Acoustic Assessment Report

Foxton Solar Farm Project
Fast Track Approvals Act Application

Genesis Energy Limited

Prepared by:
SLR Consulting New Zealand

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Basis of Report

This report has been prepared by SLR Consulting New Zealand (SLR), on the instruction of Genesis Energy Limited (the Client), in accordance with the agreed scope of work. It is intended to support the Client's application under the Fast Track Approvals Act 2024 and may be relied upon by the Expert Panel and relevant administering agencies for the purposes of assessing the application. While SLR has exercised due care in preparing this report, it does not accept liability for any use of the report beyond its intended purpose. Where information has been supplied by the Client or obtained from external sources, it has been assumed to be accurate unless otherwise stated.

Statement of Qualifications and Experience

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Lodewyk Jansen is an Associate Consultant at SLR Consulting New Zealand Limited (SLR), a global environmental consultancy. He joined SLR in 2020 and is a full member of the Acoustical Society of New Zealand (ASNZ).

He holds a BSc (Hons) in Environmental Sciences and Development from North West University, South Africa (2009) and has over 13 years' experience in acoustics, including nine in New Zealand. His expertise focuses on environmental noise for industrial, infrastructure, and utility projects. Lodewyk has contributed to numerous assessments, including three solar farm applications under the COVID-19 Recovery (Fast-track Consenting) Act 2020. He has participated in Environment Court mediation and presented technical evidence at Council hearings.

As author of this report, Lodewyk confirms compliance with the Environment Court of New Zealand Practice Note 2023, section 9 – Code of Conduct for Expert Witnesses.

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Peter Runcie is Technical Director at SLR Consulting New Zealand Limited. He holds a BSc (Hons) in Audio Technology from the University of Salford (UK, 2007) and is a full member of the Institute of Acoustics (UK), ASNZ, and the New Zealand Planning Institute. He also represents SLR NZ in the Association of Australasian Acoustical Consultants.

Peter has over 18 years' experience in acoustic consultancy across New Zealand, Australia, the Middle East, and the UK. His work includes environmental noise assessments for industrial, infrastructure, and land-use planning projects. He has presented expert evidence at Council hearings and in the Environment Court.

As reviewer of this report, Peter confirms compliance with the Environment Court of New Zealand Practice Note 2023, section 9 – Code of Conduct for Expert Witnesses.

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Acronyms and Abbreviations

Abbreviation	Description
Ambient noise level	The all-encompassing sound is associated with an environment or area, including the specific sound. Also referred to as the “Total Sound”
Background noise level (LA90)	The level in decibels equalled or exceeded for 90% of the measurement interval. It is the component of residual sound that subjectively is perceived as continuously present. The sample time shall be indicated in the descriptor (example dB LA90(15minutes))
BESS	Battery Energy Storage System
dB	Decibel
dBA	‘A’ weighted decibel.
DIN 4150-3	German Standard DIN 4150-3 “Structural Vibrations – Part 3: Effects of vibration on structures”
Impulsive noise	Transient sound having a peak level of short duration, typically less than 100 milliseconds.
Intermittent noise	Noise that varies in level with the change in level being audible.
ISO 9613-2	International Standards Organisation ISO 9613-2:1996 “Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation”.
L90, L10, LN, etc.	Statistical exceedance levels, where LN is the sound pressure level exceeded for N% of a given measurement period.
LAeq	The ‘A’ weighted equivalent noise level. It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
LAmax	The A’ weighted maximum sound pressure level of an event.
Lp or SPL	Sound Pressure Level.
Lw or SWL	Sound Power Level.
MW	Megawatt
MWp	Megawatt peak – a measure of the maximum potential output of power. A unit of measurement for the output of power from a source such as solar or wind where the output may vary according to the strength of sunlight or wind speed
Noise logger	A self-contained, battery powered item of equipment that is used to measure noise levels over several days.
NZS 6801:2008	New Zealand Standard NZS 6801:2008 “Acoustics – Measurement of Environmental Sound”.
NZS 6802:2008	New Zealand Standard NZS 6802:2008 “Acoustics – Environmental Noise”.
NZS 6803:1999	New Zealand Standard NZS 6802:2008 “Acoustics – Construction Noise”.
Rating level (LR)	A derived level used for comparison with a noise limit.
Residual noise level	The total sound remaining at a given position in a given situation when the specific sound under consideration is suspended or is an insignificant part of the total sound.
SAC	Special Audible Characteristics
Specific sound	The component of the total sound that can be identified as associated with a specific source.
Specific source	An activity or object that emits sound and includes a site from which noise is emitted.
Steady-state noise	A noise that remains relatively constant in level over time, as opposed to time-varying noise which fluctuates over time.
Tonality	Noise that contains a prominent frequency.

1.0 Introduction

SLR has been engaged by Genesis Energy Limited (Genesis) to assess acoustic effects associated with the construction and operation of a 180 MWac Solar Farm with a 100 MW Battery Energy Storage System Facility (**BESS**) located between Wall Road and Motuiti Road near Foxton. It is understood that the proposed Solar Farm Project requires resource consent in accordance with the Horowhenua District Plan and Horizons Regional Plan. The acoustic component of the project is assessed accordingly within in this report.

This assessment details the noise generating activities associated with the project, assumptions made and evaluating the predicted levels against the relevant noise rules set out in the Horowhenua District Plan (the **Plan**). Where required, management measures and mitigation have been identified to control noise and minimise effects.

2.0 Site Location and Project Description

2.1 Site Description

The subject site for the proposed solar farm is located at at 304 - 508 Wall Road and 447 Motuiti Road, Foxton within the Horowhenua District. The site is situated approximately 4 km north of the Foxton town centre, on a 488 hectare site currently used for dairy farming and runoff grazing.

It and all neighbouring properties are located on land zoned *General Rural*. The area is sparsely populated with concentrations of existing dwellings north and south of the site. A detailed list of neighbouring properties (assessment locations) and a figure showing their location relative to the site is provided in **Appendix A**. Any other dwellings or properties not included in the detailed list of properties are located further from the site and the predicted noise levels and noise effects are similar or lower than predicted at the assessment locations used in the assessment.

2.2 Project Description

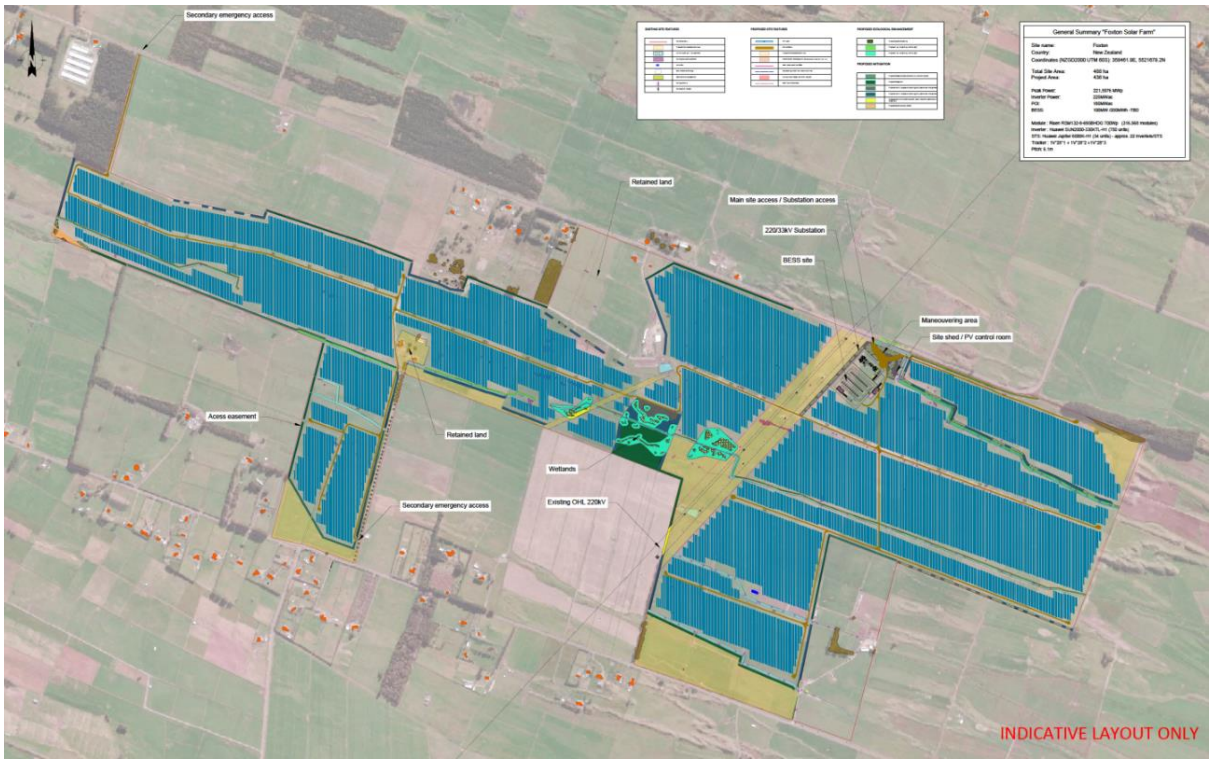
The solar farm would consist of solar panels and power generation equipment arranged in rows across the site with a battery energy storage system. The renewable electricity generated will be connected to the National Grid via a new on-site substation and connection assets. Overall, the project development area is approximately 335 ha, of which the BESS and substation would take up a total 3 ha. The proposed site layout (provided by Fotowatio Renewable Ventures “Foxton Solar Farm – General Layout” (revision 01.12) dated 24 November 2024) is shown in **Figure 1**.

The solar farm component would generate electricity during the daylight hours, from approximately 5:00 am to 6:00 pm in summer and between 8:00 am to 4:00 pm in winter. The PV panels arrays would track the sun path during the day using small electric motors that would rotate the solar array frame around a central horizontal axis. These tracker motors are understood to operate intermittently during the daylight hours and only for a short period as they are only required to make small incremental adjustments. The electricity generated by the PV arrays would be converted from direct current (**DC**) to alternating current (**AC**) through central inverter units.

The BESS would store energy that can be discharged to the local grid when required. It is understood that the most common time for the BESS to discharge would be during peak electricity demand periods; these typically occur during the daytime such as in the mornings between 7:00 am and 9:00 am and the evenings between 5:00 pm and 7:00 pm. The BESS component comprises battery units, power control system inverter units with medium voltage transformer and switchgear mounted on skids.

For the facility to supply electricity during the peak electricity demand periods without interruption, the BESS would recharge from the local network during the night and/or during the day when electricity demand is low.

Figure 1 Proposed Site Layout



The BESS is likely to operate at lower levels during times when it is required to provide services that are necessary to keep the electricity grid stable, including assisting with the control of grid frequency (this is known as frequency keeping), supporting voltage on the grid (voltage support), and being ready to rapidly supply electricity to make up for shortfalls if another generating plant or transmission line on the system trips (reserves). This latter operational mode may require the output of the facility to increase to a high output in a moment's notice and could occur at any time during the day or night – albeit this is understood to be unlikely to occur at night.

The solar farm project would connect to the local electrical grid, through the proposed substation and transformer unit.

Day-to-day operations would primarily be on automatic control 24 hours per day 7 days per week with very little human intervention.

3.0 Performance Standards

3.1 Construction Noise

Construction work is anticipated to take more than 20 weeks to complete. Rule NOISE-R1(5) of the Plan states that construction noise must comply with the requirements specified in NZS 6803:1999 "Acoustics - Construction Noise" (**NZS6803**).

NZS 6803 outlines noise limits for construction works lasting longer than 20 weeks, which apply to this project. These noise limits, reproduced in **Table 1**, are measured at a distance of 1 m from the facade of any dwellings occupied during the works.

Table 1 Construction Noise Limits – Table 2 of NZS 6803 (Long-term Duration)

Time of Week	Time Period	Long-term duration of Construction work (more than 20 weeks)	
		dB L_{Aeq}	dB L_{Amax}
Weekdays	6:30 am – 7:30 am	55	75
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	65	80
	8:00 pm – 6:30 am	45	75
Saturdays	6:30 am – 7:30 am	45	75
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	45	75
	8:00 pm – 6:30 am	45	75
Sundays and public holidays	6:30 am – 7:30 am	45	75
	7:30 am – 6:00 pm	55	85
	6:00 pm – 8:00 pm	45	75
	8:00 pm – 6:30 am	45	75

3.2 Operational Noise

NOISE-R1(3) of the Plan states that noise levels generated from any activity and received at or within any other "General Rural" zoned property should not exceed the limits in **Table 2**. The noise limits apply at or within the boundary of surrounding properties, irrespective of whether they contain dwellings.

Table 2 Operational Noise Limits – Rule NOISE-R1(3)

Period	Timeframe	Noise Criteria
Daytime	7:00 am – 7:00 pm	55 dB $L_{Aeq(15min)}$
Evening	7:00 pm – 10:00 pm	50 dB $L_{Aeq(15min)}$
Night-time	10:00 pm – 7:00 am	40 dB $L_{Aeq(15min)}$ 65 dB L_{Amax}

The Plan notes that noise levels should be measured in compliance with the requirements outlined in NZS 6801:2008 "Acoustic Measurement of Environmental Sound" (**NZS6801**) and assessed following NZS 6802:2008 "Acoustics Environmental Noise" (**NZS6802**).

3.3 Vibration

3.3.1 Construction Vibration

Rule NOISE-R4(3) of the Plan requires the measurement and assessment of vibration in accordance with four standards. The following three of the named standards are not considered applicable to construction works (as they either relate to ongoing operational vibration or vibration from blasting which does not form part of the proposal):

- Australian Standard AS 2670.1-2001 “Evaluation of human exposure to whole body vibration - Part 1: General requirements”,
- Australian Standard AS2670.2-1990 “Evaluation of human exposure to whole-body vibration - Continuous and shock-induced vibration in buildings (1 to 80 Hz)”, and
- New Zealand Standard NZS 4403:1976 Code of practice for the storage, handling and use of explosives (Explosives Code)”.

