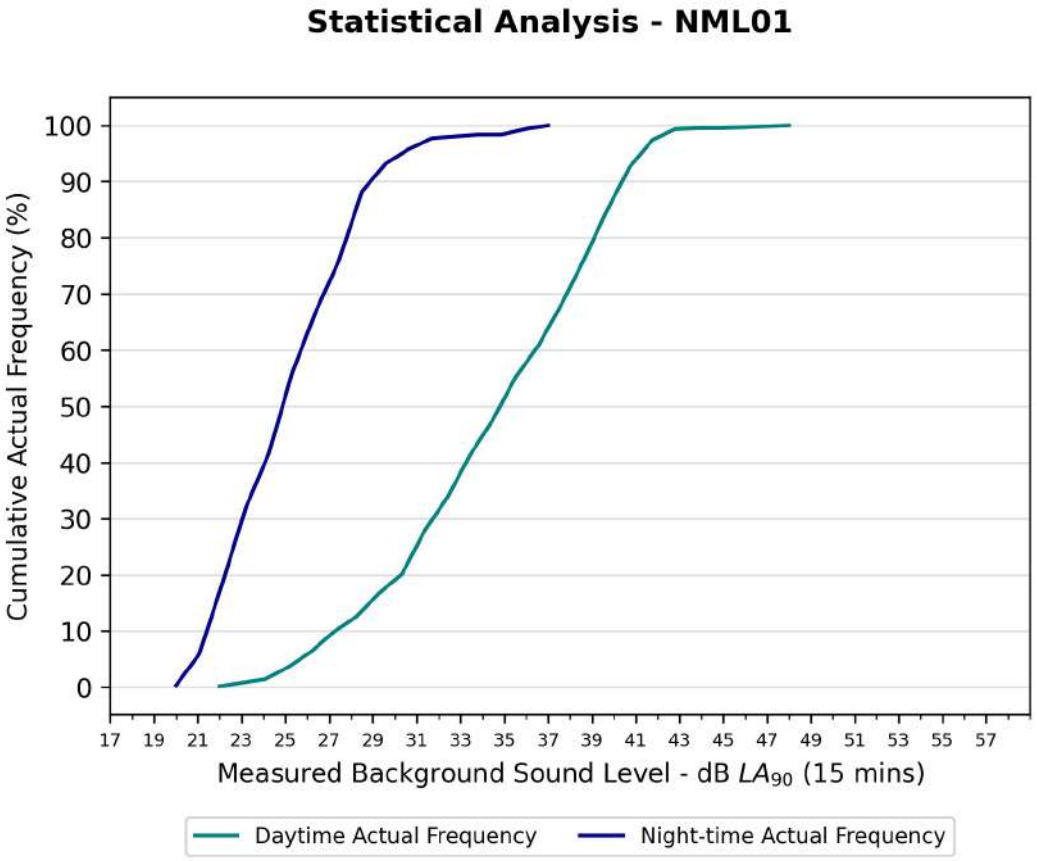


16267 - Alleston Solar Farm - Measured Sound Levels:

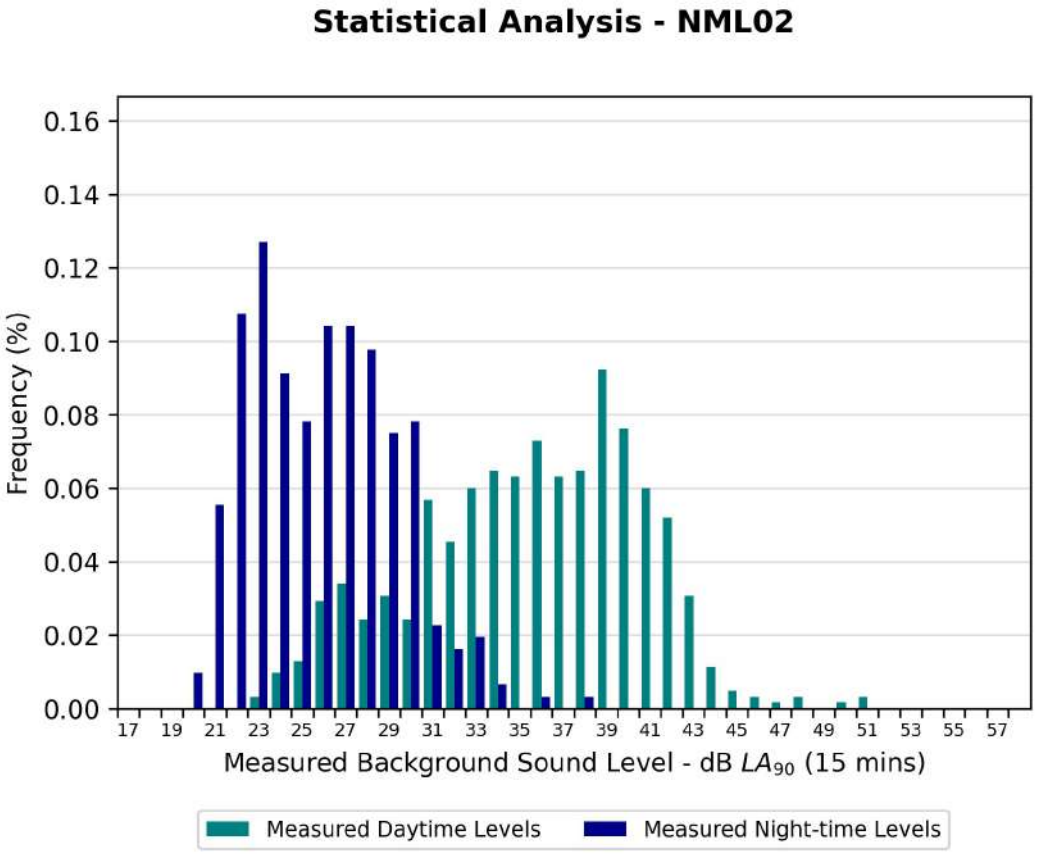


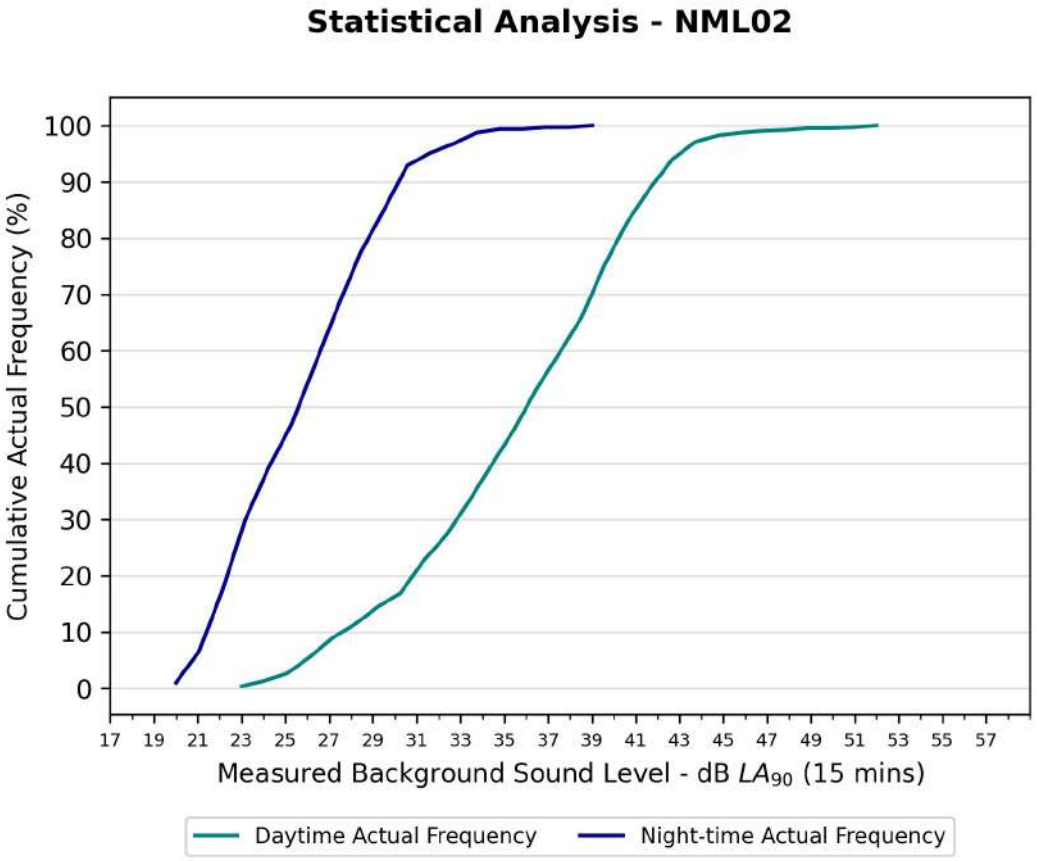
16267 - Alleston Solar Farm - Measured Sound Levels:



