SHALLOW BAY QUARRY CONSTRUCTION AND OPERATIONAL NOISE AND VIBRATION ASSESSMENT

Prepared for Ironhide Enterprises Pty Ltd

Prepared by RCA Australia

RCA ref 17519-401.1

May 2025

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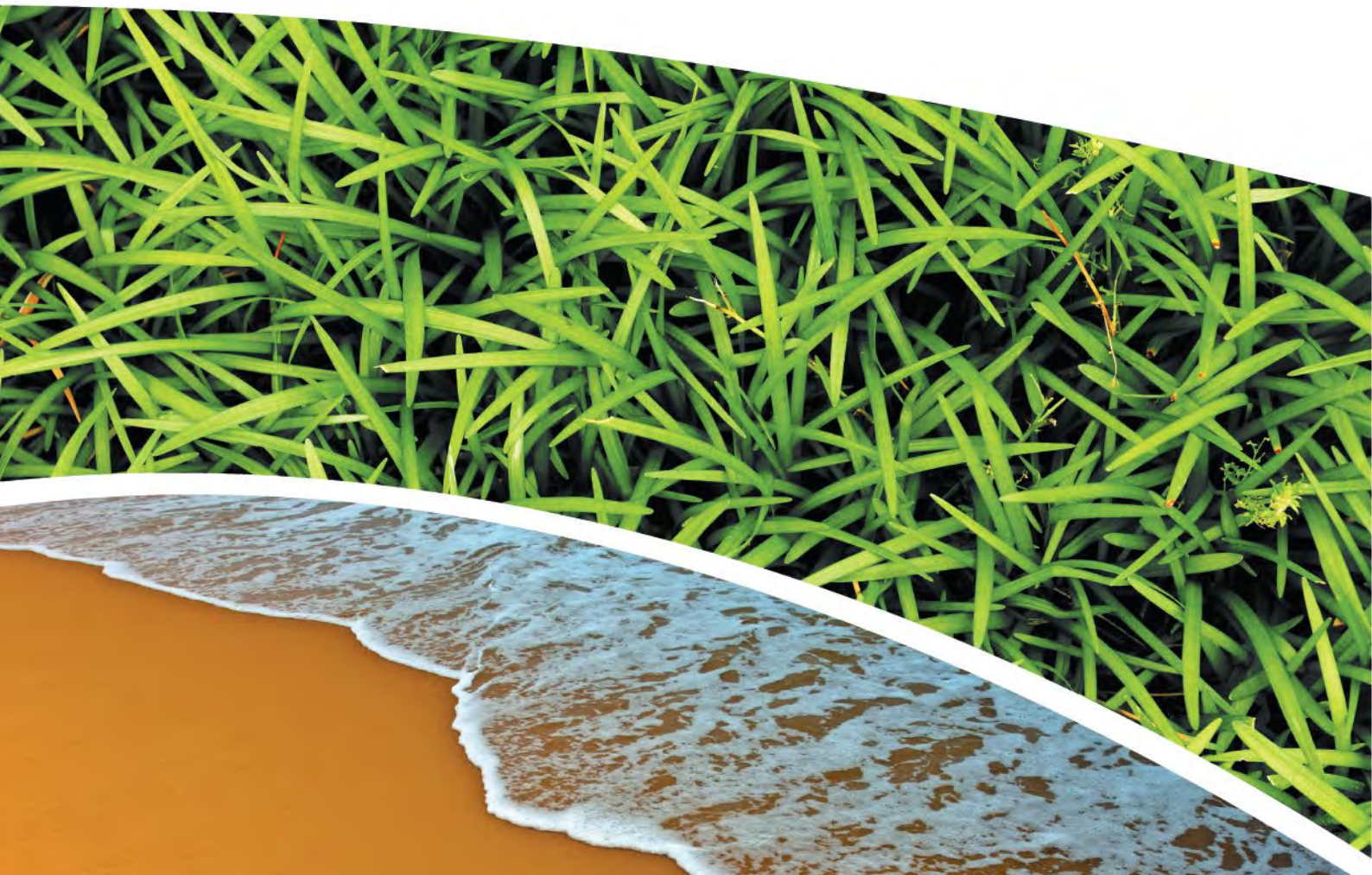

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DOCUMENT STATUS						
Rev No	**Comment**	**Author**	**Reviewer**	**Approved for Issue (Project Manager)**		
				Name	**Signature**	**Date**
/0	Draft	Sascha Keats	Alex Rees	Alex Rees	-	29/04/2025
/1	Final	Sascha Keats	Alex Rees	Alex Rees	A.Rees	01/05/2025

DOCUMENT DISTRIBUTION				
Rev No	**Copies**	**Format**	**Issued to**	**Date**
/0	1	Electronic (email)	Matthew Goodwin - info@quarryplannsw.com.au	29/04/2025
/0	1	Electronic report	RCA – job archive	29/04/2025
/1	1	Electronic (email)	Matthew Goodwin - info@quarryplannsw.com.au	01/05/2025
/1	1	Electronic report	RCA – job archive	01/05/2025

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Ironhide Enterprises Pty Ltd

Attention: Matthew Goodwin

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SHALLOW BAY QUARRY AT 465 SHALLOW BAY ROAD, SHALLOW BAY NSW CONSTRUCTION AND OPERATION NOISE & VIBRATION IMPACT ASSESSMENT

1 INTRODUCTION

RCA Australia (RCA) have been engaged by Ironhide Enterprises Pty Ltd (the client) to prepare a Construction and Operational Noise and Vibration Impact Assessment (CONVIA) for the proposed Shallow Bay Quarry at 465 Shallow Bay Road, Shallow Bay NSW. The 16/02/2025 Statement of Environmental Effects (SEE) by Ironhide Enterprises Pty Ltd has been referenced.

1.1 RELEVANT GUIDELINES AND STANDARDS

This assessment has been prepared in accordance with the following standards and guidelines:

- *Interim Construction Noise Guideline (ICNG) (DECC, 2009)*
- *Noise Policy for Industry (NPI) (EPA, 2017)*
- *NSW Road Noise Policy (RNP) (DECCW, 2011)*
- *AS1055:2018 Acoustics – Description and measurement of environmental noise*
- *Australian and New Zealand Environment Conservation Council (ANZECC) 1990, Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration*
- *AS 2187.2-2006 Explosives - Storage and Use - Use of Explosives*
- *BS 7385 Part 2-1993 'Evaluation and measurement for vibration in buildings Part 2'*

2 STUDY AREA

The study area consists of rural land located at 465 Shallow Bay Road, Shallow Bay, NSW 2428, approximately 10.5 km southwest of Forster. **Figure 1** provides aerial imagery of the site, highlighting the nearest residential receivers and noise monitoring locations. According to the Great Lakes Local Environmental Plan 2014, the area is designated as "RU2 – Rural Landscape," while nearby receivers are classified as "rural residential" under the NPI. Background noise levels in rural areas are generally low; however, agricultural equipment such as tractors and slashers are commonly used on surrounding properties.

The nearest noise sensitive receivers within 1 km from the proposed Quarry were identified from aerial imagery. These are shown in **Table 1** and **Figure 1**.

Table 1 *Identified residential noise sensitive receiver*

Receiver ID	Address	Approximate distance from site	Receiver type
R1	73 Salisbury Way	530 m	Residential
R3	466 Shallow Bay Rd	650 m	Residential
R4	554B Shallow Bay Rd	650 m	Residential
R5	81 Salisbury Way	700 m	Residential
R6	462 Shallow Bay Rd	840 m	Residential
R7	556 Shallow Bay Rd	770 m	Residential
R8	570 Shallow Bay Rd	820 m	Residential
R9	574 Shallow Bay Rd	880 m	Residential
R10	80 Salisbury Way	980 m	Residential
R11	365 Shallow Bay Rd	1020 m	Residential

3 DESCRIPTION OF PROPOSAL

The project involves extracting up to 30,000 tonnes of rock annually, with an expected average extraction rate of approximately 20,000 tonnes per year. The quarry will cover an area of approximately 1.51 hectares and has an estimated total resource of 725,730 tonnes. Operations will include drilling, blasting, and processing using a mobile crushing and screening plant.

The quarry will have a maximum depth of approximately 32.8 metres below the existing ground level. The project is expected to operate for 20 to 40 years depending on demand.

The project will proceed in the following stages:

- Construction Stage: Initial establishment, including pre-stripping soil, constructing bunds, stockpiling soil and establishing a water management system. An initial blast will also occur to lower the quarry floor to the initial operational height of at least 5 m below surface level.
- Operational Stage: Rock extraction, drilling, blasting, crushing, screening, and transportation of materials.

4 EXISTING ACOUSTIC ENVIRONMENT

4.1 NOISE ENHANCING WEATHER ANALYSIS

The NPI directs that noise enhancing weather includes light winds (up to and including 3 m/s) in the direction of the source to the receiver and temperature inversions which may occur during early winter mornings. The NPI provides two options for assessing potential noise impacts under noise enhancing weather. These can be summarised as follows:

- Analyse historical weather data to determine if light winds and/or temperature inversions are a feature of the area (occur at least 30% of the time, during any season and any assessment period). The NPI provides a procedure for this; or
- Assume that noise enhancing weather (light winds from source to receiver, and temperature inversions during winter nights and early mornings) are a feature of the area and adopt the NPI's "noise enhancing meteorological conditions" in the assessment.

If weather analysis is undertaken and it is found that noise enhancing weather is not a feature of the area, the NPI provides "standard meteorological conditions" that are to be adopted for the assessment. The standard and noise enhancing meteorological conditions are presented below.

Table 2 *NPI's standard and noise-enhancing meteorological conditions*

Meteorological conditions	Meteorological parameters
Standard meteorological conditions	Day/evening/night: stability categories A-D with wind speed up to 0.5 m/s at 10 m AGL
Noise-enhancing meteorological conditions	Daytime/evening: stability categories A-D with light winds (up to 3 m/s at 10 m AGL). Night: stability categories A-D with light winds (up to 3 m/s at 10 m AGL) and/or stability category F with winds up to 2 m/s at 10 m AGL.

RCA sourced weather data from the Bureau of Meteorology's Taree Airport automatic weather station (station ID 95784) for the full year 2024. This station is about 35 km from the site. Since the Quarry is not going to be operational at nighttime, no temperature inversion analysis was undertaken. The results of RCA's noise enhancing weather analysis for the daytime period are summarised in **Table 3**. These results indicate that the NPI's "standard meteorological conditions" can be adopted for the purpose of modelling daytime operation noise levels. Wind rose charts are provided in **Appendix D**.

Table 3 *Noise enhancing weather analysis*

Season	Day (7 am – 6 pm)
Summer	Wind is not a feature. Assumed no temperature inversion.
Autumn	Wind is not a feature. Assumed no temperature inversion.
Winter	Wind is not a feature. Assumed no temperature inversion.
Spring	Wind is not a feature. Assumed no temperature inversion.

Noise Monitoring Location

R9
R8
R7
R4
R10
R1
R5
R6
R3
R11

SALISBURY WAY
PITCHFORK PLACE
SHALLOW BAY ROAD

Quarry

Locality Plan
N.T.S.

LEGEND

- Receivers
- Noise monitoring location
- Quarry
- Access track

Notes:
1. Aerial image taken from Nearmap, 14 April 2024 (used in accordance with commercial licence)

0 65 130 260 390 520
metres

N

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QUARRY LOCATION AND NEAREST NOISE SENSITIVE RECEIVERS SHALLOW BAY QUARRY 465 SHALLOW BAY ROAD, SHALLOW BAY

CLIENT	Quarry Plan NSW			RCA Ref	17519-401.0
DRAWN BY	AR	SCALE	1:8,000 (A3)	Figure No 1	REV 0
APPROVED BY	AR	DATE	24/03/2025	OFFICE	NEWCASTLE

4.2 NOISE MONITORING EQUIPMENT

RCA have undertaken long-term unattended noise measurements in preparing this assessment. All sound level meters used were Class 1 instruments which comply with *IEC61672-1:2013 Electroacoustics – Sound level meters – Part 1: Specifications* and were in current *NATA* calibration at the time of the monitoring. Additional equipment details are provided in **Table 4**. All sound level meters were set to "A-weighted" and "Fast" time response.

Table 4 *Monitoring equipment*

	Make / model	Serial number	Previously NATA Calibrated
Sound level meter	Svan 971	55580	April 2023
Calibrator	SV33B	86489	March 2024
Rainwise Wind logger	Windlog	8003387RW4523	-
Rainwise Rain logger	Rainlog 2.0	2008631	-

4.3 UNATTENDED NOISE MONITORING

To determine the existing acoustic environment a noise monitor was deployed on site. The method to determine the Assessment Background Level (ABL) and the Rating Background Level (RBL) is defined in the NPI. L_{A90} levels were continuously measured over 15-minute periods during the unattended monitoring survey. The ABL is then determined for each assessment period each 24 hours as the 10^{th} percentile of the L_{A90} levels during that period. The RBLs for each assessment period were then determined as the median ABL for each 'Day', 'Evening' and 'Night' assessment period. These overall RBLs will be considered when setting construction and operational noise criteria for residential receivers. The NPI also sets minimum RBLs to adopt if the measured RBLs are below these. The minimum RBLs are:

- 35 dBA for the day time; and
- 30 dBA for both the evening and night time.

The location of the noise logger deployment is shown in **Figure 1**. A picture of the noise logger and weather station deployment is shown in **Figure 2**.

Meteorological data for the survey period was recorded with RCA's local weather station deployed at the site. Measured 15-minute noise descriptors for each day are included in **Appendix E**. Periods of rain and/or wind above 5 m/s have been excluded prior to analysis and are shaded grey. A daily summary is provided in **Table 5**. Measured RBLs are shown in brackets where the NPI's minimum RBLs have been adopted.