The relevant construction vibration standard is the German Standard DIN 4150-3:1999 “Structural Vibrations – Part 3: Effects of vibration on structures” (**DIN4150-3**). This standard is commonly used throughout New Zealand to assess construction vibration at buildings and provides guideline vibration values that “when complied with, would not result in damage that could have an adverse effect on the structure’s serviceability.” For residential-type buildings, the standard considers serviceability to have been reduced if:

- Cracks form in plastered surfaces of walls.
- Existing cracks in the building become enlarged.
- Partitions become detached from load-bearing walls or floors.

These effects are deemed “minor damage”.

The DIN 4150-3 guideline values for evaluating short-term and long-term vibration on structures are given in **Table 3**. “Short-term” vibrations are defined as those that do not occur often enough to cause structural fatigue and do not produce resonance in the structure being evaluated. “Long-term” vibrations are all the other types of vibration.

To provide a conservative approach, vibration levels from construction activities have been assessed against the “Long-term Vibration” limits.

Table 3 Guideline Values for Vibration to be Used when Evaluating the Effects of Short-term and Long-term Vibration on Structures (DIN 4150-3)

Line	Type of Structure	Guideline values for vi in mm/s				
		Short-term Vibration				Long-term Vibration
		Vibration at the foundation at a frequency of:			Vibration at horizontal plane of highest floor at all frequencies	Vibration at horizontal plane of highest floor at all frequencies
		1-10Hz	10-50Hz	50-100Hz		
1	Commercial type building	20	20-40	40-50	40	10
2	Residential type building	5	5-15	15-20	15	5
3	Listed buildings and sensitive to vibrations	3	3-8	8-10	8	2.5

3.3.2 Operational Vibration

It is generally agreed that solar farms do not generate significant vibration levels during operation. The primary components, such as solar panels, inverters, and battery storage, are stationary and operate without substantial vibration. Overall, vibration levels from solar farms are minimal and unlikely to be noticeable, especially at distances beyond 150 meters from the source.

4.0 Existing Noise Levels

Noise monitoring was carried out to characterise and quantify the noise environment of the surrounding area. To that end two noise loggers were placed north and south of the site as shown in **Figure 2**.

Both noise loggers were Svantek 977D Type 1 sound level meters (serial numbers SN 99014 and SN 98460) and were deployed on Friday, 2 August 2024 and collected after seven days. Noise levels were measured in general accordance with NZS 6801 with no significant drift in calibration found before and after the monitoring period. The weather conditions during the period were generally appropriate for noise measurements with rainfall events or periods of high wind speed removed during post processing of the data.

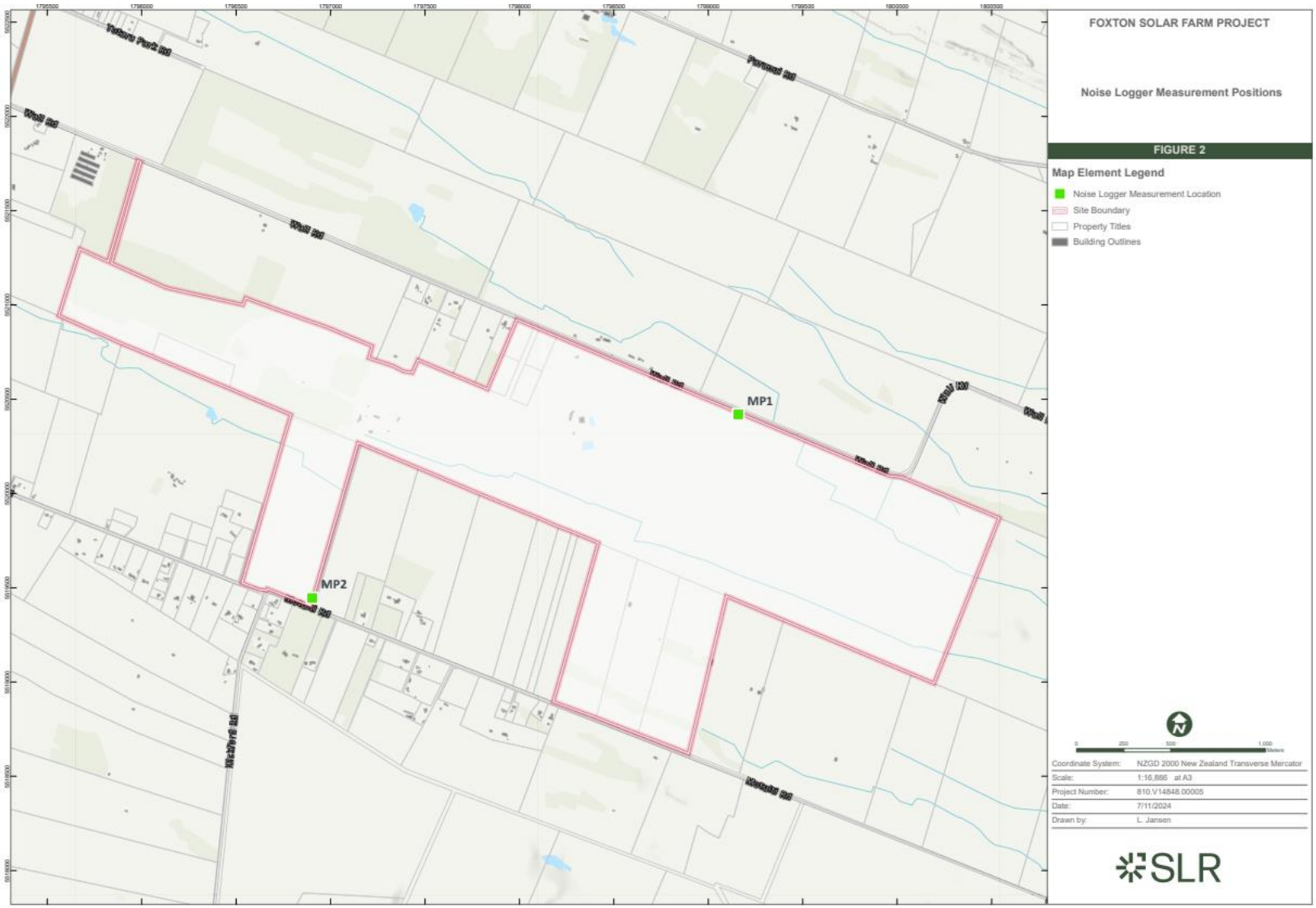
The measured noise levels at the two positions are summarised and presented in **Table 4**. The graphical representation of the measured noise levels is presented in **Appendix B**.

During the deployment and collection of the loggers, the dominant noise sources in the area were observed to be predominantly from wind moving vegetation, occasional local farming activity (onsite farming machinery and irrigation); road traffic noise was audible in the distance. The area could be described as a quiet rural area.

Table 4 Existing Measured Residual Noise Levels

Date	Daytime (T=7:00 am to 7:00 pm)			Evening (T= 7:00 pm to 10:00 pm)			Night-time (10:00 pm to 7:00 am)		
	L_{Amax}	$L_{Aeq,T}$	$L_{A90,T}$	L_{AFmax}	$L_{Aeq,T}$	$L_{A90,T}$	L_{Amax}	Range $L_{Aeq(15min)}$	Range $L_{A90(15min)}$
Northern Position (MP1)									
2/08	81	51	35	56	29	22	79	21 - 53	19 - 29
3/08	83	49	34	46	27	22	78	22 - 54	20 - 32
4/08	82	48	34	76	40	26	80	24 - 53	21 - 37
5/08	85	51	34	85	49	29	81	27 - 54	23 - 37
6/08	86	51	36	77	44	25	80	26 - 53	21 - 34
7/08	81	49	35	53	31	26	80	28 - 55	23 - 36
8/08	81	50	38	57	34	31	78	28 - 54	25 - 34
9/08	79	51	37	n/a	n/a	n/a	n/a	n/a	n/a
Southern Position (MP2)									
2/08	79	52	42	74	51	23	73	22 - 51	19 - 39
3/08	85	52	38	77	51	23	72	22 - 51	20 - 37
4/08	83	51	38	71	46	30	73	24 - 51	21 - 42
5/08	84	54	41	77	48	30	72	31 - 53	26 - 42
6/08	84	54	39	73	47	31	72	27 - 50	22 - 44
7/08	86	54	40	70	46	29	74	32 - 51	25 - 43
8/08	84	53	41	68	45	35	71	31 - 54	29 - 46
9/08	83	56	43	n/a	n/a	n/a	n/a	n/a	n/a

Figure 2 Noise Logger Monitoring Locations



5.0 Construction Assessment

5.1 Noise

At the time of writing, a detailed programme of construction works, hours and likely plant items (quantity and size) to be used on site are not available. Therefore, the assessment of construction noise has been based on typically expected plant derived from experience working on similar projects. It is anticipated that the construction works could occur between 7:00 am and 7:00 pm, Monday to Saturday. High noise-generating motorised equipment are understood to only operate between 7:30 am and 7:00 pm, when the noise limits are higher. No high noise generating work would occur on Sundays and public holidays.

The proposed construction work is expected to involve the clearing and levelling of specific areas (localised at the new substation and BESS footprint). The delivery of equipment and assembly of the BESS and substation infrastructure would take place after the earthworks are completed.

The loudest construction activity from solar farm projects is typically impact piling of the structural support for the solar panel arrays, which is completed using a specialist piece of equipment. Typical impact piling rigs are diesel powered, track mounted, high-speed hydraulic piling rigs. A full sequence for completing a pile, (which includes traversing to next pile position, lifting and loading the pile into position, hammering in the pile, releasing the hammered pile), would typically take two minutes to complete, of which half the time includes hammering.

Staging of construction works across the site typically dictates the types of equipment that may work close to each other at any one time.

A summary of typically expected equipment and associated reference sound pressure levels are provided in **Table 5**. These levels are based on a combination of measurements of other similar activities and published data (BS 5228-1: 2009 “Code of practice for noise and vibration control on construction and open sites – Part 1; Noise”).

Table 5 Plant Items and Typical Noise Emission Levels

Stage	Plant Item	Sound Pressure Level at 10 m	Approximate setback distance without mitigation	
			70 dB L_{Aeq}	65 dB L_{Aeq}
Earthworks (Clear and Grade)	Excavator (25-30t) fitted with bucket attachment	75 dB LAeq	20 m	30 m
	Dozer (30-40t)	80 dB LAeq	30 m	55 m
	Grader (15-20t)	75 dB LAeq	20 m	30 m
	Vibratory Roller (Single Drum 20t)	80 dB LAeq	30 m	55 m
Assembly Work (Infrastructure Delivery and Assembly and installation)	Trucks	75 dB LAeq	20 m	30 m
	Forklift or Telehandler	75 dB LAeq	20 m	30 m
	Generator	65 dB LAeq	5 m	10 m
	Crane	70 dB LAeq	10 m	20 m

Stage	Plant Item	Sound Pressure Level at 10 m	Approximate setback distance without mitigation	
			70 dB L_{Aeq}	65 dB L_{Aeq}
Piling	Worst-case Pile Driver	97 dB LAeq	150 m	250 m
	Mini Pile Driver or with shroud	85 dB LAeq	50 m	80 m

At times it is reasonable that some construction equipment, especially during earthworks, could operate in proximity of each other. This cumulation of noise would impact the estimated setback distances to compliance with the 70 dB L_{Aeq} and 65 dB L_{Aeq} noise limit. Based on the loudest earthworks equipment (in this instance being a dozer and an excavator) the setback distance to compliance with the 70 dB L_{Aeq} limit is approximately 45 m. For compliance with the 65 dB L_{Aeq} limit the distance is approximately 80 m.

As the nearest existing noise-sensitive receiver is approximately 50 m from potential works, compliance with the 70 dB L_{Aeq} and 65 dB L_{Aeq} limit can be achieved during general construction activities.

Impact Piling

In the event that up to two impact piling rigs operate in close proximity of each other, a greater setback distance of approximately 220m would be required to comply with the 70 dB L_{Aeq} limit and a setback distance of more than 370m to meet the 65 dB L_{Aeq} limit. Although the operation of impact piling between 6:00 pm and 7:00 pm could be feasible where the works are more than a significant distance away from any dwellings, it is recommended that impact piling should be restricted to occur between 7:30 am and 6:00 pm, Monday to Friday.

Based on the above identified noise levels and setback distances, compliance with the 70 dB L_{Aeq} and 65 dB L_{Aeq} limits can be achieved through appropriate management based on the distance of impact piling from surrounding dwellings, as follows:

Between 7:30am and 6:00pm (70 dB L_{Aeq} limit):

- Geater than 220 metres from a dwelling piling may occur with simultaneous operation of two large rigs.
- Between 150 and 220 metres from a dwelling (e.g., 447 Motuiti Road, 516 Hickford Road, 212 Motuiti Road, 185 Motuiti Road and 181 Motuiti Road) piling should be limited to a single large piling rig.
- Between 50 and 150 metres from a dwelling (e.g., 371 Wall Road) piling should be limited to a single mini-pile driving rig.

Between 6:00pm and 7:00pm (65 dB L_{Aeq}):

- Geater than 370 metres from a dwelling piling may occur with simultaneous operation of two large rigs.
- Between 250 and 370 metres from a dwelling (e.g., Lot 4 DP385111, 254A Wall Road, 282 Wall Road, 368 Motuiti Road, 525 Hickford Road, 220 Motouiti Road and 194 Motuiti Road) piling should be limited to a single large piling rig.
- Between 80 and 250 metres from a dwelling (e.g., 371 Wall Road, 447 Motuiti Road, 516 Hickford Road, 212 Motuiti Road, 185 Motuiti Road and 181 Motuiti Road) piling should be limited to a single mini-pile driving rig.
- Within 80 metres of a dwelling (e.g., 371 Wall Road) no piling should be carried out during this time period.

