Prepared for
Sydney Water
ABN: 49 776 225 038

North West Treatment Hub

Compliance Upgrade - Noise and Vibration Assessment

09-Aug-2021
North West Treatment Hub
Doc No. 60659367-RPNV-01_C

aecom.com

Delivering a better world

North West Treatment Hub

Compliance Upgrade - Noise and Vibration Assessment

Client: Sydney Water

ABN: 49 776 225 038

Prepared by

AECOM Australia Pty Ltd
Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com
ABN 20 093 846 925

09-Aug-2021

Job No.: 60659367

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

Quality Information

Document North West Treatment Hub

Ref 60659367

Date 09-Aug-2021

Prepared by Geoff Lucas

Reviewed by Gayle Greer

Revision History

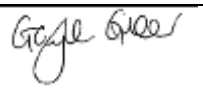
Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	02-Jul-2021	Draft for Client Review	Gayle Greer Acoustics Team Leader – NSW	GG
B	13-Jul-2021	Updated Client Comments	Gayle Greer Acoustics Team Leader – NSW	GG
C	09-Aug-2021	Updated Minor Comments	Gayle Greer Acoustics Team Leader – NSW	

Table of Contents

Executive Summary

A construction and operational Noise and Vibration Impact Assessment has been completed for the proposed upgrade of the North West Treatment Hub (NWH). This assessment considers upgrades to the Castle Hill WRP, Rouse Hill WRP and Riverstone WWTP. The upgrades are required to meet the current EPL compliance requirements.

Nearby noise and vibration sensitive receivers were identified. Attended and unattended noise measurements were completed to characterise the existing noise environment. The measured noise levels were used to establish operational criteria and construction noise management levels.

Construction impacts

The construction works are expected to be undertaken during standard construction hours only. Construction work packages have been developed in consultation with Sydney Water and the proposed equipment has been detailed within this report. Construction noise impacts were assessed at all nearby residential and other noise sensitive receivers.

Construction noise

The predicted construction noise levels are not expected to exceed the construction noise management levels at the closest noise sensitive receivers for the Rouse Hill WRP and Riverstone WWTP. Exceedances are predicted for the Castle Hill WRP upgrade. Construction mitigation measurements have been recommended to manage the construction noise impacts.

Construction vibration

Minimum working distances have been provided that allow for compliance with the construction vibration criteria. It is not considered likely that works would occur within the minimum working distances. If, however, vibration intensive works are required within these minimum working distances, mitigation measures to control excessive vibration have been outlined.

Construction traffic

Construction traffic noise is expected to comply with the Road Noise Policy.

Operational noise impacts

Site operational noise

During the operation of the Proposal, there may be changes to the existing noise levels. Noise levels have been assessed in accordance with the *Noise Policy for Industry.* The Castle Hill WRP, Rouse Hill WRP and Riverstone WWTP upgrades are predicted to comply with the operational noise criteria at all noise sensitive receivers.

Recommendations to control noise associated with the Castle Hill WRP upgrade have been included.

Operational road traffic noise

Vehicle movements generated by the Proposal is expected to comply with the Road Noise Policy.

1.0 Introduction

1.1 Background information

AECOM Australia Pty Ltd (AECOM) has been commissioned by Sydney Water to undertake a Noise and Vibration Impact Assessment of the construction and operation of the proposed upgrade of the North West Treatment Hub (NWH) (the Proposal).

The NWTH program of works involves compliance upgrades to the Castle Hill water recycling plant (WRP), Rouse Hill WRP and Riverstone waste water treatment plant (WWTP). The upgrades are required to meet the current EPL compliance requirements including reducing nutrient loads in treated water, improve odour, to meet overflow requirements and improve water quality.

Following compliance upgrades (addressed in this report), Rouse Hill WRP and Riverstone WWTP will be upgraded to cater for growth in the catchment. This includes a proposal for a new dedicated sludge pipeline from Castle Hill to Rouse Hill WRP, then to Riverstone WWTP for consolidated biosolids handling at Riverstone WWTP servicing the NWH catchment.

1.2 Scope

The scope of this Noise and Vibration Impact Assessment is to:

- Establish the existing background noise levels in the vicinity of the Proposal
- Establish operational noise criteria, construction noise management levels and vibration limits that would apply to the Proposal
- Predict construction noise and vibration levels at nearby residential and other sensitive receivers due to the Proposal
- Predict operational noise levels at nearby noise sensitive receivers due to operation of the Proposal
- Predict noise levels from additional off-site traffic generated by both the operation and construction of the Proposal
- Assess the operational noise in accordance with the established environmental noise emission criteria and provide indicative noise control measures where necessary
- Review the potential impacts of construction noise and vibration in relation to identified sensitive sites. Determine in principle mitigation measures if required including silencing treatment of mechanical and mobile plant, management of mechanical and mobile plant, community consultation and/or other noise mitigation and management measures
- Assess road traffic noise arising from additional traffic generation as a result of operation and construction of the Proposal and if necessary, recommend management and mitigation measures.

1.3 Policies and Guidelines

The following policies and guidelines are relevant for this assessment:

- *Interim Construction Noise Guideline* (ICNG), Department of Environment and Climate Change, 2009
- *Assessing Vibration: A Technical Guideline* (AVATG), Department of Environment and Conservation, 2006
- *NSW Road Noise Policy* (RNP), Department of Environment, Climate Change and Water, 2011
- *Noise Policy for Industry* (NPfI), Environment Protection Authority, 2017
- *Industrial Noise Policy (INP),* Environment Protection Authority, 2000
- *Construction Noise and Vibration Strategy* (CNVS), Transport for NSW, 2019

- DIN Standard 4150: Part 3 1999 *Structural Vibration in Buildings - Effects on Structures*, 1999
- British Standard 7385: Part 2 1993 *Evaluation and Measurement of Vibration in Buildings*, 1993
- British Standard 6472: Part 1 2008 *Evaluation of Human Exposure to Vibration in Buildings*, 2008
- Australian Standard AS 2436-2010, *Guide to noise and vibration control on construction, demolition and maintenance sites*, 2010
- British Standard 5228: Part 1 2009 *Code of practice for noise and vibration control on construction and open sites*, 2009.

Definitions for acoustic terminology used within this report can be found in Appendix A.

2.0 Existing Acoustic Environment

2.1 Site description

The Proposal sites are located within mainly suburban environments. The closest residential receivers are located:

- to the east and west of the Castle Hill WRP. The closest receivers are approximately 55 m from the site. An active recreation area is also located to the south of the Castle Hill WRP.
- to the north-west, south-west and south-east of the Rouse Hill WRP. The closest receivers are approximately 200 m from the site. A childcare centre, two places of worship and various commercial buildings are also located within 400 m of the Rouse Hill WRP site.
- to the north and east of the Riverstone WWTP. The closest receivers are approximately 320 m from the site.

The location of the WRPs and WWTP is shown below in Figure 1.

Figure 1 Site Map

2.1.1 Heritage items

No known heritage items such as rock shelters or structures are located in the vicinity of the WRPs and WWTP. There are aboriginal heritage deposits (in soils) near the Rouse Hill WRP however this project is unlikely to impact this.

2.2 Noise measurement methodology

Long term unattended and short term attended measurements were undertaken to establish the existing ambient and background noise environment at potentially affected receivers.

2.2.1 Unattended noise measurement methodology

Long term unattended noise monitoring was conducted at eight locations between 27 May and 9 June 2021. One noise logger was placed within each NCA at a representative location at the properties indicated in Table 1. The noise loggers were calibrated prior to and after the monitoring period with a drift in calibration not exceeding ± 0.5 dB.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of "*AS IEC 61672.1-2004 Electroacoustics - Sound level meters - Specifications*" and were within their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period (i.e. calibration in the last two years).

Table 1 Noise monitoring details

Logger[1]	NCA	Location	Model	Serial number
1	1 – Riverstone WWTP	43 Clyde Street, Vineyard	Rion NL52	00164396
3	3 – Rouse Hill WRP	18 Nelson Road, Box Hill	Rion NL52	00164395
4	4 – Rouse Hill WRP	Lot 2/DP 839874	Rion NL52	00175550
7	7 – Castle Hill WRP	19 Woodstream Crescent, Kellyville	Rion NL52	00175537
8	8 – Castle Hill WRP	15 Knightsbridge Place, Castle Hill	Rion NL52	00164393

Notes:

1. Data from noise loggers 2, 5 and 6 will be included in a future report considering the growth package

In accordance with the EPA's NSW *Noise Policy for Industry*, noise monitoring affected by adverse weather conditions or extraneous noise events was excluded from the monitoring data. The *Noise Policy for Industry* advises that data may be affected where adverse weather, such as wind speeds higher than 5 m/s or rain, occurs. Weather data were acquired from the Bureau of Meteorology's Richmond RAAF and Sydney Olympic Park weather stations (station numbers 067105 and 066212).

The loggers measured the noise levels over the sample period and then determined L_{A1}, L_{A10}, L_{A90}, and L_{Aeq} levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} noise levels are the levels exceeded for 1%, 10% and 90% of the measurement period respectively. The L_{A90} is taken as the background level. The L_{A1} is indicative of the maximum noise levels due to individual noise events such as the pass-by of a heavy vehicle. The L_{Aeq} level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The L_{A90} noise levels were analysed to determine a single assessment background level (ABL) for each day, evening and night period in accordance with the *Noise Policy for Industry* for each monitoring location. The ABL is established by determining the lowest ten-percentile level of the L_{A90} noise data acquired over each period of interest. Table 2 presents individual ABLs for each day's assessment periods. The background noise level or rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring period.

2.2.2 Attended noise measurement methodology

Attended noise measurements were conducted at the eight unattended monitoring locations on 27 and 28 May 2021 during the daytime. Each measurement was conducted over a 15 minute period. Weather conditions were overcast on the days of monitoring, with no wind.

Attended noise measurements were conducted using Brüel & Kjær Type 2250 sound level meter. The sound level meter used is designated as a Type 1 instrument and has accuracy suitable for laboratory and field use. The sound level meter was calibrated before and after the measurements with a no drift in calibration exceeding ±0.5 dB.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of "*AS IEC 61672.1-2004 Electroacoustics - Sound level meters - Specifications*" and were within their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period (i.e. calibration in the last two years).

2.3 Site operational noise

2.3.1 Existing situation

AECOM undertook noise measurements and observations at Riverstone WWTP, Rouse Hill WRP and Castle Hill WRP on 27 May 2021. Appendix B presents the sound pressure levels that were measured.

2.4 Noise measurement results

2.4.1 Unattended noise measurement results

Table 2 presents the existing overall representative L_{Aeq} ambient noise level and the background L_{A90} noise levels for the day, evening and night-time periods, in accordance with the *Noise Policy for Industry.* The overall representative L_{Aeq} noise levels were determined by logarithmically averaging each assessment period for the entire monitoring period.

In total 13 days of logging were completed, however some periods of noise logging were excluded due to adverse weather. The data were processed in accordance with Fact Sheet B of the *Noise Policy for Industry*.

The results for each day and the graphical noise logging results are presented in Appendix C.

Table 2 Existing background (L_{A90}) and ambient (L_{Aeq}) noise levels

Location and NCA	L_{A90} background rating noise level, dB(A)			Log average noise (ambient) L_{Aeq} levels dB(A)		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
1 – Riverstone WWTP	37	33	30[2]	57	45	47
3 – Rouse Hill WRP	44	43	36	55	51	50
4 – Rouse Hill WRP	41	35	30[2]	51	40	40
7 – Castle Hill WRP	35[3]	33[4]	30[2]	49	43	40
8 – Castle Hill WRP	35[3]	30[4]	30[2]	46	41	39

Notes:

1. *Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays & Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday & Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays & Public Holidays.*
2. *Night-time RBL adjusted to the minimum RBL of 30 dB(A) in accordance with the Noise Policy for Industry*
3. *Daytime RBL adjusted to the minimum RBL of 35 dB(A) in accordance with the Noise Policy for Industry*
4. *Evening RBL adjusted to the same as the daytime measured RBL in accordance with the Noise Policy for Industry. This is because the community generally expects greater control of noise during the more sensitive evening periods than during the daytime period.*

2.4.2 Attended noise measurements

The results of the attended noise monitoring are presented in Table 3. The daytime measurements indicated that residential receivers are generally affected by road traffic noise and natural sounds.

Table 3 Attended noise measurements

Logger and NCA	Date	Time	L_{Aeq} dB(A)	L_{A90} dB(A)	Comments
1 – Riverstone WWTP	27/05/2021	10:33 AM	61	38	Distant road traffic noise audible on Hamilton street. Truck pass by on Hamilton Street 52 dB(A). Bird calls 43 dB(A). Dog barking occasionally 83 dB(A). Car pass by on Hamilton street 46 dB(A). Some construction noise audible in the distance. Sunny weather, no wind.
3 – Rouse Hill WRP	27/05/2021	11:58 AM	52	43	Background dominated by road traffic noise on Nelson Road 48 - 55 dB(A). Horse, sheep, chickens, roosters and 3 dogs roaming freely and contribute to the ambient noise levels, 44 dB(A). Rooster crowing 53 dB(A). Bird calls audible. Truck pass by on Nelson Road 65 dB(A) . Sunny weather, no clouds, no wind.
4 – Rouse Hill WRP	27/05/2021	1:10 PM	55	45	Ambient noise dominated by bird calls 51 dB(A). Distant construction noise audible (hammering and drilling) 56 dB(A).
7 – Castle Hill WRP	27/05/2021	3:31 PM	46	40	Ambient noise levels dominated by bird calls, rustling leaves and barking dogs at the property and nearby. Bird calls 50 – 53 dB(A).
8 – Castle Hill WRP	27/05/2021	4:19 PM	54	38	Ambient noise levels dominated by local road traffic noise and bird calls. Background with bird calls 54 – 61 dB(A). Car pass by 50 dB(A). Sunny weather, mild breeze. Background 39-41 dB(A).

2.5 Existing noise environment summary

Noise catchment areas (NCA) have been applied to the project area, combining areas with a similar noise environment. The location of the NCAs is shown in Figure 1. A description of the noise environment for each NCA has been provided below.

Table 4 Existing noise environment

NCA	Noise environment description
1 – Riverstone WWTP	Local traffic noise audible. Natural sounds such as wind and bird noise are also audible along with some construction noise.
3 – Rouse Hill WRP	Dominated by traffic noise. Natural sounds such as wind and bird noise are also audible along with some animal noise.
4 – Rouse Hill WRP	Natural sounds dominate. Also some distant construction noise.
7 – Castle Hill WRP	Natural sounds dominate. Some local traffic noise audible.
8 – Castle Hill WRP	Natural sounds dominate. Some local traffic noise audible.

3.0 Construction Noise and Vibration Criteria

3.1 Construction activity noise criteria

3.1.1 Interim Construction Noise Guideline

The potential risk of adverse impact of construction noise on a receiver is determined by the extent of its emergence above the existing background noise level, the duration of the event and the characteristics of the noise.

The *Interim Construction Noise Guideline* is a NSW Government document that sets out ways to deal with the impacts of construction noise on residences and other sensitive land uses. It presents assessment approaches tailored to the scale of the construction project and identifies practices to minimise noise impacts. As the proposed works are expected to continue for a period of more than three weeks and are within relatively close proximity to noise sensitive receivers, a quantitative assessment, based on 'reasonable' worst case construction scenarios, has been carried out for these works.

Noise levels resulting from construction activities are predicted at nearby noise sensitive receivers (e.g. residences, schools, hospitals, places of worship, passive and active recreation areas) are compared to the levels provided in the ICNG. Where an exceedance of the management levels is predicted the ICNG advises that receivers can be considered 'noise affected' and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially affected residents of the nature of the works to be carried out, the expected noise level and duration, as well as contact details should they wish to make a complaint.

Where construction noise levels at the receiver reach 75 dB(A) residential receivers are considered to be 'highly noise affected' and the proponent should, in consultation with the community, consider restrictions to the hours of construction to provide respite periods.

The construction noise management levels (NML) for the residential and other sensitive land uses are detailed in Table 5, Table 6 and Table 7.

Table 5 ICNG Residential noise management levels

Time of day	NML, $L_{Aeq,15min}$, dB(A)[1]	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 (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after 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 works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Notes:

1. *Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.*

The ICNG defines what is considered to be feasible and reasonable as follows:

- *"Feasible*

  A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.

- *Reasonable*

  Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure."

Table 6 presents the NMLs applicable to residential receivers nearby to this development.

Table 6 Construction noise management levels – Residential receivers

Area	Period	RBL, L_{A90} dB(A)	Standard hours noise management levels, $L_{Aeq,15min}$, dB(A)	Out-of-hours noise management levels, $L_{Aeq,15min}$, dB(A)
NCA 1	Day	37	47	43
	Evening	33	-	38
	Night	30	-	35
NCA 3	Day	44	54	49
	Evening	43	-	48
	Night	36	-	41
NCA 4	Day	41	51	46
	Evening	35	-	40
	Night	30	-	35
NCA 7	Day	35	45	40
	Evening	33	-	38
	Night	30	-	35
NCA 8	Day	35	45	40
	Evening	30	-	35
	Night	30	-	35

Table 7 presents the NMLs applicable to other noise sensitive receivers such as educational facilities and places of worship and to commercial receivers.

Table 7 Construction noise management levels – Other receivers

Land use	Noise management levels, $L_{Aeq,15min}$ (applies when properties are in use)
Places of worship	55 dB(A)[1]
Childcare centres	55 dB(A)[1]
Active Recreation	65 dB(A)
Commercial premises (including offices, retail outlets)	70 dB(A)
Industrial Premises	75 dB(A)

Notes:

1. *These external management levels are based upon a 45 dB(A) internal noise management level and a 10 dB reduction from outside to inside through an open window.*

3.1.2 Sleep disturbance criteria

The ICNG requires a sleep disturbance analysis where construction works are planned to extend over more than two consecutive nights. The L_{A1} noise levels and number of expected L_{A1} noise events should be predicted in order to determine the likelihood of potential sleep disturbance.

The EPA recommends that to minimise the risk of sleep disturbance during the night-time period (10.00 pm to 7.00 am), the $L_{A1(1\ min)}$, noise level outside a bedroom window should not exceed the $L_{A90\ (15\ minute)}$ background noise level by more than 15 dB. If this screening criterion is found to be exceeded then a more detailed analysis must be undertaken and include the extent that the maximum noise level exceeds the background noise level and the number of times this is likely to happen during the night-time period.

Sleep disturbance research presented in the *Road Noise Policy* concludes that *'Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions'*. Therefore, given that an open window provides approximately 10 dB in noise attenuation from outside to inside, external noise levels of 60-65 dB(A) are unlikely to result in awakening reactions.

Based on the measured background noise levels during the night, the sleep disturbance criteria for the nearest noise sensitive residential receivers are presented in Table 8.

Table 8 Sleep disturbance criteria

Area	Background noise level (L_{A90}), dB(A)	Sleep disturbance criteria,	$L_{A1(1\ minute)}$, dB(A)
		Screening level	Awakening reaction
NCA 1	30	45	65
NCA 3	36	51	65
NCA 4	30	45	65
NCA 7	30	45	65
NCA 8	30	45	65

3.2 Construction traffic noise criteria

To assess noise impacts from construction traffic an initial screening test should be undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A), in line with the *Road Noise Policy*. Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. However, where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criterion then noise mitigation should be considered for those receivers affected. The *Road Noise Policy* does not require assessment of noise impact to commercial or industrial receivers.

Wrights Road and Drawbridge Place in Castle Hill and Withers Road, Rouse Hill provide the main access roads to the site. These roads are classified as sub-arterial and local roads are listed in Table 9. The external noise criteria are applied one metre from the external facade of an affected building.

Table 9 Roads used by construction traffic

Road	Type	Residential receivers	Estimated existing Annual Average Daily Traffic (AADT)
Wrights Road	Sub Arterial	Yes	> 2,000
Drawbridge Place	Local	Yes	< 1000
Withers Road	Sub Arterial	Yes	> 2,000

3.3 Construction vibration criteria

The relevant standards/guidelines for the assessment of construction vibration are summarised in Table 10.

Table 10 Standards/guidelines used for assessing construction vibration

Item	Standard/guideline
Structural damage	German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures (DIN 4150)
Human comfort (tactile vibration) [1]	*Assessing Vibration: A Technical Guideline* (AVATG)

Note 1: This document is based upon the guidelines contained in British Standard 6472:1992, "Evaluation of human exposure to vibration in buildings (1-80 Hz)". This British Standard was superseded in 2008 with BS 6472-1:2008 "Guide to evaluation

of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting" and the 1992 version of the Standard was withdrawn. Although a new version of BS 6472 has been published, the Environment Protection Authority still requires vibration to be assessed in accordance with the 1992 version of the Standard at this point in time.

Vibration, at levels high enough, has the potential to cause damage to structures and disrupt human comfort. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent as follows:

- continuous vibration continues uninterrupted for a defined period and includes sources such as machinery and continuous construction activities
- impulsive vibration is a rapid build up to a peak followed by a damped decay. It may consist of several cycles at around the same amplitude, with durations of typically less than two seconds and no more than three occurrences in an assessment period. This may include occasional dropping of heavy equipment or loading activities
- intermittent vibration occurs where there are interrupted periods of continuous vibration, repeated periods of impulsive vibration or continuous vibration that varies significantly in magnitude. This may include intermittent construction activity, impact pile driving, jack hammers.

3.3.1 Structural damage

At present, no Australian Standards exist for the assessment of building damage caused by vibration.

The German standard (DIN 4150) provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in Table 11. DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits would not necessarily result in damage.

Table 11 DIN 4150: Structural damage safe limits for building vibration

Group	Type of structure	At foundation - Less than 10 Hz	At foundation - 10 Hz to 50 Hz	At foundation - 50 Hz to 100 Hz[1]	Vibration at the horizontal plane of the highest floor for all frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20 mm/s	20 to 40 mm/s	40 to 50 mm/s	40 mm/s
2	Dwellings and buildings of similar design and/or use	5 mm/s	5 to 15 mm/s	15 to 20 mm/s	15 mm/s
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order/heritage listed)	3 mm/s	3 to 8 mm/s	8 to 10 mm/s	8 mm/s

Notes:

1. At frequencies above 100 Hz, the values given in this column may be used as minimum values

3.3.2 Human comfort

The assessment of intermittent vibration outlined in the NSW EPA guideline A*ssessing Vibration: A Technical Guideline* (AVTG) is based on Vibration Dose Values (VDVs). The VDV accumulates the vibration energy received over the daytime and night-time periods.

Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in Table 12. The VDV criteria are based on the likelihood that a person would be annoyed by the level of vibration over the entire assessment period.

Table 12 Preferred and maximum vibration dose values for intermittent vibration (m/s$^{1.75}$)

Location	Daytime[1]		Night-time[1]	
	Preferred	Maximum	Preferred	Maximum
Critical areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes:
1. Day is defined as 7:00 am to 10:00 pm. Night is defined as 10:00 pm to 7:00 am

4.0 Operational Noise Criteria

4.1 Noise Policy for Industry

The NSW *Noise Policy for Industry* (NPfI) provides guidance in relation to acceptable noise limits for industrial noise emissions, which includes, but is not limited to, noise emissions from mechanical plant.

The assessment procedure in the *Noise Policy for Industry* has two components:

- controlling **intrusive** noise impacts in the short term for residences
- maintaining noise level **amenity** for residences and other land uses.

Both components are assessed at the boundary of the noise sensitive receiver site, or if the site boundary is more than 30 m from the noise sensitive building, a distance of 30 m from the noise sensitive building.

4.1.1 Intrusive noise impacts

The *Noise Policy for Industry* states that the noise from any single noise source should not be greatly above the prevailing background noise level. Industrial noise sources are generally considered acceptable if the A-weighted equivalent continuous sound pressure level of noise from the source, measured over a 15 minute period ($L_{Aeq,15\ min}$) does not exceed the Rating Background Level (RBL) by more than 5 dB(A) for the period under consideration. This is termed the Intrusiveness Criterion.

The RBL is the background noise level to be used for assessment purposes and is determined by the methods given in the *Noise Policy for Industry*.

The RBL and the respective intrusive criteria for the day, evening and night periods are provided in Table 13. Only the NCAs directly adjacent to the WRPs and WWTP have been included below, compliance within these NCAs implies compliance within NCAs which are located further from the WRPs and WWTP.

Table 13 Intrusive criteria

Location	Period	RBL (L_{A90}), dB(A)	Intrusive criteria (RBL+5), dB(A)
NCA 1 – Riverstone WWTP	Day	37	42
	Evening	33	38
	Night	30	35
NCA 3 – Rouse Hill WRP	Day	44	49
	Evening	43	48
	Night	36	41
NCA 4 – Rouse Hill WRP	Day	41	46
	Evening	35	40
	Night	30	35
NCA 7– Castle Hill WRP	Day	35	40
	Evening	33	38
	Night	30	35
NCA 8– Castle Hill WRP	Day	35	40
	Evening	30	35
	Night	30	35

4.1.2 Protecting amenity

To limit continuing increase in noise levels, the maximum ambient noise level within an area from all industrial noise sources should not normally exceed the recommended amenity noise levels specified in

Table 2.2 of the *Noise Policy for Industry*. The recommended amenity noise levels take into account the particular locality and land use.

Where there is existing industrial noise in an area the amenity level for a project is usually set to the recommended amenity level minus 5 dB. This correction ensures that industrial noise levels, from both existing and new sources, remain within the recommended noise levels for an area.

As there is no other existing industrial noise sources affecting the residential receivers in Castle Hill the '-5 dB' correction does not need to be applied. The '– 5 dB' correction has been applied to the amenity level for receivers in Rouse Hill and Riverstone. The relevant project amenity noise levels are presented in Table 14. The project amenity levels for each period (day, evening and night-time) are then converted to project amenity levels for a 15 minute period by adding 3 dB(A). The 15 minute project amenity noise levels applicable to the Proposal are also provided in Table 14.

Table 14 Project amenity noise levels

Type of receiver	Indicative noise amenity area	Time of day	Project amenity noise level, dB(A)	
			$L_{Aeq\ (period)}$	$L_{Aeq\ (15\ minute)}$
Residential receivers – NCA 1	Suburban	Day	50	53
		Evening	40	43
		Night	35	38
Residential receivers – NCA 3&4	Suburban	Day	50	53
		Evening	40	43
		Night	35	38
Residential receivers – NCA 7&8	Suburban	Day	55	58
		Evening	45	48
		Night	40	43
School classroom[2]	All	Noisiest 1-hour period when in use	45[1]	48
Place of worship	All	When in use	50[1]	53
Commercial premises	All	When in use	65	68
Active recreation area	All	When in use	55	58

Notes:

1. *External noise levels are based upon a 10 dB reduction from outside to inside through an open window.*
2. *School classroom criteria has been used for childcare centres.*

4.1.3 Summary

A summary of the project noise trigger levels is presented in Table 15 below. These trigger levels apply to environmental noise emissions from any activity undertaken or plant installed as part of the Proposal.

Table 15 Summary of environmental noise emission criteria

Location	Time of day	Project noise trigger levels[1] L_{Aeq}, dB(A)
NCA 1	Day	42
	Evening	38
	Night	35
NCA 3	Day	49
	Evening	43
	Night	38
NCA 4	Day	46
	Evening	40
	Night	35
NCA 7	Day	40
	Evening	38
	Night	35
NCA 8	Day	40
	Evening	35
	Night	35
School classroom	Noisiest 1-hour period when in use	48
Place of Worship	When in use	53
Commercial premises	When in use	68
Active recreation area	When in use	58

Notes:

1. Project Noise Trigger Levels represent the lower of the intrusive (Table 13) and amenity criteria (Table 14).

4.1.4 Maximum noise level assessment

The *Noise Policy for Industry* requires the potential for sleep disturbance to be assessed by considering maximum noise levels events during the night-time period.

Where the subject development/premises night-time noise levels at a residential location exceed the following screening levels a detailed maximum noise level event assessment should be undertaken:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is the greater,

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Based on the measured background noise levels during the night, the sleep disturbance criteria for the nearest noise sensitive residential receivers are presented in Table 16.

Table 16 Night-time sleep disturbance screening levels

Location	Measured night-time RBL, $L_{A90,\ 15\ mins}$ dB(A)	Sleep disturbance screening levels	
		$L_{Aeq,15min}$, dB(A)	L_{AFmax}, dB(A)
NCA 1	30	40	52
NCA 3	36	41	52
NCA 4	30	40	52
NCA 7	30	40	52
NCA 8	30	40	52

5.0 Construction Noise Assessment

5.1 Construction sources

In consultation with Sydney Water, the following items of construction equipment have been assumed for the Proposal. These would be confirmed by the construction contractor prior to construction commencing and further assessment would be undertaken if required.

Noise sources and their respective L_{Aeq} sound power levels for each work package are shown in Table 17. These sound power levels are typical values taken from data provided in Australian Standard AS2436-2010, *Guide to noise and vibration control on construction, demolition and maintenance sites* and British Standard 5228: Part 1 2009 *Code of practice for noise and vibration control on construction and open sites*, 2009 and assume equipment is modern and in good working order.

Construction works are generally expected to be undertaken during standard construction hours only. Similar equipment is to be used for the Castle Hill WRP and Rouse Hill WRP upgrades. The Riverstone WWTP upgrades are minor and as such construction noise associated with this site has not been assessed in this report.

Table 17 Equipment sound power levels

Equipment	Sound power level, dB(A)
15T Franna crane	94
30T- 55T Crane	98
Asphalt laying machine	103
Cherry picker	95
Concrete kerbing machine	103
Concrete pumps	106
Concrete trucks	103
Delivery trucks	108
Excavator 20T or 30T	106
Excavator with rock breaker	116
Grader	106
Hand tools	94
Micro-tunnelling machine	105
Scissor lifts	98
Sheet piling	116
Truck and dog	107
Vibrating pad compactor	95
Vibrating rollers	105
Water truck	109

5.2 Modelling conditions

In order to assess noise impacts from the site during construction, a noise model was created to represent ‘reasonable’ worst periods of upgrade works.

The construction of the Proposal has been modelled in SoundPLAN Version 8.0. The following features were included in the noise model:

- ground topography
- ground absorption and reflection
- buildings (residential and commercial)
- construction noise sources (listed in Table 17).

Noise emissions from the construction sites have been modelled using an implementation of the CONCAWE propagation algorithm with neutral metrological conditions.

It can be expected that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the plant equipment. The acoustic shielding calculated in the model due to fixed building structures would also vary as the construction equipment moves around the site.

5.3 Construction noise assessment

The identified residential and non-residential receivers have been assessed against the standard hours noise management levels. The level of impact may change depending on the final construction methodology.

During construction it is likely that all equipment would not be operating simultaneously at all times and in the one location, which would result in reduced noise levels compared with those predicted. As each construction work package would be occurring discretely a cumulative noise impact is unlikely. Mitigation measures have been specified in Section 5.6 which may reduce the impact of these exceedances on receivers.

Noise results are presented graphically in Appendix D.

5.3.1 Summary of impacts during standard hours

Results show construction noise levels are expected to exceed the noise management levels during standard hours at a number of noise sensitive receivers near the Castle Hill WTP. Noise levels at most impacted properties do not exceed the NMLs by more than 20 dB where noise levels could be considered audible or moderately intrusive.

Earthworks, sheet piling and rock breaking are considered to be the noisiest activities. For these activities up to 4 properties are expected to be exposed to noise levels which exceed the NMLs by more than 20 dB. These activities would be intermittent in nature and occur within a period of up to 12 months.

No properties are considered to be highly affected, all construction noise levels are expected to be less than 75 dB(A) at residential receivers.

Table 18 Castle Hill WRP Construction Works – Standard hours work

NCA	L_{Aeq} NML dB(A)	Maximum L_{Aeq} noise level dB(A)	Number of properties where noise levels are expected to exceed the NML			Highly noise affected
			1-10 dB(A) exceedance	11-20 dB(A) exceedance	> 20 dB(A) exceedance	
Earthworks						
NCA7	68	45	142	20	2	0
NCA8	61	45	56	16	0	0
Sheet piling or rock breaking						
NCA7	72	45	236	60	4	0
NCA8	65	45	148	28	0	0
Lifting						
NCA7	65	45	105	9	0	0
NCA8	58	45	27	8	0	0
Concreting						
NCA7	64	45	87	7	0	0
NCA8	57	45	27	6	0	0
Assembly and cladding						
NCA7	57	45	15	1	0	0
NCA8	50	45	12	0	0	0
Pipe installation						
NCA7	61	45	44	3	0	0
NCA8	54	45	23	0	0	0

Results show construction noise levels are not expected to exceed the noise management levels during standard hours at any noise sensitive receivers near the Rouse Hill WTP.

Table 19 Rouse Hill WRP Construction Works – Standard hours work

NCA	L_{Aeq} NML dB(A)	Maximum L_{Aeq} noise level dB(A)	Number of properties where noise levels are expected to exceed the NML			Highly noise affected
			1-10 dB(A) exceedance	11-20 dB(A) exceedance	> 20 dB(A) exceedance	
Earthworks						
NCA3	54	45	0	0	0	0
NCA4	51	45	0	0	0	0
Sheet Piling or Rock Breaking						
NCA3	54	46	0	0	0	0
NCA4	51	46	0	0	0	0
Lifting						
NCA3	54	< 45	0	0	0	0
NCA4	51	< 45	0	0	0	0
Concreting						
NCA3	54	< 45	0	0	0	0
NCA4	51	< 45	0	0	0	0
Assembly and Cladding						
NCA3	54	< 45	0	0	0	0
NCA4	51	< 45	0	0	0	0
Pipe Installation						
NCA3	54	< 45	0	0	0	0
NCA4	51	< 45	0	0	0	0

5.3.2 Summary of impacts outside of standard hours

No works are expected outside of standard hours.

5.4 Construction traffic assessment

The numbers of construction vehicle movements have been estimated to be up to 40-50 light and 20 heavy vehicles per day during peak construction periods. Vehicles would access the Castle Hill WRP site by Wrights Road and Drawbridge Place and the Rouse Hill site by Withers Road.

The existing traffic flow on Wrights Road and Withers Road is substantially greater than the proposed construction traffic numbers. Therefore, the additional traffic would have a minor impact on existing road traffic noise in these roads (traffic noise levels during construction are expected to increase by less than 2 dB). Traffic noise on Drawbridge Place may increase by more than 2 dB however it is unlikely to exceed $L_{Aeq\ 1hr}$ 55 dB(A).

5.5 Construction vibration assessment

Vibration intensive works may include the use of the following items of equipment:

- Rock breakers; and
- Vibrating rollers and vibrating pad compactors

The minimum working distances of these items of equipment from off-site receivers are shown in Table 20 which is based on recommendations of the TfNSW *Construction Noise and Vibration Strategy* (CNVS). If these minimum working distances are complied with no adverse impacts from vibration intensive works are likely in terms of human response or cosmetic damage.

Based on the indicative construction activities assessed for the Proposal, it is not considered likely that works would occur within the minimum working distances. If, however, vibration intensive works are required within these minimum working distances, mitigation measures to control excessive vibration would be implemented as outlined in Section 5.6.

Residents located within 100 m may respond to vibratory rollers greater than 7 tonnes. Typically, a vibratory roller of 10 tonnes would be used for the proposal at Castle Hill WRP, however, rollers less than 7 tonnes may be preferred to avoid this impact. A large hydraulic hammer would be used for construction of the inlet works at Castle Hill WRP. The closest receiver to these works is approximately 90 m to the north east which achieves the minimum working distances recommended.

Table 20 Minimum working distances of vibration intensive equipment to be used during the Proposal

Plant	Rating/ description	Cosmetic damage	Human response
		Residential/ commercial	
Vibratory roller	< 50 kN (typically 1-2t)	5 m	15 m
	< 100 kN (typically 2-4t)	6 m	20 m
	< 200 kN (typically 4-6t)	12 m	40 m
	< 300 kN (typically 7-13t)	15 m	100 m
	> 300 kN (typically 13-18t)	20 m	100
	> 300 kN (> 18 t)	25 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	1,600 kg (18 to 34t excavator)	22 m	73 m

5.6 Construction mitigation measures

5.6.1 Construction Noise and Vibration Management Plan

A Construction Noise and Vibration Management Plan (CNVMP) should be developed for the Proposal and implemented prior to commencement of construction activities. The CNVMP should include all reasonable and feasible safeguards to manage the noise emissions from the site and any complaints which may occur due to construction noise. The CNVMP should include, the following:

- identification of nearby residences and other sensitive land uses
- description of approved hours of work
- description and identification of all construction activities, including work areas, equipment and duration
- description of what work practices (generic and specific) would be applied to minimise noise and vibration
- a complaints handling process
- noise and vibration monitoring procedures, including for heritage structures
- overview of community consultation required for identified high impact works.

Construction works should be planned and carried out during standard construction hours wherever possible. Table 21 presents the mitigation measures contained within the which should be considered as mitigation measures as part of the CNVMP.

Table 21 Recommended construction mitigation measures

Action required	Safeguard details
Management measures	
Site inductions	All site inductions shall brief workers, contractors, and visitors on the neighbouring sensitive receivers (if applicable) and general noise safeguards and compliance obligations relating to the site.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. All staff and contractors should take reasonable steps to ensure that noise from reactive work is minimised. Comply with the *Noise Management Code of Behaviour* for works outside of standard daytime hours.
Site risk assessments	Site risk assessments to include noise as a potential risk and identify controls to reduce the risk. Conditions of Approval issued as part of a planning approval may prescribe specific noise related compliance obligations for some sites.
Approval conditions	Sites shall comply with any planning approval conditions of approval for their site and the EPA's Noise Policy for Industry (2017).
Equipment procurement	Consideration should be given to purchasing goods which are noise efficient. Refer to Guidance Sustainable Procurement in Supply Contracts.

Action required	Safeguard details
Source controls	
Construction hours and scheduling	Where feasible and reasonable, construction will be carried out during the standard daytime working hours only.
Equipment selection	Quieter and less vibration emitting construction methods will be used where feasible and reasonable (e.g. rubber wheeled instead of steel tracked plant). Equipment will be regularly inspected and maintained to ensure it is in good working order.
Maximum noise levels	The noise levels of plant and equipment will have operating sound power or sound pressure levels that would meet the predicted noise levels.
Rental plant and equipment	Noise emissions will be considered as part of the selection process.
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver will be avoided. The offset distance between noisy plant and adjacent sensitive receivers will be maximised. Plant used intermittently will be throttled down or shut down. Plant and vehicles will be turned off when not in use. Noise-emitting plant will be directed away from sensitive receivers where reasonable and feasible.
Plan works site and activities to minimise noise and vibration	Traffic flow, parking and loading/unloading areas will be planned to minimise reversing movements within the site. Truck drivers will be advised of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (i.e. minimising the use of engine brakes, and no extended periods of engine idling).
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site and for extended work hours construction work.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries will occur as far as possible from sensitive receivers. Delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible.
Silencers on mobile Plant	Where possible noise from mobile plant will be reduced through additional fittings including: • Residential grade mufflers • Air Parking brake engagement is silenced.
Construction related traffic	The speed of vehicles will be limited and the use of engine compression brakes limited. On-site storage capacity will be maximised to reduce the need for truck movements during sensitive times.
Vibration safe working distances	If vibration intensive equipment is to be used within the minimum working distances for cosmetic damage, as presented in Table 20, then a permanent vibration monitoring system should be installed.

Action required	Safeguard details
Path controls	
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources will be enclosed or shielded to the greatest extent possible whilst ensuring that the occupational health and safety of workers is maintained.
Shield sensitive receivers from noisy activities	Structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) will be used.
Reporting and Resolving Noise Complaints	
Report and manage noise complaints	Report and manage noise complaints in accordance with the Sydney Water Complaint Procedure
Complaints entered into the Customer Relationship Management	All complaints should be entered into the Customer Relationship Management (CRM) system including the customers' details. The complaint then needs to be assigned to the appropriate area for action. If staff are not familiar with CRM, the complaint should be reported to their direct manager and phone calls transferred to the Customer Contact Centre.
Investigated complaints	All noise complaints are to be investigated and rectified as soon as possible (e.g. amending work practices, implementing additional reasonable and feasible mitigation measures etc). Resolution of the complaint concludes with the customer being advised of actions taken to rectify issue. Noise monitoring should be considered when investigating complaints to understand if construction noise is consistent with the predictions in the noise assessment.
Works notification	Where complainant locations are likely to be affected by future works, project notifications would be provided no less that seven days before works are undertaken.
Noise complaint analysis	
Reviewed complaints	Noise complaints are to be reviewed at least every 6 months to ensure correct categorisation in CRM for reporting purposes.
Report complaints and improvements	Noise complaints and opportunities for improvement (if identified) are to be reported through the Integrated Management Systems Management Review.

6.0 Operational noise

6.1 Noise modelling

In consultation with Sydney Water noise models have been prepared for the WRPs and WWTP for both the existing case and the upgraded using SoundPLAN Version 8.0. The models are based on the following information.

6.1.1 Topography

The operational noise model has been based upon topographical information (contours provided at 1.0 m intervals). Ground has been modelled with a ground absorption of 0.75.

6.1.2 Buildings

Buildings have been incorporated into the model as follows:

- Existing buildings beyond the site boundaries including industrial, commercial and residential buildings (obtained from digital survey information and/or digitisation of aerial photography)
- Proposed and existing buildings within the site boundary.

6.1.3 Meteorological conditions

AECOM has undertaken modelling of industrial noise emission from the site under the following meteorological conditions:

- Neutral weather conditions – 0.5 m/s winds and D class stability
- Adverse weather conditions - 3 m/s winds in the worst case direction and D class stability (night and evening only) or Temperature inversion – 2 m/s winds and F class stability (night only).

6.2 Noise sources

The noise sources to be included in the noise model are discussed below.

6.2.1 Noise model sound pressure levels – existing noise sources

Appendix B presents the sound pressure levels which were used in the operational noise model. These sound pressure levels are based upon measurements that AECOM made on the 27 May 2021 at the WWTP and WRPs and AECOM's library of sound power data.

6.2.2 Noise model sound pressure levels – proposed noise sources

The equipment proposed to be included in the update WRPs and WWTP are provided below in Table 22, Table 23 and Table 24.

Table 22 Proposed equipment and sound power levels – Castle Hill WRP

Description	Number of	Rated power, kW	Operational time	Sound Power level, L_{Aeq} dB(A)
Grit extraction pump	2	4	Daytime only	75
Primary sludge pump	1	11	Daytime only	79
Extraction fan	1	11	Day and night	86[1]
Sludge screen	2	3	Daytime only	83
Bypass macerator	2	3	Daytime only	83
UF feed pump	1	55	Day and night	76[1]
UF feed pump	1	55	Daytime only	76[1]
Blower	1	37	Day and night	76[1]
UF back wash pump	1	15	Daytime only	71[1]
CIP transfer pump	1	15	Daytime only	71[1]
Air compressor	1	11	Day and night	77
RE - supply pump	2	30	Day and night	74[1]
Gallery ventilation fan	1	4	Day and night	83[1]
Sludge transfer pump	1	150	Day and night	81[1]

Notes:

1. The SWL quoted assumes includes noise attenuation as discussed below in section 6.2.3

Table 23 Proposed equipment and sound power levels – Rouse Hill WRP

Description	Number of	Rated Power kW	Operational time	Sound Power level, L_{Aeq} dB(A)
Grit pump	2	5.5	Daytime only	76
Primary screen	13	4	Daytime only	84
Raw sludge pump (duty)	2	7.5	Day and Night	78
Wet weather primary sludge pump	2	30	Daytime only	84
Fan - OCF	1	110	Day and Night	100
Fan – Ventilation	1	2.2	Day and Night	81
OCF Blowdown pump (duty)	1	7.5	Daytime only	78
RE pump	2	22	Day and Night	82
RE pump	2	22	Daytime only	82

Table 24 Proposed equipment and sound power levels – Riverstone WWTP

Description	Number of	Rated Power kW	Operational time	Sound Power level, L_{Aeq} dB(A)
Annamox blower	1	90	Day and Night	90
Annamox blower	1	90	Daytime only	90
Treated liquor pump	1	5.5	Day and Night	76

6.2.3 Noise treatment options for Castle Hill WRP

The following treatment options (or similar measures to achieve required operational noise reduction) should be considered for the proposed noise sources. Please note where more than one option is listed only one needs to be considered for each plant item.

