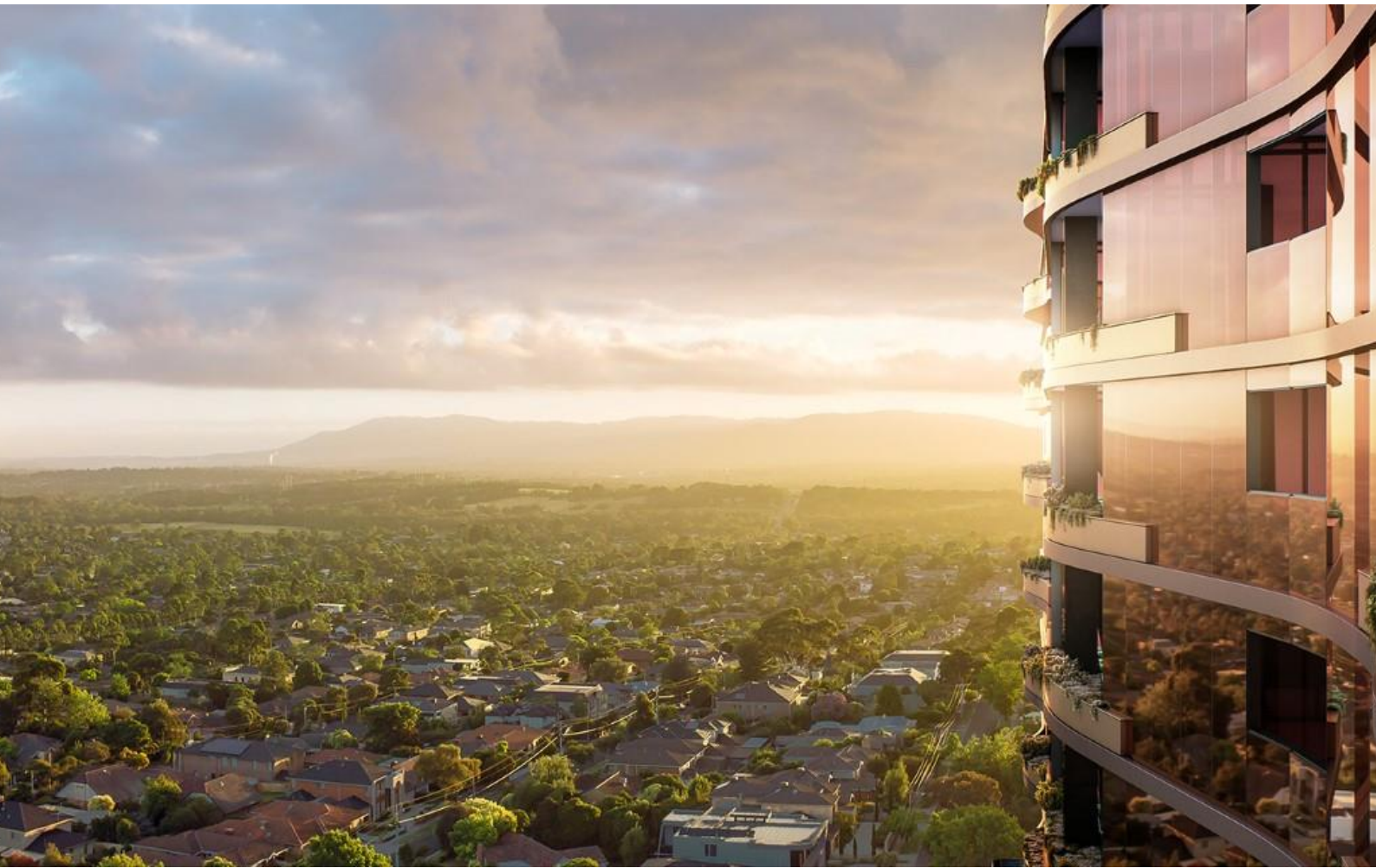
Solar Energy Facility
Goroke-Harrow Road, Charam,VIC

