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PROPOSED SOLAR FARM

**4785 WESTERN HIGHWAY
LEDCOURT
VICTORIA**

Town Planning Submission

Acoustic Report

Client Details:

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Ref: 12638-1jg
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EXECUTIVE SUMMARY

Watson Moss Growcott Acoustics (WMG) has undertaken an acoustic assessment for the proposed construction and operation of a Solar Farm facility at the land described as 4785 Western Highway, Ledcourt.

The purpose of the assessment has been to consider any potential noise emissions associated with the proposed use which may impact on residential receptors located nearby to the subject site.

Due to the location of the subject site, and based on previous experience involving similar proposals, the assessment has been undertaken in accordance with methodologies described within Environment Protection Authority Publication 1411 Noise from Industry in Regional Victoria – Recommended Maximum Noise Levels from Commerce, Industry and Trade Premises in Regional Victoria.

The findings of the noise assessment have concluded that in the absence of any noise control measures, there is potential for noise emissions associated with the proposed use to exceed relevant criteria at noise sensitive residential receptors.

In consideration of the above, WMG has developed suitable noise control strategies for the proposed operations which once implemented are predicted to result in compliance with relevant criteria at noise sensitive residential receptors.

The primary noise control strategy will include utilising single air conditioning units for each battery storage container and configuring the air conditioning units to maximise noise shielding in the direction of residential receptors.

This will involve grouping the air conditioning units and locating the units behind and adjacent to the battery storage containers when viewed from the most sensitive residential receptor to the east and west.

In addition to the above, it is recommended that as part of detailed design for the project, an acoustic consultant is engaged to undertake a review of the final proposal and ensure that compliance with relevant criteria is achieved at each of the noise sensitive residential receptors

JORDAN GROWCOTT
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1. INTRODUCTION

The proposal includes the construction and operation of a new solar farm facility within the boundaries of the land described as 4785 Western Highway, Ledcourt.

The land associated with the proposed use is currently vacant and is generally surrounded by farm zoned land including some scattered residential premises.

Equipment operating as part of the solar farm will generate noise emissions which have the potential to impact on the acoustic amenity of noise sensitive residential receptors located nearby to the subject site.

In consideration of the above, Watson Moss Growcott Acoustics (WGM) has been engaged to undertake an acoustic assessment for the proposal.

The assessment has been conducted in accordance with EPA Publication 1411: Noise from Industry in Regional Victoria Recommended Maximum Noise Levels from Commerce, Industry and Trade Premises in Regional Victoria (NIRV).

This report presents a summary of the assessment, and where appropriate, includes indicative noise control strategies to achieve relevant criteria at noise sensitive receptors.



2. NOISE ASSESSMENT TERMINOLOGY

Noise assessment terminology used within this report is defined within Table 1 below.

Table 1: Noise Assessment Terminology

Terminology	Definition
dB(A)	Decibels recorded on a sound level meter, which has had its frequency response modified electronically to an international standard, to quantify the average human loudness response to sounds of different character
L_{eq}	The equivalent continuous level that would have the same total acoustic energy over the measurement period as the actual varying noise level under consideration. It is the noise measure defined by the EPA as the measure of the noise to use in assessing compliance with noise limits.
Sound Power Level (L_w)	The sound power level of a noise source is the inherent noise of the device. Therefore, sound power level does not vary with distance from the noise source or with a different acoustic environment. $L_w = L_p + 10 \log_{10} 'a'$ dB, re: 1pW, (10-12 watts) where 'a' is the measurement noise-emission area (m ²) in a free field.
Sound Pressure Level (L_p)	The level of sound measured on a sound level meter and expressed in decibels (dB). Where $L_p = 10 \log_{10} (P_a/P_o)^2$ dB (or $20 \log_{10} (P_a/ P_o)$ dB) where P_a is the rms sound pressure in Pascal and P_o is a reference sound pressure conventionally chosen is 20 μ Pa (20 x 10 ⁻⁶ Pa) for airborne sound. L_p varies with distance from a noise source.

3. SUBJECT SITE AND SURROUNDING ENVIRONMENT

The site under consideration is located within farm zoned land and abuts the Western Highway to the north and farm zoned land to the east, west and south.

When considering noise sensitive receptors located within proximity of the proposed use, the closest and therefore most noise sensitive will include the dwelling located to the west of the proposed use at 4785 Western Highway, and the dwelling located to the east of the proposed use at 4730 Western Highway.

