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Middlebrook Solar Farm - Modification Noise Review

1 Introduction

Renzo Tonin & Associates was engaged to review the noise impacts with the proposed modification for the Middlebrook Solar Farm.

2 Proposed Modification

The proposed modification to the approved project that may change potential noise impacts include:

1. Minor increase to the consented Development Footprint
2. Relocation of an existing private landholder access within the consented Development Footprint, to improve access for the host landholder
3. Change in BESS from 780 to 1450MWh AC delivery capacity and from 3 hrs to 4.5+ hrs storage
4. Change in transformer number at the onsite substation
5. Inclusion of blast walls around the transformers, in the event that these may be required by Transgrid

3 Review of Noise Impacts

Review of the noise impacts with the proposed modifications is based on the modified layout changes provided by NGH on 25 September 2025. The review will include a comparison of the changes to noise impacts due to the proposed modifications relative to the approved project noise impacts presented in the EIS Noise Report (ref. TN180-01F02 Report (r6), dated 20 March 2024))

3.1 Operational Noise Impacts

A review for the proposed modification to the approved project that may change potential noise impacts is as follows:

- Minor increase to the consented Development Footprint: Removal of associated dwelling and the corresponding increase to footprint of solar array is insignificant as it is a small area and in the middle of the subject site. The expanded temporary construction laydown area will have no impact on the operational noise as it is only utilised for the construction phase. The expanded construction area for New England Highway / Middlebrook Road upgrades will have no impact on the operational noise as it is only utilised for the construction phase.
- Relocation of an existing private landholder access within the consented Development Footprint, to improve access for the host landholder: Usage of the access path remains the same and no additional operational noise impacts is expected with this inclusion.
- Change in BESS from 780 to 1450MWh AC delivery capacity and from 3 hrs to 4.5+ hrs storage: The proposed modification will increase the BESS equipment 315 Battery Units and 63 PCUs. The resultant total Sound Power Level (SWL) of the BESS component will increase by 0.5dB(A) and noise impact at surrounding receivers will still be predominately from the solar farm.
- Change in transformer number at the onsite substation: To reduce the weight of Over Size Over Mass (OSOM) loads across the Goonoo Bridge, three smaller transformers would be installed as part of the substation instead of the two approved larger transformers. As the smaller transformers are rated at 99dB(A) SWL compared with the approved larger transformers rated 102dB(A), this proposed modification will result in a reduction in noise impact from the transformers from 105db(A) total SWL (approved project) to 104dB(A) total SWL (modification).
- Inclusion of blast walls around the transformers: The blast walls may provide some noise shielding to surrounding receivers but since the acoustic integrity of the blast walls is unknown the shielding effects have been omitted for a conservative assessment.

Proposed modifications that may potentially change operational noise impacts were updated in the noise model prepared for the EIS Noise Report and it was found that overall modifications noise impacts were predicted to be the same as presented in the EIS Report. Therefore, no additional noise impacts are expected with the proposed modification.

3.2 Construction Noise Impacts

A review for the proposed modification to the approved project that may change potential construction impacts is as follows:

- Minor increase to the consented Development Footprint: Expanded temporary construction laydown area and the demolition of associated dwelling are all within the previously modelled

worst case construction noise emissions envelope. Therefore, no increase to construction noise impacts is expected with this inclusion.

The expanded construction area for New England Highway / Middlebrook Road upgrades will likely increase construction noise impacts to surrounding receivers. Predicted construction noise impacts from the expanded construction area for New England Highway / Middlebrook Road upgrades are shown in the table below

Table 3.1 – Predicted $L_{Aeq,15\text{ min}}$ Road Upgrade Construction Noise Levels at Receiver Locations, dB(A)

Plant Item	Plant Description	Predicted $L_{eq,15\text{ min}}$ Construction Noise Levels				
		R10	R22	R29	R33	R36
Noise Management Level		45	45	45	45	45
2	Crane	<20- 48	<20-39	<20- 50	<20-41	<20-44
3	Drum roller	<20- 47	<20-38	<20- 49	<20-40	<20-43
4	Padfoot roller	<20- 47	<20-38	<20- 49	<20-40	<20-43
5	Wheeled loader	<20- 47	<20-38	<20- 49	<20-40	<20-43
6	Dump truck	<20- 46	<20-37	<20- 48	<20-39	<20-42
7	30t Excavator	<20-45	<20-36	<20- 47	<20-38	<20-41
8	Grader	<20-45	<20-36	<20- 47	<20-38	<20-41
9	Chain trencher	<20-42	<20-36	<20-44	<20-35	<20-38
10	Water truck	<20-42	<20-33	<20-44	<20-35	<20-38
11	Telehandler	<20-36	<20-27	<20-38	<20-29	<20-32
12	Forklift	<20-28	<20-19	<20-30	<20-21	<20-24
Up to 3 (noisiest) plant operating concurrently		<20- 52	<20-43	<20- 54	<20-45	<20- 48
Notes: 1. Bold font denotes exceedance of Noise Management Level						