Table 25 Castle Hill WRP noise treatment options

Plant Item	Treatment Recommended
Extraction fan and gallery ventilation fan	Install attenuator to reduce the external sound power levels to those listed in Table 22.
UF feed pumps, UF back wash pump, CIP transfer pump and RE - supply pumps	Construct housing or shroud that reduces the sound power levels to those listed in Table 22. This should provide a10 dB reduction approximately; or
	Construct noise barrier which is at least 1.5 m above the height of these items of equipment, of solid construction and free from gaps. The vertical inner surfaces of all barriers facing plant should be faced with sound absorptive panels which will provide a minimum NRC of 0.9.
Blower	Construct housing or shroud that reduces the sound power levels to those listed in Table 22. This should provide a10 dB reduction approximately; or
	Construct noise barrier which is at least 1.5 m above the height of these items of equipment, of solid construction and free from gaps. The vertical inner surfaces of all the barriers facing the plant should be faced with sound absorptive panels which will provide a minimum NRC of 0.9; or
	Locate blower within a building.

It should be noted that barriers have not been considered to the east of the Castle Hill WRP as they are unlikely to be effective due to the ground typography (receivers to the east are around 15 m higher in elevation than the WRP) and are not required to meet the noise limits for the proposed plant items.

6.3 Site operational noise

6.3.1 Existing situation

As noted in section 2.2.2 AECOM undertook noise measurements and observations at the WWTP and WRPs on 27 May 2021. Based on these measurements and observations a SoundPLAN noise model of the WRPs and WWTP was developed. Table 26 to Table 28 show the modelled noise levels for the existing plants.

Table 26 Existing operational noise levels of the Castle Hill WRP

Location	Distance from Proposal (m)	Sound pressure level, L_{Aeq} dB(A)	
		Daytime	Night-time
4 Courtyard Place, Castle Hill	150	38	38
13 Lancelot Court, Castle Hill	95	40	40
23 Lancelot Court, Castle Hill	80	35	35
29 Connelly Way, Kellyville	70	35	35
190 Wrights Road, Kellyville	55	40	40

Table 27 Existing operational noise levels of the Rouse Hill WRP

Location	Distance from Proposal (m)	Sound pressure level, L_{Aeq} dB(A)	
		Daytime	Night-time
20 Mailey Circuit, Rouse Hill	400	43	31
95 Mile End Road, Rouse Hill	350	41	22
133 Mile End Road, Rouse Hill	480	41	21
328 Annangrove Road, Rouse Hill	200	42	31

Table 28 Existing operational noise levels of the Riverstone WWTP

Location	Distance from Proposal (m)	Sound pressure level, L_{Aeq} dB(A)	
		Daytime	Night-time
21 Clyde Street, Vineyard	550	33	33
6 Ashford Road, Vineyard	320	35	35
8 Dulwich Road, Vineyard	400	32	32
3 St James Road, Vineyard	400	32	32

6.3.2 Proposed situation

Based on the assumptions, modelling parameters and noise attenuation measures as set out in the previous sections, the typical operational noise levels were predicted at the receiver most likely to be affected. The operational noise levels were predicted under neutral and adverse meteorological conditions. The results of the modelling are presented in Table 29 to Table 31. It is noted that while a single night-time operational scenario has been assessed it is representative of the likely worst case.

An assessment of the resultant noise levels at receivers for tonality and low frequency noise indicated that no corrections were required to be applied in accordance with the *Noise Policy for Industry*.

The results are presented at the worst affected receivers. Noise contour plots for normal operational scenarios are presented in Appendix E for daytime and night-time periods and neutral and adverse weather conditions (wind 3 m/s source to receiver or an F class inversion).

The predicted noise levels due to the proposed Castle Hill WRP upgrade are compared to the NPfI criteria in Table 29. It can be seen that during the daytime the L_{Aeq} levels either do not exceed the trigger levels or exceed by a negligible amount (≤2 dB). During the night -time exceedances of up to 6 dB are predicted under neutral weather conditions and up to 7 dB under adverse weather conditions.

For an existing facility (in operation for more than 10 years) where there is a proposed discrete development the NPfI notes that the proposal should not increase the overall noise emissions from the entire site. The increase in noise from the site due to the proposed upgrades has been considered in Table 29. For the cases where there is an exceedance of the trigger level by more than 2 dB the overall increase in noise from the current case is considered negligible ≤1 dB. In addition the predicted noise levels of the proposed upgrade all comply with the amenity noise levels (see Table 14). Furthermore, the existing plant equipment typically dominates the predicted noise level.

Table 29 Predicted operational noise levels due to the Proposal – Castle Hill WRP

Location	Distance from WRP (m)	Sound pressure level, L_{Aeq} dB(A)				
		Current	Proposed	Trigger Level	Exceed-ance	Increase
Daytime – Neutral Weather						
4 Courtyard Place Castle Hill	150	38	38	40	-	-
13 Lancelot Court Castle Hill	95	40	40	40	-	-
23 Lancelot Court Castle Hill	80	35	37	40	-	2
29 Connelly Way Kellyville	70	35	36	40	-	1
190 Wrights Road Kellyville	55	40	40	40	-	-
Night-time – Neutral Weather						
4 Courtyard Place Castle Hill	150	38	38	35	3	-
13 Lancelot Court Castle Hill	95	40	40	35	5	-
23 Lancelot Court Castle Hill	80	35	35	35	-	-
29 Connelly Way Kellyville	70	35	35	35	-	-
190 Wrights Road Kellyville	55	40	40	35	5	-
Daytime – Adverse Weather						
4 Courtyard Place Castle Hill	150	40	41	40	1	1
13 Lancelot Court Castle Hill	95	42	42	40	2	-
23 Lancelot Court Castle Hill	80	37	39	40	-	2
29 Connelly Way Kellyville	70	37	37	40	-	-
190 Wrights Road Kellyville	55	42	42	40	2	-
Night-time – Adverse Weather						
4 Courtyard Place Castle Hill	150	40	41	35	6	1
13 Lancelot Court Castle Hill	95	42	42	35	7	-
23 Lancelot Court Castle Hill	80	37	38	35	3	1
29 Connelly Way Kellyville	70	37	37	35	2	-
190 Wrights Road Kellyville	55	42	42	35	7	-

The predicted noise levels due to the proposed Rouse Hill WRP upgrade are compared to the NPfI criteria in Table 30. It can be seen that during the daytime the L_{Aeq} levels do not exceed the trigger levels.

Table 30 Predicted operational noise levels due to the Proposal – Rouse Hill WRP

Location	Distance from WRP (m)	Sound pressure level, L_{Aeq} dB(A)				
		Current	Proposed	Criteria	Exceed-ance	Increase
Daytime – Neutral Weather						
20 Mailey Circuit Rouse Hill	400	43	44	49	-	1
95 Mile End Road Rouse Hill	350	41	41	46	-	-
133 Mile End Road Rouse Hill	480	41	41	46	-	-
328 Annangrove Road Rouse Hill	200	42	42	49	-	-
Night-time – Neutral Weather						
20 Mailey Circuit Rouse Hill	400	31	37	38	-	6
95 Mile End Road Rouse Hill	350	22	26	35	-	3
133 Mile End Road Rouse Hill	480	21	22	35	-	1
328 Annangrove Road Rouse Hill	200	31	34	38	-	3
Daytime – Adverse Weather						
20 Mailey Circuit Rouse Hill	400	46	47	49	-	1
95 Mile End Road Rouse Hill	350	44	44	46	-	-
133 Mile End Road Rouse Hill	480	43	44	46	-	-
328 Annangrove Road Rouse Hill	200	45	46	49	-	-
Night-time – Adverse Weather						
20 Mailey Circuit Rouse Hill	400	34	40	38	-	6
95 Mile End Road Rouse Hill	350	26	29	35	-	4
133 Mile End Road Rouse Hill	480	25	26	35	-	1
328 Annangrove Road Rouse Hill	200	34	37	38	-	4

The predicted noise levels due to the proposed Riverstone WWTP upgrade are compared to the NPfI criteria in Table 31. It can be seen that during the daytime the L_{Aeq} levels do not exceed the trigger levels or exceed by a negligible amount (<=2dB).

Table 31 Predicted operational noise levels due to the Proposal – Riverstone WWTP

Location	Distance from WRP (m)	Sound pressure level, L_{Aeq} dB(A)				
		Current	Proposed	Criteria	Exceed-ance	Increase
Daytime – Neutral Weather						
21 Clyde Street Vineyard	550	32	32	42	-	-
6 Ashford Road Vineyard	320	33	34	42	-	-
8 Dulwich Road Vineyard	400	30	30	42	-	-
3 St James Road Vineyard	400	30	30	42	-	1
Night-time – Neutral Weather						
21 Clyde Street Vineyard	550	32	32	35	-	-
6 Ashford Road Vineyard	320	33	34	35	-	-
8 Dulwich Road Vineyard	400	30	30	35	-	-
3 St James Road Vineyard	400	30	30	35	-	1
Daytime – Adverse Weather						
21 Clyde Street Vineyard	550	34	34	42	-	-
6 Ashford Road Vineyard	320	36	36	42	-	1
8 Dulwich Road Vineyard	400	33	33	42	-	-
3 St James Road Vineyard	400	32	33	42	-	1
Night-time – Adverse Weather						
21 Clyde Street Vineyard	550	34	34	35	-	-
6 Ashford Road Vineyard	320	36	36	35	1	1
8 Dulwich Road Vineyard	400	33	33	35	-	-
3 St James Road Vineyard	400	32	33	35	-	1

6.3.3 Sleep disturbance results

The sleep disturbance noise levels associated with the typical operation of the proposed Castle Hill WRP upgrade were predicted at nearby receivers under calm meteorological conditions and worst case weather conditions. The results are presented in Table 32 and Table 33. It can be seen the L_{Amax} and L_{Aeq} levels from the operation of the facility generally comply with the project sleep disturbance criterion, with the exception of a negligible exceedance (≤2 dB) under worst case weather conditions.

Table 32 Predicted night-time L_{Amax} operational noise levels and sleep disturbance criteria – Castle Hill WRP

Weather conditions	Distance from Proposal (m)	Sound pressure level, L_{Amax} dB(A)		
		Result	Criterion	Exceedance
Night-time – Neutral Weather				
4 Courtyard Place Castle Hill	150	38	52	-
13 Lancelot Court Castle Hill	95	40	52	-
23 Lancelot Court Castle Hill	80	35	52	-
29 Connelly Way Kellyville	70	35	52	-
190 Wrights Road Kellyville	55	40	52	-
Night-time – Adverse Weather				
4 Courtyard Place Castle Hill	150	41	52	-
13 Lancelot Court Castle Hill	95	42	52	-
23 Lancelot Court Castle Hill	80	38	52	-
29 Connelly Way Kellyville	70	37	52	-
190 Wrights Road Kellyville	55	42	52	-

Table 33 Predicted night-time L_{Aeq} operational noise levels and sleep disturbance criteria – Castle Hill WRP

Weather conditions	Distance from Proposal (m)	Sound pressure level, L_{Aeq} dB(A)		
		Result	Criterion	Exceedance
Night-time – Neutral Weather				
4 Courtyard Place Castle Hill	150	38	40	-
13 Lancelot Court Castle Hill	95	40	40	-
23 Lancelot Court Castle Hill	80	35	40	-
29 Connelly Way Kellyville	70	35	40	-
190 Wrights Road Kellyville	55	40	40	-
Night-time – Adverse Weather				
4 Courtyard Place Castle Hill	150	41	40	1
13 Lancelot Court Castle Hill	95	42	40	2
23 Lancelot Court Castle Hill	80	38	40	-
29 Connelly Way Kellyville	70	37	40	-
190 Wrights Road Kellyville	55	42	40	2

The sleep disturbance noise levels associated with the typical operation of the proposed Rouse Hill WRP upgrade were predicted at nearby receivers under calm meteorological conditions and worst case weather conditions. The results are presented in Table 34 and Table 35. It can be seen the L_{Amax} and L_{Aeq} levels from the operation of the facility comply with the project sleep disturbance criterion.

Table 34 Predicted night-time L_{Amax} operational noise levels and sleep disturbance criteria – Rouse Hill WRP

Weather conditions	Distance from Proposal (m)	Sound pressure level, L_{Amax} dB(A)		
		Result	Criterion	Exceedance
Night-time – Neutral Weather				
20 Mailey Circuit Rouse Hill	400	37	52	-
95 Mile End Road Rouse Hill	350	26	52	-
133 Mile End Road Rouse Hill	480	22	52	-
328 Annangrove Road Rouse Hill	200	34	52	-
Night-time – Adverse Weather				
20 Mailey Circuit Rouse Hill	400	40	52	-
95 Mile End Road Rouse Hill	350	29	52	-
133 Mile End Road Rouse Hill	480	26	52	-
328 Annangrove Road Rouse Hill	200	37	52	-

Table 35 Predicted night-time L_{Aeq} operational noise levels and sleep disturbance criteria – Rouse Hill WRP

Weather conditions	Distance from Proposal (m)	Sound pressure level, L_{Aeq} dB(A)		
		Result	Criterion	Exceedance
Night-time – Neutral Weather				
20 Mailey Circuit Rouse Hill	400	37	41	-
95 Mile End Road Rouse Hill	350	26	40	-
133 Mile End Road Rouse Hill	480	22	40	-
328 Annangrove Road Rouse Hill	200	34	41	-
Night-time – Adverse Weather				
20 Mailey Circuit Rouse Hill	400	40	41	-
95 Mile End Road Rouse Hill	350	29	40	-
133 Mile End Road Rouse Hill	480	26	40	-
328 Annangrove Road Rouse Hill	200	37	41	-

The sleep disturbance noise levels associated with the typical operation of the proposed Riverstone WWTP upgrade were predicted at nearby receivers under calm meteorological conditions and worst

case weather conditions. The results are presented in Table 36 and Table 37. It can be seen the L_{Amax} and L_{Aeq} levels from the operation of the facility comply with the project sleep disturbance criterion.

Table 36 Predicted night-time L_{Amax} operational noise levels and sleep disturbance criteria – Riverstone WWTP

Weather conditions	Distance from Proposal (m)	Sound pressure level, L_{Amax} dB(A)		
		Result	Criterion	Exceedance
Night-time – Neutral Weather				
21 Clyde Street Vineyard	550	32	52	-
6 Ashford Road Vineyard	320	34	52	-
8 Dulwich Road Vineyard	400	30	52	-
3 St James Road Vineyard	400	30	52	-
Night-time – Adverse Weather				
21 Clyde Street Vineyard	550	34	52	-
6 Ashford Road Vineyard	320	36	52	-
8 Dulwich Road Vineyard	400	33	52	-
3 St James Road Vineyard	400	33	52	-

Table 37 Predicted night-time L_{Aeq} operational noise levels and sleep disturbance criteria – Riverstone WWTP

Weather conditions	Distance from Proposal (m)	Sound pressure level, L_{Aeq} dB(A)		
		Result	Criterion	Exceedance
Night-time – Neutral Weather				
21 Clyde Street Vineyard	550	32	40	-
6 Ashford Road Vineyard	320	34	40	-
8 Dulwich Road Vineyard	400	30	40	-
3 St James Road Vineyard	400	30	40	-
Night-time – Adverse Weather				
21 Clyde Street Vineyard	550	34	40	-
6 Ashford Road Vineyard	320	36	40	-
8 Dulwich Road Vineyard	400	33	40	-
3 St James Road Vineyard	400	33	40	-

6.3.4 Discussion

Operational noise from the Proposal is not expected to exceed the project noise trigger levels at nearby sensitive receivers at Rouse Hill WRP and Riverstone WWTP.

Exceedances are predicted at the Castle Hill WRP during the night-time and under neutral and adverse weather conditions. Noise attenuation treatments have been recommended for proposed plant items and are listed in section 6.2.3. With these treatments in place the existing plant equipment typically dominates the predicted noise level.

It is noted that where there is an exceedance of the trigger level by more than 2 dB the overall increase in noise from the existing situation case is considered negligible ≤1 dB. In addition the predicted noise levels of the proposed upgrade all comply with the amenity noise levels (see Table 14). Therefore the requirements of the Noise Policy for Industry are considered to be complied with.

No significant exceedances of the sleep disturbance criteria are predicted as a result of the Proposal at any of the WRPs or the WWTP.

6.4 Treatment of existing plant items at Castle Hill WRP

As noise levels from the existing Castle Hill WRP exceed the project noise trigger levels the NPfI requires that ‘feasible’ and ‘reasonable’ noise control measures be considered for existing plant items. Control measures that should be considered (or similar measures to achieve required operational noise reduction) include:

- Providing housing or a shroud around the Sodium Hypochlorite Motor. This should provide approximately 10 dB reduction; and
- Covering the grate between the blower room and the second clarifier to reduce the water noise emanating from the grate.

Control measures for the clarifiers and aeration tanks are not considered feasible.

6.5 Operational traffic

Once operational the Proposal is expected to include truck movements for daily chemical deliveries at both plants as well as waste out-loading at Rouse Hill WRP. In total there will be 10 truck movements per day at both Castle Hill WRP and Rouse Hill WRP. The existing traffic flow on Wrights Road and Withers Road is substantially greater than the proposed operational traffic numbers. Therefore, the traffic would have a minor impact on existing road traffic noise in these roads.

7.0 Conclusions

A construction and operational Noise and Vibration Impact Assessment has been completed for the proposed upgrade of the North West Treatment Hub (NWH). This assessment considers upgrades to the Castle Hill WRP, Rouse Hill WRP and Riverstone WWTP. The upgrades are required to meet the current EPL compliance requirements such as reducing nutrient loads in treated water, improve odour and to meet overflow requirements.

Nearby noise and vibration sensitive receivers were identified. Attended and unattended noise measurements were completed to characterise the existing noise environment. The measured noise levels were used to establish operational and construction noise management levels.

7.1 Construction noise impacts

The construction works are expected to be undertaken during standard construction hours only. Construction work packages have been developed in consultation with Sydney Water and the proposed equipment has been detailed within this report. Construction noise impacts were assessed at all nearby residential and other noise sensitive receivers.

The predicted construction noise levels are not expected to exceed the construction noise management levels at the closest noise sensitive receivers for the Rouse Hill WRP and Riverstone WWTP. Exceedances are predicted for the Castle Hill WRP upgrade. Construction mitigation measurements have been recommended to manage the construction noise impacts.

Minimum working distances have been provided that allow for compliance with the construction vibration criteria. It is not considered likely that works would occur within the minimum working distances. If, however, vibration intensive works are required within these minimum working distances, mitigation measures to control excessive vibration have been outlined.

7.2 Operational noise impacts

7.2.1 Site operational noise

During the operation of the Proposal, there may be changes to the existing noise levels due to the operation of the WRPs and WWTP. Noise levels have been assessed in accordance with the *Noise Policy for Industry.* The Castle Hill WRP, Rouse Hill WRP and Riverstone WWTP upgrades are predicted to comply with the operational noise criteria at all noise sensitive receivers.

Attenuators and noise barriers are recommended for the Castle Hill WRP upgrade.

7.2.2 Operational road traffic noise

The number of vehicle movements during operation will be similar to existing operations.

Appendix A

Acoustic Terminology

Appendix A Acoustic Terminology

Sound power level	The total sound emitted by a source.
Sound pressure level	The amount of sound at a specified point.
Decibel [dB]	The measurement unit of sound.
A Weighted decibels [dB(A)]	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(A)	747 take off at 250 metres

Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
L_{max}	The maximum sound pressure level measured over the measurement period.
L_{min}	The minimum sound pressure level measured over the measurement period.
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.
L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.

Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Day	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
Noise catchment area [NCA]	The noise environment at each of the sensitive receivers within a noise catchment area is considered to be similar to the unattended monitoring location within that NCA.
Assessment background level [ABL]	The overall background level for each day, evening and night period for **each day** of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the **entire length** of noise monitoring.

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*, the EPA's *Noise Policy for Industry* and the EPA's *Road Noise Policy*.