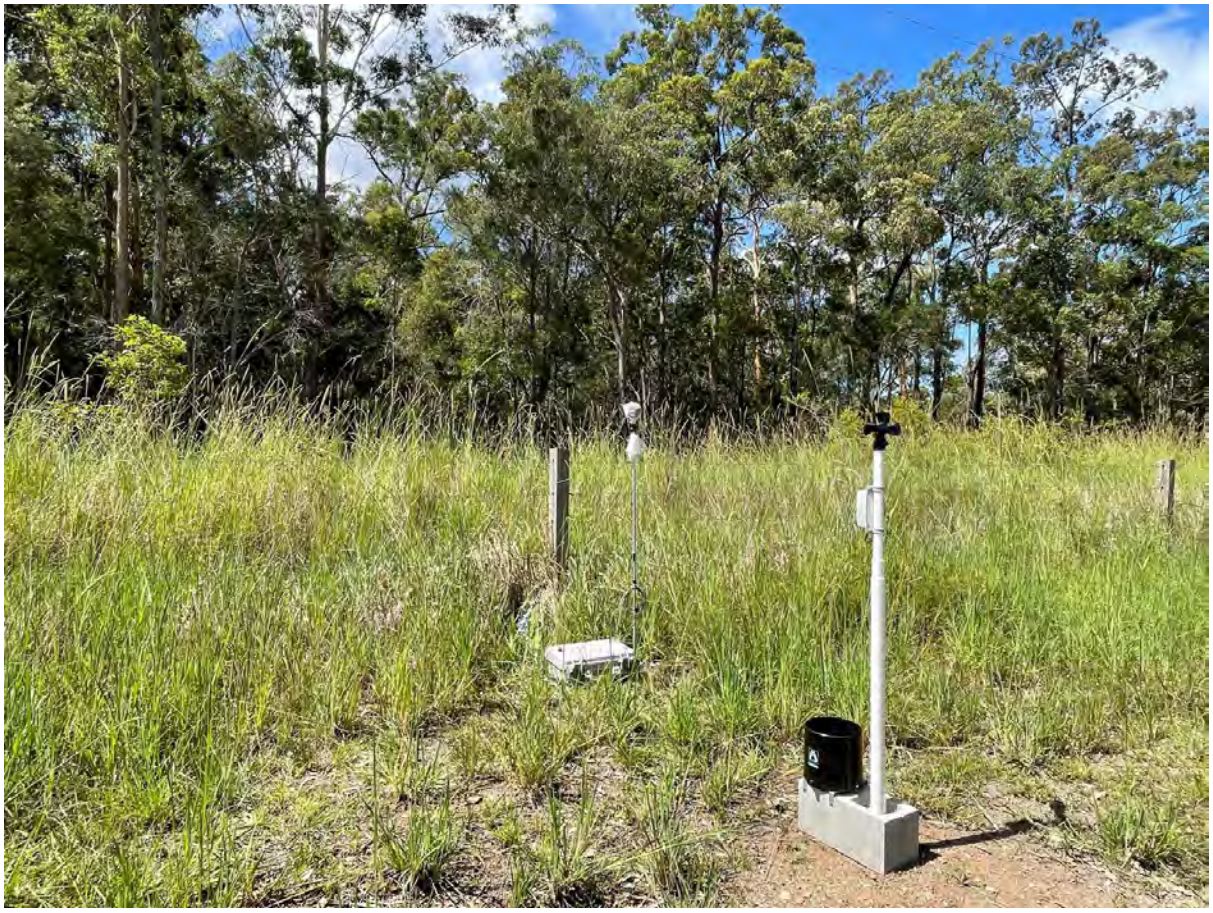

Figure 2 *Noise logger and weather station deployment*

Table 5 *Daily summary of measured ambient noise levels, dB(A)*

Date	Day ABL	Eve ABL	Night ABL	Day L_{Aeq}	Eve L_{Aeq}	Night L_{Aeq}
17-Feb-25	-	32	23	-	55	41
18-Feb-25	26	28	26	45	58	50
19-Feb-25	27	31	30	45	57	46
20-Feb-25	28	-	35	62	-	47
21-Feb-25	25	30	32	44	57	48
22-Feb-25	27	33	30	59	53	45
23-Feb-25	27	35	29	58	56	46
24-Feb-25	29	33	30	47	61	52
25-Feb-25	29	26	30	48	53	51
26-Feb-25	26	29	27	61	52	43
27-Feb-25	28	35	30	50	54	46
RBLs	**35 (27)**	**32**	**30**	**-**	**-**	**-**
Overall LAeq	**-**	**-**	**-**	**57**	**56**	**48**

Note: `-` Denotes insufficient data due to either rain or wind > 5 m/s

The NPI defines: 'Day' is between 7 am – 6 pm, 'Evening' is between 6 pm – 10 pm and 'Night' is between 10 pm – 7 am

4.4 ATTENDED NOISE MONITORING

RCA conducted a 15-minute attended noise measurement at the time of the unattended noise monitor retrieval. The purpose of this measurement was to assist in identifying and quantifying local noise sources and their contribution to the ambient acoustic environment. Noise measurement results and operator observations are shown in **Table 6**.

Table 6 *Attended noise monitoring results*

Date and time of measurement	LAeq,15-minute dBA	LA90,15-minute dBA	Observations
28/02/2025 10:45am – 11:00am	35	31	Wind in trees and insects: ~32 - 36 dB Vehicle passes: ~45 - 60 dB

5 CONSTRUCTION NOISE AND VIBRATION CRITERIA

Construction of this project will impact receivers for more than three weeks and therefore requires a quantitative noise assessment according to the Interim Construction Noise Guideline (ICNG).

5.1 CONSTRUCTION NOISE

A quantitative construction noise assessment for residential receivers requires criteria to be determined based on the adopted rating background levels (RBLs). These were measured and are presented in **Table 5**. **Table 7** outlines the ICNG criteria for residences.

Table 7 *ICNG construction noise criteria for residences*

Time of day	Management level $L_{Aeq,15\ min}$	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,15\ min}$ 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 works to be carried out, the expected noise levels and duration, as well as contact details
	Highly noise affected 75 dB(A)	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 may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:

Time of day	Management level $L_{Aeq,15\ min}$	How to apply
		1. Times identified by the community when they are less sensitive to noise (such as before and afternoon school for works near schools, or mid-morning or mid-afternoon for works near residences. 2. 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 + 5 dB	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 the noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

Construction noise criteria were then determined for the closest residential receivers based on the measured RBLs. These are presented in **Table 8**. No non-residential noise sensitive receivers have been identified.

Table 8 *Construction noise criteria for identified residences*

	Standard Hours (Day) dBA	Out of Hours (Day) dBA	Out of Hours (Evening) dBA	Out of Hours (Night) dBA
RBL	35 (measured 27)		32	30
Noise Affected ($L_{Aeq,15min}$)	45	40	37	35
Highly Noise Affected ($L_{Aeq,15min}$)	75	N/A	N/A	N/A

Standard construction hours are Monday – Friday (7am – 6pm). Saturday (8am – 1pm). No work Sunday or Public Holidays.

The Noise Policy for Industry recommends that the following minimum RBL levels be adopted in the event that the measured RBLs are lower than the following: Day – 35 dBA, Evening – 30 dBA and Night 30 dBA.

5.2 Road Noise Impacts From Construction Traffic

The Road Noise Policy (*RNP)* states that any increase in road noise due to additional traffic on existing roads generated by land use developments should be limited to 2 dB. This 2 dB increase will be used as a screening test to assess construction traffic noise. The *RNP* objectives will be met if it can be demonstrated that the increase in road noise due to construction traffic is no greater than 2 dB. If that is the case, no further assessment of construction road traffic noise is required.

Otherwise, the RNP also provides assessment criteria for existing residences affected by traffic on an existing sub-arterial road generated by land use developments. The daytime road noise criterion for sub-arterial roads is $L_{Aeq,15hr}$ 60 dBA (external).

5.3 CONSTRUCTION VIBRATION

While it is recognised that this project need not be assessed against Transport for NSW guidelines, the *Construction Noise and Vibration Guideline (CNVG) (TfNSW, 2023)* provides useful information on minimum working distances from sensitive receivers to avoid both cosmetic and human comfort vibration impacts. The relevant plant and their associated minimum working distances are reproduced in **Table 9**.

Table 9 *Minimum working distances to avoid cosmetic and human comfort vibration impacts*

Plant item	Rating / description	Minimum working distance	
		Cosmetic damage (*BS 7385*)	Human response (OH&E Vibration Guideline)
Vibratory roller	< 50 kN (1 – 2 t)	5 m	15 m to 20 m
	<100 kN (2 – 4 t)	6 m	20 m
	< 200 kN (4 – 6 t)	12 m	40 m
	< 300 kN (7 – 13 t)	15 m	100 m
	> 300 kN (13 – 18 t)	20 m	100 m
	> 300 kN (> 18 t)	25 m	100 m
Small Hydraulic Hammer	(300 kg – 5 to 12 t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18 t excavator)	7 m	23 m
Pile Boring	≤ 800 mm	2 m	4 m
Jackhammer	Handheld	1 m	2 m

According to this advice, no vibration impacts are expected due to either the construction or operation of the proposal. No further assessment of vibration is required. Blasting is assessed separately in **Section 11** and **Section 12**.

5.4 SUMMARY OF CONSTRUCTION NOISE AND VIBRATION TARGETS

A summary of construction noise and vibration targets is presented in table below.

Table 10 *Summary of construction noise and vibration objectives*

Noise / vibration consideration	Daytime objective at residential receiver
Construction noise	ICNG sets daytime Noise affected level: $L_{Aeq,15\ min}$ 45 dBA ICNG sets Highly noise affected level: $L_{Aeq,15\ min}$ 75 dBA
Road noise increase due to additional traffic	RNP sets target of limiting increase to no more than 2 dB; or $L_{Aeq,15\ hr}$ 60 dBA at façade of any residents on local roads.
Construction vibration	Vibration is not a concern given separation distance to any receiver is greater than 600 m

6 DESCRIPTION OF CONSTRUCTION

The construction phase of the quarry will involve excavating the quarry floor to a depth of five metres. This is to avoid the predicted noise exceedances at nearby residential receivers if the initial operations occurred at the natural ground surface level. RCA understand that a single blast will be required to achieve this depth. Two construction scenarios have been modelled; one with drilling for blasting and one without drilling.

Project construction and establishment is expected to take up to three months and involve the following elements:

- Stripping available topsoil and using it to establish a compacted earth bund/berm about one metre high around the upslope site perimeter.
- Blasting and excavation to lower the quarry floor to a depth of five metres.
- Creating an earth bund at least 2.5 m tall to block line of sight between the crushing and loading activities and the receivers north of the quarry.
- Stockpiling the remaining stripped soil in two stockpiles along the downslope, northern and northwestern edges, of the site. The stockpiles reach up to approximately three metres.
- Converting an existing excavation within the site to create an initial sump for retention of onsite dirty stormwater flows.

6.1 CONSTRUCTION HOURS

Construction hours will be from 7 am to 6 pm weekdays only. The construction noise assessment only needs to consider standard construction hours.

6.2 CONSTRUCTION EQUIPMENT USE

Indicative construction equipment is presented in **Table 11**. RCA have sourced representative sound data from our database and the *Construction Noise and Vibration Guideline (CNVG) (TfNSW, 2023)* based on indicative equipment models provided by the client.

Table 11 *Indicative construction equipment and SWLs*

Equipment	Sound power level, dBA
Excavator, Komatsu PC270-8	107
Excavator, Kobelco SK140-7	105
Front end loader, Komatsu 420	111
Water cart, Cat CT600 C15 Acert engine	102
Light Vehicles, TBD	90
Compactor	106
Grader	113
Blast Drill	124

6.3 CONSTRUCTION NOISE MODEL INPUTS

Using the CONCAWE algorithm within CadnaA (version 2025) software, a 3D computer noise model was generated for representative construction scenarios. This algorithm was used to predict environmental noise levels under light winds in all directions and considers topography and ground cover. **Table 12** provides details on the noise model setup. Construction noise is assessed over 15-minute periods. Individual plant items naturally have periods of high intensity work interspersed with periods of inactivity. The model assumes the selected plant are all working simultaneously for a full 15-minute period which provides some conservatism in the predictions made.

Table 12 *Computer noise model inputs for construction phase*

Noise model parameter	Settings
Algorithm / standard	CONCAWE NPI standard meteorological conditions (wind speed of 0.5 m/s in all directions, stability class D)
Digital ground elevation data	5 m digital terrain data provided by Australian government agencies and the client
Ground absorption coefficient and foliage	Ground absorption equal to 0.75 to model mostly grass cover between source and receiver
Noise sources	2 x Excavators, front end loader, compactor, grader and blast drilling are modelled as point sources within the Quarry site shown in **Figure 1**. Water cart modelled as a line source. Sound powers for each source are shown in **Table 11**. Blasting is assessed separately.

7 CONSTRUCTION ASSESSMENT RESULTS

Typical worst-case construction noise levels have been modelled in CadnaA according to the CONCAWE algorithm. A summary of construction noise impacts is shown in **Table 13**. Noise exceedances are shaded in the table below. Construction noise level contours without drilling are presented in **Appendix A1**, and with drilling in **Appendix A2**.

Mitigation measures are discussed in **Section 13** which aim to minimise noise impacts to nearby receivers.

Table 13 *Summary of construction noise impacts*

Receiver	Day time Project Trigger Level, $L_{Aeq,15\ min}$ dBA	Predicted construction noise impact, $L_{Aeq,15\ min}$ dBA (without blast drilling)	Exceedance, dBA	Predicted construction noise impact, $L_{Aeq,15\ min}$ dBA (with blast drilling)	Exceedance, dBA
R1	45	47	2	53	8
R3	45	43	Nil	51	6
R4	45	44	Nil	51	6

Receiver	Day time Project Trigger Level, $L_{Aeq,15\ min}$ dBA	Predicted construction noise impact, $L_{Aeq,15\ min}$ dBA (without blast drilling)	Exceedance, dBA	Predicted construction noise impact, $L_{Aeq,15\ min}$ dBA (with blast drilling)	Exceedance, dBA
R5	45	43	Nil	51	6
R6	45	41	Nil	49	4
R7	45	42	Nil	50	5
R8	45	41	Nil	49	4
R9	45	40	Nil	49	4
R10	45	40	Nil	49	4
R11	45	27	Nil	34	Nil

Without any blast drilling, there is a negligible exceedance at R1 of 2 dBA. With blast drilling an exceedance of 8 dBA is expected at R1. However, blast drilling is expected to occur only once per year for approximately one week before blasting. Even with these exceedances during blast drilling, the highly affected level of 75 dBA is not exceeded.

7.1 CONSTRUCTION TRAFFIC NOISE ON PUBLIC ROADS

Less than one light and one heavy vehicle movement per hour to and from site are anticipated during construction. While RCA do not have existing traffic volumes for Shallow Bay Road, we can assume that adding no more than two vehicle movements to the sub-arterial road will have a negligible effect to the 15-hour averaged LAeq and thus the RNP objectives will be met.

8 OPERATIONAL NOISE CRITERIA

8.1 OPERATIONAL TRAFFIC NOISE

Operational road noise impacts will be assessed against the same criteria discussed in **Section 5.2**.

8.2 OPERATIONAL NOISE

Assessment criteria have been determined in accordance with the *NPI*. The *NPI* provides guidance on setting noise criteria and includes consideration of two types of criteria: amenity noise criteria and intrusive noise criteria.

The *NPI* sets an Intrusiveness Noise criterion (applicable for residential receivers only) which is $L_{Aeq,15min}$ equal to the RBL plus 5 dB. Amenity noise levels for a rural residency are taken from Table 2.2 of the *NPI*. The most stringent of the project intrusiveness noise level and the project amenity noise level is adopted as the project noise trigger level after converting both criteria to a 15-minute period.

The derived Intrusiveness and Amenity noise criteria for residential receivers is shown in **Table 14** below. Only the daytime criterion is relevant to this proposal.

Table 14 *Residential Intrusiveness and Amenity Noise Criteria, dB(A)*

Assessment period	Adopted RBL	Intrusiveness Noise Level, $L_{Aeq,15min}$	Rural Amenity Noise Level, L_{Aeq}	Project Amenity Noise Level, $L_{Aeq,15min}$	Project specific noise trigger level, $L_{Aeq,15min}$
Day	35	40 (35 + 5)	50	48 (50 – 5 + 3)	**40**

8.3 SLEEP DISTURBANCE

The Shallow Bay Quarry is proposed to be only operational during the day. Therefore, a sleep disturbance assessment is not required.

8.4 OPERATIONAL VIBRATION IMPACTS

Given the large separation distance between the quarry and receivers, no vibration impacts are anticipated, and no further operational vibration impact assessment is discussed in this report. Vibration from blasting is discussed in **Section 12.2** of this report.

9 DESCRIPTION OF OPERATION

9.1 HOURS OF OPERATION

The hours of operation for the proposed quarry are reproduced in the table below.

Table 15 *Hours of operation*

Activity	Hours and days of operation
Extraction, crushing & screening	Monday to Friday: 7 am to 6 pm Weekends & Public holiday: no work
Loading trucks delivery off site	
Maintenance	
Drilling and blasting	Blasts are expected to have a maximum frequency of once per year according to the SEE. Blast drilling will take place for approximately one week prior to each blast. Blasting is not to occur before 9am.
Light maintenance	All hours.

Light maintenance will be undertaken without the use of tools which are likely to create significant noise impacts.

