NOISE IMPACT ASSESSMENT

PROPOSED BATTERY ENERGY STORAGE SYSTEM

CARBEAN ROAD

KARARA

Prepared for:
Saunders Havill Group Pty Ltd

Prepared by:
MWA Environmental

22 January 2025

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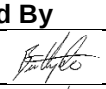
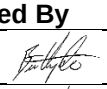
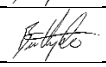
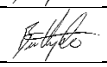
1 Report	22.01.2025	BH		BH	
2 Typo Correction	22.01.2025	BH		BH	
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1.0 INTRODUCTION

1.1 STUDY BRIEF

MWA Environmental has been commissioned to prepare a Noise Impact Assessment for the proposed Karara Battery Energy Storage System ("**BESS**") by ACCIONA Energy Australia Global Pty Ltd over land located at Carbean Road, Karara QLD 4352, formally described as part of Lot 15 on SP332758 ("**the subject land**").

The assessment has considered the potential noise amenity impacts of the proposed development upon surrounding sensitive land uses. The assessment has been based on ambient noise monitoring conducted on site, source noise level specifications for the key equipment associated with the facility and detailed noise propagation modelling.

The development application comprises a Development Permit for Material Change of Use (MCU) for a Battery Storage Facility.

The development application is Impact Assessable under the Goondiwindi Regional Council Planning Scheme 2018.

1.2 SITE DESCRIPTION

The site is located off Carbean Road, Karara. The site has a real property description of (part of) Lot 15 on SP332758.

The site location is shown on **Figure 1**.

The subject land and surrounding properties are zoned Rural (Traprock Precinct) under the *Goondiwindi Regional Council Planning Scheme 2018* ("**the GRC Planning Scheme**").

The subject land is adjacent to compatible land uses including the MacIntyre Wind Farm project, Over-head Transmission Line and MacIntyre Intermediate Switching Station.

The sensitive receptors are the locality are isolated dwellings on large rural properties. The BESS site is well setback from sensitive receptors, with the nearest sensitive receptor setback approximately 4 kilometres from the BESS pad.

Twenty-eight (28) sensitive receptors are identified on **Figure 2** and labelled R1 to R28 for the purpose of this assessment.

1.3 PROPOSED DEVELOPMENT

The proposed development involves the construction of a grid connected Battery Energy Storage System (BESS) with estimated capacity of 400MW / 2hour (800MWh) (subject to detailed design) located adjacent to the existing Powerlink MacIntyre Intermediate Switching Station ("**the MISS substation**") and the Acciona 923MW MacIntyre Wind Farm project ("**the MIWF project**")

The proposed BESS will function by receiving and storing electricity during periods of low energy demand or oversupply and export back to the grid during periods of high demand. A battery storage facility on site will play a critical role in improving network stability and reducing the need for load shedding in addition to contributing to the Queensland Government renewable energy targets.

At this stage of the project, the detailed design and configuration of the proposed BESS has not yet been finalised. However, as illustrated in the Overall Layout Plan, the project will comprise a typical battery storage facility, incorporating:

- battery container units with associated inverters and transformers;
- a range of ancillary infrastructure including on-site substation;
- underground medium voltage reticulation cabling;
- operation and maintenance facility;
- construction laydown area;
- internal access tracks;
- perimeter security fencing (approximately 1.8m high); and
- transmission lines connecting the BESS substation to the MISS substation.

Site access for construction and operational / maintenance vehicles is proposed via the Cunningham Highway (State-controlled road), Carbean Road (GRC road) and the existing MISS substation access track.

The BESS is proposed to operate for a period of approximately 20 years with the infrastructure to be either refurbished or removed at the end of the Agreement for Lease. Following receipt of all necessary regulatory approvals, it is anticipated that the construction period for the project would be approximately 16 months.

The Overall Layout Plan is included as **Attachment 1**.

2.0 EXISTING NOISE ENVIRONMENT

2.1 EXISTING NOISE LEVELS

The subject land is relatively remote from major noise sources and, where separate from the Cunningham Highway, ambient noise levels at sensitive receptors are quiet.

MWA Environmental has conducted noise measurements to characterise the existing ambient noise environment at the surrounding sensitive receptors. Noise dataloggers were placed to the following two locations:

Noise Datalogger 1: At BESS Pad

Noise Datalogger 2: West Logger[1]

The noise datalogger locations are shown on **Figure 3**.

The noise dataloggers used were Norsonic Nor139 Class 1 sound level meters with current NATA calibration certificates, programmed to provide a statistical noise level analysis based on 15-minute sampling periods, and monitored continually for a 9 day period from 3 to 11 June 2024.

The dataloggers were pre-calibrated to 94 dB at 1kHz using a Bruel & Kjaer Sound Level Calibrator, Type 4231A. The noise measurement instruments conform to ASIEC61672.1-2004 and the measurements were undertaken in accordance with AS1055-1997 and AS2702-1984. Pre and post measurement calibrations of the loggers were within acceptable tolerances.

The results of the datalogger noise monitoring are provided in **Table 1** and **Table 2.** The recorded noise levels are presented as the following statistical parameters:

- L_1: Noise level exceeded for 1 percent of the measurement period, referred to as the adjusted maximum sound pressure level.
- L_{10}: Noise level exceeded for 10 percent of the measurement period, referred to as the averaged maximum sound pressure level.
- L_{90}: Noise level exceeded for 90 percent of the measurement period. AS1055.1–1997[2] notes that the L_{90} is described as the background sound pressure level.
- L_{eq}: An “average” measurement, and as per AS1055.1–1997 defined as the value of the sound pressure level of a continuous steady sound state, that within a measurement period, has the same mean square sound pressure as a sound under consideration whose level varies with time.

[1] representative of Cunningham Highway setback of the nearest sensitive receptors to the BESS pad

[2] Australian Standard *AS 1055.1-1997 Acoustics – Description and measurement of environmental noise, Part 1: General procedures*

Table 1: Ranges of Recorded Statistical Noise Levels
Datalogger Location 1 'BESS Pad'
3 to 11 June 2024 – 15 Minute Averages

PARAMETER	PERIOD	RECORDED NOISE LEVELS - dBA		
		MINIMUM	MAXIMUM	AVERAGE
L_1	Daytime (7am-6pm)	22	86	44
	Evening (6pm-10pm)	21	55	27
	Nighttime (10pm-7am)	21	57	28
L_{10}	Daytime (7am-6pm)	21	54	35
	Evening (6pm-10pm)	21	46	24
	Nighttime (10pm-7am)	20	44	25
L_{90}	Daytime (7am-6pm)	20	35	25
	Evening (6pm-10pm)	20	27	21
	Nighttime (10pm-7am)	20	34	21
L_{eq}	Daytime (7am-6pm)	21	71	34
	Evening (6pm-10pm)	21	47	23
	Nighttime (10pm-7am)	20	44	24

The recorded noise levels at Datalogger Location 1 are included as graphical traces of noise level versus time for the statistical noise level descriptors L_1, L_{10}, L_{90} and L_{eq} in **Attachment 2.**

Table 2: Ranges of Recorded Statistical Noise Levels
Datalogger Location 2 'West'
3 to 11 June 2024 – 15 Minute Averages

PARAMETER	PERIOD	RECORDED NOISE LEVELS - dBA		
		MINIMUM	MAXIMUM	AVERAGE
L_1	Daytime (7am-6pm)	33	62	45
	Evening (6pm-10pm)	26	54	40
	Nighttime (10pm-7am)	20	62	37
L_{10}	Daytime (7am-6pm)	29	49	38
	Evening (6pm-10pm)	22	49	34
	Nighttime (10pm-7am)	20	53	31
L_{90}	Daytime (7am-6pm)	20	38	28
	Evening (6pm-10pm)	20	43	23
	Nighttime (10pm-7am)	19	35	22
L_{eq}	Daytime (7am-6pm)	27	48	36
	Evening (6pm-10pm)	21	47	31
	Nighttime (10pm-7am)	20	49	29

The recorded noise levels at Datalogger Location 2 are included as graphical traces of noise level versus time for the statistical noise level descriptors L_1, L_{10}, L_{90} and L_{eq} in **Attachment 3**.

The Rating Background Levels for each of the monitoring locations were at or below 25 dB(A) for the day, evening and night periods. The DEHP *Guideline: Noise Planning for Noise Control* (2016) sets a minimum background noise level threshold of L_{A90} 25 dB(A) for the determination of noise criteria.

3.0 NOISE ASSESSMENT CRITERIA

3.1 RELEVANT PLANNING SCHEME PROVISIONS

The GRC Planning Scheme Rural Zone Code includes overall outcomes that support non-rural uses in the Rural zone where those uses do not impact adversely on the amenity of the Rural zone.

Performance Outcome PO4 of the Rural Zone Code addresses amenity impacts, including noise, as follows:

Amenity	
PO4 Development does not detract from the amenity of the local area through unacceptable impacts relating to: (a) noise; (b) hours of operation; (c) traffic; (d) advertising devices (e) lighting; (f) visual amenity; (g) privacy; (h) odour; or (i) emissions. Editor's note: Any development involving a sensitive land use must take into account and mitigate any nuisance impacts from existing development in the locality.	**AO4** No acceptable outcome provided.

No acceptable outcomes or specific noise assessment criteria are referenced in the GRC Planning Scheme.

In this instance, assessment of unacceptable noise amenity impacts will have regard to both:

- Noise planning levels for residential land uses, with reference to the acoustic quality objectives stated in the *Environmental Protection (Noise) Policy 2019*; and
- The potential for the activity to cause unreasonable intrusive noise and/or result in significant 'background creep'.

3.2 ACOUSTIC QUALITY OBJECTIVES

The *Environmental Protection (Noise) Policy 2019* specifies Acoustic Quality Objectives for sensitive receptors to enhance or protect acoustic amenity.

The relevant outdoor and indoor Acoustic Quality Objectives for surrounding sensitive land uses (dwellings) are as follows:

Column 1	**Column 2**	**Column 3**			**Column 4**
Sensitive receptor	**Time of day**	**Acoustic quality objectives (measured at the receptor) *dB(A)***			**Environmental value**
		$L_{Aeq,adj,1hr}$	**$L_{A10,adj,1hr}$**	**$L_{A1,adj,1hr}$**	
dwelling (for outdoors)	daytime and evening	50	55	65	health and wellbeing
dwelling (for indoors)	daytime and evening	35	40	45	health and wellbeing
	night-time	30	35	40	health and wellbeing, in relation to the ability to sleep

Acoustic quality objectives are specified as L_{A1}, L_{A10} and L_{Aeq} noise levels.

Considering the nature of noise emissions from the proposed development and our previous experience it is evident that the most stringent of the Acoustic Quality Objective parameter for dwellings are the L_{Aeq} levels for each period of the day.

Considering the proposed operating hours and a noise attenuation of 7 dB(A) through an open window[3] the most stringent Acoustic Quality Objectives **assessed external to residential dwellings** are:

7am to 10pm – Day and Evening

L_{Aeq} (1 hour): 42 dB(A) external (35 internal + 7 sound transmission loss)

10pm to 7am - Night

L_{Aeq} (1 hour): 37 dB(A) external (30 internal + 7 sound transmission loss)

The 50 dB(A) $L_{Aeq,1hr}$ outdoor acoustic quality objective is achieved at a dwelling if the adopted 42 dB(A) $L_{Aeq,1hr}$ external level is satisfied to achieve the relevant indoor acoustic quality objective with an open window.

[3] AS3671 states approximate 10 dB(A) noise reduction through a façade with 10% open area. Thus approximately 7 dB(A) noise reduction through a façade with 20% open area. A typical 1200x1800 sliding window relates to approximately 10% open area. A large 2100x2300 sliding glass door represents approximately 20% open area. Thus, 7dB(A) noise reduction is conservatively adopted based upon a large sliding glass door in the affected façade. Openings larger than 20% open area are unlikely to be necessary for ventilation. For a typical sliding glass window in the open position a 10dB(A) noise reduction would be expected.

3.3 CONTROLLING BACKGROUND CREEP

The acoustic quality objectives may not be appropriate noise criteria for the long-term planning assessment of amenity impacts from sources that generate a 'steady-state' noise, such as the proposed BESS, at sensitive receptors in locations with low ambient noise levels.

The *Environmental Protection (Noise) Policy 2008* referenced in the planning scheme included provisions for the control of background noise creep, with specific 'background plus excess' criteria applied to limit the impact of specific activities. The *Environmental Protection (Noise) Policy 2019* still retains provisions around the management of background noise creep but does not prescribe specific noise criteria to achieve the intent of the policy.

'Background plus excess' noise limit schemes such as the specified controlling background creep criteria from the *Environmental Protection (Noise) Policy 2008* aim to prevent environmental harm and unreasonable environmental nuisance through management of the 'intrusiveness' of noise emissions from an activity relative to the otherwise prevailing background noise level.

Considering the nature of noise emissions from the development, the 'controlling background creep' criteria specified in Part 4, Section 10 of the *Environmental Protection (Noise) Policy 2008* for both 'continuous noise' and 'noise that varies over time' are relevant, as follows:

> ***10 Controlling Background Creep***
>
> *(1) This section states the management intent for an activity involving noise.*
> *Note—*
> *See section 51 of the Environmental Protection Regulation 2008.*
>
> *(2) To the extent that it is reasonable to do so, noise from an activity must not be—*
>
> *(a) for noise that is continuous noise measured by $L_{A90,T}$ – more than nil dB(A) greater than the existing acoustic environment measured by $L_{A90,T:+}$ or*
>
> *(b) for noise that varies over time measured by $L_{Aeq,adj,T}$ - more than 5 dB(A) greater than the existing acoustic environment measured by LA90,T.*

Given the steady-state nature of noise emissions from the BESS equipment, the relevant 'controlling background creep' noise criterion for the operational phase of the proposed development is that noise from BESS mechanical plant measured as the $L_{A90,adj,T}$[4] does not exceed the otherwise prevailing $L_{A90,T}$. The noise modelling has assessed the $L_{Aeq,adj,T}$ parameter on the basis of the noise data but the $L_{Aeq,adj,T}$ and $L_{A90,adj,T}$ noise levels are generally consistent for steady-state noise from the BESS equipment during the peak noise emission scenarios.

The DEHP *Guideline: Noise Planning for Noise Control* (2016) sets a minimum background noise level threshold of L_{A90} 25 dB(A) for the determination of noise criteria. The applicable 'controlling background creep' criteria determined on this basis are presented in **Table 3.**

Table 3: Adopted Background Creep Noise Criteria

Period	Adopted Background Level (L_{A90}) – dB(A)	Mechanical Plant Noise Criteria (L_{A90}) – dB(A)	Overall Noise Criteria (L_{Aeq}) – dB(A)
Daytime (7am to 6pm)	25	**25**	30
Evening (6pm to 10pm)	25	**25**	30
Night-time (10pm to 7am)	25	**25**	30

4 The Queensland *Ecoaccess Guideline: Planning for Noise Control* (2016) defines 'Steady Noise' as noise that gives fluctuations over a range of not more than 3dB on a sound level meter set to frequency weighting 'A' and time weighting 'F.' This is relevant to BESS noise emissions over 15 minute or 1 hour assessment periods

4.0 OPERATIONAL PHASE NOISE ASSESSMENT

4.1 DESCRIPTION OF OPERATIONAL PHASE NOISE EMISSIONS

Operational phase noise emissions from the BESS are primarily related to thermal management systems associated with the Battery Container Modules and Power Station Modules.

The HV Transformers at the new BESS substation are the only other significant noise source associated with the proposed development.

The preliminary equipment selections for the 400MW / 2hr BESS (800MWh) project are as follows, noting that equipment selections may change at the detailed design phase of the project:

- 192x Battery Container Modules – Hithium Infinity Block L5015 0.5P V2.0
- 128x Power Station Modules - SMA MV Power Station 4400-S2, each with 1x SMA Sunny Central Storage UP-XT 3800 inverter and 1x 4.4MVA MV transformer
- 8x 1.5MVA auxiliary supply transformers
- 2x HV Transformers at BESS substation – nominally 330kV / 250MVA

Routine daily staff activities (passenger cars, carparking and small office air-conditioning equipment) will be insignificant in the context of the overall BESS noise emissions given the separation distances to sensitive receptors.

4.2 NOISE SOURCES AND SOUND POWER LEVELS

Source noise data for the preliminary mechanical equipment selections were supplied by Acciona, as follows:

Battery Container Modules
Hithium Infinity Block L5015 0.5P V2.0

- Manufacturer supplied 1/3rd octave band sound pressure levels for the battery storage module in various operational modes, with the loudest operating mode (compressor speed = 7000RPM, fan speed = 95%) sound pressure levels applied by MWA Environmental to derive the 93.4 dB(A) sound power level.
- Manufacturer supplied sound pressure levels at multiple locations around the container module, which was analysed by MWA Environmental to distribute the overall sound power between each of the container ‘faces’ to ensure correct directional input to the model for the loudest operating mode (compressor speed = 7000RPM, fan speed = 95%).

Power Station Modules
SMA MV Power Station 4400-S2, each with 1x SMA Sunny Central Storage UP-XT 3800 inverter and 1x 4.4MVA MV transformer

- Manufacturer supplied sound power level of 93 dB(A) for the inverter modules, with the SWL applied by MWA Environmental to a representative frequency spectrum for an inverter from a past project.
- Sound power level of 75 dB(A) derived from the 'standard maximum' sound power specification in Annex ZA from AS 60076.10:2023 for a 4.4MVA transformer, with the SWL applied by MWA Environmental to a representative frequency spectrum for a transformer from a past project
- The overall SWL was derived from the sum of each 1/3rd octave for the above inverter and transformer combination.

Auxiliary Supply Transformer
Nominally 1.5MVA

- Sound power level of 68.4 dB(A) derived from the 'standard maximum' sound power specification in Annex ZA from AS 60076.10:2023 for a 1.5MVA transformer.
- The overall SWL was applied by MWA Environmental to a representative frequency spectrum for a transformer from a past project.

HV Transformer
Nominally 330kV / 250MVA

- Sound power level of 99.5 dB(A) derived from the 'standard maximum' sound power specification in Annex ZA from AS 60076.10:2023 for a 250MVA transformer.
- The overall SWL was applied by MWA Environmental to a representative frequency spectrum for a transformer from a past project.

The sound power levels have been represented in the SoundPLAN model as summarised in **Table 4**.

Table 4: BESS Equipment Sound Power Levels – dB(A)
Preliminary Equipment Selections

NOISE SOURCE	SOUND POWER LEVEL BY 1/3 OCTAVE FREQUENCY BAND											OVERALL SWL PER UNIT dB(A)	# OF UNITS
	12.5 16 20 Hz	25 31 40 Hz	50 63 80 Hz	100 125 160 Hz	200 250 315 Hz	400 500 630 Hz	800 1k 1.25k Hz	1.6k 2k 2.5k Hz	3.15k 4k 5k Hz	6.3k 8k 10k Hz	12.5k 16k 20k Hz		
Battery Container Module (Mode: 7000 RPM, Fan speed = 95%)	- - -	- - -	60.2 57.4 62.6	64.9 71.9 87.1	73.9 74.7 74.7	76.4 81.0 82.4	81.2 82.6 83.8	82.4 81.0 81.3	78.9 77.1 76.9	73.9 70.3 65.6	60.6 53.9 43.8	93.4	192
Power Station Module (inverter component)	- - -	42.9 50.9 53.6	57.3 60.4 64.2	69.0 66.8 69.0	74.2 77.6 80.8	79.7 78.5 75.6	79.4 77.9 76.7	77.7 76.4 80.6	89.9 69.7 72.3	81.5 68.7 67.9	- - -	93.0	128
Power Station Module (MV transformer component)	- 18.2 21.7	25.5 26.5 32.5	43.4 37.9 54.9	74.5 55.7 51.6	57.6 51.5 54.2	52.0 54.7 56.0	54.5 53.7 51.9	50.2 48.9 48.6	47.5 45.4 42.6	38.7 34.8 31.1	- - -	75.0	128
Auxiliary Supply Transformer	- 11.7 15.1	19.0 19.9 25.9	36.8 31.4 48.4	67.9 49.2 45.0	51.0 44.9 47.7	45.5 48.1 49.5	48.0 47.2 45.4	43.7 42.4 42.0	41.0 38.8 36.0	32.2 28.3 24.6	- - -	68.4	8
HV Transformer	- 42.8 46.2	50.1 51.0 57.0	67.9 62.5 79.5	99.0 80.3 76.1	82.2 76.0 78.8	76.6 79.2 80.6	79.1 78.3 76.5	74.8 73.5 73.1	72.1 69.9 67.1	63.3 59.4 55.7	- - -	99.5	2

The modelled sound power levels for the equipment have been conservatively modelled based upon the loudest operating modes specified in the supplied manufacturer's data. Lower load operating conditions will result in lower noise levels at sensitive receptors and the noise modelling may thus be considered a 'worst-case' scenario.