Appendix B

Site Layout and Noise Sources

Appendix B Site Layout and Noise Sources

Table 38 Summary of L_{Aeq} sound pressure levels

Source	Measurement Distance, m	Sound power level (SWL, dB) at octave band centre frequency, Hz								Overall SWL dB(A)
		63	125	250	500	1000	2000	4000	8000	
Riverstone WWTP										
Bioreactor Tank	1	65	70	64	66	63	61	59	56	68
Blower House	2	62	59	59	55	53	55	47	38	60
Chlorine Contact Tanks	4	61	57	50	62	57	51	46	41	63
Chlorine Contact Tanks Water Noise	3	69	65	64	66	63	61	60	57	69
Dewatering Building	4	78	62	64	56	54	49	43	39	60
Digested Sludge Tank Pump	5	67	73	71	69	68	65	64	62	73
Fans	4	68	67	65	66	60	58	50	41	66
Filter Backwash Tank	3	62	59	57	59	55	52	50	47	61
Odour Control Facility	3	64	59	60	62	54	49	56	35	62
RAS Pump Station	5	61	54	51	51	48	46	43	48	54
RE Booster Pumps	2	63	57	62	64	66	63	63	60	71
Spray Bar Valve	1	68	60	54	51	52	58	58	60	65
Tertiary Clarifier	1	60	61	58	53	54	55	51	44	60
Tertiary Clarifier Flow Splitter	3	61	60	53	55	52	48	45	43	57
Was Gravity Thickener Fan	4	83	74	71	71	61	56	49	42	70
Waste Gas Burner	12	70	58	55	49	47	45	48	47	55
Rouse Hill WRP										
Biological Reactor	6	67	64	65	66	65	63	61	55	70
Blower House	2	65	60	58	62	53	53	49	46	61
Chlorine Contact Tank Inlet	7	67	65	62	63	59	57	54	50	65
Chlorine Contact Tank Pumps	1	66	61	62	65	61	64	63	55	69
Digester	6	65	68	67	69	68	66	61	54	73
Idal 1 Outlet Tank	1	75	67	69	69	68	66	65	61	73
Idal 2 Outlet Tank	1	68	64	62	66	65	62	57	51	69
RAS Pumps	2	64	63	61	63	62	60	57	53	67

Source	Measurement Distance, m	Sound power level (SWL, dB) at octave band centre frequency, Hz								Overall SWL dB(A)
		63	125	250	500	1000	2000	4000	8000	
Secondary Clarifier Mix	1	64	60	56	68	60	61	57	50	68
Solid Separation Tank Fan	12	68	69	60	57	54	47	43	42	59
Solids Separator	5	64	62	57	60	60	57	56	53	65
Super Chlorination	2	69	64	60	62	65	64	63	60	70
Castle Hill WRP										
Water Noise	1	77	80	74	76	77	75	72	68	74
Blower Room door	1	67	65	63	61	63	58	59	50	59
Clarifier	1	64	61	57	56	60	65	68	68	65
Sodium Hypochloride Motor	5	77	72	71	79	81	78	72	63	62
RW Pumps	1	75	72	70	74	72	71	73	72	71
Filter Fans	5	96	86	86	88	84	76	71	66	67
Aeration Tanks	1	63	57	54	59	61	60	57	51	57
Odour Scrubber	2	77	76	70	73	73	78	62	55	72

NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Noise Sources

N

0 25 50 Meters

AECOM

- New Plant
- Existing Plant

Source:

NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Noise Sources

N

0 40 80 Meters

AECOM

New Plant

Existing Plant

Source:

NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Noise Sources

N

0 40 80 Meters

AECOM

New Plant

Existing Plant

Source:

Appendix C

Noise Logging

Noise Logger Report

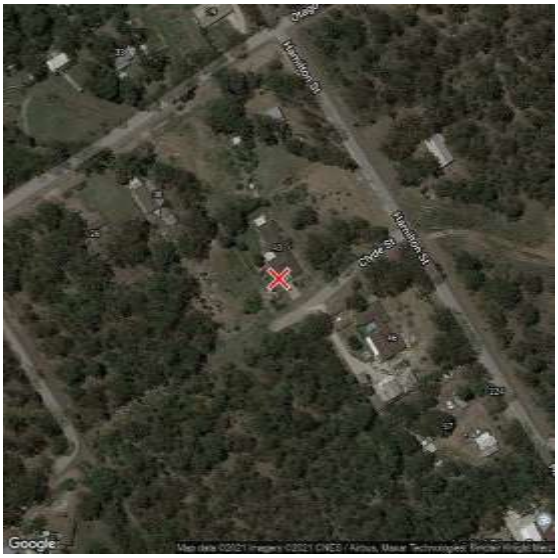
43 Clyde Street, Vineyard

Item	Information
Logger Type	NL-52
Serial number	164396
Address	43 Clyde Street, Vineyard
Location	Front yard
Facade / Free Field	Free field
Environment	Distant road traffic noise audible on Hamilton Street. Truck pass by on Hamilton Street 52 dBA. Bird calls 43 dBA. Dog barking occasionally 83 dBA. Car pass by on Hamilton Street 46 dBA. Some construction noise audible in the distance.

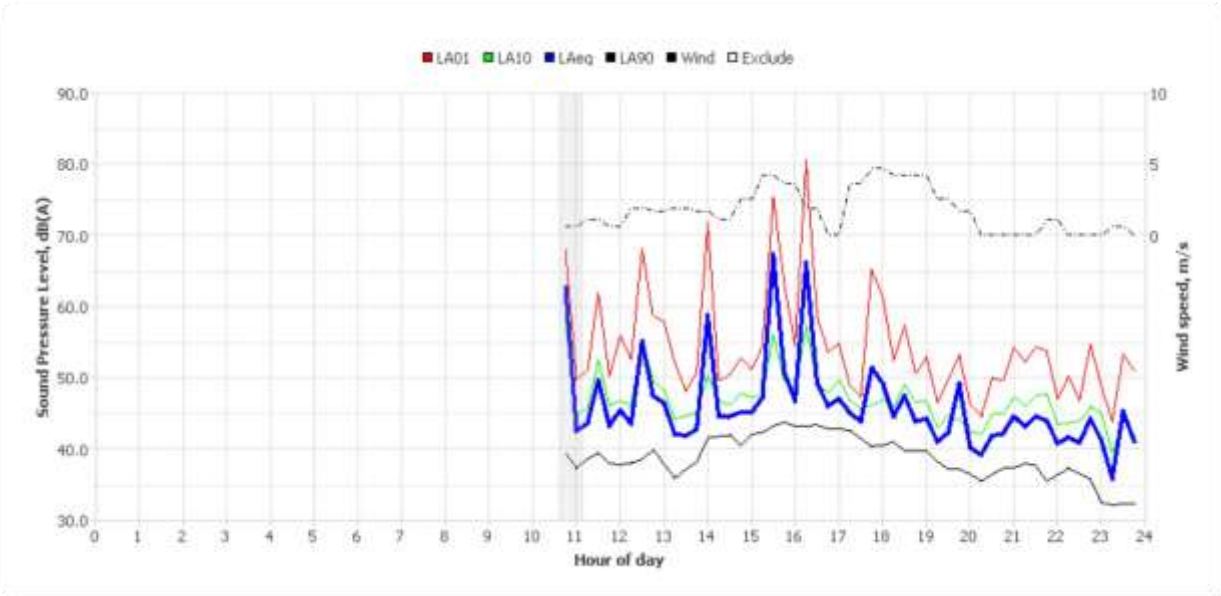
Measured noise levels

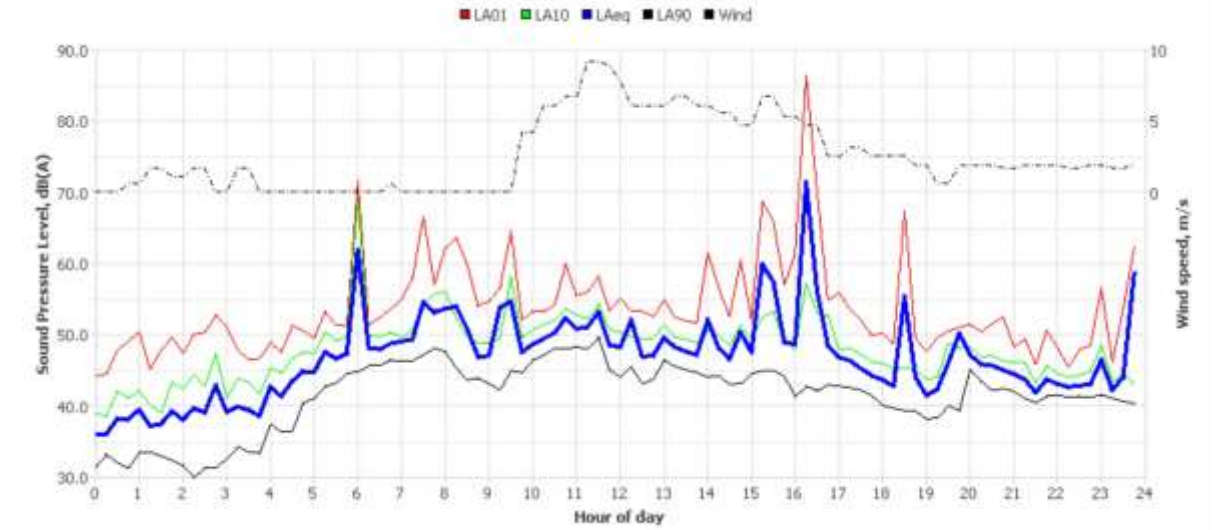
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu May 27 2021	56	45	42	-	36	-	54	42
Fri May 28 2021	58	47	49	-	38	31	56	49
Sat May 29 2021	60	-	45	-	-	-	60	45
Sun May 30 2021	-	42	39	-	29	-	42	39
Mon May 31 2021	57	44	46	37	35	28	56	46
Tue Jun 1 2021	57	48	51	38	32	30	56	51
Wed Jun 2 2021	60	46	46	44	36	29	59	46
Thu Jun 3 2021	48	43	50	-	28	26	46	50
Fri Jun 4 2021	54	-	45	40	-	-	54	45
Sat Jun 5 2021	49	-	44	36	-	-	49	44
Sun Jun 6 2021	60	41	40	35	32	-	59	40
Mon Jun 7 2021	48	-	49	-	-	-	48	49
Tue Jun 8 2021	55	-	50	-	-	-	55	50
Wed Jun 9 2021	47	-	46	-	-	-	47	46
Summary	**57**	**45**	**47**	**37**	**33**	**29**	**55**	**47**

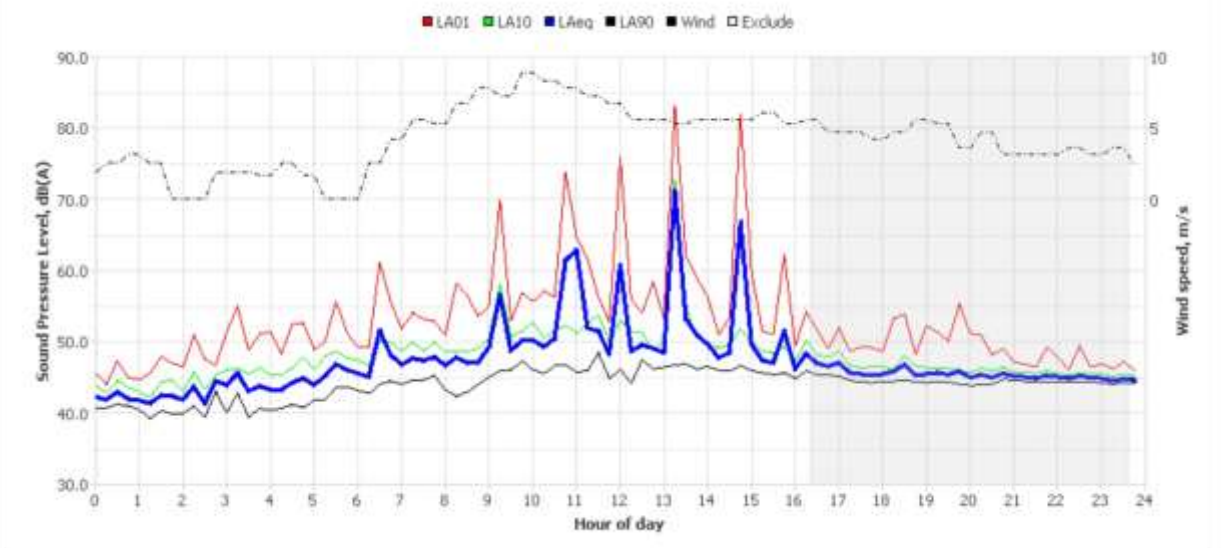
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

