Construction Noise Assessment

Micro Solar Farm
39 Hogans Lane
Deniliquin, NSW

Prepared for: Chris Smith & Associates
October 2023
MAC231915-01RP1V2

Muller Acoustic Consulting

Document Information

Construction Noise Assessment

Micro Solar Farm

39 Hogans Lane

Deniliquin, NSW

Prepared for: Chris Smith & Associates

Level 1, 135 Fryers Street

Shepparton VIC 3630

Prepared by: Muller Acoustic Consulting Pty Ltd

PO Box 678, Kotara NSW 2289

ABN: 36 602 225 132

P: +61 2 4920 1833

www.mulleracoustic.com

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Chris Smith & Associates (CS&A), on behalf of Green Gold Energy Pty Ltd (Green Gold Energy) to prepare a Construction Noise Assessment (CNA) for a proposed Micro Solar Farm near Deniliquin, NSW (the project).

A CNA is required as part of the environmental assessment to be submitted to Edwards River Council (Council) as part of the Development Application (DA). The purpose of the CNA is to quantify potential environmental noise emissions associated with the construction of the project, including road traffic noise. Where impacts are identified, the assessment includes recommendations for potential noise mitigation and management measures.

This assessment has been undertaken in accordance with the following documents:

- NSW Department of Environment and Climate Change (DECCW) – NSW Interim Construction Noise Guideline (ICNG), July 2009;
- NSW Department of Environment, Climate Change and Water (DECCW) – NSW Road Noise Policy (RNP), March 2011;
- NSW Department of Environment and Conservation (DEC) – NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline (the NSW vibration guideline), February 2006;
- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI) 2017; and
- Standards Australia AS 2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Project Description

2.1 Background

MAC understands that Green Gold Energy are proposing to establish a 4.95MW solar farm using photovoltaic (PV) technology at 39 Hogans Lane, Deniliquin, NSW (refer **Figure 1** and **Appendix B**). The project would provide renewable energy for approximately 1,000 houses in Deniliquin and the surrounding areas.

The project would consist of:

- 9,396 solar panels, mounted on single axis tracking arrays;
- 1.8m high chain mesh fence around the perimeter of the facility;
- landscaping around the perimeter of the proposal;
- new 22kV pole to connect to the overhead power line;
- one High Voltage Power Switchboard (HVSB); and
- one inverter station consisting of an inverter and transformer.

The construction of the project will comprise four key components, described as follows:

- Early Works – consisting of piling tests, road construction and upgrades for site access, including road widening and paving;
- Civil Works – consisting of land clearing, levelling and earthworks, internal road construction, drainage installation, laydown area preparation, fencing installation, site establishment, preparation of delivery station and inverter station, and vegetation screening/landscaping;
- Mechanical Works – consisting of foundation piling, tracker installation, module installation and delivery; and
- Electrical Works – consisting of solar cabling of aerials and conduit, DC main cabling via direct burial, MV cabling from inverter station to delivery station through direct buried, module connection, connection of junction boxes-inverters-delivery station, connection to grid and finally testing and commissioning.

Indicative construction staging is presented in **Table 1**.

Table 1 Indicative Construction Works and Staging

Month	Stage	Site Works
1	Site Establishment	■ Fencing ■ Planting of landscaping buffer ■ Construction of access track from the existing crossover on Hogans Lane to the site access gate; ■ Construction of laydown area and car parking areas; and ■ Setup of site amenities.
1-6	Deliveries	■ Delivery of components and materials to site.
2	Pile Driving	■ Pile driving tracking panel supports (4 weeks maximum duration)
2-7	Installation Works	■ Installation of tracking panels, modules and cable string; ■ Trenching and installation of underground DC cables and HV cables; ■ Construction of concrete footings for inverter station and HVSB; ■ Installation of inverter station and HVSB; and ■ Installation of market meter, weather station, Supervisor Control and Data Acquisition system and security cameras.
7-9	Electrical Works	■ HVSB connection, testing and commissioning.
9	Site Cleanup and Demobilisation	■ Site cleanup and demobilisation.

The project construction is forecast to be approximately nine months. It is anticipated that all components will be delivered in containers by semi-trailer trucks and deliveries will be scheduled across the project construction period. All works would be undertaken during standard construction hours.

2.2 Receiver Review

A review of aerial imagery and geospatial information identified that the noise environment surrounding the project site is typical of a rural environment, with dominant sources likely to include agricultural noise and environmental noise (ie birds and insects).

Using aerial photography, geospatial information and other project design information, MAC has identified the following potentially sensitive receivers that may be affected by noise from construction of the project.

Table 2 presents a summary of receiver identification, address and MGA (55) coordinates. The locality plan identifying the position of the potentially affected receivers is provided in **Figure 2**.

Table 2 Receiver Locations

Receiver ID	Description	Receiver Type	MGA55 Coordinates	
			Easting	Northing
R1[1]	39 Hogans Lane	Residential	321493	6066662
R2	31 Hogans Lane	Residential	321545	6066727
R3	335 Flanagans Lane	Residential	321586	6067061
R4	313 Flanagans Lane	Residential	321451	6067636
R5	146 McEwans Lane	Residential	321432	6067876
R6	Kygala Property, Flanagans Lane	Residential	322173	6066944
R7	463 Flanagans Lane	Residential	322896	6066942
R8	378 Aratula North Road	Residential	323383	6066234
R9	239 Aratula North Road	Residential	322828	6065472
R10	221 Aratula North Road	Residential	321937	6065273
R11	Beronghi Property, Hogans Lane	Residential	321334	6065834
R12	83 Hogans Lane	Residential	321491	6066282

Note 1: Project related receiver.