It is noted that the sound power levels have been represented in the model based upon the preliminary equipment selections for the BESS project. If materially different and/or higher noise emission equipment is specified at the detailed design phase of the project, then the noise assessment should be reviewed to ensure that outcomes will remain compliant with the relevant noise amenity criteria.

4.3 OPERATIONAL PHASE NOISE MODEL

To enable assessment of noise from the proposed development a detailed noise model has been established using the SoundPLAN 9.0 software applying the ISO9613 standard. This model is an accepted regulatory model that allows input of site-specific terrain data and source noise data as sound power level spectra.

The noise modelling undertaken considered meteorological conditions as per the methodology of the ISO9613 standard, with a temperature of 10 degrees Celsius and 70% humidity, a temperature inversion and the following wind conditions as per the adverse meteorological assumptions of ISO9613:

> *Downwind propagation conditions for the method specified in this part of ISO 9613 are as specified in 5.4.3.3 of ISO 1996-2:1987, namely*
>
> - *Wind direction within an angle of $\pm$ 45^o of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region, with the wind blowing from source to receiver, and*
>
> - *Wind speed between approximately 1m/s and 5m/s, measured at a height of 3m to 11m above the ground.*

As such, given the above adverse meteorological assumptions, it is considered that the noise modelling represents the resultant noise levels of the proposed development during noise propagation enhancing meteorological conditions.

The model was established over an area of more than 28km x 19km centred on the subject land. The topography of the subject site and surrounding area was sourced from State of Queensland (Department of Natural Resources, Mines and Energy) 5 metre topographical contours.

The natural surface elevations were modified in the model to represent the conceptual BESS pads as per the Overall Layout Plan.

The model domain was represented soft (absorbent) ground in the SoundPLAN model with the exception of the BESS pad and BESS substation pad areas which were modelled as partially soft a 0.6 or 60%

In order to assess the potential 'worst-case' noise emissions from the proposed BESS operations, the following noise modelling scenario has been prepared:

- 192x Battery Container Modules operating at loudest operating mode (compressor speed = 7000RPM, fan speed = 95%)
- 128x Power Station Modules
- 8x 1.5MVA auxiliary supply transformers
- 2x 250MVA HV Transformers at BESS substation

The operational phase noise model layout and the source locations are shown on the drawings included in **Attachment 4**.

The BESS equipment has been represented as box shaped objects in the SoundPLAN model with dimensions commensurate with the equipment specifications and SWLs consistent with the data presented in **Section 4.2**. The equipment sources were set out in the noise model as per the Overall Layout Plan.

4.4 PREDICTED NOISE LEVELS

The predicted resultant noise levels from the BESS at the representative receptor locations (refer **Figure 2**) are summarised in the following **Table 5** for all equipment operating at the loudest mode(s) coinciding with noise propagation enhancing meteorological conditions.

The predicted noise levels represent a worst-case assessment of the resultant noise levels from the proposed BESS project, with noise levels expected to be substantially lower for the majority of the time when equipment is not operating in the loudest mode and/or meteorological conditions are not enhancing noise propagation to the sensitive receptor location(s).

The results of the SoundPLAN 9.0 modelling for the BESS are provided in **Attachment 5** as contours of predicted resultant noise levels on a cadastral base showing the locations of the surrounding sensitive receptors (refer **Figure 2**).

It is noted that other residential dwellings within the model domain, which are not summarised in **Table 5**, are no more affected than the selected representative receptors.

At each of the assessed receptor locations, it is noted that the results of the noise modelling indicate that the received sound pressure level will include a dominant component of tonal noise in the 160Hz 1/3rd octave. In these circumstances, the overall noise level has been adjusted in accordance with the detailed quantitative tonality adjustment process outlined in *Noise Measurement Manual* prepared by Department of Environment and Science (version 4.01, dated 10 March 2020).

Consequently, the summary of model results presented in **Table 5** includes both the unadjusted overall levels ($L_{Aeq,T}$) and the noise-character adjusted noise levels ($L_{Aeq,adj,T}$) at each receptor.

The predicted noise levels are presented as the $L_{Aeq,adj,T}$ parameter on the basis of the source noise data but the $L_{Aeq,adj,T}$ and $L_{A90,adj,T}$ noise levels are generally consistent for steady-state noise from the BESS equipment during the peak noise emission scenarios.

Table 5: Summary of Model Results – dB(A)
Operational Phase

Sensitive Receptor (refer Figure 2)	7000 RPM, FAN SPEED = 95% MODE SCENARIO L_{AeqT} dB(A)	7000 RPM, FAN SPEED = 95% MODE SCENARIO $L_{Aeq,adj,T}$ dB(A)
R1	18.7	21.5
R2	13.3	16.1
R3	6.2	9.3
R4	7.2	9.9
R5	13.5	16.7
R6	6.9	9.3
R7	7.8	11.0
R8	12.1	15.4
R9	10.7	13.8
R10	11.7	15.0
R11	8.4	11.4
R12	8.2	11.3
R13	15.7	18.4
R14	18.2	20.8
R15	12.6	15.4
R16	9.3	12.3
R17	9.2	11.8
R18	<5	<5
R19	<5	<5
R20	<5	<5
R21	7.4	10.6
R22	10.4	13.6
R23	11.9	15.2
R24	16.4	19.6
R25	9.5	11.3
R26	16.6	19.5
R27	13.6	16.7
R28	13.2	16.3

4.5 OUTCOMES OF OPERATIONAL PHASE NOISE ASSESSMENT

The noise modelling predictions demonstrate that noise emissions from the proposed BESS development will result in noise levels at sensitive receptors that are:

- Below the existing ambient noise levels measured at the locality;
- Compliant with the 'controlling background creep' noise amenity criteria specified in **Table 3**; and
- Well below the Queensland *Environmental Protection (Noise) Policy 2019* acoustic quality objectives for dwellings specified in **Section 3.2**.

The BESS project will not result in unreasonable impact on noise amenity at the surrounding sensitive receptors.

5.0 CONSTRUCTION PHASE NOISE ASSESSMENT

5.1 CONSTRUCTION NOISE REGULATION

Section 440R of the Queensland *Environmental Protection Act 1994* ("**the EP Act**") regulates noise from the construction phase / building work, as follows:

> **440R Building work**
>
> (1) A person must not carry out building work in a way that makes an audible noise—
>
> (a) on a business day or Saturday, before 6.30a.m. or after 6.30p.m; or
>
> (b) on any other day, at any time.
>
> (2) The reference in subsection (1) to a person carrying out building work—
>
> (a) includes a person carrying out building work under an owner-builder permit; and
>
> (b) otherwise does not include a person carrying out building work at premises that are the person's principal place of residence.

The EP Act default noise standards thus regulate hours for construction works but does not limit the level of noise from the construction work.

Construction phase works for the proposed development are anticipated to be done over 12 hour shifts Monday to Saturday. The shifts may be within the 6:30am to 6:30pm timeframe specified in Section 440R of the EP Act or may vary slightly (e.g. 6am to 6pm). MWA Environmental considers that such variations from the default building work times can be accommodated for this development given the substantial separation distances to sensitive receptors.

Although not applicable to building work / construction noise, the Queensland *Environmental Protection (Noise) Policy 2019* acoustic quality objectives for dwellings, as outlined in **Section 3.2**, have been applied in this assessment for the purpose of screening potential noise amenity impacts and requirements for non-standard noise management measures.

5.2 DESCRIPTION OF CONSTRUCTION PHASE NOISE EMISSIONS

The construction phase works will progress in stages, including:

- Vegetation and topsoil clearing
- Access track construction
- Bulk earthworks and stabilisation of the BESS pads and BESS substation pad

- Construction of foundations for equipment, including concrete pours via concrete deliveries from off-site
- Installation of equipment and cabling
- Completion and post-commissioning rehabilitation

For the purposes of the noise assessment, noise modelling has been undertaken to represent construction operations in the bulk earthworks and stabilisation stage as this is anticipated to be the highest noise emission period.

Typically, a total of 80 daily staff are anticipated during the construction period with, maximum estimates in the order of 200 construction staff to be on-site during peak periods. Burchills[5] have provided estimated traffic generation rates through the construction phase of the project based upon a peak staffing period of 200 workers on-site. The trip generation rates conservatively assume that workers will be accommodated remotely (e.g. in Warwick) rather than at the existing MIWF project accommodation facility. The overall daily traffic generated on Carbean Road during the construction phase is projected to be in the order of 231 trips per day including 36.5 percent heavy vehicles (trucks) delivering equipment and concrete.

5.3 NOISE SOURCES AND SOUND POWER LEVELS

The construction (earthworks and stabilisation stage) phase noise emissions have been represented in the noise model with the following indicative equipment and operations:

- 2x cranes at the BESS pad area
- 1x piling drill rig at the BESS pad area
- 2x bulldozers at the BESS pad area
- 2x dump trucks at the BESS pad area
- 2x excavators at the BESS pad area
- 1x water truck operating along the MISS access track and through the BESS pad
- 20x truck trips per peak hour along the MISS access track and to the BESS pad
- 6x bus trips per peak hour along the MISS access track and to the Site Compound pad
- 33x passenger vehicle trips per peak hour along the MISS access track and to the Site Compound pad
- Carparking noise at the Site Compound pad

[5] *BESS Project, Carbean Road, Karara - Traffic Impact Assessment Report* (Burchills, 19 July 2024)

Noise emissions from the earthworks machinery at the BESS pad have been modelled as area sources covering the extent of the BESS pad.

Vehicle trips along the MISS access track to the BESS pad and Site Compound pad have been modelled as line sources.

Noise from carparking at the Site Compound pad has been represented as an area source.

The modelled sound power levels for each of the sources is summarised in **Table 6** below.

Table 6: Construction Phase Sound Power Levels – dB(A)

NOISE SOURCE	# OF SOURCES	SOURCE TYPE	SOURCE HEIGHT (m)	SOUND POWER LEVEL LAeq - dB(A)	ACTIVITY RATE
Bulldozer	2	Area source	2	118	Each source operating at 50% activity rate per hour
Crane	2	Area source	3	113	Each source operating at 25% activity rate per hour
Car parking activities	1	Area source	0.5	82.2	33 carpark turnovers / hour. Includes noise from car starts and car door slams.
Drill Rig	1	Area source	1.5	115	Source operating at 50% activity rate per hour
Excavator	2	Area source	3	110	Each source operating at 50% activity rate per hour
Buses	1	Line source	2.5	61/m^2	SWL per bus travelling at 20km/hr. Activity rate adjusted for 6 trips per hour
Cars	1	Line source	0.5	46/m^2	SWL per car travelling at 20km/hr. Activity rate adjusted for 33 trips per hour
Delivery Truck	1	Line source	2.5	61/m^2	SWL per truck travelling at 20km/hr. Activity rate adjusted for 20 trips per hour
Water Truck	1	Line source	2.5	114	Source operating at 50% activity rate per hour

5.4 CONSTRUCTION PHASE NOISE MODEL

To enable assessment of noise from the construction operations on-site a detailed noise model has been established using the SoundPLAN 9.0 software applying the ISO9613 standard. The model is further described in **Section 4.3**.

The construction phase noise model layout and the source locations are shown on the drawings included in **Attachment 6**.

5.5 PREDICTED NOISE LEVELS

The predicted construction phase noise levels from the project at the representative receptor locations (refer **Figure 2**) are summarised in the following **Table 7.**

The results of the construction phase noise modelling are provided in **Attachment 7** as contours of predicted resultant noise levels on a cadastral base showing the locations of the surrounding sensitive receptors (refer **Figure 2**).

It is noted that other residential dwellings within the model domain, which are not summarised in **Table 7**, are no more affected than the selected representative receptors.

Table 7: Summary of Model Results – dB(A) Construction Phase

Sensitive Receptor (refer Figure 2)	CONSTRUCTION PHASE LOUDER EARTHWORKS STAGE $L_{Aeq,T}$ dB(A)
R1	18.8
R2	13.3
R3	7.1
R4	8.4
R5	12
R6	9.5
R7	7.3
R8	11.3
R9	11.3
R10	10.9
R11	9.1
R12	8.5
R13	16.3
R14	19.3
R15	13.1
R16	10.8
R17	10.8
R18	<5
R19	<5
R20	3.6
R21	6.8
R22	9.5
R23	10
R24	15.3
R25	12.8
R26	16.1
R27	12.4
R28	12.2

5.6 CONSTRUCTION PHASE ROAD TRAFFIC NOISE ASSESSMENT

The Queensland *Environmental Protection (Noise) Policy 2019* acoustic quality objectives specifically do not apply to "*noise from the ordinary use of a public road or State-controlled road*[6]. The *Environmental Protection (Noise) Policy 2019* does not provide any assessment criteria relevant to the impact of public road noise from a specific use.

The road traffic noise planning level that has historically been applied in Queensland and is commonly applied by local authorities and the Department of Transport and Main Roads is 63 dB(A) L_{10} (18 hour) (including facade reflection) at residential dwellings.

Burchills have estimated the overall daily traffic generated on Carbean Road during the construction phase is projected to be in the order of 231 trips per day including 36.5 percent heavy vehicles (trucks) delivering equipment and concrete.

Access to the BESS project will be via the Cunningham Highway and then along Carbean Road to the existing MISS access track.

The construction phase trips associated with the project are insignificant in the context of overall traffic along the Cunningham Highway such that no noise assessment is warranted for sensitive receptors along the Highway.

Carbean Road has been upgraded for the MIWF project construction, which generated higher trip rates than will be associated with the BESS project construction phase. Construction of the BESS project will commence after the MIWF project construction has been completed.

Only two (2) sensitive receptors (R13 and R14 on **Figure 2**) are located along Carbean Road between the Cunningham Highway and the MISS access track. These sensitive receptors are setback more than 190 metres from Carbean Road.

Road traffic noise modelling has been undertaken using the SoundPLAN 8.2 software applying the CoRTN prediction methodology accepted by regulatory authorities in Queensland. The road noise model was setup to represent the 231 trips per day (36.5 percent heavy vehicles) on Carbean Road between the Cunningham Highway and the MISS access track.

The predicted construction phase road traffic noise levels from the project at the sensitive receptors along Carbean Road (refer **Figure 2**) are summarised in the following **Table 8.**

[6] i.e. noise mentioned in Schedule 1, Part 1, Section 1 of the Queensland *Environmental Protection Act 1994*

Table 8: Predicted Road Traffic Noise Levels – dB(A) Construction Phase

Sensitive Receptor (refer Figure 2)	L_{10} (18hour) Including Façade Reflection dB(A)
R13	38
R14	43

The predicted construction phase road traffic noise levels at sensitive receptors along Carbean Road between the Cunningham Highway and the MISS access track are well below the 63 dB(A) L_{10} (18 hour) (including facade reflection) planning level.

5.7 OUTCOMES OF CONSTRUCTION PHASE NOISE ASSESSMENT

The noise modelling predictions demonstrate that construction phase noise emissions from the project will result in noise levels at sensitive receptors that are:

- Below the existing ambient noise levels measured at the locality; and
- Well below the Queensland *Environmental Protection (Noise) Policy 2019* acoustic quality objectives for dwellings specified in **Section 3.2**.

Given the substantial separation distances to sensitive receptors and the outcomes of the noise modelling assessment, there are no specific requirements for construction phase noise control measures. Some variation from the EP Act default building work times can be accommodated without resulting in noise nuisance at sensitive receptors.

Construction phase road traffic noise levels at sensitive receptors along Carbean Road between the Cunningham Highway and the MISS access track will be well below the traditional road traffic noise planning levels. Occasional delivery of machinery to the site outside of standard construction hours will not result in unreasonable noise amenity impacts at sensitive receptors along Carbean Road.

The construction phase of the project will have a minimal overall impact on noise amenity at the surrounding sensitive receptors.

6.0 CONCLUSIONS

MWA Environmental has been commissioned to prepare a Noise Impact Assessment for the proposed Karara Battery Energy Storage System by ACCIONA Energy Australia Global Pty Ltd over land located at Carbean Road, Karara QLD 4352. The BESS project will deliver a grid connected 400MW / 2hr battery energy storage system.

The noise assessment has considered the potential amenity impacts of the proposed development upon surrounding sensitive uses during the construction and operational phases of the project. The assessment has been based on ambient noise monitoring conducted at the locality, manufacturer supplied noise emission specifications for the preliminary equipment selections and detailed noise propagation modelling.

The noise assessment based upon the conservative assessment of all equipment operating at the loudest mode(s) coinciding with noise propagation enhancing meteorological conditions demonstrates that operational phase noise emissions from the proposed BESS development will result in noise levels at sensitive receptors that are:

- Below the existing ambient noise levels measured at the locality;
- Compliant with the 'controlling background creep' noise amenity criteria; and
- Well below the Queensland *Environmental Protection (Noise) Policy 2019* acoustic quality objectives for dwellings.

The assessment has been based upon sound power levels for the preliminary equipment selections. If materially different and/or higher noise emission equipment is specified at the detailed design phase of the project, then the noise assessment should be reviewed to ensure that outcomes will remain compliant with the relevant noise amenity criteria.

The noise modelling predictions demonstrate that construction phase noise emissions from the project will result in noise levels at sensitive receptors that are:

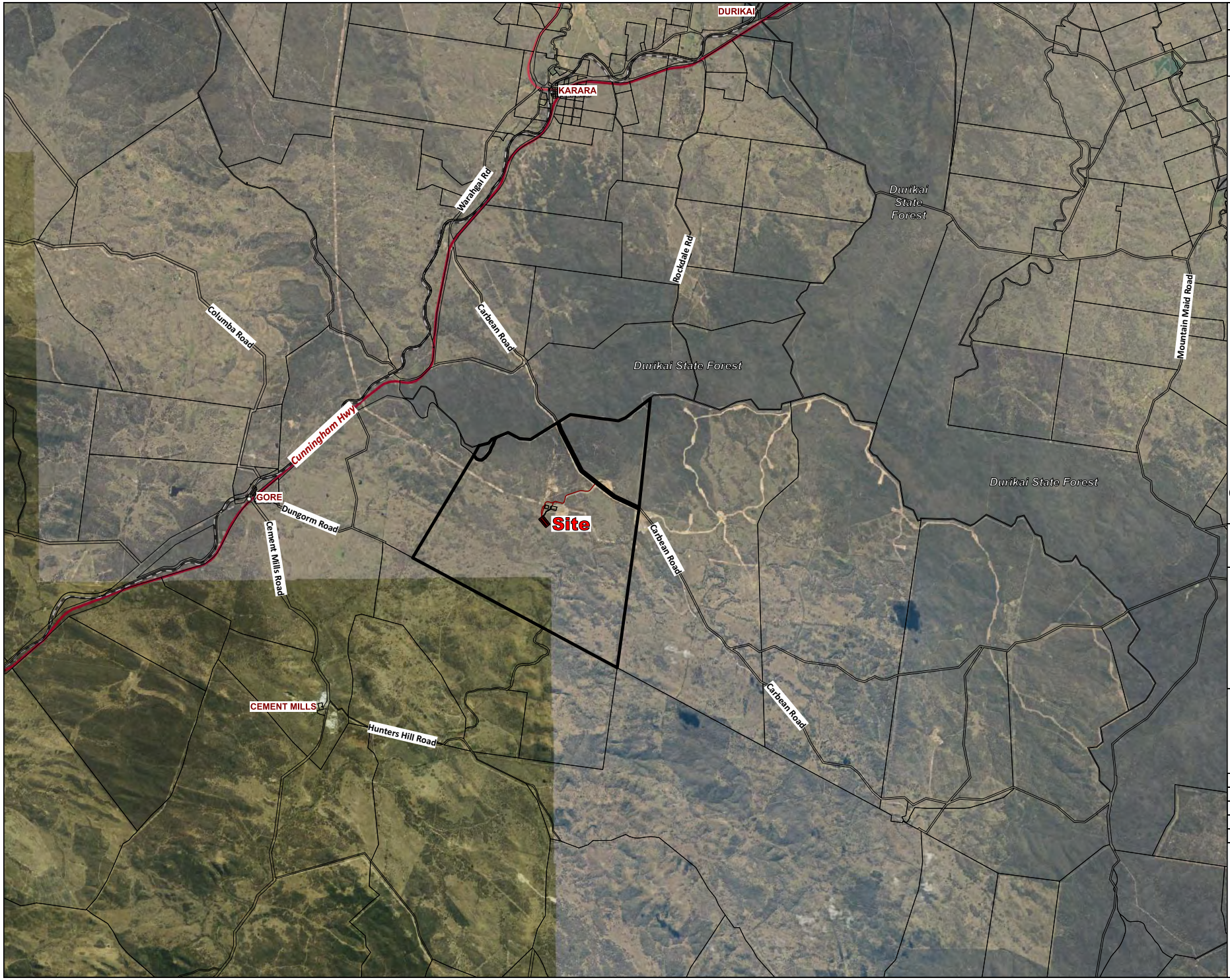
- Below the existing ambient noise levels measured at the locality; and
- Well below the Queensland *Environmental Protection (Noise) Policy 2019* acoustic quality objectives for dwellings.

