Beane Solar Farm

Acoustic Assessment

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Contents

Revision History

Issue	Date	Name	Latest Changes	File References
01	08/08/2024	Mike Craven	Finalised	05003-8104140 05003-8104137
02	30/09/2024	Mike Craven	Minor Updates	05003-8104140 05003-8660047

1 Introduction

This report provides an acoustic assessment of the proposed Beane Solar Farm (incorporating energy storage facilities), referred to as 'the Proposed Development' herein, in terms of operational impacts. Three Members of the Institute of Acoustics have been involved in its production and details of their experience and qualifications can be found in **Appendix A**.

An assessment of the sound generated by the equipment to be installed as part of the Proposed Development has been undertaken in accordance with BS 4142:2014+A1:2019 'Methods for Rating and Assessing Industrial & Commercial Sound'.

2 Planning Policy, Guidance & Standards

2.1 National Planning Policy Framework (NPPF)

The treatment of sound (or noise) is defined in the context of planning by the National Planning Policy Framework (NPPF) [1] which details the Government's planning policies and how these are expected to be applied. The NPPF provides advice on the role of the planning system in helping to prevent and limit potential adverse effects of noise, stating that planning policies and decisions should aim to avoid noise giving rise to significant adverse impacts, whilst at the same time mitigating and reducing other adverse impacts on health and quality of life to a minimum. The NPPF refers to the Noise Policy Statement for England (NPSE) which provides guidance on the categorisation of impact levels.

2.2 Noise Policy Statement for England (NPSE)

The Noise Policy Statement for England (NPSE) [2] sets out the long-term vision of Government noise policy which is to '… promote good health and quality of life through effective noise management within the context of sustainable development'. In order to weigh noise impacts against the economic and social benefits of the activity under consideration, the NPSE defines three categories of effect levels:

- No Observed Effect Level (NOEL) - noise levels below this have no detectable effect on health and quality of life;
- Lowest Observed Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and,
- Significant Observed Adverse Effect Level (SOAEL) - the level above which effects on health and quality of life become significant.

2.3 National Planning Practice Guidance (NPPG): Noise

National Planning Practice Guidance (NPPG) [3] on noise puts the effect levels defined by the NPSE into greater context by explaining how such noise levels might be perceived, providing examples of outcomes based on likely average response, and advising on appropriate actions. These are reproduced in **Table 1**.

Table 1 - Noise Exposure Hierarchy

Response	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect	No specific measures required
	No Observed Effect Level (NOEL)		
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
	Lowest Observed Adverse Effect Level (LOAEL)		
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
	Significant Observed Adverse Effect Level (SOAEL)		
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

In addition to this guidance, which is applicable to all forms of environmental noise, specific guidance relating to nationally significant energy infrastructure has been published by the Department for Energy Security and Net Zero (DESNZ). Whilst the proposed development is not of a scale that would be deemed nationally significant, the relevant National Policy Statements (NPS) are informative in that they suggest an assessment methodology that would be considered appropriate for the type of development being proposed.

2.4 The Overarching National Policy Statement for Energy (EN-1)

The Overarching National Policy Statement for Energy (EN-1) [4] outlines the need for new electricity capacity from renewable sources as the country transitions to a low carbon electricity system. However, when referring to the NPSE, EN-1 recognises the potential for energy infrastructure to impact on health and quality of life if it results in excessive noise and goes on to state that where noise impacts are likely to arise, they should be assessed according to the principles of the relevant British Standards. Of the examples provided, the standards BS 4142 and BS 8233 (discussed below) relate to operational sound/noise.

2.5 National Policy Statement for Renewable Energy Infrastructure (EN-3)

The National Policy Statement for Renewable Energy Infrastructure (EN-3) [5] refers back to EN-1 for the purposes of addressing noise impacts from renewable energy development on sensitive locations and provides general advice as to potential mitigation measures in specific instances.

2.6 The National Policy Statement for Electricity Networks Infrastructure (EN-5)

The National Policy Statement for Electricity Networks Infrastructure (EN-5) [6], relevant to the transmission and distribution parts of the electricity network along with any associated infrastructure, such as substations and converter stations, again points to the appropriateness of BS 4142 (discussed at **Section 2.7**) in assessing the operational acoustic impact of such projects.

2.7 BS 4142 Methods for Rating and Assessing Industrial & Commercial Sound

BS 4142:2014+A1:2019 [7] describes methods for rating and assessing sound of an industrial or commercial nature. Outdoor sound levels are used to assess the likely effects on people who might be inside or outside a residential property via the comparison of the pre-existing background sound levels with the predicted/modelled sound associated with the introduction of a particular development, known as the 'rating' level, which also accounts for any distinguishing characteristics of the emitted sound.

To determine a value for the background sound level at a specific assessment point, a series of measurements are made at a location at, or representative of, a dwelling or receptor of interest. The standard requires that that the background sound measurements (dB $L_{A90,\,T}$ - the sound level exceeded for 90% of the time, or the lowest 10 % of sound, for the reference time period, T) should be measured during times when the sound source in question could or will be operating and that the individual measurement intervals should not normally be less than 15-minutes in length. The objective is then to determine a justifiable representative background sound level for time periods of interest via statistical analysis and/or observations of the data set collected. The standard states that the representative background sound level '… should not automatically be assumed to be either the minimum or modal value'.

The 'rating' level is defined as the 'specific' sound level (dB L_{Aeq} – the average sound level) plus any adjustment for the characteristic features of the sound generated by the source in question. In instances where the source is unlikely to have a specific character at the assessment location then the 'rating' level can be assumed to equal to the 'specific' sound level. Where tones are present a correction of 2 to 6 dB can be added to the 'specific' sound level to determine the 'rating' level and further adjustments may be added where the source has other applicable characteristics.

The defined representative background sound level(s) and rating level(s) are then compared to determine the possible impact but with consideration of the context in which the industrial or commercial sound source to be introduced presents itself in respect of other sound sources and the existing character of the area. **Table 2** provides a summary of expected impacts when comparing background and rating levels.

Table 2 – BS 4142 Assessment Criteria

Rating Level	BS 4142 Assessment Criteria
Equal to or below background	'…an indication of the specific sound source having a low impact, depending on the context'.
Approximately +5 dB greater than the background sound level	'…an indication of an adverse impact, depending on the context'.
Approximately +10 dB or more greater than the background sound level	'…an indication of a significant adverse impact, depending on the context'.

Further to the above, it may not be appropriate or proportionate to undertake a full assessment in accordance with the BS 4142 standard, particularly when the sound level associated with the new source is particularly low at neighbouring receptors and/or is expected to be much lower than the existing background sound levels. The previous version of BS 4142 [8] stated that this version of the standard is not appropriate for use in instances where background and rating levels are very low and that '… background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low'.

2.8 NANR45 Procedure for the Assessment of Low Frequency Noise Complaints

NANR45 - Procedure for the Assessment of Low Frequency Noise Complaints [9] provides a generalised procedure and aid as to the investigation and assessment of low frequency noise (LFN) for instances where complaints occur. The procedure contains generic internal noise criteria, over a range of 1/3 octave bands, which can be referenced when determining whether a LFN issue exists. The values are intended as a guide and are not intended to be used as any fixed criteria for planning purposes or otherwise. However, they have been referenced here to provide context as to the potential sound levels resulting from the introduction of the Proposed Development in the low frequency range. The values are provided in **Table 3** for reference and the corresponding A-weighted levels are also shown.

Table 3 - NANR45 Internal Low Frequency Noise Criteria

ID	Centre of 1/3 Octave Band (A-Weighted), Hz												
	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
Linear, dB L_{eq}	92	87	83	74	64	56	49	43	42	40	38	36	34
A-Weighted, dB L_{Aeq}	22	23	27	24	19	17	15	13	16	18	19	20	21

2.9 Local Guidance & Consultation

The Environmental Health Department of East Herts District Council (EHDC) was initially contacted to agree indicative background sound monitoring locations to be used to inform this acoustic assessment and to suggest that low level fixed limits may be appropriate in some instances where the expected impact is low, in which case the level of monitoring proposed could be scaled back. A response indicated that the councils preferred criteria would be that overall A-weighted sound levels from the Proposed Development should not exceed a level 10 dB below the existing background sound and that levels in the 100 & 200 Hz one third octave band frequency ranges should also be 10 dB below the pre-existing background levels in these frequency bands. The suggested criteria were justified on the basis that other solar and/or energy storage facilities within the borough had caused complaints due to low frequency tonal sound emanating from them and that resolution of these issues was particularly challenging, as discussed further during a follow-up meeting. As a result, the council is working to ensure that similar issues do not occur in the future and that these types of development in rural spaces would generally be considered to be out of character on this basis. However, the response came with the caveat that the Proposed Development would be considered on its own merit once a full assessment, including the consideration of the sound levels in one third octave bands, is provided and that the level of potential sound emanating from the Proposed Development has been shown to be reduced as far as practicably possible.

The criteria suggested by the council is particularly stringent, contradicts the requirements suggested within BS 4142 where impacts could be judged to be low (see **Section 2.7**) and may even preclude the reasonable development of renewable and industrial facilities in areas that can be considered rural. As such, the sound levels expected to be generated by the Proposed Development are assessed against more typical criteria applied to planning applications of this kind. However, further additional information has been provided in respect of the existing and projected sound levels in one third octave bands, with reference to current guidance in this respect where applicable and/or considered to provide useful context.

Further contact was made with the Environmental Health Department to agree proxy background sound measurement locations as access to the gardens of neighbouring properties was not available. The proposed locations were considered to be suitably representative.

3 Baseline Environment

The current sound environment at properties surrounding the site typically consists of traffic along local roads including the A507 and wider road network, birdsong, a bird scarer located to the north of the Proposed Development, wind in the trees and foliage, the pattering of rain, localised human activities and aircraft overhead.

A list of locations considered representative of residences located closest to the Proposed Development is provided in **Table 4** as also shown in **Figure 1, Section 5**.

Table 4 – Assessment Locations

Location	ID	Co-ordinates	
		Easting	Northing
Cromer	H1	529921	228673
Cottered	H2	531470	229301
Cumberlow Green	H3	530194	230352
Luffenhall	H4	529457	228992
Scaldsgrove	H5	531212	228846
Hare Street	H6	530854	228642
Cromer Windmill	H7	530472	228634

A survey of the existing background and ambient sound levels was undertaken at four locations considered representative of the environment at properties neighbouring the Proposed Development (L1, L2, L3 & L4), as discussed and agreed with the EHO dealing with the Proposed Development. The monitoring locations are marked in **Figure 1 – Section 5**. The potential for installing the survey equipment within the gardens of properties neighbouring the Proposed Development was explored but access was unfortunately denied.

Sound level meters (SLMs) were installed at the identified measurement locations between the 22nd and 29th February 2024 with the equipment setup to collect average ambient (dB L_{Aeq}) and background (dB L_{A90}) sound levels in consecutive 15-minute intervals, including the associated 1/3 octave band levels for each and various other statistical parameters throughout the week-long survey period.

The equipment was housed with appropriate outdoor protections and uprated microphone wind shields. The microphones were placed at a height approximately 1.3 m above the ground, in free-field conditions and the equipment was field calibrated at the start of the survey and checked at the end, with the drift in calibration level being well within normal tolerances.