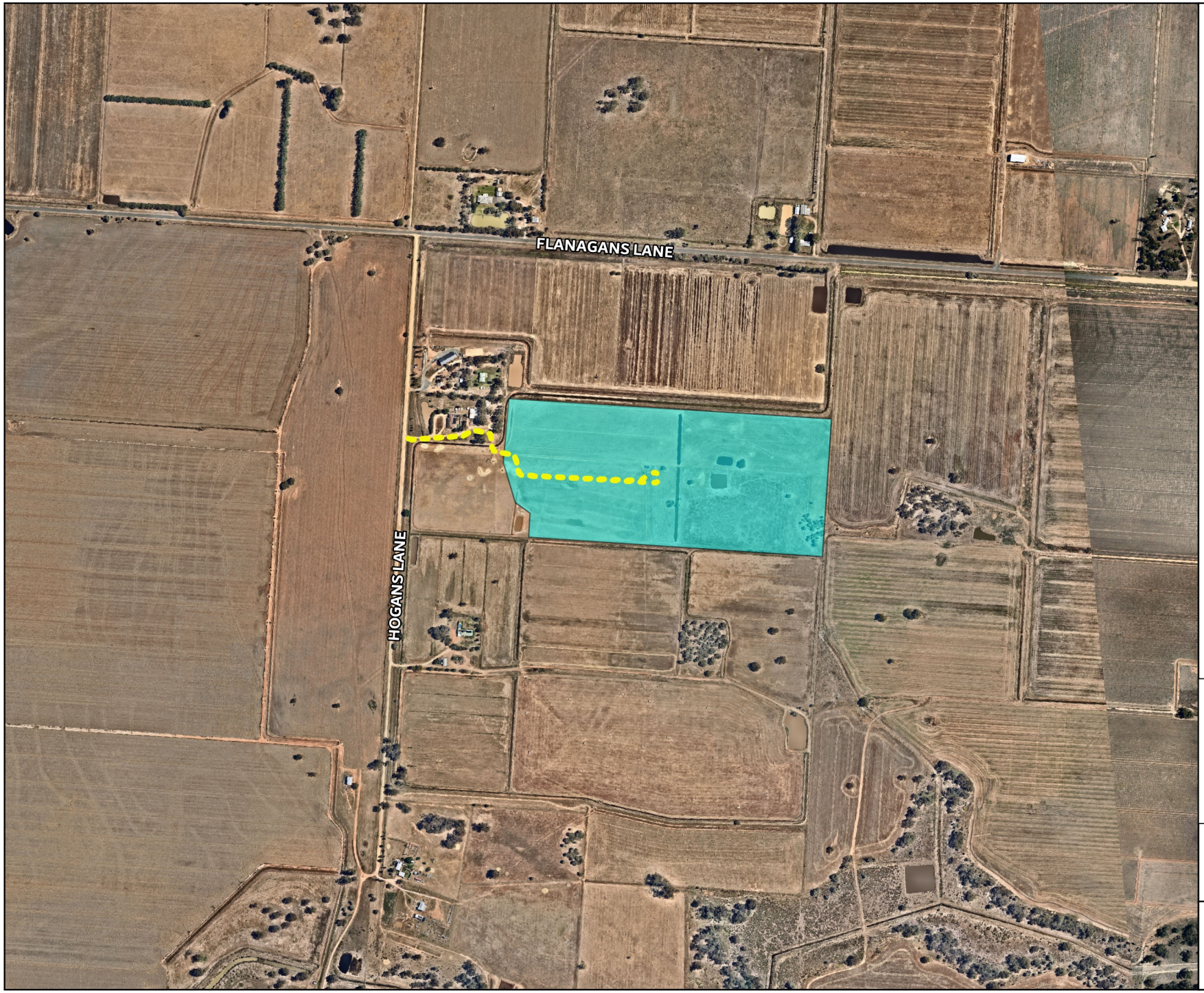

FIGURE 1

Project Site

MAC231915-01

Deniliquin Micro Solar Farm

KEY

Project Site

Access Road

0 100 200 300 400 m

N

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FIGURE 2

Receiver Map

MAC231915-01

Deniliquin Micro Solar Farm

KEY

Project Site

Access Road

Residential Receivers

0 150 300 450 600 m

N

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3 Noise Policy and Guidelines