Noise Impact Assessment

Prepared for: Chris Smith & Associates

Project No: MEL2375
Date: 12 September 2023
Revision: 01



Project:	Solar Energy Facility	Goroke-Harrow Road, Charam,VIC
Location:	Allot. 33, Goroke-Harrow Road Charam, VIC, 3318	
Prepared by:	ADP Consulting Pty Ltd Level 13, 55 Collins Street Melbourne VIC 3000	
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Project Team

Client / Principal	Green Gold Energy
Project Manager / Planners	Chris Smith & Associates

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Appendices

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1. Introduction

1.1 Document purpose

ADP Consulting Pty Ltd has been engaged by Chris Smith & Associates to undertake a noise impact assessment for the proposed Goroke-Harrow Road solar energy facility near Charam, Western Victoria.

This report is prepared to provide acoustic design advice for documentation by others and addresses the impact on nearby sensitive receivers from the operation of the proposed development. These impacts include noise emission from equipment associated with solar farms and namely the photovoltaic inverters, BESS and solar tracking motors.

It is understood that this document will be submitted to the Department of Environment, Land, Water and Planning to satisfy requirements of a noise impact assessment against the EPA Noise Protocol.

It is the responsibility of the relevant contractor to ensure the implementation of the acoustic design intent of this document; including compliance with criteria, codes, standards, specifications etc.

1.2 Referenced drawings, codes and standards

The following drawings, conditions and other project-specific information has been referenced in preparing this report:

- Green Gold Energy's "Goroke Harrow Road Charam" Site Plan, dated 16 August 2023
- NEXTracker Motor Sound Test Summary, dated March 2017
- TBEA Inverter Noise Test Report, dated March 2020

The following guidelines, standards and regulatory requirements have been used to define the site-specific acoustic criteria for the development:

- EPA Victoria's Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues, Publication 1826.4 dated 4 May 2021 (EPA Noise Protocol)

1.3 Project summary

The following is understood by ADP Consulting regarding the proposed Solar Energy Facility project at Goroke-Harrow Road, Charam VIC:

- 1 centrally located photovoltaic inverter will be utilised (shown in Figure 1)
- Battery storage system ST-2752UX will have an assumed sound power level of 97dBA (each).
- Battery storage system ST-2752UX (numbers of battery units is TBD, 2,4&8 off)
- Each photovoltaic inverter will have a maximum sound pressure level of 63 dB(A) at 1m.
- Each photovoltaic inverter will generate tonal noise.
- One set of tracking motors will be installed for each 2 strings of solar panels (total being approx. 132 motors).
- The sound power of each tracking motor is 49dB(A) and will operate for 5-10 seconds every few minutes.
- The proposed development and nearest residential receiver are located in zones characterised as Farming FZ.
- Tracking motors will all operate during daylight hours and reset at night (we have assumed that a worst-case scenario that all tracking motors are running at the same time).
- Inverters will operate continuously over a 24 hr period.