The measurement setup at each survey locations are shown in **Appendix B** of this report.

A meteorological station was located beside Location 1 (L1) which obtained wind speed and precipitation information throughout the survey period for the same time intervals such that the data collected from the sound level meters may be readily filtered to remove any data considered to be affected by adverse weather conditions and/or the sound associated with the pattering of rain on the measurement equipment and its

surroundings. This is the most exposed measurement location at the site and it can be reasonably inferred that the wind speed at the other measurement locations would be lower than measured at L1.

The sound level meters used for the measurement campaign, corresponding serial numbers and calibration records are shown in **Table 5**.

Table 5 - Instrumentation Records

Location	L1	L2	L3	L4
Type	RION NL-52	RION NL-52	RION NL-52	RION NL-52
Serial No.	00586905	00620964	00732101	00620802
Calibration Certificate No.	UCRT23/1722	UCRT24/1267	UCRT23/1688	UCRT24/1046
Date of Issue	30 May 2023	16 February 2024	22 May 2023	9 January 2024
Microphone Serial No.	19107	03884	05286	03628
Preamp Serial No.	87024	21005	32129	20862
Calibrator Type	NC-74			
Calibrator Serial No.	35173596			
Calibrator Certificate No.	UCRT24/1024			
Date of Issue	4 January 2024			

The data sets were filtered to remove periods where measured wind speeds were above 5 $m.s^{-1}$ and where any precipitation was detected during any 15-minute measurement period.

The adopted background (dB L_{A90}) and ambient (dB L_{Aeq}) sound levels have been determined from statistical analysis and observations of the remaining filtered data sets collected during daytime (07:00 – 23:00) and night-time (23:00 – 07:00) periods respectively for all measurement locations. The median value of the filtered data sets has been used as a reasonable basis of assessment.

Figures showing the collected data sets and background and ambient/residual sound analysis are provided within **Appendix C** of this report. The results are summarised in **Table 6** with corresponding indicative 1/3 octave band sound levels provided in **Tables 7 & 8** respectively.

Table 8 shows that existing sound levels in the 100 Hz band range from approximately 25-33 dB L_{Aeq} and 16-23 L_{Aeq} during the daytime and night-time respectively. The 200 Hz band has levels that range from approximately 31-41 dB L_{Aeq} during the day and 19-31 dB L_{Aeq} during the night.

Table 6 - Existing Background & Ambient Sound Levels

ID	Co-ordinates		Background Sound Level, dB L_{A90}		Ambient Sound Level, dB L_{Aeq}	
	Easting	Northing	Daytime	Night-time	Daytime	Night-time
L1	530189	230164	41	28	53	43
L2	531424	229291	41	27	51	42
L3	529904	228699	35	26	47	36
L4	530624	228813	36	26	47	36

Table 7 - Indicative One Third Octave Band Background Levels, dB L_{A90}

Period	ID	Centre of 1/3 Octave Band (A-Weighted), Hz											
		50	63	80	100	125	160	200	250	315	400	500	630
Daytime	L1	18	21	22	23	24	24	25	25	24	22	23	25
	L2	13	16	18	20	21	22	22	23	23	23	24	25
	L3	14	18	19	19	20	19	19	20	20	19	20	22
	L4	16	18	19	21	21	20	20	20	18	17	19	22
	ID	**800**	**1k**	**1.25k**	**1.6k**	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**
	L1	28	30	30	28	25	22	23	23	18	11	9	8
	L2	30	32	32	30	28	27	23	20	14	11	9	8
	L3	26	29	28	25	20	15	12	11	10	10	9	8
	L4	23	23	20	17	14	16	18	20	17	10	9	8
Period	**ID**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**
Night-time	L1	9	11	13	14	14	12	11	11	11	13	16	18
	L2	8	11	12	14	14	13	12	11	11	13	16	18
	L3	6	8	10	11	12	13	14	13	13	14	16	18
	L4	6	7	7	10	10	9	8	4	6	10	13	15
	ID	**800**	**1k**	**1.25k**	**1.6k**	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**
	L1	18	18	14	12	10	8	8	8	8	9	8	7
	L2	19	17	12	9	7	7	8	8	8	9	8	7
	L3	19	19	16	13	10	9	9	9	9	9	8	7
	L4	17	17	14	10	7	6	7	7	8	9	8	7

Table 8 - Indicative One Third Octave Band Ambient/Residual Levels, dB L_{Aeq}

Period	ID	Centre of 1/3 Octave Band (A-Weighted), Hz											
		50	63	80	100	125	160	200	250	315	400	500	630
Daytime	L1	27	28	30	33	36	39	41	40	39	39	38	38
	L2	22	28	30	29	33	35	36	39	40	40	40	41
	L3	18	21	24	27	29	31	34	36	37	39	39	39
	L4	19	21	22	25	29	31	31	36	35	36	39	38
	ID	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
	L1	40	43	43	43	44	42	40	37	38	36	33	20
	L2	41	42	41	41	40	37	35	34	31	29	25	20
	L3	39	37	35	32	27	22	18	16	12	11	9	7
	L4	37	38	37	35	31	27	27	32	34	26	11	8
Period	ID	50	63	80	100	125	160	200	250	315	400	500	630
Night-time	L1	15	19	19	22	24	27	31	31	31	29	31	28
	L2	15	19	21	23	24	25	27	26	25	25	28	28
	L3	11	13	13	17	16	17	20	24	27	27	27	28
	L4	11	13	13	16	19	20	19	22	26	25	25	26
	ID	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
	L1	31	35	36	36	32	27	23	20	16	13	10	8
	L2	32	34	34	33	31	28	26	25	23	20	16	12
	L3	26	25	22	20	15	10	10	9	9	9	8	7
	L4	27	26	22	18	13	8	7	8	8	9	8	7

4 Predictions

A model of the solar and energy storage facilities, including the site surroundings has been developed using CadnaA[1] sound modelling software. The ISO 9613-2 [10] sound propagation/prediction methodology has been employed to predict the specific sound levels resulting from the development at nearby residential properties, incorporating various assumptions and factors which are considered appropriate for use here:

- The various plant to be installed as part of the development has been modelled as point sources at their layout location with a height of 2 m and these sources are assumed to be operating at their maximum potential output for all time periods as a conservative basis of assessment;
- Soft ground conditions have been assumed (i.e. G=1) as representative of the farmland surrounding the Proposed Development. The ISO 9613-2 standard allows for a range of ground conditions to be applied, from porous ground conditions (G=1), which includes surfaces suitable

[1] https://www.datakustik.com/

for the growth of vegetation (i.e. farmland), to hard ground (G=0), such as paving, water and concrete;

- The receptors have been assigned a height of 1.5 m;
- Atmospheric attenuation corresponding to a temperature and relative humidity of 10 °C and 70 % respectively, as defined within ISO 9613-1 [11], which represents relatively low levels of sound absorption in the atmosphere;
- The topography of the site and surroundings has been included within the model; and,
- The photovoltaic panels to be introduced as part of the development have also been included within the prediction model as 'floating barriers', 0.75 m from the ground and with an overall height of 3 m. This provides some shielding of sound generated by the equipment to be installed at the Proposed Development where certain panels are located directly between residences and the respective plant. The panels may have a height of over 3.5 m in practice, which would serve to further reduce the projected sound levels.

ISO 9613-2 is a downwind propagation model. Where conditions less favourable to sound propagation occur, such as when the assessment locations are upwind of the Proposed Development, the sound levels would be expected to be less and the downwind predictions presented as part of this report would be regarded as conservative, i.e. greater than those likely to be experienced in practice.

The predominant sources of sound to be introduced as part of the Proposed Development are the inverters/power conversion system (PCS) units, transformers, energy storage containers and substation transformer.

The site has been designed on an iterative basis with a view to minimising, as far as practicably possible, the projected operational sound levels with due regard to the relative sensitivity of neighbouring premises and all other site constraints.

The assumed sound power data for the equipment to be installed as part of the Proposed Development are provided at **Table 9**. The overall levels correspond to the maximum expected sound output for each of the respective plant that will be available at the time of potential procurement/installation, should the site be granted planning consent, and as advised by candidate manufacturers.

Table 9 – Overall Sound Power Levels, dB L_{WA}

Equipment & ID	Sound Power Level, dB L_{WA}
Energy Storage System (ESS)	68
Attenuated Power Conversion System (PCS)	80
Transformer (TRA)	76
Substation (SUB)	90

The source data is further supplemented by the level of sound in 1/3 octave and octave bands, as provided at **Tables 10 & 11**. This information is based on a combination of expected manufacturers data and RES experience of similar plant.

The combination of assumptions detailed above are considered to provide a conservative prediction/modelling basis overall. The results of the predictions at the various residences surrounding the Proposed Development are shown in **Section 5**.

Table 10 – Octave Band Sound Power Levels, dB L_{WA}

ID	Overall, dB L_{WA}	Centre of Octave Band (A-Weighted), Hz							
		63	125	250	500	1k	2k	4k	8k
PCS	80	55	65	75	73	73	72	69	63
BESS	68	56	60	61	61	63	58	48	41
TRA	76	41	62	70	74	64	57	51	49
SUB	90	55	77	85	88	78	71	65	64

Table 11 – 1/3 Octave Band Sound Power Levels, dB L_{WA}

ID	Centre of 1/3 Octave Band (A-Weighted), Hz											
	50	63	80	100	125	160	200	250	315	400	500	630
PCS	47	49	52	55	59	62	69	72	69	66	69	68
BESS	47	53	53	53	56	56	54	56	57	55	57	57
TRA	28	35	39	62	45	44	67	55	68	72	67	65
SUB	43	50	54	77	60	59	81	69	82	86	82	79
ID	**800**	**1k**	**1.25k**	**1.6k**	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**
PCS	68	69	68	68	67	66	65	64	63	61	57	54
BESS	59	59	57	56	52	49	46	43	40	37	37	31
TRA	59	59	59	53	52	51	48	44	45	46	43	42
SUB	73	74	74	68	66	65	62	59	60	61	58	57

The sound emitted by the various equipment to be introduced as part of the Proposed Development can occasionally have distinctive tonal character (i.e. a whine, whistle or hum). Under the subjective method described in BS 4142, a correction of 2 dB has been applied to account for this feature. However, the assessed specific and rating sound levels detailed in **Section 5** are particularly low and potential tonal character in the sound emitted from the various plant may well be masked by existing sources of sound in the area in reality.

A warranty and/or guarantee will be sought from the manufactures of the equipment to be installed as part of the Proposed Development that limits the potential for a tonal character to be present in the sound generated. This will allow for appropriate recourse with the manufacturer in the instance that tones (in the low frequency region or otherwise) be present in practice, should the site become operational.

5 Assessment

The predicted specific sound and corresponding rating levels (i.e. including for a 2 dB penalty for tonal character) at the properties located nearest to the Proposed Development are shown in **Table 12**. The rating level is compared to the background sound levels detailed in **Section 3**, which are applied to each of the assessment locations for which the nearest existing sound level information is available, to provide the associated impact.