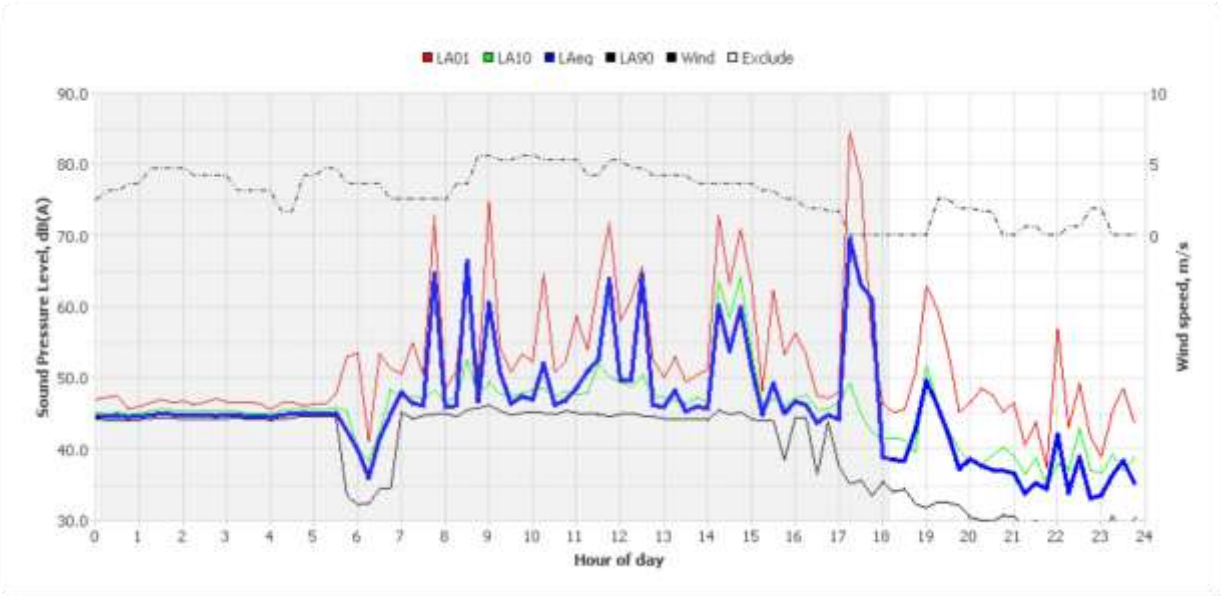
Logger Location	Logger Deployment Photo
	

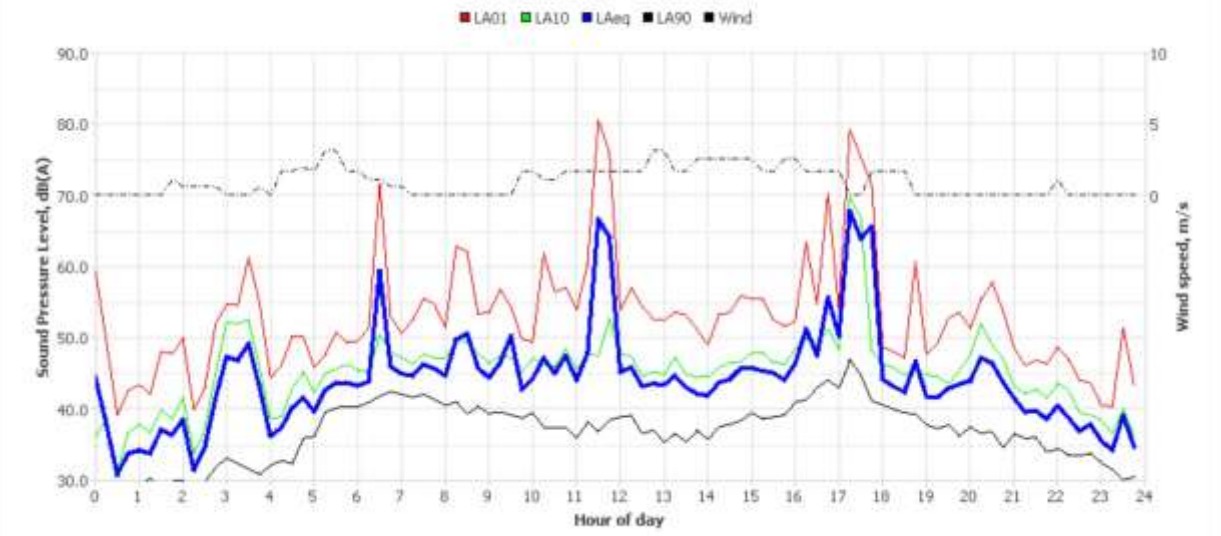
43 Clyde Street, Vineyard

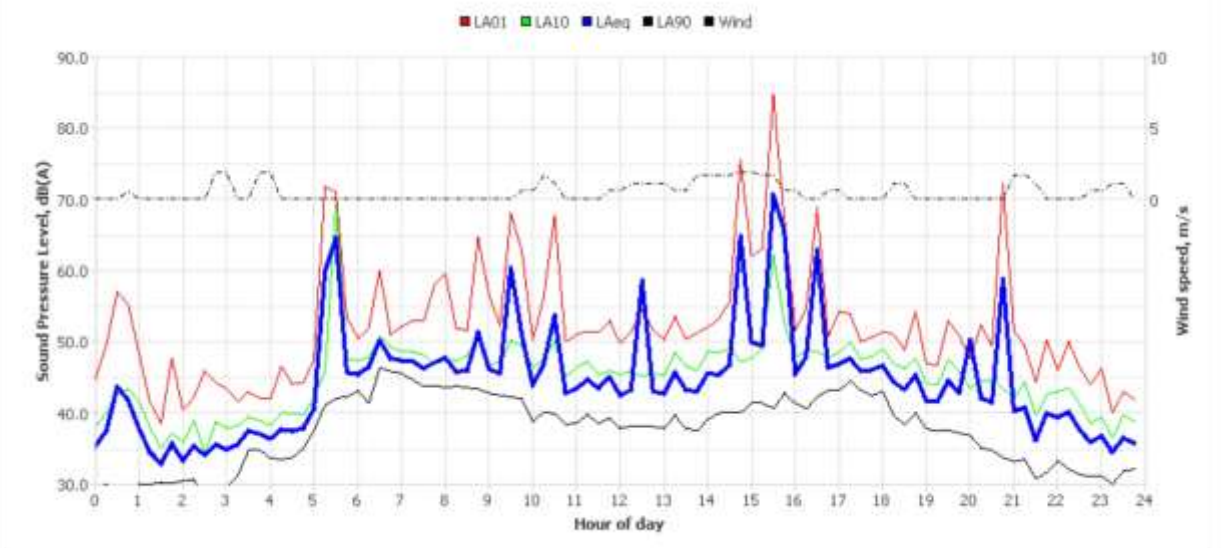

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

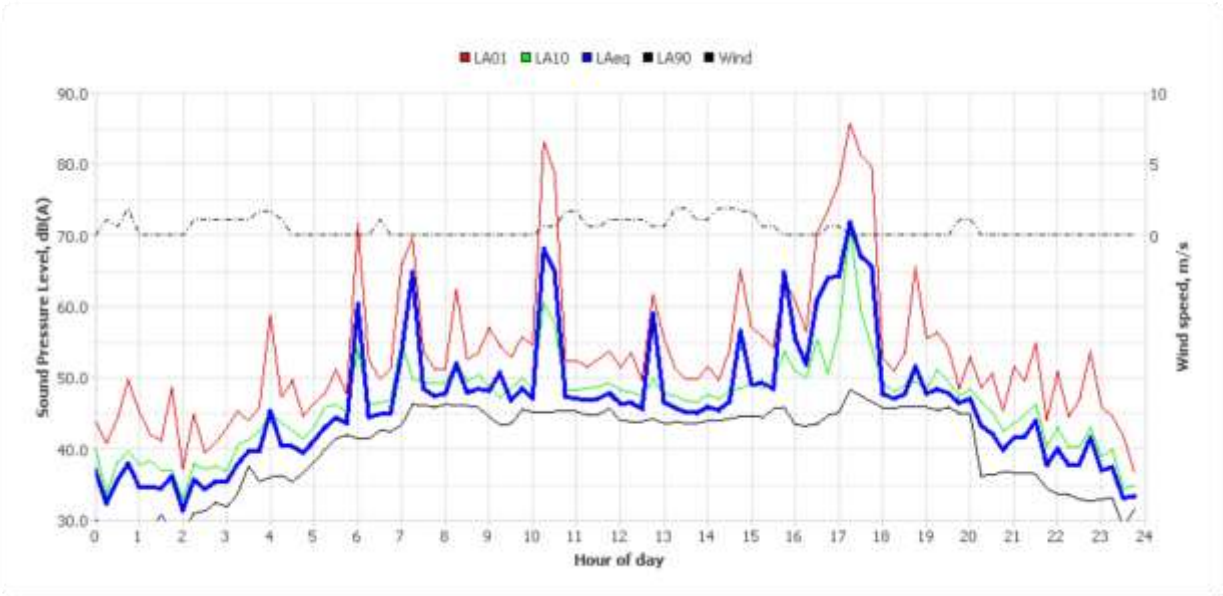

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

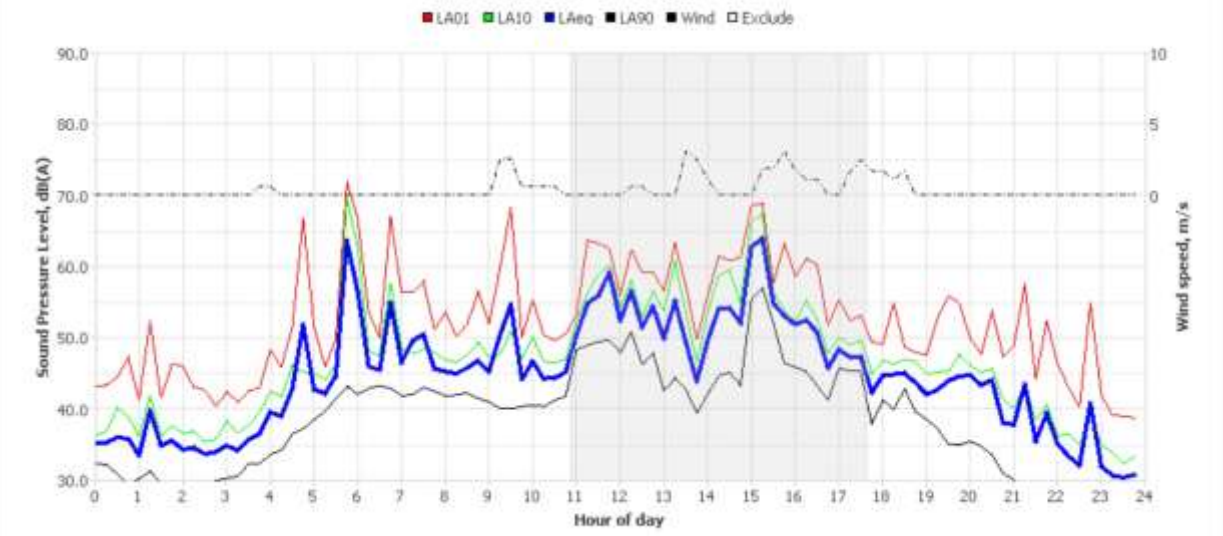

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

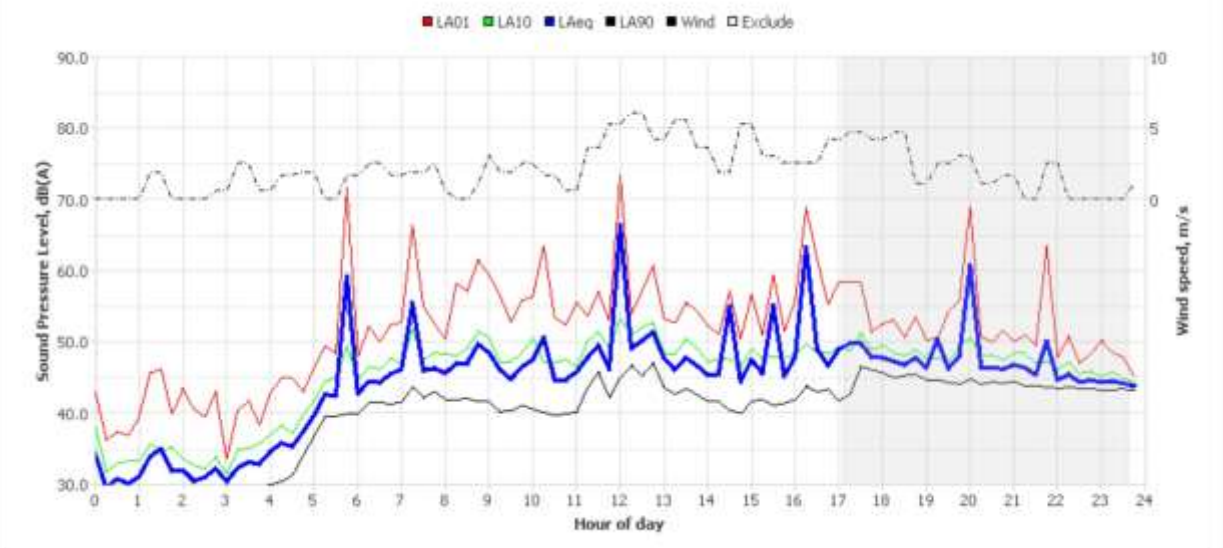

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

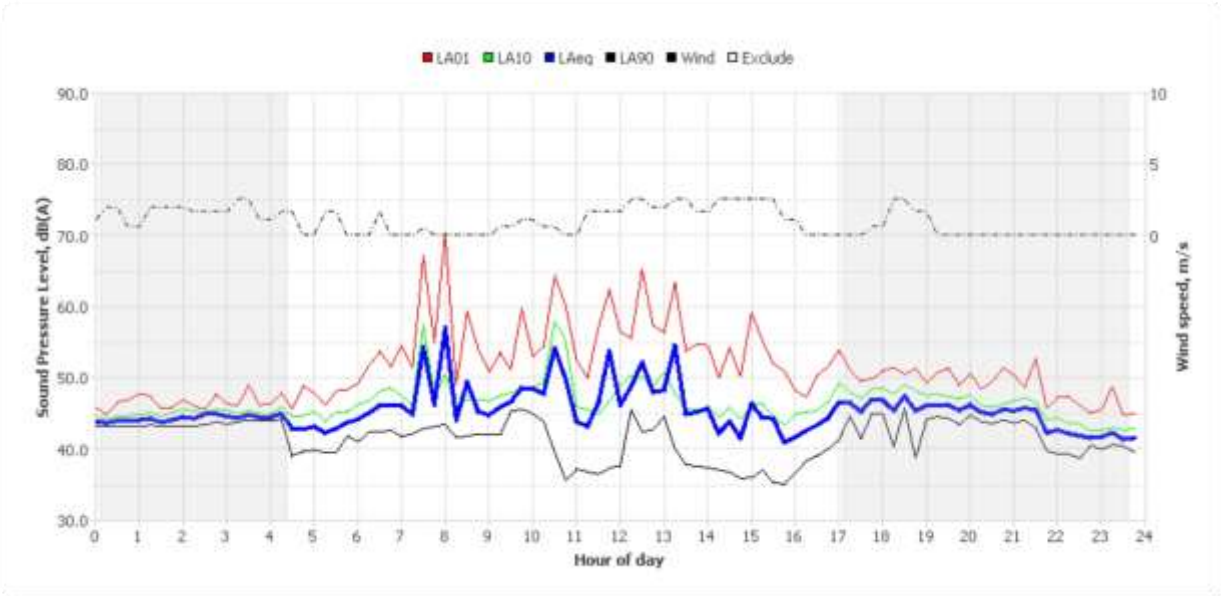

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

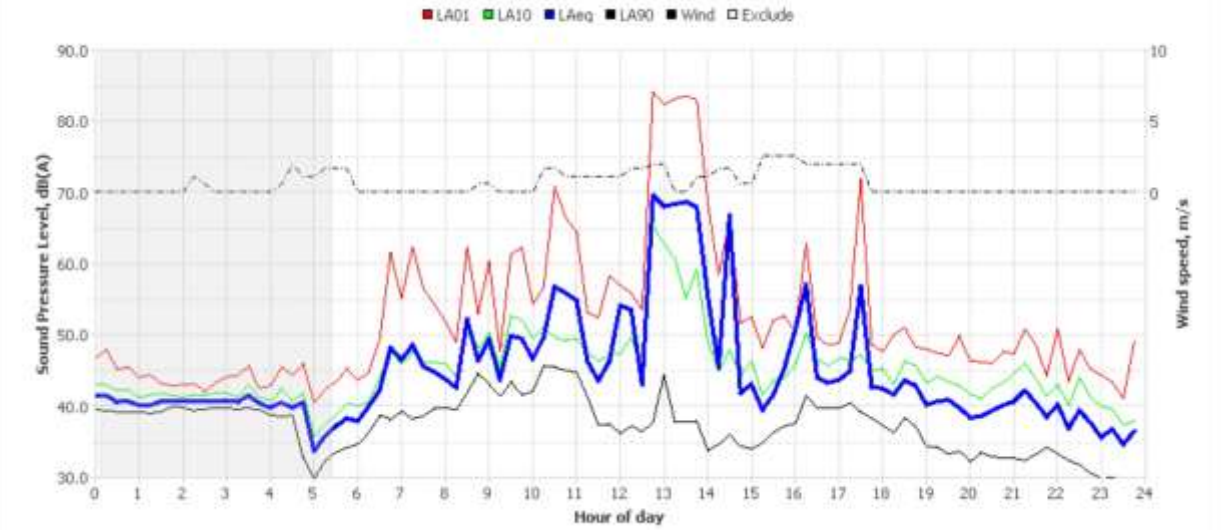

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

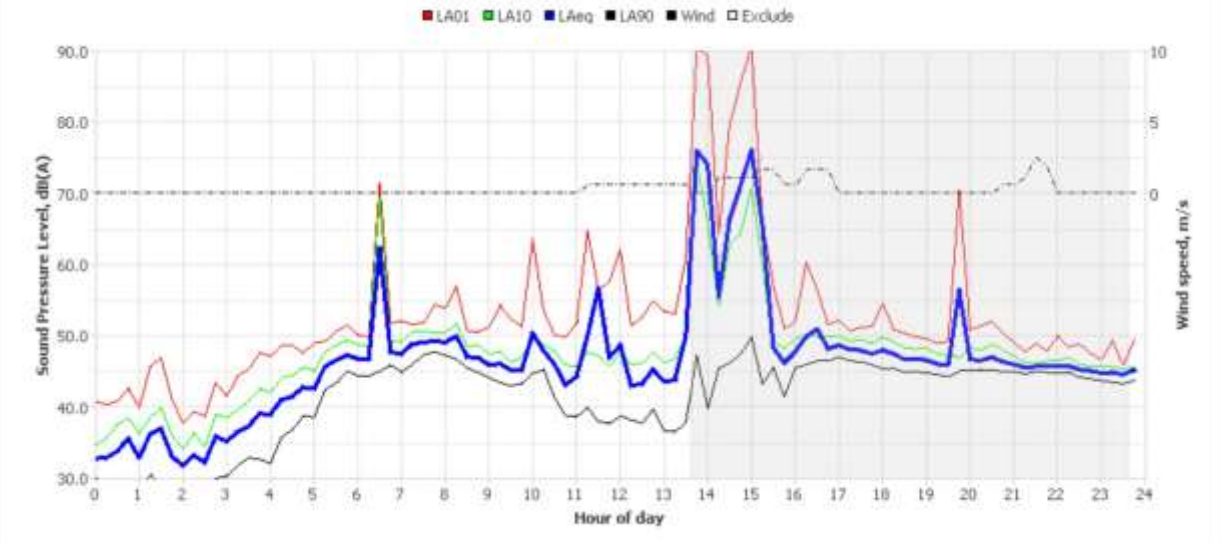

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

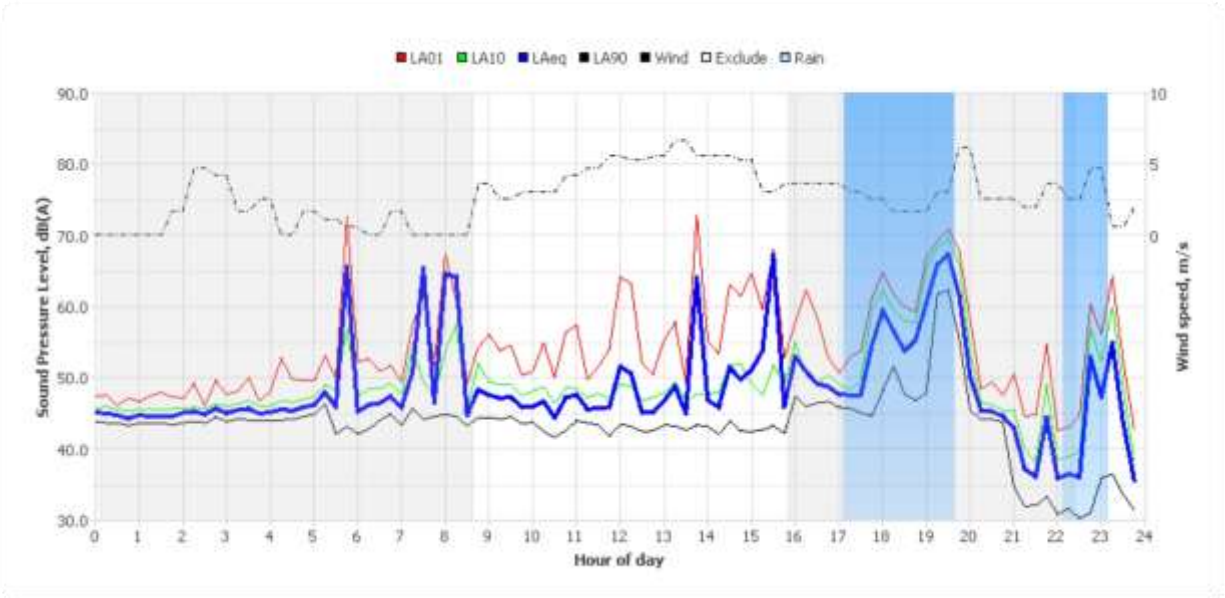

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

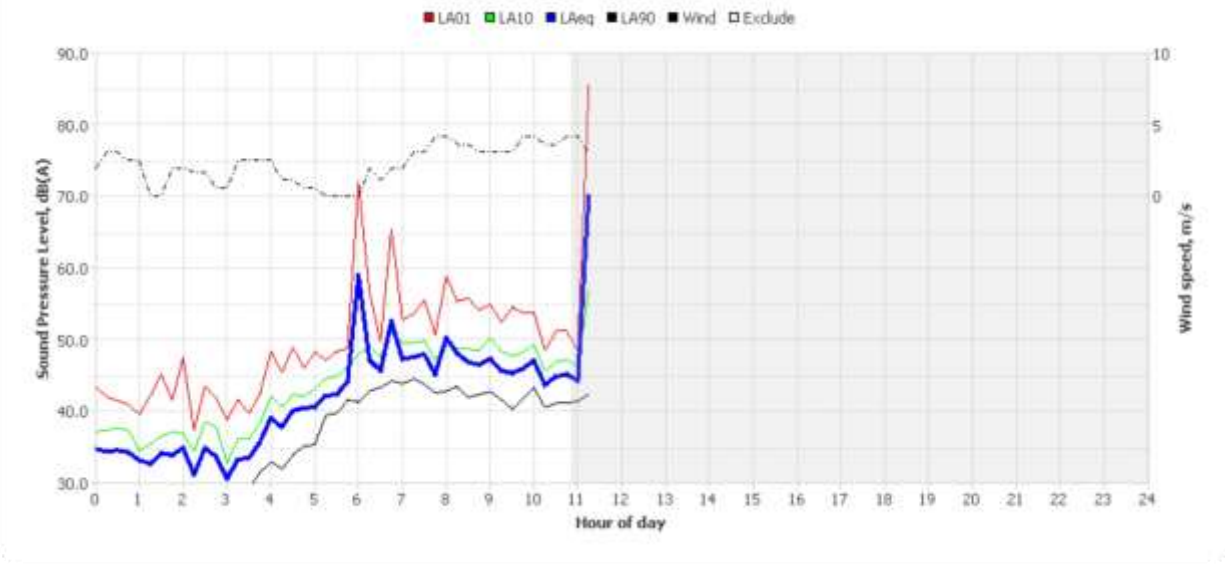

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

Noise Logger Report

669 Windsor Road, Vineyard

Item	Information
Logger Type	NL-52
Serial number	1043455
Address	669 Windsor Road, Vineyard
Location	Front Yard
Facade / Free Field	Free field
Environment	Background dominated by road traffic noise on Windsor Road. Truck pass by 70dBA. Cars north and south bound 65 dBA. Truck north bound 68 dBA.

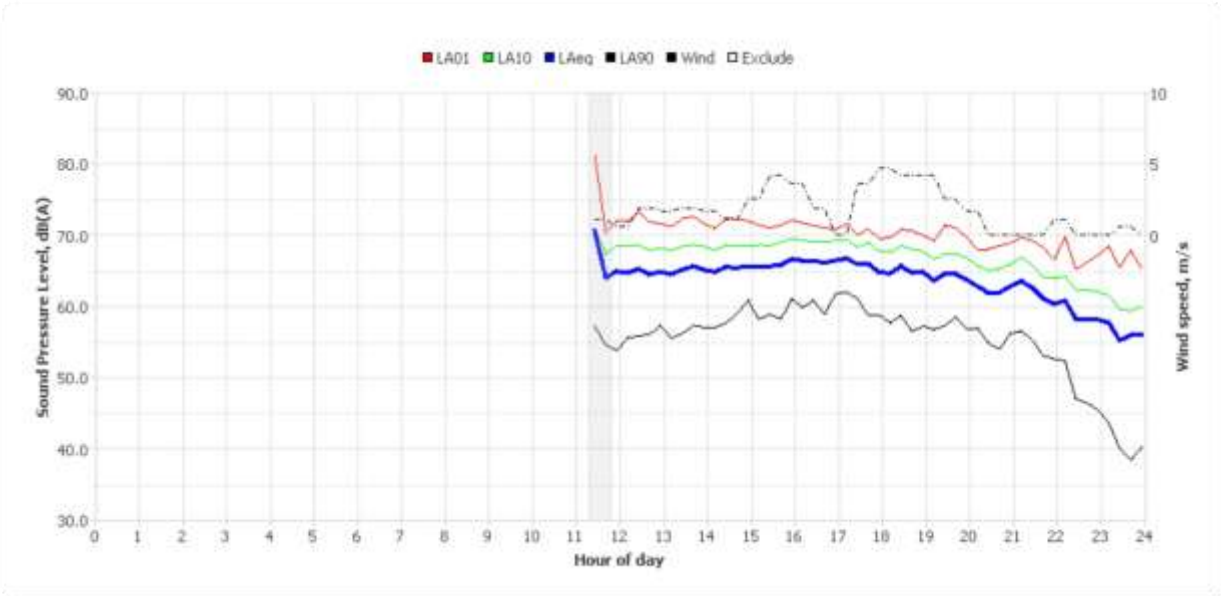
Measured noise levels

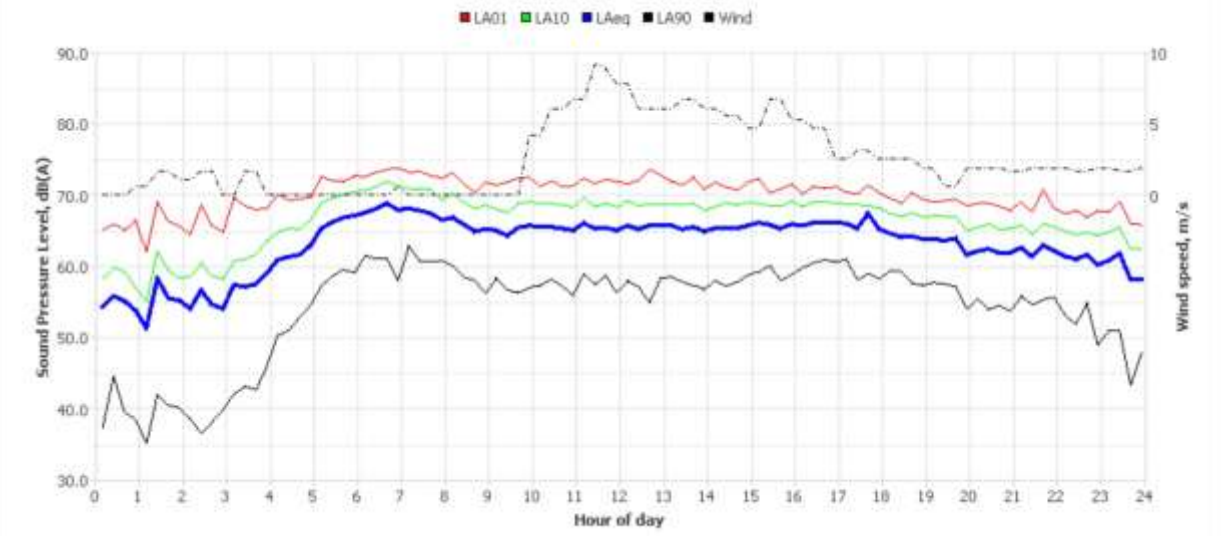
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu May 27 2021	66	64	58	-	53	-	65	58
Fri May 28 2021	66	63	63	-	54	38	65	63
Sat May 29 2021	64	61	60	-	-	35	62	60
Sun May 30 2021	64	60	55	-	44	29	63	55
Mon May 31 2021	65	62	61	54	50	35	65	61
Tue Jun 1 2021	66	63	62	56	48	36	65	62
Wed Jun 2 2021	65	63	62	55	50	34	65	62
Thu Jun 3 2021	67	63	62	57	49	34	66	62
Fri Jun 4 2021	66	63	62	56	52	30	65	62
Sat Jun 5 2021	64	63	60	55	52	37	64	60
Sun Jun 6 2021	64	62	56	53	50	35	63	56
Mon Jun 7 2021	65	63	62	54	51	36	65	62
Tue Jun 8 2021	65	61	62	-	-	34	64	62
Wed Jun 9 2021	66	-	63	-	-	-	66	63
Summary	**65**	**62**	**61**	**55**	**50**	**35**	**65**	**61**

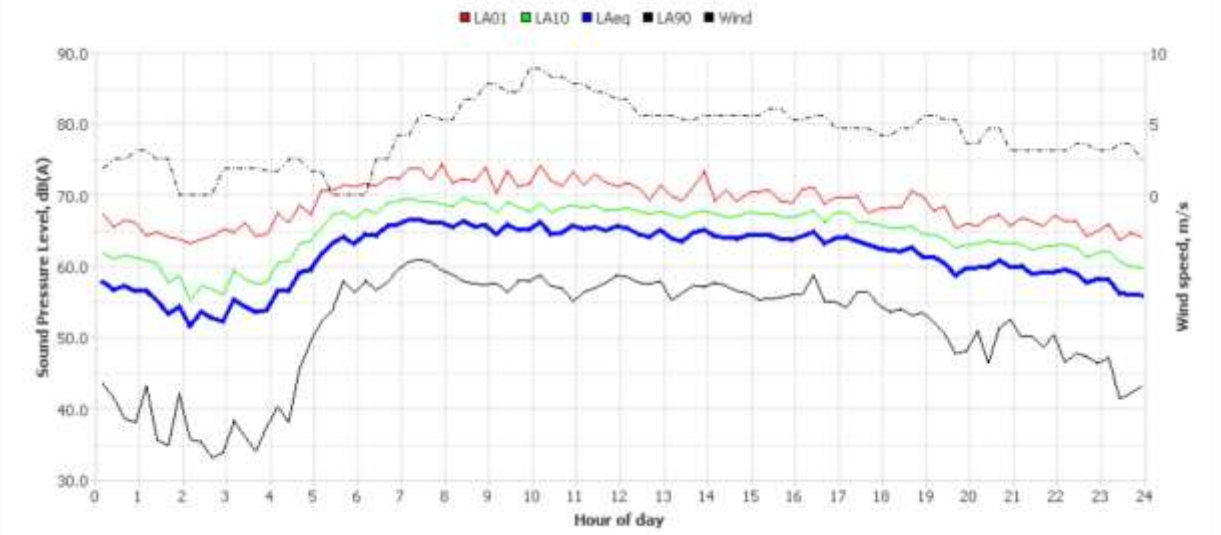
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