Construction phase road traffic noise levels at sensitive receptors along Carbean Road between the Cunningham Highway and the MISS access track will be well below the traditional road traffic noise planning levels. Occasional delivery of machinery to the site outside of standard construction hours will not result in unreasonable noise amenity impacts at sensitive receptors along Carbean Road.

The BESS project will not result in unreasonable impact on noise amenity at the surrounding sensitive receptors.

MWA Environmental
22 January 2025

FIGURES



LEGEND

PROPERTY BOUNDARIES

DRAWING REFERENCE

CLIENT

SAUNDERS HAVILL GROUP PTY LTD

PROJECT

NOISE IMPACT ASSESSMENT

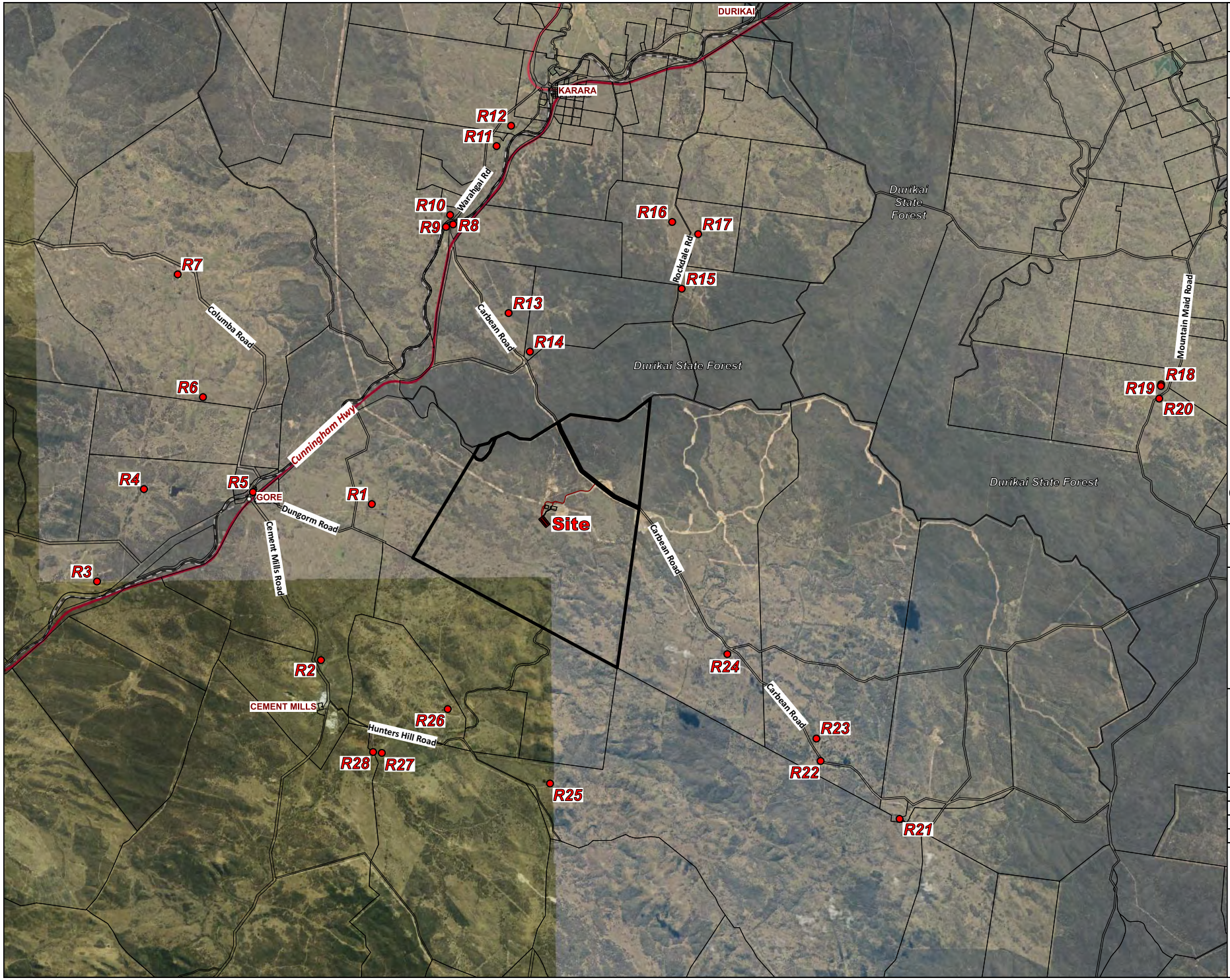
PROPOSED BATTERY ENERGY STORAGE FACILITY CARBEAN ROAD KARARA QLD

TITLE

SITE LOCATION

JOB	KARARA	**FIGURE 1**
JOB NO.	24079	
DATE	16/01/25	DWG NUMBER
SCALE	1:120000 (A4)	**24079-1**
REV.		

Max Winders & Associates Pty Ltd tas MWA Environmental
Level 7, 241 Adelaide St, Brisbane. GPO BOX 3137, Brisbane Qld 4001
P 07 3002 5500 E mail@mwaenviro.com.au
W www.mwaenviro.com.au
ABN 94 010 833 084



LEGEND

PROPERTY BOUNDARIES

RECEPTOR LOCATIONS (R1-R28)

DRAWING REFERENCE

0 100 200 300 400m

CLIENT

SAUNDERS HAVILL GROUP PTY LTD

PROJECT

NOISE IMPACT ASSESSMENT

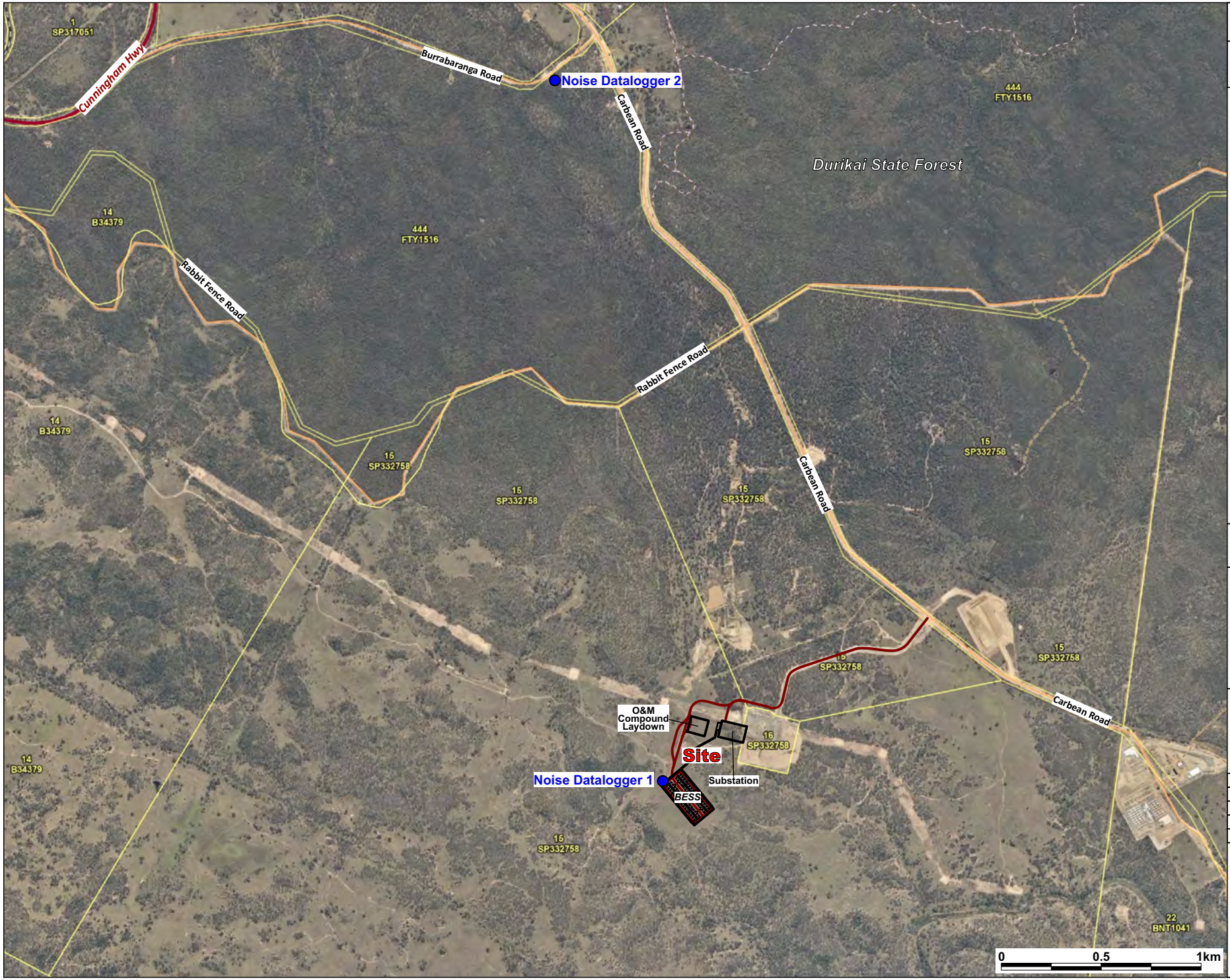
PROPOSED BATTERY ENERGY STORAGE FACILITY CARBEAN ROAD KARARA QLD

SURROUNDING LAND USES AND RECEPTOR LOCATIONS

TITLE

JOB	KARARA	**FIGURE 2**
JOB NO.	24079	
DATE	16/01/25	DWG NUMBER
SCALE	1:120000 (A4)	**24079-2**
REV.		

Max Winders & Associates Pty Ltd tas MWA Environmental
Level 7, 241 Adelaide St, Brisbane. GPO BOX 3137, Brisbane Qld 4001
P 07 3002 5500 E mail@mwaenviro.com.au
W www.mwaenviro.com.au
ABN 94 010 833 084



LEGEND

NOISE DATALOGGER LOCATIONS (2)

DRAWING REFERENCE

CLIENT

SAUNDERS HAVILL GROUP PTY LTD

PROJECT

NOISE IMPACT ASSESSMENT

PROPOSED BATTERY ENERGY STORAGE FACILITY CARBEAN ROAD KARARA QLD

TITLE

NOISE DATALOGGER LOCATIONS

JOB	KARARA	**FIGURE 3**
JOB NO.	24079	
DATE	16/01/25	DWG NUMBER
SCALE	1:25000 (A4)	**24079-3**
REV.		

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W www.mwaenviro.com.au
ABN 94 010 833 084

ATTACHMENT 1

Overall Layout Plan

LEGEND

- KARARA BESS ACCESS TRACKS
- MISS ACCESS TRACK
- UNDERGROUND MV TRENCH
- CADASTRAL BOUNDARY

0 100 200 m

15SP332758

ASP332758

15SP332758

330kV OHTL (Existing)

TSP332758

MISS Substation

Macintyre Intermediate Switching Station (MISS) (Existing)

16SP332758

O&M Compound

Substation

Temporary Laydown

330kV OHTL (Existing)

USP332758

15SP332758

BESS Area

acciona energía

08 Nov 2024		G	FOR INFORMATION	CONCEPT LAYOUT
DATE	ER LAYOUT	REV	PURPOSE	DESCRIPTION
CHANGE LOG				

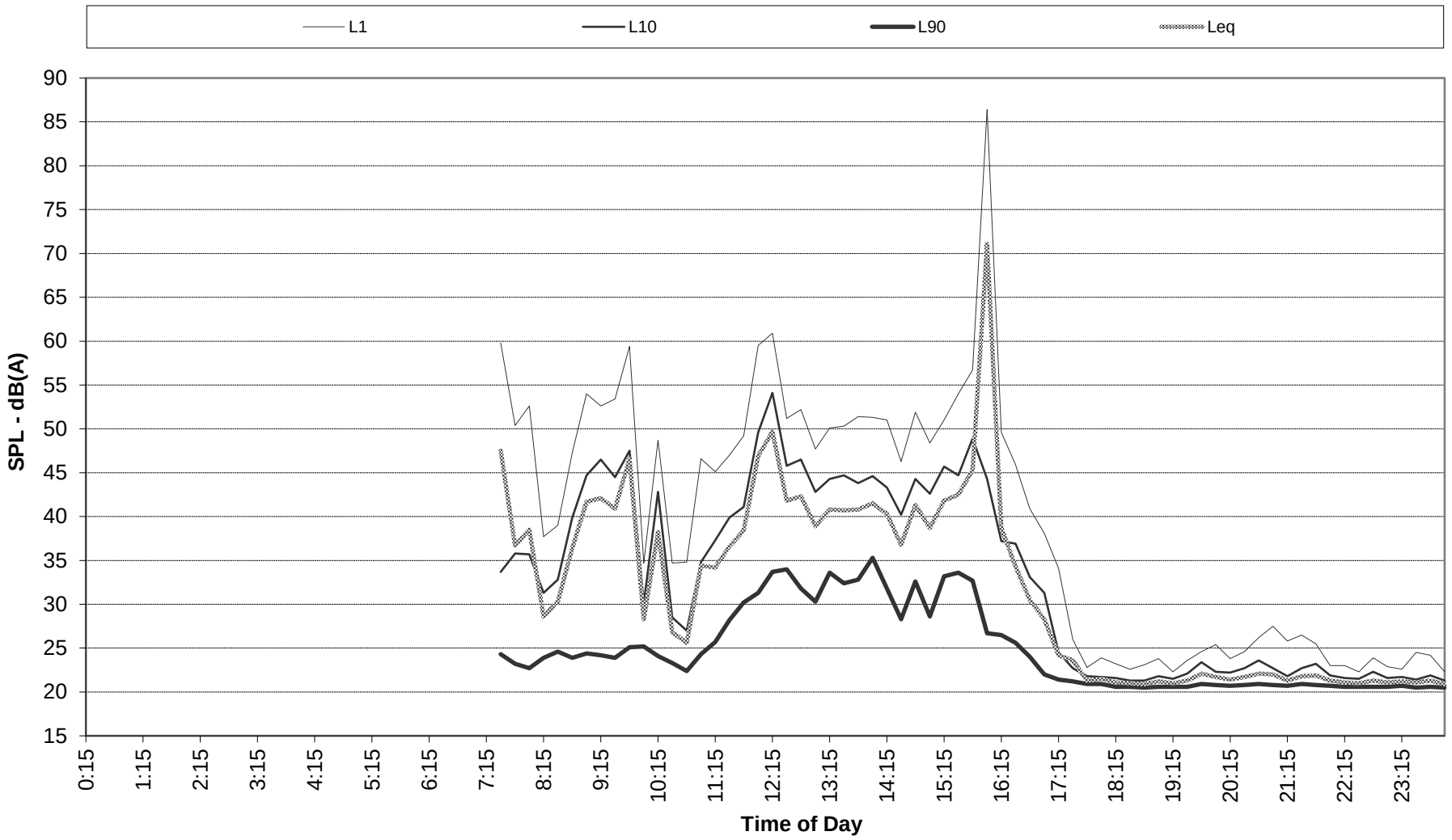
PROJECT	KARARA BESS			
TITLE	INFRASTRUCTURE LAYOUT REV G			
PROJECTION	MGA ZONE 56 GDA 1994		DATUM	AUSTRALIAN HEIGHT DATUM
DESIGNED	BL	DRAWN	BL	REVIEWED	VERIFIED	APPROVED
EXTERNAL CODE			SCALE See Scale Bar	SHEET 1 OF 1	REVISION A
AE CODE			DATE 21 Nov 2024	DRAW NO. N/A	PAPER A3