The resultant impact is described as 'negligible' if the rating level is 10 dB or more below the determined background sound level; 'low' if the rating level is less than or equal to the background sound level; 'minor' if not more than 5 dB above; 'moderate' if not more than 10 dB above and major if more than 10 dB above. These criteria compare to the categories defined by the NPSE, with rating levels less than or equal to background sound level representing the NOEL, 5 dB above background representing the LOAEL and 10 dB above background the SOAEL.

Table 12 – BS 4142 Assessment

House ID	Specific Level, dB L_{Aeq}	Rating Level, dB L_{Ar}	Background Level, dB L_{A90}	L_{Ar} – L_{A90}, dB	Potential Impact
Daytime					
H1	17	19	35	-16	Negligible
H2	16	18	41	-23	Negligible
H3	15	17	41	-24	Negligible
H4	12	14	35	-21	Negligible
H5	15	17	36	-19	Negligible
H6	15	17	36	-19	Negligible
H7	16	18	36	-18	Negligible
Night-time					
H1	17	19	26	-7	Low
H2	16	18	27	-9	Low
H3	15	17	28	-11	Negligible
H4	12	14	26	-12	Negligible
H5	15	17	26	-9	Low
H6	15	17	26	-9	Low
H7	16	18	26	-8	Low

The assessment indicates that the predicted sound impact from the Proposed Development at the nearest neighbouring properties is negligible for daytime and negligible-to-low for night-time periods.

An illustrative sound footprint for the proposed development showing the predicted rated sound level (dB L_{Ar}) is provided in **Figure 1**. The background sound survey locations are marked in red.

Figure 1 - Rated Sound Level Contour Plot, dB L_{Ar}

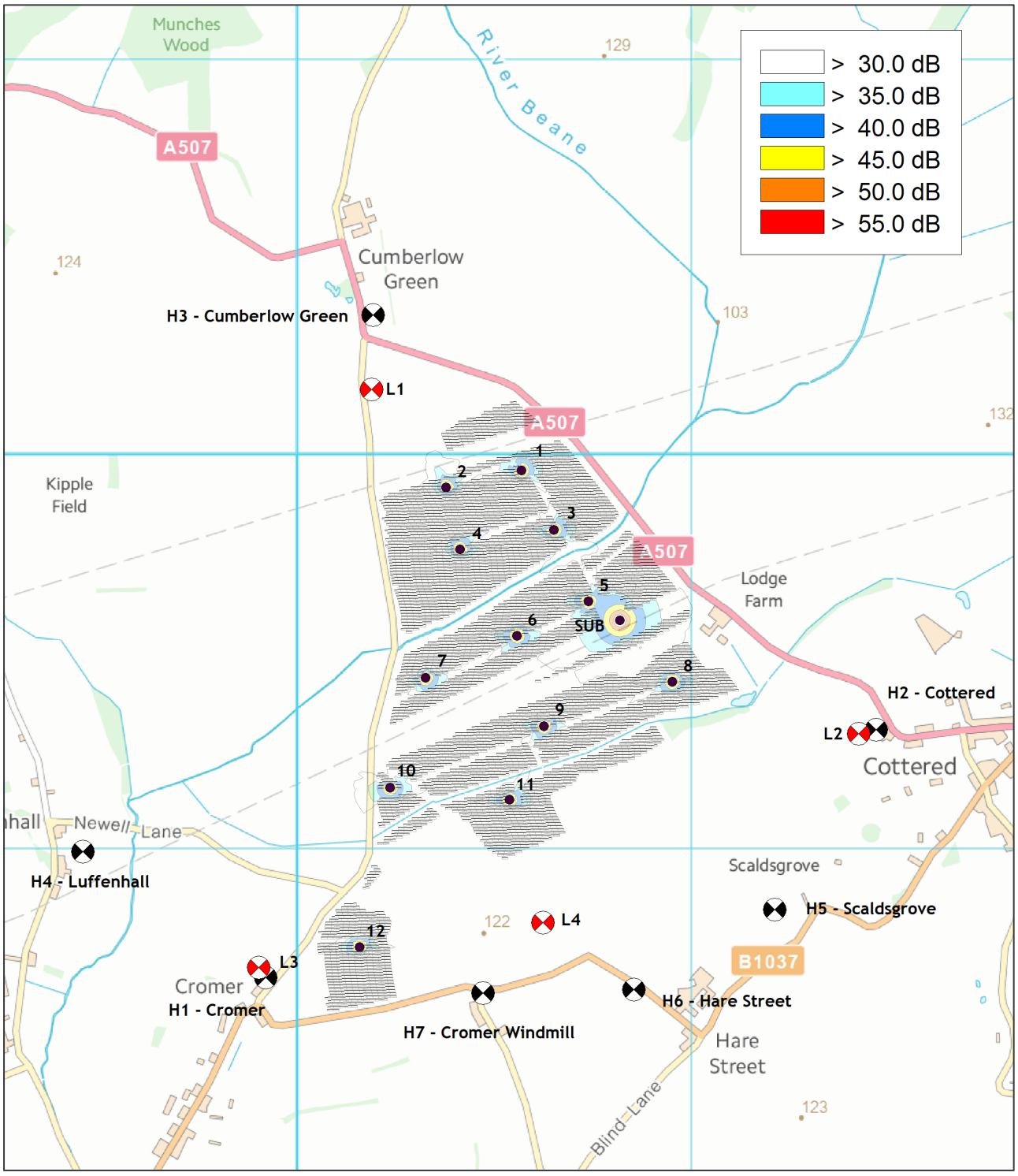


Table 13 shows the predicted one third octave band sound levels externally to each of the assessment locations. These levels are all below the DEFRA LFN criteria (see **Section 2.8**) even when considering that the criteria is intended to be applied internally. Actual internal sound levels due to the introduction of the Proposed Development will be substantially (>10 dB) less, well below levels which would be considered problematic under normal circumstances.

Table 13 - One Third Octave Band Predicted Levels, dB L_{Aeq}

ID	Centre of 1/3 Octave Band (A-Weighted), Hz											
	50	63	80	100	125	160	200	250	315	400	500	630
H1	-10	-5	-4	2	-1	1	2	2	2	10	7	6
H2	-13	-8	-7	2	-6	-4	2	-1	3	11	7	5
H3	-12	-6	-6	0	-4	-2	1	0	2	9	6	5
H4	-10	-5	-4	-5	-9	-7	-2	-3	-2	6	3	1
H5	-13	-8	-7	0	-7	-5	1	-1	2	10	6	4
H6	-12	-7	-6	-1	-6	-4	1	0	1	9	6	4
H7	-10	-5	-4	2	-2	0	2	2	3	10	8	6
ID	**800**	**1k**	**1.25k**	**1.6k**	**2k**	**2.5k**	**3.15k**	**4k**	**5k**	**6.3k**	**8k**	**10k**
H1	6	7	6	4	2	0	-4	-8	-13	-22	-36	-54
H2	4	5	3	0	-3	-8	-14	-23	-33	-50	-74	-83
H3	4	4	2	0	-3	-7	-13	-20	-29	-45	-67	-83
H4	2	2	0	-3	-6	-11	-19	-29	-43	-66	-81	-83
H5	3	3	2	-2	-5	-10	-17	-26	-38	-59	-81	-83
H6	4	4	2	-1	-4	-8	-15	-24	-35	-54	-78	-83
H7	5	6	4	1	-2	-5	-10	-17	-25	-38	-56	-78

Overall, in this context and based on the modelling assumptions and assessment results presented, the sound emitted by the Proposed Development can be considered not significant and 'present and not intrusive' in terms of government policy and guidance provided within the NPSE & NPPG.

The wording for a suggested planning condition that would restrict sound associated with the introduction of the Proposed Development, should the site gain planning consent, is provided in **Appendix D**.

6 Conclusions

An acoustic impact assessment of the proposed Beane Solar Farm (incorporating energy storage facilities) has been undertaken. The results show that sound levels resulting from the operation of the site will generally be low in the context of relevant assessment criteria (i.e. BS 4142) and can be considered 'present and not intrusive' in terms of government policy and guidance provided within the NPSE & NPPG.

A warrantee and/or guarantee will be sought from the manufactures of the equipment to be installed as part of the Proposed Development that limits the potential for a tonal character to be present in the sound generated. This will also allow for appropriate recourse with the manufacturer if tones (in the low frequency region or otherwise) are present in practice, should the site become operational.

7 References

[1] Department for Levelling Up, Housing and Communities (September 2023) National Planning Policy Framework

[2] Department for Environment, Food and Rural Affairs (March 2010) Noise Policy Statement for England

[3] Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (July 2019) National Planning Practice Guidance: Noise

[4] Department for Energy Security & Net Zero (November 2023) Overarching National Policy Statement for Energy (EN-1)

[5] Department for Energy Security & Net Zero (November 2023) National Policy Statement for Renewable Energy Infrastructure (EN-3)

[6] Department for Energy Security & Net Zero (November 2023) National Policy Statement for Electricity Networks Infrastructure (EN-5)

[7] British Standards Institution (2019) BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound

[8] British Standards Institution (1997) BS 4142:1997 Rating Industrial Noise Affecting Mixed Residential and Industrial Areas

[9] University of Salford (February 2005) NANR45 - Procedure for the Assessment of Low Frequency Noise Complaints

[10] International Organisation for Standardisation (December 1996) ISO 9613-2:1996 Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation

[11] International Organisation for Standardisation (June 1993) ISO 9613-1:1993 Acoustics - Attenuation of Sound During Propagation Outdoors - Part 1: Calculation of the Absorption of Sound by the Atmosphere

Appendix A – Experience & Qualifications

Table A.1 - Author

Name	Mike Craven
Experience	Senior Acoustic Specialist, Renewable Energy Systems (RES), 2023-Present Principal Acoustic Consultant, Hayes McKenzie Partnership Limited (HMPL), 2019-2022 Senior Acoustic Consultant, HMPL, 2013-2019 Acoustic Consultant, HMPL, 2011-2013 Acoustic Consultant, URS/Scott Wilson, 2008-2011 Acoustic Consultant, HMPL, 2004-2008
Qualifications	MIOA, Member of the Institute of Acoustics BSc Audio Technology, University of Salford

Table A.2 - Checker

Name	Stuart Hill
Experience	Senior Acoustic Specialist, RES, 2024-Present Senior Acoustic Consultant, Mabbett, 2022-2024 Senior Environmentalist (Acoustics), Amey, 2021-2022 Associate Consultant – Acoustics, Noise & Vibration, SLR Consulting, 2017-2020 Technical Analyst/Senior Acoustic Analyst, RES, 2013-2017
Qualifications	AMIOA, Associate Member of the Institute of Acoustics MInstP, Member of the Institute of Physics MSc Principles and Applications of Radiation in Industry, the Environment and Medicine, University of St Andrews BEng Electronics Engineering, University of Aberdeen

Table A.3 - Approver

Name	Dr Jeremy Bass
Experience	Head of Specialist Services/Senior Technical Manager, RES, 2000-Present Technical Analyst/Senior Technical Analyst, RES, 1990-2000 Foreign Exchange Researcher, Mechanical Engineering Laboratory, Tsukuba, Japan, 1989-1990 Research Associate, Energy Research Unit, Rutherford Appleton Laboratory, 1986-1989
Qualifications	MIOA, Member of the Institute of Acoustics MInstP, Member of the Institute of Physics PhD, The Potential of Combined Heat & Power, Wind Power & Load Management for Cost Reduction in Small Electricity Supply Systems, Department of Applied Physics, University of Strathclyde BSc Physics, University of Durham