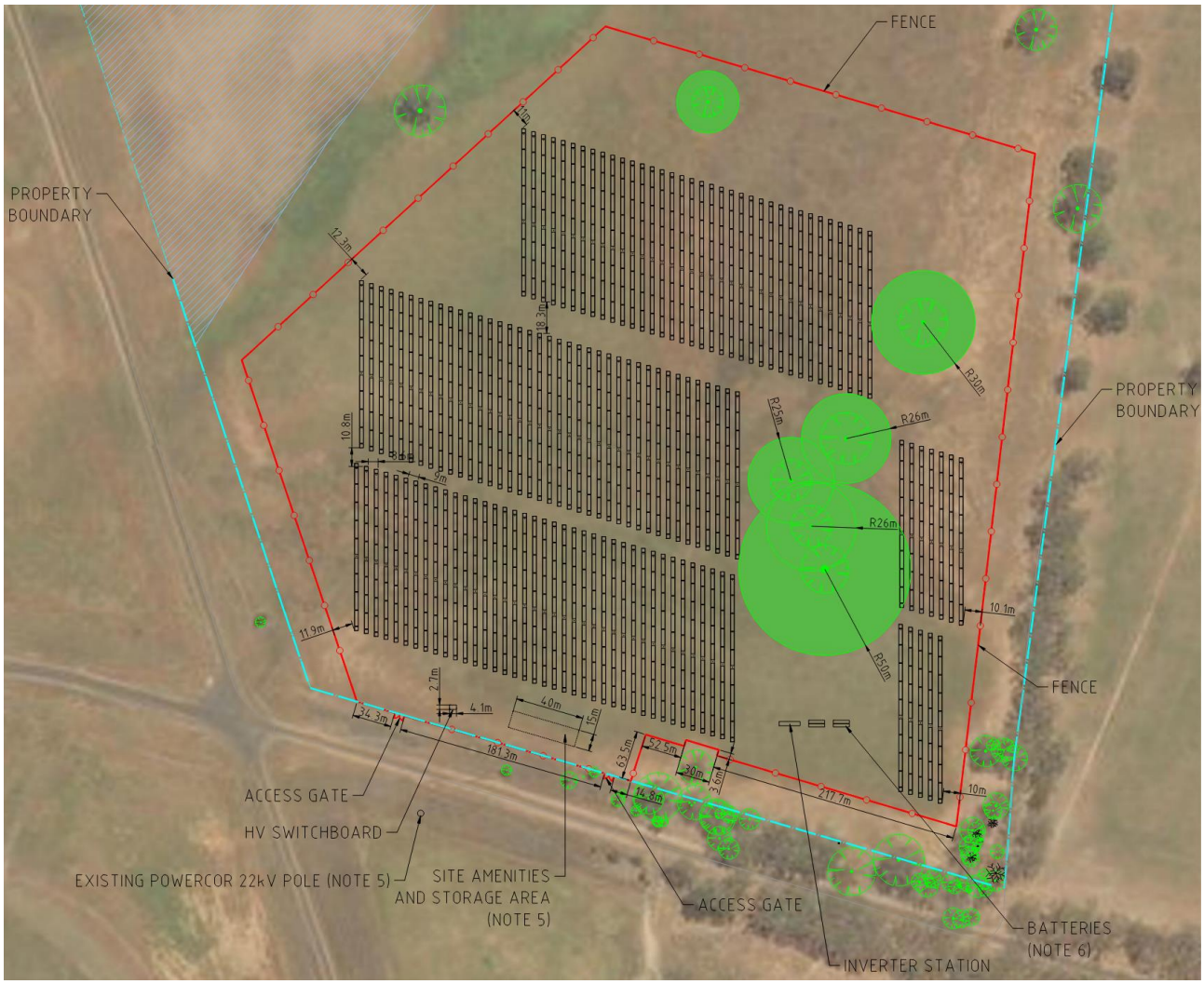
Based on our site investigations we have identified the following noise sensitive receivers:

- Residence to the north-west, on Mclennans Road, located approximately 2 kilometres away from the proposed development.
- Konnepra State Forest to the located approximately 1.25 kilometres east of the proposed development.

Figure 1 and Figure 2 provide a site map of the proposed development and its surrounds.

Figure 1 Site plan with nearby sensitive receivers

Figure 2 Detailed site plan from Green Gold Energy



2. Noise emission criteria – EPA Noise Protocol

Noise emission restrictions apply to the operation of the proposed development. These must be planned, designed and installed to include suitable sound attenuation, and other necessary acoustic treatments. This report provides an approach that needs to be incorporated in the proposed development to meet the noise emission requirements of the EPA Noise Protocol.