9.2 OPERATIONAL STAGES

The operational phase is broken down into three stages:

- **Stage 1** – Begins once pit floor has been lowered to a depth of 5 m.
- **Stage 2** – Operations at about 20 m deep pit floor. This stage is planned to start at year 15 with extraction rate of 30,000 Tonnes per year.
- **Stage 3** – Operations at about 30 m deep pit floor (final pit floor). This stage is planned to start at year 25 with extraction rate of 30,000 Tonnes per year.

9.3 OPERATIONAL EQUIPMENT USE

RCA have sourced representative sound power levels from our database and the *CNVG (TfNSW, 2023)* based on indicative plant models provided by the client.

Table 16 *Sound power levels of operational noise sources*

Equipment	Quantity	Sound power level, dBA
Excavator, Komatsu PC270-8	1	107
Excavator, Kobelco SK140-7	1	105
Crusher and screens, Terex 114 with Cat C9 Acert engine	1	116
Conveyer stacker	1	110
Front end loader, Komatsu 420	1	110
Water cart, Cat CT600 C15 Acert engine	1 movement per 15 mins	102
Water pumps (TBD)	2	95
Haul Trucks, Mix of 12T rigid & 36 T super dogs	2 movements per 15 mins	102
Blast drill	1 (approx. 1 week per year)	124

9.4 OPERATIONAL NOISE MODEL INPUTS

Table 17 provides details on the 3D noise model setup in CadnaA. The model assumes all equipment to be working simultaneously for a full 15-minute period which provides some conservatism in the predictions made.

Table 17 *Computer noise model inputs for operational stages*

Noise model parameter	Settings
Algorithm / standard	CONCAWE NPI standard meteorological conditions (wind speed of 0.5 m/s in all directions, stability class D).
Digital ground elevation data	Operational - 5 m digital terrain data by the client at pit floor (surface level). Operational - 5 m digital terrain data by the client at initial pit floor (5m).
Ground absorption coefficient and foliage	Ground absorption equal to 0.75 to model mostly grass cover between source and receiver.
Noise sources	2 x Haul trucks movements per 15 mins modelled as a line source along the Quarry access route shown in **Figure 1**. 1 x Water truck movements per 15 mins modelled as a line source with same route as Haul trucks. Excavator, crusher and screens and front-end loader modelled as point source along with a drill within the Quarry site. Sound power (A-weighted levels) for each source are shown in **Table 16**.
Earth mounds	An earth mound to the north of the quarry has been modelled with a height of 2.5 m. The location of the earth mound is shown in **Appendix C1** and **Appendix C2**.

10 OPERATIONAL NOISE ASSESSMENT RESULTS

Modelling demonstrated that there would be significant noise exceedances if the quarry were operational at surface level. The client subsequently agreed to only commence operations once the quarry floor had reached a depth of five metres.

The predicted noise levels from operations at surface level are presented in **Table 18** for additional information only.

Table 18 *Summary of predicted noise levels with quarry in operation at surface level*

Receiver	Day time Project Trigger Level, $L_{Aeq,15\ min}$ dBA	Predicted construction noise impact, $L_{Aeq,15\ min}$ dBA (without blast drilling)	Exceedance, dBA
R1	40	49	9
R3	40	47	7
R4	40	47	7
R5	40	44	4
R6	40	44	4
R7	40	44	4
R8	40	44	4
R9	40	43	3
R10	40	42	2
R11	40	31	Nil

A summary of the modelling results for operational noise at a quarry depth of five metres is presented in **Table 19**. The operational phase noise model captures the site plant and configuration agreed with the client. The crushing and drilling operations are modelled on the quarry floor which is five metres deep.

Table 19 *Operational noise predictions at five metres depth*

Receiver	Day time Project Trigger Level, $L_{Aeq,15\ min}$ dBA	Predicted $L_{Aeq,15min}$ dBA (without blast drilling)	Exceedance, dB	Predicted $L_{Aeq,15min}$ dBA (with blast drilling)	Exceedance, dB
R1	40	41	1	44	4
R3	40	39	Nil	41	1
R4	40	37	Nil	41	1
R5	40	38	Nil	41	1
R6	40	36	Nil	38	1
R7	40	36	Nil	41	1
R8	40	35	Nil	41	1
R9	40	33	Nil	40	Nil
R10	40	35	Nil	39	Nil

Receiver	Day time Project Trigger Level, $L_{Aeq,15\ min}$ dBA	Predicted $L_{Aeq,15min}$ dBA (without blast drilling)	Exceedance, dB	Predicted $L_{Aeq,15min}$ dBA (with blast drilling)	Exceedance, dB
R11	40	26	Nil	28	Nil

Furthermore, the assessment is considered conservative as all plant is assumed to be operating simultaneously, and noise modelling considers earth bunding, but no additional shielding provided by stockpiles. As stockpiles accumulate, they will provide increased noise shielding.

Modelling showed that when the quarry floor is at a depth of five metres, the pit walls offer effective shielding for all assessed residential receivers, regardless of where plant is located within the pit.

LAeq,15 min noise contours for surface quarry operations are presented in **Appendix B. Appendix C1** and **Appendix C2** present operational noise contours with and without blast drilling with the quarry depth at five metres respectively.

10.1 POTENTIAL ANNOYING CHARACTERISTICS

A full low frequency and tonality test for operational noise cannot be undertaken at this point because spectral noise data is not available for all noise sources. However, RCA have taken sound measurements of similar crushing and screening plant and found that no penalty applied. RCA do not have spectral data for the drill but note that this would only operate for approximately one week per year.

10.2 OPERATIONAL TRAFFIC NOISE

According to the SEE, the maximum annual truck movements is estimated at 2,061, and based on a year with 300 working days, equating to an average of seven truck movements per day. RCA considers an increase in seven truck movements on a sub-arterial road per day to be negligible. The RNP noise objectives are therefore expected to be met.

11 BLASTING CRITERIA

The proponent plans to use blasting to assist resource extraction. This process begins by drilling holes in a carefully planned pattern, with precise control over their angle, depth, and spacing. These holes are then packed with an emulsion-based explosive. To trigger the explosion, primers and detonators are used. Each hole is detonated in a staggered sequence, ensuring that they fire one after the other in quick succession. This method increases the blast's effectiveness while also minimizing blast noise and vibration.

11.1 HUMAN COMFORT

The Environmental Protection Authority (EPA) assesses the impact of blasting on humans using criteria outlined in the Australian and New Zealand Environment Conservation Council guidelines *'Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration'* (the ANZECC guideline) (1990).

These guidelines focus on two main factors that affect human perception of blasting:

- Airblast overpressure

- Ground vibration

For airblast overpressure, a level of 115 dB linear peak may be exceeded in up to 5% of total blasts over a 12-month period, but the level must never exceed 120 dB linear peak.

For ground vibration, the peak particle velocity (PPV) should not surpass 5 mm/s in more than 5% of blasts over a 12-month period, and it must never exceed 10 mm/s.

12 BLASTING ANALYSIS

Blasting should only be permitted during the hours of 9 am to 5 pm, Monday to Saturday. Blasting should not take place on Sundays or Public Holidays. For the Shallow Bay Quarry, maximum blasting frequency will be once per year.

The following preliminary blast design information is taken from the latest SEE:

"Blast drilling at this site is expected to involve holes about 89mm in diameter and ~11m deep distributed on a grid pattern of 3 by 3 metres, or a similar arrangement.

Blast designs will be varied based on location within the quarry, geological structures, product requirements and consideration of potentially sensitive areas (including amenities building, crushing equipment, etc). One blast will be sufficient to fragment about 30,000 tonnes of rock."

Estimating ground vibration and airblast overpressure levels accurately is challenging due to the non-linear nature of blasting and the varying characteristics of most rock types. This makes it difficult to predict environmental impacts with precision.

Since field data or opportunities for blasting trials in the target area is not yet available, likely ground vibration and airblast overpressure levels can be estimated using simple charge weight scaling laws. These laws consider the charge weight per delay and the distance between the blast and the monitoring location. Two site-specific parameters are also considered, which affect both the peak levels and the rate at which they decay.

12.1 AIRBLAST OVERPRESSURE

Predictions for airblast overpressure have been conducted using the "Terrock airblast overpressure model" taken from *Richards, A.B. (2013). Terrock Model 2013: Predictive modelling of airblast overpressure. Terrock Consulting Engineers*. The airblast overpressure level is given by:

$$\boldsymbol{D_{115} = \left(\frac{K_a \, x \, d}{B \; or \; SH}\right)^{2.5} \; x \; \sqrt[3]{m}} \qquad \textbf{Equation 1}$$

Where 'SH' is the Stemming height (mm), 'B' is the Front Row Burden (mm), 'm' is the Maximum Instantaneous Charge mass (MIC) (Kg), 'K_a' is the Site constant (250 for front of face and 190 for behind/side of blast), 'D_{115}' is the Distance to 115 dBL level (m) and 'd' is the Blast hole diameter (mm).

With a Site Constant K_a of 250 for a front to free-face blast, hole diameter d of 89 mm, a front-row burden B of 3000 mm, a maximum MIC of 44.2 Kg is allowed before the limit of 115 dBL is exceeded at the nearest residential receiver (~530m).

These preliminary predictions demonstrate that compliance can be easily achieved, but the blast contractor should refine these predictions once site constants are available from blast data. Airblast results heavily depend on factors such as blast confinement, atmospheric conditions and the topography between the blast and sensitive receiver.

Until the site laws are determined, it is recommended to conduct blasts at or below explosives instantaneous charge mass of 44 kg.

12.2 GROUND VIBRATION

Preliminary predictions for ground vibrations have been prepared based on equations and advice from the Australian Standard AS 2187.2 *'Explosives - Storage and use - Use of explosives'* (2006).

Since many site-specific factors influence how vibrations travel through the ground, the most accurate prediction comes from vibration measurements taken directly at the site. However, if such data isn't available, ground vibration can be estimated using the following equation taken from AS 2187.2-2006:

$$V = K_g \left(\frac{R}{\sqrt{Q}}\right)^{-B} \qquad \textbf{Equation 2}$$

Where 'V' is the ground vibration as vector peak particle velocity (mm/s), 'Q' is the Maximum Instantaneous Charge (MIC) (kg), 'R' is the distance between the explosive to the receiver (m), 'K_g' is the site constant and 'B' is the site exponent. This equation gives an estimate of the mean (50% probability of exceedance) vector peak particle velocity.

For this assessment, it is assumed for the site to conduct blasting free face in 'average' field conditions which gives the site exponent 'B' value of 1.6 and site constant 'K_g' to be 1140. Assumed site constants will need to be verified with blast data from site

At the initial recommended maximum MIC of 44 Kg, the predicted ground vibration levels at the closest residential receiver (~530 m) are 1 mm/s. The predicted vibration levels are well below the relevant adopted criteria for human comfort.

13 MITIGATION MEASURES

An affective operational noise mitigation measure that the client will implement is lowering the quarry floor to a depth of five metres before operations commence. This provides significant noise attenuation and consequently the noise levels at all residential receivers. Further, the client has agreed to construct bunding to the northern side of the quarry to aid in blocking noise from quarry operations to residential receivers.

Another key mitigation measure already adopted by the proposal is to undertake construction activities during standard construction hours only, and to operate during "daytime" hours only.

The quarry is to prepare an operational Noise Management Plan which will form part of the training to all staff.

The blast contractor is to use MIC no greater than 44 kg for initial blasts and in determining site constants.

14 CONCLUSION

14.1 CONSTRUCTION IMPACTS

RCA's noise model predictions show that the construction noise levels with no blast drilling will cause a 2 dB exceedance of noise management levels during the daytime at receiver R1. This exceedance is considered negligible according to the NPI. While blast drilling is taking place, the exceedance at R1 is predicted to increase to up to 8 dB. However, blast drilling is expected to only take place for approximately one week each year.

Exceedances ranging from 4 to 6 dB are predicted at receivers R3 to R10 during blast drilling. During periods of no blast drilling, construction noise is predicted to cause no exceedances at receivers R3 to R11.

14.2 OPERATIONAL IMPACTS

A 4 dB exceedance of noise management levels is predicted at R1 during blast drilling. Drilling is expected to only last for approximately one week each year. Without drilling, an exceedance of 1 dB is expected at R1. This is a negligible exceedance. The client has altered their proposal to lower the quarry floor to a depth of five metres before normal operations commence. This is expected to greatly improve the environmental noise performance of the quarry.

14.3 BLASTING IMPACTS

Since blasting data for the site is not available yet, predictions for the airblast overpressure using the Terrock airblast model show that the allowable MIC is 44 kg before the 115 dB limit is exceeded at the nearest residential receiver (R1 ~530 m).

Predictions show that the MIC of 44 Kg will not exceed the adopted ground vibration criteria at the nearest residential receiver.

Therefore, it is recommended to conduct initial blasting at or below MIC of 44 kg, unless the blasting contractor can demonstrate predictions based on more detailed design will meet the criteria. Determining the site-specific laws will allow predictions to be more accurate.

14.4 SUMMARY

RCA were engaged by Ironhide Enterprises Pty Ltd to prepare a Construction and Operational Noise and Vibration Impact Assessment for the proposed Shallow Bay Quarry at 465 Shallow Bay Road, Shallow Bay. RCA found that there will be a 2 dB exceedance at one receiver during the construction phase when no blast drilling is taking place which is considered negligible. An exceedance of up to 8 dB at R1 is predicted during construction when blast drilling is taking place, however, no receivers are predicted to experience levels greater than the highly noise affected level. At the nearest receiver during the operational phase, an exceedance of 1 to 4 dB is predicted without and with the blast drilling respectively.

RCA understand that drilling is expected to operate for one week per year prior to blasting during the operational stage and once during the construction phase.

Blasting predictions using Terrock airblast model allow for MIC up to 44 kg before it exceeds the airblast overpressure limit of 115 dBA at the nearest receiver. All receivers including the are predicted to remain below the relevant ground vibration targets based on MIC 44 Kg.

Yours faithfully

RCA AUSTRALIA

Sascha Keats
Graduate Acoustic Engineer

GLOSSARY

dB (A)	Unit of sound pressure level, modified by the A-weighting network to represent the sensitivity of the human ear.
SPL (Lp)	The incremental variation of sound pressure from the reference pressure level expressed in decibels.
SWL (L_W)	Sound Power Level of a noise sources per unit time expressed in decibels from reference level $W_{O.}$
L_X	Statistical noise descriptor. Where (x) represents the percentage of the time for which the specified noise level is exceeded.
L_{eq}	Equivalent continuous noise level averaged over time on an equivalent energy basis.
L_{90}	Average Minimum Noise Level in a measurement period.
L_{max}	Maximum Noise Level in a measurement period.
ABL	Noise level determined for planning purposes as the one tenth percentile of the ambient L_{A90} noise levels in one day.
RBL	Noise level determined for planning purposes as the median ABL in one week.

Appendix A1

Predicted Construction without blast drilling $L_{Aeq,15min}$ Noise Contours

R9
40 dBA

R8
41 dBA

R7
42 dBA

R4
44 dBA

R6
41 dBA

R10
40 dBA

R1
47 dBA

R5
43 dBA

R3
43 dBA

SHALLOW BAY ROAD

Water Cart

FEL

Grader

Komatsu
Excavator

R11
27 dBA

Locality Plan
N.T.S.