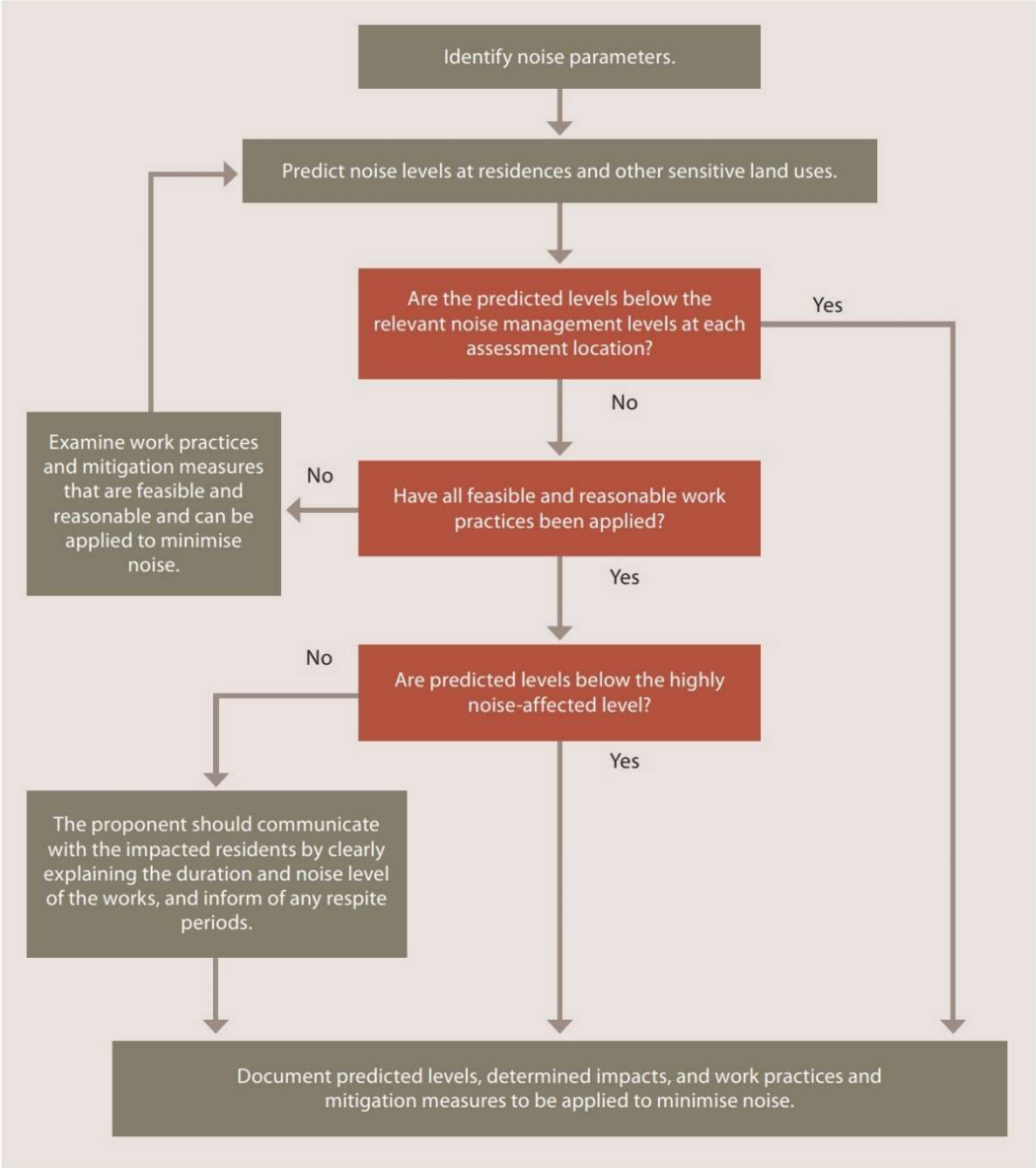
3.1 Interim Construction Noise Guideline

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment. The ICNG provides two methodologies for the assessment of construction noise emissions:

- quantitative, which is suited to major construction projects with typical durations of more than three weeks; and
- qualitative, which is suited to short term infrastructure maintenance (< three weeks).

The qualitative assessment methodology is a more simplified approach that relies on noise management strategies. This CNA has adopted a quantitative assessment approach which is summarised in **Figure 3.** The quantitative approach includes identification of potentially affected receivers, derivation of the construction Noise Management Levels, quantification of potential noise impact at receivers via predictive modelling and, provides management and mitigation recommendations.

Figure 3 Quantitative Assessment Processes for Assessing and Managing Construction Noise



Source: Department of Environment and Climate Change, 2009.

3.1.1 Standard Hours for Construction

Table 3 presents the ICNG recommended standard hours for construction works.

Table 3 Recommended Standard Hours for Construction

Daytime	Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

These recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

Construction activities are anticipated to be undertaken during standard construction hours.

3.1.2 Out of Hours Construction

Works conducted outside of recommended standard hours are considered Out of Hours work (OOH). The ICNG suggests that any request to vary the hours of construction activities as identified above shall be:

- considered on a case-by-case basis or activity-specific basis;
- accompanied by details of the nature and need for activities to be undertaken during the varied construction hours;
- accompanied by written evidence that activities undertaken during the varied construction hours are strongly justified;
- appropriate consultation with potentially affected receivers and notification of the relevant regulatory authorities has occurred; and
- all practicable and reasonable mitigation measures will be put in place.

3.1.3 Construction Noise Management Levels

Section 4 of the ICNG details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Levels (NMLs) and are important indicators of the potential level of construction noise impact. **Table 4** reproduces the ICNG Noise Management Level (NML) for residential receivers. The NML is determined by adding 10dB (standard hours) or 5dB for OOH to the Rating Background Level (RBL) for each specific assessment period.

Table 4 Noise Management Levels

Time of Day	Management Level LAeq(15min)[1]	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly Noise Affected 75dBA (HNA)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours.	Noise affected RBL + 5dB	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see Section 7.2.2 of the ICNG.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

3.1.4 Construction Sleep Disturbance

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights. Given that construction activities are anticipated to occur during standard construction hours, sleep disturbance has not been considered in this assessment.

3.2 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in **Section 4.3**.

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4 Assessment Criteria

Due to the rural nature of the locality and the likelihood of low ambient noise levels, background noise monitoring has not been conducted for this project. Hence, the minimum assumed Rating Background Levels (RBL) of 35dBA for the daytime period and 30dBA for the evening and night-time periods have been adopted in accordance with NPI methodology.

4.1 Construction Noise Management Levels

The relevant NMLs for standard construction hours are presented in **Table 5**.