Appendix B – Measurement Locations

Figure B.1 – Measurement Location 1

Figure B.2 – Measurement Location 2

Figure B.3 - Measurement Location 3

Figure B.4 - Measurement Location 4

Appendix C – Survey Data & Analysis

Figure C.1 – Location 1 - Time Series

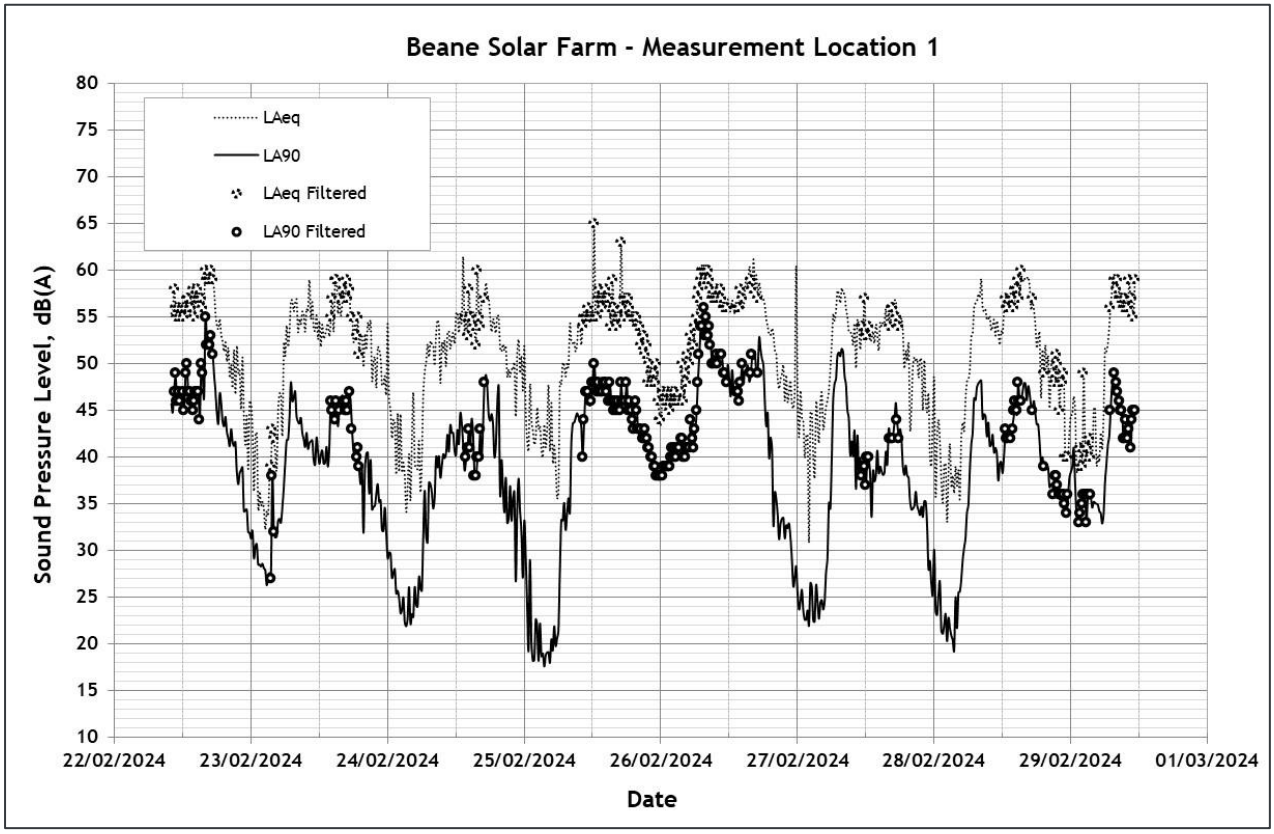


Figure C.2 – Location 1 Data Analysis – All Data

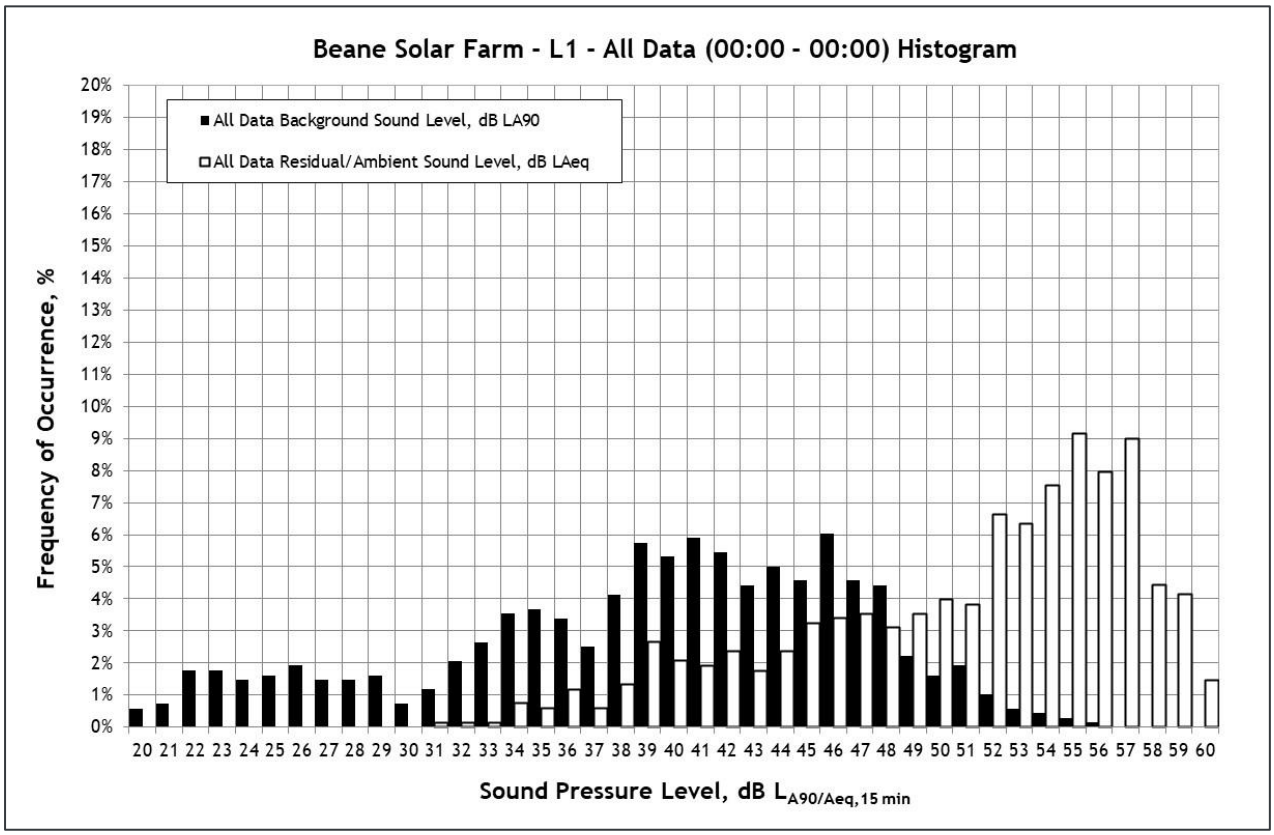