LEGEND

- Quarry operations
- Point sources
- Receivers

Noise contours

35	55	75
40	60	80
45	65	85
50	70	

Notes:
1. Aerial image taken from Nearmap, 23 February 2025 (used in accordance with commercial licence)

0 60 120 240 360 480
metres

N

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APPENDIX A1:
CONSTRUCTION WITHOUT BLAST DRILLING
SHALLOW BAY QUARRY
465 SHALLOW BAY ROAD, SHALLOW BAY

CLIENT	NT Quarries Pty Ltd			RCA Ref	17519-401
DRAWN BY	SK	SCALE	1:7,000 (A3)	DRAWING No A1	REV 0
APPROVED BY	AR	DATE	30/04/2025	OFFICE	NEWCASTLE

Appendix A2

Predicted Construction with blast drilling $L_{Aeq, 15min}$ Noise Contours

R9
49 dBA

R8
49 dBA

R7
50 dBA

R4
51 dBA

R10
49 dBA

R1
53 dBA

R5
51 dBA

R6
49 dBA

R3
51 dBA

SHALLOW BAY ROAD

Water Cart

Blast Drill

FEL

Grader

Komatsu
Excavator

Shallow Bay

R11
34 dBA

LEGEND

Quarry operations

Point sources

Receivers

Noise contours

35 40 45 50 55 60 65 70 75 80 85

Notes:
1. Aerial image taken from Nearmap, 23 February 2025 (used in accordance with commercial licence)

0 60 120 240 360 480
metres

N

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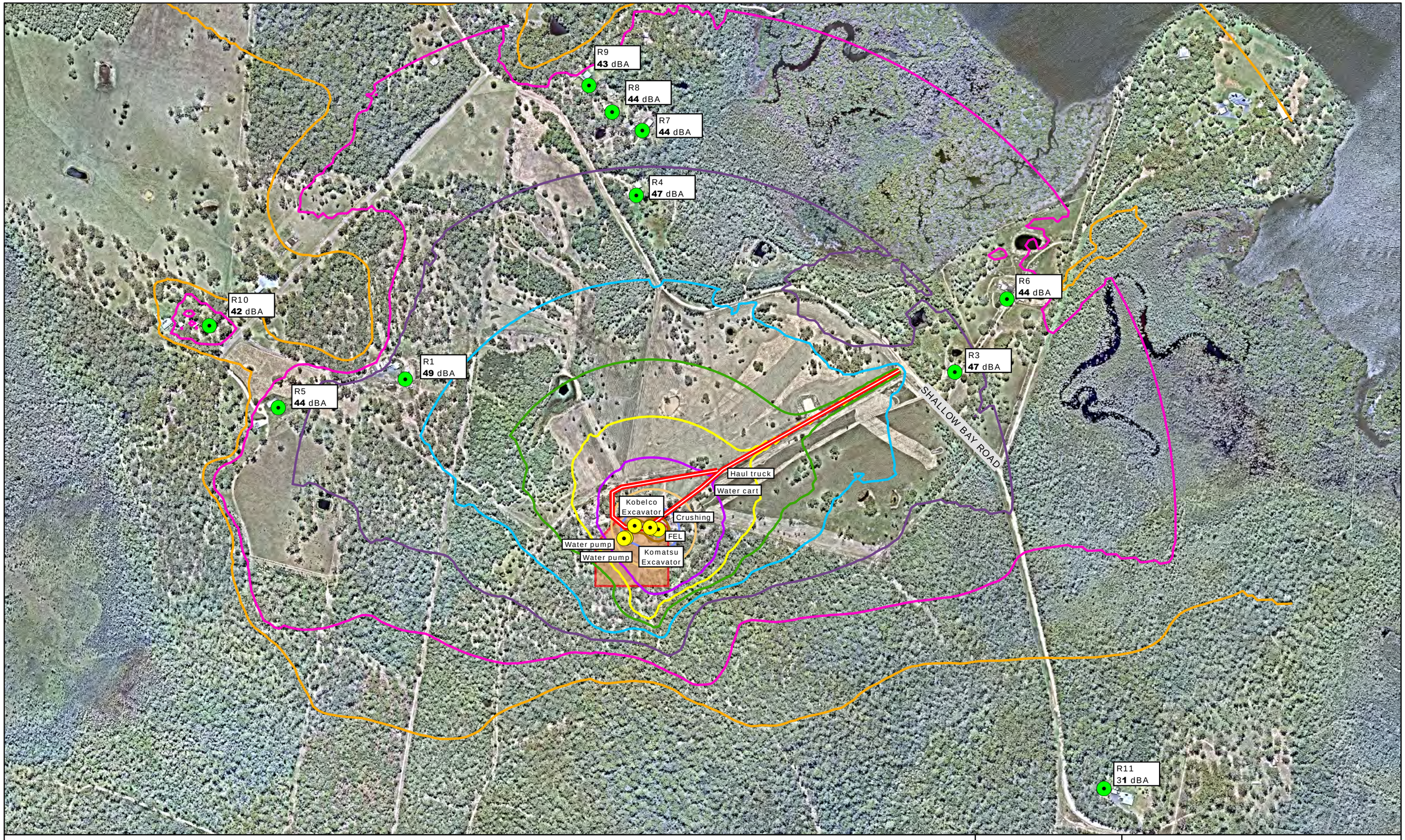
APPENDIX A2:
CONSTRUCTION WITH BLAST DRILLING
SHALLOW BAY QUARRY
465 SHALLOW BAY ROAD, SHALLOW BAY

CLIENT	NT Quarries Pty Ltd			RCA Ref	17519-401
DRAWN BY	SK	SCALE	1:7,000 (A3)	DRAWING No A2	REV 0
APPROVED BY	AR	DATE	30/04/2025	OFFICE	NEWCASTLE

Appendix B

Predicted surface operations $L_{Aeq, 15min}$ Noise Contours



LEGEND

Quarry operations
Line sources
Point sources
Receivers

Noise contours

35 40 45 50 55 60 65 70 75 80 85

Notes:
1. Aerial image taken from Nearmap, 23 February 2025 (used in accordance with commercial licence)

0 60 120 240 360 480
metres

N

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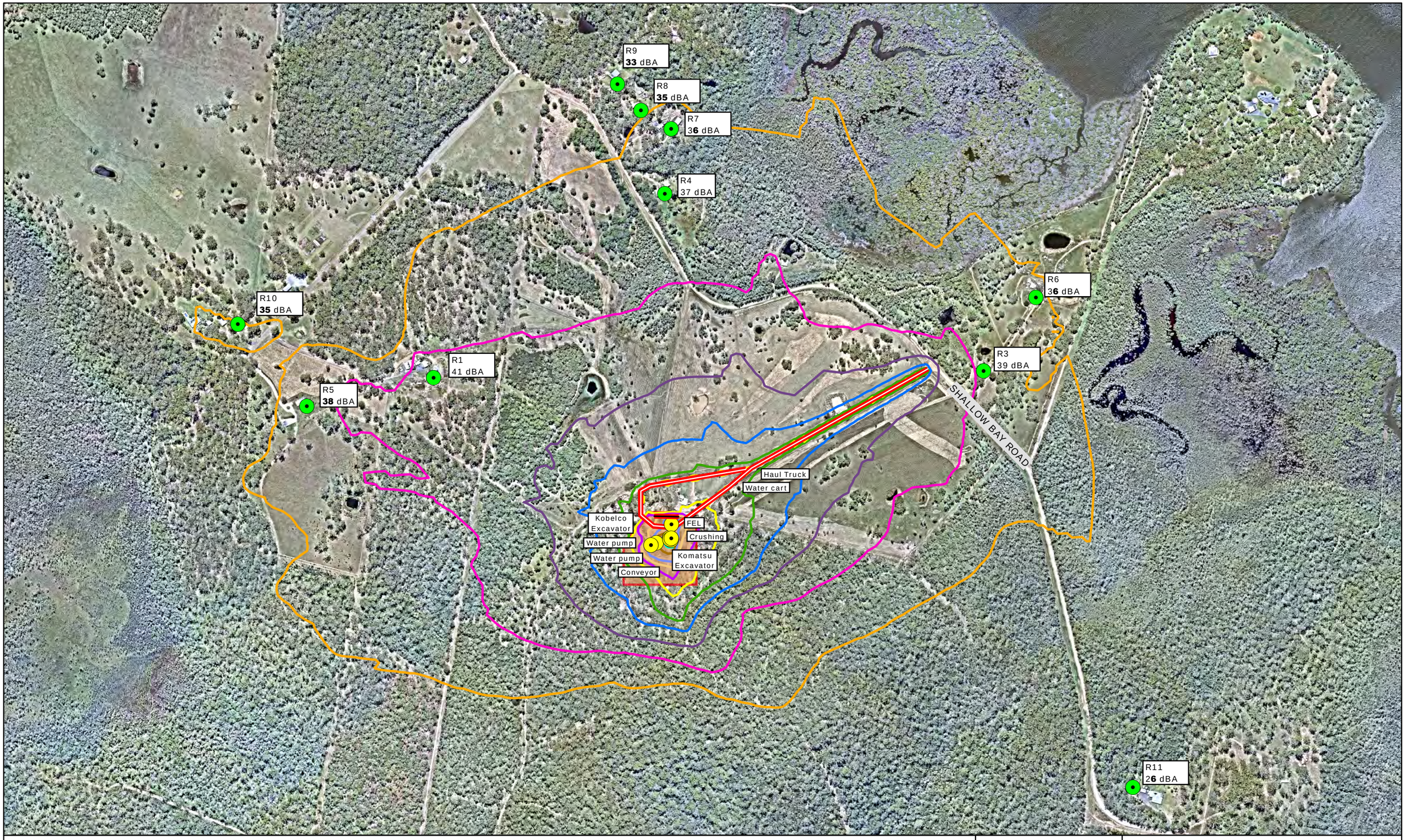
APPENDIX B:
OPERATIONAL - SURFACE LEVEL
SHALLOW BAY QUARRY
465 SHALLOW BAY ROAD, SHALLOW BAY

CLIENT	NT Quarries Pty Ltd			RCA Ref	17519-401
DRAWN BY	SK	SCALE	1:7,000 (A3)	DRAWING No B	REV 0
APPROVED BY	AR	DATE	30/04/2025	OFFICE	NEWCASTLE

Appendix C1

Predicted operations (5m) without blast drilling $L_{Aeq,\ 15min}$ Noise Contours



LEGEND

- Quarry operations
- Line sources
- Point sources
- Receivers
- Bunding

Noise contours

35 40 45 50 55 60 65 70 75 80 85

Notes:
1. Aerial image taken from Nearmap, 23 February 2025 (used in accordance with commercial licence)

0 60 120 240 360 480
metres

N

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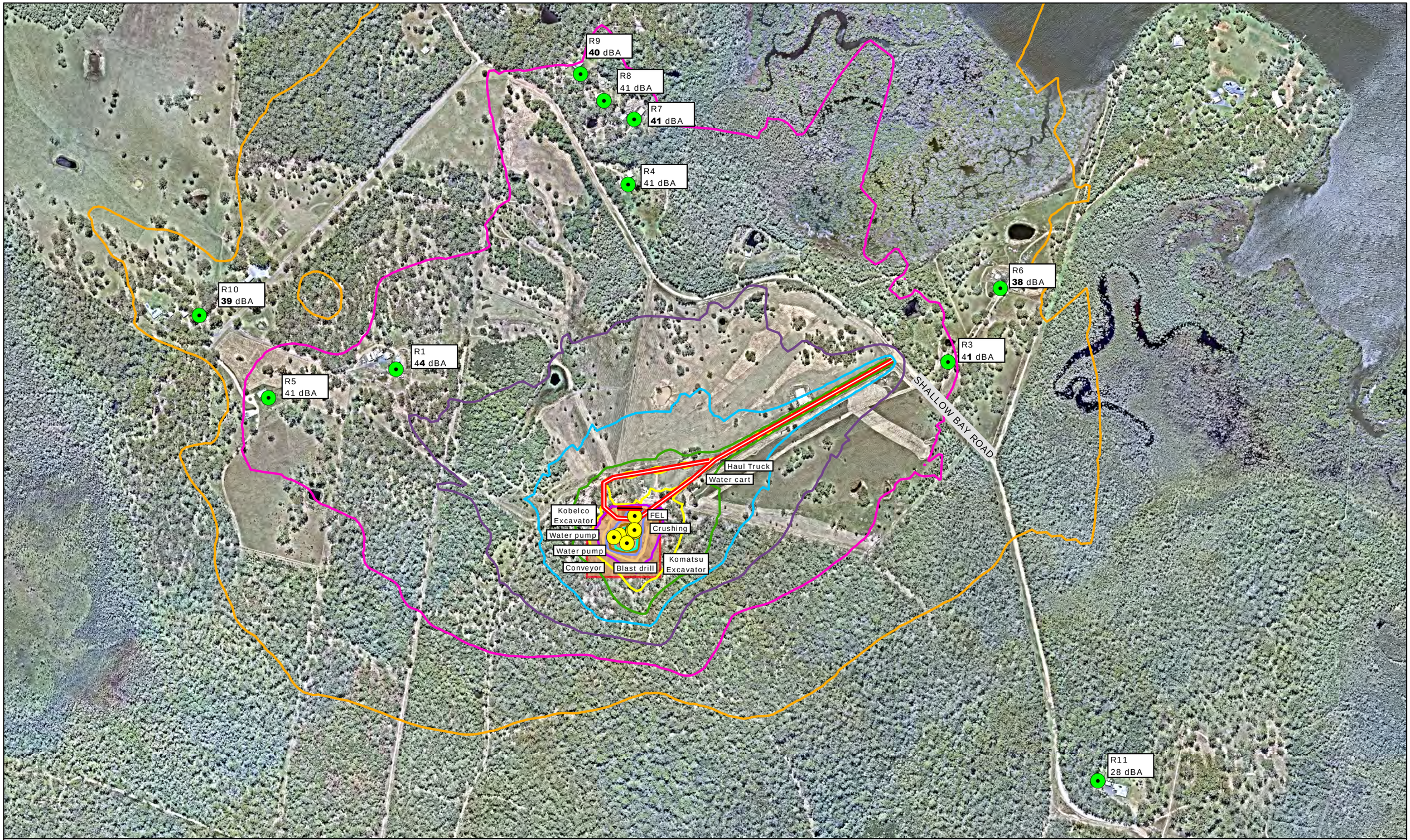
APPENDIX C1:
OPERATIONAL - 5m WITHOUT BLAST DRILLING
SHALLOW BAY QUARRY
465 SHALLOW BAY ROAD,
SHALLOW BAY

CLIENT	NT Quarries Pty Ltd			RCA Ref	17519-401
DRAWN BY	SK	SCALE	1:7,000 (A3)	DRAWING No C1	REV 0
APPROVED BY	AR	DATE	30/04/2025	OFFICE	NEWCASTLE

Appendix C2

Predicted operations (5m) with blast drilling
LAeq, 15min Noise Contours



LEGEND

- Quarry operations
- Line sources
- Point sources
- Receivers
- Bunding

Noise contours

- 35
- 40
- 45
- 50
- 55
- 60
- 65
- 70
- 75
- 80
- 85

Notes:
1. Aerial image taken from Nearmap, 23 February 2025 (used in accordance with commercial licence)