File Name: Karara BESS Infrastructure Layout.qgz

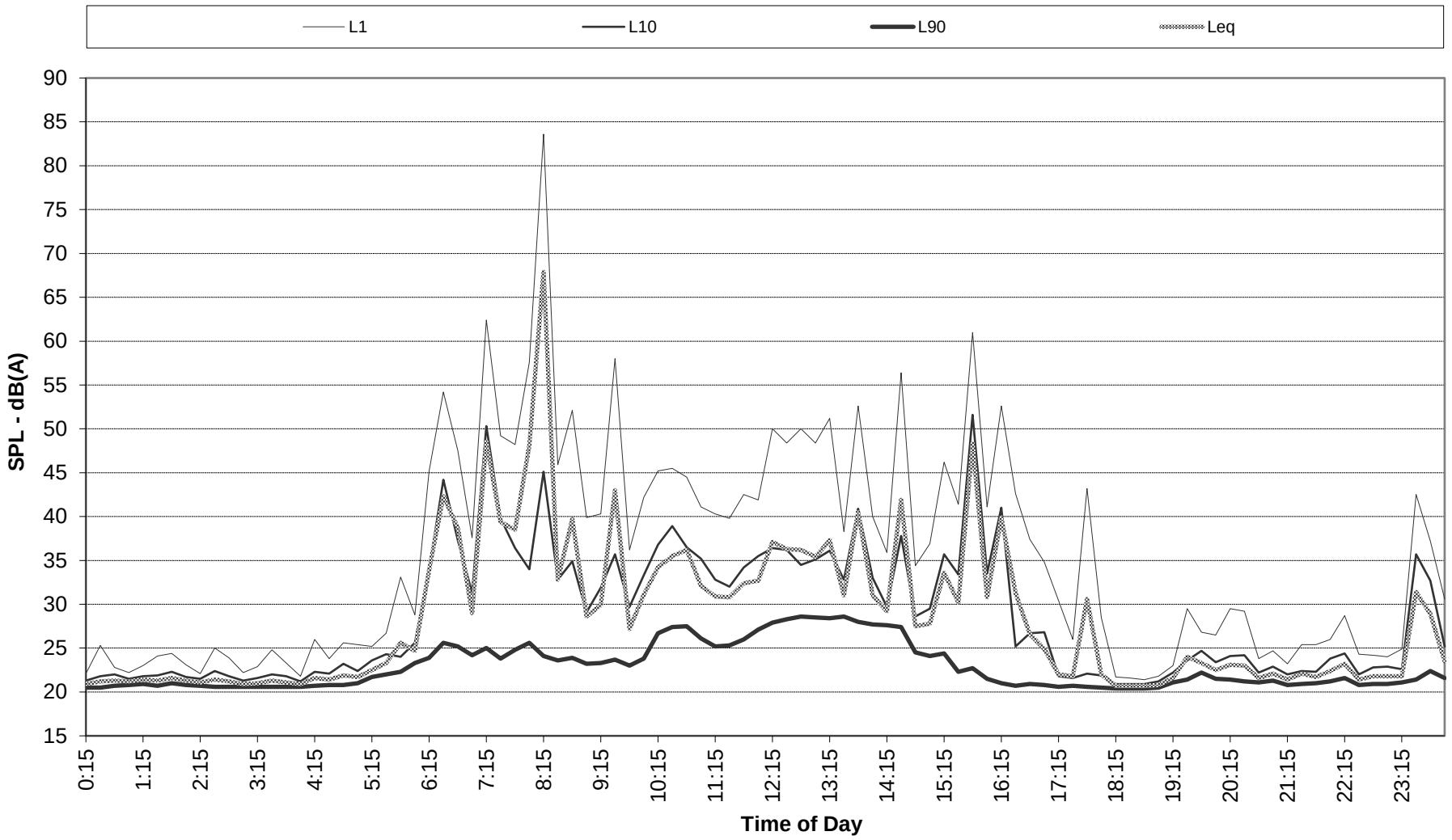
ATTACHMENT 2

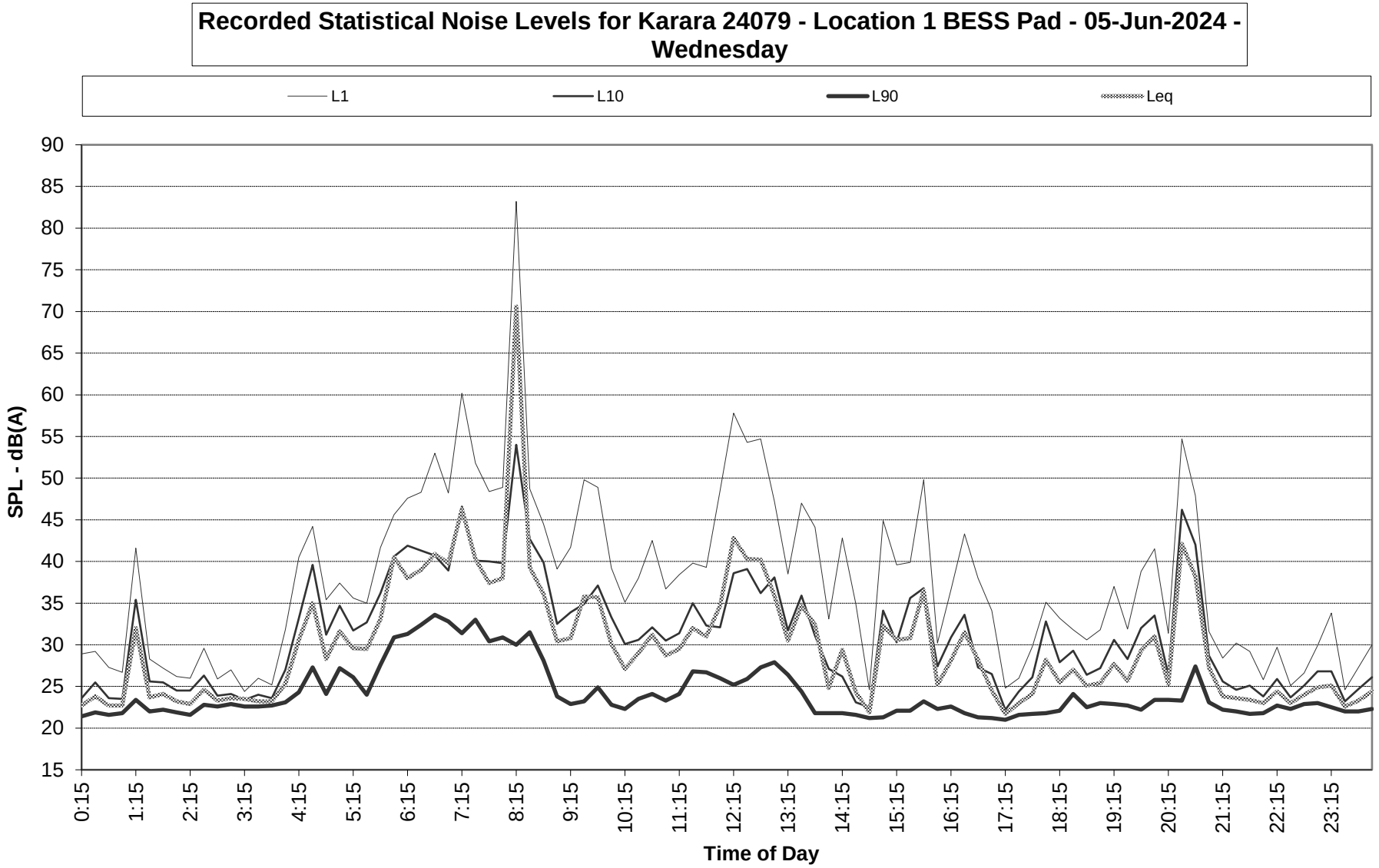
Noise Datalogger Results
Datalogger Location 1 'BESS Pad'

Recorded Statistical Noise Levels for Karara 24079 - Location 1 BESS Pad - 03-Jun-2024 - Monday

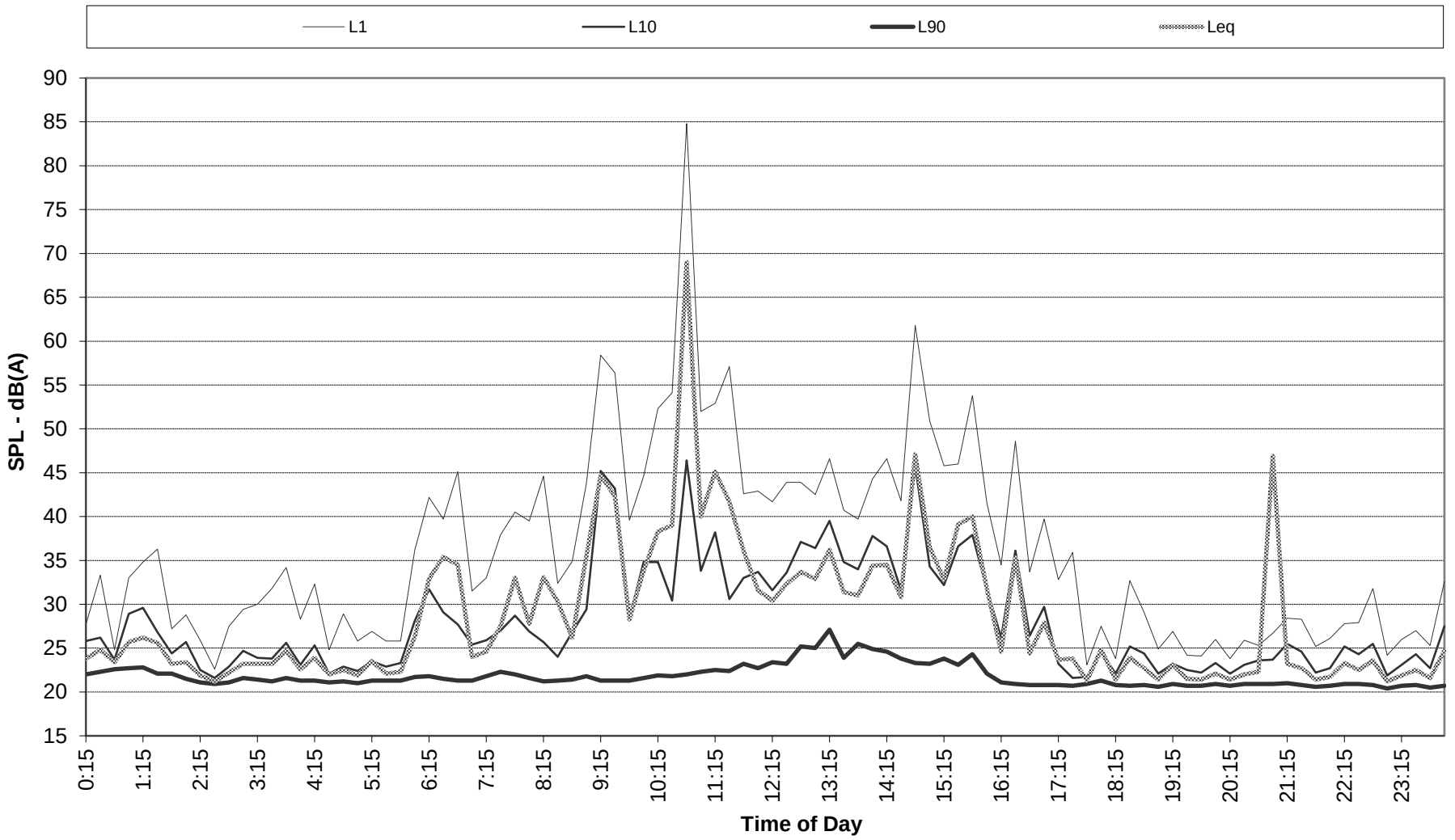


Recorded Statistical Noise Levels for Karara 24079 - Location 1 BESS Pad - 04-Jun-2024 - Tuesday

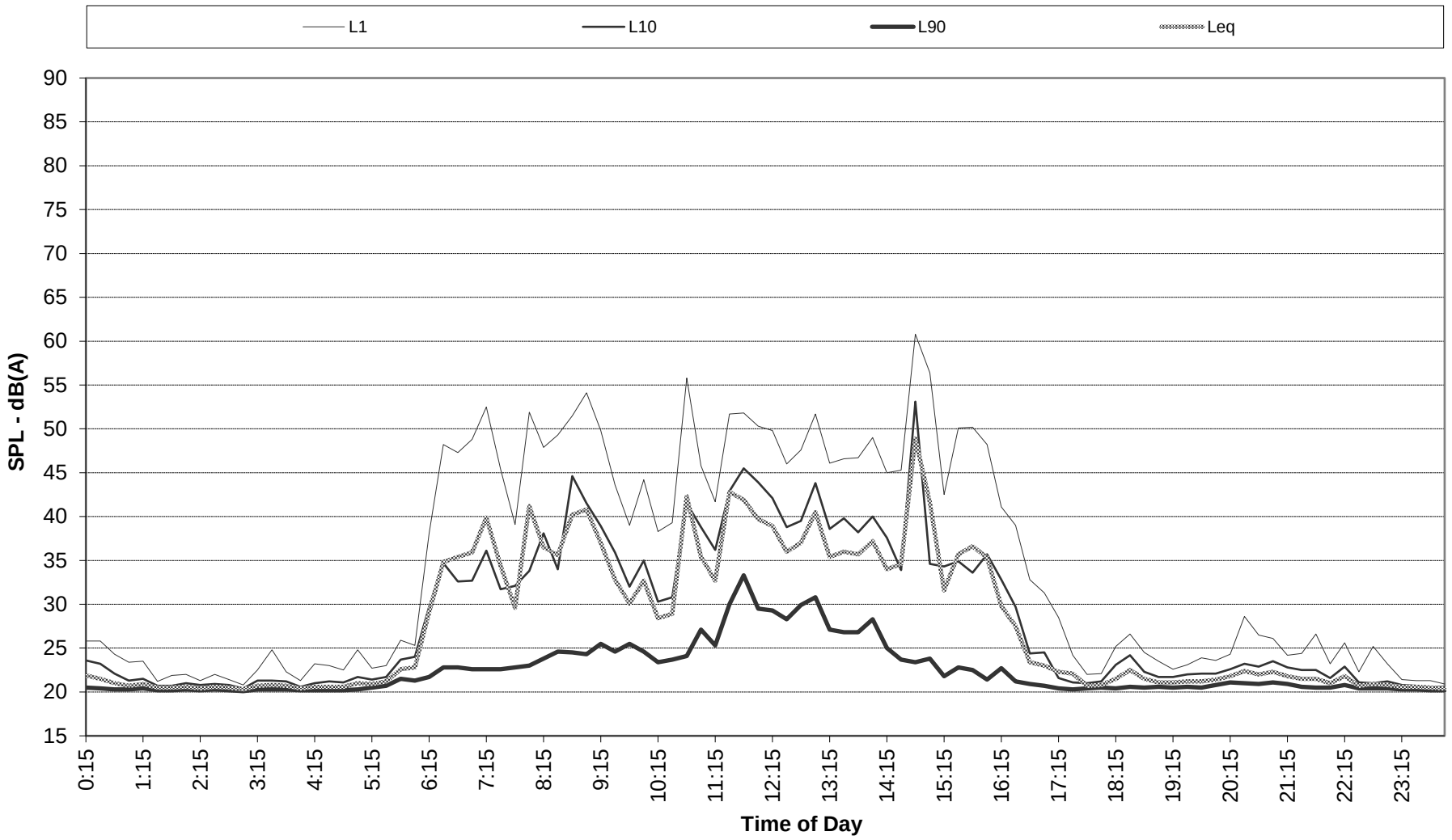



Recorded Statistical Noise Levels for Karara 24079 - Location 1 BESS Pad - 05-Jun-2024 - Wednesday
L1
L10
L90
Leq
SPL - dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
0:15
1:15
2:15
3:15
4:15
5:15
6:15
7:15
8:15
9:15
10:15
11:15
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day

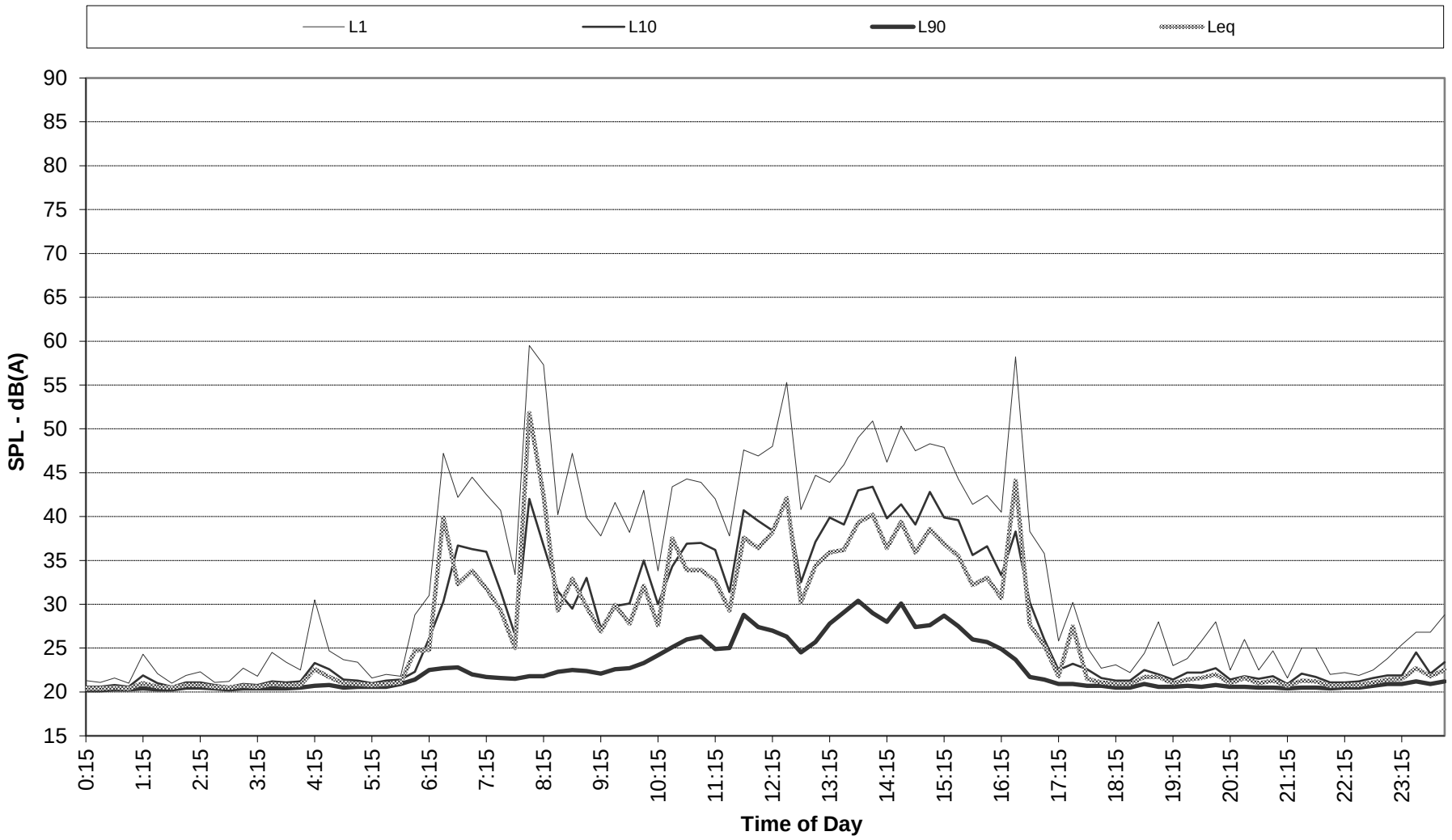
Recorded Statistical Noise Levels for Karara 24079 - Location 1 BESS Pad - 06-Jun-2024 - Thursday



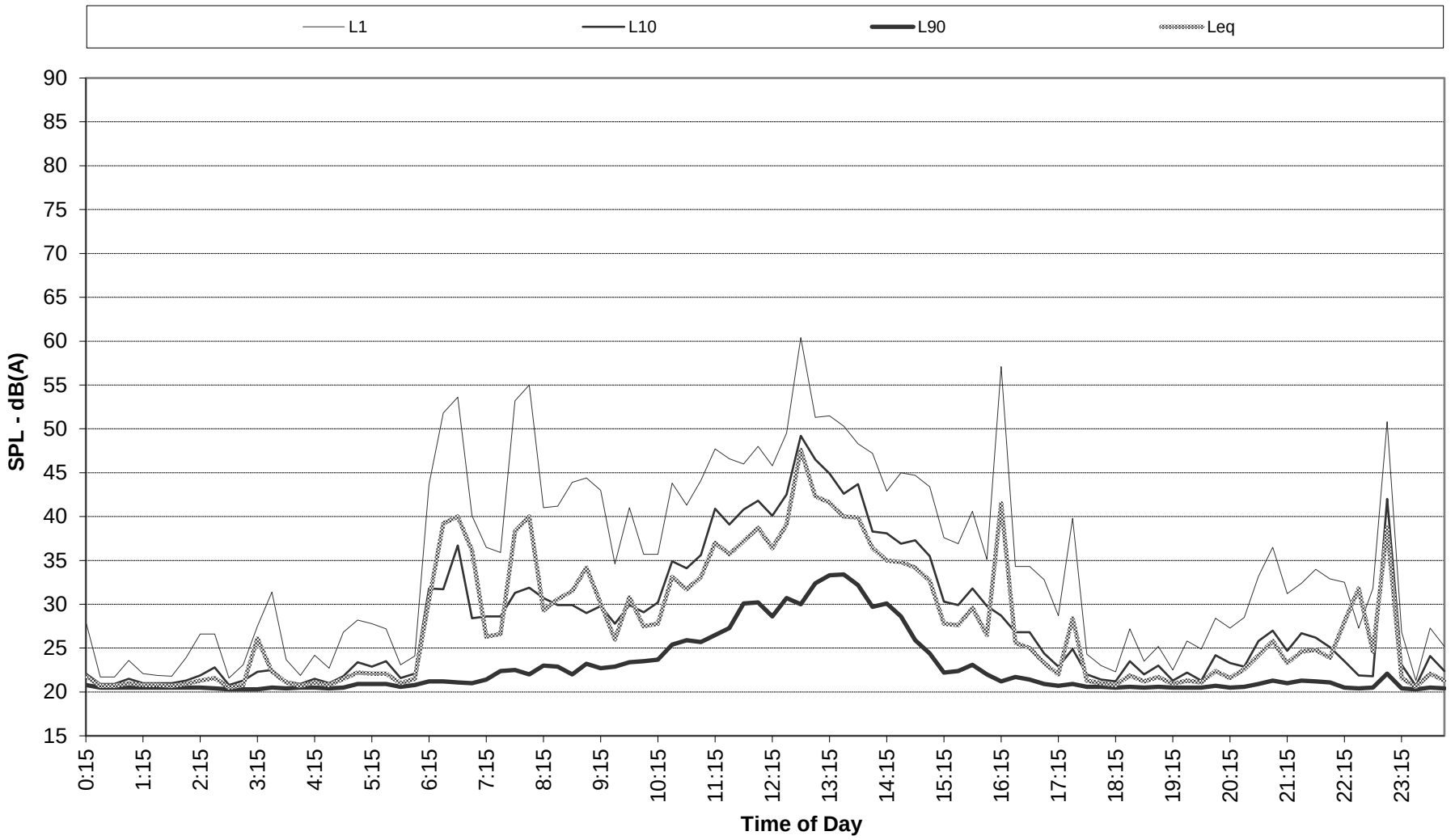
Recorded Statistical Noise Levels for Karara 24079 - Location 1 BESS Pad - 07-Jun-2024 - Friday