Table 5 Construction Noise Management Levels

Receiver ID	Assessment Period[1]	Adopted RBL dB LA_{90}	NML dB $LA_{eq(15min)}$
All residential	Standard Hours	35	45 (RBL+10dBA)

Note 1: Refer to **Table 3** for Standard Recommended Hours for Construction.

4.2 Construction Vibration

A qualitative assessment of potential vibration impacts has been completed. Due to the nature of the works proposed and distances to potential vibration sensitive receivers, vibration impacts from the project would be negligible.

The Construction Noise & Vibration Strategy (CNVS) (V4.2 Transport for NSW, 2019) sets out safe working distances to achieve the human response criteria for vibration. The key vibration generating source proposed to be used is an impact piling rig during installation of tracking panel support poles. For a piling rig (hammer), the CNVS sets a safe working distance of 50m to achieve the residential human response criteria for continuous vibration. Therefore, as the nearest receiver to the project is greater than 90m, human exposure to vibration is anticipated to be negligible. Furthermore, where the human response criteria are satisfied, the structural or cosmetic criteria for sensitive receivers will be achieved. Therefore, vibration impacts are not considered to be a significant issue and have not been considered further in this assessment.

4.3 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the RNP. For this assessment, the 'Local road' category for Flanagans Lane has been adopted. The relevant road traffic noise criteria are provided in the RNP and are presented in Table 6 for residential receivers.

Table 6 Road Traffic Noise Assessment Criteria

Road category	Type of project/development	Assessment Criteria – dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Local roads	Existing residences affected by additional traffic on local roads generated by land use developments	55dB LAeq(1hr)	50dB LAeq(1hr)

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dBA, which is generally accepted as the threshold of perceptibility to a change in noise level.

5 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers using DGMR (iNoise, Version 2023.02) noise modelling software. iNoise is an intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613:1 and ISO 9613:2 including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standards are the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

5.1 Construction Assessment Methodology

Construction activities are proposed to be progressive and will occur at several locations simultaneously. Noise emissions were modelled for the following scenarios:

- site preparation works, including fencing, planting of landscaping buffer, earthworks for site access / internal roads and laydown / car parking areas, and setup of site amenities;
- pile driving works for tracking panel supports;
- installation of tracking systems, trenching for cabling and installation of panel assemblies, inverter station, MVPS and HVSB;
- HVSB connection, testing and commissioning; and
- site cleanup and demobilisation.

[1] Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

It is anticipated that the delivery of components and material to site, and site preparation works would likely occur simultaneously. Testing and commissioning of the HVSB, site cleanup and demobilisation may also occur simultaneously. Noise emission data and assumptions used in this assessment are summarised in **Table 7**. All significant noise generating construction activities will be limited to standard construction hours.

Table 7 Construction Equipment Sound Power Levels, Lw dBA (re 10^{-12} Watts)

Noise Source/Item	Utilisation %	Quantity	Lw/Item	Total Lw
Early Works / Site Preparation				
Slasher / Mower	100	1	102	102
Ute mounted auger	50	1	102	99
Concrete truck and pump	80	1	106	105
Excavator	80	1	105	104
Compactor	80	1	106	105
Grader	80	1	112	111
Mobile crane/HIAB	75	1	98	97
Water cart	100	1	101	101
Delivery trucks	40	1	104	101
Light vehicles	25	2	76	73
Total – Early Works / Site Preparation				**115**
Piling Works				
Piling rig (hydraulic)	80	1	113	112
Delivery trucks	40	1	104	101
Light vehicles	25	2	76	73
Total – Piling Works				**112**
Installation Works				
Excavator	80	1	105	104
Compactor	80	1	106	105
Tele-handler	75	1	99	98
Mobile crane/HIAB	75	1	98	97
Hand tools/Power tools	50	1	102	99
Water cart	100	1	101	101
Waste truck (fortnightly)	40	1	104	101
Light vehicles	25	2	76	73
Total – Installation Works				**110**

Table 7 Construction Equipment Sound Power Levels, Lw dBA (re 10^{-12} Watts)				
Electrical Works				
EWP	75	1	98	97
Hand tools/Power tools	50	1	102	99
Waste truck (fortnightly)	40	1	104	101
Light vehicles	25	2	76	73
Total – Electrical Works				**104**
Site Cleanup and Demobilisation				
Delivery trucks	40	1	104	101
Light vehicles	25	2	76	73
Waste truck (fortnightly)	40	1	104	101
Total – Site Cleanup / Decommissioning				**104**

5.2 Construction Road Noise Assessment Methodology

Due to the low traffic volume generated by the project over a typical day, road traffic noise calculation methods such as Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3) by Department of Transport (UK) 1988 or Traffic Noise Model (TNM) by the United States Department of Transport, Federal Highway Administration are not considered appropriate as they are primarily intended to calculate noise emissions from motorways and highways. Whilst each method has a low volume correction, the project traffic volume is out of the scope of these methods.

Therefore, road traffic noise has been modelled using iNoise modelling software using ISO 9613-1 and ISO 9613-2 calculation methods, representing the road traffic as "moving sources" along the transport route using the parameters presented in **Table 8.**

Construction traffic volumes were sourced from the Traffic Impact Assessment Report for the project (Traffic Works, 2023; Ref: 201077). Forecast construction traffic movements comprise up to 40 light vehicle movements per day (20 light vehicle movements during the AM and PM busy hour), and a total of 10 heavy vehicle movements per day. It is anticipated that one heavy vehicle movement would occur during the AM or PM busy hour, with all remaining movements occurring throughout the remainder of the shift. Existing traffic volumes on Flanagans Lane and Hogans Lane were considered to be negligible (<50 vehicle movements per day).