5.2 Vibration

It is worth noting that the principal concern of receivers regarding vibration relates to the potential damage to property, rather than impact on amenity. A certain level of amenity impact is expected and common during construction (as is the case with noise) and is commonly accepted with prior advice, such as letter drop and to make occupants aware ahead of the works beginning.

The nearest dwelling is 50 m from the works, therefore compliance with the construction vibration limits would be readily expected at all receivers.

6.0 Operational Noise

6.1 Sound Propagation Methodology and Assumptions

Operational noise generated by the proposal has been predicted using the calculation algorithms outlined in ISO 9613-2:1996 as implemented in version 9.0 of SoundPLAN. This standard provides a general method of calculation for the attenuation of sound outdoors, considering various factors such as source sound power levels, distances, ground reflection, meteorological conditions (the noise model assumes meteorological conditions that slightly enhance propagation in all directions in accordance with NZS 6802), barrier effects and the directivity of a noise source.

The assessment is based on the following information and assumptions with noise source levels associated discussed in **Section 6.2** to **Section 6.4** below and summarised in **Table 6**:

- Addresses, building footprints and property boundaries data obtained from the LINZ Open Data Portal (https://data.linz.govt.nz/).
- Terrain data for the site and surrounding area is based on the drone survey and data obtained from LINZ.
- The proposed site layout and structure heights based on the information provided in the drawings prepared Fotowatio Renewable Ventures “Foxton Solar Farm – General Layout” (revision 01.12) dated 24 November 2024
- All receivers at 1.5 m above ground level at the property boundary.
- The BESS and Substation areas formed of hard acoustically reflective ground, and all other ground surfaces modelled as soft acoustically absorptive ground.

6.2 Assessment Scenario

In lieu of a final design ,the acoustic assessment of the Solar Farm Project is based on the following expected equipment:

a) Solar Component –

i. Approximately 4,200 Individual Tracker Motors (anticipated to run for approximately one minute every 15-minutes to make the required small adjustments to follow the sun).

ii. Approximately 34 low voltage transformers located near central inverter units.

iii. Approximately 67 Central Inverter Units (units without localised mitigation are recommended be located at least 150 m away from the subject site boundary, understood from the project team to be feasible).

b) BESS Component –

   i. Approximately 66 Battery Units
   (based on Canadian Solar Solbank 3.0 Battery Units (S-5016-2H-EU / S-5016-4H-EU and system duty not exceeding 80%).

   ii. Approximately 33 Power Control System Units
   (based on SMA Sunny Central Storage UP (SCS-3950-UP and system duty not exceeding 80%).

   iii. Approximately 11 medium voltage transformer and switchgear mounted on skids.

c) Substation with high voltage transformer.

Noise emissions of the Solar Farm Project are likely to be controlled by the cooling noise from the BESS battery units. With the noise levels varying depending on the percentage of maximum power (charge/discharge) and the temperatures, both ambient and that generated by the equipment.

To provide a conservative approach the operational noise assessment is based on all equipment (Solar Farm, BESS and Substation) operational under clear and sunny conditions (representative of the daytime peak generation conditions) and evaluated against the most stringent night-time noise limit. However, it is unlikely that all equipment would operate simultaneously at full capacity within the night-time period, when solar intensity is less.

It should be noted that the assessment is based on central inverter units that are louder than string inverter units, providing a conservative assessment.

6.3 Noise Sources

The sound power levels (L_{WA}) used in the assessment are based on a combination of measurements, manufacturer's published noise data, and information provided by the project team. All items are modelled based on operating at full load, at a constant state, representing at least a 15-minute period to provide a conservative and robust assessment of the potential upper bound of noise effects.

The acoustic performance of the units in **Table 6** are indicative of units available in the market. The sound power levels of the transformers have been derived based on the rated MVA for this BESS site and reference to AS/NZS 60076.1:2014 “Power transformers General”. The spectrum for the transformers was adopted from reference data by “Bies and Hanson (11.16)”.

No duration adjustment has been applied to the noise sources to represent a robust and conservative approach.

6.3.1 Special Audible Characteristics

Section 6.3 of the NZS6802:2008 contains provisions for adjustments for undesirable noise characteristics such as tonality and impulsiveness. If one or more characteristics are present at the receptor under assessment, then an SAC adjustment should be applied to the overall noise level at that receiver. The following outlines why no SAC is considered relevant to this assessment.

Tonality

Whilst it is not uncommon for inverters, batteries or transformers to exhibit tonal characteristics at various frequencies near the noise sources, given the propagation distance to the nearest receiver combined with residual noise in the area, it is not expected that the source would be perceived to be tonal at the receptors (following the methodology in

Appendix B of NZS 6802:2008) and so an SAC adjustment on the basis of tonality is not considered applicable.

Impulsiveness

The impulsiveness characteristic refers to a dominant sudden acoustic peak, or series of peaks. In this instance noise generation associated to this proposal is not expected to be impulsive in nature.

Table 6 List of Operational Noise Sources

Source	Sound Power Level (dB L_{WA}), per unit
Solar Component	
Individual Tracker Motor	66 dB L_{WA}
Low Voltage Transformer	83 dB L_{WA}
Central Inverter Station	92 dB L_{WA}
BESS Component	
Battery Unit	90 dB L_{WA}
Power Control System	88 dB L_{WA}
Medium Voltage Transformer	70 dB L_{WA}
Substation Transformer	90 dB L_{WA}

Note to **Table 6**:
All sources have been modelled using octave band spectra based on a combination of measurements, manufacturer's published noise data, and information provided by the project team.

6.4 Acoustic Barrier and Mitigation

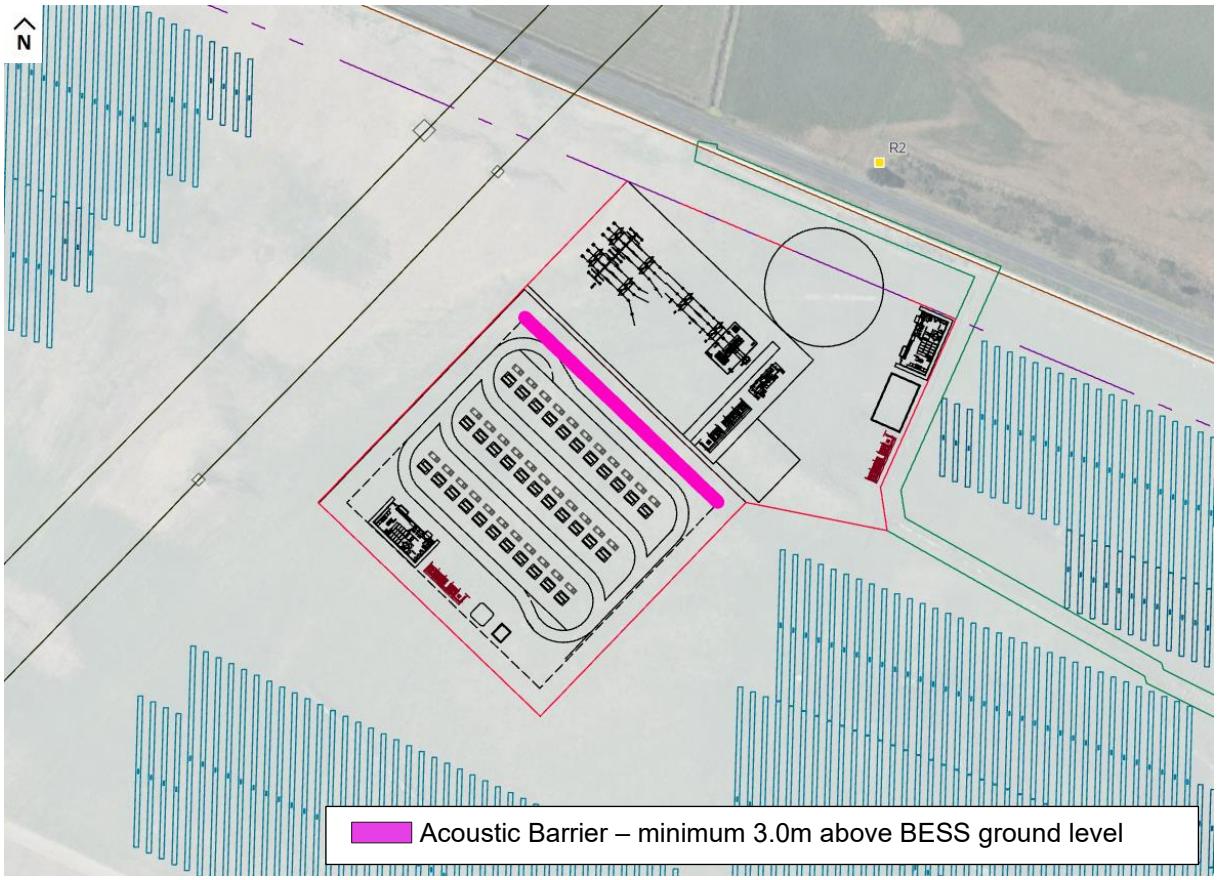
To control noise levels received at the neighbouring property boundaries, based on the indicative noise from the BESS equipment available at the time of preparation, acoustic barrier (in the form of a vertical screening or earthbund) with a minimum height of 3.0 m above BESS ground level along the northern boundary of the BESS facility is recommended and is included in the noise model. The location of the barrier is shown in **Figure 3**.

For an acoustic barrier to be effective, there should be no gaps between panels or between the barrier and the ground. The barrier material must have a minimum surface mass of 10 kg/m^2.

Due to the continued development of BESS and other solar farm related equipment as the market matures, it is possible that this acoustic barrier or above assumed set back distances may not be required if technological advances enable selection of quieter units.

The details of final mitigation measures shall be identified at the time of the detailed site design and equipment selection.

Figure 3 Acoustic Barrier North of BESS Facility



6.5 Predicted Operational Noise Levels

Predicted noise levels are detailed in **Appendix C** at individual receiver locations and in the form of a noise contour map. **Table C-1** lists the predicted highest noise rating levels at or within the boundary of the surrounding receivers and **Table C-2** lists the noise rating levels at 1 m from the façade of the building (the predicted levels include façade reflection). The predicted noise levels show that the worst-case assessment scenario can meet the daytime, evening and night-time noise limits at most of the surrounding properties.

Assessment of Effects

Daytime

The solar farm and BESS facility is predicted to comply with the daytime noise limit of 55 dB L_{Aeq} at the nearest property boundary, being the undeveloped land at Part Himatanangi 3A3F Block (PROP45), north of the BESS facility. At the facade of the most exposed existing dwelling, 371 Wall Road (RES08), the predicted worst-case noise level is more than 15 dB below the daytime limit.

Compliance with the noise limit at the most exposed boundary is predicted with a margin of 10 dB. Predicted levels are approximately 5 dB lower than the measured average daytime ambient noise levels and so would not be expected to be intrusive.

Noise from the solar farm is therefore unlikely to interfere with communication at surrounding property boundaries.

On this basis the daytime noise effects from the proposal can be considered reasonable.

Night-time

The predicted levels comply with the night-time noise limit, 40 dB L_{Aeq}, at most of the surrounding property boundaries, except at the undeveloped land at Part Himatanangi 3A3F Block (PROP45), north of the BESS facility. The predicted night-time noise level at this property infringes the relevant noise limit (40 dB L_{Aeq}), by up to 5 dB at the boundary. This predicted infringement is driven by the contribution from the BESS facility. For information, the contribution from the solar farm component (being tracker motors, inverter system, low voltage transformer units and the substation transformer) is 4 dB below the night-time noise limit.

The nearest existing dwelling is 371 Wall Road, and the predicted worst-case noise level at the facade is 37 dB L_{Aeq}, 3 dB below the night-time limit. In terms of potential effects, night-time noise effects are experienced inside dwellings, rather than outside. Windows partially open for cooling and ventilation on warm summers nights typically reduce external noise levels by approximately 15 dB (a greater reduction is achieved with closed windows). The internal noise contribution from the proposed project at the nearest existing dwelling is anticipated to be below 23 dB L_{Aeq} at all times, with windows partially open. This level it is below the recommended internal noise level range specified in AS/NZS 2107:2016 “Acoustics - Recommended design sound levels and reverberation times for building interiors” (AS/NZS2107) for “sleeping areas in rural zones with negligible transportation noise” (range between 25-30 dB L_{Aeq}).

Furthermore, in the event a new dwelling would establish in the location exposed to the highest noise contribution form the proposal, at the property boundary of Part Himatanangi 3A3F Block, the resulting internal noise level, with partially open windows, would be no more than 30 dB L_{Aeq} at times. Whilst at this level of contribution from the proposal may be audible, at this level it is in the range recommended by AS/NZS 2107 for “sleeping areas in rural zones with negligible transportation noise” (range between 25-30 dB L_{Aeq}). This level aligns with the guideline values from the World Health Organisation (WHO) for the avoidance of sleep impacts (30 dB $L_{Aeq(8hour)}$).

On this basis, whilst noise may be audible at night at times, impacts on sleep are not anticipated at surrounding receivers (existing or future) and night-time noise effects from the proposal can therefore be considered reasonable.

7.0 Conclusion

SLR has been engaged to assess the potential construction and operational noise of the proposed 200 MWp Solar Farm with a 100 MW Battery Energy Storage System Facility between Wall Road and Motuiti Road near Foxton, within the Horowhenua District.