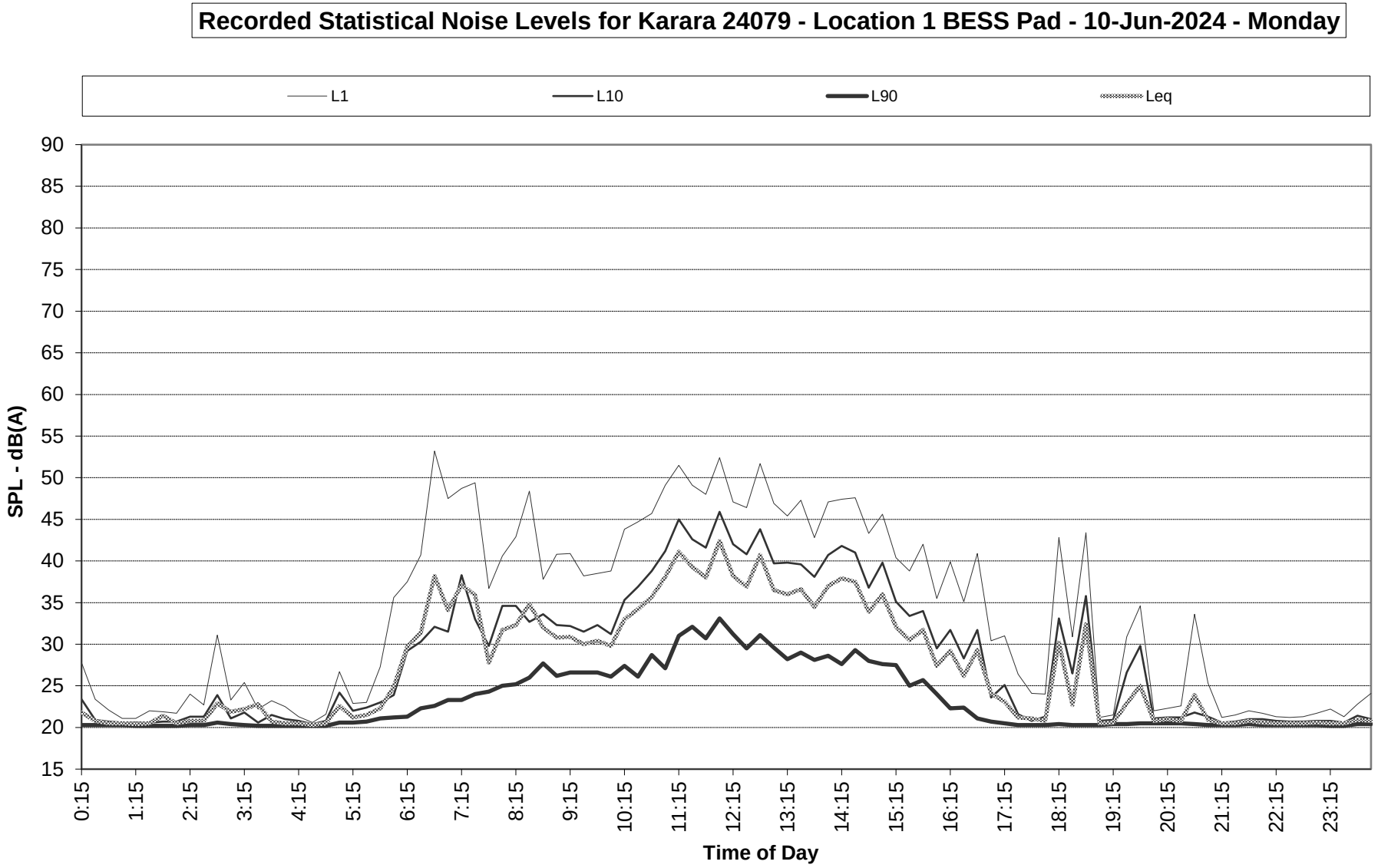


Recorded Statistical Noise Levels for Karara 24079 - Location 1 BESS Pad - 08-Jun-2024 - Saturday



Recorded Statistical Noise Levels for Karara 24079 - Location 1 BESS Pad - 09-Jun-2024 - Sunday




Recorded Statistical Noise Levels for Karara 24079 - Location 1 BESS Pad - 10-Jun-2024 - Monday
L1
L10
L90
Leq
SPL - dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
0:15
1:15
2:15
3:15
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5:15
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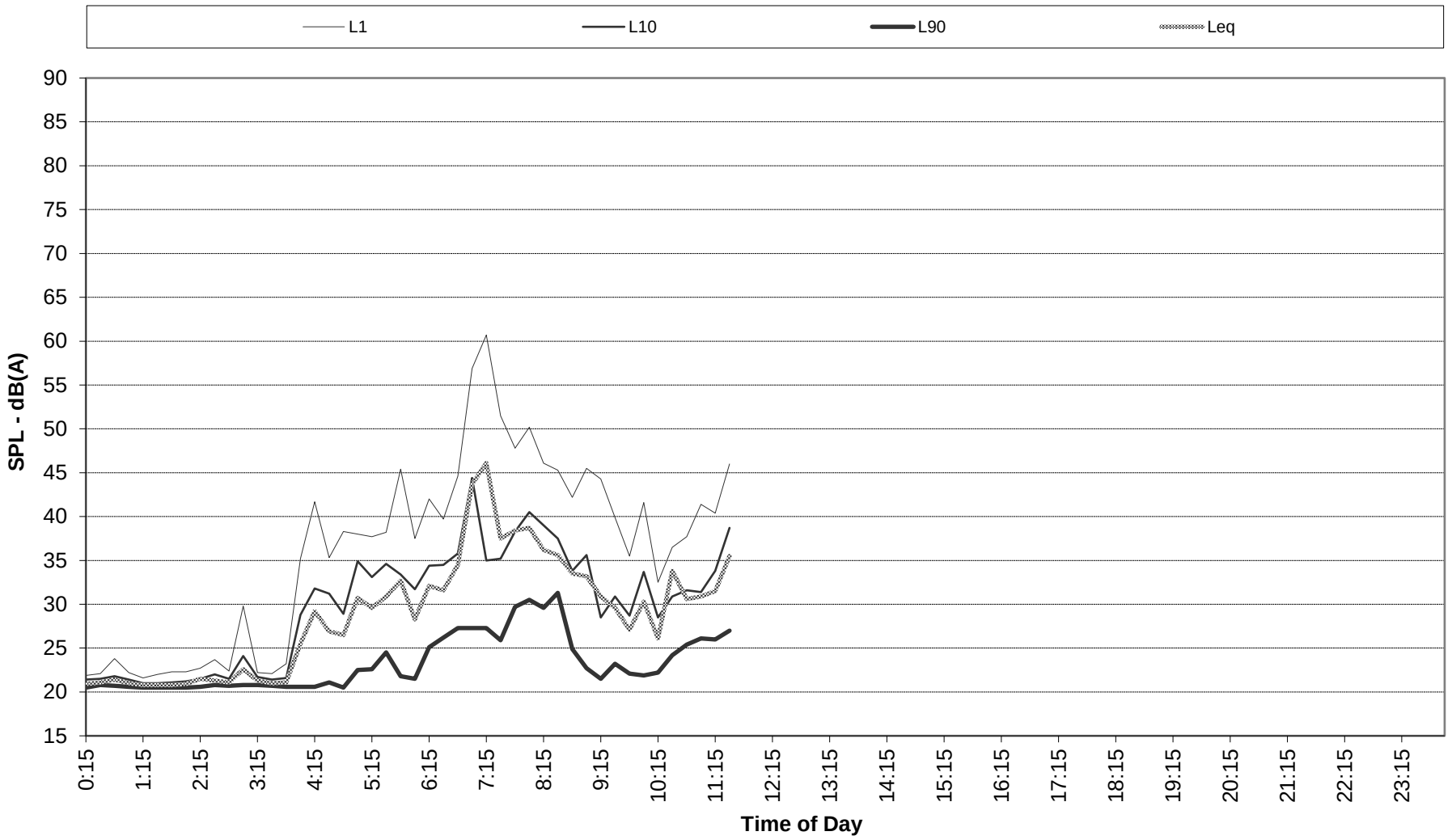
12:15
13:15
14:15
15:15
16:15
17:15
18:15
19:15
20:15
21:15
22:15
23:15
Time of Day

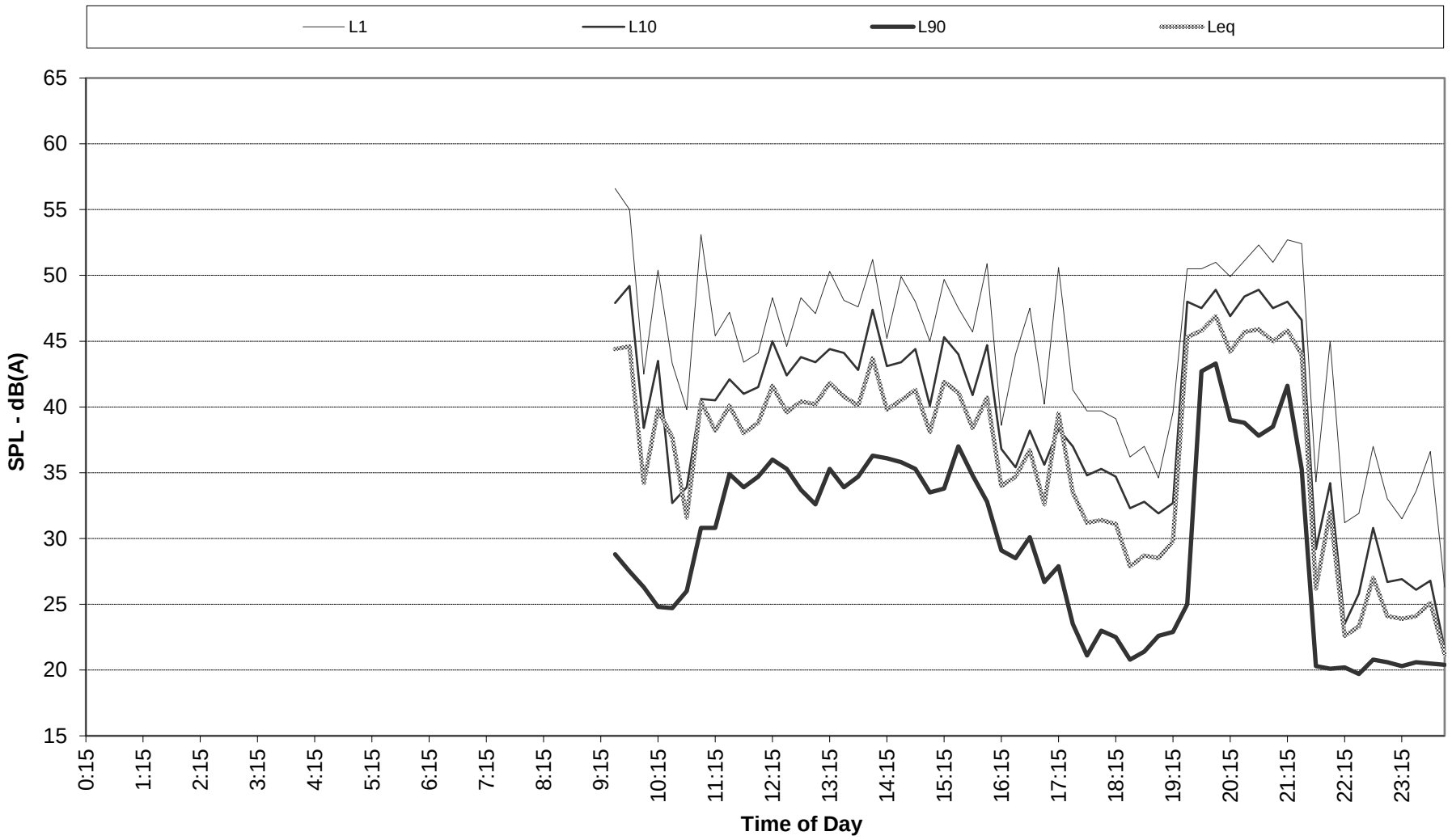
Recorded Statistical Noise Levels for Karara 24079 - Location 1 BESS Pad - 11-Jun-2024 - Tuesday



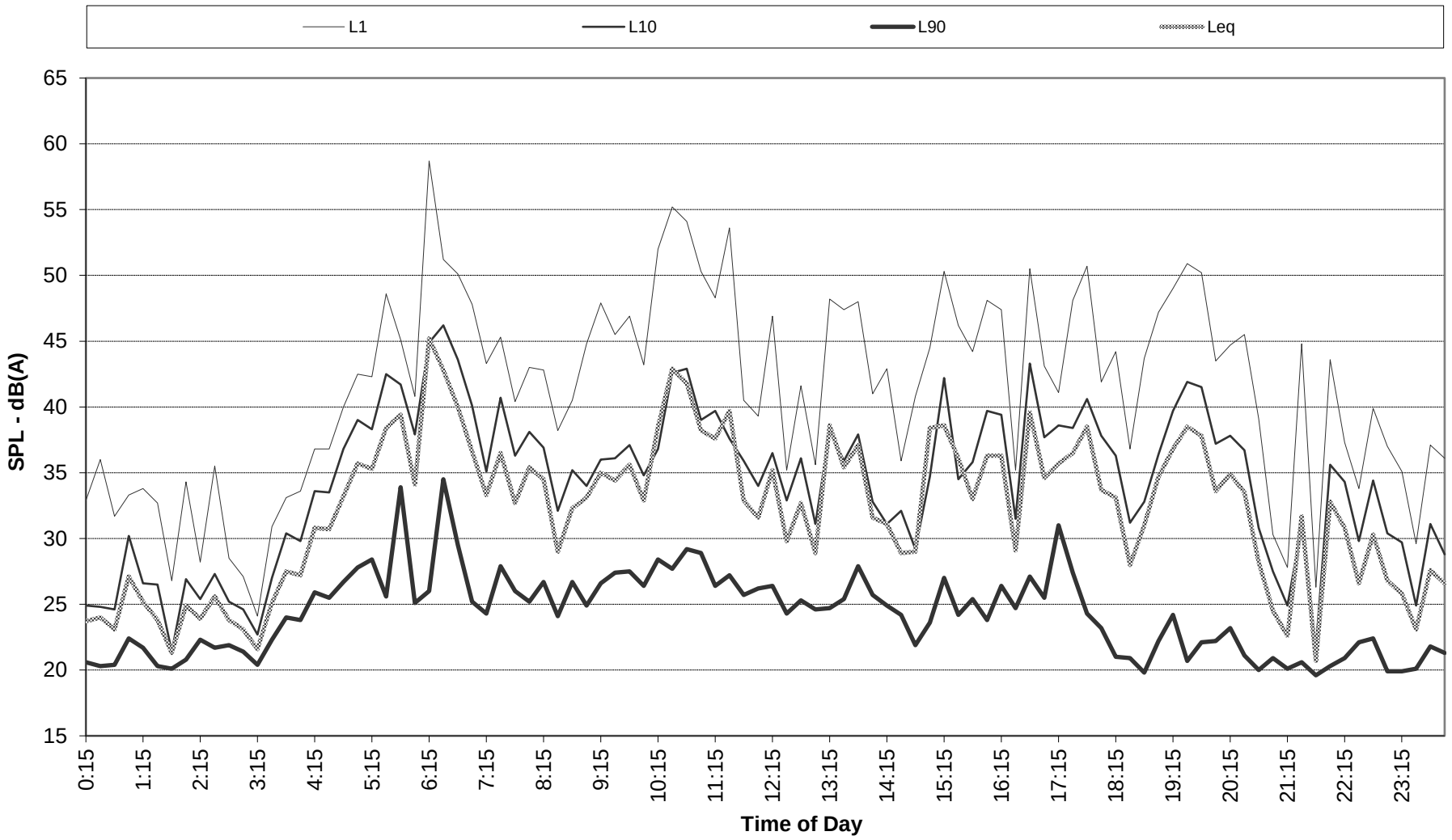
ATTACHMENT 3

Noise Datalogger Results
Datalogger Location 2 'West'

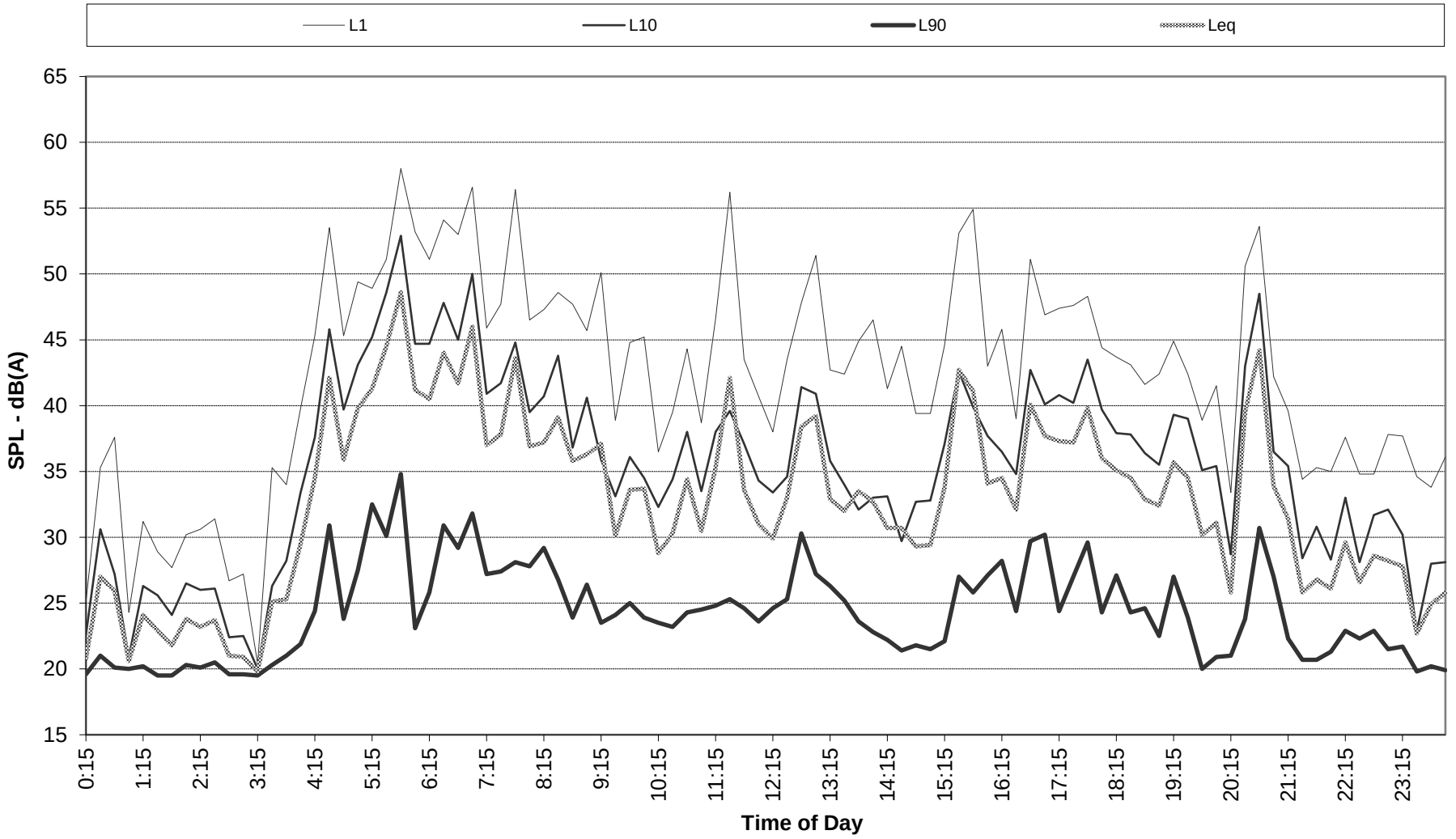
Recorded Statistical Noise Levels for Karara 24079 - Location 2 West - 03-Jun-2024 - Monday