Table 8 Road Traffic Noise Modelling Parameters

Noise Source/Item	Lw dBA re 10^{-12} W	Movements/hr	Speed, km/h	Source Height, m[1]
Heavy vehicle	104	1	50	1.5
Light vehicle	96	20	50	0.75

Note 1: Height above ground level.

6 Noise Assessment Results

This assessment has quantified operational noise levels at the nearest receivers.

6.1 Construction Noise Assessment

Noise levels were predicted for all identified receivers at 1.5m above ground level for typical construction activities for standard construction hours. **Table 9** summarises the predicted noise level range for each of the construction scenarios at identified receivers. It is noted that receiver R1 is a project-related receiver and has been included in this assessment for completeness purposes.

Table 9 Predicted Construction Noise Levels

Receiver ID	Predicted Noise Level Range, dB $L_{Aeq(15min)}$[1]					NML Standard Hours
	Early Works	Piling Works	Installation	Electrical	Cleanup	dB $L_{Aeq(15min)}$
R1[2]	49 – 60	46 – 49	47 – 58	43	47	n/a
R2	47 – 53	41 – 49	41 – 45	39	39	45
R3	39 – 42	37 – 43	35 – 39	30	<30	45
R4	<30 – 32	31 – 34	up to 30	<30	<30	45
R5	up to 30	30 – 32	<30	<30	<30	45
R6	38 – 43	39 – 45	37 – 42	<30	<30	45
R7	<30 – 33	32 – 37	<30 – 33	<30	<30	45
R8	<30	<30 – 32	<30	<30	<30	45
R9	<30	30 – 33	<30	<30	<30	45
R10	up to 30	31 – 34	<30	<30	<30	45
R11	33 – 36	34 – 38	31 – 34	<30	<30	45
R12	42 – 46	39 – 48	37 – 44	34	31	45

Note: Predicted construction noise levels above the NMLs are highlighted and shown in **bold**.

Note 1: Noise levels from construction activities vary due to their position across the project site with respect to surrounding receivers.

Note 2: Project related receiver.

The results of the predictive noise modelling demonstrates that construction noise levels are anticipated to exceed the NMLs at the following receiver locations under worst-case construction activities (ie all plant and equipment operating simultaneously at the nearest point to the receiver):

- R2 and R12 during early works (including the installation of the boundary fence and construction of access road) and piling works.

It is noted that the activities with the highest potential for noise emissions, including early works / site establishment and piling works, are scheduled to occur during Month 1 and Month 2 of the construction period respectively. Furthermore, piling works are anticipated to occur for a maximum of four weeks only.

It is reiterated that exceedances of the NMLs at the nearest residential receivers are predicted under worst-case construction activities with all plant and equipment operating simultaneously at the closest point of the construction area to the nearest receivers. During construction, it is highly unlikely that all plant and equipment would operate simultaneously or operate in the same immediately vicinity. Hence, the predicted noise levels should be interpreted as being overly conservative. Furthermore, as demonstrated by the range of predicted construction noise levels, exceedances are only anticipated when the works are at their nearest proximity to the receivers. Where this occurs, it is anticipated that impacts would occur for over a short duration.

6.1.1 Assessment of Receiver Perception

The Transport for NSW (TfNSW) Construction Noise and vibration Guideline (CNVG) (2023) provides a useful guide to the potential magnitude of noise impacts through classification of the receiver perception of noise emissions from construction activities from noticeable noise levels to highly intrusive noise levels. The CNVG also provides recommended additional mitigation measures for the management of residual impacts following the implementation of standard mitigation measures.

The receiver perception categories and applicable additional mitigation measures, as per the CNVG, are summarised as follows:

- 40 – 44dBA would be perceived as 'noticeable';
- 45 – 54dBA would be 'clearly audible';
- 55 – 64dBA would be moderately intrusive, and would require notification (ie letterbox drop) to residents and verification monitoring; and
- 65 – 75dBA would be 'highly intrusive' and would require notification (ie letterbox drop) to residents and verification monitoring.

An assessment of the receiver perception of noise impacts during construction works is provided in Table 10. It is noted that the assessment of receiver perception of noise is based on worst-case construction noise levels, without the implementation of standard mitigation measures. Where standard mitigation measures are effectively implemented, construction noise emissions would be reduced, and the receiver perception would be improved.

Table 10 Predicted Magnitude of Impact – Worst-Case Scenario					
Receiver ID	Highest Predicted Noise Level above NML				
	Early Works	Piling Works	Installation	Electrical	Cleanup
R1[2]	n/a	n/a	n/a	n/a	n/a
R2	Clearly Audible	Clearly Audible	Noticeable	--	--
R3	Noticeable	Noticeable	--	--	--
R4	--	--	--	--	--
R5	--	--	--	--	--
R6	Noticeable	Clearly Audible	Noticeable	--	--
R7	--	--	--	--	--
R8	--	--	--	--	--
R9	--	--	--	--	--
R10	--	--	--	--	--
R11	--	--	--	--	--
R12	Clearly Audible	Clearly Audible	Noticeable	--	--

The results of the receiver perception analysis of worst-case construction noise emissions are provided as follows:

- the perceived impact of construction noise emissions during worst-case construction activities would typically be negligible at most receiver locations;
- worst-case construction noise emissions are not predicted at the moderately intrusive or highly intrusive receiver perception categories;
- during early works, including installation of the boundary fence and construction of the access road, worst-case construction activities are anticipated be noticeable at R3 and R6, and clearly audible at R2, R6 and R12;
- during installation works, including trenching for cabling and installation of equipment, worst-case construction activities are anticipated to be noticeable at R3, and clearly audible at R2 and R12; and
- noise levels are anticipated to be below the perception levels at all receiver locations during commissioning and testing, and site cleanup / decommissioning.