0 60 120 240 360 480
metres

N

RCA AUSTRALIA
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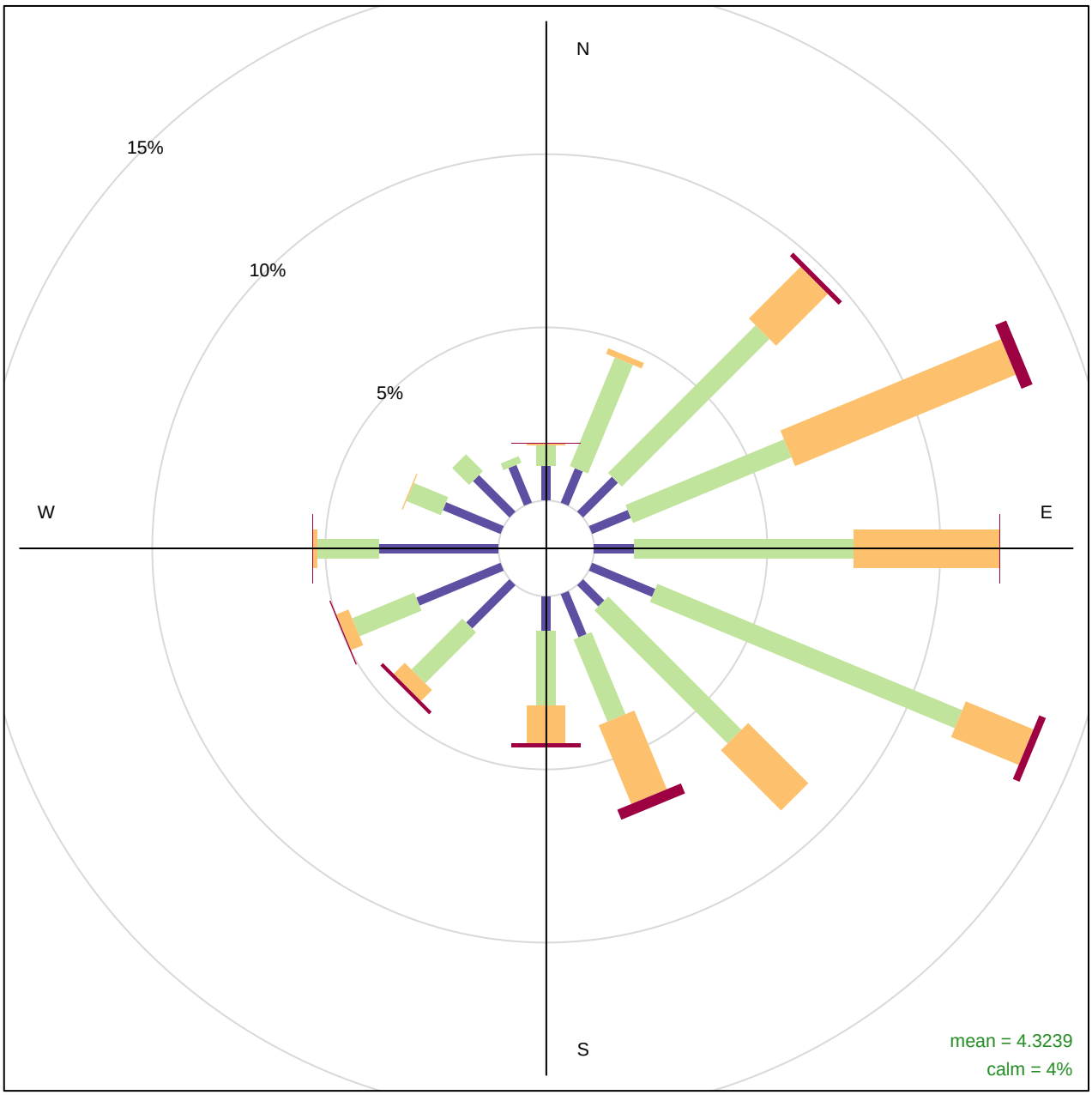
APPENDIX C2:
OPERATIONAL - 5m WITH BLAST DRILLING
SHALLOW BAY QUARRY
465 SHALLOW BAY ROAD, SHALLOW BAY

CLIENT	NT Quarries Pty Ltd			RCA Ref	17519-401
DRAWN BY	SK	SCALE	1:7,000 (A3)	DRAWING No C2	REV 0
APPROVED BY	AR	DATE	30/04/2025	OFFICE	NEWCASTLE

Appendix D

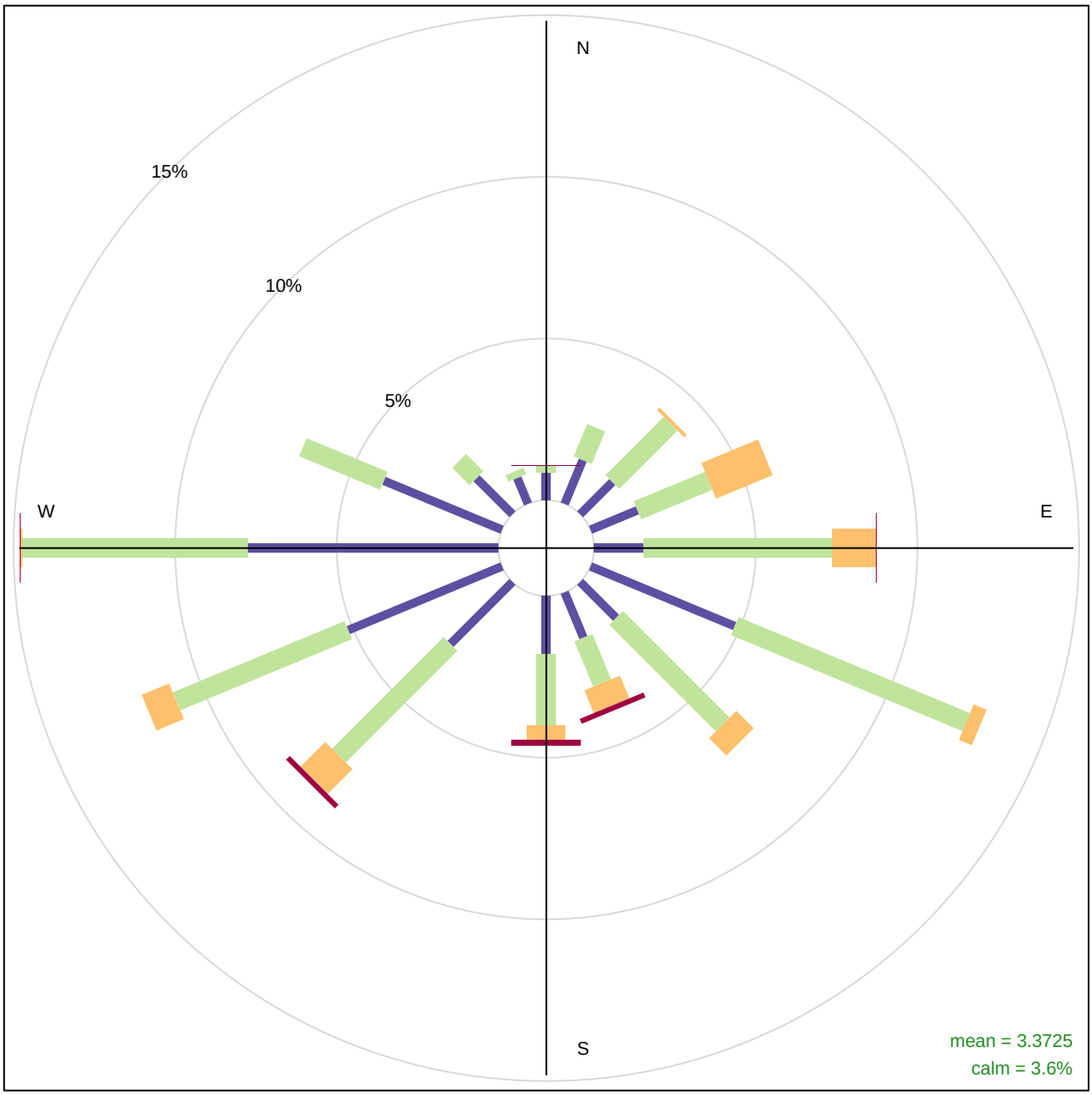
Seasonal Daytime Wind Rose

Taree AP daytime windrose, Summer



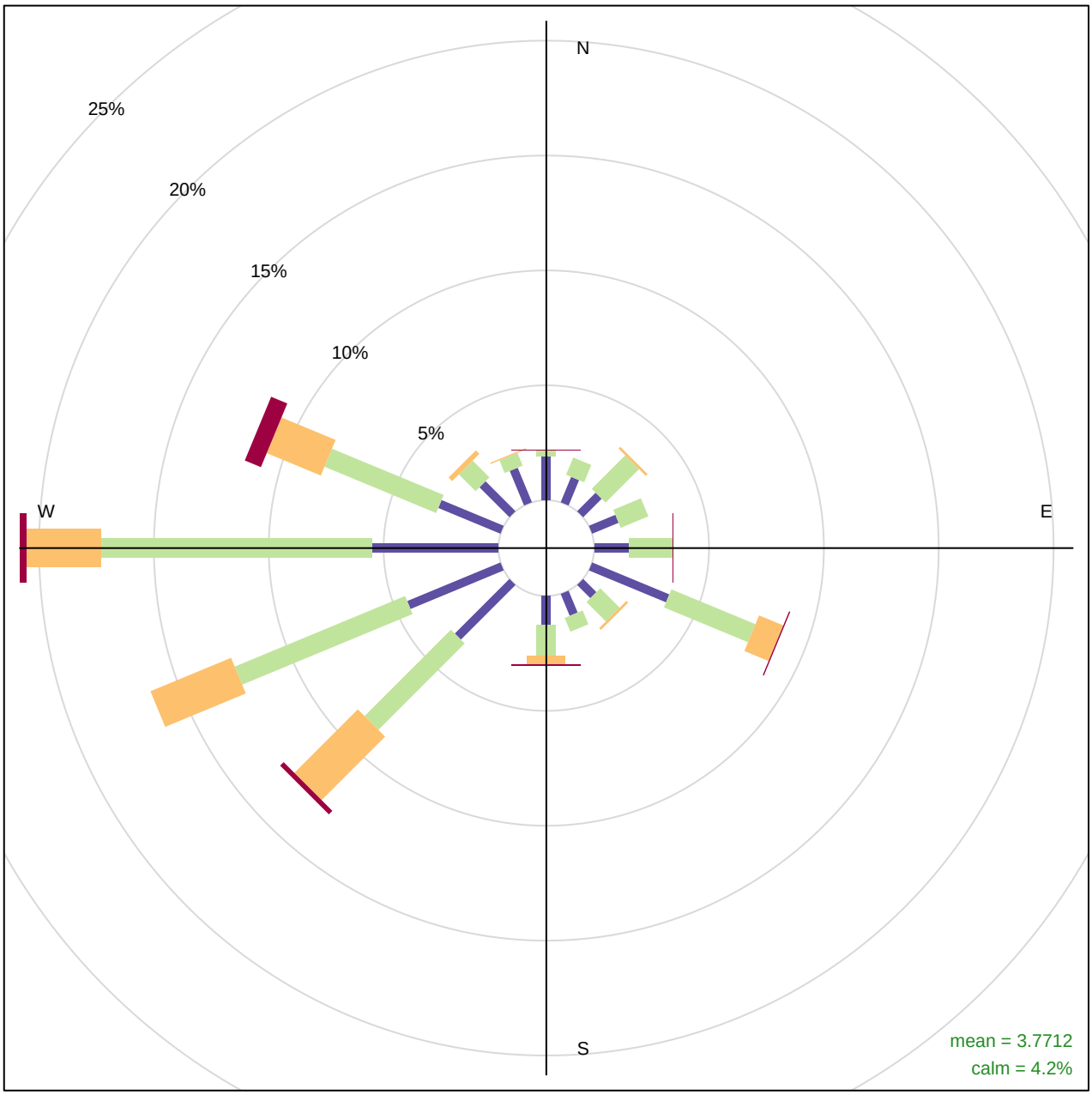
Frequency of counts by wind direction (%)

Taree AP daytime windrose, Autumn



Frequency of counts by wind direction (%)

Taree AP daytime windrose, Winter

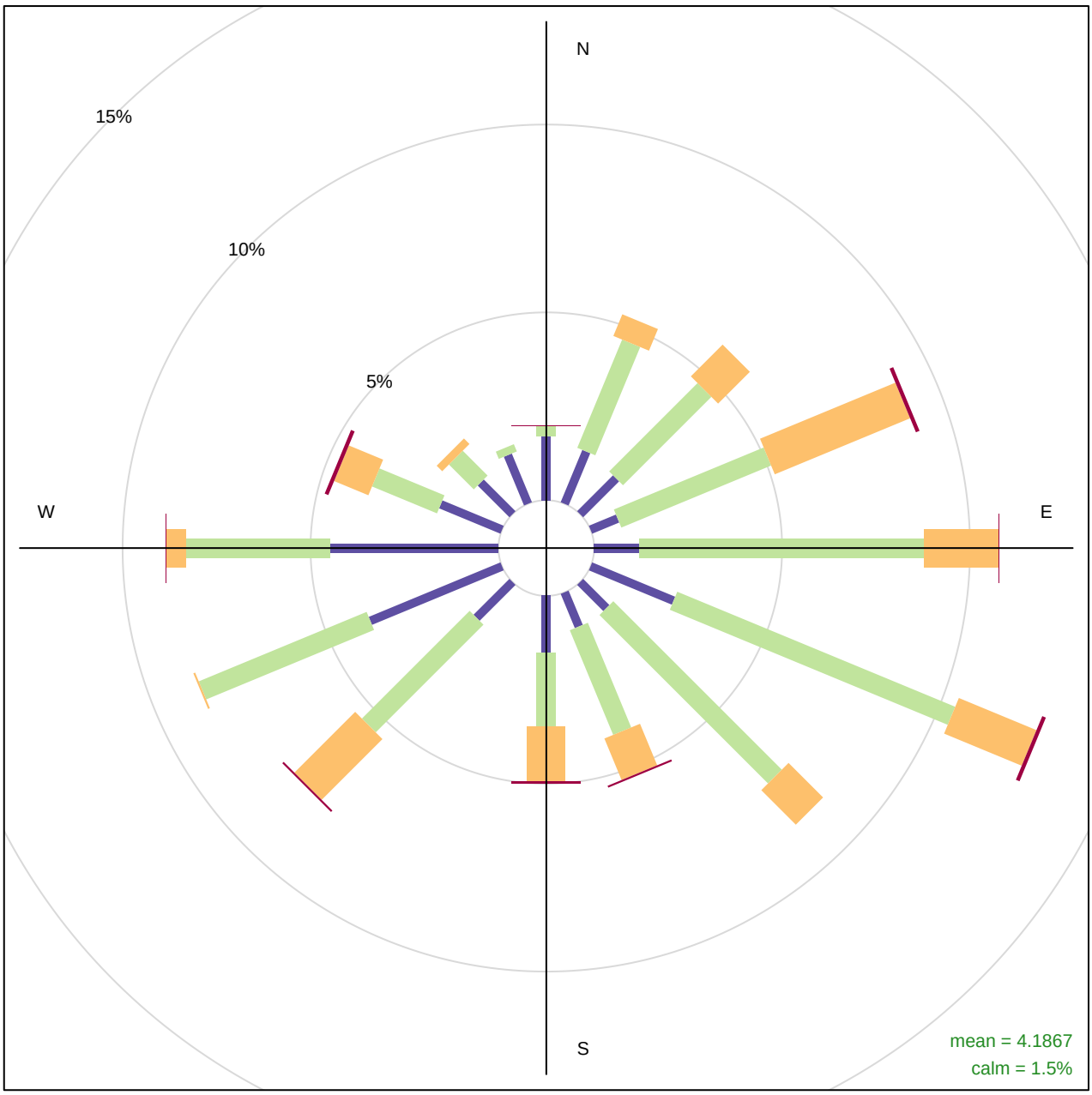


0 to 3 | 3 to 6 | 6 to 9 | 9 to 11.39

(m s^{-1})

Frequency of counts by wind direction (%)