The construction noise assessment identified that predicted noise levels can comply with the relevant construction noise limits due to the setback distance from the works to receivers.

Operational noise levels have been predicted that represent the likely peak operation of the site and equipment. Predicted levels comply with the relevant daytime and evening noise limits at all the surrounding property boundaries. Noise from the proposal is expected to be largely inaudible during the day and evening period; and sufficiently low as to not impact on speech within garden areas.

The predicted worst-case operational noise levels comply with the night-time limit at all but one property boundary, being Part Himatangi 3A3F Block (currently undeveloped). Noise levels at all properties that have existing dwellings, comply with the night-time limit.

Due to the large separation distance from existing dwellings, it is expected that noise from the solar farm would not result in sleep impacts at any of the existing dwellings, with partially open windows.

In the event if a future dwelling is constructed on Part Himatangi 3A3F Block at the most exposed location, the result internal noise level at this dwelling would be within the acceptable range for the avoidance of sleep impacts, with windows open. The resulting internal noise level would be further reduced with closed windows, further minimising any potential effects.

In summary, the noise effects associated with the construction and operation of the solar farm are considered reasonable.

Due to the continued development of BESS and other solar farm related equipment as the market matures, it is recommended that the details of final mitigation measures shall be identified at the time of the detailed site design and equipment selection.

Appendix A List of Surrounding Receivers

Acoustic Assessment Report

Foxton Solar Farm Project
Fast Track Approvals Act Application

Genesis Energy Limited

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Figure A- 1 Assessment Locations for all Nearest Property Boundaries, including Dwellings

Table A- 1 List of Surrounding Property Boundaries and Existing Residences

Assessment Location		Address	Legal Description
Boundary	Dwelling		
PROP01	RES01	n/a	Lot 4 DP385111
PROP02	RES02	254A Wall Road	Lot 2 DP 376038
PROP03	RES03	282 Wall Road	Lot 1 DP 354340
PROP04	RES04	286 Wall Road	Lot 2 DP 354340
PROP06-08	RES06-08	371 Wall Road	Himatngi 3A3G1 Block
PROP09	RES09	447 Motuiti Road	Lot 3 DP31997 and Part Himatangi 5A4B Block
PROP10	RES10	368 Motuiti Road	Lot 2 DP 343966
PROP18	RES18	516 Hickford Road	Lot 2 DP 389184
PROP19	RES19	212 Motuiti Road	Lot 1 DP 351786
PROP20	RES20	525 Hickford Road	Lot 2 DP 356695
PROP24	RES24	185 Motuiti Road	Lot 3 DP 520424
PROP26	RES26	125 Motuiti Rod	Lot 7 DP564913
PROP38	RES38	220 Motouiti Road	Lot 1 DP 338576
PROP39	No dwelling	n/a	Lot 8 DP564913
PROP40	RES40	58 Wall Road	Lot 1 DP 393907 and Lot 3 DP 40855
PROP41	RES41	181 Motuiti Road	Lot 4 DP 520424
PROP42	RES42	180 Motuiti Road	Lot 6 DP 85425
PROP43	RES43	194 Motuiti Road	Lot 1 DP 356695
PROP44	RES44	366 Motuiti Road	Lot 1 DP 343966
PROP45	No dwelling	449 Wall Road	Part Himatangi No. 3A3F Block
PROP46	No dwelling	152 Wall Road	Lot 2 DP 427921
PROP47	No dwelling	n/a	Himatangi 7 Block
PROP48	No dwelling	n/a	Himatangi 5A9C 2Block
PROP49	No dwelling	n/a	Himatangi 5A9B Block
PROP50	No dwelling	233 Motuiti Road	Lot 2 DP 304320
PROP51	No dwelling	n/a	Lot 2 DP481340
PROP52	No dwelling	301 Motuiti Road	Himatangi 5A5B Block
PROP53	No dwelling	n/a	Himatangi 5A5C2C Block
PROP54	No dwelling	n/a	Part Himatangi 5A5C2B Block
PROP55	No dwelling	n/a	Part Himatangi 5A5C2A Block
PROP56	No dwelling	n/a	Part Hohotaka 5A5C Sec1 Block
PROP57	No dwelling	420 Motuiti Road	Lot 1 DP 19089
PROP58	No dwelling	438 Motuiti Road	Lot 1 DP31400
PROP59	No dwelling	n/a	Himatangi 5A3A Block

Assessment Location		Address	Legal Description
Boundary	**Dwelling**		
PROP60	No dwelling	541 Motuiti Road	Himatangi 5A3B Block
PROP61	No dwelling	n/a	Part Himatangi 4C3 Block
PROP62	No dwelling	522 Wall Road	Part Himatangi No. 3A 3E Block
PROP63	No dwelling	442 State Highway 1	Section 722 Town of Carnavon and Part Himatangi 3A3H Block
PROP64	No dwelling	n/a	Part Himatangi 5A6B Block
PROP65	No dwelling	n/a	Part Himatangi 5A6A2 Block

Appendix B Graphical Representation of Measured Noise Logger Data

Acoustic Assessment Report

Foxton Solar Farm Project
Fast Track Approvals Act Application

Genesis Energy Limited

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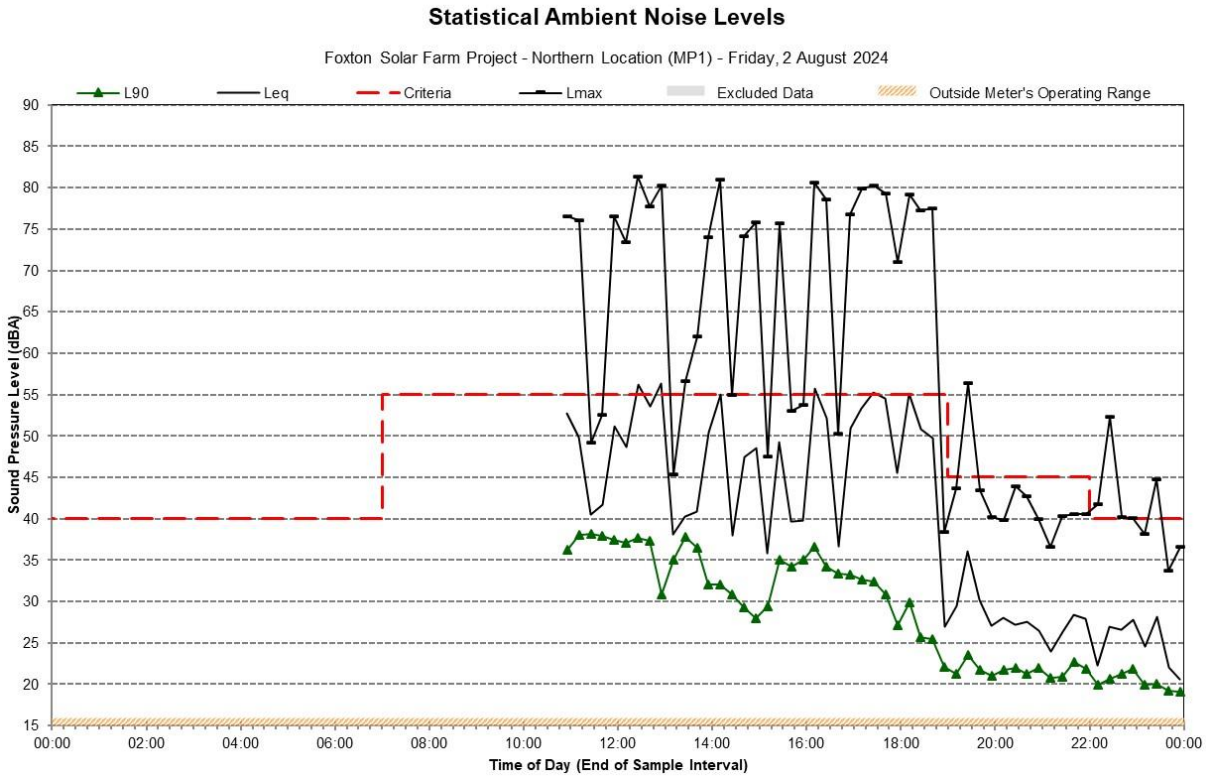
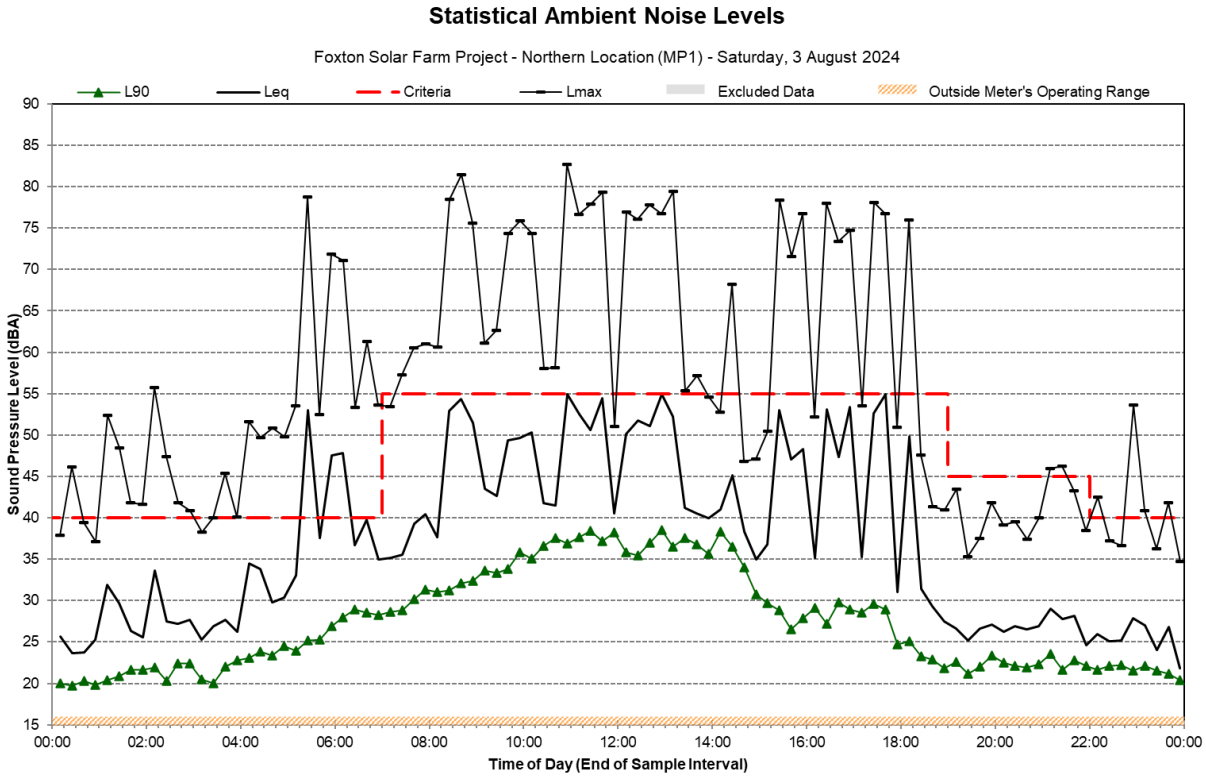
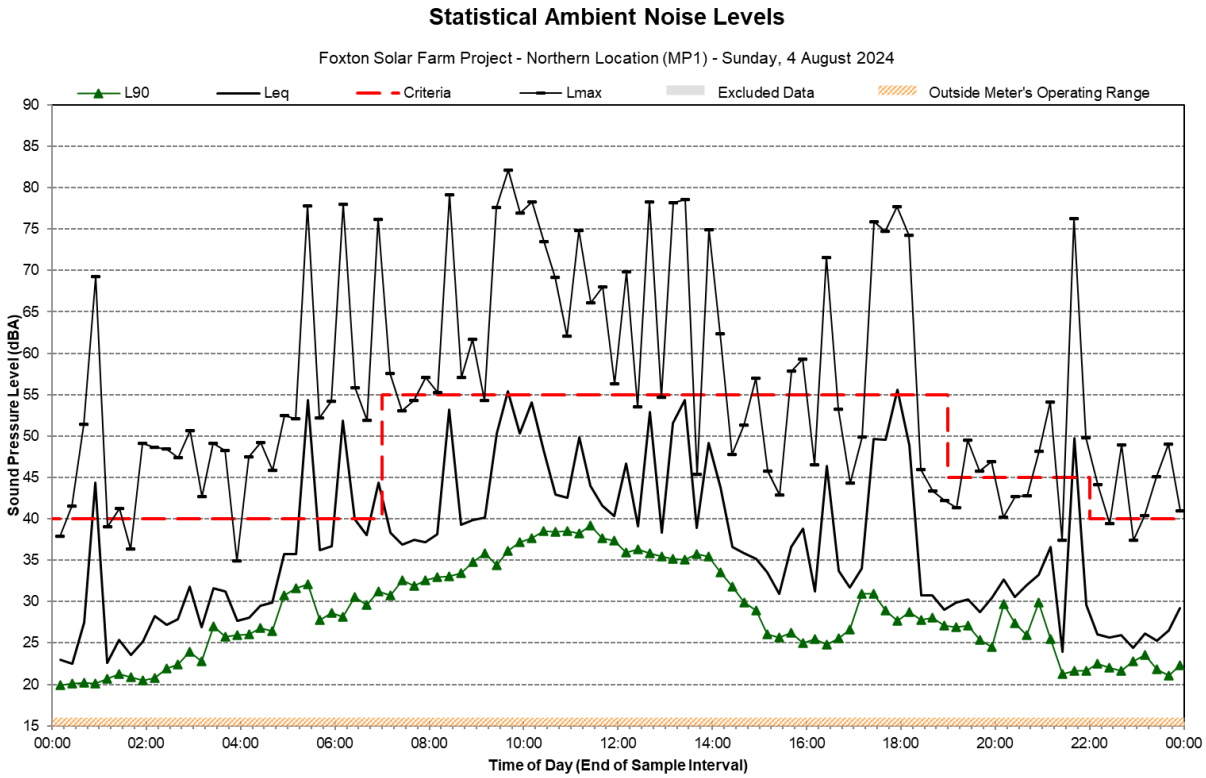
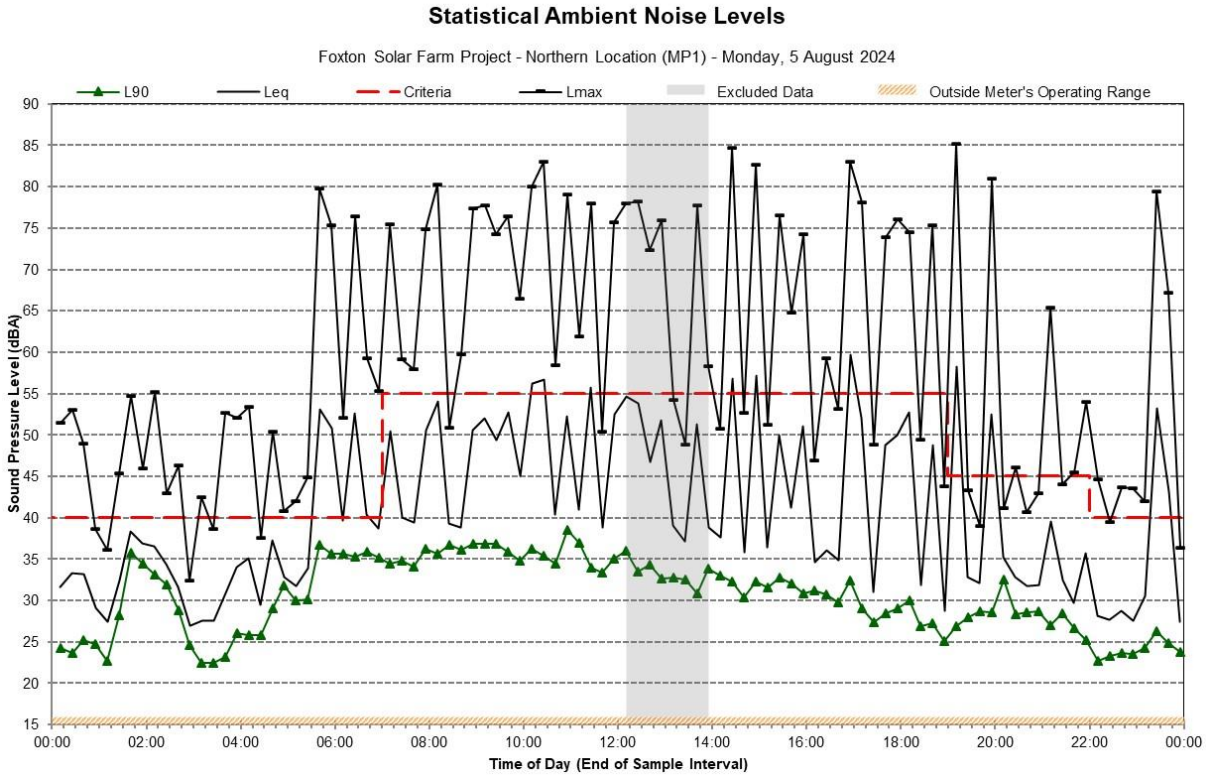
B.1 Measured Noise Levels at MP-North