The expanded construction area for New England Highway / Middlebrook Road upgrades will result in an increase in predicted construction noise levels for Receivers R22, R33 and R36. Receivers R22 and R33 remain compliant with the construction NML. Receiver R36 will exceed the construction NML when the 3 noisiest plant are operating concurrently in close proximity to this receiver. Construction noise for this receiver should be managed as per the management measures adopted for receiver R10 and R29.

- Relocation of an existing private landholder access within the consented Development Footprint, to improve access for the host landholder: Predicted construction noise impacts from the construction of this access path to surrounding receivers are shown in the table below.

Table 3.2 – Predicted $L_{Aeq,15\text{ min}}$ Access Path Construction Noise Levels at Receiver Locations, dB(A)

Plant Item	Plant Description	Predicted $L_{eq,15\text{ min}}$ Construction Noise Levels							
		R3	R4	R5	R6	R7	R8	R9	R10
Noise Management Level		45	45	45	45	45	45	45	45
1	Crane	<20-43	<20-24	<20-38	<20-39	<20-32	<20-34	<20-33	<20-26
2	Drum roller	<20-39	<20-20	<20-34	<20-35	<20-28	<20-30	<20-29	<20-22
3	Padfoot roller	<20-38	<20	<20-33	<20-34	<20-27	<20-29	<20-28	<20-21
4	Wheeled loader	<20-38	<20	<20-33	<20-34	<20-27	<20-29	<20-28	<20-21
5	Dump truck	<20-38	<20	<20-33	<20-34	<20-27	<20-29	<20-28	<20-21
6	30t Excavator	<20-37	<20	<20-32	<20-33	<20-26	<20-28	<20-27	<20-20
7	Grader	<20-36	<20	<20-31	<20-32	<20-25	<20-27	<20-26	<20
8	Chain trencher	<20-36	<20	<20-31	<20-32	<20-25	<20-27	<20-26	<20
9	Water truck	<20-33	<20	<20-28	<20-29	<20-22	<20-24	<20-23	<20
10	Telehandler	<20-33	<20	<20-28	<20-29	<20-22	<20-24	<20-23	<20
11	Forklift	<20-27	<20	<20-22	<20-23	<20	<20	<20	<20
Up to 3 (noisiest) plant operating concurrently		<20-45	<20-26	<20-40	<20-41	<20-34	<20-36	<20-35	<20-29

Table 3.1 indicates that the construction noise levels from the access path construction comply with the construction Noise Management Level for all receivers. No further reasonable and feasible noise mitigation measures are required to reduce construction noise impacts. It is noted that the construction noise at all receivers will be lower than the predicted construction noise from the construction of the solar farm as presented in the EIS report.

- Change in BESS from 780 to 1450MWh AC delivery capacity and from 3 hrs to 4.5+ hrs storage: A larger BESS area is required but still within the approved development envelope. Therefore, no increase to construction noise impacts is expected with this inclusion.
- Change in transformer number at the onsite substation: The change in transformers number would not involve any additional construction activities and/or equipment. Therefore, no increase to construction noise impacts is expected with this inclusion.
- Inclusion of blast walls around the transformers: The location of the blast walls are within the footprint of the solar farm and construction noise impacts from the construction of the blast walls will be within the predicted construction noise from the construction of the solar farm as presented in the EIS report.

4 Conclusion

Renzo Tonin & Associates have reviewed the noise impacts with the proposed modification to the Middlebrook Solar Farm. Increase to the construction noise from the expanded construction area for New England Highway / Middlebrook Road upgrades is expected and will be managed as per previous exceedances of the construction NML for the road upgrade construction works. No increase in noise impacts is expected with other proposed modification items.

Document control

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APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 120dB Deafening
dB(A)	A-weighted decibels. The A-weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L _{Max}	The maximum sound pressure level measured over a given period.
L _{Min}	The minimum sound pressure level measured over a given period.

L ₁	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L ₁₀	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L ₉₀	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L _{eq}	The “equivalent noise level” is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain L _{eq} sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.