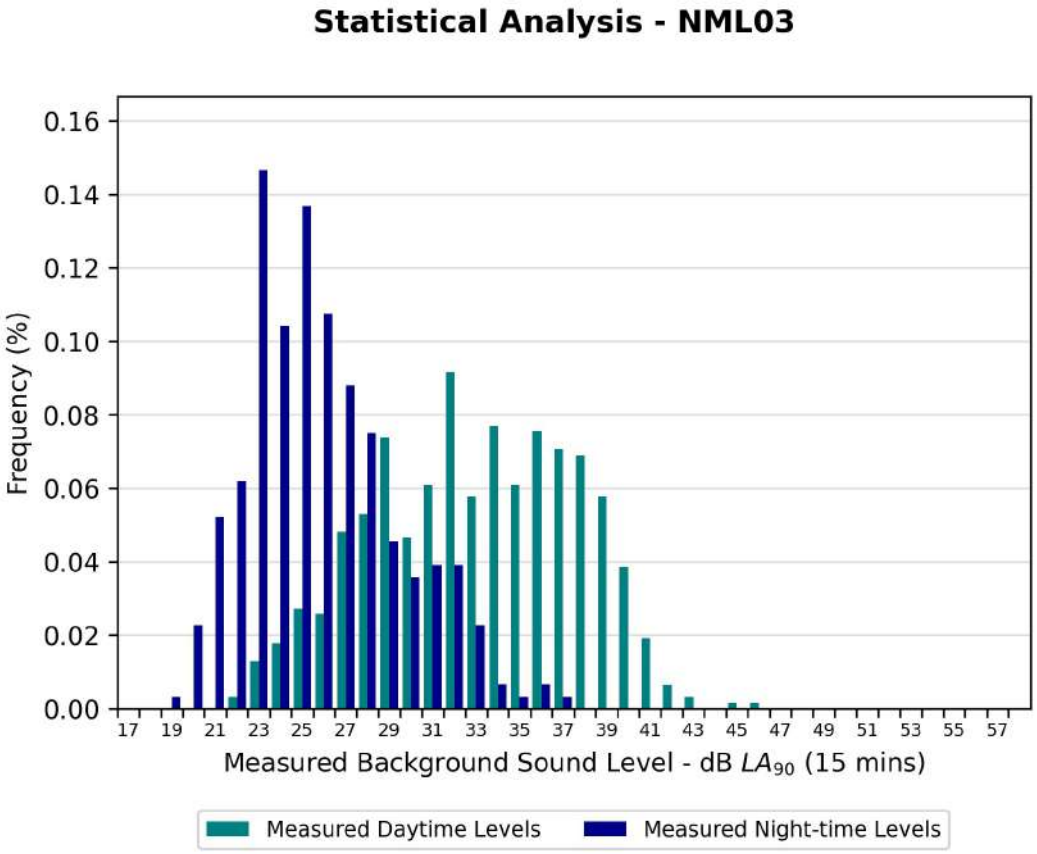


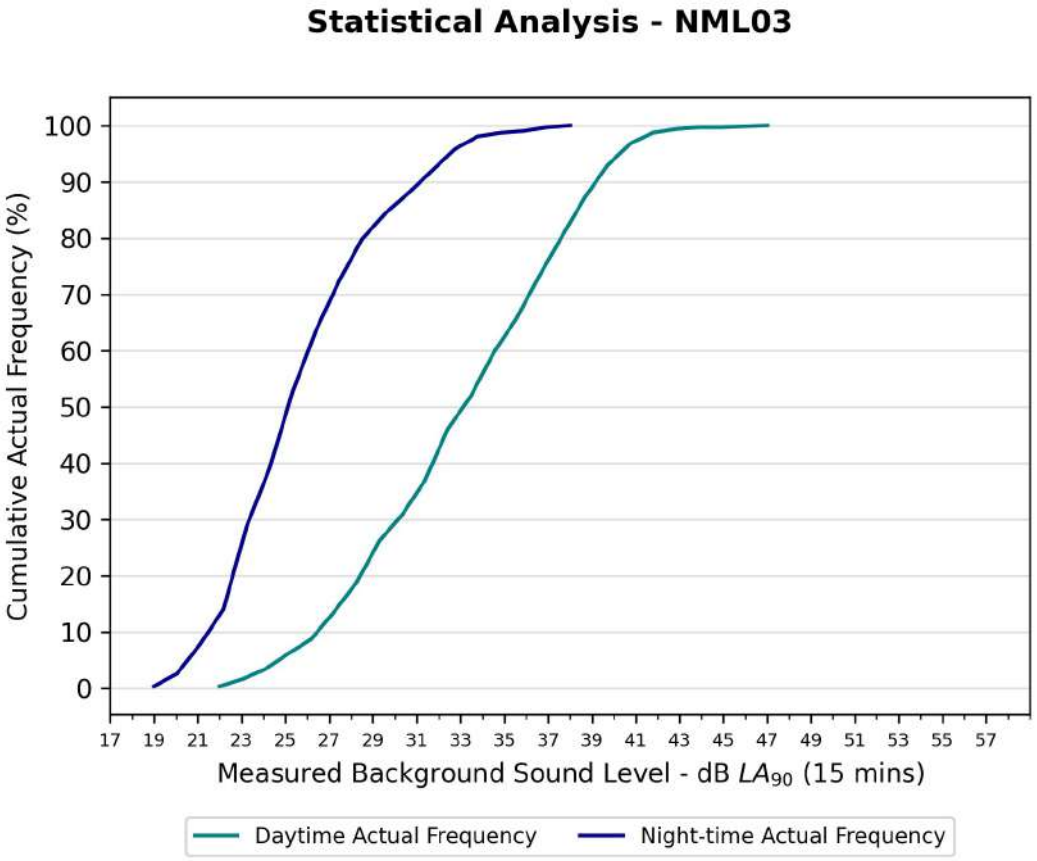
16267 - Alleston Solar Farm - Measured Sound Levels:



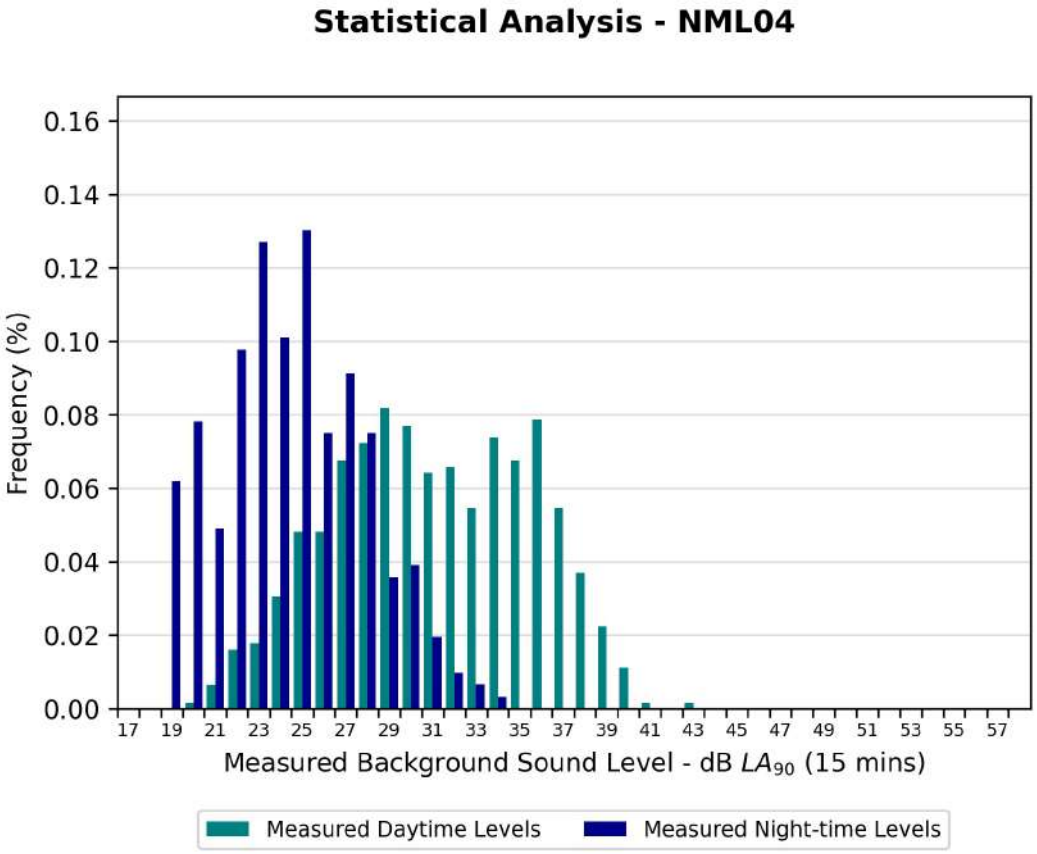


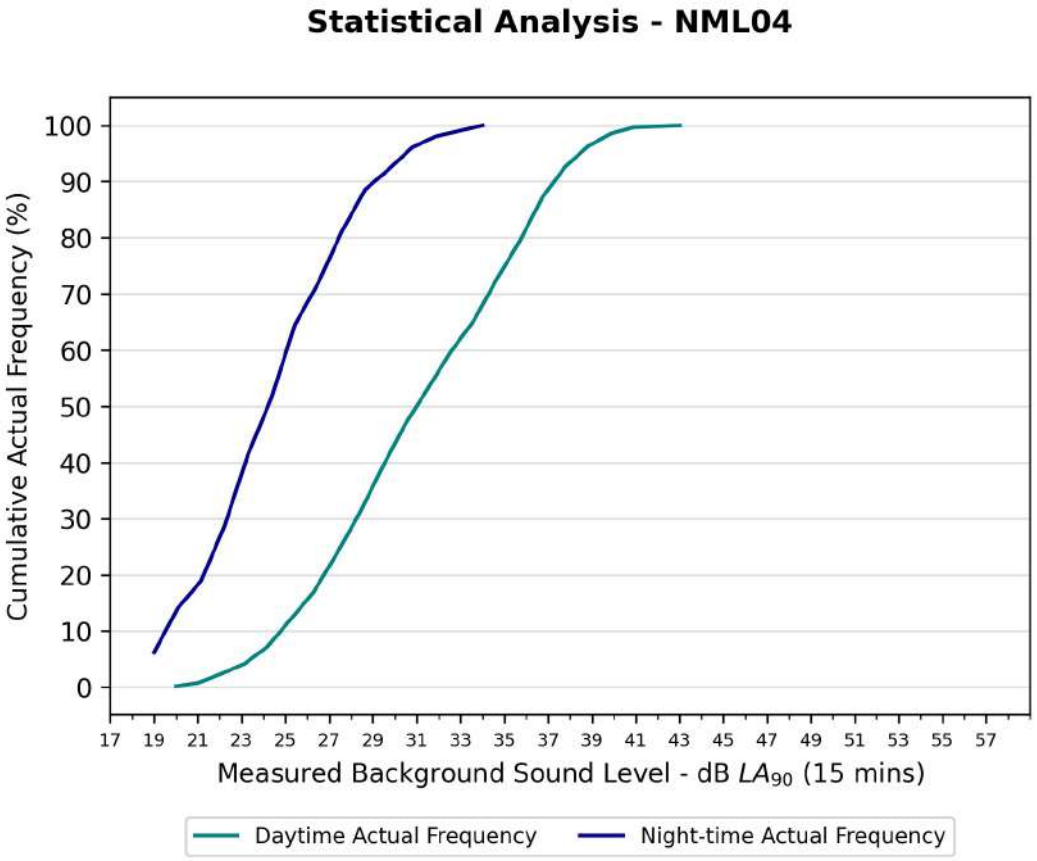
16267 - Alleston Solar Farm - Measured Sound Levels:





16267 - Alleston Solar Farm - Measured Sound Levels:





16267 – Alleston Solar Farm - Noise Monitoring Location (NML) Photos

NML01

NML02

Project Nb.& Name	16267 – Alleston Solar Farm
Client	Statkraft Ltd.

MONITORING LOCATION DETAILS

NML Nb. and Name	NML01
NML Contact Details (Name, address, phone nb..)	-
Description/Reason for exact location and Grid Coordinates	Representative of NSRs located within the centre of the proposed development boundary. X: 200460 Y: 200170

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM61	NL-52	00721060	12/10/2022
Pre Amplifier				
Microphone				
Calibrator				

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	L_{EQ}, L_{90}	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20 – 110 dB	
Audio (No ,Yes 16Khz/16bit ...)	No	
Other (GMT/BST)	GMT	
Resident Comments Sheet	N/A	
Resident consent to use photographs	N/A	

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90...)	Time Interval (10min,10s..)	Time Weighting (Fast ...)	Range (20-110 ...)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible...	Snow/River Present?
1	WC/MR	0101	23/11/2023 11:30	07/12/2023 09:20	94.0	93.8	x	x	x	x	x	x	x	x	-
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	**INSTALLATION** - Road noise to north audible - Farm dogs heard - Birdsong also - Helicopter heard overhead - Moderate breeze, wind induced noises
	DECOMMISSIONING - Quite windy - Prominent noise from wind induced noise from vegetation - Farm dogs barking

Project Nb.& Name	16267 – Alleston Solar Farm
Client	Statkraft Ltd.

MONITORING LOCATION DETAILS

NML Nb. and Name	NML02
NML Contact Details (Name, address, phone nb..)	-
Description/Reason for exact location and Grid Coordinates	Representative of NSRs located to the north and northeast of the proposed development boundary. X: 200467 Y: 200503

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM60	NL-52	00721002	05/09/2022
Pre Amplifier				
Microphone				
Calibrator				

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	L_{EQ}, L_{90}	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20 – 110 dB	
Audio (No ,Yes 16Khz/16bit ...)	No	
Other (GMT/BST)	GMT	
Resident Comments Sheet	N/A	
Resident consent to use photographs	N/A	

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90...)	Time Interval (10min,10s..)	Time Weighting (Fast ...)	Range (20-110 ...)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible...	Snow/River Present?
1	WC/MR	0201	23/11/2023 11:45	07/12/2023 11:08	94.0	93.9	x	x	x	x	x	x	x	x	-
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	**INSTALLATION** - Road noise to north quite prominent - Corona discharge heard from nearby pylons - Birdsong also prominent - Moderate breeze, wind induced vegetation noises
	DECOMMISSIONING - Quite windy and rainy - Wind induced noise from vegetation - Road noise heard but not too loud as road quite quiet at time of visit

Project Nb.& Name	16267 – Alleston Solar Farm
Client	Statkraft Ltd.

MONITORING LOCATION DETAILS

NML Nb. and Name	NML03
NML Contact Details (Name, address, phone nb..)	-
Description/Reason for exact location and Grid Coordinates	Representative of NSRs located to the west of the proposed development boundary. X: 199999 Y: 200081

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM58	NL-52	00721000	05/09/2022
Pre Amplifier				
Microphone				
Calibrator				

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	L_{EQ}, L_{90}	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20 – 110 dB	
Audio (No ,Yes 16Khz/16bit ...)	No	
Other (GMT/BST)	GMT	
Resident Comments Sheet	N/A	
Resident consent to use photographs	N/A	

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90...)	Time Interval (10min,10s..)	Time Weighting (Fast ...)	Range (20-110 ...)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible...	Snow/River Present?
1	WC/MR	0301	23/11/2023 09:45	07/12/2023 09:48	94.0	93.9	x	x	x	x	x	x	x	x	-
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	**INSTALLATION** - Distant Road Traffic - Corona discharge heard from nearby pylons - Birdsong also prominent - Passing Train heard - Moderate breeze, wind induced vegetation noises
	DECOMMISSIONING - Quite windy and rainy - Wind induced noise from vegetation dominant

Project Nb.& Name	16267 – Alleston Solar Farm
Client	Statkraft Ltd.

MONITORING LOCATION DETAILS

NML Nb. and Name	NML04
NML Contact Details (Name, address, phone nb..)	-
Description/Reason for exact location and Grid Coordinates	Representative of NSRs located to the south, southeast and southwest of the proposed development boundary. X: 200598 Y: 199677

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM59	NL-52	00721001	05/09/2022
Pre Amplifier				
Microphone				
Calibrator				

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	L_{EQ}, L_{90}	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20 – 110 dB	
Audio (No ,Yes 16Khz/16bit ...)	No	
Other (GMT/BST)	GMT	
Resident Comments Sheet	N/A	
Resident consent to use photographs	N/A	

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90...)	Time Interval (10min,10s..)	Time Weighting (Fast ...)	Range (20-110 ...)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible...	Snow/River Present?
1	WC/MR	0401	23/11/2023 10:30	07/12/2023 10:30	94.0	93.7	x	x	x	x	x	x	x	x	-
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	**INSTALLATION** - Distant Road Traffic - Birdsong - Cows Lowing - Moderate breeze, wind induced vegetation noises
	DECOMMISSIONING - Quite windy and rainy - Wind induced noise from vegetation dominant

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 28 March 2023

Certificate Number: UCRT23/1424

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	TNEI Floor 7 80 St Vincent Street Glasgow G2 5UB
Order No.	5001
Test Procedure	Procedure TP 14 Calibration of Sound Calibrators (60942:2017)
Description	Acoustic Calibrator

Identification	*Manufacturer*	*Instrument*	*Model*	*Serial No.*
	Rion	Calibrator	NC-75	35002724
Public evidence of Type Approval		Yes	Approved by PTB	

The calibrator has been tested as specified in Annex B of IEC 60942:2017. As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2017, the sound calibrator tested is considered to conform to all the class 1 requirements of IEC 60942:2017.

ANV Job No.	UKAS23/03225	
Date Received	27 March 2023	
Date Calibrated	28 March 2023	
Previous Certificate	*Dated*	21 March 2022
	Certificate No.	UCRT22/1402
	Laboratory	0653

Measurements

The sound pressure level generated by the calibrator (averaged over a 20 to 25 second period) in its WS2 configuration was measured five times (rotating the calibrator on the microphone each time) by the Insert Voltage Method using a microphone as detailed below. The mean of the results obtained is shown below.

The frequency of the sound from the calibrator was measured five times over a 20 to 25 second period and the average frequency calculated.

The total distortion + noise of the sound from the calibrator was measured, using a rejection filter distortion factor meter, five times over a 20 to 25 second period and the average distortion + noise calculated.

Test Microphone — *Manufacturer*: Brüel & Kjær — *Type*: 4134

Nominal Setting dB / Hz	Mean Level dB rel 20 µPa	Frequency	Distortion + Noise
94 / 1000	94.01 ± 0.10	1000.00 ± 0.12Hz	(0.12 ± 0.02) %

Environmental conditions during tests	Start	End		
Temperature	21.24	21.12	± 0.30	°C
Humidity	38.5	38.8	± 3.0	%RH
Ambient Pressure	100.858	100.849	± 0.030	kPa

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

The uncertainties refer to the measured values only with no account being taken of the ability of the instrument to maintain its calibration.

A small correction factor may need to be applied to the sound pressure level quoted above if the device is used to calibrate a sound level meter which is fitted with a free-field response microphone. See manufacturers handbook for details.