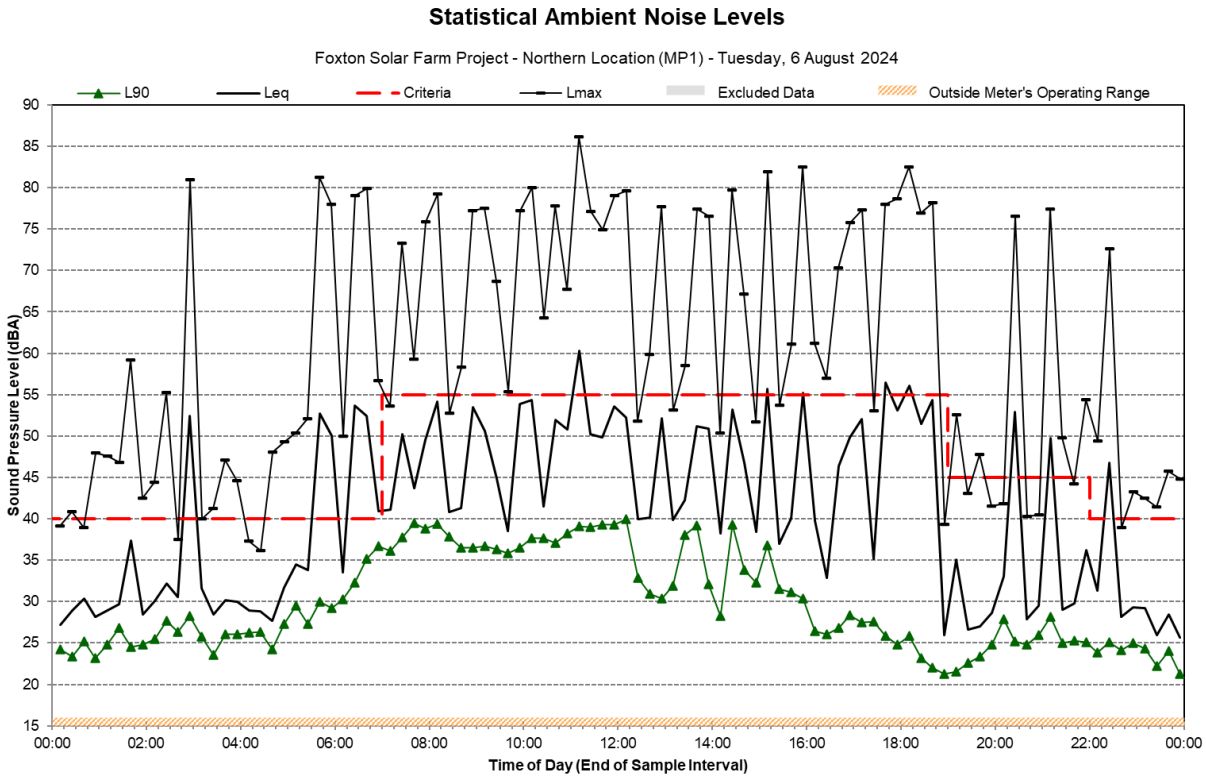
Figure B - 1 North Noise Logger

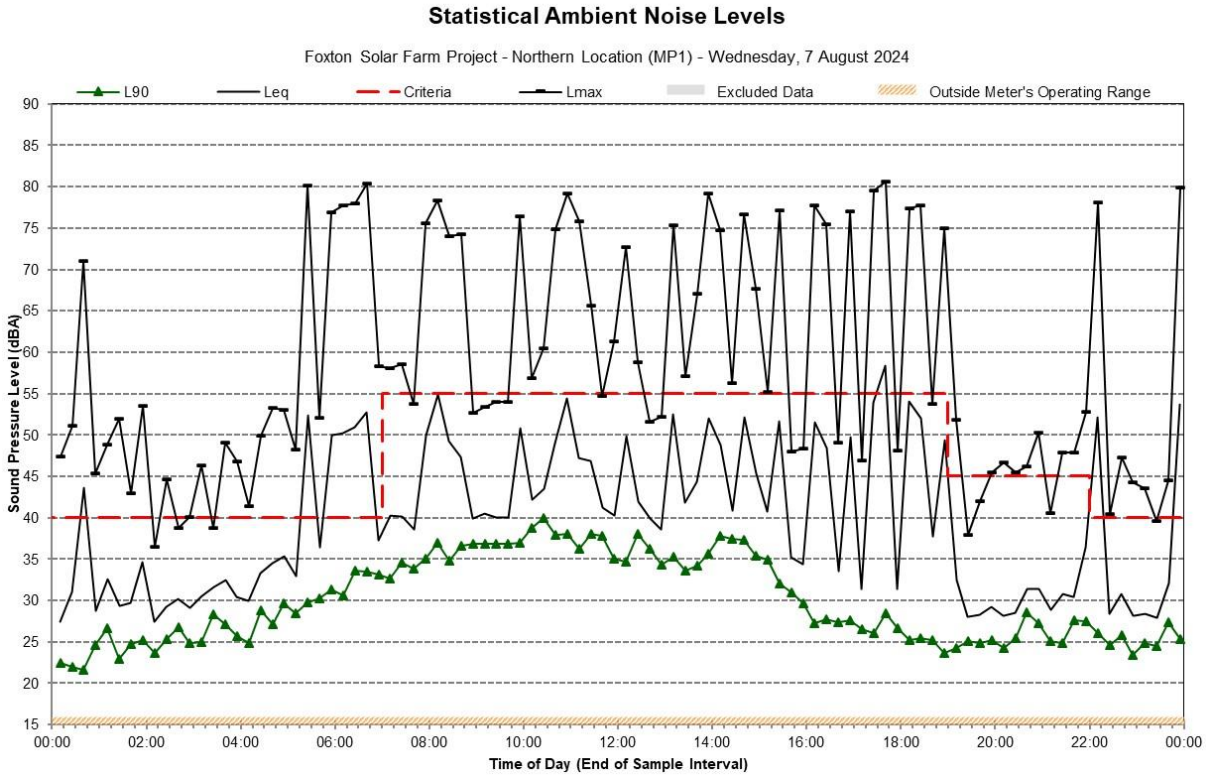


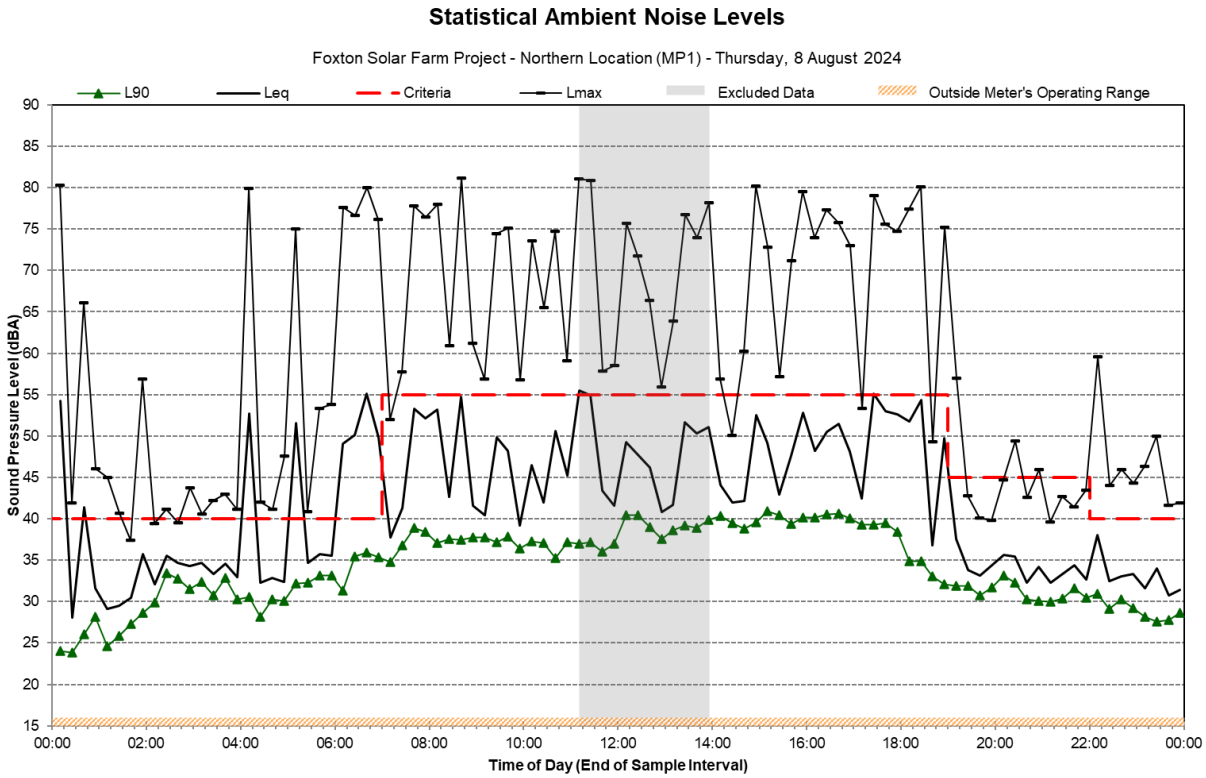

Statistical Ambient Noise Levels
Foxton Solar Farm Project - Northern Location (MP1) - Saturday, 3 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