Figure C.3 - Location 1 Data Analysis - Daytime

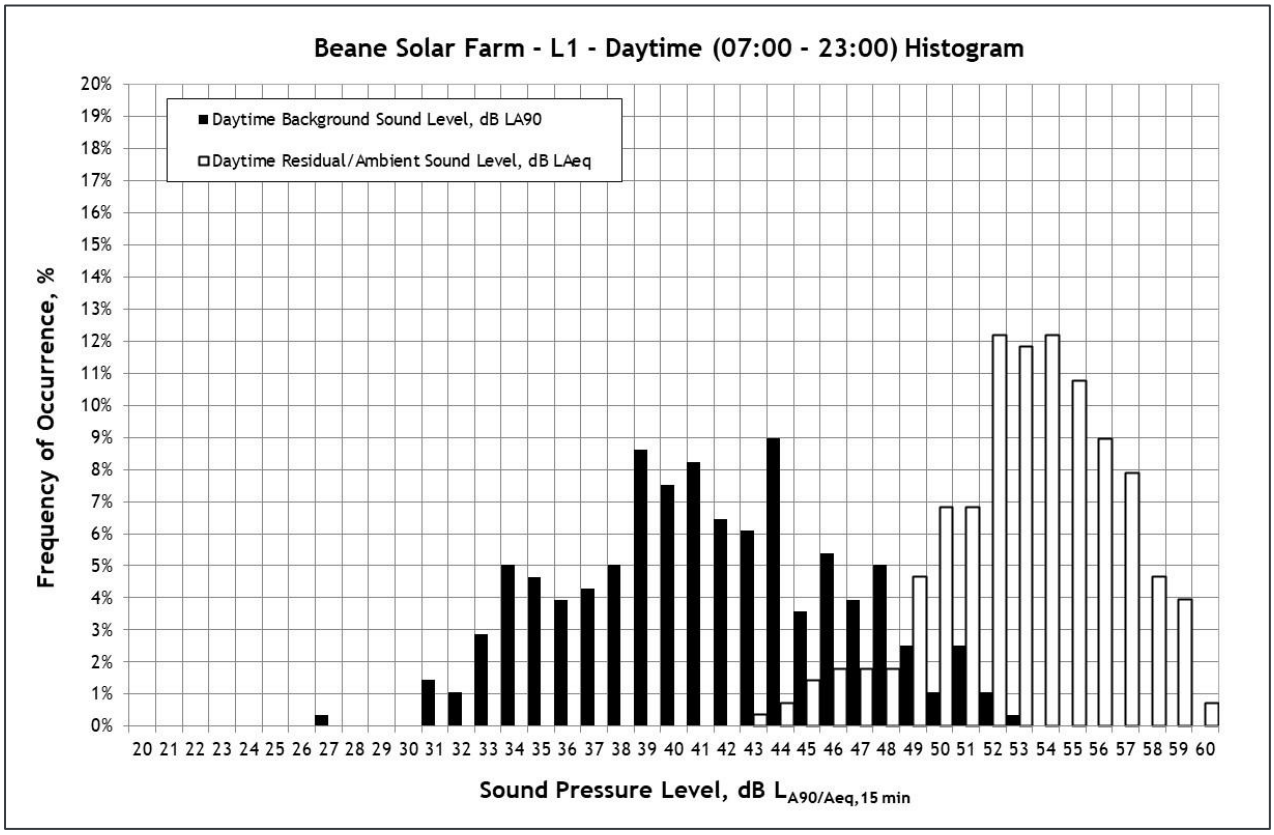


Figure C.4 - Location 1 Data Analysis - Night-time

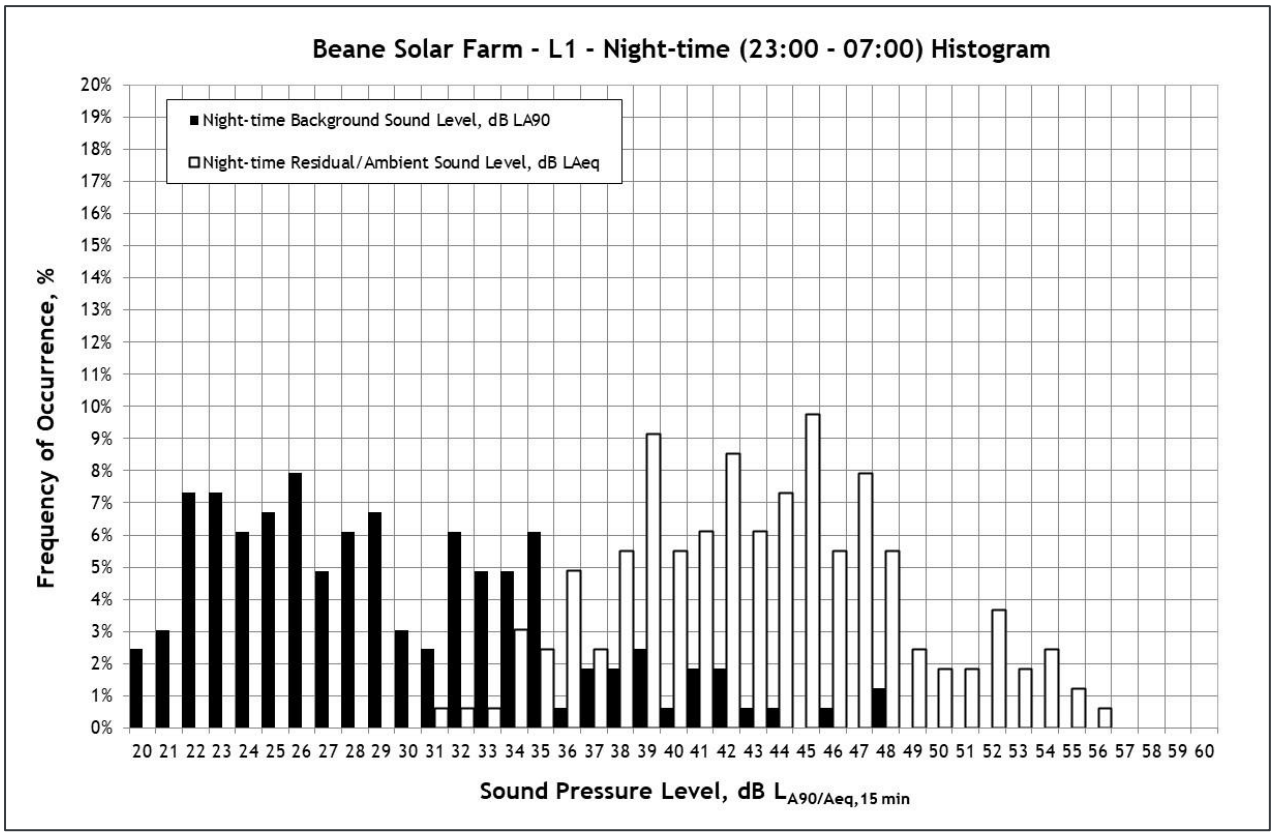


Figure C.5 - Location 2 - Time Series

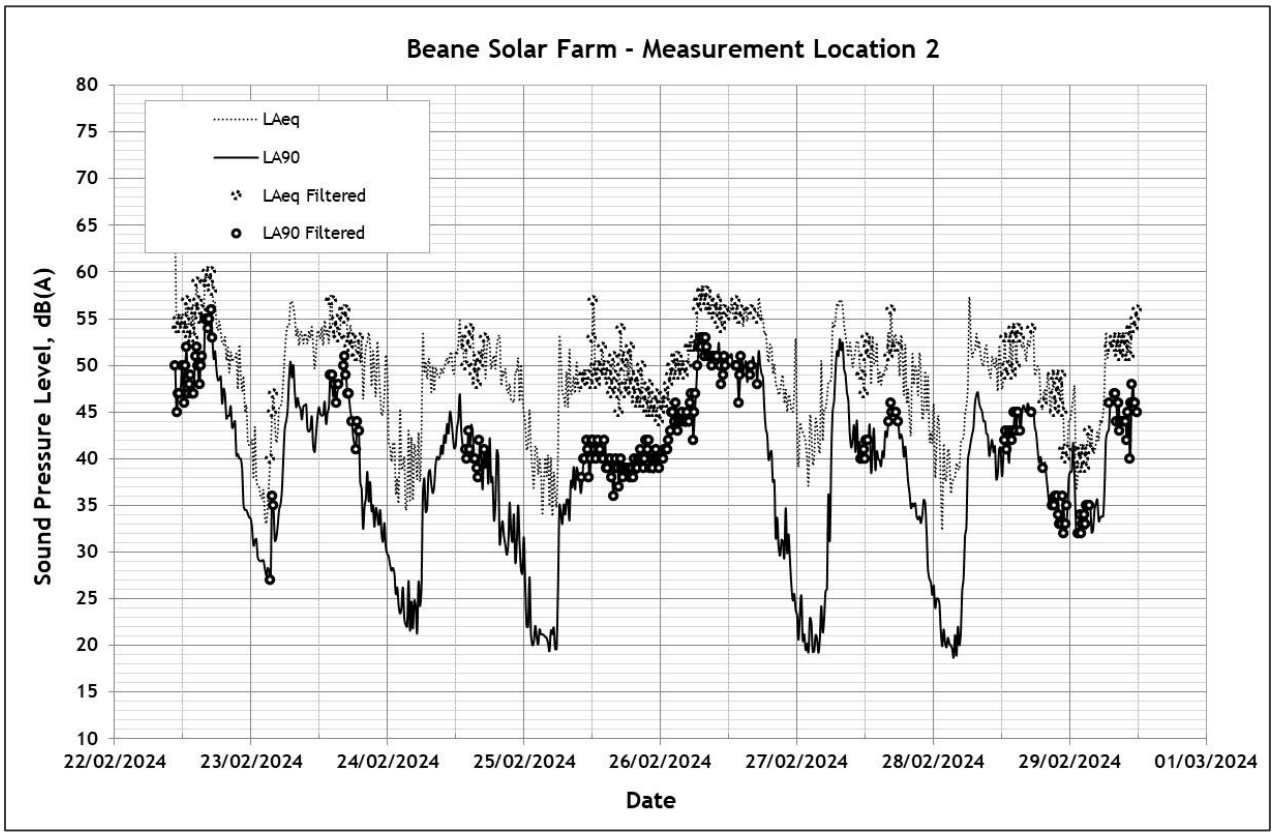


Figure C.6 - Location 2 Data Analysis - All Data

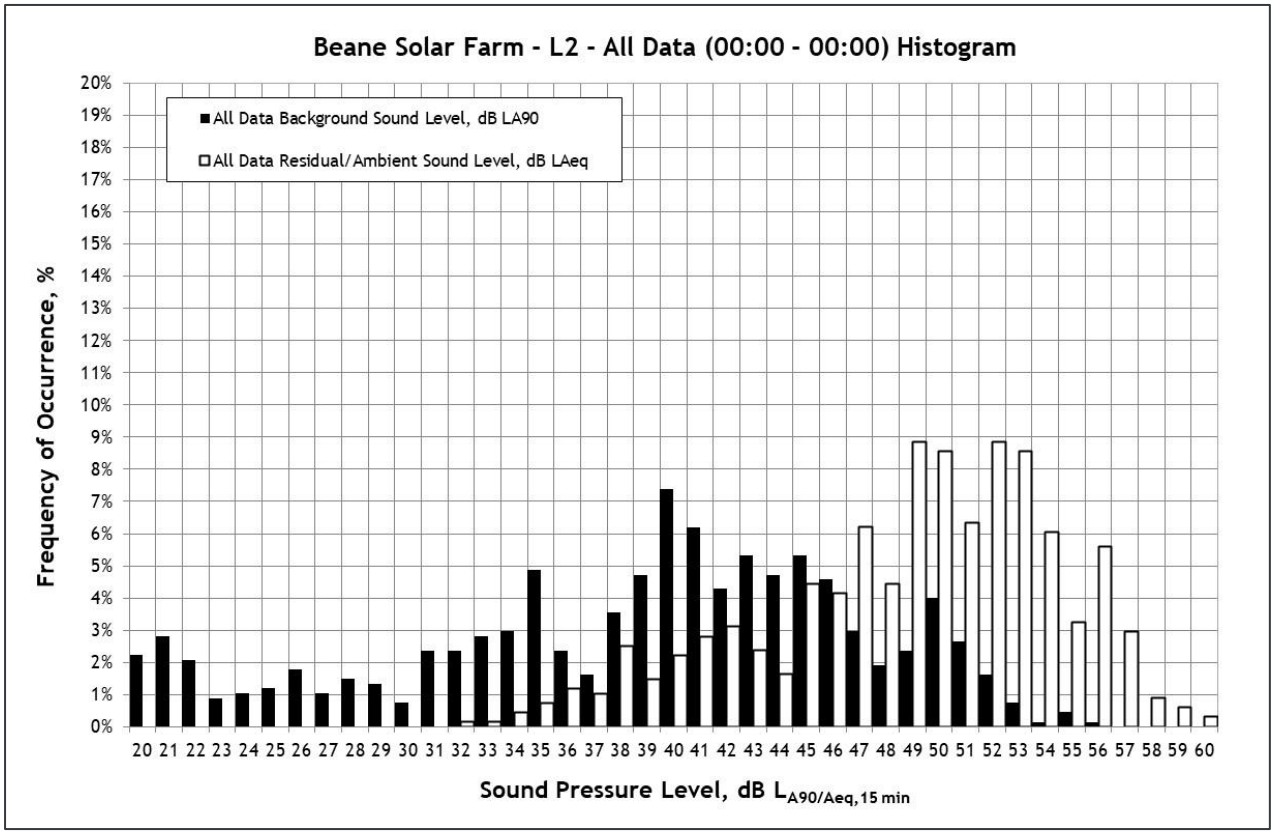


Figure C.7 - Location 2 Data Analysis - Daytime