Due to the proximity of the described dwellings to the subject site, compliance with relevant noise criteria at the described dwellings will also result in compliance at all other dwellings.

The aerial photo shown below in Figure 1 identifies the subject site under consideration and the nearby noise sensitive receptors considered relevant for this assessment.



Figure 1: Aerial Photograph of Subject Site and Surrounds



4. PROPOSED SITE PLAN AND OPERATIONS

The proposal includes electrical infrastructure including battery storage containers, inverter units and transformers located within the boundaries of the subject site land.

The client has advised that the facility will operate 24 hours per day, 7 days per week and the assets associated with the operation of the solar farm will include:

- 5 no. battery storage containers including associated air conditioning equipment.
- 2 no. inverter unit.
- 1 no. transformer unit associated with inverter unit operation.

Figure 2 below provides the site plan for the proposal.

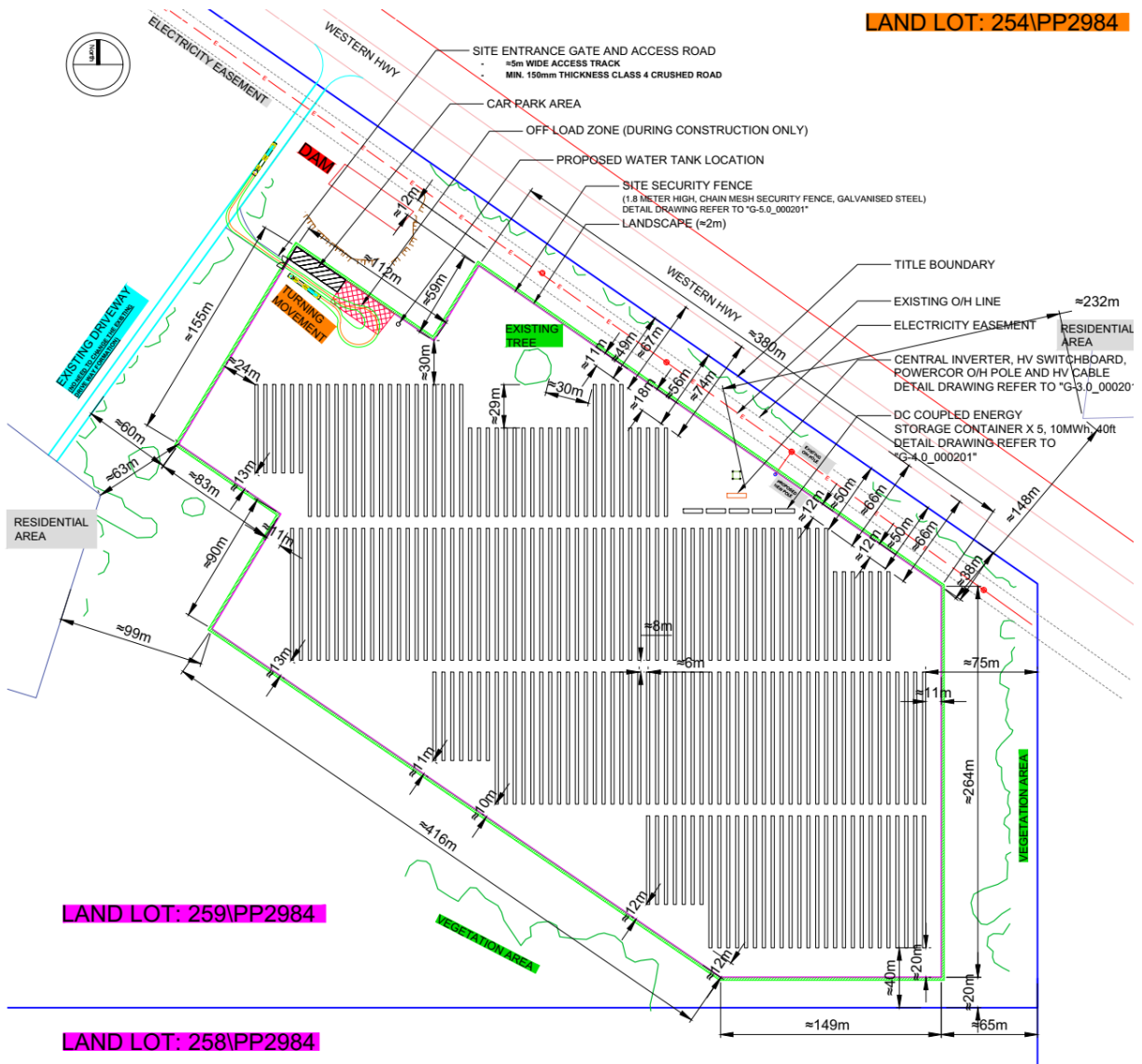


Figure 2: Site Plan



When considering noise emissions associated with the proposed use, the relevant noise sources will include:

- 5 no. battery storage containers including associated air conditioning equipment.
- 2 no. inverter unit.
- 1 no. transformer unit associated with inverter unit operation.