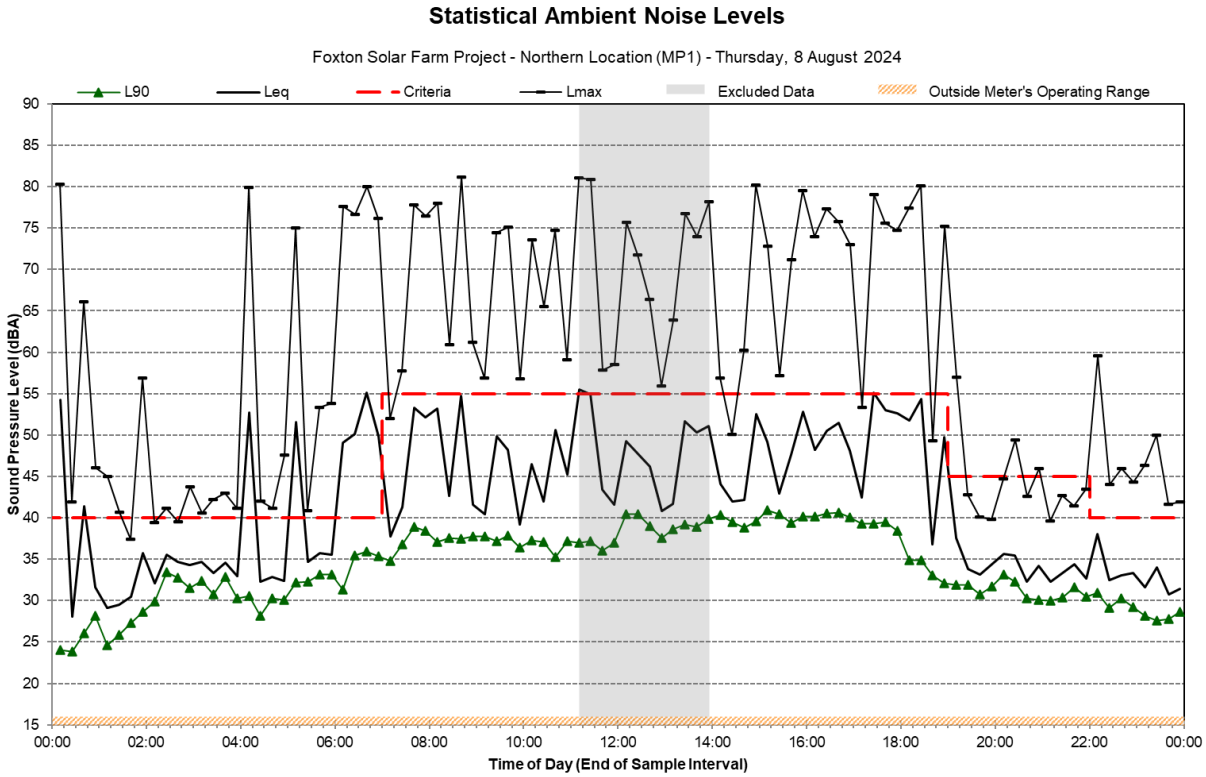

Statistical Ambient Noise Levels
Foxton Solar Farm Project - Northern Location (MP1) - Sunday, 4 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Foxton Solar Farm Project - Northern Location (MP1) - Monday, 5 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Foxton Solar Farm Project - Northern Location (MP1) - Tuesday, 6 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

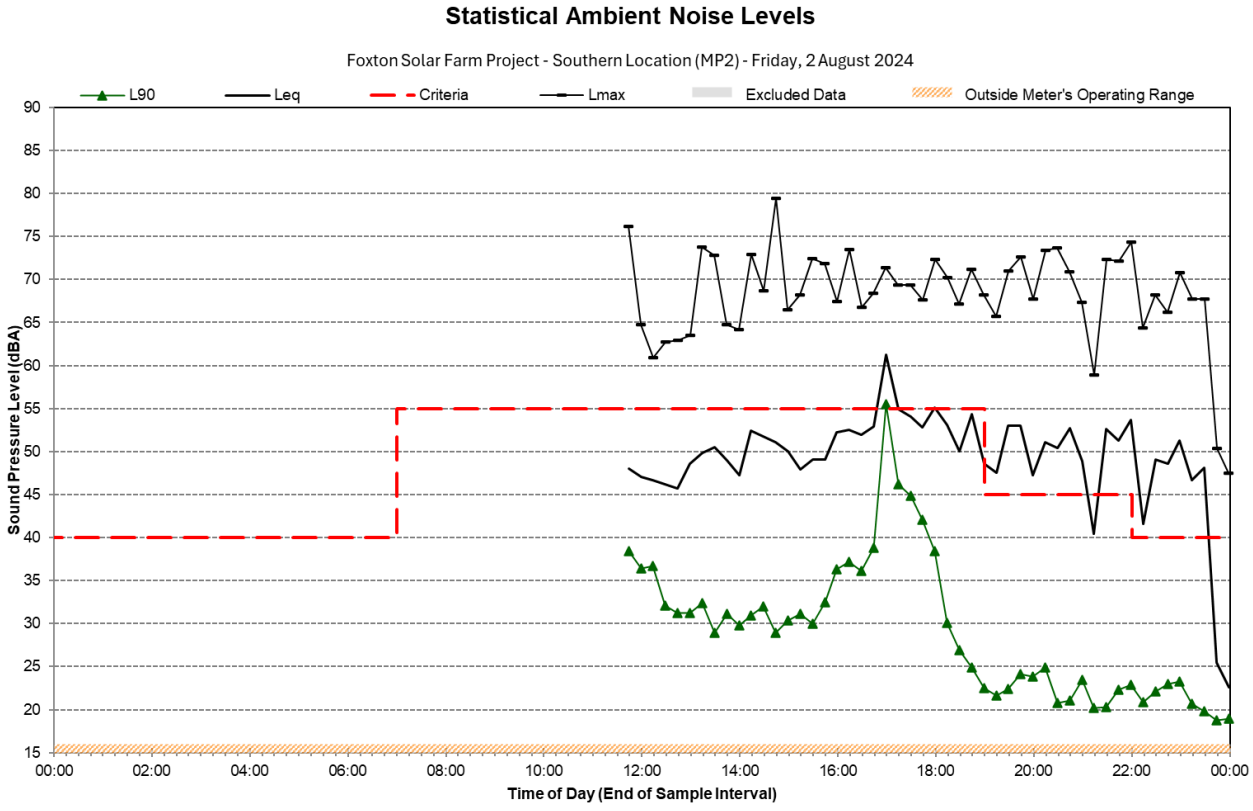

Statistical Ambient Noise Levels
Foxton Solar Farm Project - Northern Location (MP1) - Wednesday, 7 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

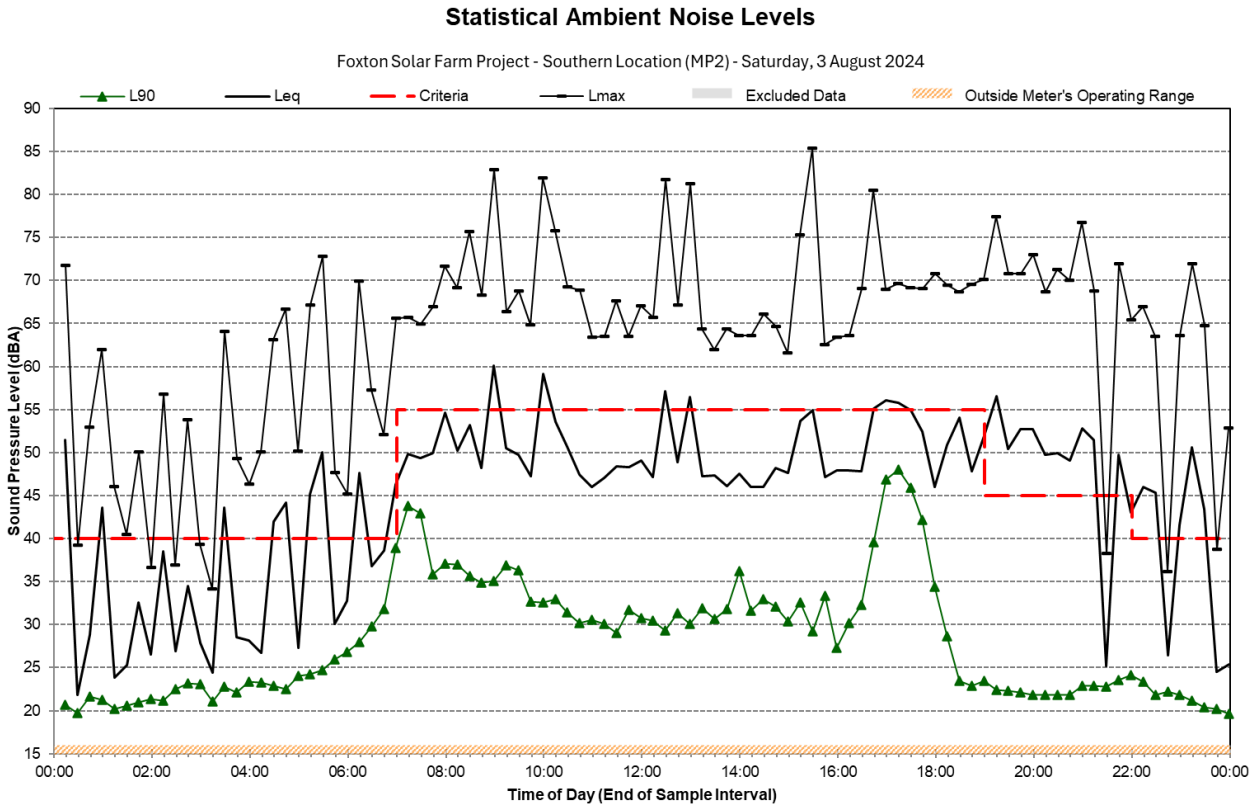

Statistical Ambient Noise Levels
Foxton Solar Farm Project - Northern Location (MP1) - Thursday, 8 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

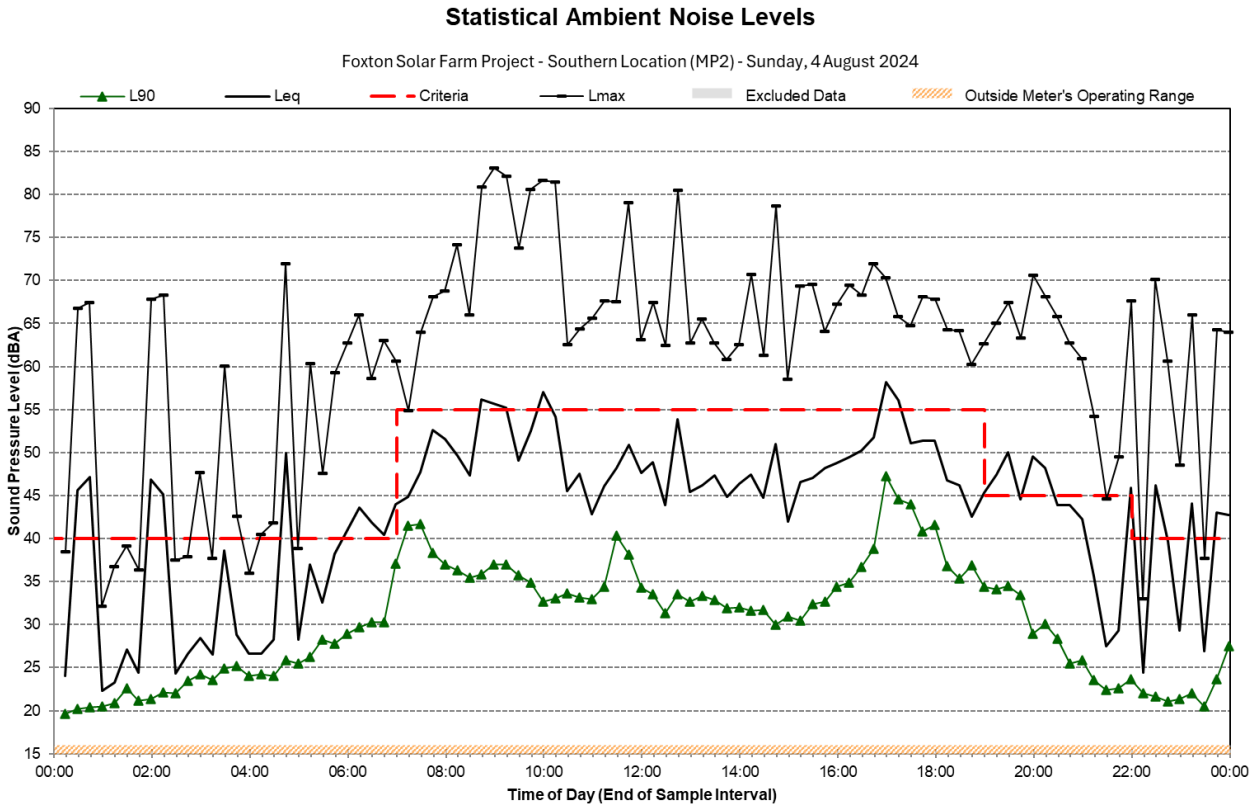

Statistical Ambient Noise Levels
Foxton Solar Farm Project - Northern Location (MP1) - Thursday, 8 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00
Time of Day (End of Sample Interval)