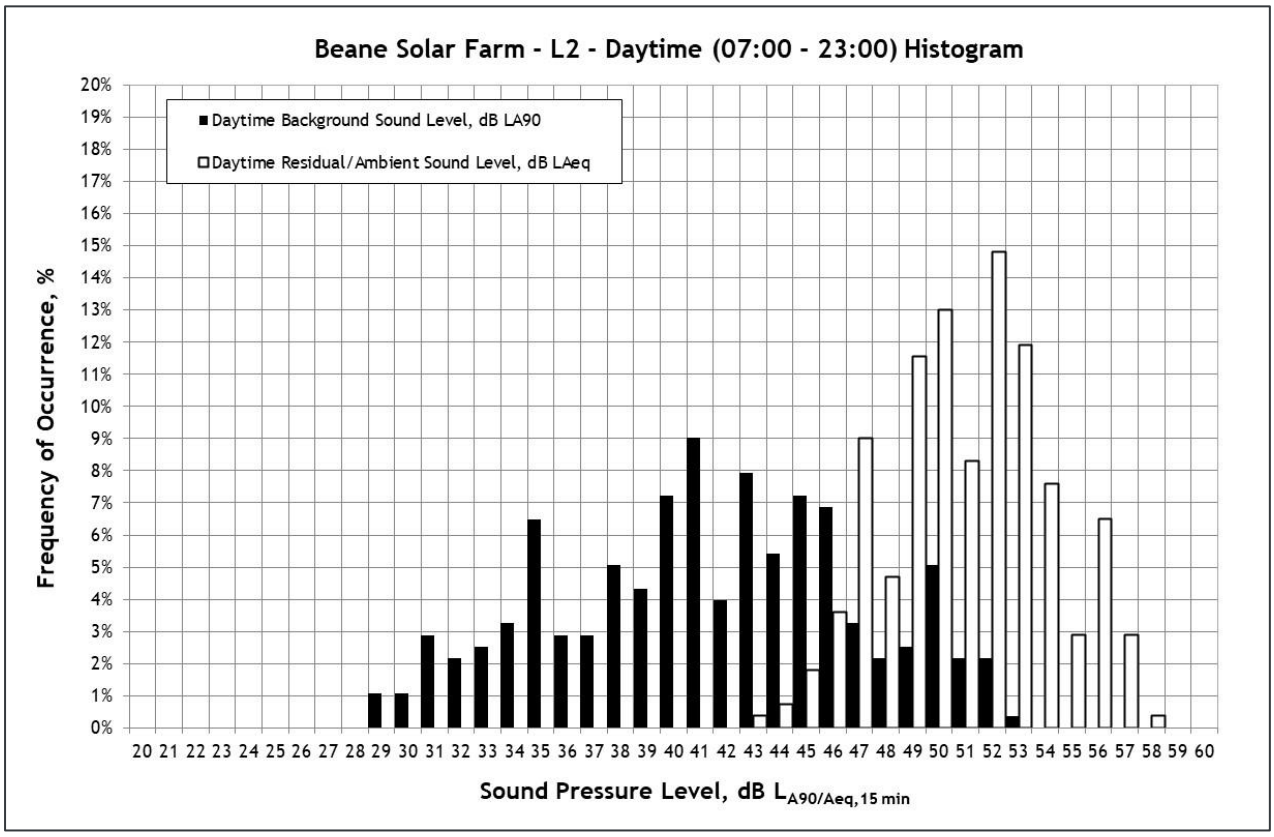


Figure C.8 - Location 2 Data Analysis - Night-time

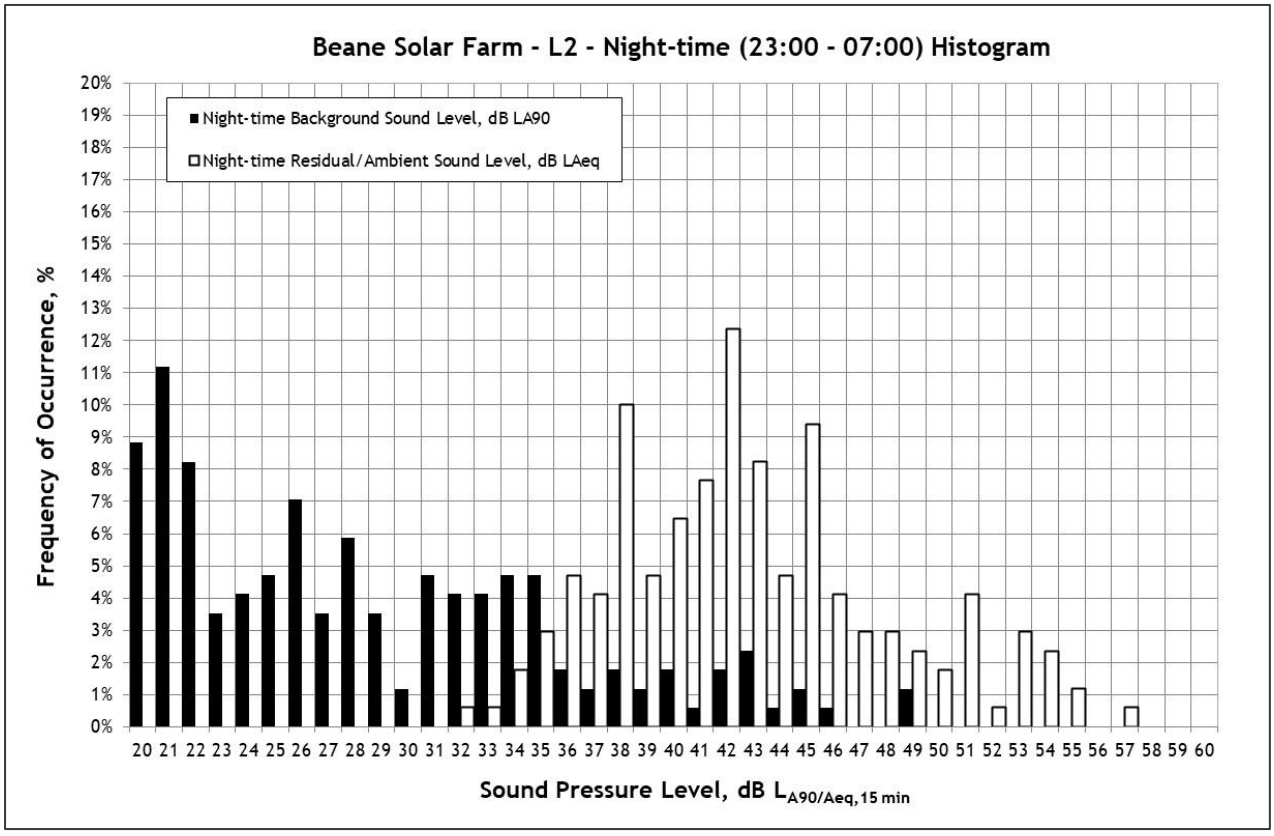


Figure C.9 - Location 3 - Time Series

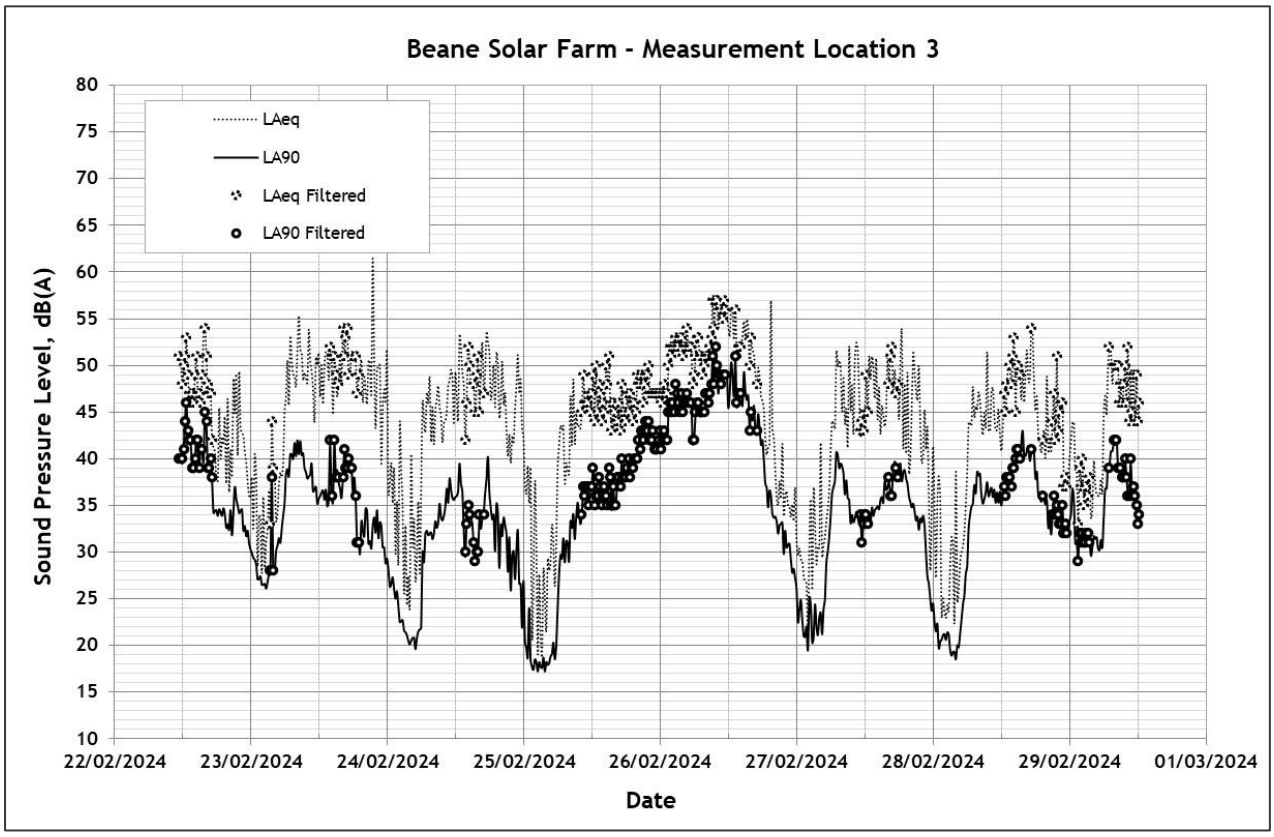


Figure C.10 - Location 3 Data Analysis - All Data

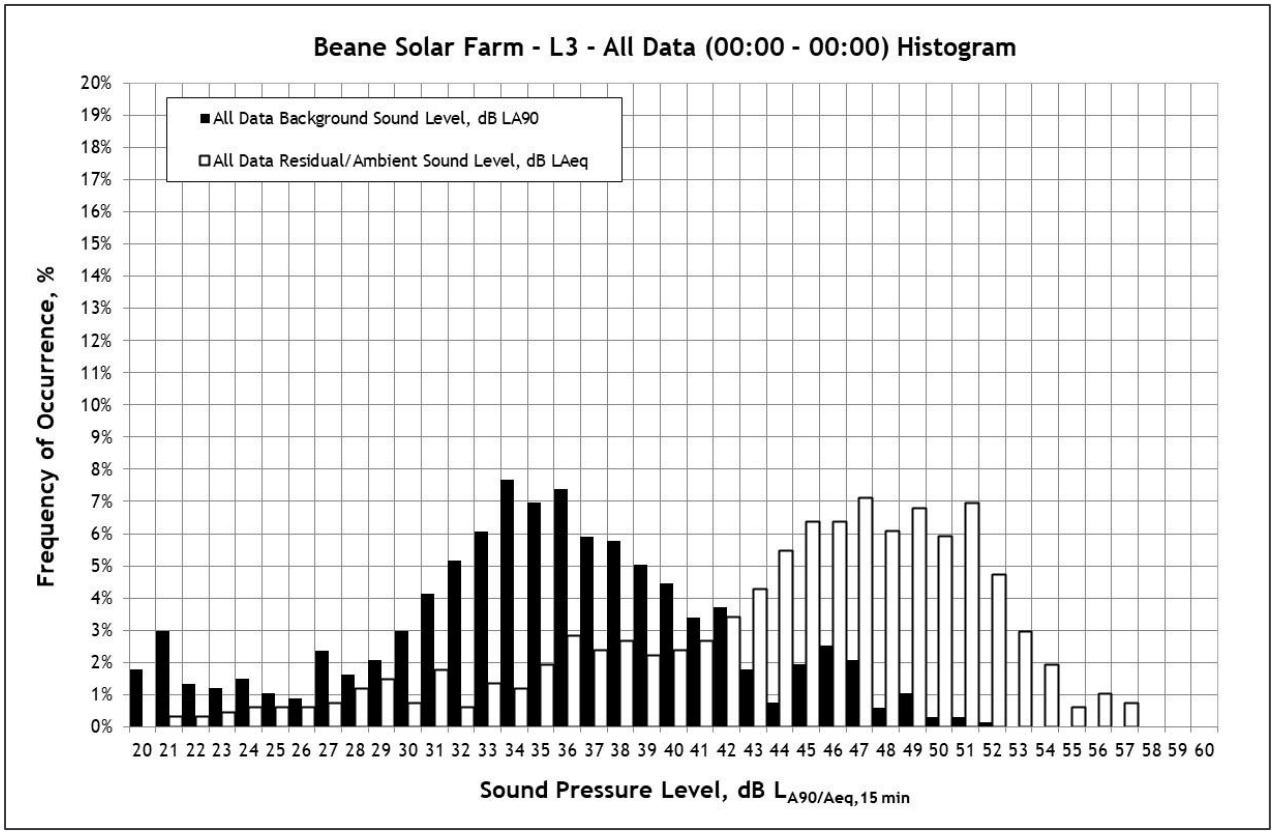


Figure C.11 – Location 3 Data Analysis - Daytime

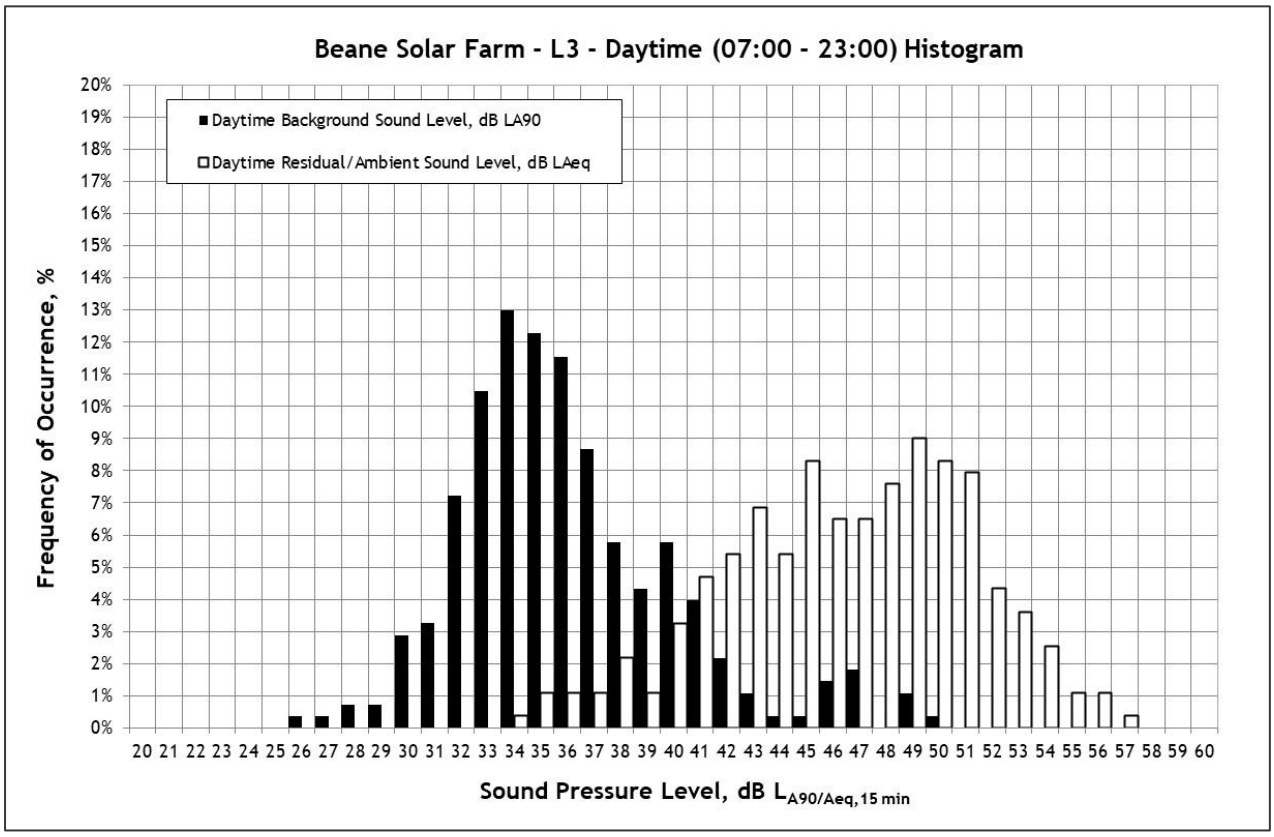