The client has also advised that the solar panels occupying the subject site will include small motors which will enable the panels to rotate throughout the day period. The client has advised that the described motors will emit negligible noise relative to the inverter, transformer, and outdoor air conditioning units.

The final design including the relevant equipment selections has not been completed.

However, based on information provided by the client, Table 2 below provides a summary of the different equipment types and the associated sound power levels adopted as the basis for this assessment.

Table 2: Summary of Noise Sources

Noise Source	Description	Adopted Sound Power
Outdoor air conditioning units	30-40 Kw unit.	81 dB(A) – per unit
Inverter units	1no. Sungrow SG4950 comprised of 2no SG2475 units.	95 dB(A) – combined
Inverter transformer	N/A	56 dB(A) – per unit

The sound power and pressure level information provided by the client has been documented as an overall dB(A) figure. For the purpose of this assessment, WMG has adopted noise level spectrum data associated with the relevant noise sources from previous investigations involving similar equipment types.

From previous experience, with the exception of the outdoor air conditioning unit it is expected that each of the relevant noise sources will likely include a tonal character.

The tonal character associated with the noise sources will require consideration when assessing noise impacts at residential receptors.



5. NOISE EMISSION ASSESSMENT CRITERIA

NIRV provides a suitable assessment criterion for considering noise emissions associated with the proposed operations at residential receptors.

The NIRV document was introduced in 2011 to provide guidance on suitable noise emission assessment criteria for regional areas outside Metropolitan Melbourne.

The document includes Recommended Maximum Noise Levels (RMNL) which are determined based on the land zoning associated with the location of the commercial noise emissions, and the zoning of the noise sensitive residential receptor.

The RMNLs described within the NIRV document are treated as guideline values. The recommended levels only gain a higher status than recommendations if adopted as Conditions in a Planning Permit or operating Licence.

For residential receptors located within major urban centres of regional Victoria (defined as a population of greater than 7000), RMNLs are calculated using methodologies described within NIRV referral document State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1 (SEPP N-1).

For sites located outside major urban centres of regional Victoria, RMNL's are calculated purely based on set methodologies described within NIRV including consideration of the land zoning of the 'noise sender' and the land zoning of the 'noise receptor'.

This approach is applicable for the subject site under consideration.

Using NIRV methodology, noise targets vary depending on the time of the day, evening or night, with the highest permitted values occurring during week daytimes, and the lowest during the night period.

The relevant day, evening, and night assessment periods are shown below in Table 3.

Table 3: EPA Assessment Periods

EPA Assessment Period	Relevant Days	Relevant Time Periods
Day	Monday to Friday	7:00am to 6:00pm
	Saturday	7:00am to 1:00pm
Evening	Saturday	1:00pm to 6:00pm
	Sunday, Public Holidays	7:00am to 6:00pm
	All Days	6:00pm to 10:00pm
Night	All Days	10:00pm to 7:00am



Table 1 from the NIRV document is used to determine the relevant RMNL values based on the 'noise sender' and 'noise receptor' land zoning. Table 1 from NIRV is shown below in Figure 3.

The subject site under consideration is located within Farming Zone (FZ1) land. Noise sensitive residential receptors surrounding the subject site are also located within FZ1 land.

The relevant zoning RMNL values are highlighted below in Figure 3.