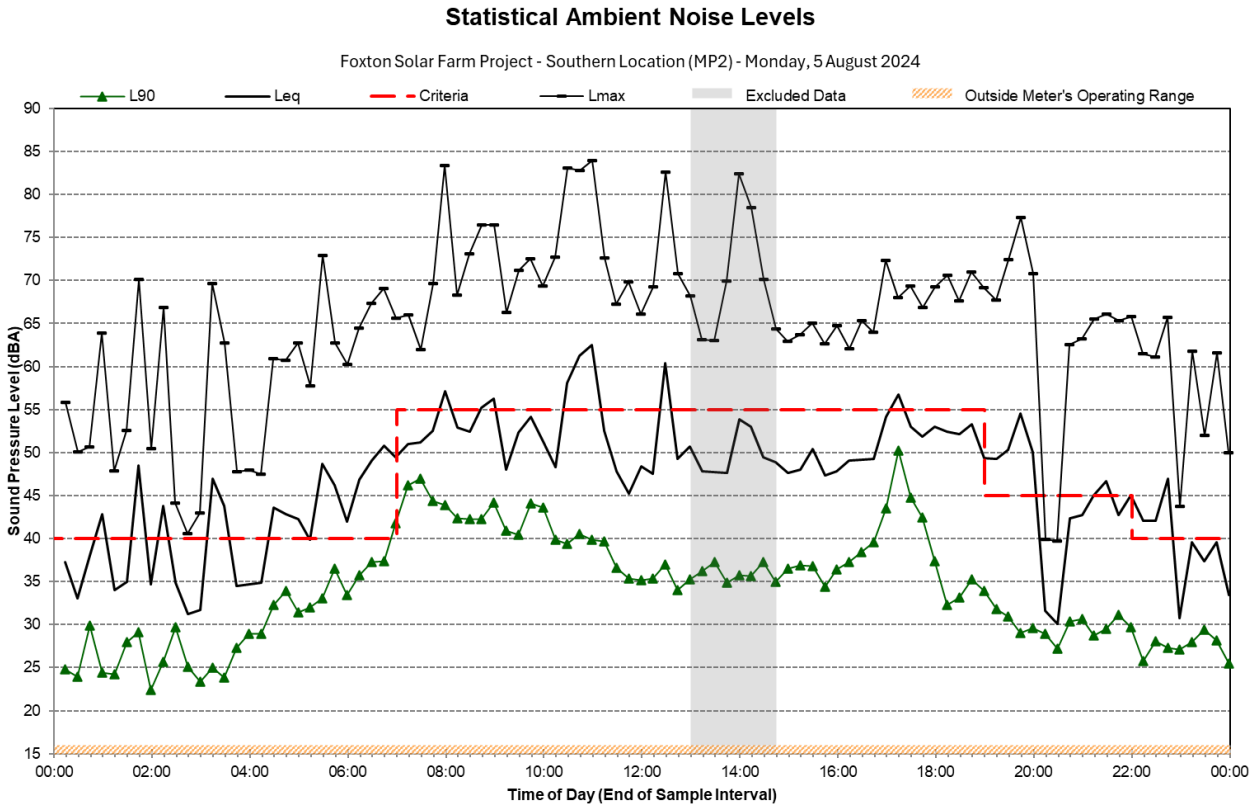
B.2 Measured Noise Levels at MP-South

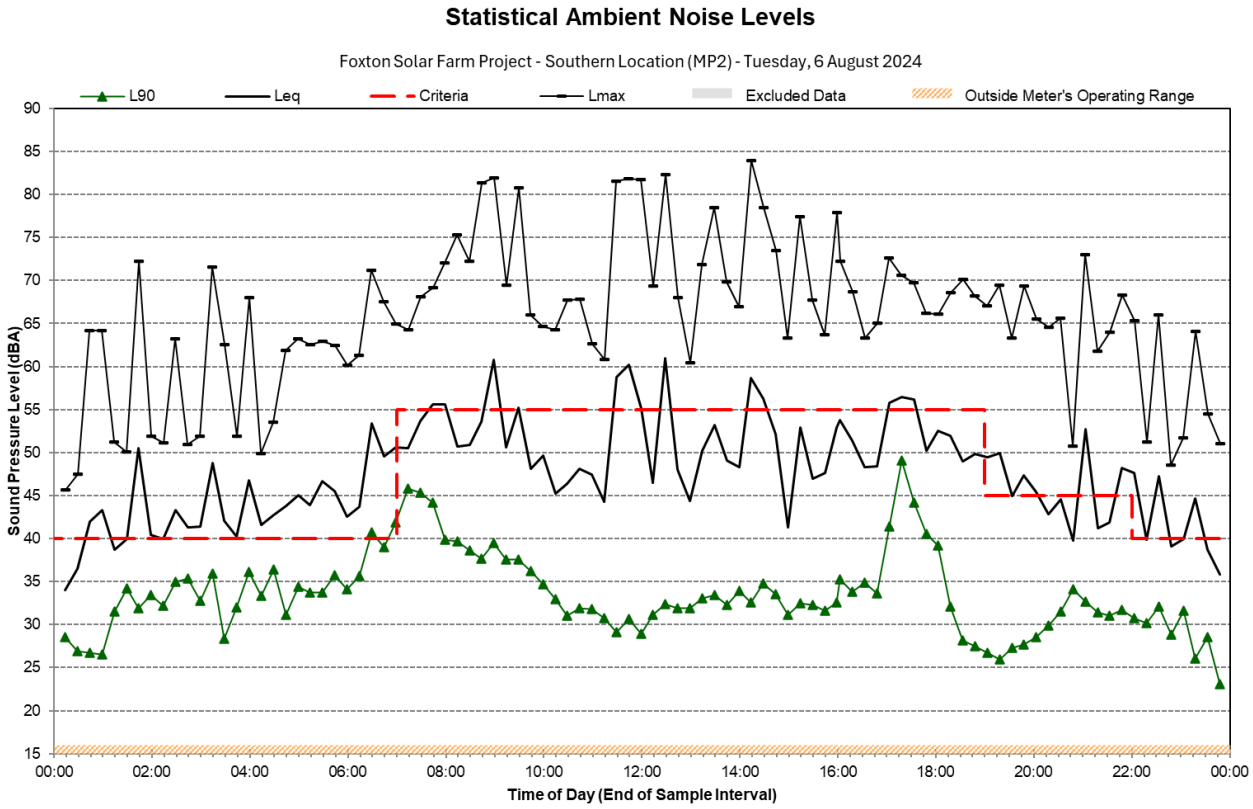
Figure B - 2 South Noise Logger

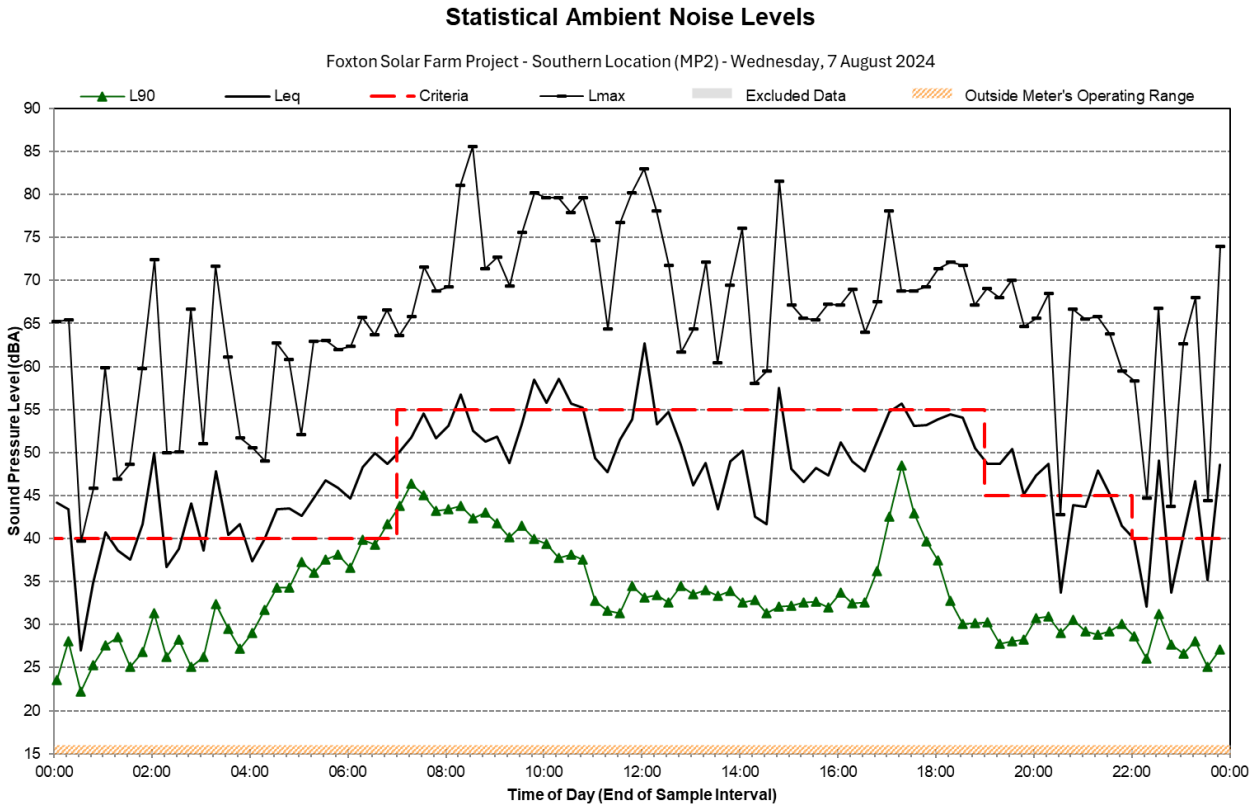


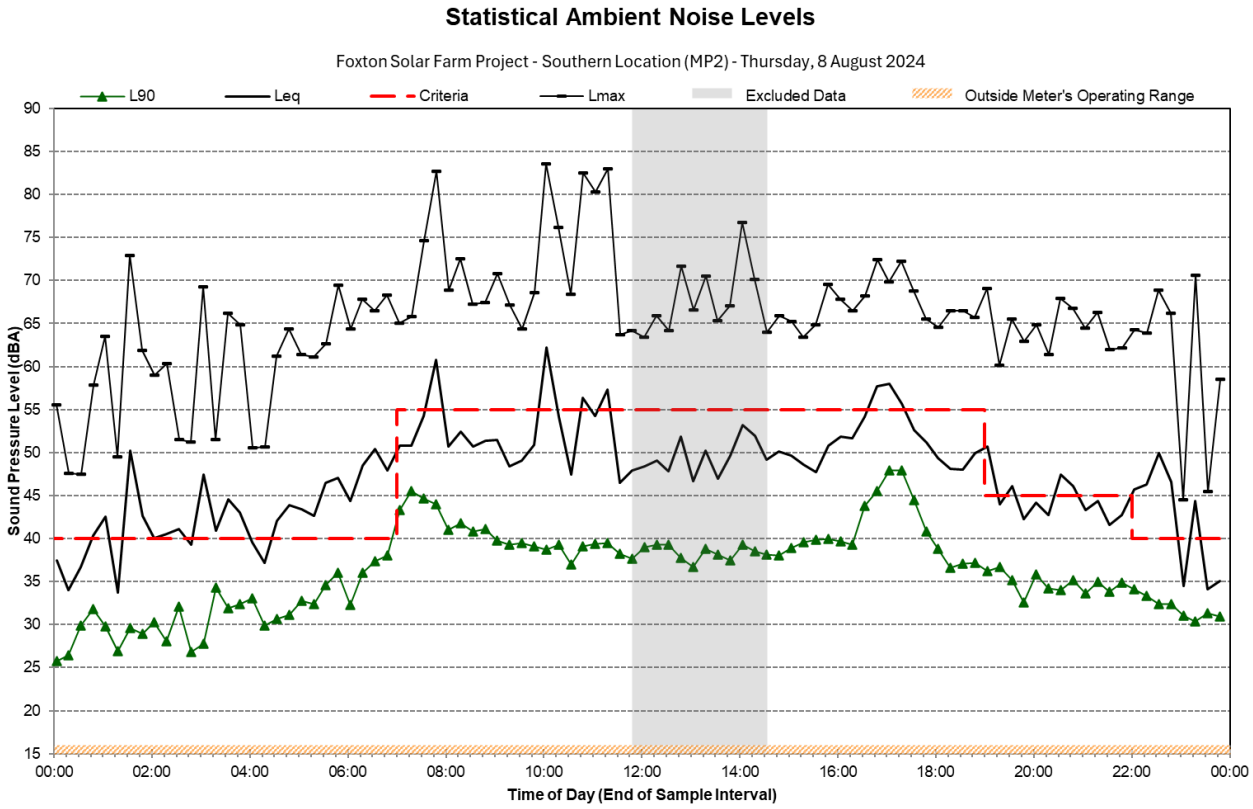

Statistical Ambient Noise Levels
Foxton Solar Farm Project - Southern Location (MP2) - Saturday, 3 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

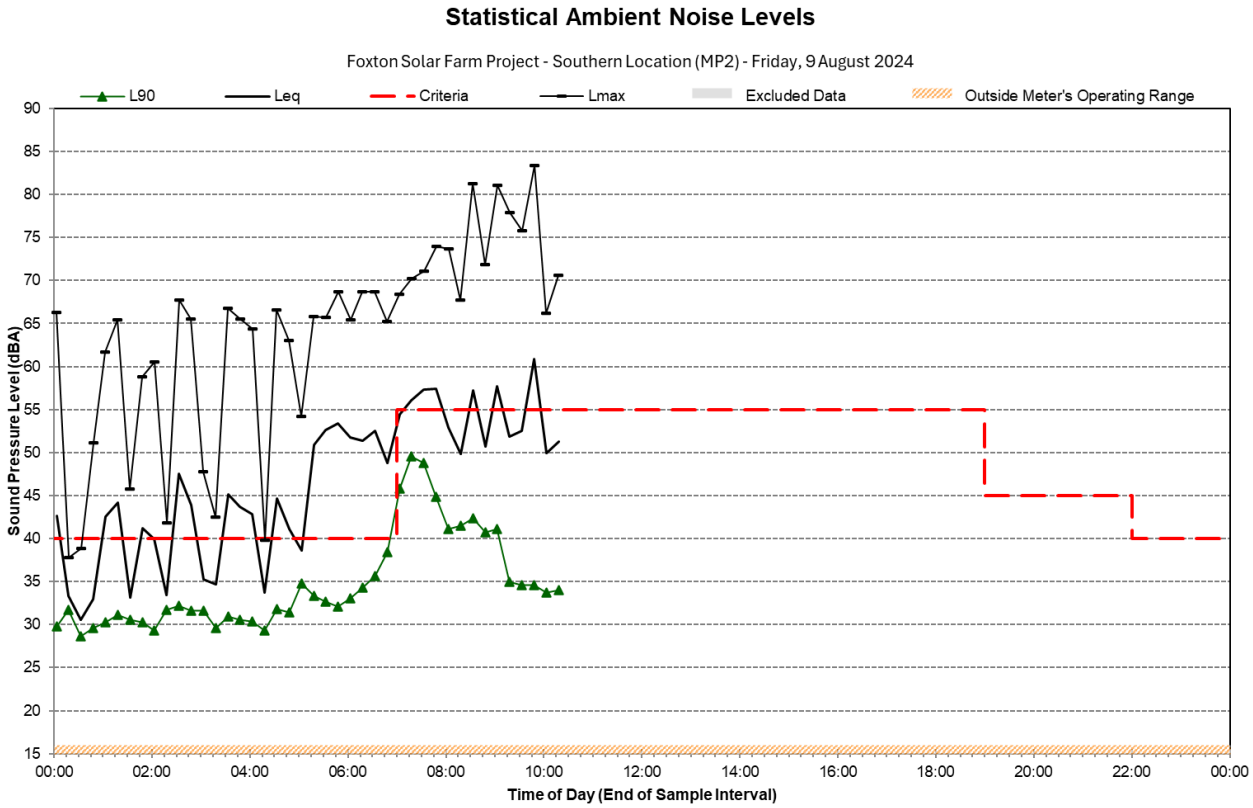

Statistical Ambient Noise Levels
Foxton Solar Farm Project - Southern Location (MP2) - Sunday, 4 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Foxton Solar Farm Project - Southern Location (MP2) - Monday, 5 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Foxton Solar Farm Project - Southern Location (MP2) - Tuesday, 6 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Foxton Solar Farm Project - Southern Location (MP2) - Wednesday, 7 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Foxton Solar Farm Project - Southern Location (MP2) - Thursday, 8 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Foxton Solar Farm Project - Southern Location (MP2) - Friday, 9 August 2024
L90
Leq
Criteria
Lmax
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00
Time of Day (End of Sample Interval)