Figure C.12 – Location 3 Data Analysis – Night-time

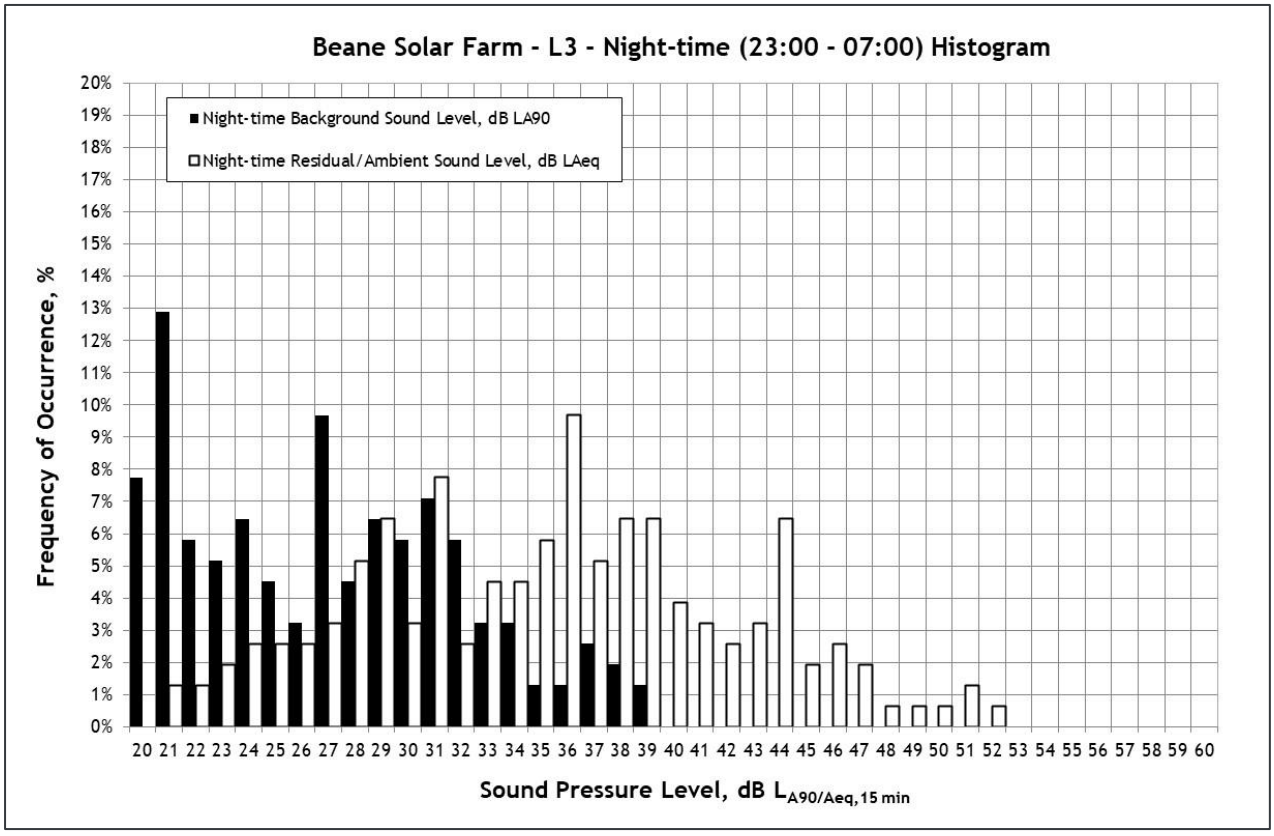


Figure C.13 - Location 4 - Time Series

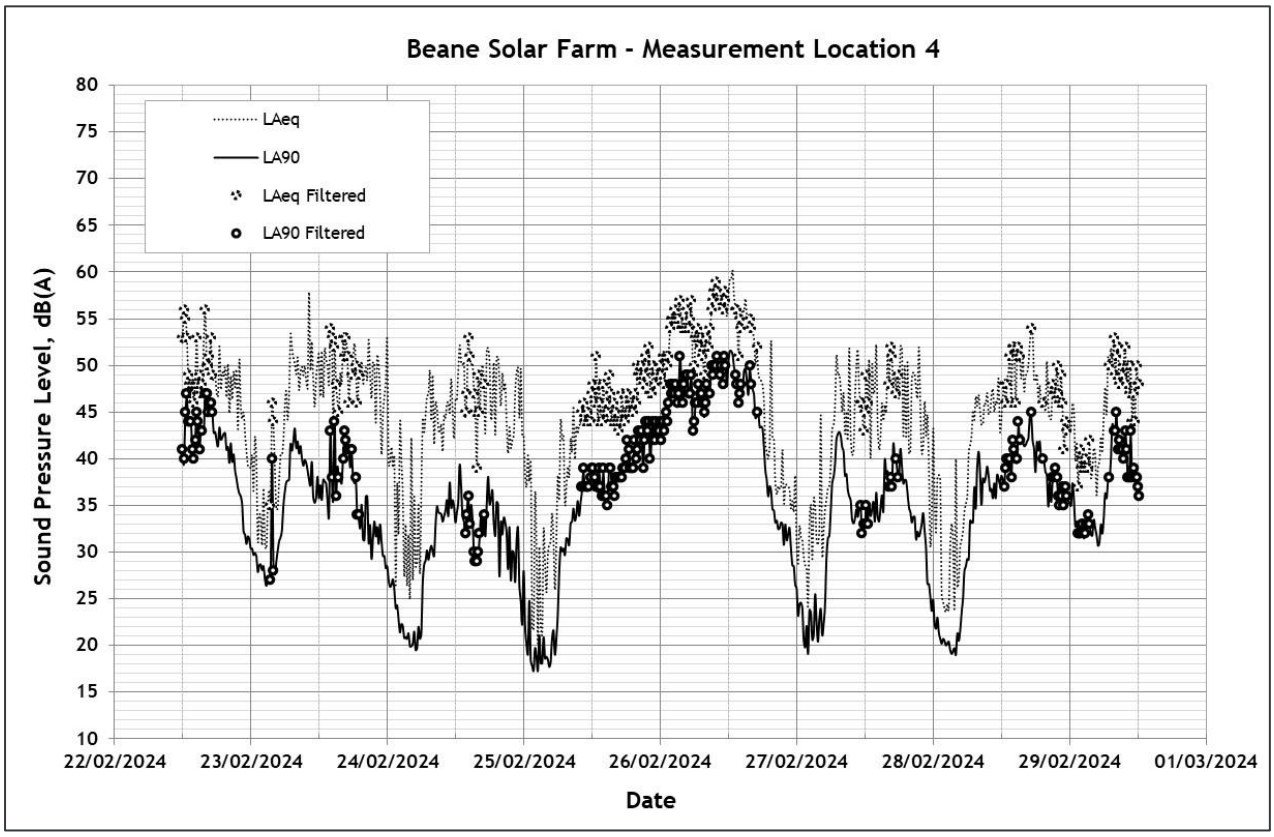


Figure C.14 - Location 4 Data Analysis - All Data

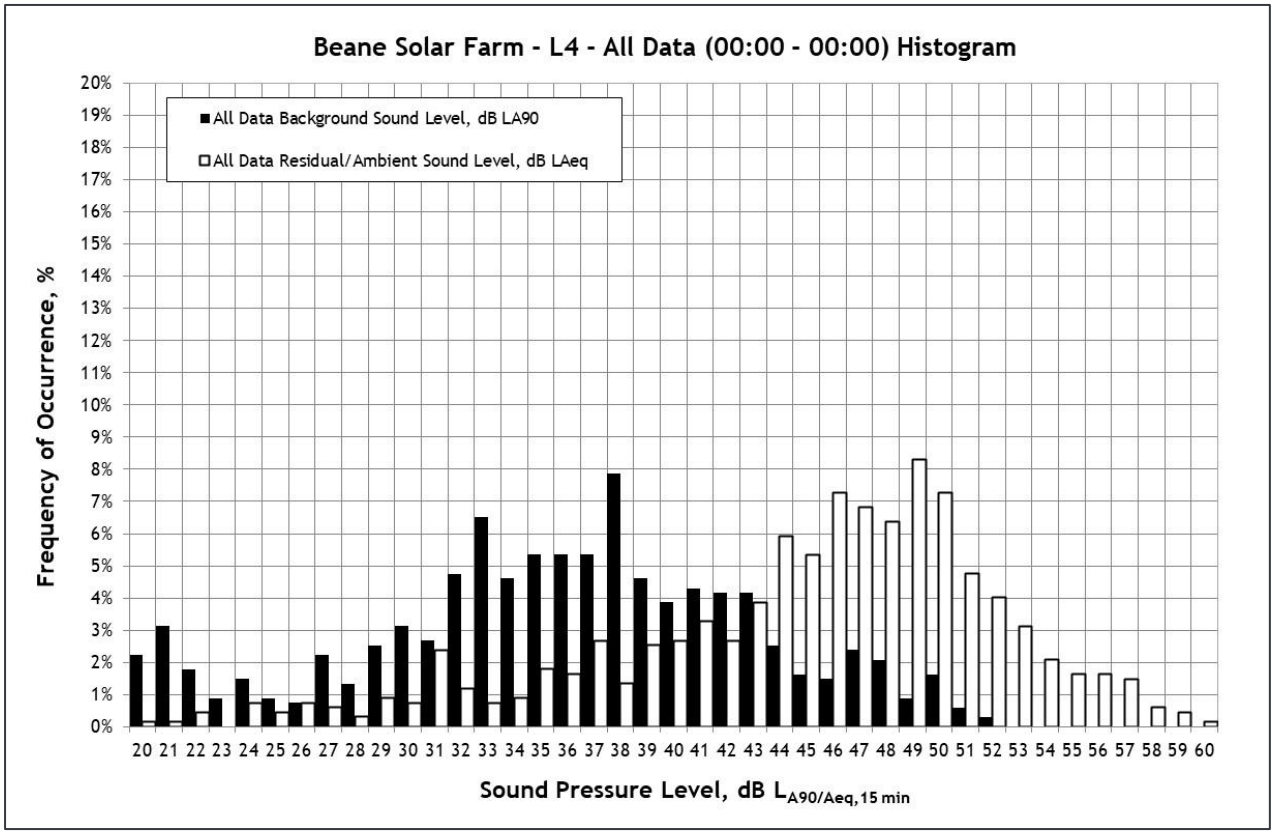


Figure C.15 – Location 4 Data Analysis - Daytime

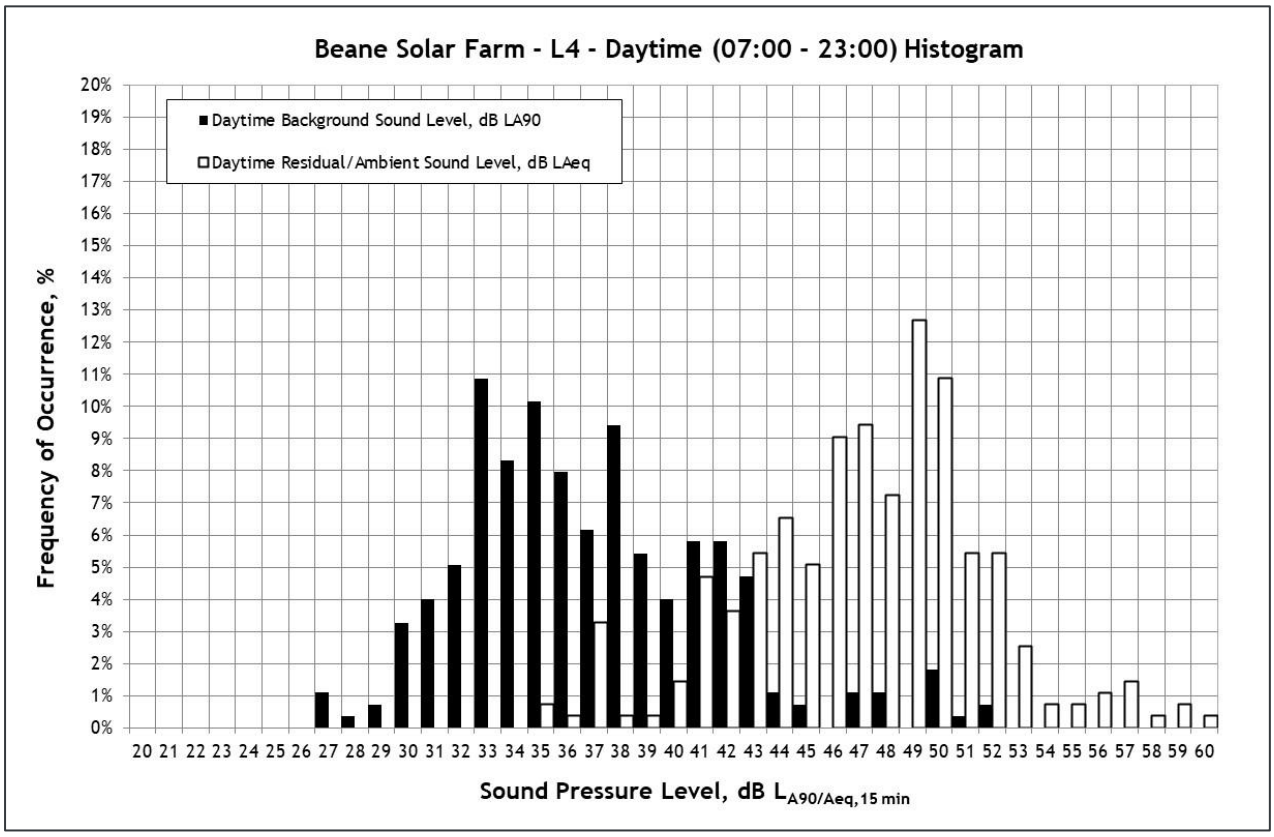
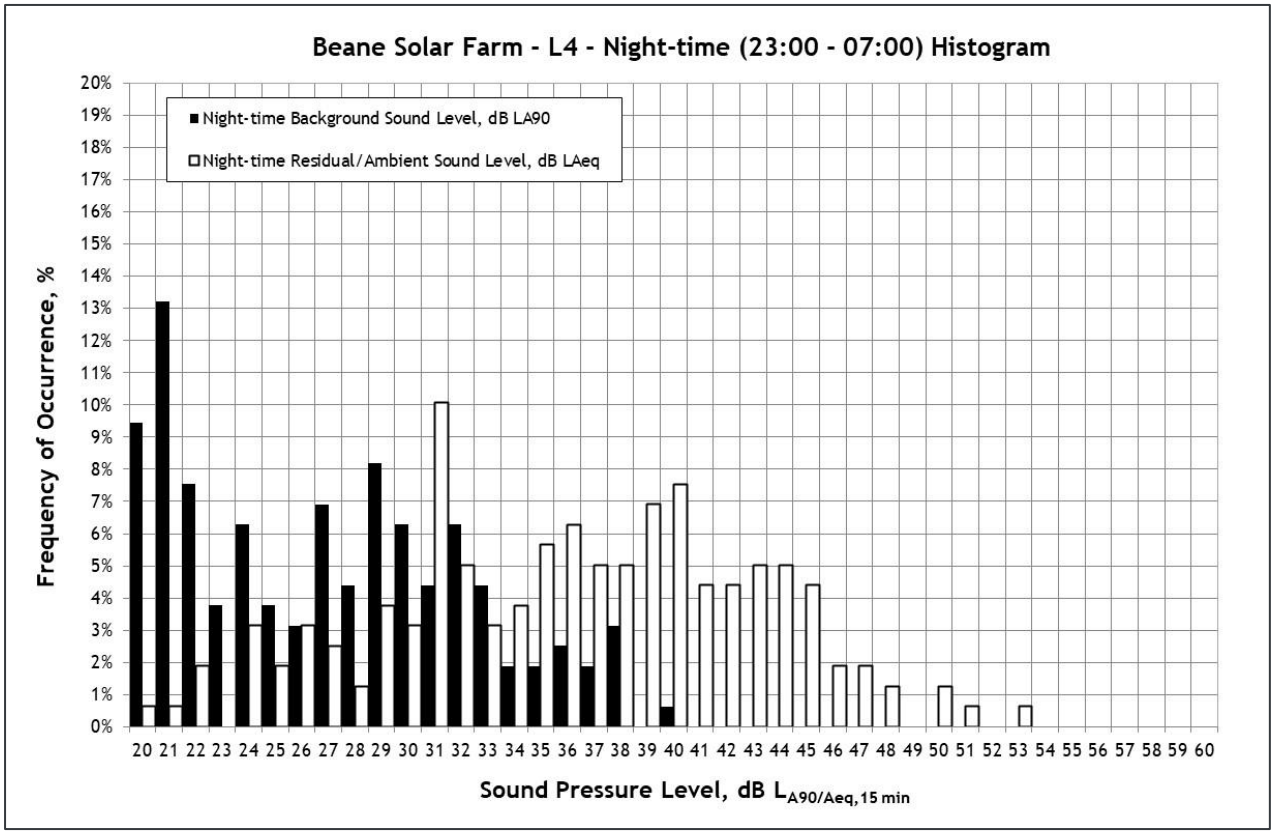


Figure C.16 – Location 4 Data Analysis – Night-time



Appendix D – Suggested Planning Condition Wording

The solar farm shall be designed and operated to ensure that the rating sound level, determined using the BS 4142:2014 + A1:2019 methodology external to an existing residence, shall not exceed 40 dB L_{Ar} or the background sound level plus 5 dB, whichever is the greater, for both daytime and night-time periods.