Table 1: Zone Levels – must only be applied in conjunction with steps 2 to 5

		Planning zone for noise-receiving location							
Receiving zone →	Generating Zone ↓	<input type="checkbox"/> Green Wedge A GWAZ	<input type="checkbox"/> Low Density Residential LDRZ	<input type="checkbox"/> Farming FZ†	<input type="checkbox"/> Business 1 B1Z	<input type="checkbox"/> Industrial 3 IN3Z	<input type="checkbox"/> Business 3 B3Z	<input type="checkbox"/> Industrial 1 IN1Z	
		<input type="checkbox"/> Rural Conservation RCZ	<input type="checkbox"/> Public Conservation and Resource PCRZ	<input type="checkbox"/> Green Wedge GWZ	<input type="checkbox"/> Business 2 B2Z	<input type="checkbox"/> Special Use SUZ‡	<input type="checkbox"/> Business 4 B4Z	<input type="checkbox"/> Industrial 2 IN2Z	
		<input type="checkbox"/> Rural Living RLZ	<input type="checkbox"/> Public Park and Recreation PPRZ	<input type="checkbox"/> Residential 1 R1Z	<input type="checkbox"/> Comprehensive Development CDZ‡				
		<input type="checkbox"/> Public Use 2,5 PUZ	<input type="checkbox"/> Urban Floodway UFZ	<input type="checkbox"/> Residential 2 R2Z	<input type="checkbox"/> Mixed Use MUZ				
				<input type="checkbox"/> Residential 3 R3Z	<input type="checkbox"/> Priority Development PDZ‡				
				<input type="checkbox"/> Rural Activity RAZ	<input type="checkbox"/> Public Use 1,3,4,6,7 PUZ				
				<input type="checkbox"/> Township TZ	<input type="checkbox"/> Road RDZ				
				<input type="checkbox"/> Urban Growth UGZ‡					
Planning zone for noise-generating use	▶ Low Density Residential LDRZ	Day: 45	Day: 45	Day: 45	Day: 47	Day: 48	Day: 50	Day: 53	
	▶ Public Conservation and Resource PCRZ	Evening: 37	Evening: 39	Evening: 40	Evening: 42	Evening: 43	Evening: 45	Evening: 48	
	▶ Public Park and Recreation PPRZ	Night: 32	Night: 34	Night: 35	Night: 37	Night: 38	Night: 40	Night: 43	
	▶ Residential 1 R1Z								
	▶ Residential 2 R2Z								
	▶ Residential 3 R3Z								
	▶ Urban Floodway UFZ								
	▶ Business 5 B5Z	Day: 45	Day: 45	Day: 46	Day: 48	Day: 50	Day: 52	Day: 54	
	▶ Farming FZ†	Evening: 38	Evening: 40	Evening: 41	Evening: 43	Evening: 45	Evening: 47	Evening: 49	
	▶ Green Wedge GWZ	Night: 33	Night: 35	Night: 36	Night: 38	Night: 40	Night: 42	Night: 44	
▶ Green Wedge A GWAZ									
▶ Public Use 2,5 PUZ	Day: 45	Day: 47	Day: 48	Day: 50	Day: 52	Day: 53	Day: 55		
▶ Rural Activity RAZ	Evening: 40	Evening: 42	Evening: 43	Evening: 45	Evening: 47	Evening: 48	Evening: 50		
▶ Rural Conservation RCZ	Night: 35	Night: 37	Night: 38	Night: 40	Night: 42	Night: 43	Night: 45		
▶ Rural Living RLZ									
▶ Urban Growth UGZ‡									
▶ Business 1 B1Z	Day: 46	Day: 49	Day: 50	Day: 52	Day: 53	Day: 55	Day: 56		
▶ Business 2 B2Z	Evening: 41	Evening: 44	Evening: 45	Evening: 47	Evening: 48	Evening: 50	Evening: 51		
▶ Comprehensive Development CDZ‡	Night: 36	Night: 39	Night: 40	Night: 42	Night: 43	Night: 45	Night: 46		
▶ Mixed Use MUZ									
▶ Priority Development PDZ‡									
▶ Public Use 1,3,4,6,7 PUZ									
▶ Road RDZ									
▶ Township TZ									
▶ Industrial 3 IN3Z	Day: 48	Day: 50	Day: 52	Day: 54	Day: 55	Day: 56	Day: 57		
▶ Special Use SUZ‡	Evening: 43	Evening: 45	Evening: 47	Evening: 49	Evening: 50	Evening: 51	Evening: 52		
	Night: 38	Night: 40	Night: 42	Night: 44	Night: 45	Night: 46	Night: 47		
▶ Business 3 B3Z									
▶ Business 4 B4Z									
▶ Industrial 1 IN1Z	Day: 50	Day: 52	Day: 53	Day: 55	Day: 56	Day: 57	Day: 58		
▶ Industrial 2 IN2Z	Evening: 45	Evening: 47	Evening: 48	Evening: 50	Evening: 51	Evening: 52	Evening: 53		
	Night: 40	Night: 42	Night: 43	Night: 45	Night: 46	Night: 47	Night: 48		

Figure 3: Table 1 from NIRV documentation



Once determined, the relevant 'Zoning' RMNL values are further adjusted based on the following:

- The presence of increased ambient background noise levels at noise sensitive receptors.