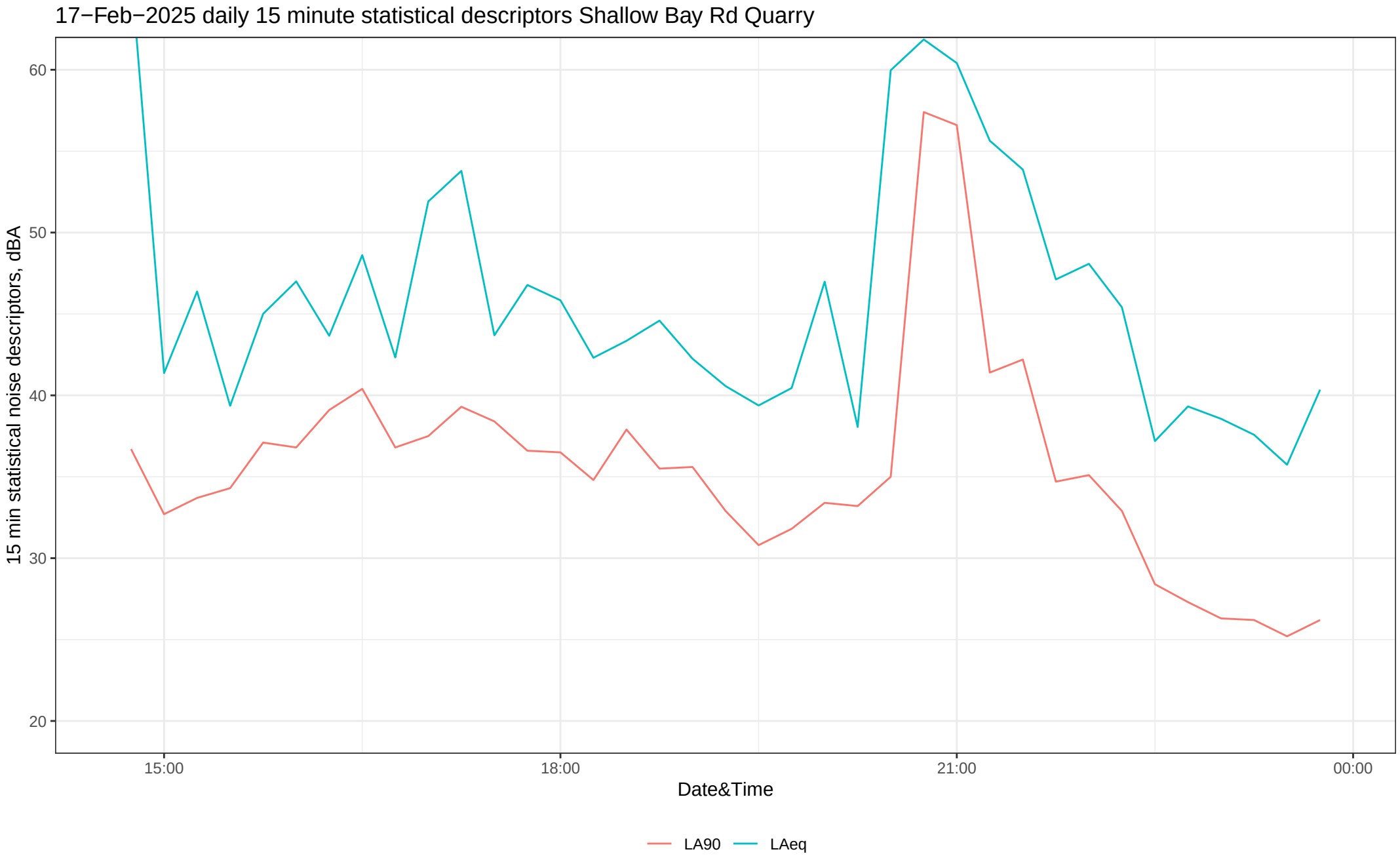
Taree AP daytime windrose, Spring

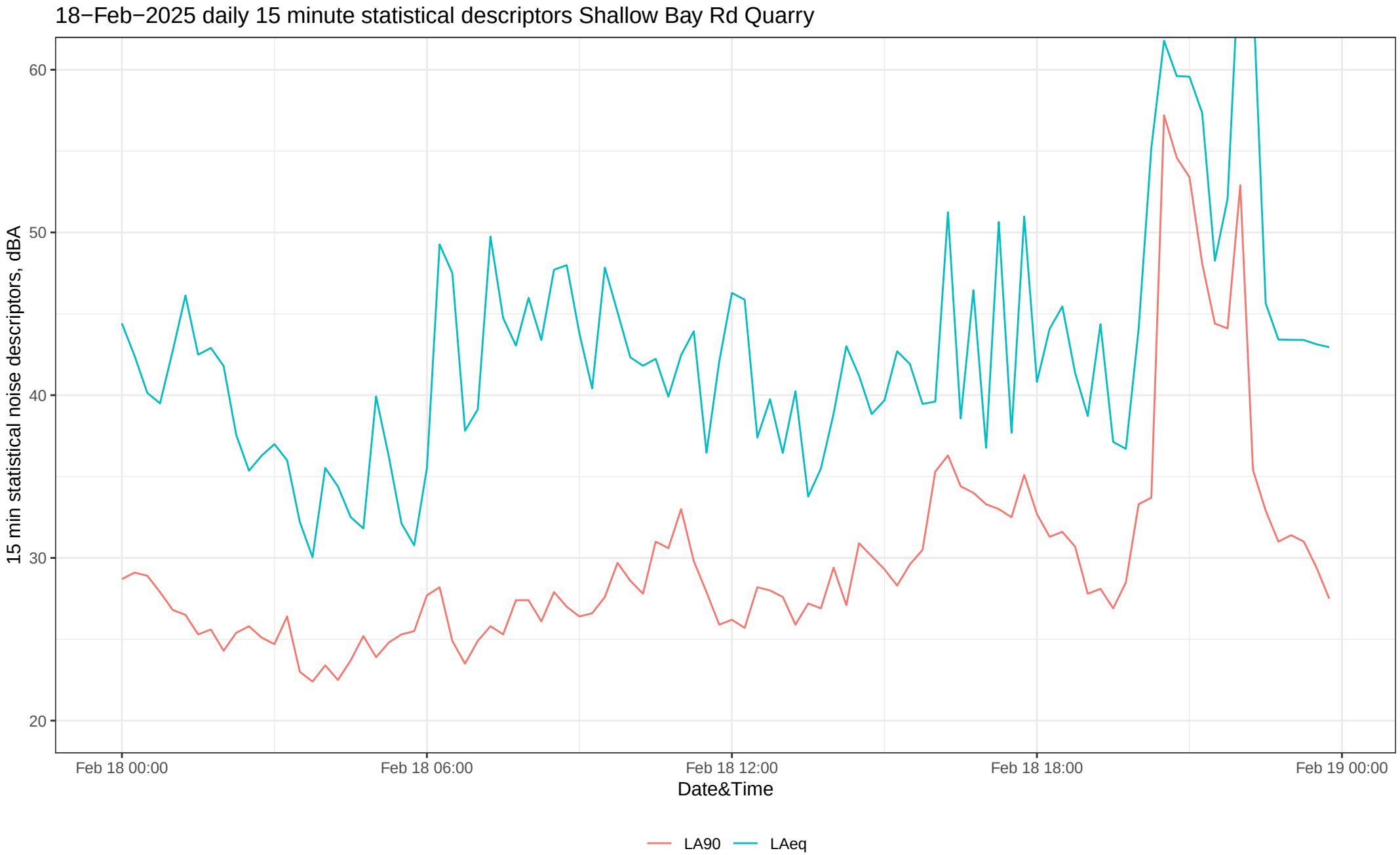


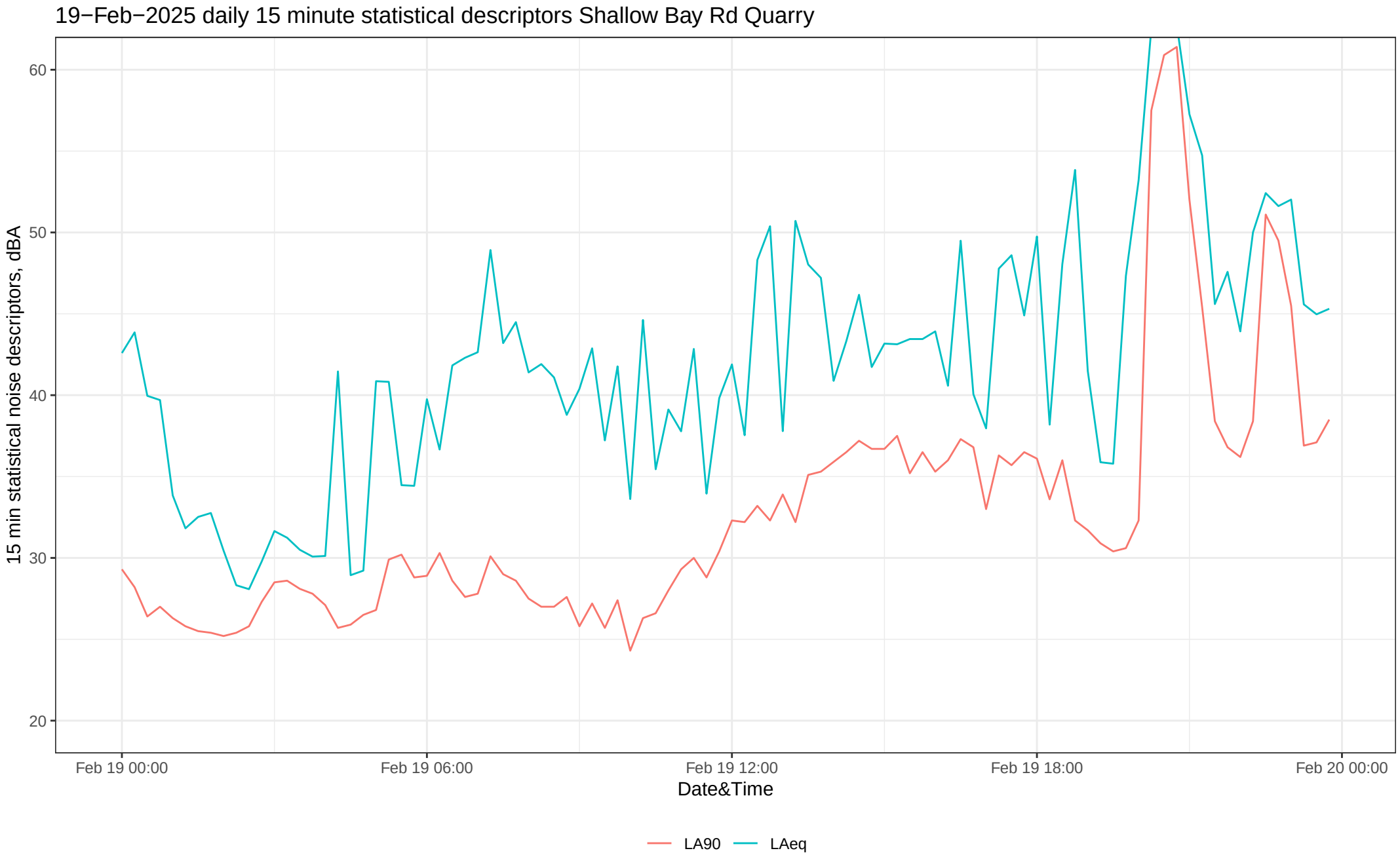
Frequency of counts by wind direction (%)