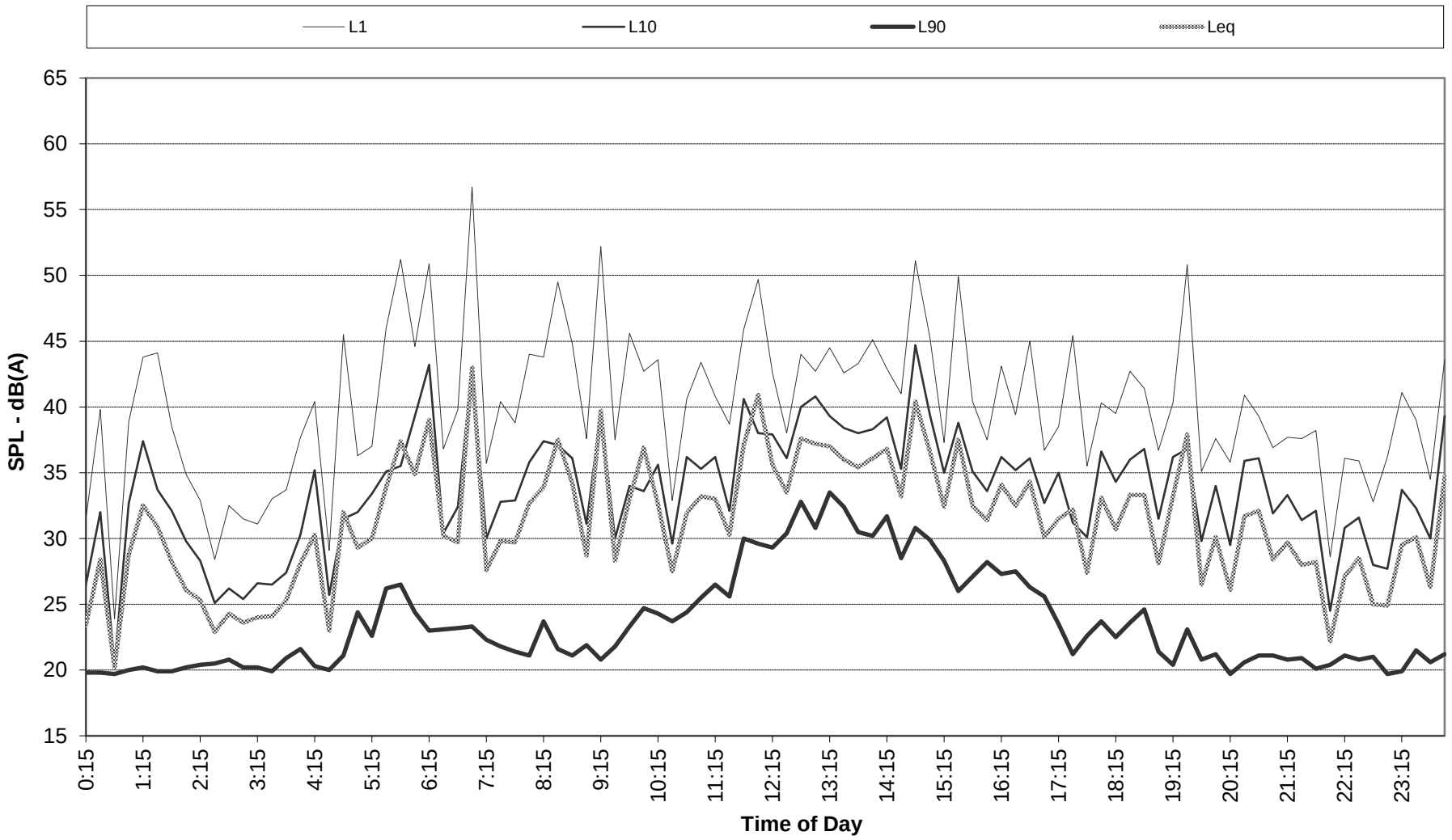
Recorded Statistical Noise Levels for Karara 24079 - Location 2 West - 04-Jun-2024 - Tuesday



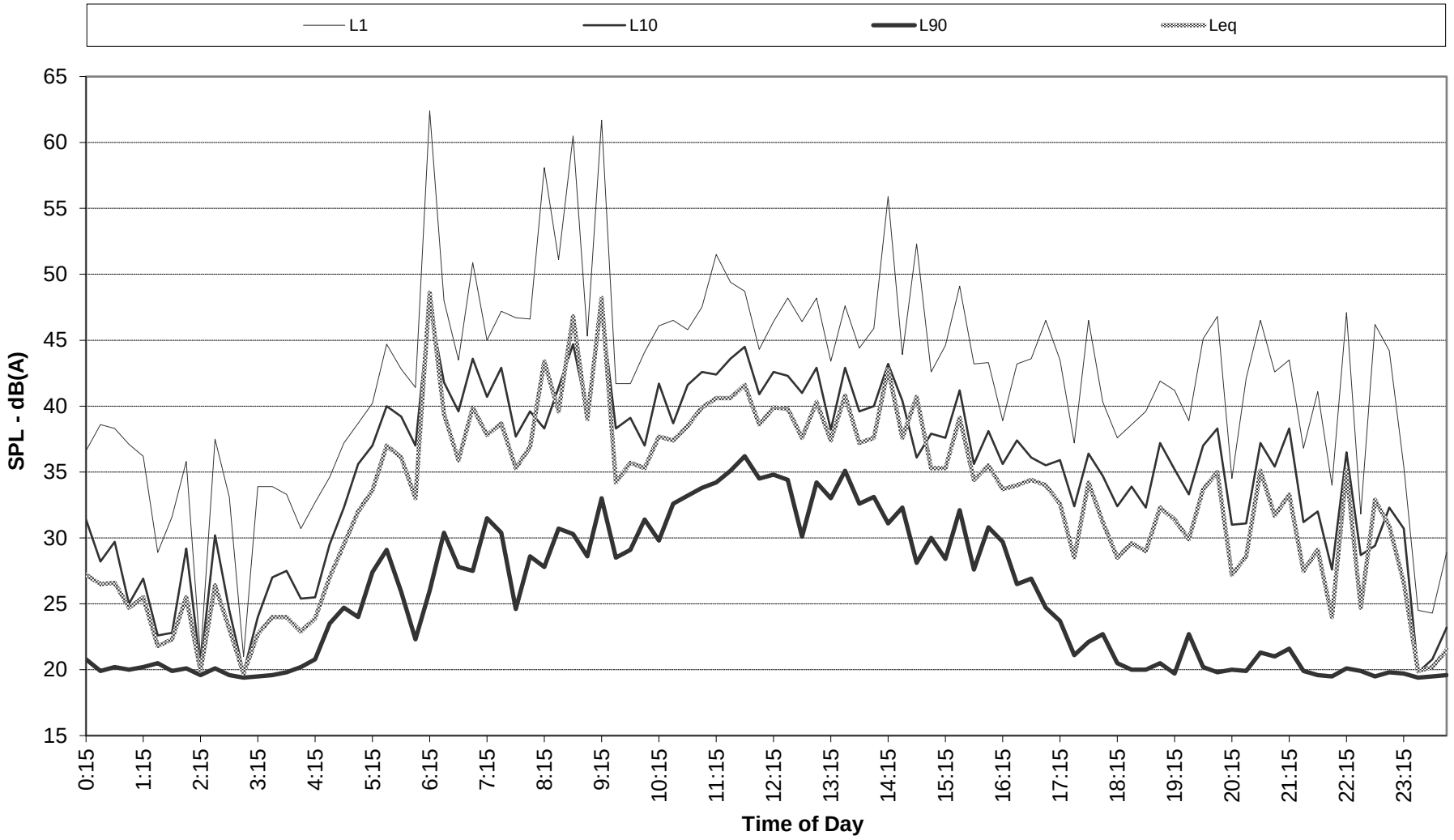
Recorded Statistical Noise Levels for Karara 24079 - Location 2 West - 05-Jun-2024 - Wednesday



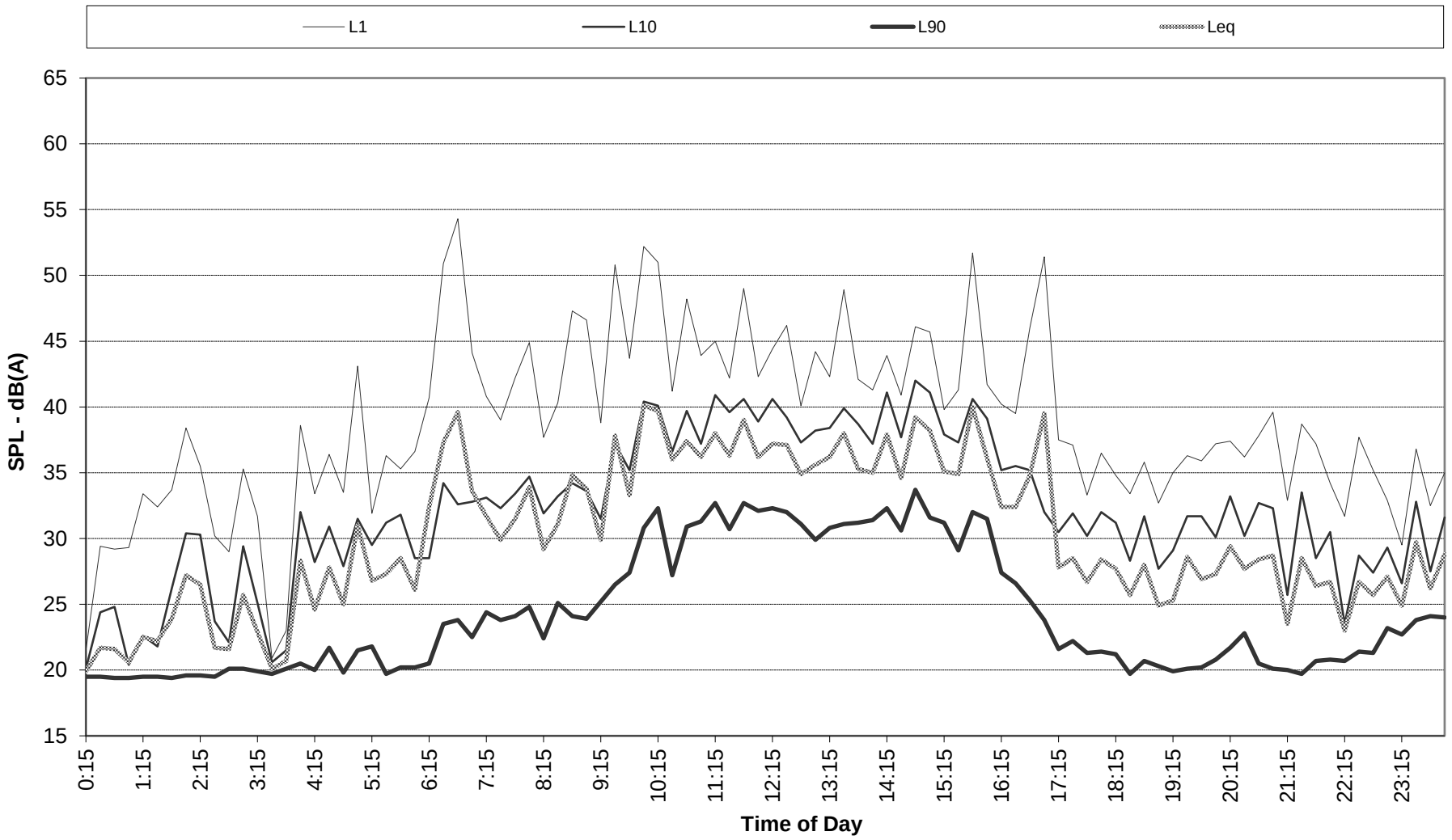
Recorded Statistical Noise Levels for Karara 24079 - Location 2 West - 06-Jun-2024 - Thursday



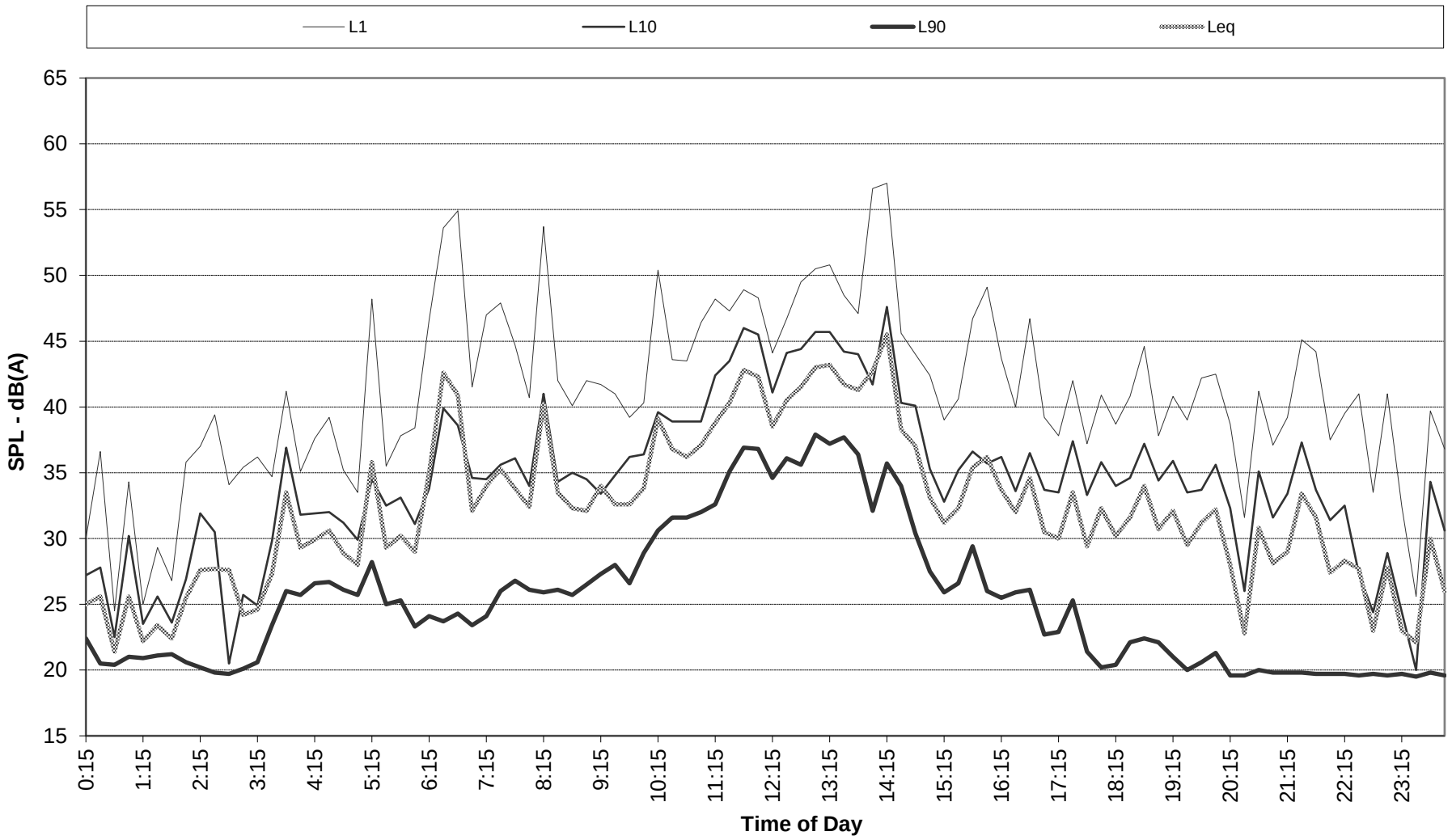
Recorded Statistical Noise Levels for Karara 24079 - Location 2 West - 07-Jun-2024 - Friday



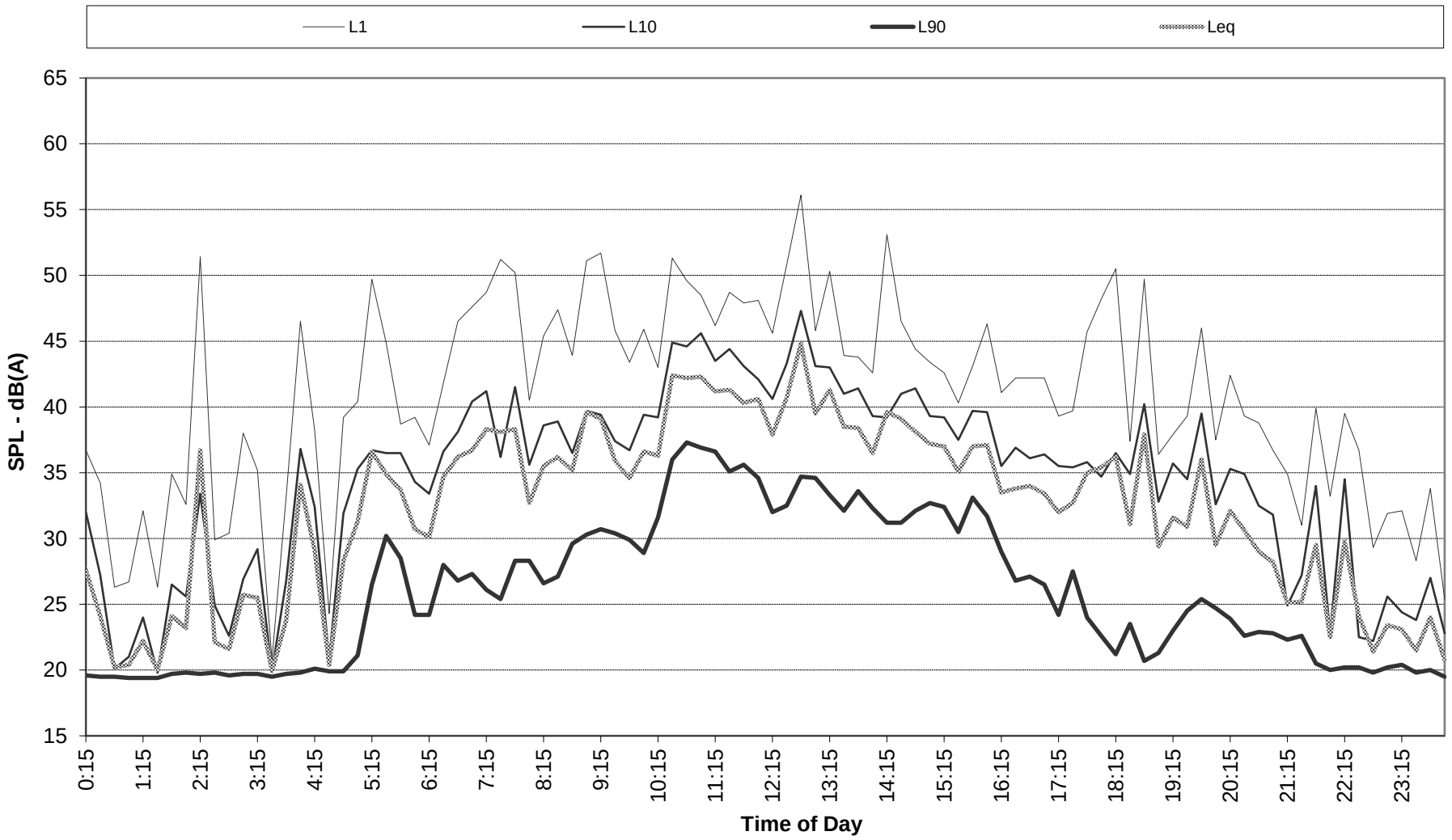
Recorded Statistical Noise Levels for Karara 24079 - Location 2 West - 08-Jun-2024 - Saturday