This is typically only relevant when receptors are located within proximity of major roadways with relatively continuous traffic flows.

- Distance adjustment due to the separation between the noise sensitive dwelling and the boundary of the land zoning associated with the 'noise sender'.

For the subject site, the ambient background noise environment has not been measured and therefore not considered as part of the assessment. Due to the proximity of the site to the Western Highway, high background noise levels may be present at residential receptors located nearby to the subject site and higher RMNL values than those described in Figure 3 above may be applicable for site operations.

It is understood that if deemed appropriate, on-site testing of ambient background noise levels may be pursued as part of detailed design for the project.

In addition, due to the land zoning of the relevant receptors located nearby to the subject site, a distance adjustment will also not be relevant.

The values highlighted in Figure 3 above will be L_{eq} values and must be achieved within 10 metres of residential dwellings located at the noise sensitive receptor, but outside the dwelling.

5.1 NIRV ASSESSMENT ADJUSTMENTS

When considering noise impacts on residential receptors, NIRV methodology includes relevant adjustment factors which account for the potential for the noise source to impact on the acoustic amenity of the noise sensitive receptor.

The proposed solar farm site will include inverter and transformer units which typically include a tonal character.

In accordance with NIRV methodology, where noise sources included a tonal character, the following adjustments will be made to noise levels impacting on residential receptors.

- When the tonal character is just detectable then the tonal adjustment will be +2dB(A).
- When the tonal character is prominent then the tonal adjustment will be +5dB(A).

The above adjustments are applied to the measured / predicted values at residential receptors to determine the 'effective' noise level impacting on the residential receptor.



6. PREDICTED NOISE IMPACTS ASSOCIATED WITH PROPOSAL

6.1 NOISE PREDICTION METHODOLOGY

Modeling of operational noise emissions associated with the proposal has been conducted using DataKustik CadnaA 2020 environmental noise modelling software.

Relevant information regarding site elevations, site buildings and the surrounding environment has been provided by the client and sourced from online databases including Nearmaps and VicMaps.

The model has been developed and configured with sufficient detail for appropriate noise emission calculations to be undertaken.

For this assessment, the modelling software has implemented the calculation procedures defined within International Standard *ISO 9613-2: 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613).

The described standard has been considered and approved as part of many previous projects requiring noise emission assessment works.

Through implementation of the Standard through CadnaA 2020, the noise emission modelling considers the following attenuation measures:

- Geometrical spreading.
- Atmospheric absorption.
- Ground attenuation.
- Meteorological effects.
- Source/Receiver height effects.
- Attenuation due to the surrounding environment including existing buildings/structures.

The noise modelling input parameters have been adjusted to reflect the Environmental Protection Authority (EPA) Victoria assessment methodology requirements. These include:

- Residual noise levels at noise sensitive receivers have been considered when weather conditions assist with propagation of emissions in the direction of the relevant receptor.
- Predicted noise levels have been assessed over a continuous 30-minute assessment period.



6.2 NOISE MODELLING INPUT PARAMETERS

Table 4 below presents a summary of the equipment operations adopted as the basis for the assessment during the EPA defined day, evening and night periods.

Table 4: Summary of Adopted Operating Parameters

Assessment Period	Noise Source Description
Day	<ul style="list-style-type: none"> ▪ 1 no. Inverter transformer units operating continuously. ▪ 2 no. Inverter units operating continuously. ▪ 5 no. Battery storage container air conditioning units operating at full capacity.
Evening	
Night	

6.3 NOISE PREDICTION RESULTS

The results of the noise modelling including the predicted noise levels at the relevant off-site residential receptors are presented below in Table 5 and 6.

Table 5: Predicted noise levels associated with proposed facility operation at 4785 Western Hwy Property

Noise Sensitive Receptor (4785 Western Hwy)	Predicted Noise Level During Relevant Assessment Period		
	Day Period	Evening Period	Night Period
Predicted Contribution due to Solar Farm	24 dB(A)	24 dB(A)	24 dB(A)
Tonal adjustment	+2 / +5 dB(A)	+2 / +5 dB(A)	+2 / +5 dB(A)
Effective noise level at receptor	26 / 29 dB(A) L_{eq}	26 / 29 dB(A) L_{eq}	26 / 29 dB(A) L_{eq}
Noise Emissions Compliant with NIRV RMNL	✓ (Note 1)	✓ (Note 1)	✓ (Note 1)