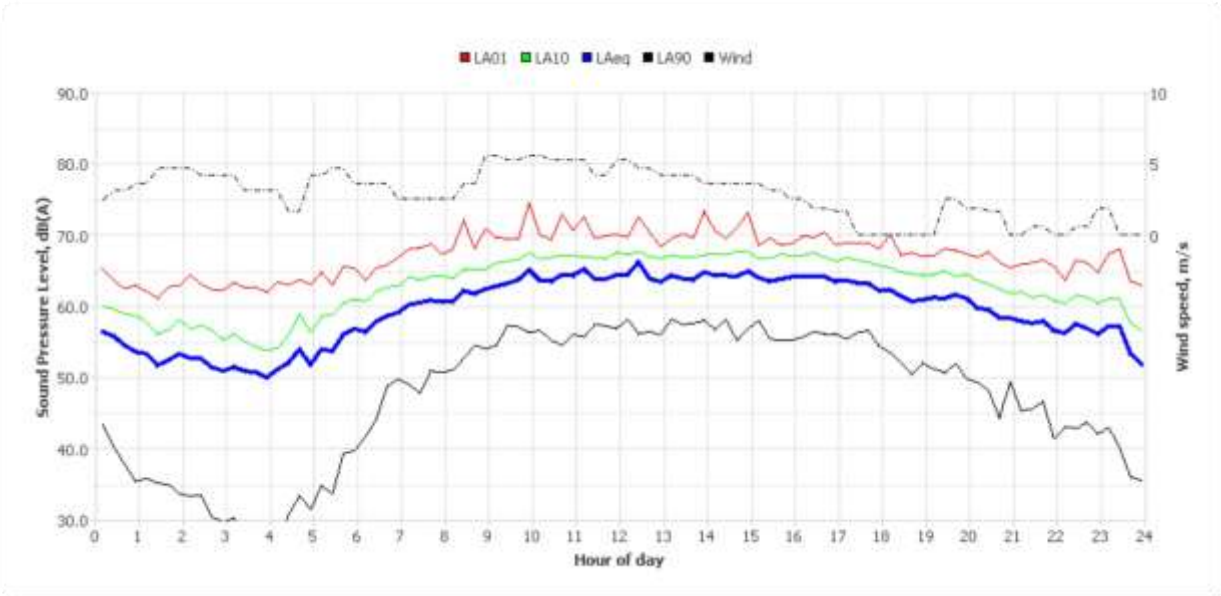
Logger Location	Logger Deployment Photo
	

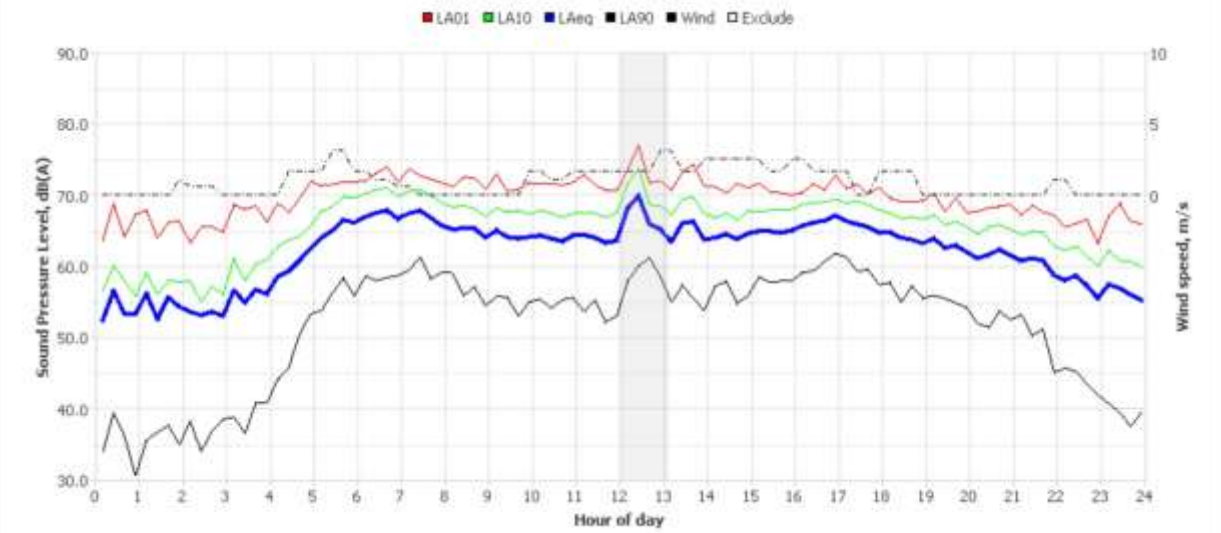
669 Windsor Road, Vineyard

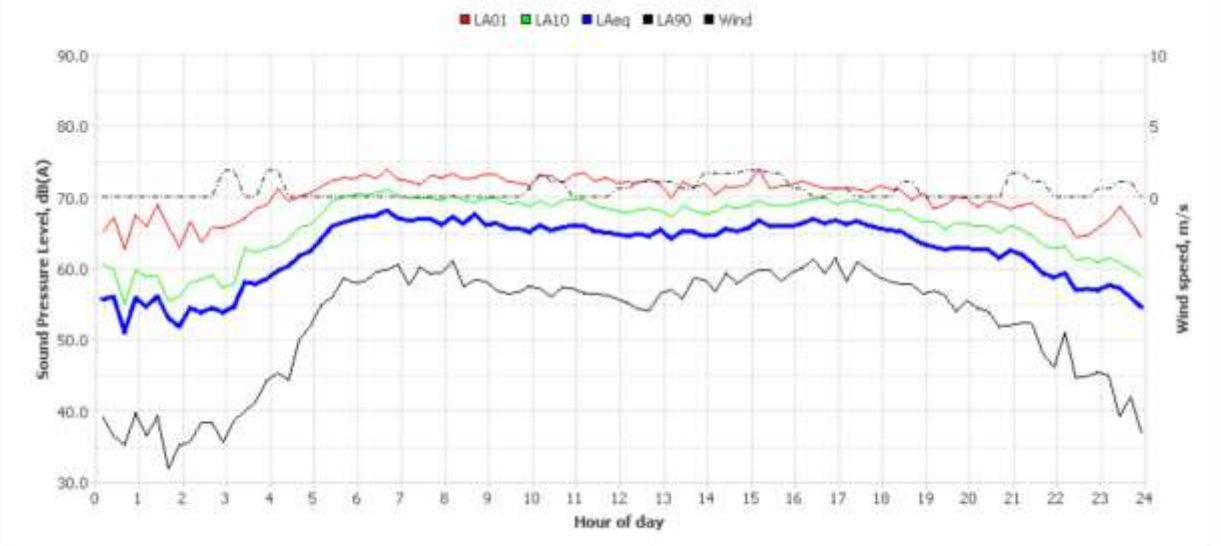

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

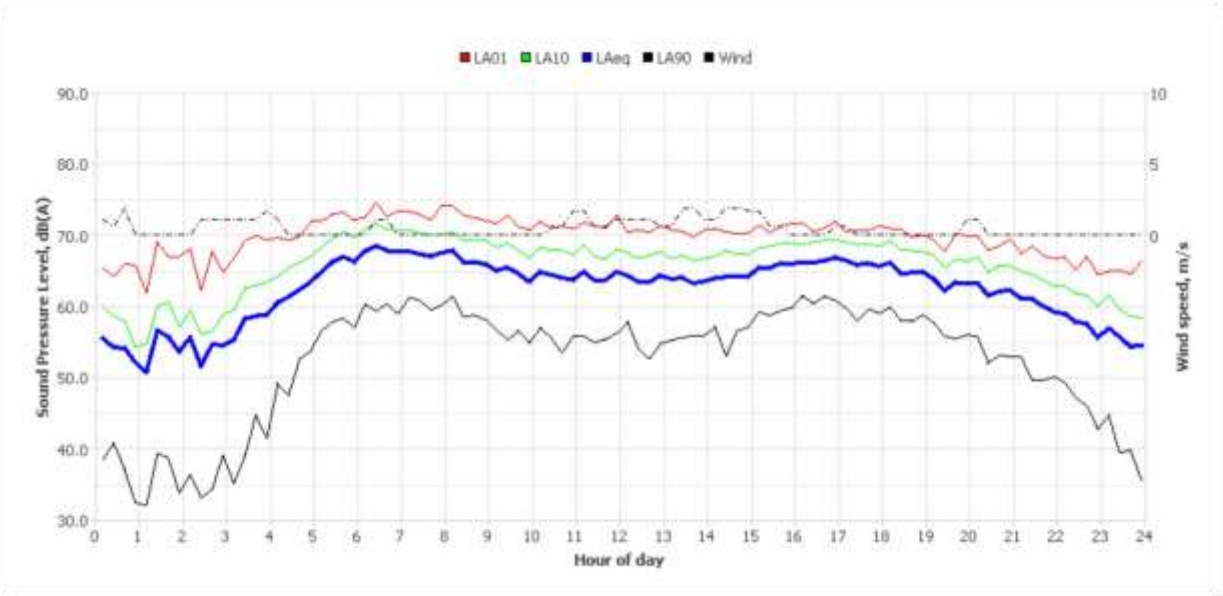

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

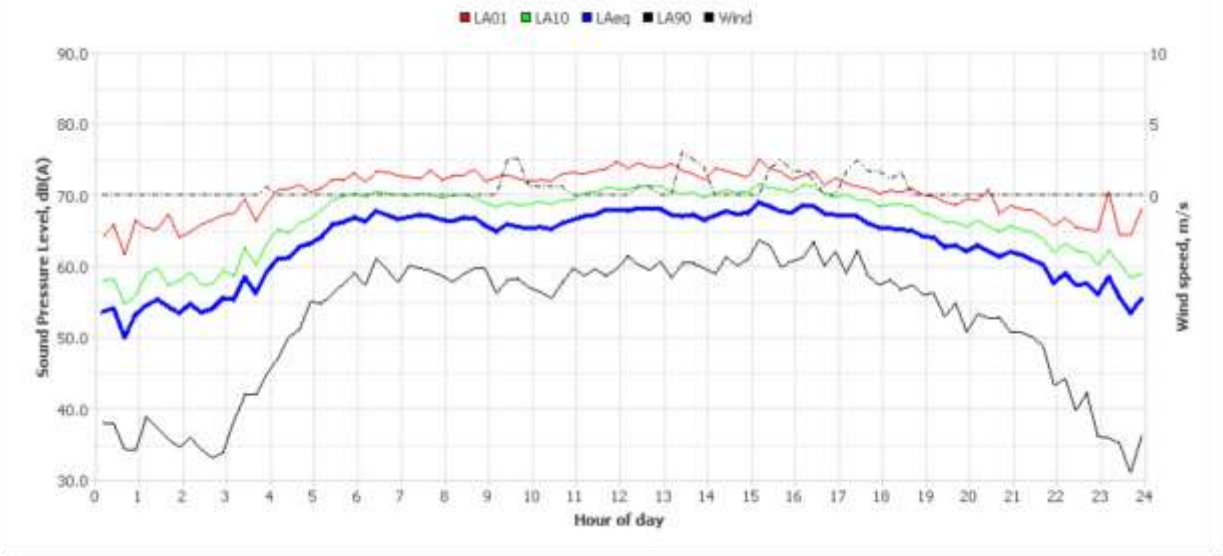

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

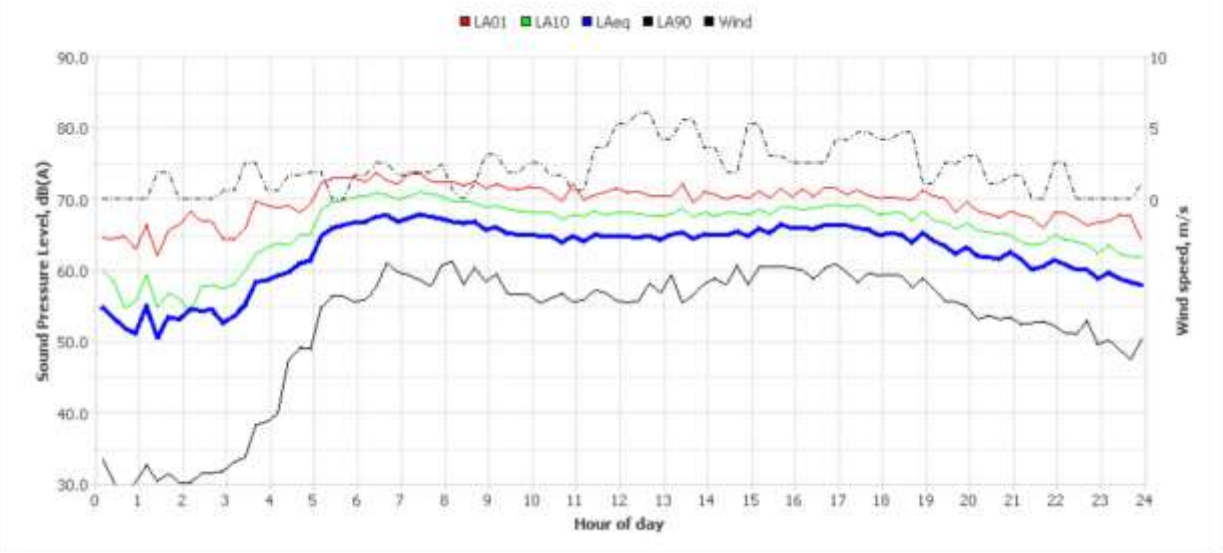

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

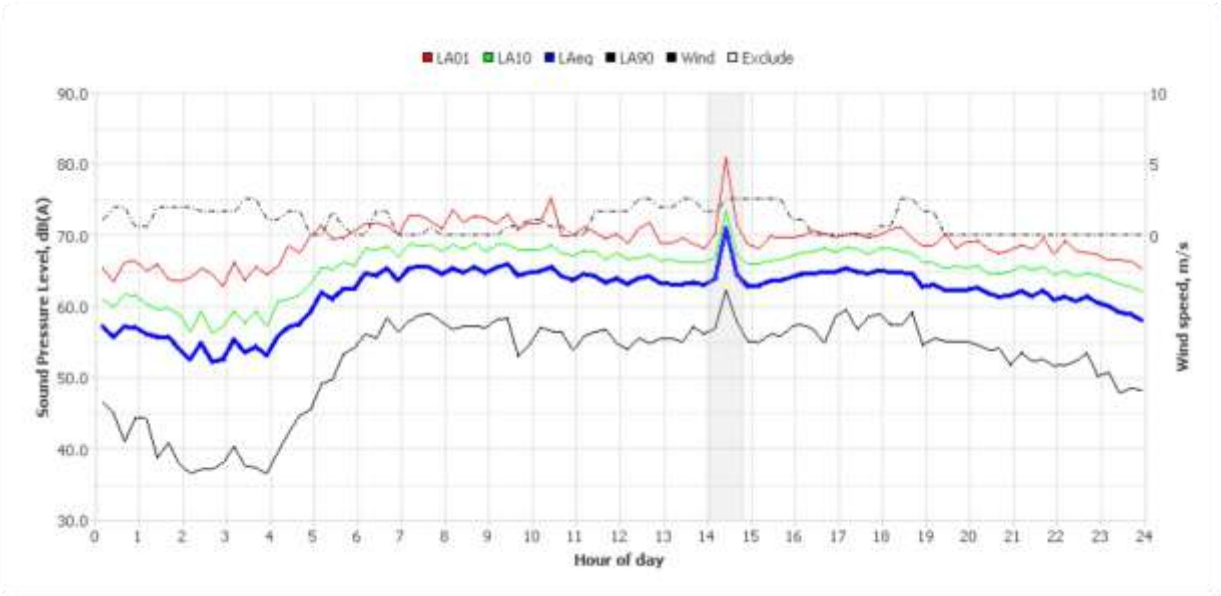

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

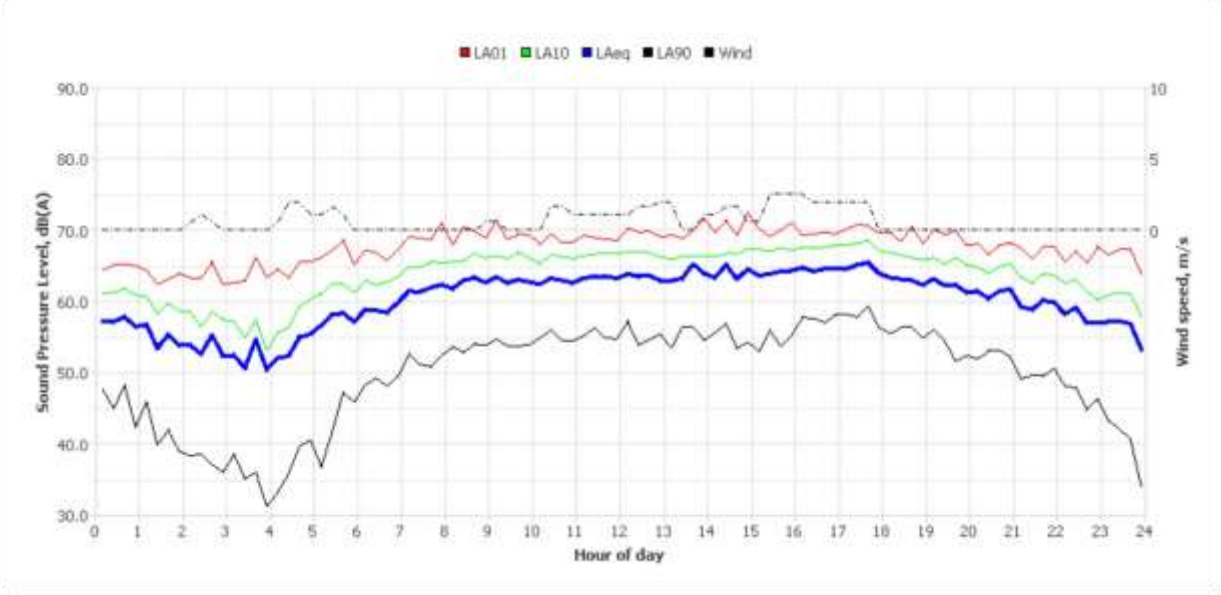

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

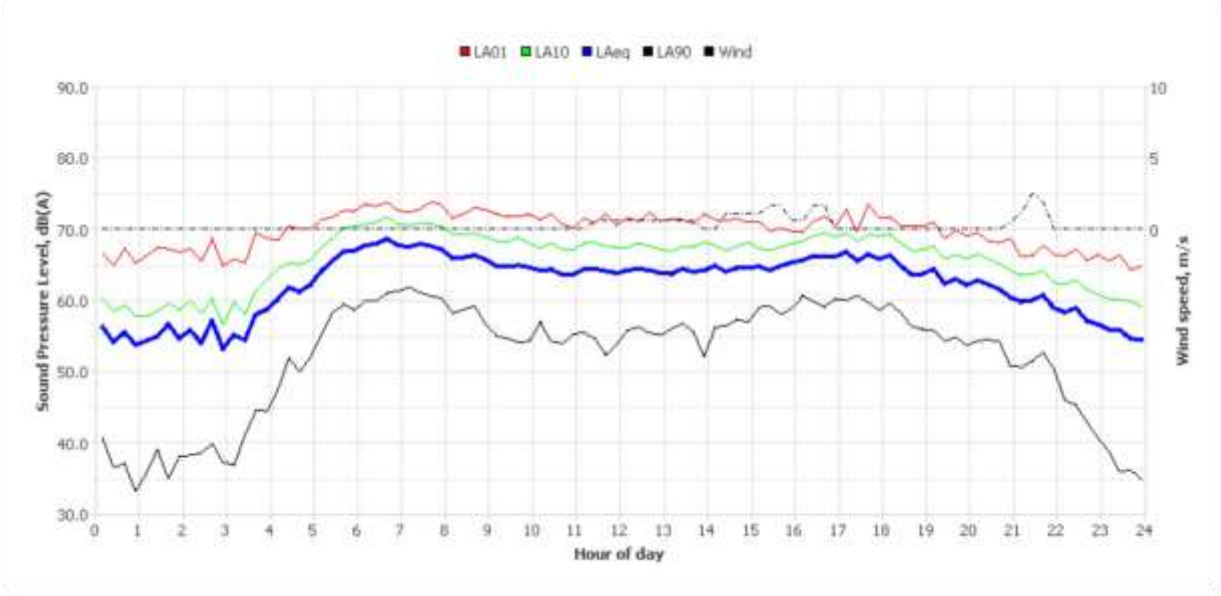

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

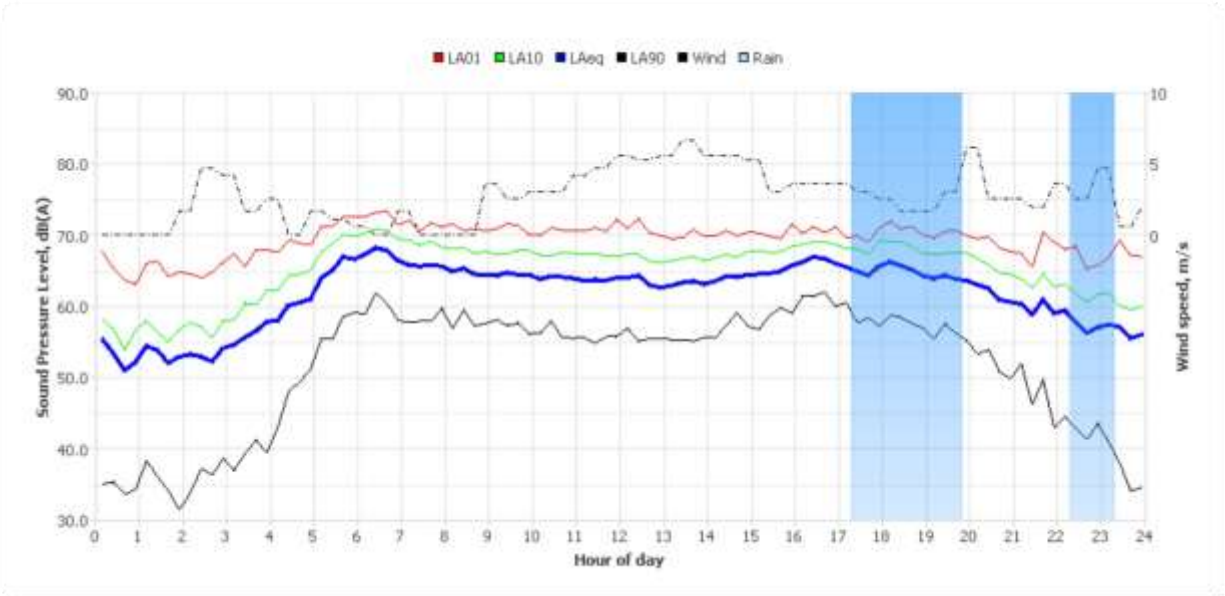

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

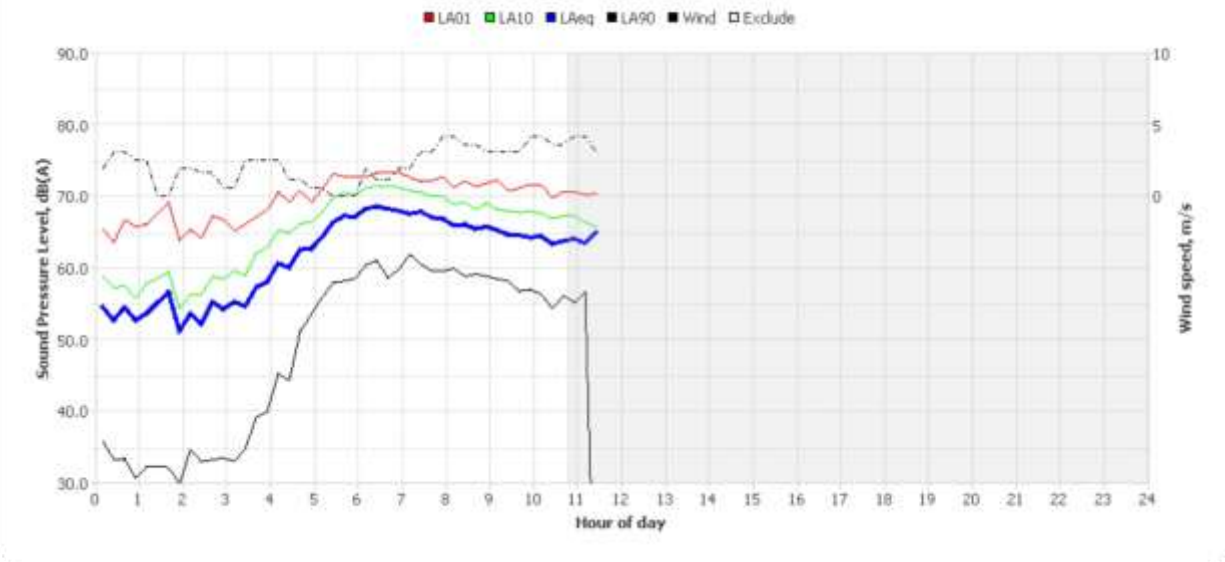

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

Noise Logger Report

18 Nelson Road, Box Hill

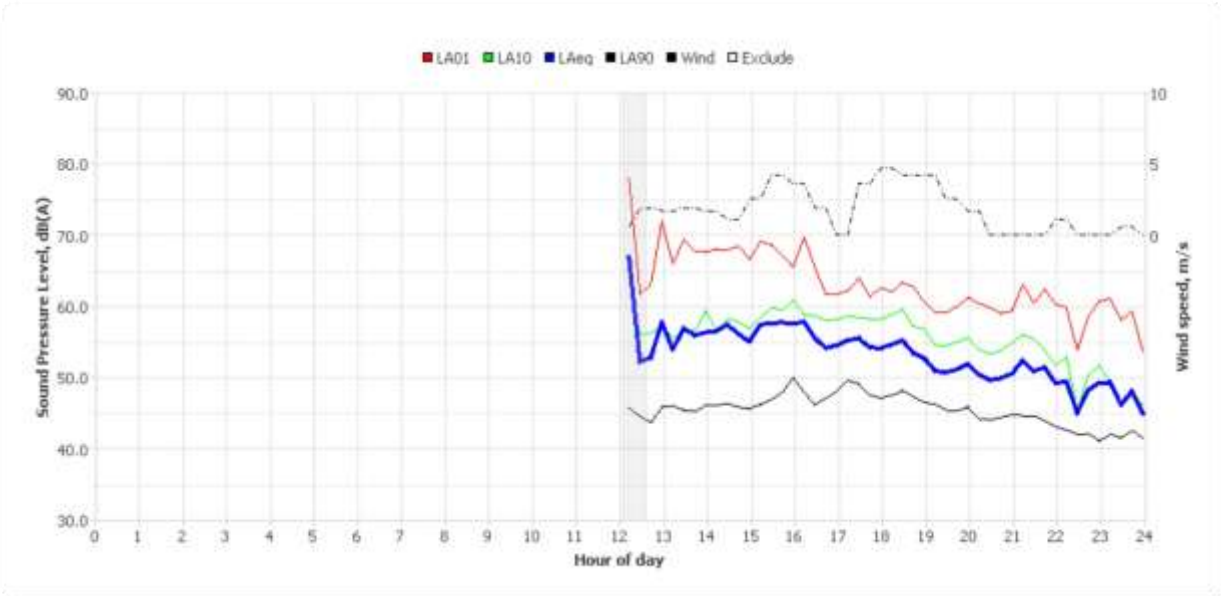
Item	Information
Logger Type	NL-52
Serial number	164395
Address	18 Nelson Road, Box Hill
Location	Back Yard
Facade / Free Field	Free field