Note: Calibrator adjusted prior to calibration? NO

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
None

Calibrated by: B. Bogdan R 2

END

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**12 October 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF102205**

	Manufacturer	Type	Serial Number
Sound Level Meter	Rion	NL-52	00721060
Preamplifier	Rion	NH-25	22166
Microphone	Rion	UC-59	22048

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 12 October 2022

B. Bogdan

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
☎ 01908 642846 🖷 01908 642814
✉ info@noise-and-vibration.co.uk 💻 www.noise-and-vibration.co.uk

SLM [redacted]60

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**05 September 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF092201**

	Manufacturer	**Type**	**Serial Number**
Sound Level Meter	Rion	NL-52	00721002
Preamplifier	Rion	NH-25	22108
Microphone	Rion	UC-59	21941

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 05 September 2022

B. Bogdan

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
☎ 01908 642846 🖷 01908 642814
✉ info@noise-and-vibration.co.uk 💻 www.noise-and-vibration.co.uk

SLM58

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**05 September 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF092203**

	Manufacturer	**Type**	**Serial Number**
Sound Level Meter	Rion	NL-52	00721000
Preamplifier	Rion	NH-25	22106
Microphone	Rion	UC-59	21938

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 05 September 2022

B. Bogdan

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
☎ 01908 642846 🖷 01908 642814
✉ info@noise-and-vibration.co.uk 💻 www.noise-and-vibration.co.uk

SLM[redacted]59

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**05 September 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF092202**

	Manufacturer	**Type**	**Serial Number**
Sound Level Meter	Rion	NL-52	00721001
Preamplifier	Rion	NH-25	22107
Microphone	Rion	UC-59	21939

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 05 September 2022

B. Bogdan

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
☎ 01908 642846 🖹 01908 642814
✉ info@noise-and-vibration.co.uk 💻 www.noise-and-vibration.co.uk

Appendix D – Noise Modelling Data

Transformer Data Sheet 275/13.8/13.8 kV, 140/70/70 MVA, ONAN/ONAF, 3 phase

Transformer Details

Continuous Maximum Rating		
HV – LV1 and HV – LV2	MVA	47/70 – 47/70
HV – (LV1 + LV2)	MVA	94/140
HV Voltage	(kV)	275
LV1 – LV2 Voltage	(kV)	13.8 – 13.8
Tapping Range (OLTC)		275 kV -19.5% to +25.5% 31 positions, 30 x 1.5% steps Principal tap shall be position 18
Impedance at principal tap – position 18 (%)		
HV – LV1 and HV – LV2 @ 70 MVA		14.0%
HV – (LV1 + LV2) @ 140 MVA		15.6%
LV1 – LV2 @ 70 MVA		25.0%
Vector Group		YNd11-d11
Cooling		ONAN/ONAF
Maximum Top Oil Rise	(°C)	60
Maximum Average Winding Rise	(°C)	65
Frequency	(Hz)	50
Connections:		
HV		Oil/air bushings
HVN		Oil/air bushing
LV		Oil/air bushing
Finish Shade		BS 381C – 632 Dark Admiralty Grey
Maximum Sound Pressure Level		
Transformer only	dB(a)	65
Transformer plus coolers	dB(a)	68
BIL HV/LV	kVp	1050/125
BIL HVN	kVp	125
SIL HV (kVp)	kVp	850
IVPD enhanced level		1.8
IVPD one-hour level		1.58
Applied Voltage		
HV to LV and earth	kV_{rms}	395
LV to HV and earth	kV_{rms}	38

Guaranteed Losses		Transformer losses shall be such as to comply with EU 548/2014, Tier 2 July 2021.
Minimum efficiency		99.770%.

Technical Schedules

Item	Units	Specified by Company	Guaranteed by GE
Continuous Maximum Rating			
HV – LV1 and HV – LV2	MVA	47/70 – 47/70	47/70 – 47/70
HV – (LV1 + LV2)	MVA	94/140	94/140
HV Voltage	(kV)	275	275
LV1 – LV2 Voltage	(kV)	13.8 – 13.8	13.8 – 13.8
Tapping Range (OLTC)		275 kV -19.5% to +25.5% 31 positions, 30 x 1.5% steps Principal tap position 18	275 kV -19.5% to +25.5% 31 positions, 30 x 1.5% steps Principal tap position 18.
Impedance at principal tap – position 18			
HV – LV1 and HV – LV2 @ 70 MVA		14.0%	14% (IEC tolerance +/- 7.5%)
HV – (LV1 + LV2) @ 140 MVA		15.6%	15.6% (IEC tolerance +/10%)
LV1 – LV2 @ 70 MVA		25.0%	25% (IEC tolerance +/-10%)
Impedance at maximum tap position 1			
HV – LV1 and HV – LV2 @ 70 MVA		-	16.4% (IEC tolerance +/10%)
HV – (LV1 + LV2) @ 140 MVA		-	17% (IEC tolerance +/10%)
LV1 – LV2 @ 70 MVA		-	TBA
Impedance at minimum tap position 31			
HV – LV1 and HV – LV2 @ 70 MVA		-	15.2% (IEC tolerance +/10%)
HV – (LV1 + LV2) @ 140 MVA		-	15.9% (IEC tolerance +/10%)
LV1 – LV2 @ 70 MVA		-	TBA
Vector Group		YNd11-d11	YNd11-d11
Cooling		ONAN/ONAF	ONAN/ONAF
Maximum Top Oil Rise	(°C)	60	60k
Maximum Average Winding Rise	(°C)	65	65k
Frequency	(Hz)	50	50
Connections:			
HV		Oil/air bushings	Oil/air bushings
HVN		Oil/air bushing	Oil/air bushings
LV		Oil/air bushing	Oil/air bushings
Finish Shade		BS 381C – 632 Dark Admiralty Grey	BS 381C – 632 Dark Admiralty Grey
Maximum Sound Pressure Level			
Transformer only	dB(a)	65	65 @1m. Sound Intensity method
Transformer plus coolers	dB(a)	68	68 @2m. Sound Intensity method
BIL HV/LV	kVp	1050/125	1050/125
BIL HVN	kVp	125	125
SIL HV (kVp)	kVp	850	850 (IEC60076-3 – Table 2)
IVPD enhanced level		1.8	1.8

IVPD one-hour level		1.58	1.58
Applied Voltage			
HV to LV and earth	kV_{rms}	395	395
LV to HV and earth	kV_{rms}	38	38
Guaranteed Losses			
No load	kW	EU 548/2014, Tier 2 July 2021	54 @1pu rated Voltage.
Full load	kW	EU 548/2014, Tier 2 July 2021	440 @ 140MVA, both LV's loaded on Nom Tap Pos 18
Minimum efficiency		99.770%.	99.78%

Core Detail	GE Transformer
Core construction, step-lap etc.	Core type, step lap.
Type of core - 3 limb, 5 limb, etc.	3 Limb.
Core plate material type	M105-30P5.
Core plate material thickness (mm)	0.3
Core diameter (mm)	773
Core area (mm^2)	432400
Flux density at 100% volts & 50 Hz (Tesla)	1.65
Core weight excluding clamps (kg)	51000
Core weight including clamps (kg)	Approximately 55850.
Clamping type, tie-rod, flitch plate	Flitch Plate.
Tie rod diameter, flitch plate thickness (mm)	10
Top/Bottom clamp thickness (mm)	70 / 50
Method of securing (bands, belts etc.)	Bands.

Winding Detail	GE Transformer			
Winding disposition core/__/__/__	LV1 Bottom - LV2 Top / HV / Taps			
Winding name	LV1 Bottom	LV2 Top	HV	Taps
Winding type - spiral/disc etc.	Layer	Layer	Shielded Disc	Disc
Total turns	87	87	1031	240
Total no. of discs/sections	2 layers	2 layers	2 x 70	2 x 32
Turns/disc or section	43.5 T/layer	43.5 T/layer	15	7.5
Min cooling gap between discs/sects (mm)	3	3	4	4
Copper hardness	80MPA	80MPA	80MPA	140MPA
Conductor type	Netted/mylar CTC	Netted/mylar CTC	CTC	Strip
For CTC - No. strips in llel	37	37	9	N/A
Bare conductor size (mm)	4.35 x 1.7	4.35 x 1.7	4.8 x 1.3	9 x 2.6
No. conductors in llel	2	2	1/half stack	2/half stack
Epoxy bonded Y/N	Y	Y	Y	N
Conductor ins - radial enamel/paper (mm)	0.04/0.075 mylar	0.04/0.75 mylar	0.04/0.55	N/A / 0.55
Conductor area (mm^2)	520.4	520.4	108.5	91.4
Max current density @ CMR (A/mm^2)	3.25	3.25	2.71	3.22
Wdg ID/OD (mm)	807 / 977	807 / 977	1109 / 1377	1507 / 1625
Wdg pressed height (mm)	2130 over LV1 + LV2	2130 over LV1 + LV2	2090	1518
Final clamping pressure (kN/mm^2). Based on worst case end force.	3.7	3.7	3.7	3.7
Shield wire used Y/N	N	N	Y	N
Dimensions and ins of shield wire	N/A	N/A	9.7x1 with 0.55 rad PC	N/A
Winding gradient to oil (°C) (ONAF)	13k calc	13k calc	15k calc	17k calc
Max winding hotspot temperature (°C) (ONAF)	69k rise	69k rise	72k rise	74k rise
Position of max wdg hotspot	Top 2 turns	Top 2 turns	Top 2 discs	Top 2 discs

Tank and Fittings	GE Transformer
Tank material	Mild Steel
Sheet thickness (mm) Bottom Sides Top	 25 10 25
Tank external dimensions L/W/H (m)	Refer to Tender General Arrangement Drawing Enclosure 12.1
High/Low kerb?	Low
Tank vacuum withstand (mm of Hg)	0.75 inside tank
Tank overpressure withstand (kPa)	Normal head plus 35 kPa
Tank suitable for skidding in both axes?	Yes
Detail tank wall shunt/flux rejectors	Tank magnetic shunts 15mm thick
Conservator thickness (mm)	8
Conservator size - diameter x length (mm)	Refer to Tender General Arrangement Drawing
Volume between high/low levels (litres)	Refer to Tender General Arrangement Drawing
No. of radiators	20
Radiator height (m)	2.5
No. of radiator elements	28

Intertek

Certificate No. 22552

ASTA Certificate

of Type Tests

Laboratory Ref. No: 19M1677-S-#01

Apparatus: Three phase, 6000 kVA, (30000±2×2.5%)/ 800/ 800 V (Ur), 50 Hz, ONAN, Category II, Dyn11-yn11, non-enclosed oil type transformer. The high voltage winding has 5 taps and the principal tap is tap 3.