Appendix C Noise Modelling Results

Acoustic Assessment Report

Foxton Solar Farm Project
Fast Track Approvals Act Application

Genesis Energy Limited

23 June 2026

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The predicted highest noise rating levels at or within the boundary of the surrounding receivers, based on the assumptions set out in **Section 6.0** (including the recommended acoustic barrier), are detailed in **Table C-1. Table C-2 presents the noise rating levels at 1 m from the façade of the building, predicted levels include façade reflection**. The modelled scenario represents the peak operation.

Table C - 1 Predicted Highest Noise Level – Property Boundaries

Assessment Location (Property Boundary)		Night-time Criterion (10:00pm to 7:00am)	Predicted Noise Level (dB L_{Aeq})	Expected Outcome
PROP01	252 Wall Road	40 dB LAeq	37	Compliance
PROP02	254A Wall Road	40 dB LAeq	37	Compliance
PROP03	282 Wall Road	40 dB LAeq	37	Compliance
PROP04	286 Wall Road	40 dB LAeq	38	Compliance
PROP08	371 Wall Road	40 dB LAeq	40~~35~~	Compliance
PROP09	447 Motuiti Road	40 dB LAeq	40	Compliance
PROP10	368 Motuiti Road	40 dB LAeq	3~~4~~2	Compliance
PROP18	516 Hickford Road	40 dB LAeq	31	Compliance
PROP19	212 Motuiti Road	40 dB LAeq	31	Compliance
PROP20	525 Hickford Road	40 dB LAeq	30	Compliance
PROP24	185 Motuiti Road	40 dB LAeq	31	Compliance
PROP26	125 Motuiti Road	40 dB LAeq	39	Compliance
PROP38	220 Motouiti Road	40 dB LAeq	31	Compliance
PROP39	187 Motuiti Road	40 dB LAeq	34	Compliance
PROP40	58 Wall Road	40 dB LAeq	32	Compliance
PROP41	181 Motuiti Road	40 dB LAeq	33	Compliance
PROP42	180 Motuiti Road	40 dB LAeq	29	Compliance
PROP43	194 Motuiti Road	40 dB LAeq	30	Compliance
PROP44	366 Motuiti Road	40 dB LAeq	34	Compliance
PROP45	449 Wall Road	40 dB LAeq	45	Complies with day and evening limit Exceed night-time limit by 5dB (see **Section 6.5**)
PROP46	152 Wall Road	40 dB LAeq	37	Compliance

Assessment Location (Property Boundary)		Night-time Criterion (10:00pm to 7:00am)	Predicted Noise Level (dB L_{Aeq})	Expected Outcome
PROP47	Himatangi 7 Block	40 dB LAeq	31	Compliance
PROP48	Himatangi 5A9C 2Block	40 dB LAeq	29	Compliance
PROP49	Himatangi 5A9B Block	40 dB LAeq	34	Compliance
PROP50	233 Motuiti Road	40 dB LAeq	35	Compliance
PROP51	Lot 2 DP481340	40 dB LAeq	37	Compliance
PROP52	301 Motuiti Road	40 dB LAeq	38	Compliance
PROP53	Himatangi 5A5C2C Block	40 dB LAeq	38	Compliance
PROP54	Part Himatangi 5A5C2B Block	40 dB LAeq	38	Compliance
PROP55	Part Himatangi 5A5C2A Block	40 dB LAeq	38	Compliance
PROP56	Part Hohotaka 5A5C Sec1 Block	40 dB LAeq	38	Compliance
PROP57	420 Motuiti Road	40 dB LAeq	35	Compliance
PROP58	438 Motuiti Road	40 dB LAeq	34	Compliance
PROP59	Himatangi 5A3A Block	40 dB LAeq	40	Compliance
PROP60	541 Motuiti Road	40 dB LAeq	36	Compliance
PROP61	Part Himatangi 4C3 Block	40 dB LAeq	38	Compliance
PROP62	522 Wall Road	40 dB LAeq	39	Compliance
PROP63	442 State Highway 1	40 dB LAeq	25	Compliance
PROP64	Part Himatangi 5A6B Block	40 dB LAeq	38	Compliance
PROP65	Part Himatangi 5A6A2 Block	40 dB LAeq	36	Compliance

Table C - 2 Predicted Highest Noise Level – Existing Dwellings~~Property Boundaries~~

Assessment Location (Dwelling)		Night-time Criterion (10:00pm to 7:00am)	Predicted Noise Level (dB LAeq)(A)	Expected Outcome
RES01	252 Wall Road	40 dB LAeq	343(B)	Compliance
RES02	254A Wall Road	40 dB LAeq	337(B)	Compliance
RES03	282 Wall Road	40 dB LAeq	347(B)	Compliance
RES04	286 Wall Road	40 dB LAeq	358(B)	Compliance
RES06	Himatangi 3A3G1 Block	40 dB LAeq	343(B)	Compliance
RES07	337 Wall Road	40 dB LAeq	376(B)	Compliance
RES08	371 Wall Road	40 dB LAeq	4037(B)	Compliance
RES09	Office at 447 Motuiti Road	40 dB LAeq	324(B)	Compliance
RES10	368 Motuiti Road	40 dB LAeq	364(B)	Compliance
RES18	516 Hickford Road	40 dB LAeq	321(B)	Compliance
RES19	212 Motuiti Road	40 dB LAeq	331(B)	Compliance
RES20	525 Hickford Road	40 dB LAeq	310(B)	Compliance
RES24	185 Motuiti Road	40 dB LAeq	301(B)	Compliance
RES26	125 Motuiti Road	40 dB LAeq	309(B)	Compliance
RES38	220 Motouiti Road	40 dB LAeq	2931(B)	Compliance
RES40	52 Wall Road	40 dB LAeq	2430(B)	Compliance
RES41	Lot 4 DP520424	40 dB LAeq	4033(B)	Compliance
RES42	180 Motuiti Road	40 dB LAeq	298(B)	Compliance
RES43	194 Motuiti Road	40 dB LAeq	2930(B)	Compliance
RES44	366 Motuiti Road	40 dB LAeq	347(B)	Compliance

Note to **Table C – 2**:

(A) Assessment location 1 m from façade of building, predicted levels include façade reflection.

(B) A typographical error in the previously reported value been corrected (no change to modelling inputs or results)

Figure C - 1 Predicted Highest Operational Noise Level (All Noise Sources)

FOXTON SOLAR FARM PROJECT

Predicted Highest Operational Noise Level
Scenario 1 - All Noise Sources

APPENDIX C-1

Map Element Legend

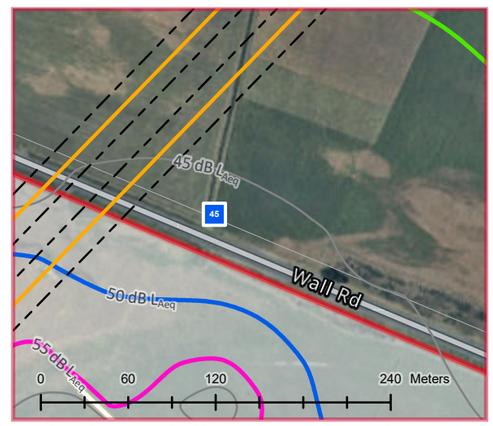
- Calculation Positions (PROP XX)
- Nearest Existing Dwellings (RES XX)
- Acoustic Screening

National Grid Transmission Line

- 220 kV Overhead
- National Grid Transmission Line - 12m buffer
- Site Boundary

Noise Contour Legend

- 30 dB L_{Aeq}
- 35 dB L_{Aeq}
- 40 dB L_{Aeq} (Night-time Noise Limit)
- 45 dB L_{Aeq}
- 50 dB L_{Aeq} (Evening Noise Limit)
- 55 dB L_{Aeq} (Daytime Noise Limit)
- 60 dB L_{Aeq}

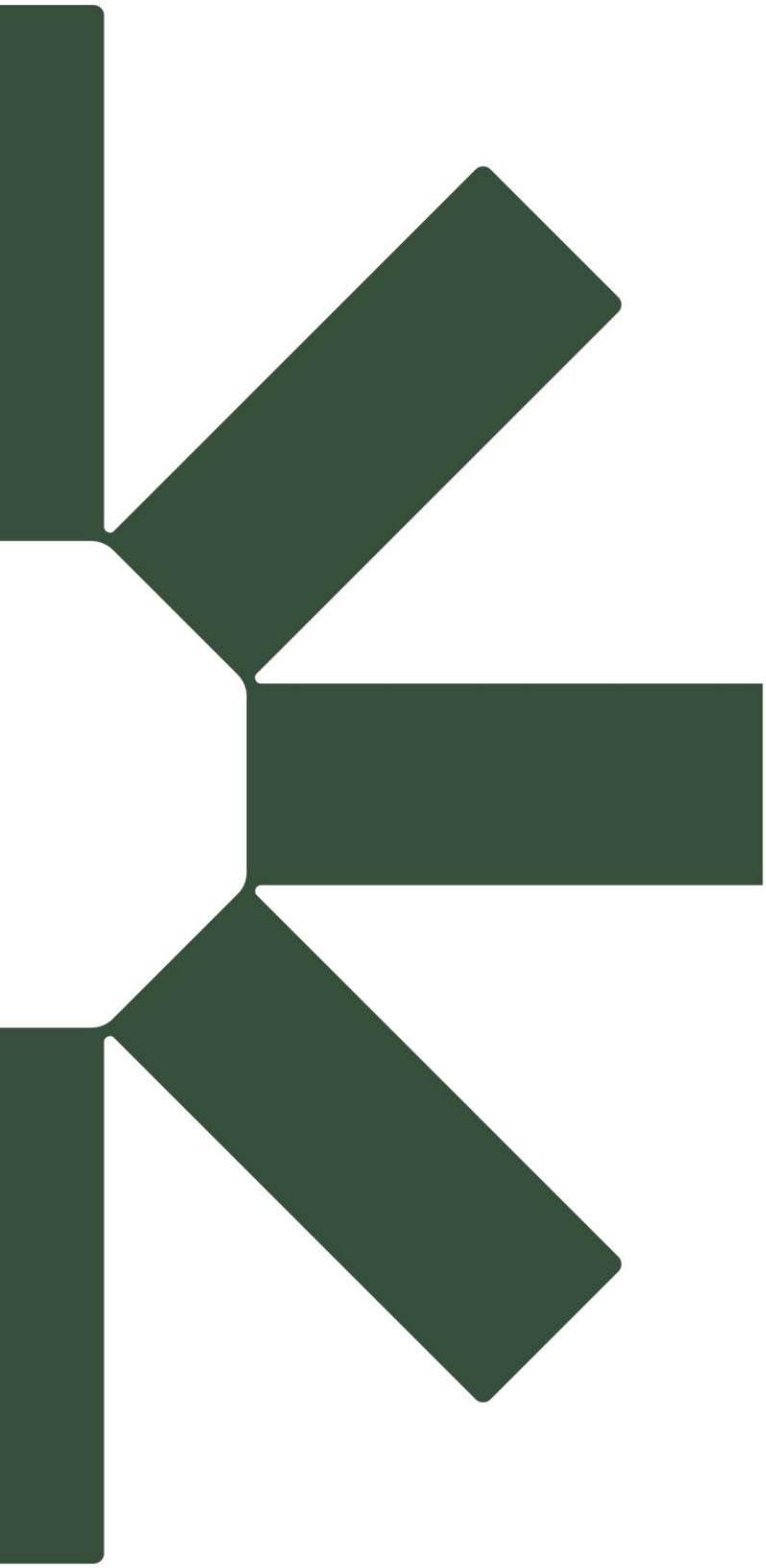


These contours are generated from the interpolation of calculation points with a 15-25m spacing, 1.5m above the ground level. Specific noise levels can be provided upon request and should not be inferred from the contours.

0 250 500 1,000 Meters

Coordinate System:	NZGD 2000 New Zealand Transverse Mercator
Scale:	1:17,000 at A3
Project Number:	810.V14848.00005
Date:	9/05/2025
Drawn by:	L. Jansen

SLR



Making Sustainability Happen