Based on the results of the predictive noise modelling and receiver perception analysis, management of construction noise impacts should be undertaken through the implementation of standard mitigation measures.

6.2 Construction Road Traffic Noise Assessment

The major transport route for all vehicles to the access the project site via Flanagans Lane and Hogans Lane. During construction, traffic generated by the project include employee/subcontractor and delivery vehicles.

A review of aerial imagery identified that the closest residential receiver along the transport route (31 Flanagans Lane) is approximately 35m from the road. Predicted noise levels from project related construction traffic has been calculated using the methodology described in **Section 0** and the parameters presented in **Table 8**. The results presented in **Table 11** show the calculated $LA_{eq(1hr)}$ noise levels to align with RNP assessment periods.

Table 11 Predicted Construction Road Traffic Noise Levels

Road Name	Offset Distance to Receiver	Predicted Noise Level	RTN Criteria	Compliance Achieved
Flanagans Lane	35m	39dB LAeq(1hr)	55dB LAeq(1hr)	✓

Results demonstrate that project construction traffic noise levels would comply with the relevant RNP criteria.

7 Construction Noise Recommendations (Standard Mitigation Measures)

The results of the assessment indicate that construction noise emissions, under worst-case conditions, are anticipated to exceed the relevant NMLs at up to two receiver locations, with the highest exceedance predicted at 8dB $LA_{eq(15min)}$ during early works, including installation of boundary fencing and construction of the access road. In accordance with the ICNG, where noise from construction works is above the NMLs, the applicant should apply feasible and reasonable work practices to minimise noise.

The ICNG and Standards Australia AS 2436-2010 "Guide to Noise Control on Construction, Maintenance and Demolition Sites" outline noise management and mitigation initiatives to minimise the impact and improve the acoustic amenity of receivers potentially affected by construction projects. Recommendations provided in the ICNG and AS2436 include combinations of operational strategies, source noise control strategies, noise barrier controls, and community consultation. Adopting strategies contained in this standard may result in the following noise attenuation:

- up to 10dBA where space requirements place limitations on the attenuation options available; and
- up to 20dBA in situations where noise source noise mitigation measures (silencers, mufflers, etc) can be combined with noise barriers and other management techniques.

When determining the best mix of work practices, the applicant needs to consider what measures are feasible and what measures can be reasonably implemented. Not all standard mitigation measures are applicable to each project and should be considered on a case-by-case basis. Furthermore, the management of construction noise should be flexible, with the effectiveness of measures reviewed throughout the construction period.

In consideration of the project site and the nature of the construction activities, it is recommended that the following standard noise mitigation measures are considered during the construction phase to reduce emissions to the surrounding community:

- preparation of a Construction Noise Management Plan (CNMP) to minimise noise emissions, and to respond to potential concerns from the community;
- where possible use localised mobile screens or construction hoarding around piling rig/plant to act as barriers between construction works and receivers, particularly where equipment is near the site boundary and/or a residential receiver including areas in constant or regular use (eg unloading and laydown areas);

- operating plant in a conservative manner (no over-revving), shutdown when not in use, and be parked/started at farthest point from relevant assessment locations;
- selection of the quietest suitable machinery available for each activity;
- minimise noisy plant/machinery working simultaneously where practicable;
- minimise impact noise through good work practices;
- utilise a broadband reverse alarm in lieu of the traditional high frequency type reverse alarm;
- provide toolbox meetings, training and education to drivers and contractors visiting the site during construction so they are aware of the location of noise sensitive receivers and to be cognisant of any noise generating activities;
- signage is to be placed at the front entrance advising truck drivers of their requirement to minimise noise both on and off-site; and
- notify potentially affected residences with project progress, proposed/upcoming potentially noise generating works, its duration and nature and complaint procedure.

The overall efficacy of the mitigation and management measures is dependent on the measures implemented and how effectively they are implemented. Based on experience, through the implementation of the recommended measures, it is anticipated that construction noise levels could be reduced by upwards of 10dBA and would therefore typically comply with the NMLs. For example:

- good work practices such as minimising noisy plant/machinery working simultaneously and operating plant in a conservative manner, construction noise levels may be reduced by upwards of 6dBA;
- temporary barriers such as hay bale stacks (mounted to a skid) to block line of sight from piling rigs and/or augers to nearby receivers, can reduce noise levels by 3 to 5dBA; and
- doubling the distance from noise sources to the nearest receivers can result in a reduction in noise levels of 6dBA.

It is reiterated that implementing noise mitigation measures will not guarantee that construction noise levels will remain below the relevant NMLs. The effectiveness of the measures should be evaluated throughout the construction period, and further measures implemented where required.

8 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Construction Noise Assessment for a proposed Micro Solar Farm at 39 Hogans Lane, Deniliquin, NSW.

The results of the Construction Noise Assessment demonstrate that construction noise levels have the potential to exceed relevant construction NMLs at two non-project related receiver locations (R2 and R12). An assessment of receiver perception indicated that worst-case construction noise levels may be perceived as clearly audible at up to three locations and noticeable at up to four locations during early works, piling works and installation works. Noise emissions are not expected to be perceived as moderately intrusive or highly intrusive at any of the assessed receiver locations.