Designation: SFL-6000

Client: Huawei Technologies Co., Ltd.
Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

Manufacturer: Jiangsu Huapeng Transformer Co., Ltd.
No.68, Kunlun Development Zone, Liyang City, Jiangsu Province, P. R. China

Tested By: Suzhou Electrical Apparatus Science Research Institute Co., Ltd
No.5 Yuexi Qianzhu Road, Wuzhong District, Suzhou, Jiangsu, China

Date(s) of tests: 9 to 20 September 2019

The apparatus, constructed in accordance with the description, drawings and photographs incorporated in this certificate has been subjected to the series of proving tests in accordance with:

IEC 60076-1: Edition 3.0 2011-04 Clauses 11.1.2.1, 11.1.3, 11.1.4 c), 11.1.4 d), 11.1.4 f), 11.1.4 h), 11.2 to 11.6 and 11.8
IEC 60076-2: Edition 3.0 2011-02 Clauses 6 and 7
IEC 60076-3: Edition 3.0 2013-07* Clauses 10, 11.3 and 13.3
IEC 60076-5: Edition 3.0 2006-02 Clause 4.2
IEC 60076-10: Edition 1.0 2001-05 Clauses 11 and 13
IEC 60076-10: Edition 2.0 2016-03* Clauses 11 and 12
and the STL Guide to IEC 60076 Issue 6.0, 1 June 2019, where applicable.

*This standard is not within our current UKAS accredited scope.

The results are shown in the Record of Proving Tests attached hereto. The values obtained and the general performance is considered to comply with the above Standard(s) and to justify the ratings assigned by the manufacturer as stated below.

For ratings assigned by the manufacturer and proven by the tests see page 1

The Certificate applies only to the apparatus tested. The responsibility for conformity of any apparatus having the same or other designations rests with the Manufacturer.

This Certificate comprises this front sheet, 1 rating page plus 71 other pages and 8 drawings as detailed on pages 2 to 3.

UKAS PRODUCT CERTIFICATION
010

..... **ASTA Observer**
Stephen Yu

..... **Certification Manager**

.....23 December 2019..... **Date**

ASTA Certificates, ASTA Licences and ASTA Test Reports
ASTA Certificates, ASTA Licences and ASTA Test Reports are issued by Intertek for the exclusive use of the party applying for the Certificate, Licence or Test Report and any related testing. Intertek assumes no liability to any parties other than those with which it has an agreement and then only in accordance with the agreed Terms and Conditions.
The Applicant is authorised to copy or distribute ASTA Certificates, ASTA Licences and ASTA Test Reports provided the entire contents are included, or Certificate Front Sheets accompanied by any associated pages on which are stated the assigned rated characteristics and no part is obscured or illegible, or Licence front sheets. Permission must be obtained from Intertek before any other kind of reproduction is made.
The holder of an ASTA Certificate may claim in Trade Journals, Catalogues, Technical Articles etc., and without the prior approval of Intertek that the product identified in an ASTA Certificate is ASTA Certified.
The holder of an ASTA Licence may claim in Trade Journals, Catalogues, Technical Articles etc., and without the prior approval of Intertek that the product identified in an ASTA Licence is ASTA Approved.
To minimise the possibility of any misunderstanding such claims must clearly identify the product(s) certified or approved, the ratings verified by ASTA and the Standard against which certification/approval has been made.
Any other use of the Intertek or ASTA names must first be approved in writing by Intertek. Test results and ratings proven by testing included in ASTA Certificates and ASTA Test Reports relate specifically to the sample(s) tested.

Types of ASTA Certificates
Certificates are issued when samples of a particular product design have been tested satisfactorily against the requirements of a National, European, International or ASTA Standard. Several forms of Certificate are available, including:

Certificate of Complete Compliance
Verifies compliance with all the requirements of a Standard

Certificate of Type/Verification Tests
Verifies complete series of type/verification tests prescribed in a Standard has been made successfully

Certificate of Selected Type/Verification Tests
Verifies specified type/verification tests have been made successfully

Supplementary Certificate
Extends the scope of an existing Certificate to cover changes in rating or in design

ASTA Test Report
An ASTA Test Report is issued when tests otherwise satisfactory cannot be included in a Certificate for one or more reasons, e.g. verification of non-standard ratings.

ASTA Licences and ASTA Diamond Mark
The use of the ASTA Diamond Mark on products is authorised by an ASTA Licence. Products covered by an ASTA Licence can be referred to as ASTA Approved. Requirements for ASTA Licences include testing for full compliance with relevant standards and satisfactory, on-going assessment of production. Validity and use of ASTA Licences are subject to compliance with Intertek Certification Regulations. For more information see http://client-webex.intertek.com/europeinspection/default.aspx

Short-Circuit Testing Liaison (STL)
Intertek (ASTA) is a member of the Short-Circuit Testing Liaison. For further details please refer to http://stl-liaison.org

Authenticity
Authenticity of any ASTA document can be confirmed by contacting the Intertek office detailed on the front of this document.

Intertek

ASTA Certificate No. 22552

Laboratory Ref. No: 19M1677-S-#01

RATINGS ASSIGNED BY THE MANUFACTURER AND PROVEN BY TEST

Characteristic verified	Clause/ Subclause	Verified Tests and Ratings	
Rated voltages, U_r	IEC 60076-1 Clause 5.4.1	U_r = (30.0 ± 2 x 2.5%) / 0.8/ 0.8 kV	
No-load loss **and** **No-load current**	IEC 60076-1 Clause 11.1.3 e	3696 W at 90% rated voltage 5852 W at 110% rated voltage 0.12% at 90% rated voltage 0.33% at 110% rated voltage	
Rated power, S_r	IEC 60076-2 Clause 7	6000 kVA ONAN	
Rated insulation level	IEC 60076-3* Clauses 10, 11 and 13	HV: LV:	U_m 36 / LI 170 / LIC 187 / AC 70 kV U_m < 1.1 / AC 5 kV
Ability to withstand short circuit	IEC 60076-5 Clause 4.2	Verified	
Sound pressure level @ 0.3 m under no-load current and rated voltage, ONAN**	IEC 60076-10: 2001 Clause 11	51 dB(A)	
Sound power level @ 0.3 m under no-load current and rated voltage, ONAN**	IEC 60076-10: 2001 Clause 13	66 dB(A), Guaranteed 70 dB(A)	
Sound pressure level @ 1.0 m under no-load current and rated voltage, ONAN**	IEC 60076-10 : 2016 Clause 11	48 dB(A)	
Sound power level @ 1.0 m under no-load current and rated voltage, ONAN**	IEC 60076-10 : 2016 Clause 12	65 dB(A), Guaranteed 70 dB(A)	

* All tests performed in accordance with IEC 60076-3: 2013. At the client's request the AV test for the LV winding was performed at higher values as per the standard values than defined in Table 2 of IEC 60076-3:2013.

** As LWA,Ir and LWA, IN were more than 10dB(A) below the guaranteed sound power level then load current sound level measurements were not required.

Date of tests: 9 to 20 September 2019

Stephen Yu, ASTA Observer

SUNGROW POWER SUPPLY CO.，LTD
No.1699 Xiyou Rd.,New & High Technology Industrial Development Zone, 230088, Hefei, P. R. China.
Tel: +86-551-65327878
E-mail:_____
www.sungrowpower.com

Noise Test Report

TYPE TEST SHEET

This Type Test sheet shall be used to record the results of the type testing of Generating Unit			
Report reference number		RZ2022080908	
Report version		V1.0	
Date of issue		2022-08-09	
Standard reference		IEC62109-1_2010	
Generating Unit technology		Grid-connected PV Inverter	
Inverter Type		SG320HX/SG350HX	
Rated power (KW)		320/352	
Rated AC voltage (V)		800	
System supplier name		Sungrow Power Supply Co., Ltd.	
Address		No.1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei, P.R. China	
Compiled by	张文翔	Approved by	

Note that testing can be done by the manufacturer of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate.

Where parts of the testing are carried out by persons or organisations other than the supplier then the supplier shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.