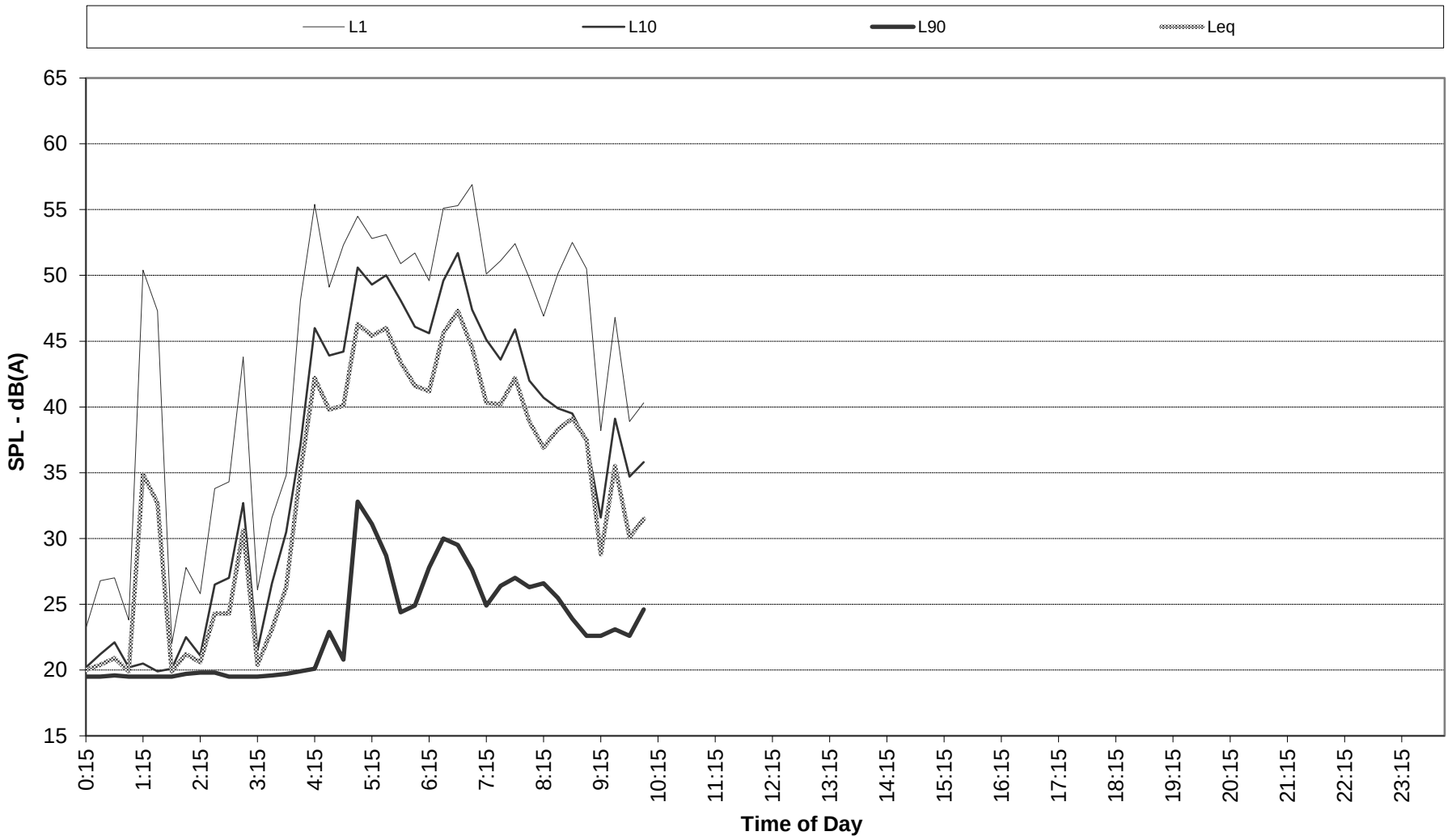
Recorded Statistical Noise Levels for Karara 24079 - Location 2 West - 09-Jun-2024 - Sunday



Recorded Statistical Noise Levels for Karara 24079 - Location 2 West - 10-Jun-2024 - Monday

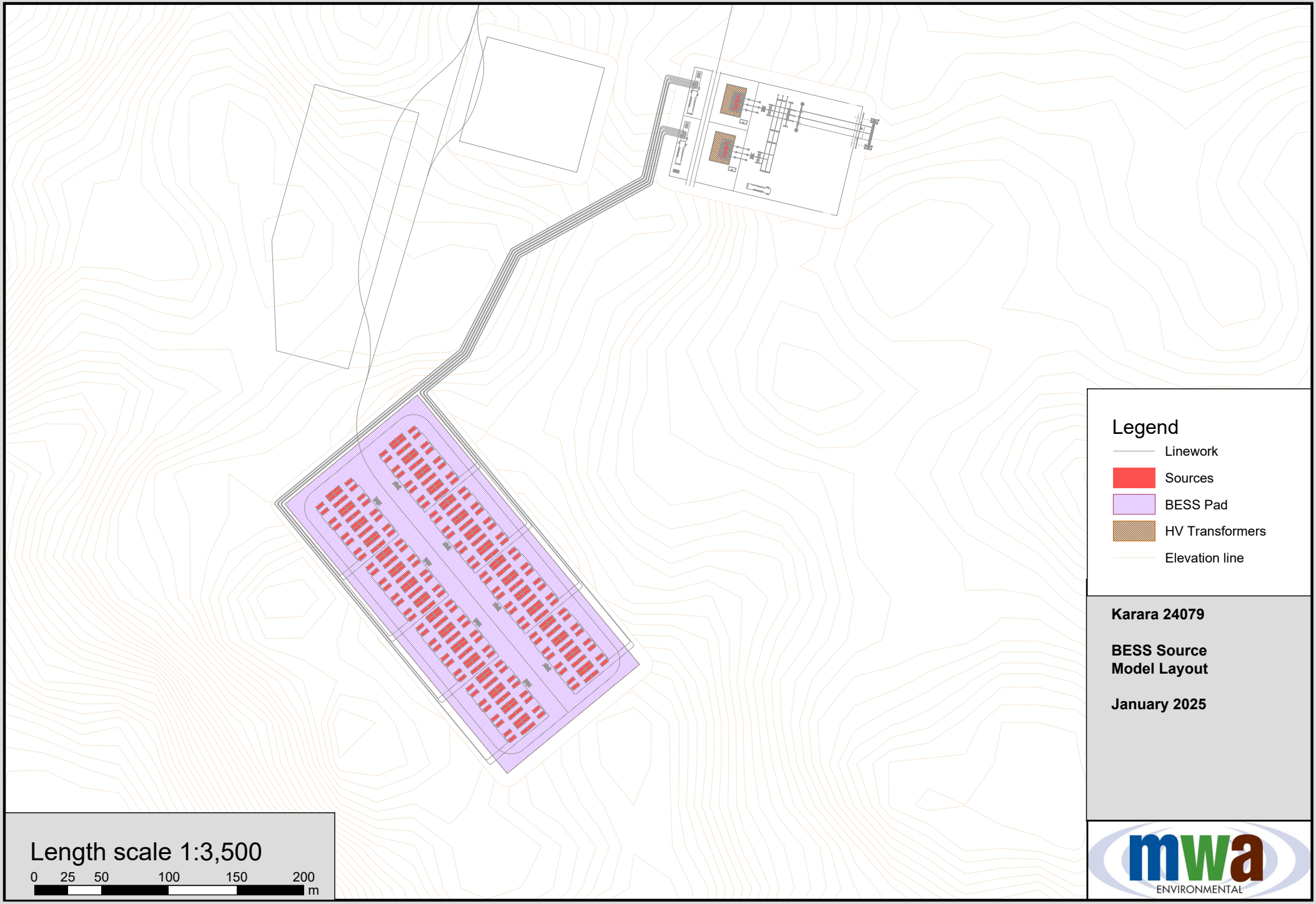


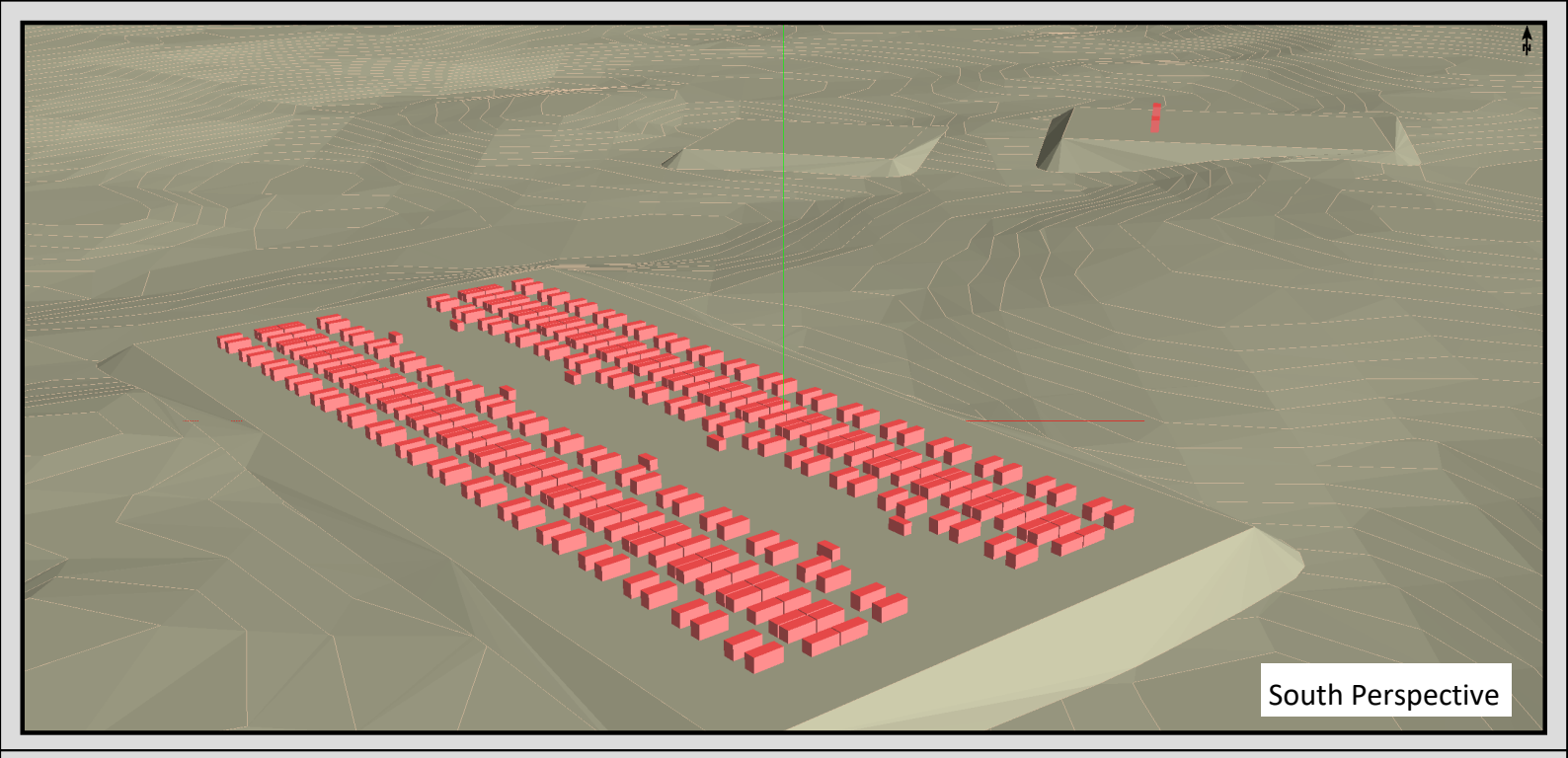
Recorded Statistical Noise Levels for Karara 24079 - Location 2 West - 11-Jun-2024 - Tuesday

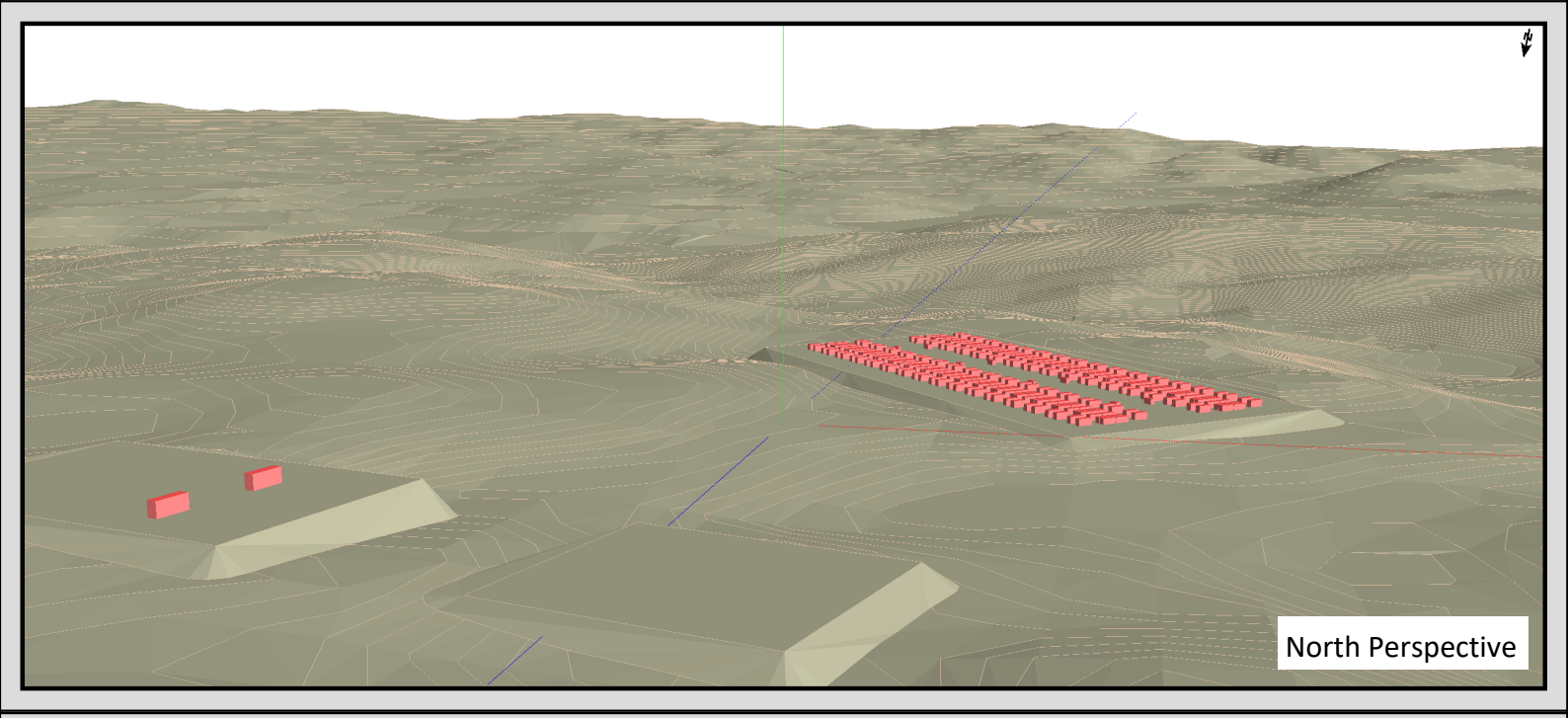


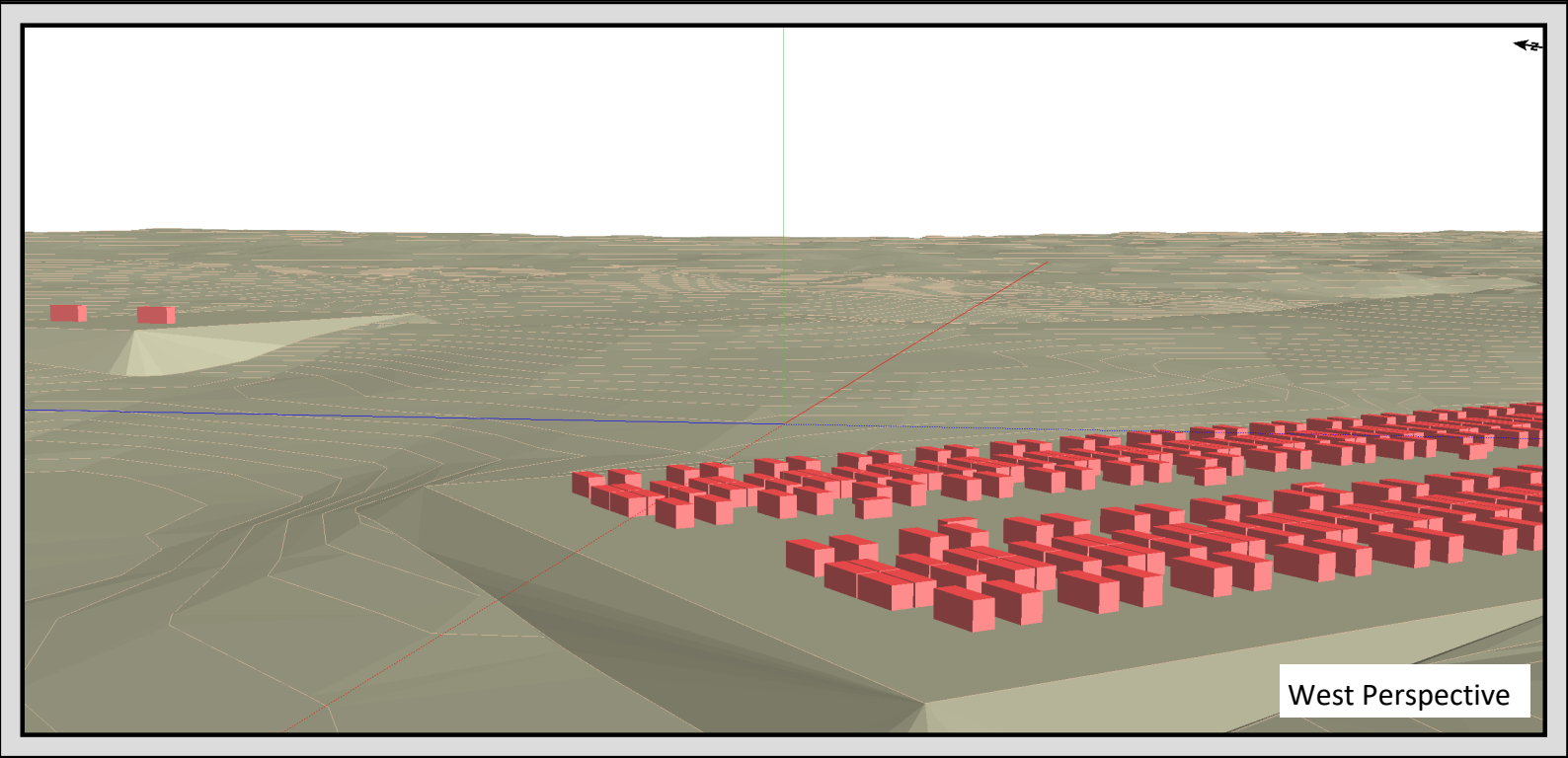
ATTACHMENT 4

SoundPLAN Model Layout
Operational Phase


Legend
Linework
Sources
BESS Pad
HV Transformers
Elevation line
Karara 24079
BESS Source
Model Layout
January 2025
Length scale 1:3,500
0 25 50 100 150 200
m
mwa
ENVIRONMENTAL