Environment	Ambient noise dominated by road traffic on Nelson Road 48 - 55 dBA. Horse, sheep, chickens, roosters and 3 dogs roaming freely and contribute to the ambient nosie level 44 dBA. Rooster crowing 53 dBA. Bird calls audible. Truck pass by on Nelson Road 65 dBA.

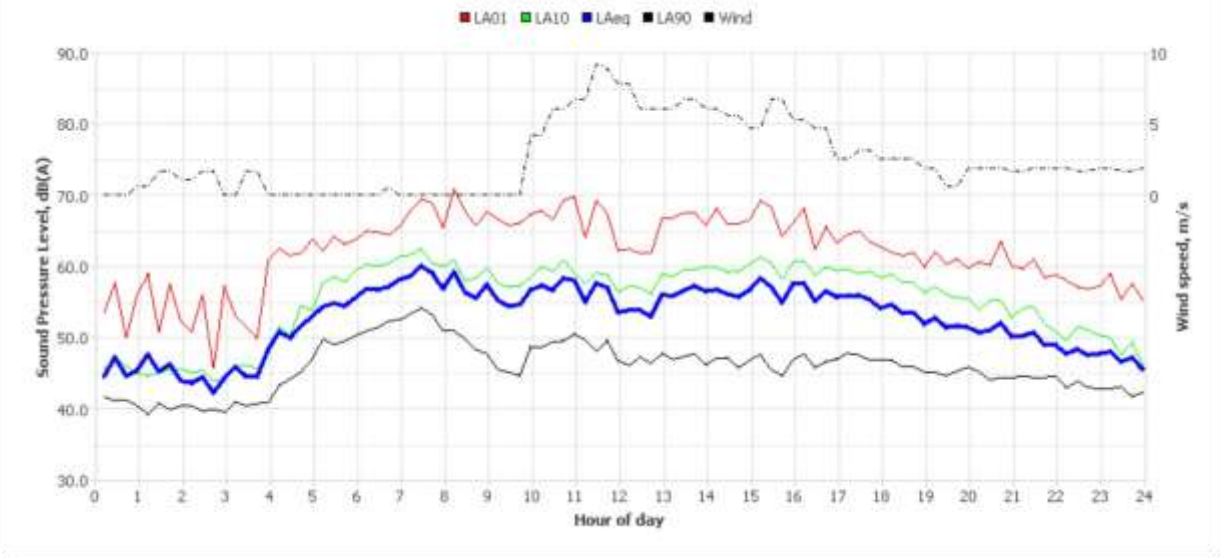
Measured noise levels

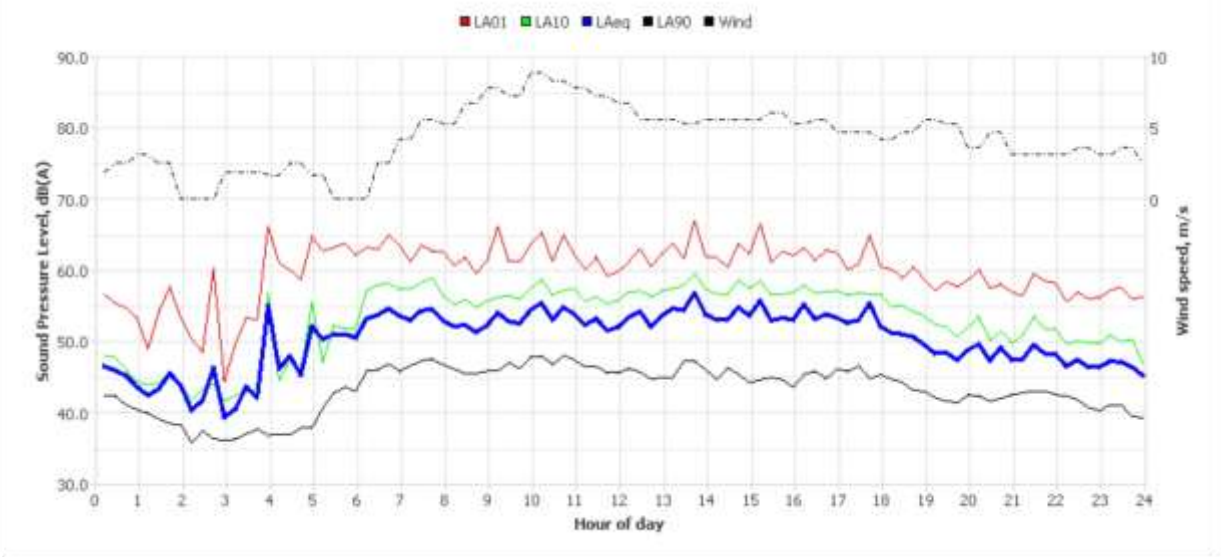
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu May 27 2021	56	52	48	-	44	-	55	48
Fri May 28 2021	57	52	51	-	44	40	55	51
Sat May 29 2021	53	49	49	-	-	36	51	49
Sun May 30 2021	52	48	46	-	41	35	51	46
Mon May 31 2021	56	52	50	42	43	40	55	50
Tue Jun 1 2021	55	52	50	44	42	38	54	50
Wed Jun 2 2021	55	52	51	44	41	35	55	51
Thu Jun 3 2021	57	51	50	44	33	31	56	50
Fri Jun 4 2021	57	53	50	46	45	30	56	50
Sat Jun 5 2021	55	53	50	41	44	39	54	50
Sun Jun 6 2021	53	52	48	40	43	36	53	48
Mon Jun 7 2021	56	52	51	44	41	34	55	51
Tue Jun 8 2021	56	49	51	-	-	34	56	51
Wed Jun 9 2021	55	-	51	-	-	-	55	51
Summary	**55**	**51**	**50**	**44**	**43**	**36**	**55**	**50**

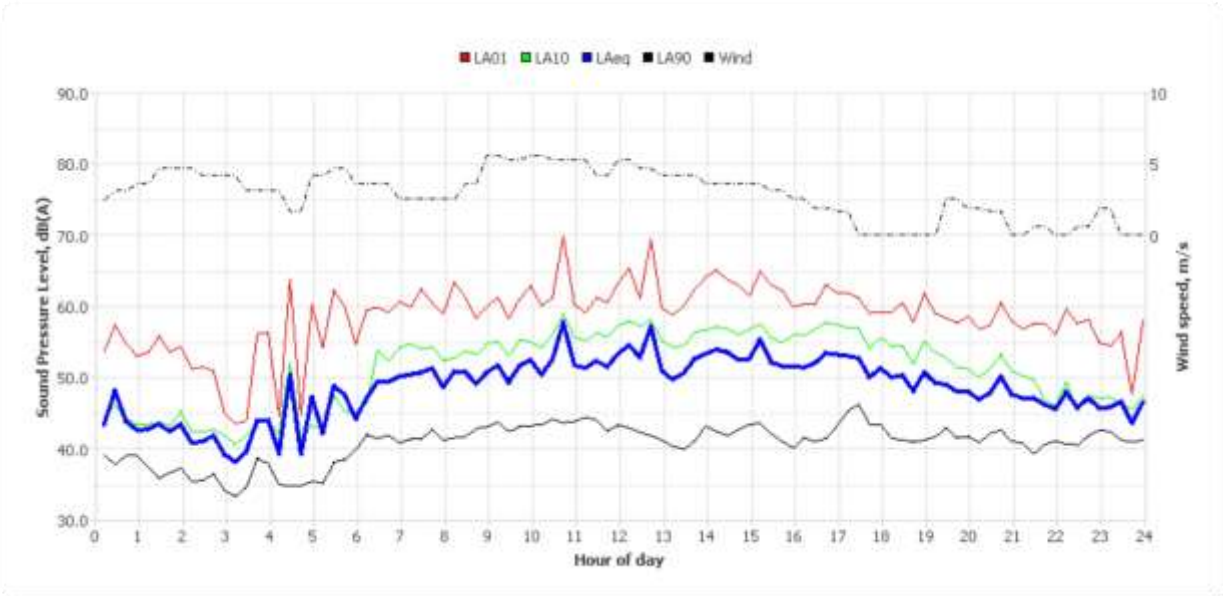
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

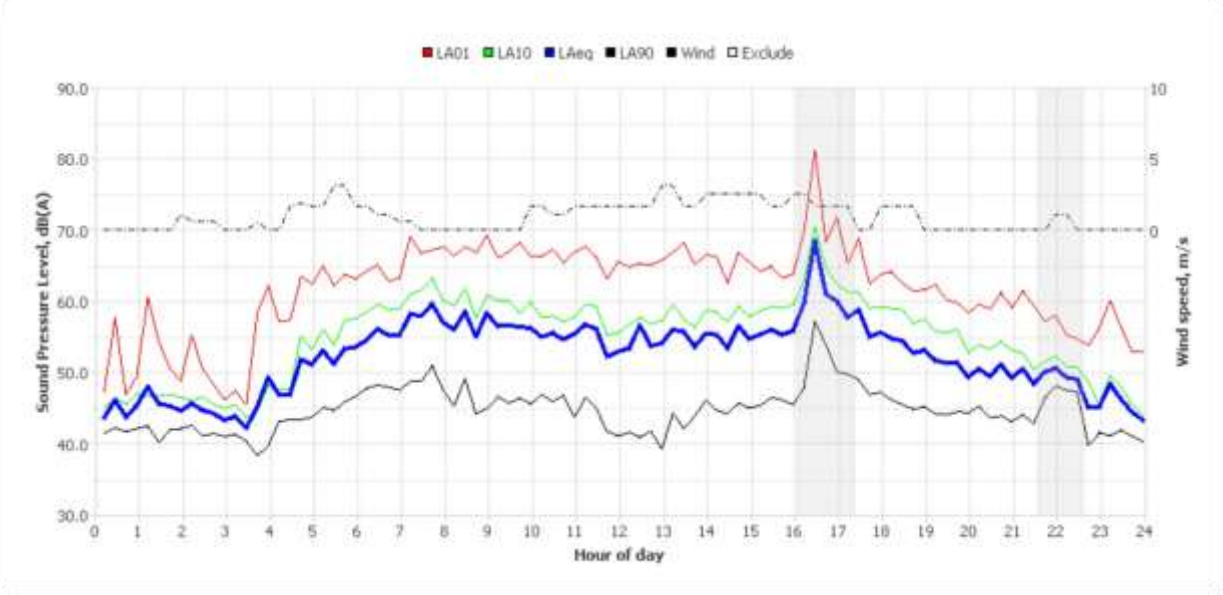
Logger Location	Logger Deployment Photo
 18 Nelson Road, Box Hill	