Recommendations have been provided to minimise the potential noise impacts from construction, albeit of a temporary nature during the daytime only, over a nine-month construction period. Through effective implementation of the recommended mitigation measures, it is anticipated that noise levels would generally comply with the relevant NMLs.

A qualitative assessment of potential vibration impacts has been completed. Due to the nature of the works proposed and distances to potential vibration sensitive receivers, vibration impacts from the project would be negligible.

Road noise emissions associated with the construction of the project are anticipated to satisfy the relevant RNP criteria at all receivers along the proposed transportation route.

Based on the Construction Noise Assessment results, there are no noise related issues which would prevent approval of the proposed project.

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Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Acoustical Terms

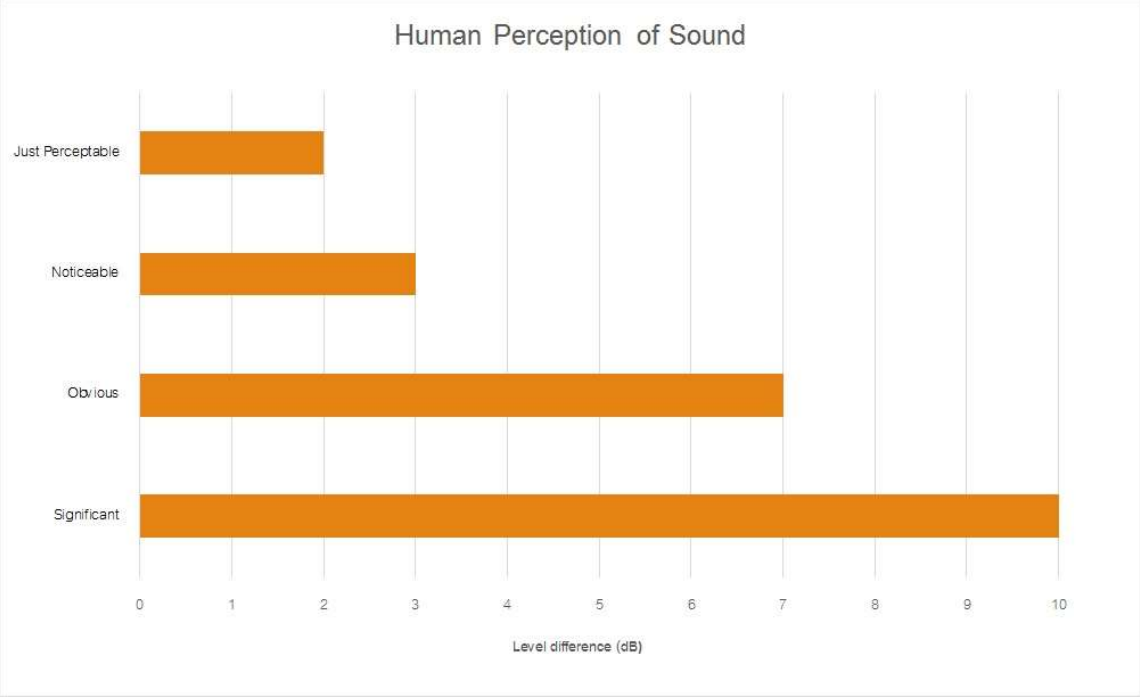
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Z-weighted or decibels Linear (unweighted).
Extraneous Noise	Sound resulting from activities that are not typical of the area.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A sound level which is exceeded 10% of the time.
LA90	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
LAeq	Represents the average noise energy or equivalent sound pressure level over a given period.
LAmax	The maximum sound pressure level received at the microphone during a measuring interval.
Masking	The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
RBL	The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period.
Sound Power Level (Lw or SWL)	This is a measure of the total power radiated by a source in the form of sound and is given by 10.log10 (W/Wo). Where W is the sound power in watts to the reference level of 10^{-12} watts.
Sound pressure level (Lp or SPL)	the level of sound pressure; as measured at a distance by a standard sound level meter. This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Pressure Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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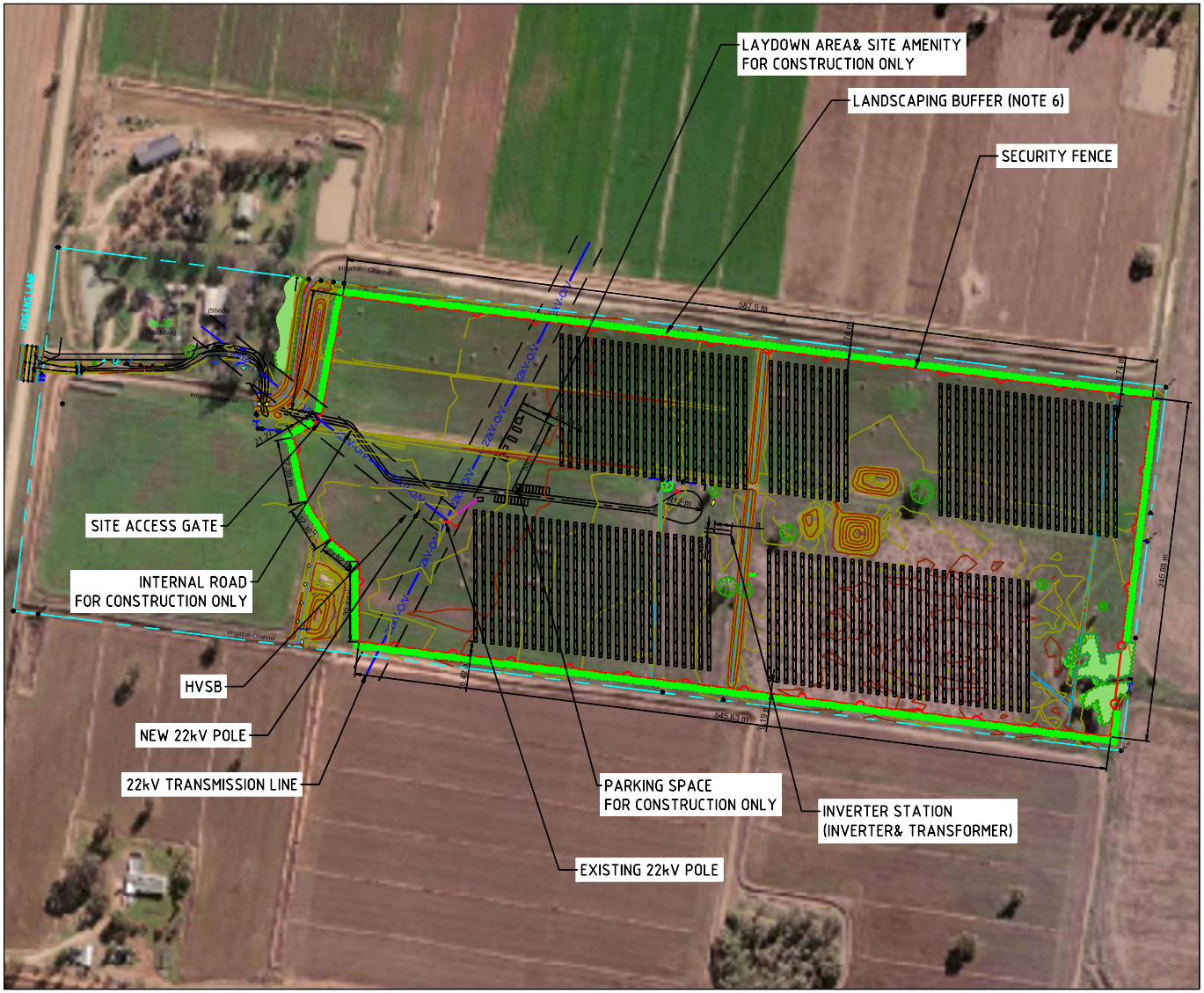
Appendix B – Project Layout