Report Version	Description
V1.0	Initial

Sound Level

Serial No. : 1ZPL001134582

Combination of sound level measurements

Rated voltage	Applied voltage	Rated current	Applied current	Tap position	Fans in operation	Pumps in operation
[%]	[kV]	[%]	[A]			
100	33	100	262.43		8	

	Frequency	Measurement 1 Sound Power Level	Measurement 4 Sound Power Level		Combined Sound Power Level
	[Hz]	[dB(A)]	[dB(A)]		[dB(A)]
Total Sound Level		76.9	87.8		**88.2**
Octave Band	63	39.6	64.4		**64.4**
	125	59.5	79.6		**79.6**
	250	76.1	81.2		**82.3**
	500	67.3	82.6		**82.7**
	1000	56.3	81.7		**81.7**
	2000	51.6	75.4		**75.4**
	4000	54.1	71.3		**71.4**
	8000	57.4	64.2		**65.0**
⅓ Octave Band	50	36.1	63.8		**63.8**
	63	37.0	47.4		**47.8**
	80	0.0	55.1		**55.1**
	100	58.4	71.9		**72.1**
	125	47.5	68.5		**68.6**
	160	51.3	78.4		**78.4**
	200	63.1	73.7		**74.1**
	250	60.9	76.4		**76.5**
	315	75.8	78.0		**80.1**
	400	61.2	77.0		**77.1**
	500	63.7	76.9		**77.1**
	630	62.5	79.2		**79.3**
	800	53.7	78.6		**78.6**
	1000	51.4	76.7		**76.7**
	1250	47.1	74.5		**74.5**
	1600	47.0	72.4		**72.4**
	2000	46.7	70.2		**70.2**
	2500	46.9	68.5		**68.5**
	3150	48.4	67.5		**67.6**
	4000	49.6	66.9		**67.0**
	5000	49.9	64.8		**64.9**
	6300	51.2	61.5		**61.9**
	8000	52.9	58.8		**59.8**
	10000	53.6	56.4		**58.2**

Rated voltage	Applied voltage	Rated current	Applied current	Tap position	Fans in operation	Pumps in operation
[%]	[kV]	[%]	[A]			

	Frequency				Combined Sound Power Level
	[Hz]				[dB(A)]
Total Sound Level					
Octave Band	63				
	125				
	250				
	500				
	1000				
	2000				
	4000				
	8000				
⅓ Octave Band	50				
	63				
	80				
	100				
	125				
	160				
	200				
	250				
	315				
	400				
	500				
	630				
	800				
	1000				
	1250				
	1600				
	2000				
	2500				
	3150				
	4000				
	5000				
	6300				
	8000				
	10000				

The aim of this test is to determine the noise level when the PV Grid inverter in rated working condition.

Standard requirements: If equipment produces noise at a level that could cause a hazard, the noise shall be measured to determine the maximum sound pressure level that the equipment can produce (except that sound from alarms and from parts located remotely is not included). If the measured sound pressure exceeds 80dBA above a reference sound pressure of 20 ⌈P, at a measurement distance of 1 m, the instructions shall include information regarding the sound pressure level and how to reduce the risk of hearing damage to safe levels, and the product shall be marked with symbol 22 of Annex C.

- **Used settings of the measurement device for Noise measurement:**

Measurement device	Calibration Date	Expire Date
AWA6228	2022-07-07	2023-07-06

- **The condition s during testing are specified below:**

PGU operation mode	Rated working condition
Voltage range	860-1300V
Grid frequency range	50Hz
Distance	1m、10 m
Date	2022-08-09

- **The system noise level please check the table below:**

1）Rated working condition（1m）

Orientation	Noise (dB)_1m
Front	74.0
Behind	75.4
Left	75.6
Right	74.4
Maximum Noise	75.6

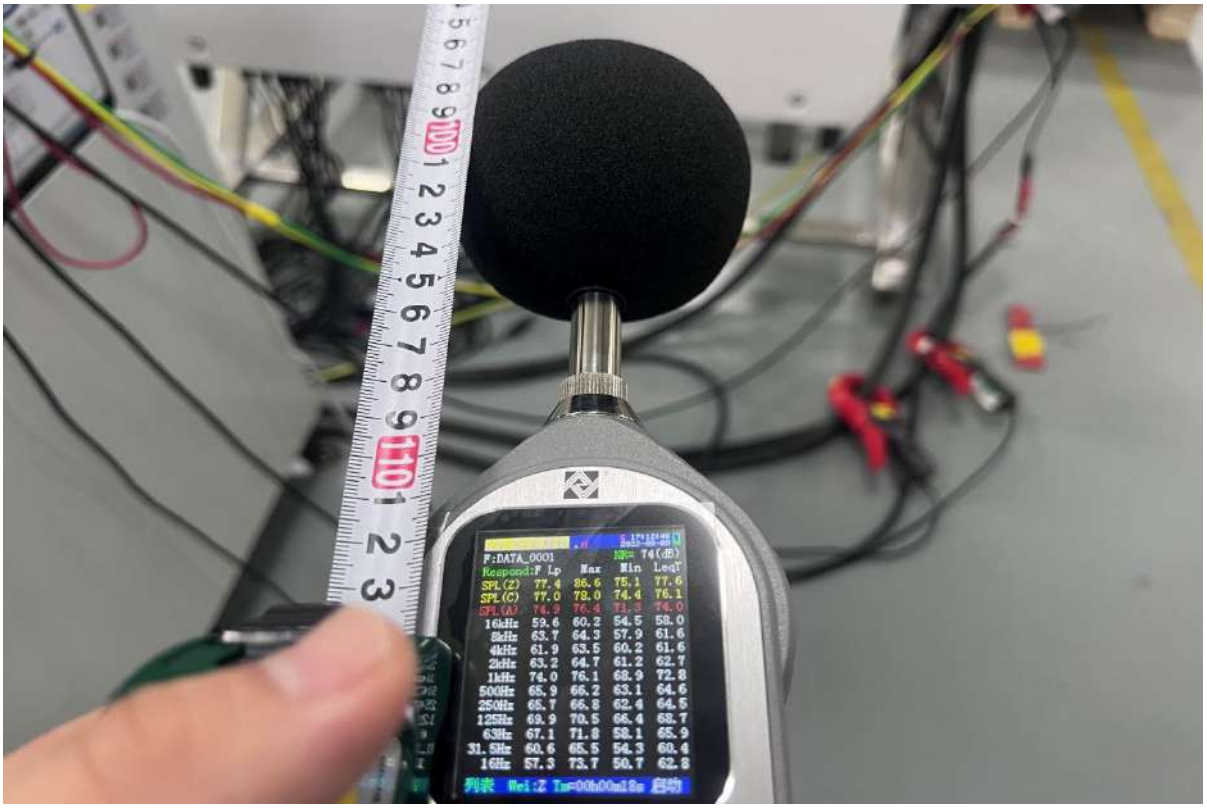
2）Rated working condition（10m）

Orientation	Noise (dB)_10m
Front	66.3
Behind	62.9
Left	68.2
Right	67.4
Maximum Noise	68.2

Photo:
Rated working condition

Operation condition	Background noise
	

1）1m noise photo

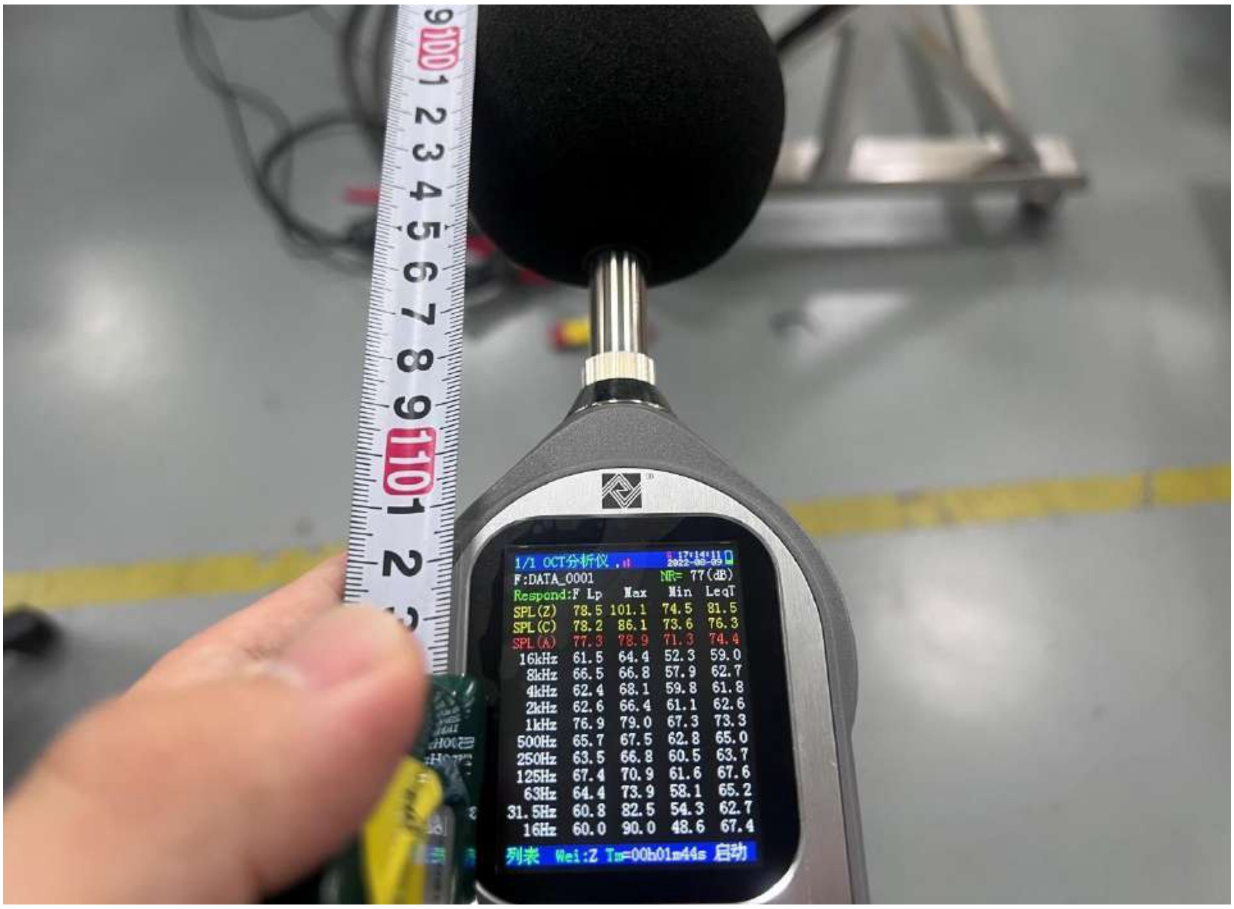


Front

Behind

F:DATA_0001
NR= 72(dB)
Respond:F Lp Max Min LeqT
SPL(Z) 96.5 129.4 73.9 102.7
SPL(C) 81.7 119.6 72.7 90.5
16kHz 60.4 71.1 52.3 61.3
8kHz 65.9 75.1 57.9 64.8
4kHz 68.1 75.3 59.8 66.5
2kHz 64.8 71.7 60.9 65.8
1kHz 73.5 81.6 65.8 73.3
500Hz 68.6 83.6 61.9 66.3
250Hz 67.2 93.2 60.5 67.0
125Hz 69.5 101.8 59.9 72.7
63Hz 78.4 112.6 56.4 82.8
31.5Hz 84.8 120.0 51.9 90.6
16Hz 81.2 122.9 47.8 94.2
列表 Wei:Z Tm=00h03m41s 过载
WA6228 型多功能声级计（噪声分析仪）