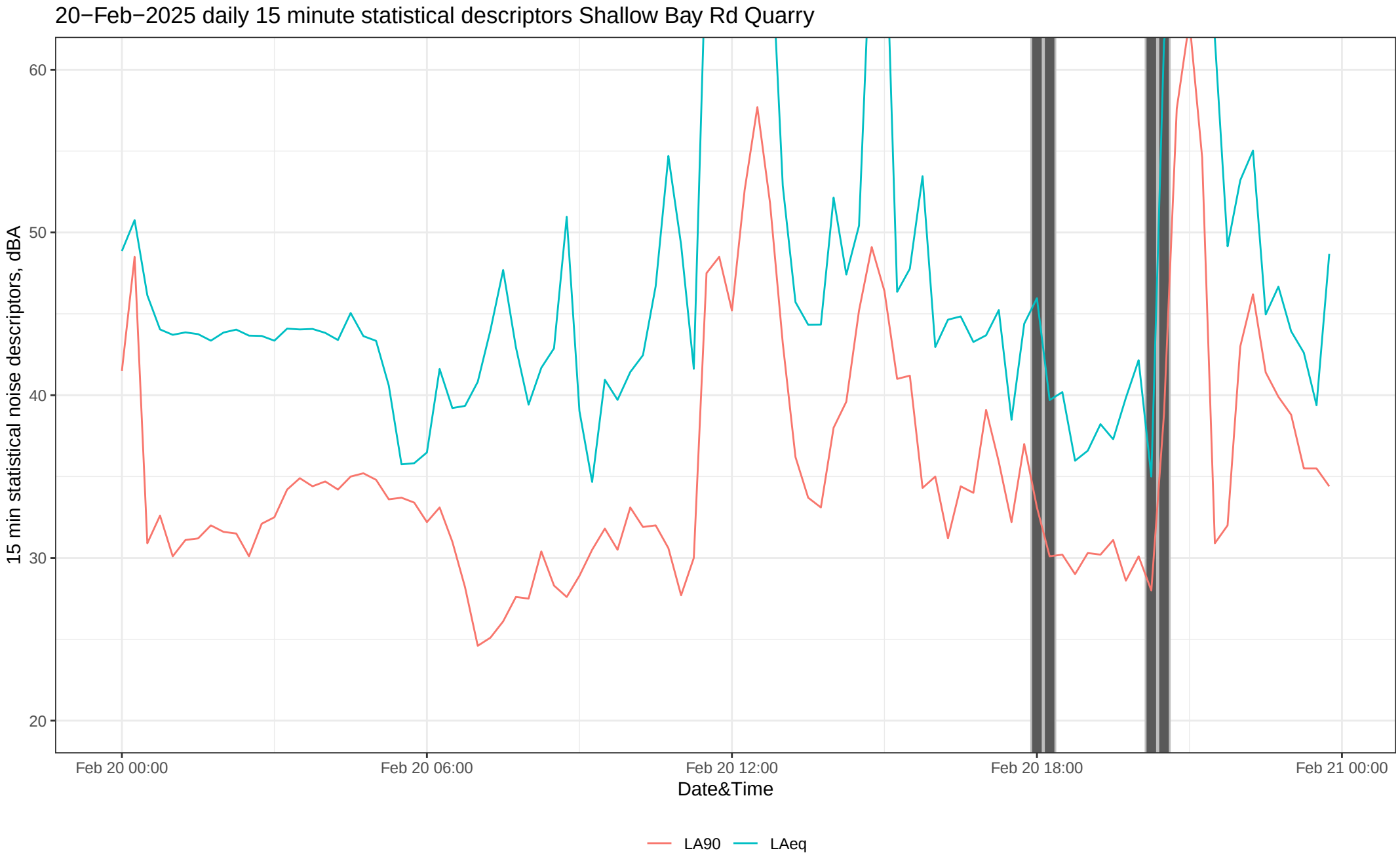
Appendix E

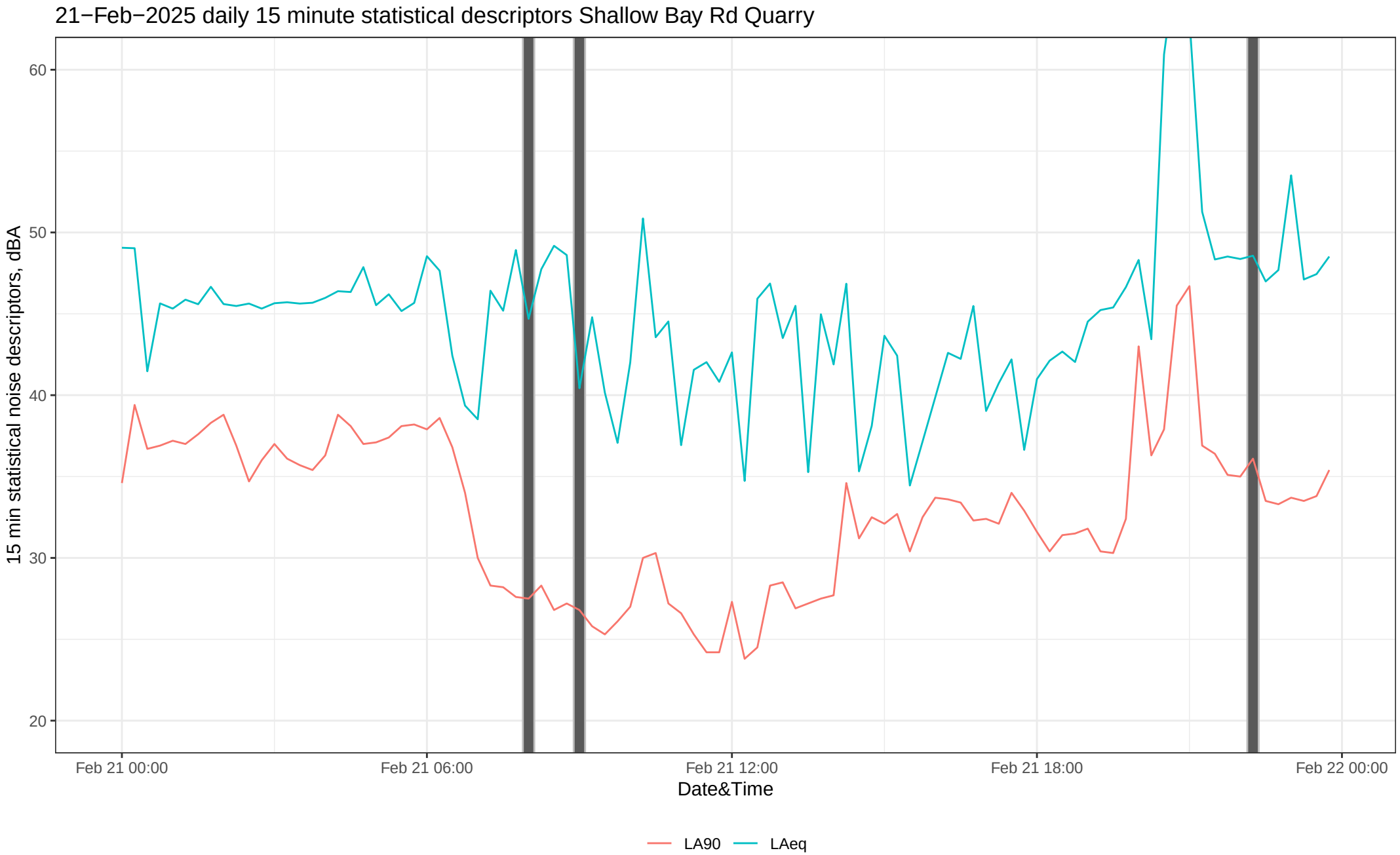
Unattended background monitoring noise levels

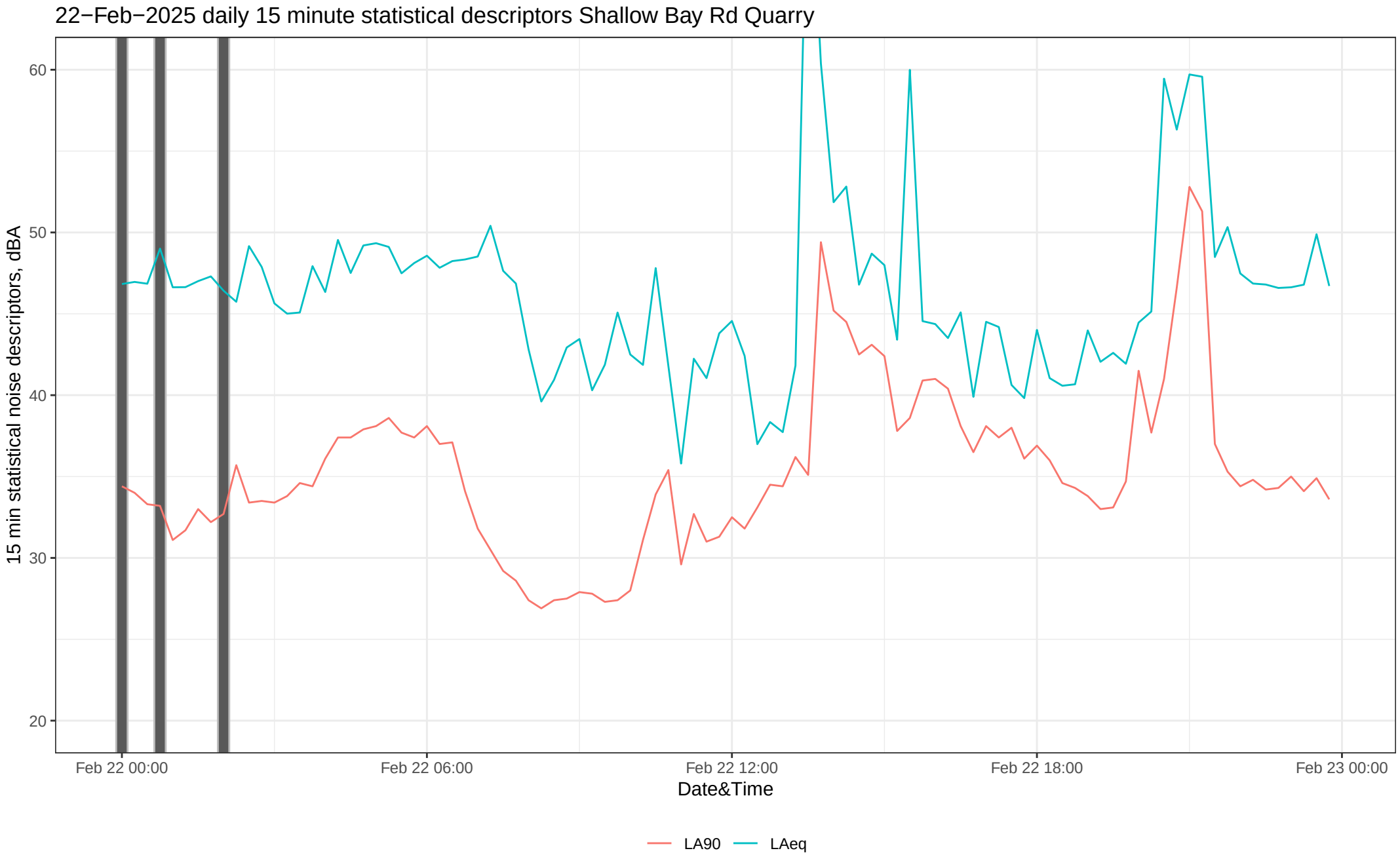

17−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
15:00
18:00
21:00
00:00
Date&Time
LA90
LAeq

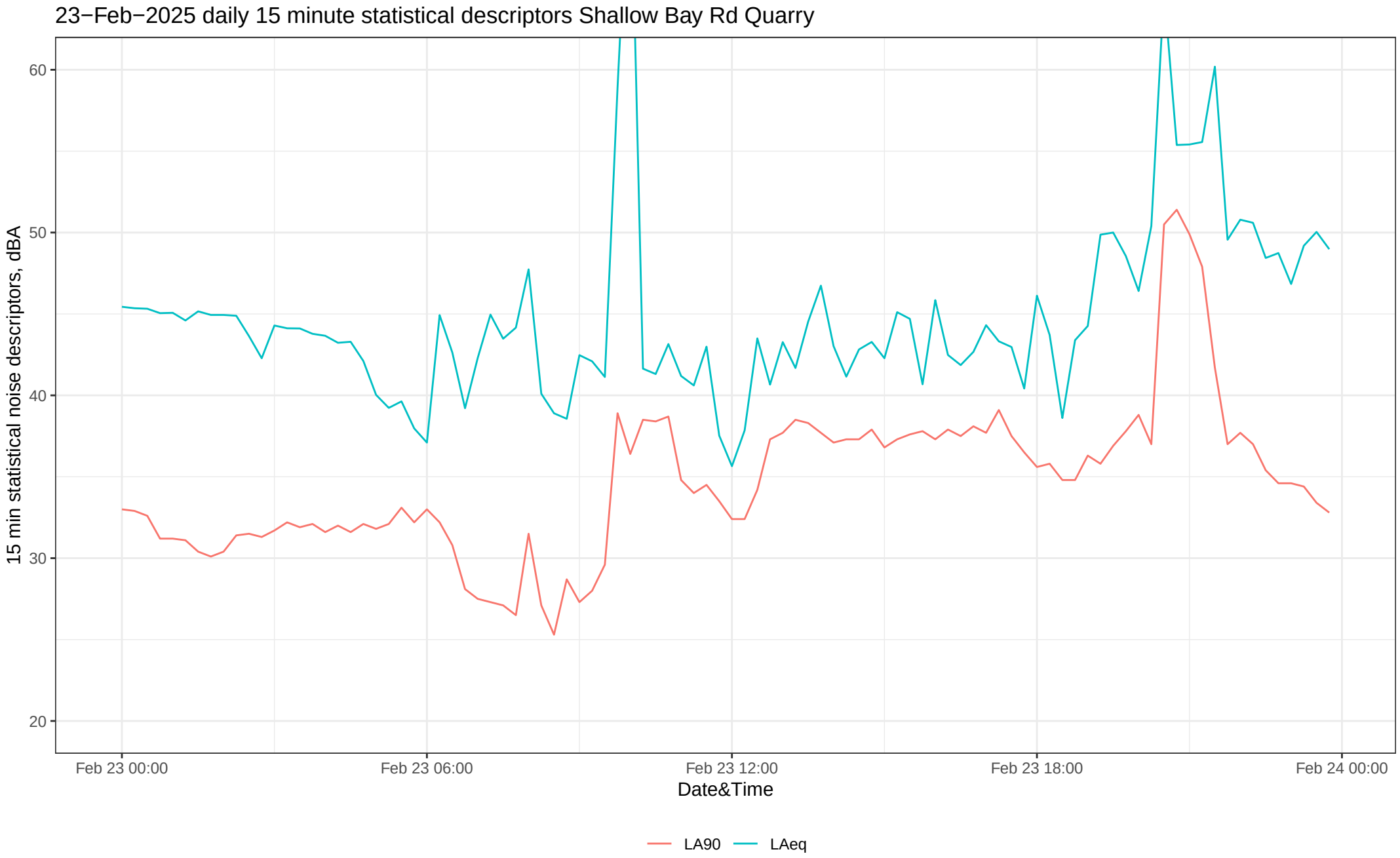

18−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
Feb 18 00:00
Feb 18 06:00
Feb 18 12:00
Feb 18 18:00
Feb 19 00:00
Date&Time
LA90
LAeq

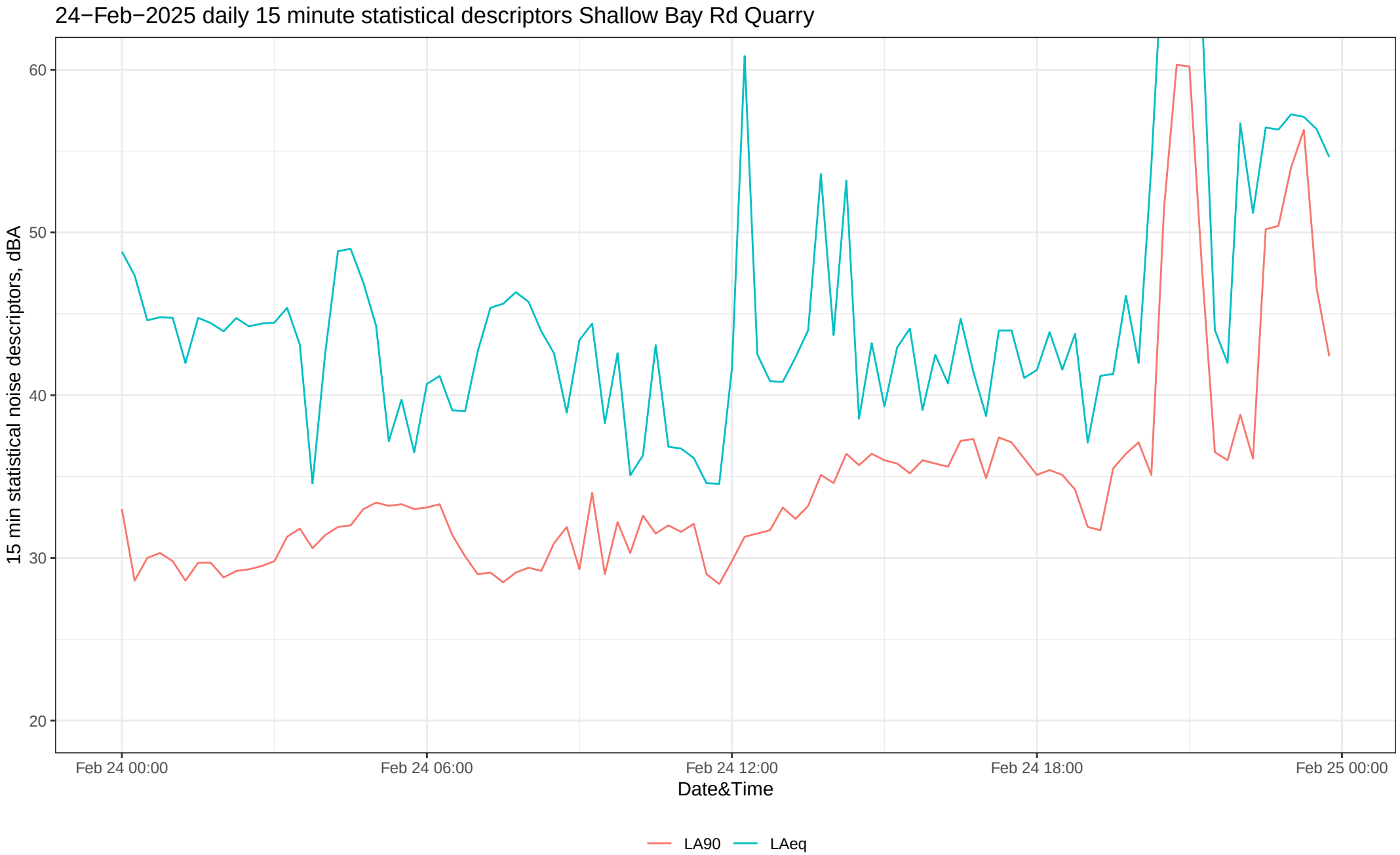

19−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
Feb 19 00:00
Feb 19 06:00
Feb 19 12:00
Feb 19 18:00
Feb 20 00:00
Date&Time
LA90
LAeq