SITE LAYOUT (1:1500)

0 25m 50m 75m 100m 125m 150m

LOCALITY PLAN

NOTES

1. ACTUAL DIMENSIONS AND CLEARANCES MAY VARY SUBJECT TO SITE CONDITIONS.
2. DIMENSIONS OF ELECTRICAL EQUIPMENT ARE INDICATIVE ONLY. ACTUAL DIMENSIONS TO BE CONFIRMED.
3. EXISTING ESSENTIAL ENERGY 22 kV POLE IS FOR ILLUSTRATION ONLY. ACTUAL POSITION IS SUBJECT TO THE ACTUAL MEASUREMENT ON SITE.
4. LOCATION OF ESSENTIAL ENERGY 22 kV OVERHEAD DISTRIBUTION LINE AND SYSTEM CONNECTION TO BE CONFIRMED.
5. SITE STORAGE AND AMENITY FACILITIES TO BE ON SITE ONLY DURING CONSTRUCTION PHASE. NO PERMANENT BUILDINGS TO BE KEPT ON SITE AFTER CONSTRUCTION COMPLETED.
6. SECURITY FENCE SETS BACK 9M FROM TITLE BOUNDARY TO ACCOMMODATE 6M WIDE LANDSCAPING BUFFER AND 3M MAINTENANCE TRACK.

LEGEND

- PROPOSED PV ARRAY
- SECURITY FENCE
- PROPERTY BOUNDARY
- 22 kV OVERHEAD LINE WITH EASEMENT

SYSTEM SPECIFICATIONS				
DC	5.17	MW	TOTAL MODULES	9396
MODULE CAPACITY	550	W	MODULES PER STRING	27
NUMBER OF INVERTERS	1	-	NUMBER OF STRINGS	348
INVERTER MODEL	SG4950HV-MV	-	MODULE MODEL	LR5-72HPH-550M

FOR INFORMATION

No	DATE	DRN	CHK	ENG	Q.A.	PROJECT	DESCRIPTION
F	24/01/23	MG	ACE	MG	ACE	NSW-38	UPDATE TRACKER ARRANGEMENT
E	23/01/23	MG	ACE	MG	ACE	NSW-38	UPDATE LANDSCAPING
D	05/09/22	ACE	ACE	ACE	ACE	NSW-38	UPDATE VEGE. BUFFER
C	06/03/22	ACE	ACE	ACE	ACE	NSW-38	UPDATE INFO. LAYOUT
H	11/10/23	MG	ACE	MG	ACE	NSW-38	RE-ARRANGE SITE LAYDOWN
G	21/02/23	MG	ACE	ACE	ACE	NSW-38	UPDATE SITE BOUNDARY

REVISION | NUMBER | TITLE | REFERENCE DRAWINGS

GREEN GOLD ENERGY

39 Hogans Lane, Deniliquin, NSW, 2710.
4.15 MW PV EXPORT SYSTEM
SITE PLAN

DATE: 11/10/23	DRN: MG	CHK: ACE	ENG: ACE	Q.A: ACE	SCALE: 1:1500
PROJ No NSW-38	DRG No				REV H

AUTOCAD A1SHEET

Muller Acoustic Consulting Pty Ltd
PO Box 678, Kotara NSW 2289
ABN: 36 602 225 132
Ph: +61 2 4920 1833
www.mulleracoustic.com

MAC
Muller Acoustic Consulting