Left



1/1 OCT分析仪
17:14:11
2022-08-09
F:DATA_0001
NR= 77(dB)
Respond:F Lp Max Min LeqT
SPL(Z) 78.5 101.1 74.5 81.5
SPL(C) 78.2 86.1 73.6 76.3
SPL(A) 77.3 78.9 71.3 74.4
16kHz 61.5 64.4 52.3 59.0
8kHz 66.5 66.8 57.9 62.7
4kHz 62.4 68.1 59.8 61.8
2kHz 62.6 66.4 61.1 62.6
1kHz 76.9 79.0 67.3 73.3
500Hz 65.7 67.5 62.8 65.0
250Hz 63.5 66.8 60.5 63.7
125Hz 67.4 70.9 61.6 67.6
63Hz 64.4 73.9 58.1 65.2
31.5Hz 60.8 82.5 54.3 62.7
16Hz 60.0 90.0 48.6 67.4
列表 Wei:Z Tm=00h01m44s 启动

Right

2）10m noise photo

Front

Behind

Left

Right

Additional comments
N/A

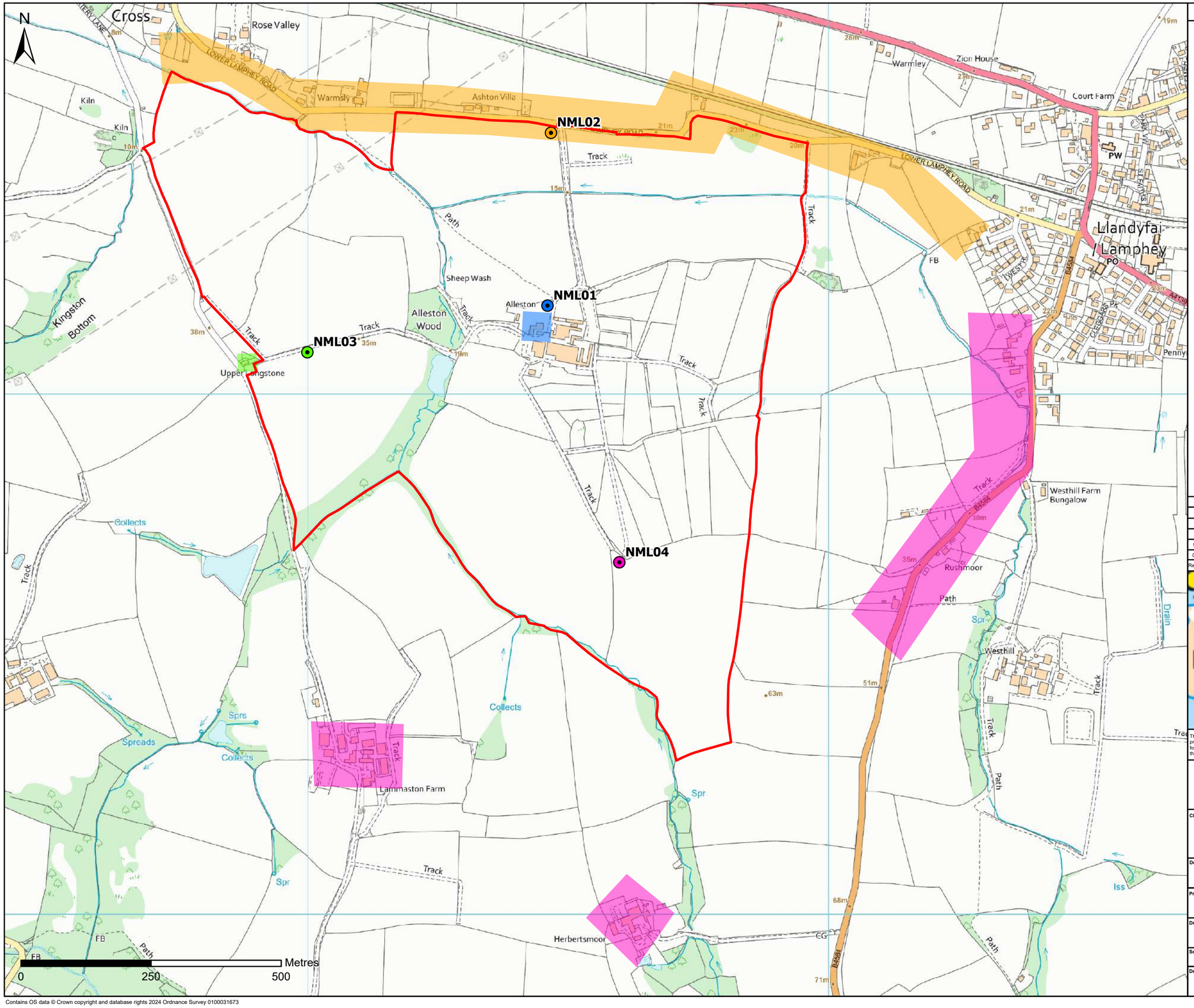
(2) Test Result

Tab. 6 Test Result of SG350HX

No.	Working Conditions	Sound power level/dB(A)
1	Running at 110% power, daytime	83.5
2	Running at 100% power, daytime	83.6
3	Running at 70% power, daytime	76.1
4	Running at 50% power, daytime	74.8
5	Running at 30% power, daytime	62.5

6	Running at 10% power, daytime	54.9
7	Running at 50% power under 105.5kVA, nighttime	66.6

Appendix E – Figures



LEGEND

- Red Line Boundary

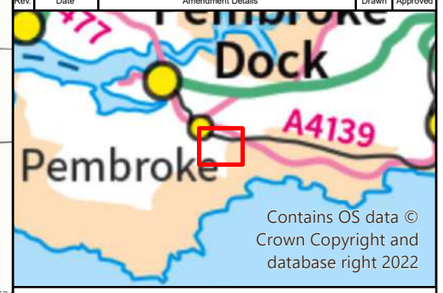
Noise Monitoring Locations (NMLs)

- NML01
- NML02
- NML03
- NML04

Noise Sensitive Receptors (NSRs)

- NSRs Represented by NML01
- NSRs Represented by NML02
- NSRs Represented by NML03
- NSRs Represented by NML04

Rev.	Date	Amendment Details	Drawn	Approved
1	17/09/2024	CLIENT COMMENTS	JCM	EW
0	10/05/2024	FIRST ISSUE	JCM	GC



tnei

Client: Statkraft

Drawing Status: FOR PLANNING

Project Title: ALLESTON SOLAR FARM

Drawing Title: FIGURE 01: NOISE STUDY AREA

Scale:	Original Size:	Spatial Reference:
1:6,750	A3	British National Grid

Drawing Number: 16267-004

N

NAL03
NAL04
NAL05
NAL06
NAL07
NAL08
NAL09
NAL10
NAL11
NAL12
NAL01a
NAL01b
NAL02

Inset 1
Inset 2
Inset 3

45
40
35
30
25
20

Metres
0 250 500

Inset 1 - Scale: 1:4000

Inset 2 - Scale: 1:3500

Inset 3 - Scale: 1:2500

LEGEND

- Red Line Boundary
- Noise Assessment Locations (NALs)
- Solar Panels
- Modelled Buildings
- Modelled Noise Sources

Predicted Noise Levels (dBA)

20 - 25	45 - 50
25 - 30	50 - 55
30 - 35	55 - 60
35 - 40	60 <
40 - 45	

Noise contours modelled in accordance with ISO 9613 Part 2:1996 at a height of 4 m and displayed on a 10 m by 10 m grid.

All noise sources assumed to be operating concurrently.

All levels shown as dB LAeq(t).