Table 6: Predicted noise levels associated with proposed facility operation at 4730 Western Hwy Property

Noise Sensitive Receptor (4730 Western Hwy)	Predicted Noise Level During Relevant Assessment Period		
	Day Period	Evening Period	Night Period
Predicted Contribution due to Solar Farm	33 dB(A)	33 dB(A)	33 dB(A)
Tonal adjustment	+2 / +5 dB(A)	+2 / +5 dB(A)	+2 / +5 dB(A)
Effective noise level at receptor	35 / 38 dB(A) L_{eq}	35 / 38 dB(A) L_{eq}	35 / 38 dB(A) L_{eq}
Noise Emissions Compliant with NIRV RMNL	✓ (Note 1)	✓ (Note 1)	✓ (Note 1)

(Note 1)

Given the distance separation between the site land and the noise sensitive receptor, the required tonal adjustment for the potential noise impacts at the receptor has not been confirmed.

For the 4785 Western Hwy property, compliance has been determined with both a +2 dB(A) and +5 dB(A) adjustment.

For the 4730 Western Hwy property, It is noted that compliance with relevant assessment criteria is predicted to be achieved with a +2 dB(A) adjustment, but marginally exceeded with the inclusion of a +5 dB(A) adjustment.

Consideration of the above is discussed further in Section 7.3.



7. NOISE CONTROL STRATEGIES

The findings of the acoustic assessment have concluded that compliance with relevant Environment Protection Authority NIRV Recommended Maximum Noise Levels can be achieved through the implementation of suitable noise control strategies at the subject site.

The treatments described within this report are tentative in nature.

Should other initiatives or provisions be incorporated within the development which ensure that the relevant Recommended Maximum Noise Levels are met, the treatments herein may be amended at the approval of a qualified acoustic consultant.

7.1 EQUIPMENT SELECTIONS

The equipment selections associated with the proposal have not been finalised at this stage.

The primary recommendation will be that once equipment selections are finalised, the proposal is reviewed by a suitably qualified acoustic consultant to ensure that compliance with relevant criteria is achieved at nearby noise sensitive receptors.

Should equipment with lower sound power level information that adopted within Table 2 be included in the proposal, then the nominated noise control strategies may be amended with approval by a suitably qualified acoustic consultant.

7.2 BATTERY STORAGE CONTAINER AIR CONDITIONING SYSTEM CONFIGURATION

The battery storage container air conditioning system must be operated as a single outdoor unit servicing each individual container.

Based on noise level calculations, the outdoor air conditioning units must be configured in groups of two or less centrally between the battery storage containers.

The location of the air conditioning equipment must ensure that the battery storage containers provide noise shielding in the direction of the most noise sensitive receptor to the east and west.

7.3 CONSIDERATION OF NIRV TONAL CHARACTER ADJUSTMENT

When considered at the 4730 Western Hwy property, the noise modelling has indicated that compliance with relevant criteria will be achieved if a + 2 dB(A) tonal adjustment is applied to the predicted noise levels. However, if a + 5 dB(A) adjustment is applied, the effective noise levels at the noise sensitive receptor will marginally exceed the relevant criteria.

As is discussed in Section 7.1, it is envisaged that as part of detailed design for the project, equipment selections and the final configuration of the site will be reviewed to ensure that compliance with relevant criteria is achieved at noise sensitive receptor locations.

Should detailed design determine marginal non-compliance, then the introduction of localised acoustic barriers around the proposed inverter units will provide adequate noise control to ensure that compliance will be achieved at noise sensitive receptors.

The design and construction of the barriers will rely on input from a suitably qualified acoustic consultant and must be reviewed and approved by the consultant prior to construction.



8. CONCLUSIONS

WMG has carried out an acoustic assessment for the Solar Farm facility proposed to be constructed and operated at the land described as 4785 Western Highway, Leducourt.

The purpose of the assessment has been to consider any potential noise emissions associated with the proposed use which may impact on residential receptors located nearby to the subject site.

Noise emissions associated with the proposed use have been considered in accordance with methodologies described in Environment Protection Authority Publication 1411 Noise from Industry in Regional Victoria – Recommended Maximum Noise Levels from Commerce, Industry and Trade Premises in Regional Victoria (NIRV).

Based on the assessment, WMG has concluded that noise control strategies including a specific equipment configuration will be required in order to achieve compliance with relevant assessment criteria.

The relevant strategies are discussed in Section 7 of the report.