Part 1 Section A2 of the EPA Noise Protocol provides a methodology to determine the noise emission criteria in rural areas for commercial, industrial and trade premises. The criteria apply at sensitive receivers and are derived based on the characterisation of the Generating Zone as Farming FZ and the Receiving Zones as Farming FZ and Public Conservation and Resource Zone PCRZ, as per Annex B of the EPA Noise Protocol.

Table 1 summarises the noise emission criteria presented in the EPA Noise Protocol for the nearest residence and Konnepra State Forest.

Table 1 Noise emission criteria summary for the local residences and State Forest

Day of operation	Time of operation	Noise Limit, dB(A) Residences	Noise Limit, dB(A) State Forest
Monday to Friday	Day (7am to 6pm)	46	45
	Evening (6pm to 10pm)	41	40
	Night (10pm to 7am)	36	35
Saturday	Day (7am to 1pm)	46	45
	Evening (1pm to 10pm)	41	40
	Night (10pm to 7am)	36	35
Sunday	Evening (7am to 6pm)	41	40
	Night (10pm to 7am)	36	35

It should be noted that the cumulative noise emission from the operations of the proposed development are to meet the specific noise criteria in Table 1.

3. Noise assessment

3.1 Plant and equipment noise levels

Table 2 presents the major plant and equipment sound power levels to be used in the development, as provided by Chris Smith & Associates. We should note that these sound power levels are assumed to be maximum and that any alternative plant is not to exceed these levels.

Table 2 Plant and equipment sound power levels

Equipment in use	Sound Power Level, dB(A)
TBEA Inverter noise	81
NEXTracker Motor (each, approx. 132off)	49
BESS ST2752UX Liquid Cooling Battery Container System* (each, approx. 8off for worst case scenario)	97

*ADP is unaware of the equipment selection at this stage, manufacturer data has been chosen to represent typical noise associated with solar power generation and storage.

3.2 Noise assessment

The proposed development will encompass of one (1) centrally located photovoltaic inverters and approx. 132 tracking motors. The minimum separation distance between plant and neighbouring receivers was calculated to ensure compliance with the EPA Noise Protocol criteria (Table 1).

In this assessment, the following was considered:

- Maximum sound power levels of plant, scheduled in Section 3.1
- Proposed hours of operation, scheduled in Section 1.3
- Noise emission penalties applied for the tonal characteristics of the photovoltaic inverters and intermittent use of the tracking motors

As the photovoltaic inverters are likely to be tonal in nature and the tracking motors will be intermittent, we have used the methodology presented in the EPA Noise Protocol for tonal noise. This resulted in a total penalty adjustment of 5dB(A) (2dB(A) for tonality and 3dB(A) for intermittency) being applied to the overall noise emission levels from the solar farm.

We have used distance sound attenuation formulas for the photovoltaic inverters and tracking motors in an unshielded (ie. buildings, barriers, mounds or hills, etc) free field. This is a conservative approach as any shielding between the photovoltaic inverters and sensitive receivers has not been included.

Table 3 schedules the calculated noise levels at the nearby sensitive receivers and checks for compliance with the noise criteria outlined in Section 2.

Table 3 Noise emission levels at closest sensitive receivers

Receiver location	Time of day	Receiver noise levels, dB(A)	Criteria, dB(A)	Compliance
Residence to the north-west, on Mclennans Road	Day (7am to 6pm)	22	46	Yes
	Evening (6pm to 10pm)	22	41	Yes
	Night (10pm to 7am)	22	36	Yes
Konnepra State Forest	Day (7am to 6pm)	31	45	Yes
	Evening (6pm to 10pm)	31	40	Yes
	Night (10pm to 7am)	31	35	Yes

4. Conclusion

Current regulations and standards associated with the development of the Solar Energy Facility at Goroke-Harrow Road, Charam, have been reviewed and assessed in accordance with existing site constraints.

We have used distance sound attenuation formulas for the photovoltaic inverters and solar panel tracking motors in an unshielded (ie. buildings, barriers, mounds or hills, etc) free field. This is a conservative approach as shielding between the noise sources and any sensitive receiver has not been included.