Rev	Date	Amendment Details	Drawn	Approved
2	17/09/2024	THIRD ISSUE	JCM	EW
1	12/09/2024	SECOND ISSUE	EH	GC
0	10/05/2024	FIRST ISSUE	JCM	GC

Haverfordwest, Milford Haven, Johnston, Whitland, Pembroke Dock, Pembroke, Tenby, Saundersfoot, Penalun, St Govan's Head

tnei

Client: Statkraft

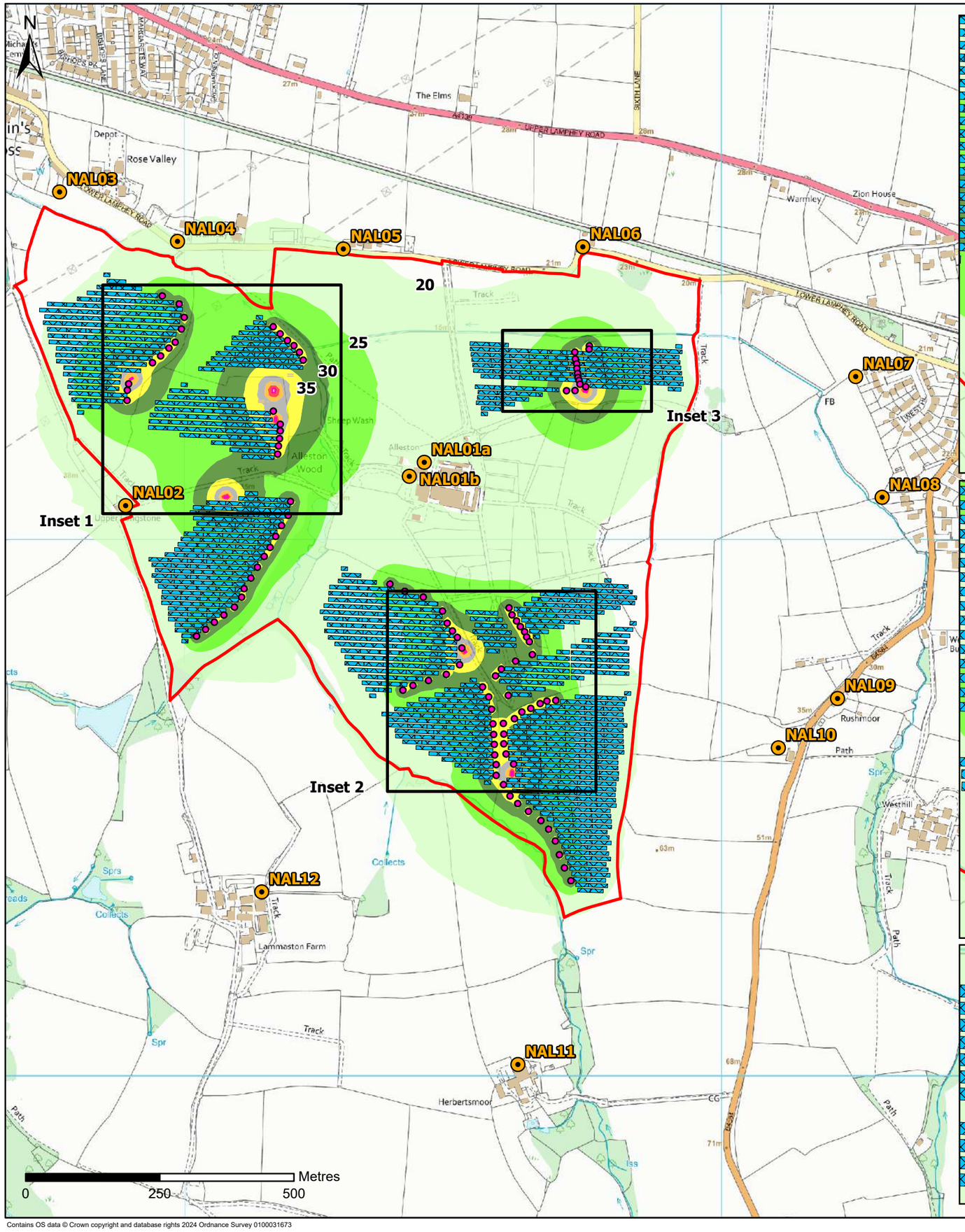
Drawing Status: FOR PLANNING

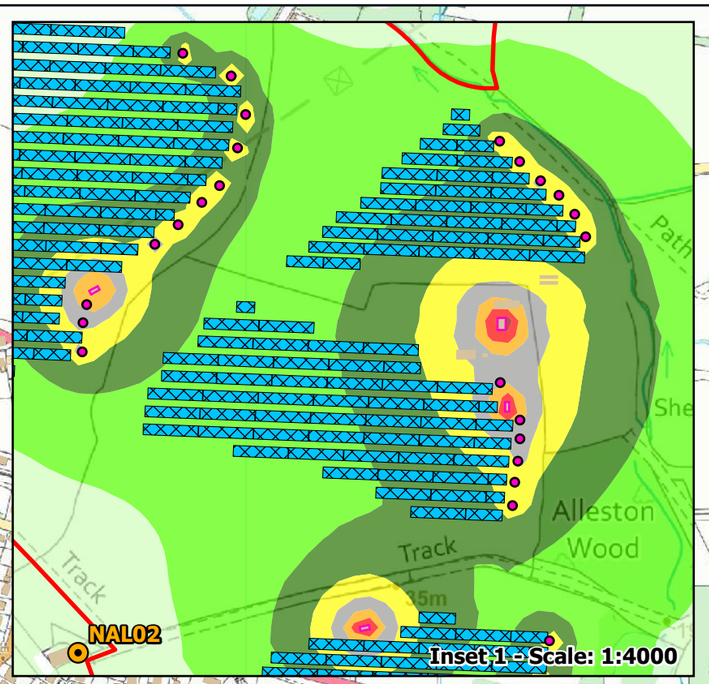
Project Title: ALLESTON SOLAR FARM

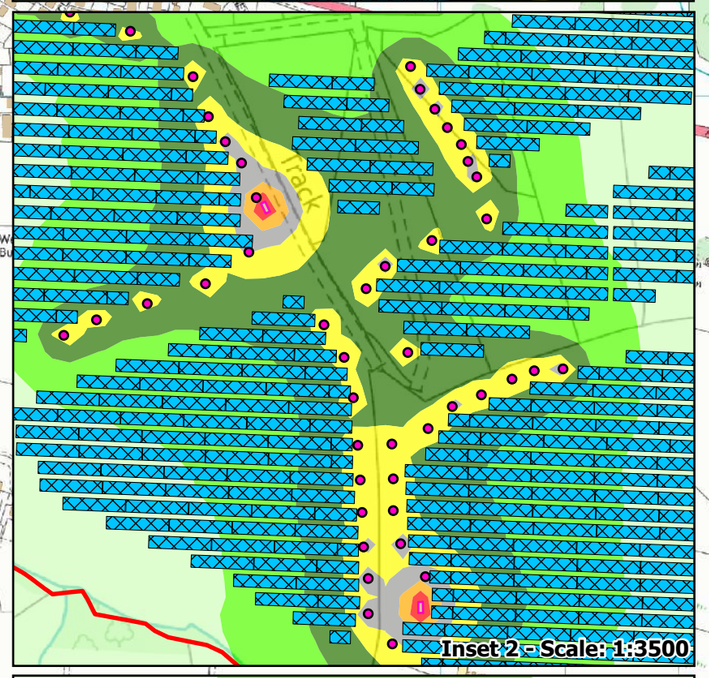
Drawing Title: FIGURE 02: NOISE CONTOUR PLOT - DAYTIME

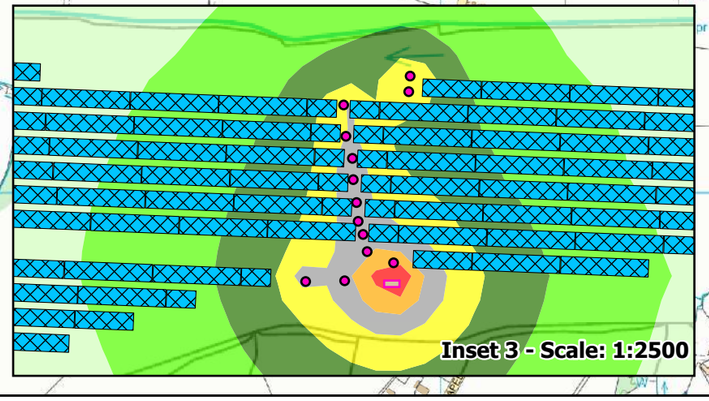
Scale:	Original Size:	Spatial Reference:
1:8,000	A3	British National Grid

Drawing Number: 16267-005









LEGEND

- Red Line Boundary
- Noise Assessment Locations (NALs)
- Modelled Noise Sources
- Solar Panels
- Modelled Buildings

Predicted Noise Levels (dBA)

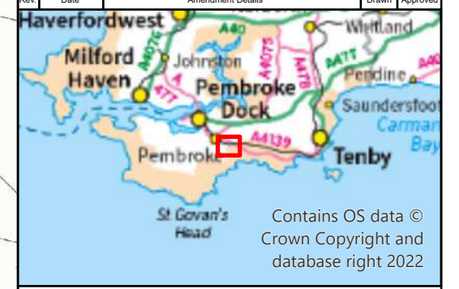
20 - 25	45 - 50
25 - 30	50 - 55
30 - 35	55 - 60
35 - 40	60 <
40 - 45	

Noise contours modelled in accordance with ISO 9613 Part 2:1996 at a height of 4 m and displayed on a 10 m by 10 m grid.

All noise sources assumed to be operating concurrently.

All levels shown as dB LAeq(t).

Rev.	Date	Amendment Details	Drawn	Approved
2	17/09/2024	THIRD ISSUE	JCM	EW
1	12/09/2024	SECOND ISSUE	EH	GC
0	10/05/2024	FIRST ISSUE	JCM	GC



tnei

Client: Statkraft

Drawing Status: FOR PLANNING

Project Title: ALLESTON SOLAR FARM

Drawing Title: FIGURE 03: NOISE CONTOUR PLOT - NIGHT-TIME

Scale:	Original Size:	Spatial Reference:
1:8,000	A3	British National Grid

Drawing Number: 16267-006