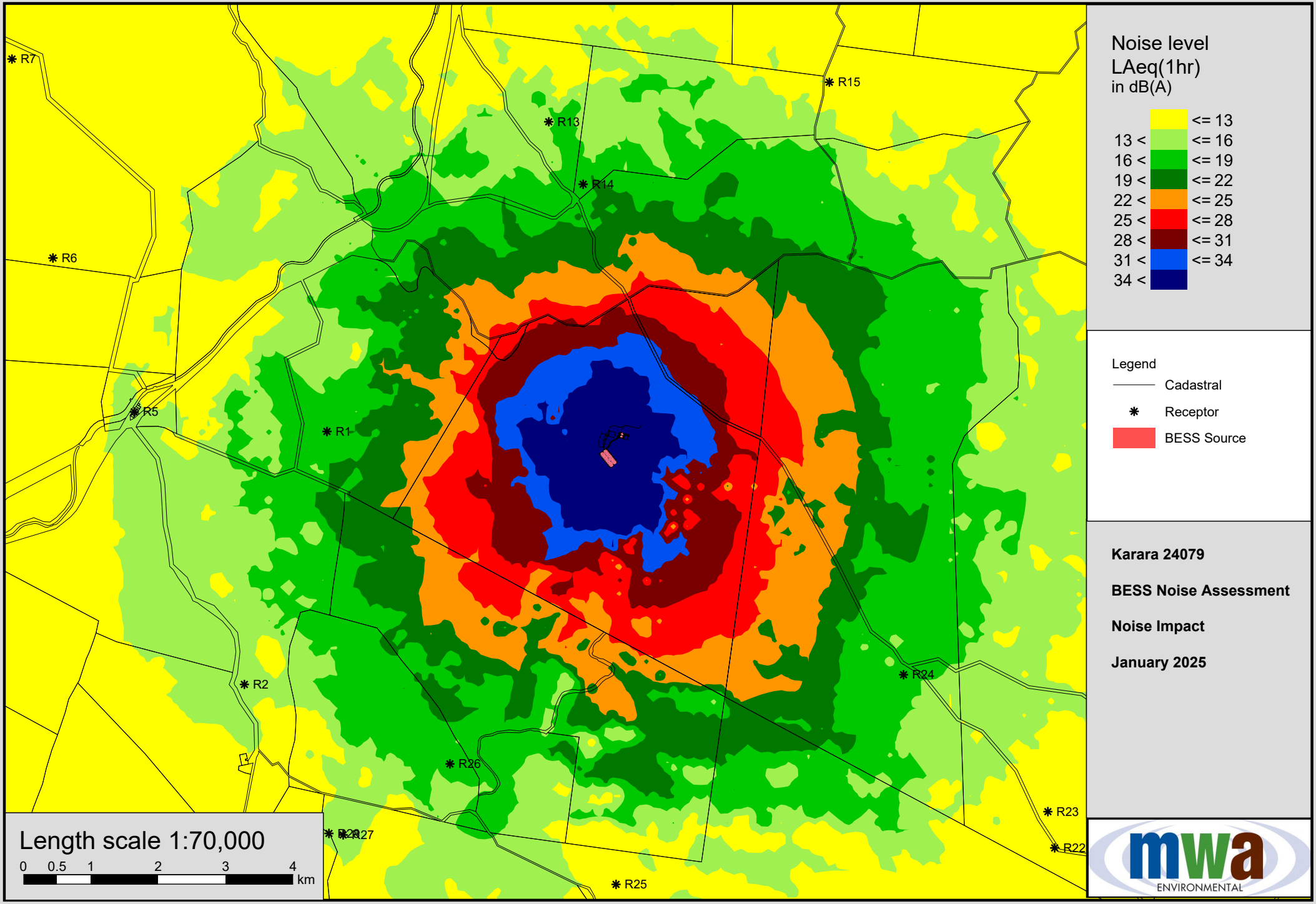

South Perspective


North Perspective


West Perspective

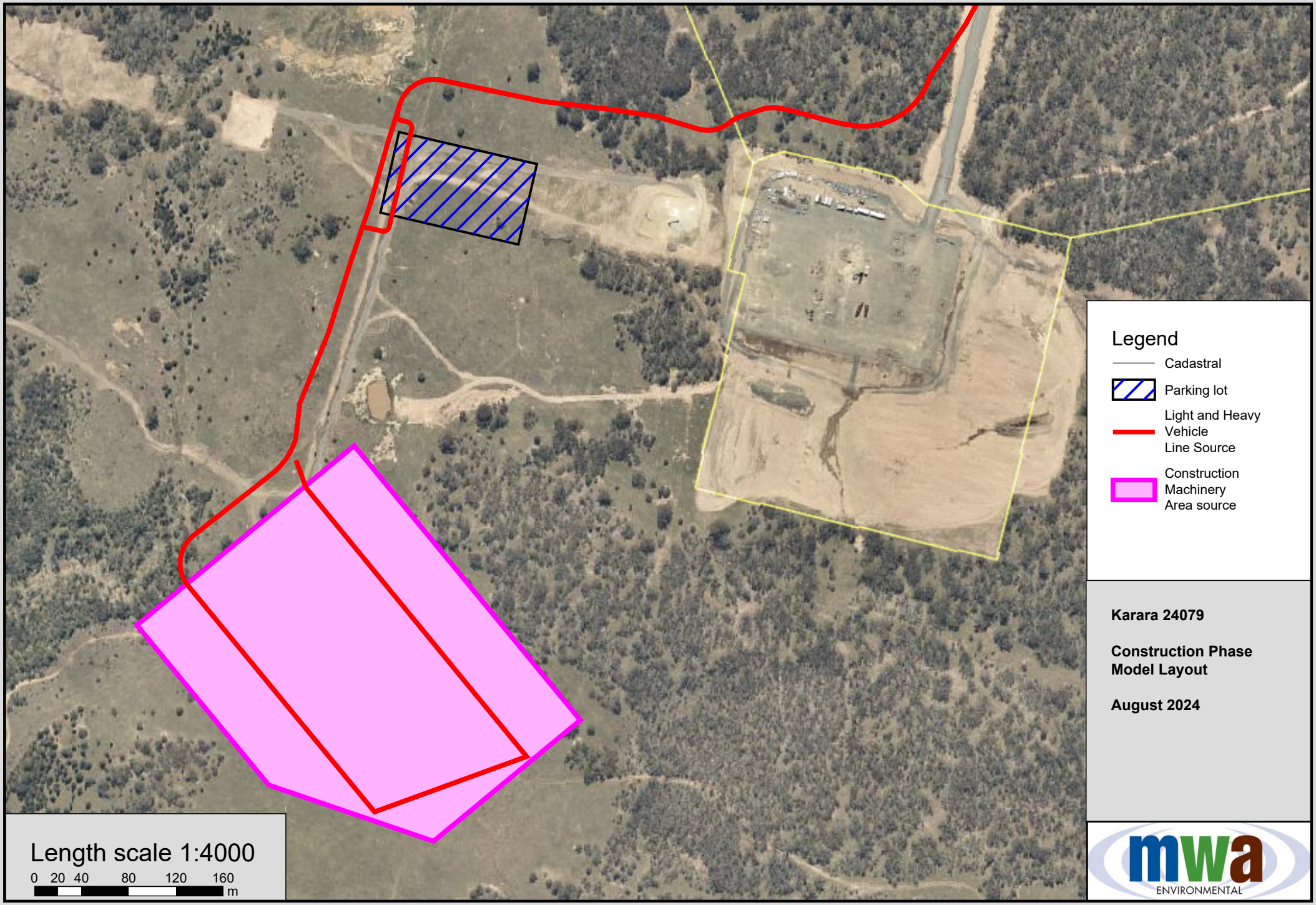
ATTACHMENT 5

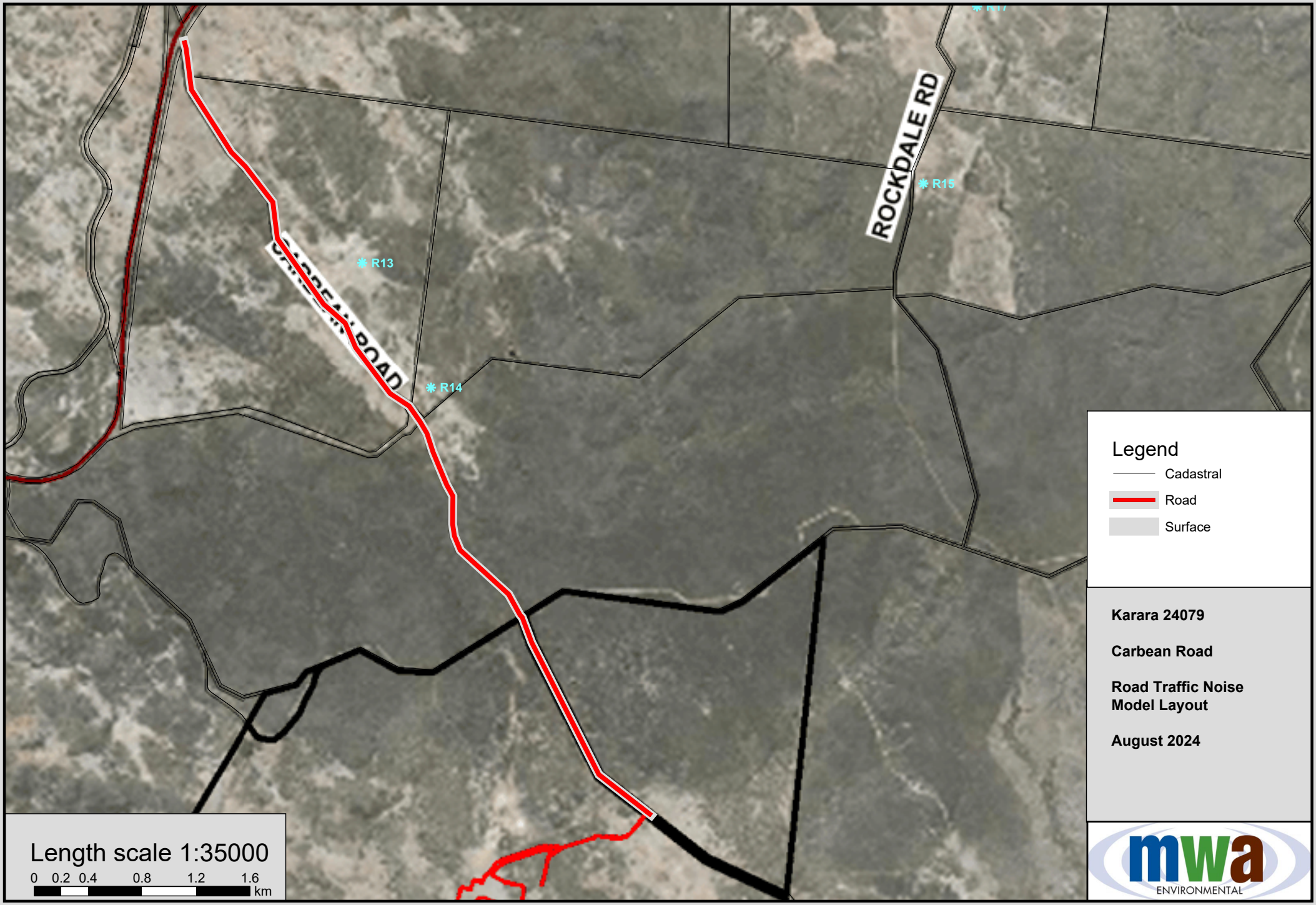
Predicted Noise Levels
Operational Phase


R7
R15
R13
R14
R6
R5
R1
R2
R24
R26
R23
R22
R25
Noise level
LAeq(1hr)
in dB(A)
<= 13
13 < <= 16
16 < <= 19
19 < <= 22
22 < <= 25
25 < <= 28
28 < <= 31
31 < <= 34
34 <
Legend
Cadastral
Receptor
BESS Source
Karara 24079
BESS Noise Assessment
Noise Impact
January 2025
Length scale 1:70,000
0 0.5 1 2 3 4
km
mwa
ENVIRONMENTAL

ATTACHMENT 6

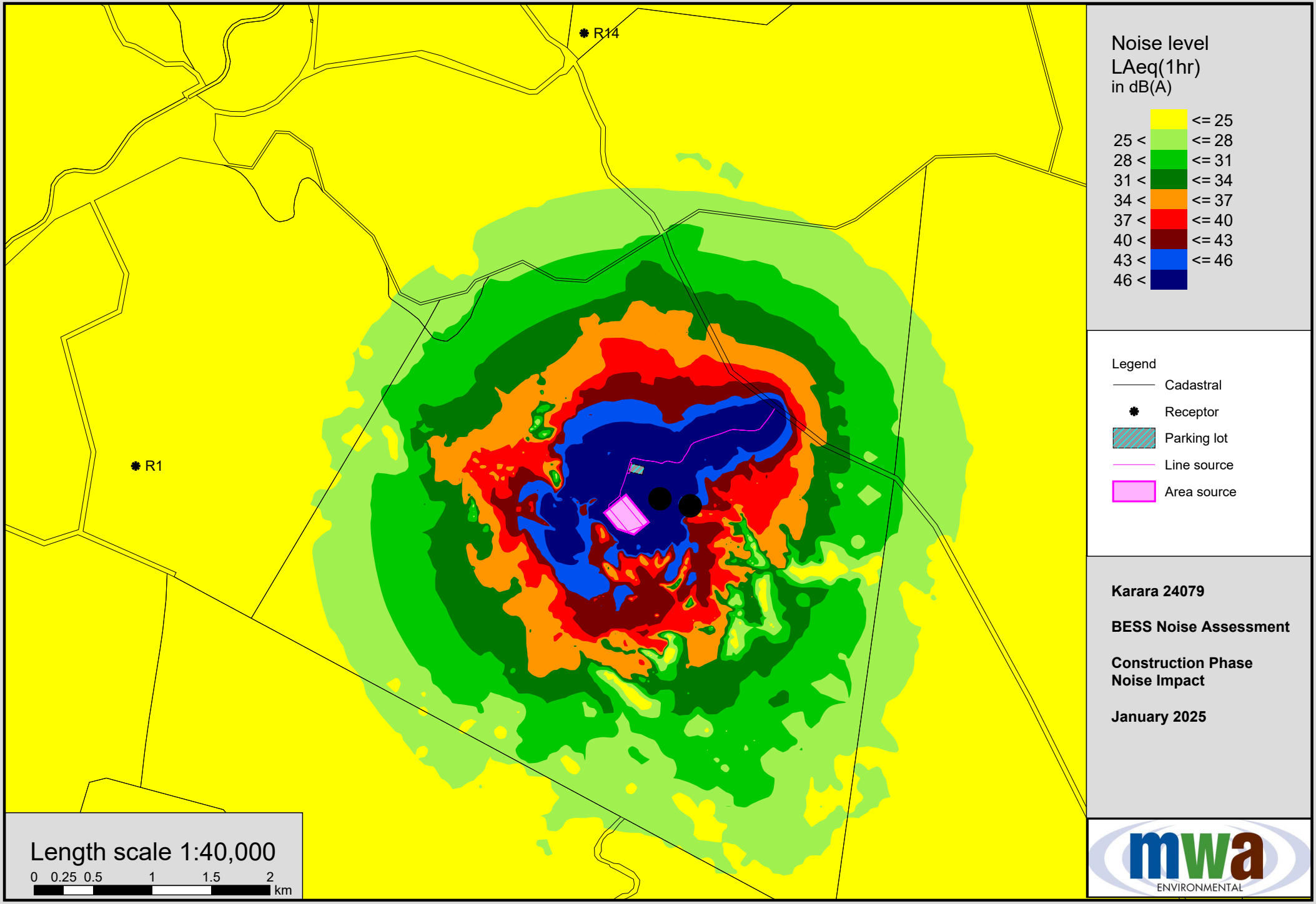
SoundPLAN Model Layout
Construction Phase

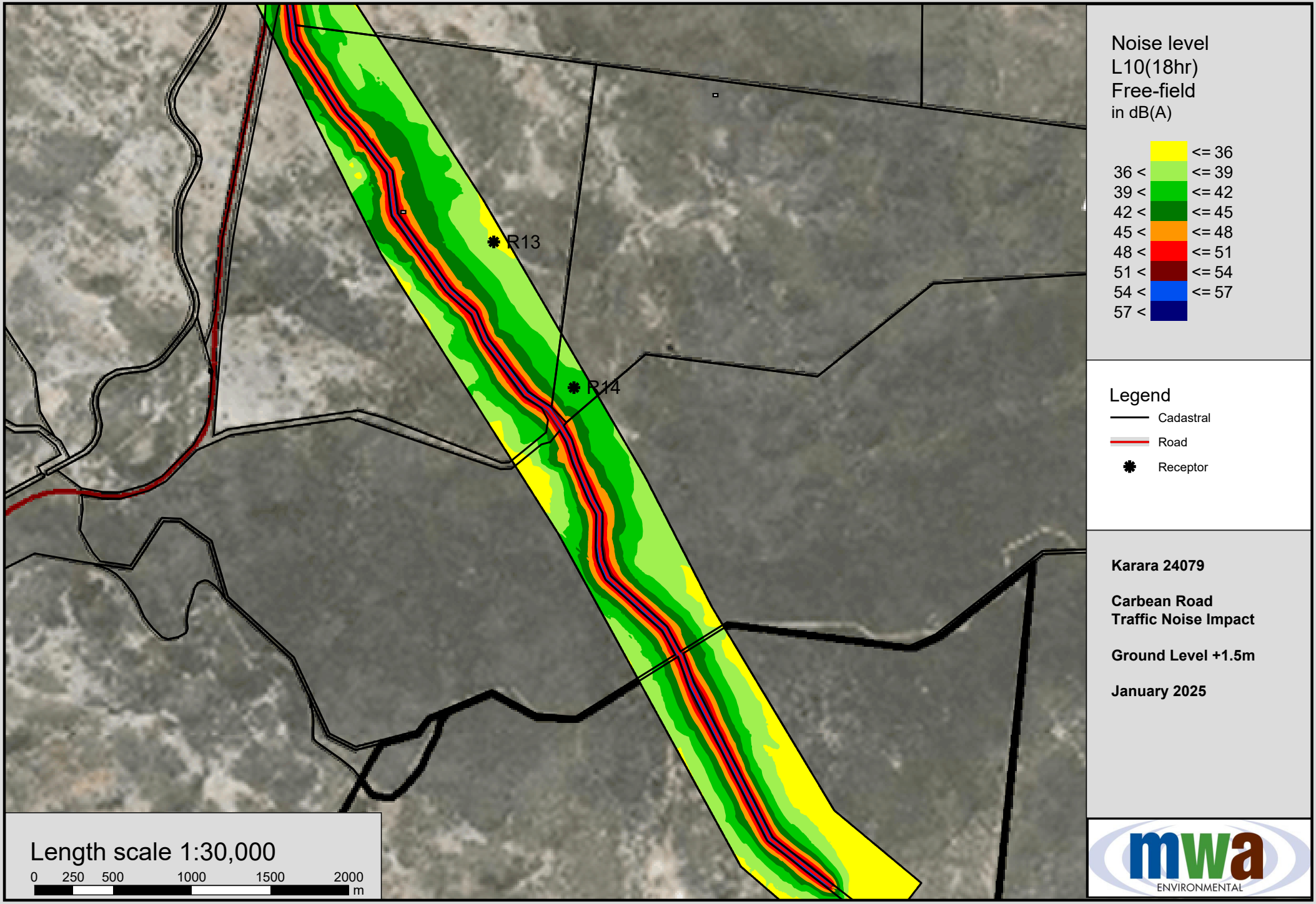

Legend
Cadastral
Parking lot
Light and Heavy Vehicle Line Source
Construction Machinery Area source
Karara 24079
Construction Phase Model Layout
August 2024
Length scale 1:4000
0 20 40 80 120 160
m
mwa
ENVIRONMENTAL


ROCKDALE RD
R13
R14
R15
Legend
Cadastral
Road
Surface
Karara 24079
Carbean Road
Road Traffic Noise Model Layout
August 2024
Length scale 1:35000
0 0.2 0.4 0.8 1.2 1.6
km
mwa
ENVIRONMENTAL

ATTACHMENT 7

Predicted Noise Levels
Construction Phase


R14
R1
Noise level
LAeq(1hr)
in dB(A)
<= 25
25 < <= 28
28 < <= 31
31 < <= 34
34 < <= 37
37 < <= 40
40 < <= 43
43 < <= 46
46 <
Legend
Cadastral
Receptor
Parking lot
Line source
Area source
Karara 24079
BESS Noise Assessment
Construction Phase
Noise Impact
January 2025
Length scale 1:40,000
0 0.25 0.5 1 1.5 2
km
mwa
ENVIRONMENTAL


R13
R14
Noise level
L10(18hr)
Free-field
in dB(A)
<= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 < <= 51
51 < <= 54
54 < <= 57
57 <
Legend
Cadastral
Road
Receptor
Karara 24079
Carbean Road
Traffic Noise Impact
Ground Level +1.5m
January 2025
Length scale 1:30,000
0 250 500 1000 1500 2000
m
mwa
ENVIRONMENTAL