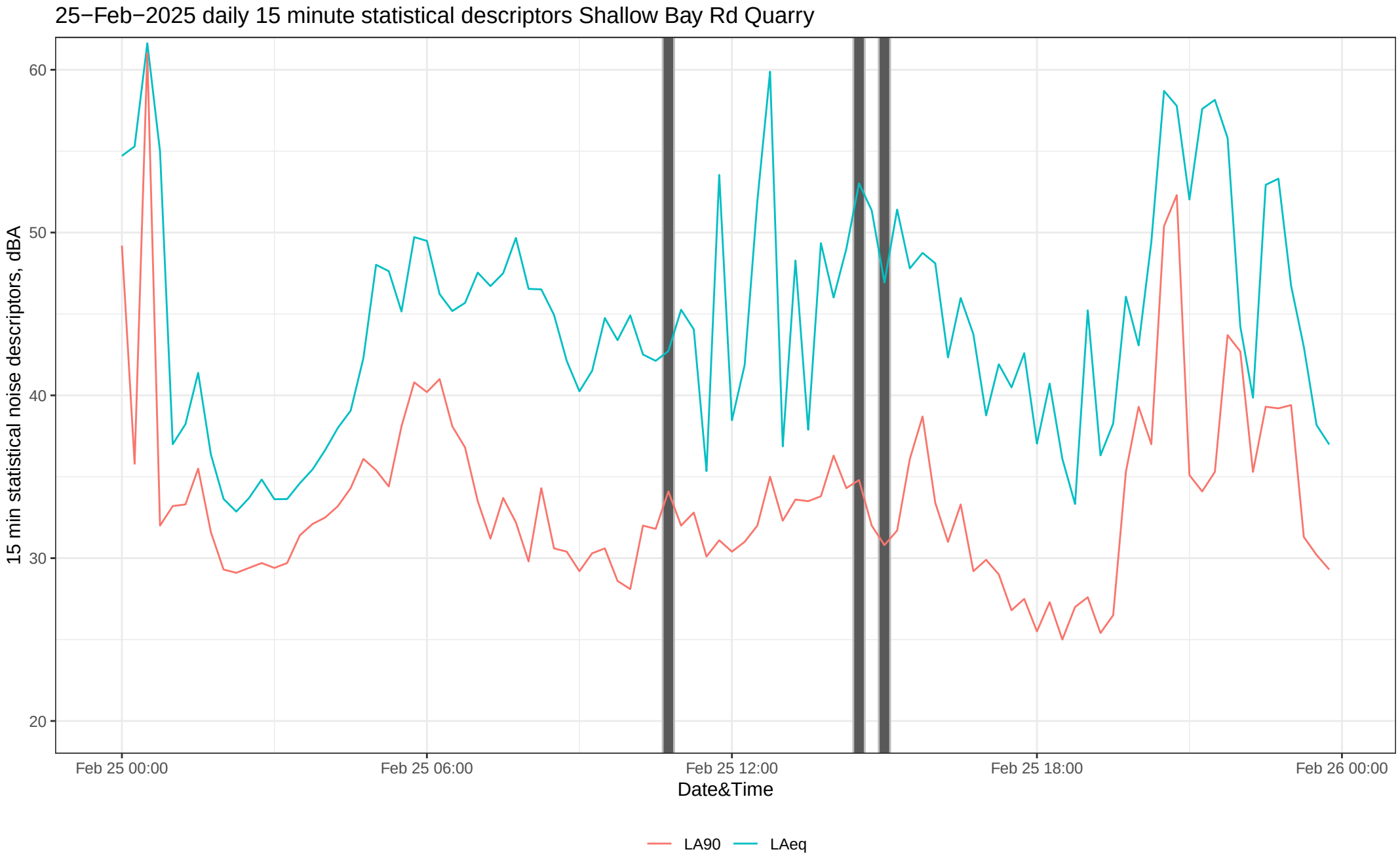

20−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
Feb 20 00:00
Feb 20 06:00
Feb 20 12:00
Feb 20 18:00
Feb 21 00:00
Date&Time
LA90
LAeq

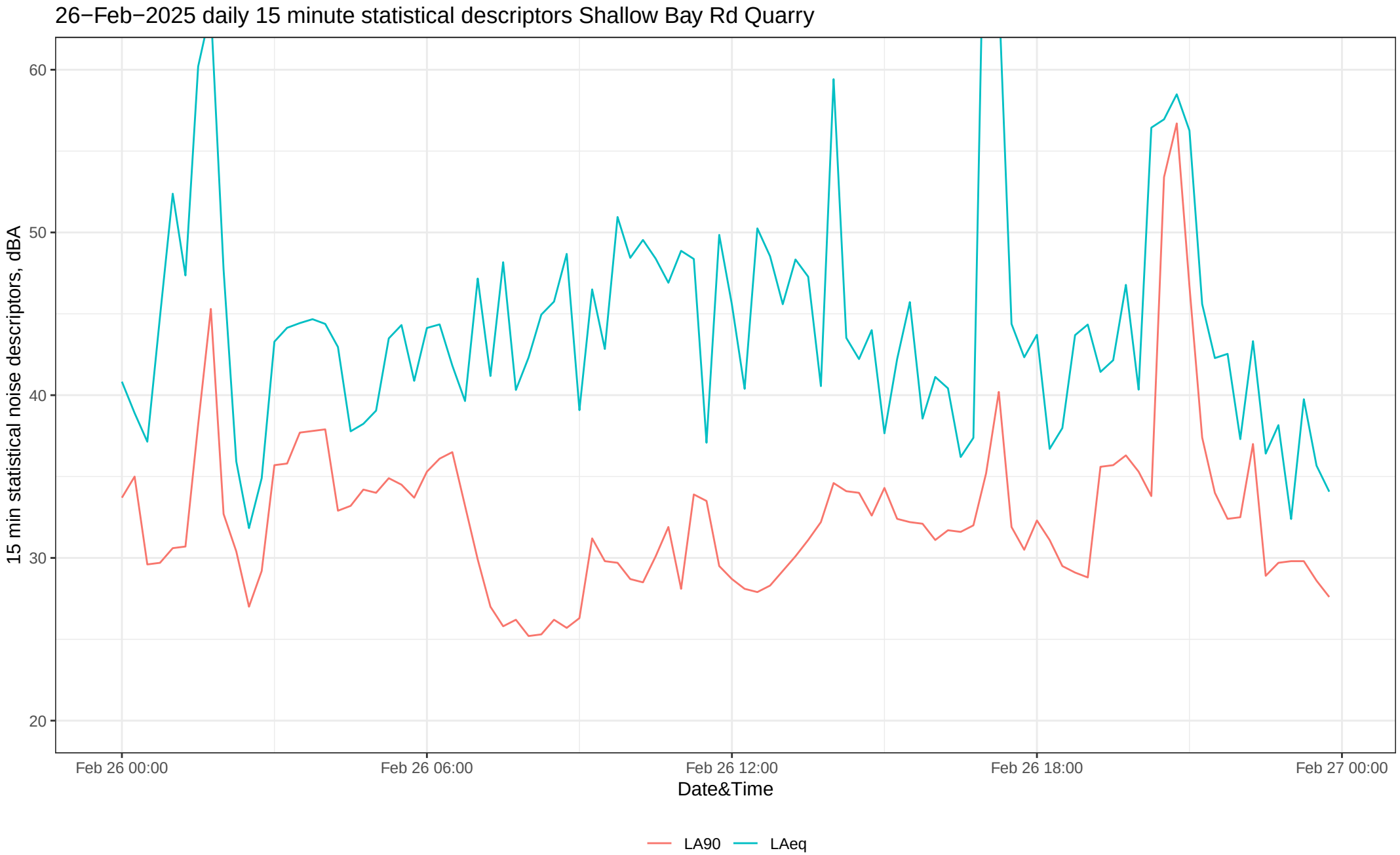

21−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
Feb 21 00:00
Feb 21 06:00
Feb 21 12:00
Feb 21 18:00
Feb 22 00:00
Date&Time
LA90
LAeq

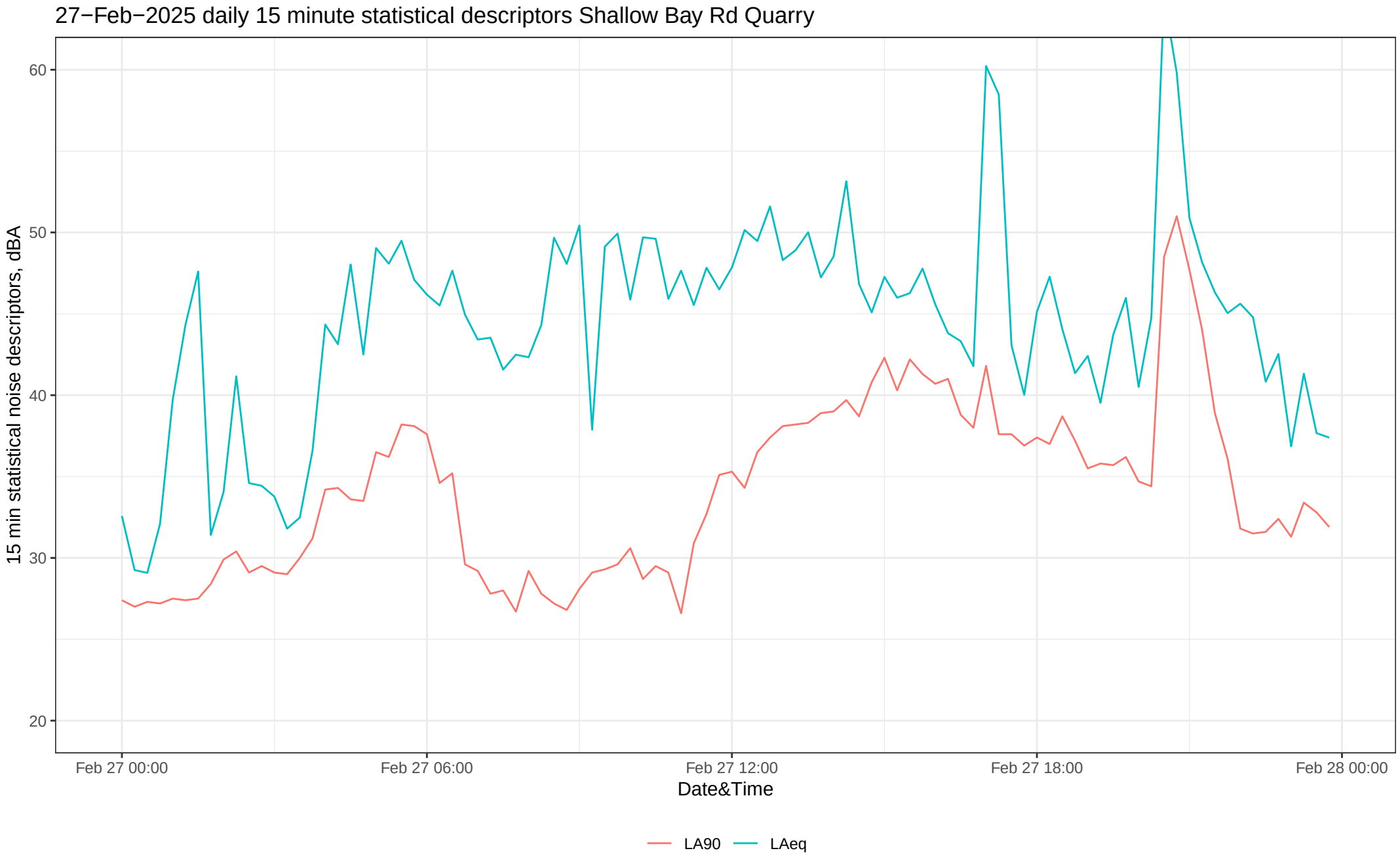

22−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
Feb 22 00:00
Feb 22 06:00
Feb 22 12:00
Feb 22 18:00
Feb 23 00:00
Date&Time
LA90
LAeq

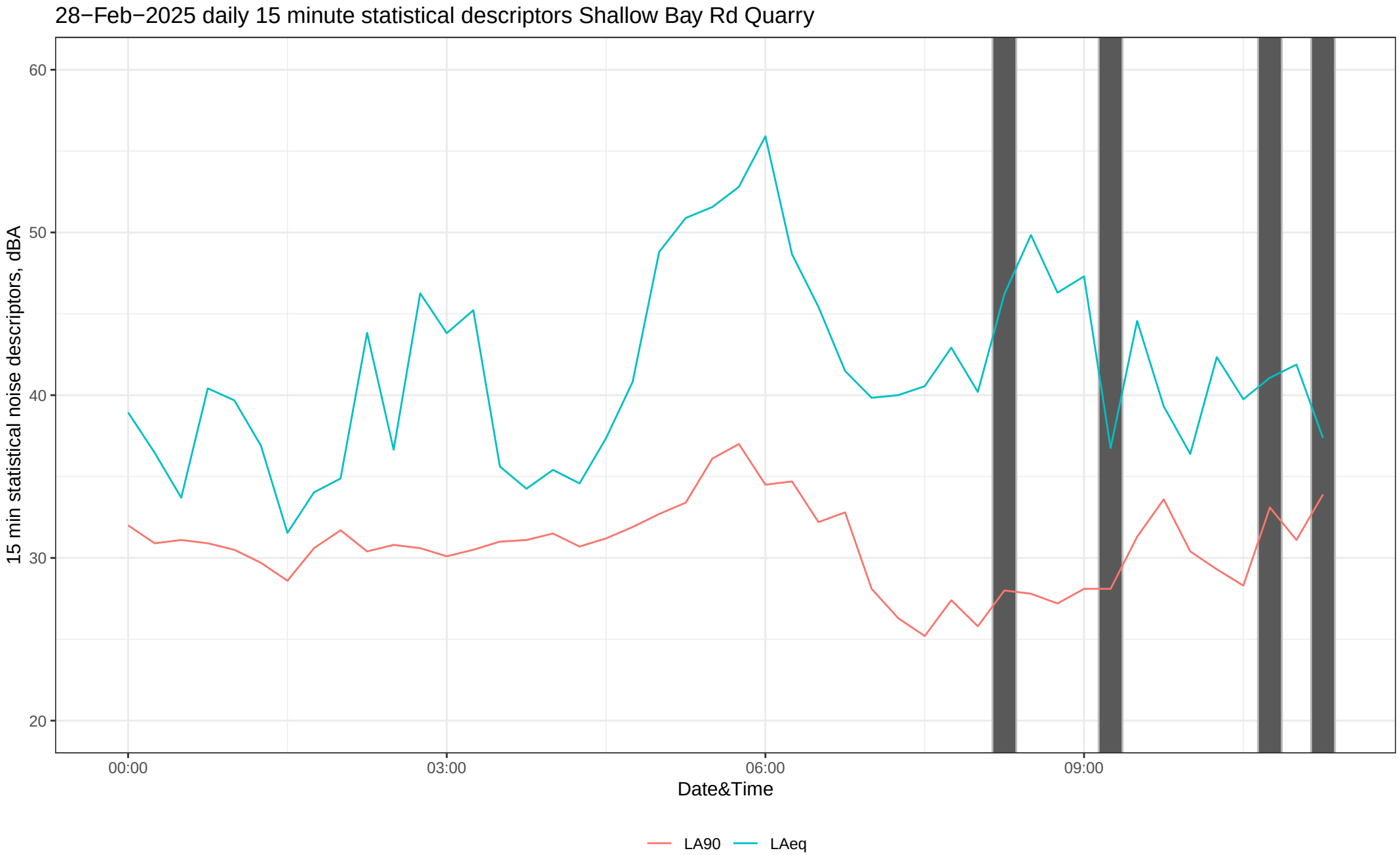

23−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
Feb 23 00:00
Feb 23 06:00
Feb 23 12:00
Feb 23 18:00
Feb 24 00:00
Date&Time
LA90
LAeq


24−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
Feb 24 00:00
Feb 24 06:00
Feb 24 12:00
Feb 24 18:00
Feb 25 00:00
Date&Time
LA90
LAeq


25−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
Feb 25 00:00
Feb 25 06:00
Feb 25 12:00
Feb 25 18:00
Feb 26 00:00
Date&Time
LA90
LAeq


26−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
Feb 26 00:00
Feb 26 06:00
Feb 26 12:00
Feb 26 18:00
Feb 27 00:00
Date&Time
LA90
LAeq


27−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
Feb 27 00:00
Feb 27 06:00
Feb 27 12:00
Feb 27 18:00
Feb 28 00:00
Date&Time
LA90
LAeq


28−Feb−2025 daily 15 minute statistical descriptors Shallow Bay Rd Quarry
15 min statistical noise descriptors, dBA
60
50
40
30
20
00:00
03:00
06:00
09:00
Date&Time
LA90
LAeq