Based on the assessment detailed in Section 3.2, ADP Consulting believe there are no site conditions, statutory or other requirements that would preclude this development from complying with the criteria defined in this report.

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Appendix A
Glossary of acoustic terms

Air-borne sound

The sound emitted directly from a source into the surrounding air, such as speech, television or music.

Ambient sound

Of an environment: the all-encompassing sound associated with that environment, being a composite of sounds from many sources, near and far. This is normally taken to be the L_{Aeq} value.

Background noise level

The average of the lowest levels of the noise levels measured in an affected area in the absence of noise from occupants and from unwanted external ambient noise sources. Usually the L_{A90} value represents the background noise level.

dB(A)

Unit of acoustic measurement weighted to approximate the sensitivity of human hearing to sound frequency.

Decibel scale

The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. Therefore, a 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. It is generally accepted that a 10 dB increase in the sound pressure level corresponds to a perceived doubling in loudness.

Examples of decibel levels of common sounds are as follows:

- 0 dB(A) Threshold of human hearing
- 30 dB(A) A quiet country park
- 40 dB(A) Whisper in a library
- 50 dB(A) Open office space
- 70 dB(A) Inside a car on a freeway
- 80 dB(A) Outboard motor
- 90 dB(A) Heavy truck pass-by
- 100 dB(A) Jackhammer / Subway train
- 110 dB(A) Rock Concert
- 115 dB(A) Limit of sound permitted in industry
- 120 dB(A) 747 take off at 250 metres

Frequency

The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high-pitched sound and a low frequency to a low-pitched sound.

L_{90}, L_{10}, etc

A statistical measurement giving the sound pressure level which is exceeded for the given percentile of a measurement period (i.e. L_{90} is the level which is exceeded for 90 percent of a measurement period). L_{90} is commonly referred to as a basis for measuring the background sound level.

$L_{Aeq,T}$

The equivalent continuous A-weighted sound pressure level. The value of the A-weighted sound pressure level of a continuous steady sound that, within a measurement time interval T, has the same A-weighted sound energy as the actual time-varying sound.

L_{Amax}

The maximum sound pressure level measured over the measurement period.

L_{Amin}

The minimum sound pressure level measured over the measurement period.

Day

Referred to as the period between 7am and 6pm for Monday to Saturday and 8am to 6pm for Sundays and Public Holidays.

Evening

Referred to as the period between 6pm and 10pm for Monday to Sunday and Public Holidays.

Night

Referred to as the period between 10pm and 7am for Monday to Saturday and 10pm to 8am for Sundays and Public Holidays.

Assessment background level (ABL)

The overall background noise level on each day, evening and night periods for each day of the noise monitoring.

Rating background level (RBL)

The overall background level on each day, evening and night periods for the entire length of noise monitoring.

Reverberation

The persistence, after emission by the source has stopped, of a sound field in an enclosure.

Sound isolation

A reference to the degree of acoustical separation between two spaces. Sound isolation may refer to sound transmission loss of a partition or to noise reduction from any unwanted noise source. The term 'sound isolation' does not specify any grade or performance quality and requires the units to be specified for any contractual condition.

Sound pressure level, L_p, dB of a sound

A measurement obtained directly obtained using a microphone and sound level meter. Sound pressure level varies with distance from a source and with changes to the measuring environment. Sound pressure level equals 20 times the logarithm to the base 10 of the ratio of the R.M.S. sound pressure to the reference sound pressure of 20 micro Pascals.

ADP
Consulting : Engineering

Creating great environments with great people.

Melbourne
Level 11, 60 Albert Road
South Melbourne VIC 3205
T. 03 9521 1195

Sydney
Level 3, 8 Spring Street
Sydney NSW 2000
T. 02 8203 5447

Brisbane
Ground Floor, 102 Adelaide Street
Brisbane QLD 4000
T. 07 3088 4022

adpconsulting.com.au