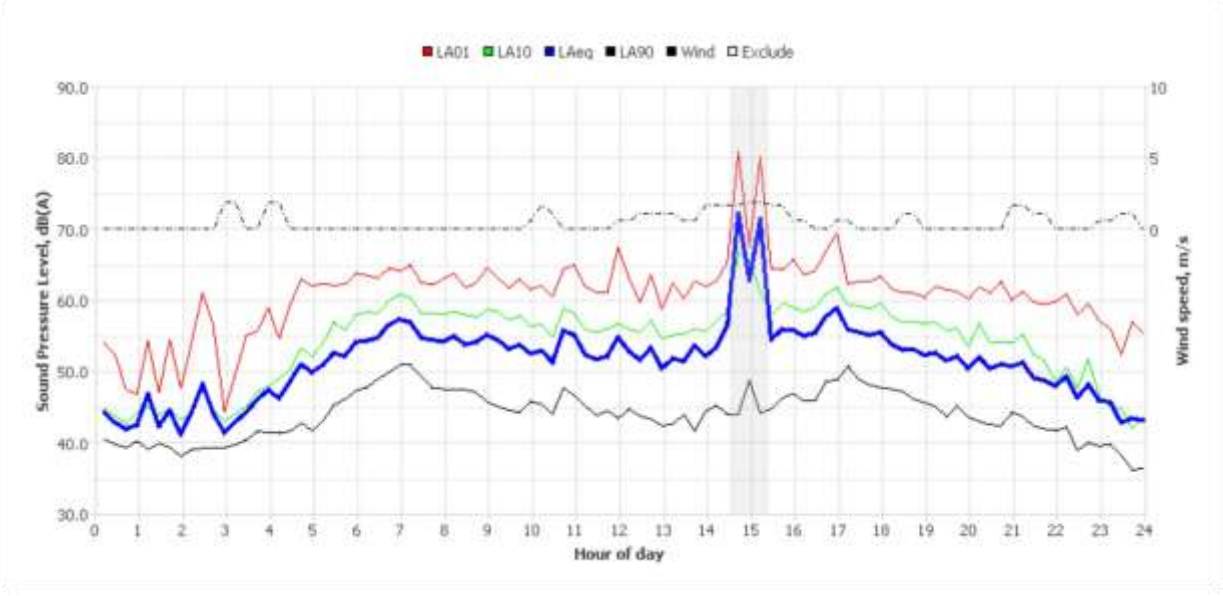

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

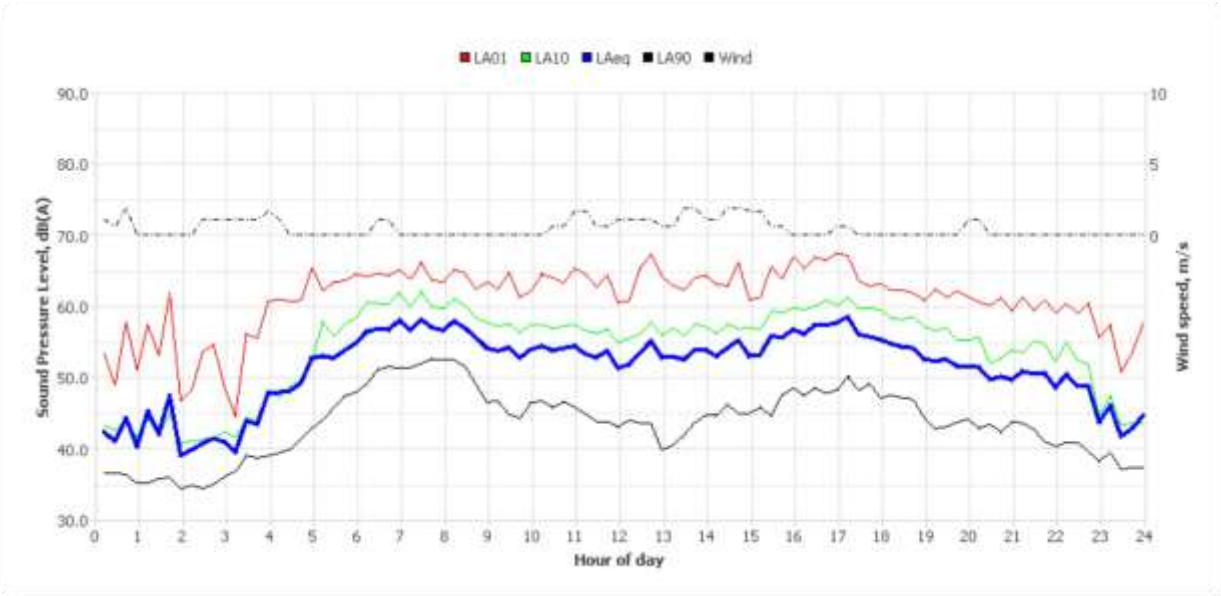

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

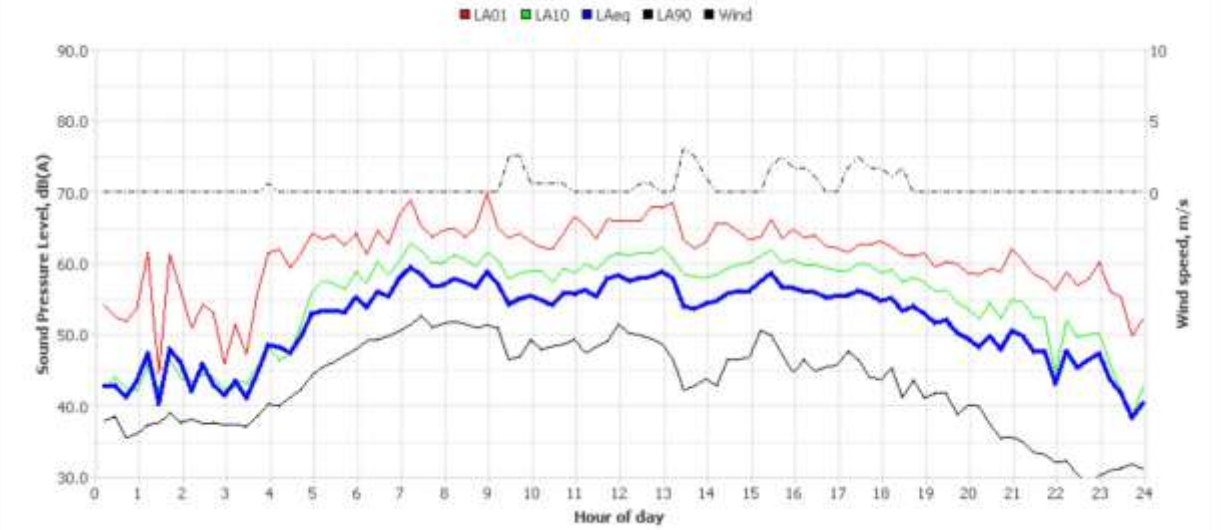

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

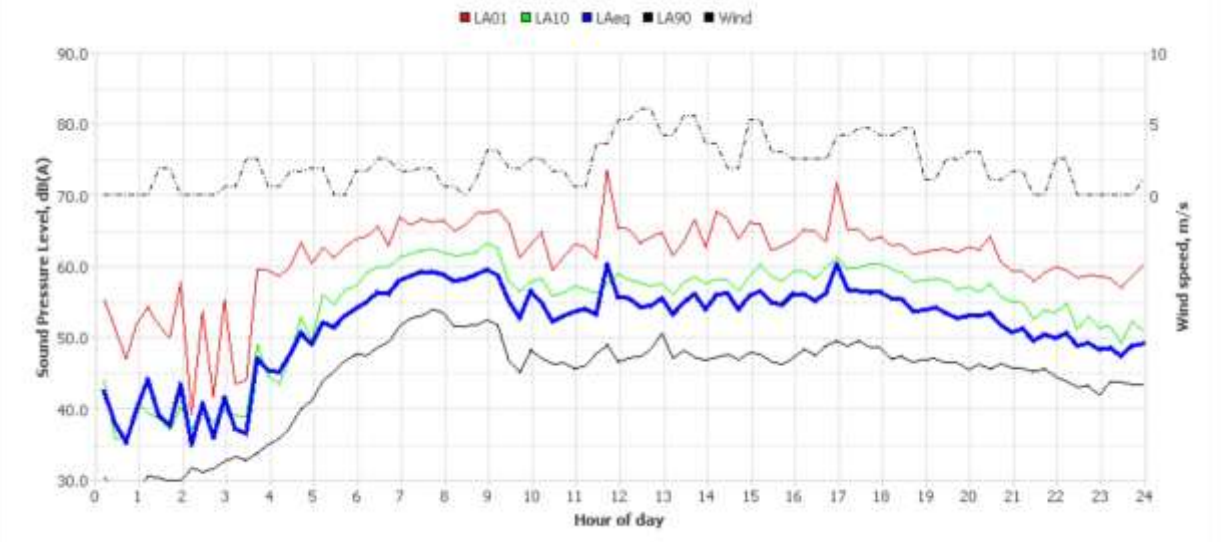

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

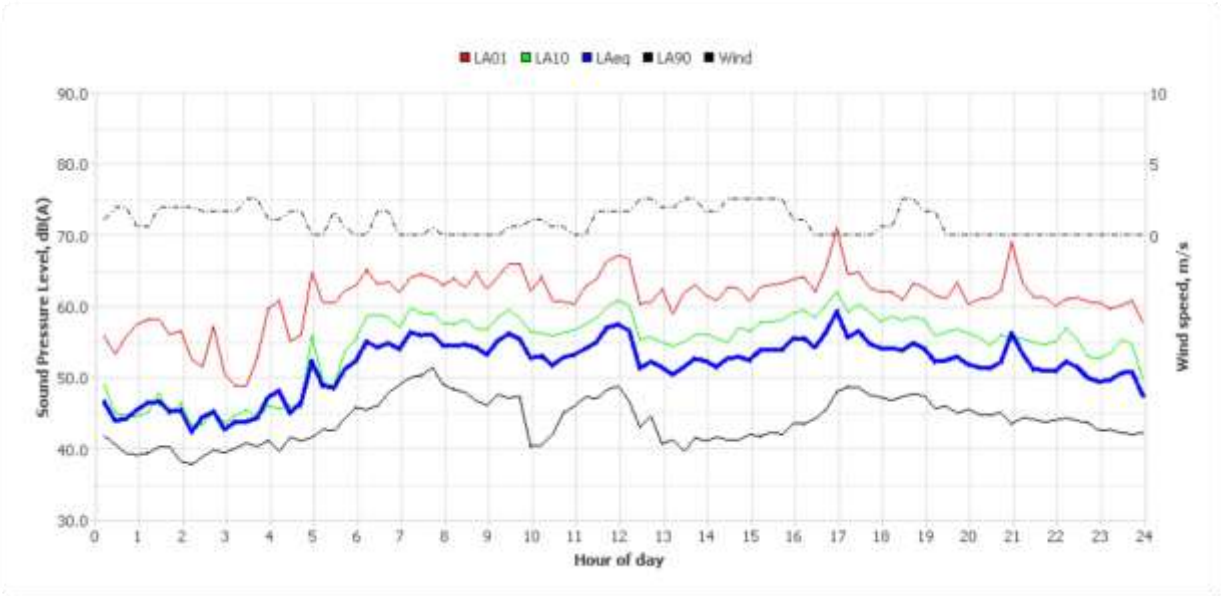

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

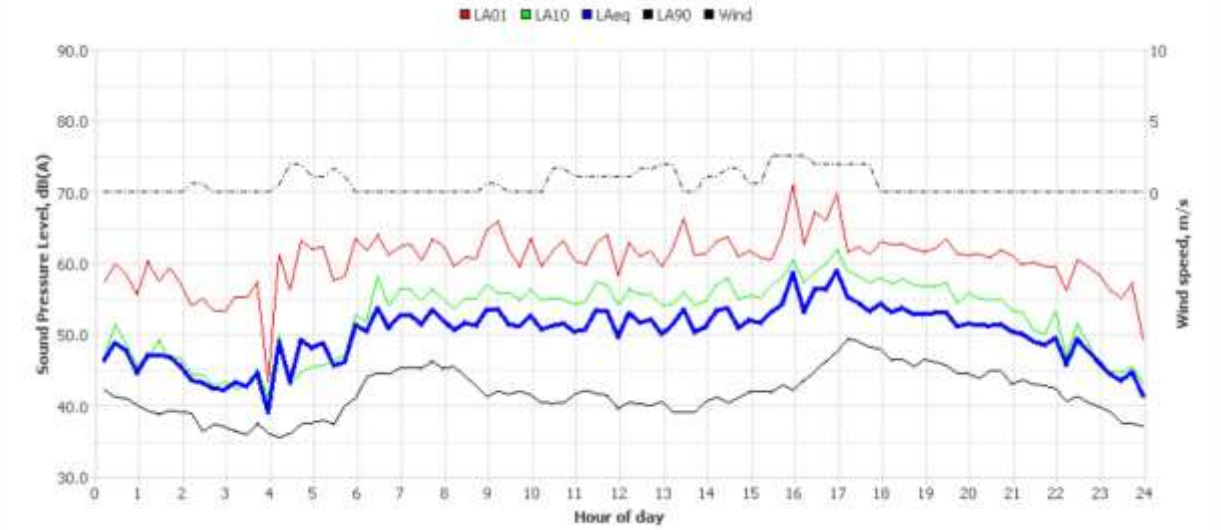

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

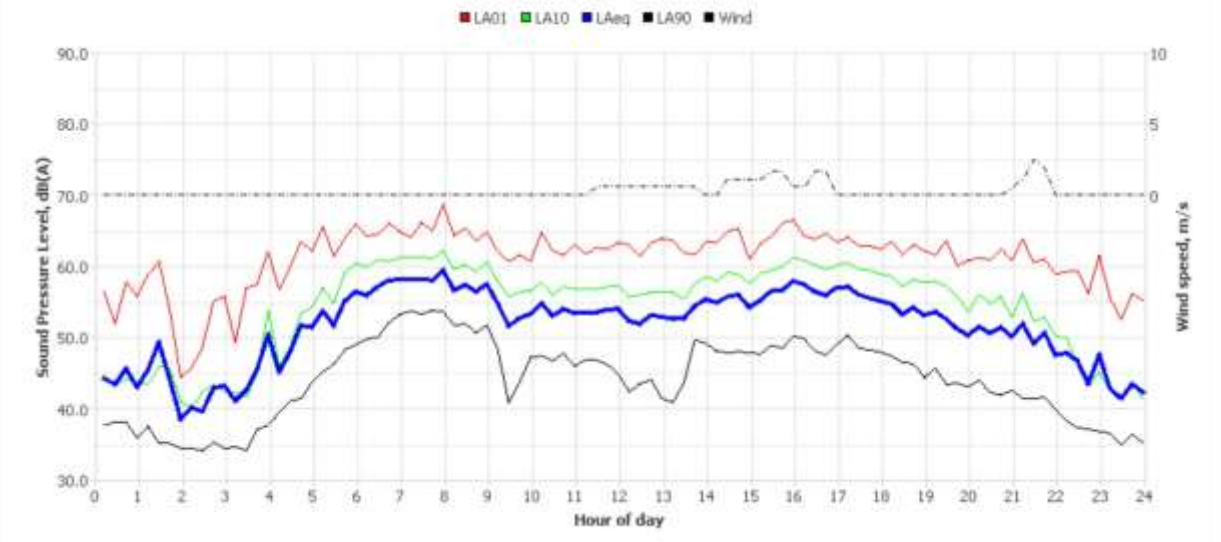

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

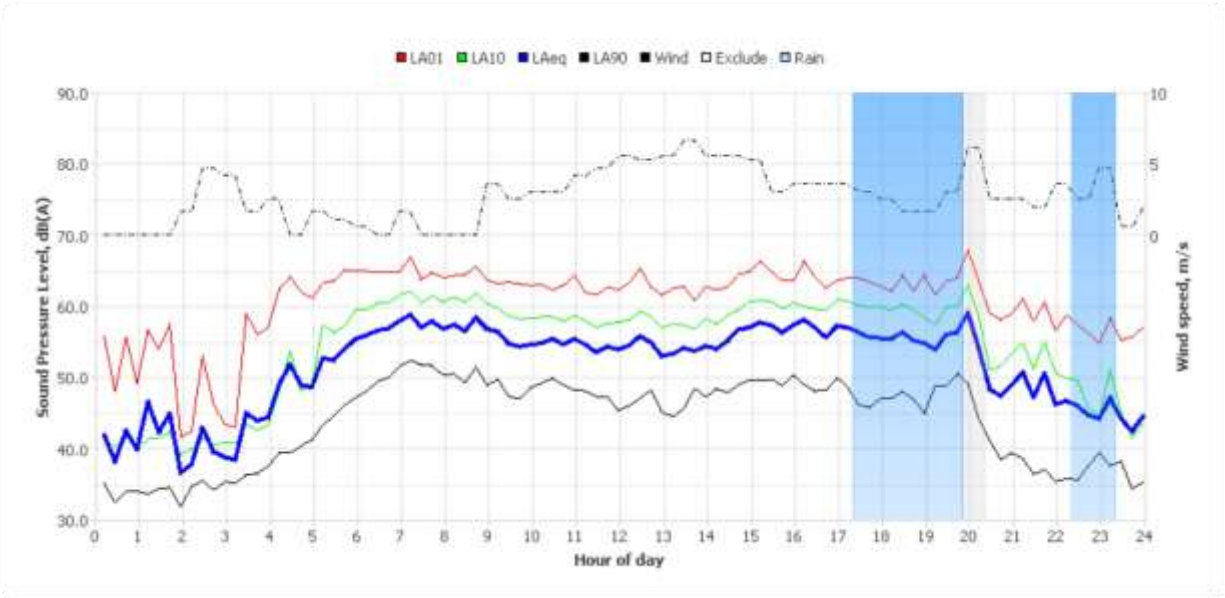

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

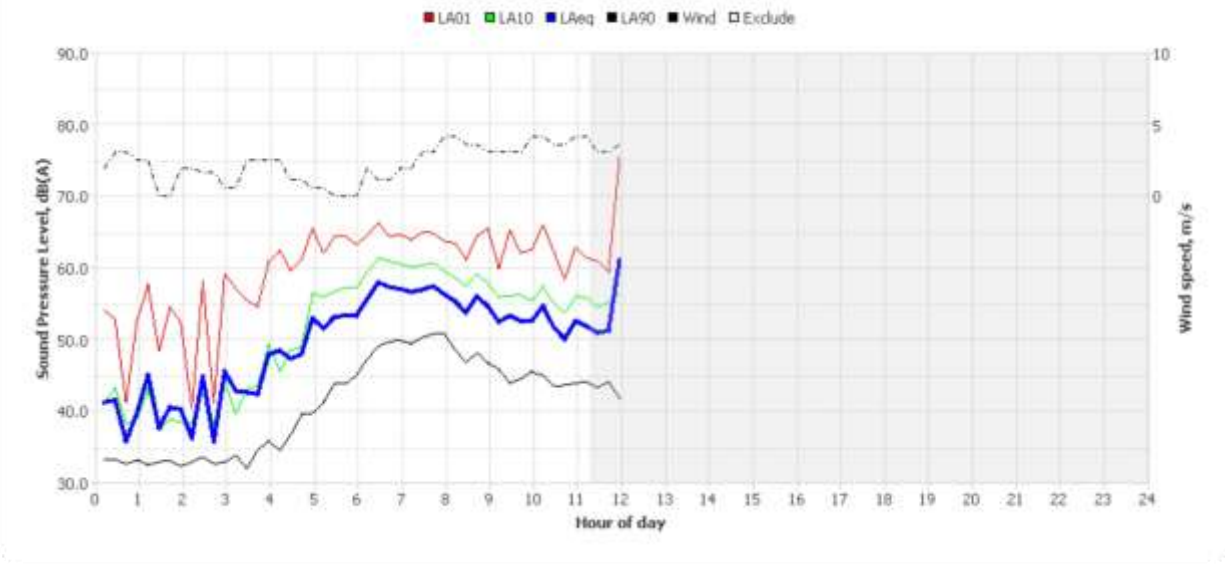

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

Noise Logger Report

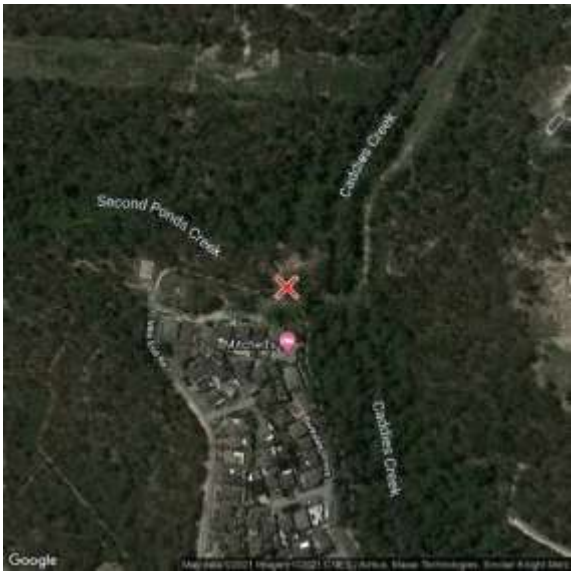
Lot 2 DP839874, The Hills Shire

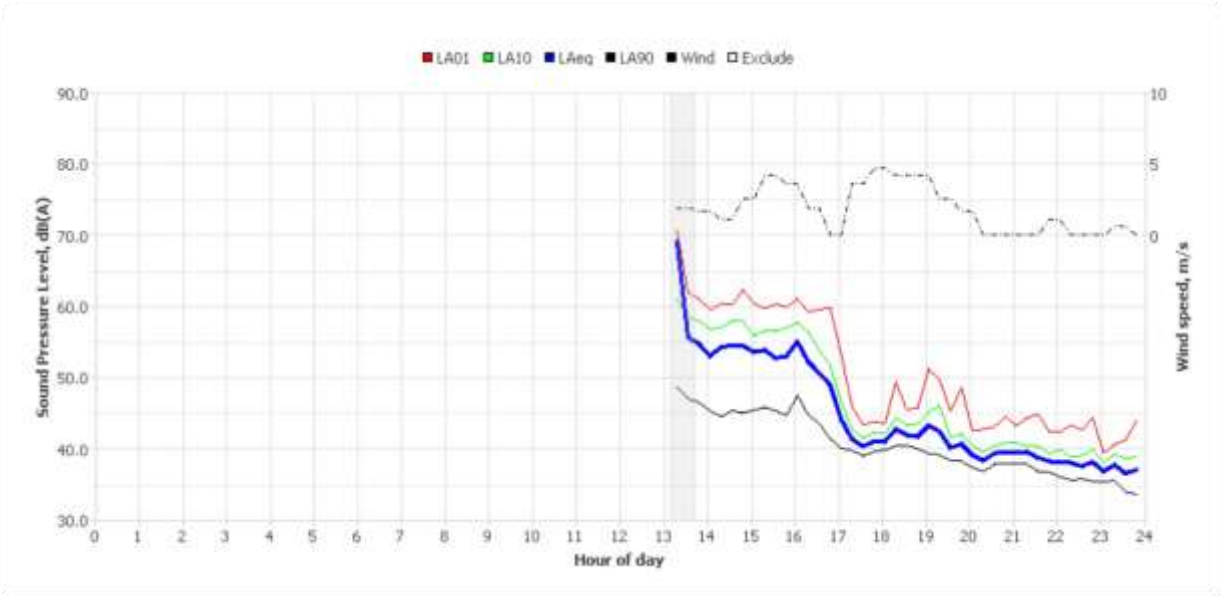
Item	Information
Logger Type	NL-52
Serial number	175550
Address	Lot 2 DP839874, The Hills Shire
Location	Lot 2 DP839874
Facade / Free Field	Free field
Environment	Ambient noise levels dominated by bird calls during the daytime 51 dBA. Distant construction noise audible (hammering and drilling) 56 dBA.

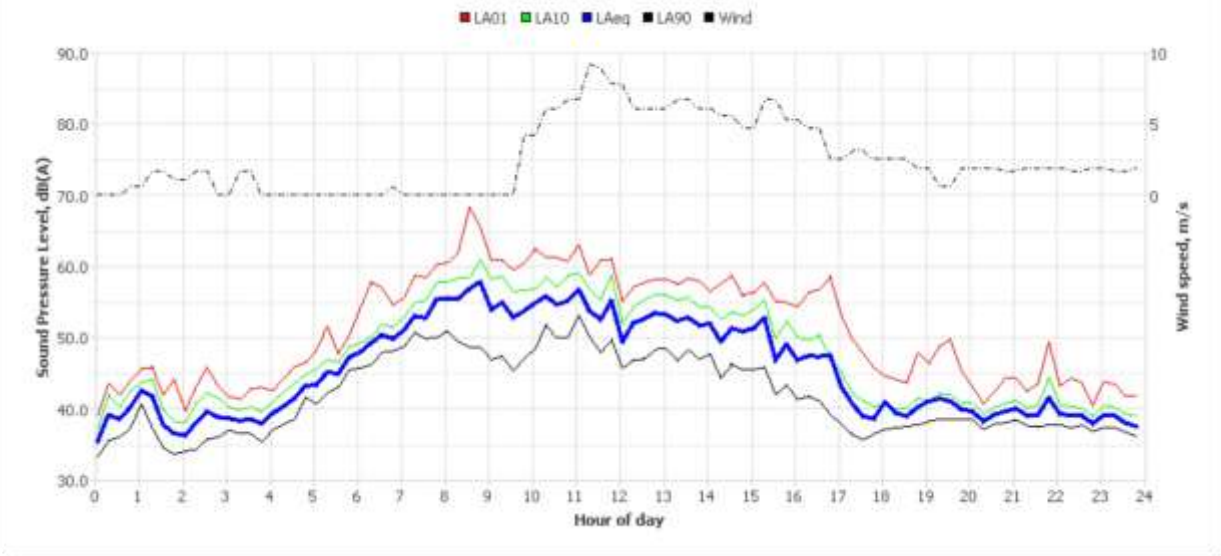
Measured noise levels

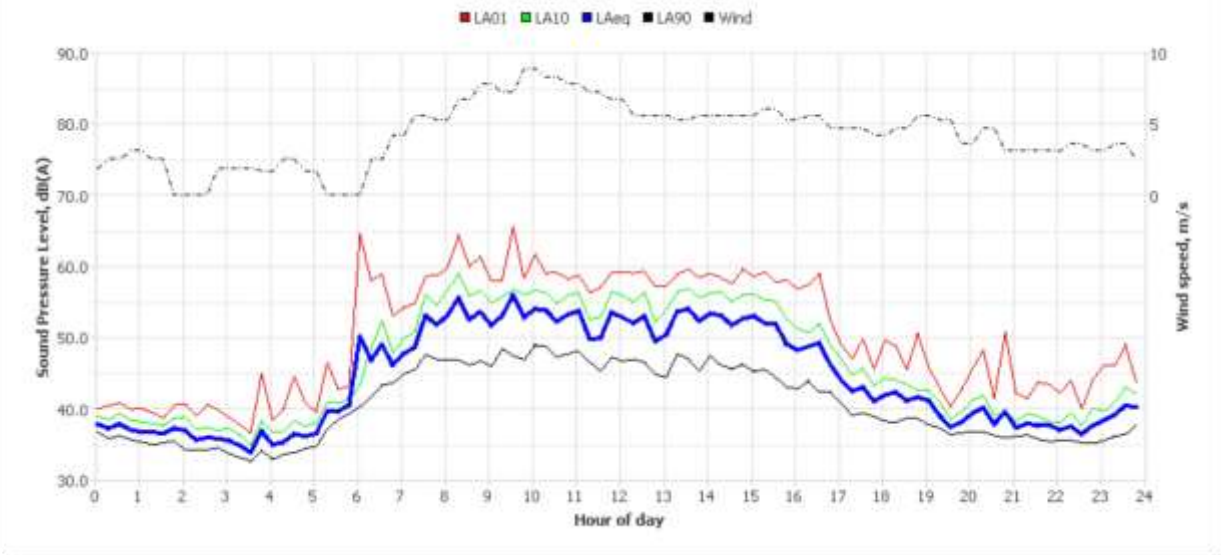
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu May 27 2021	52	41	38	-	37	-	50	38
Fri May 28 2021	53	40	43	-	37	34	51	43
Sat May 29 2021	45	40	41	-	-	34	42	41
Sun May 30 2021	50	35	38	-	30	30	49	38
Mon May 31 2021	52	40	39	43	33	26	51	39
Tue Jun 1 2021	52	41	39	42	36	27	51	39
Wed Jun 2 2021	52	40	41	40	34	28	51	41
Thu Jun 3 2021	50	39	40	37	29	26	49	40
Fri Jun 4 2021	51	42	40	42	37	28	50	40
Sat Jun 5 2021	50	43	39	39	38	29	49	39
Sun Jun 6 2021	49	40	43	39	35	30	48	43
Mon Jun 7 2021	51	40	41	42	34	28	50	41
Tue Jun 8 2021	50	35	41	-	-	-	50	41
Wed Jun 9 2021	50	-	40	-	-	-	50	40
Summary	**51**	**40**	**40**	**41**	**35**	**28**	**50**	**40**

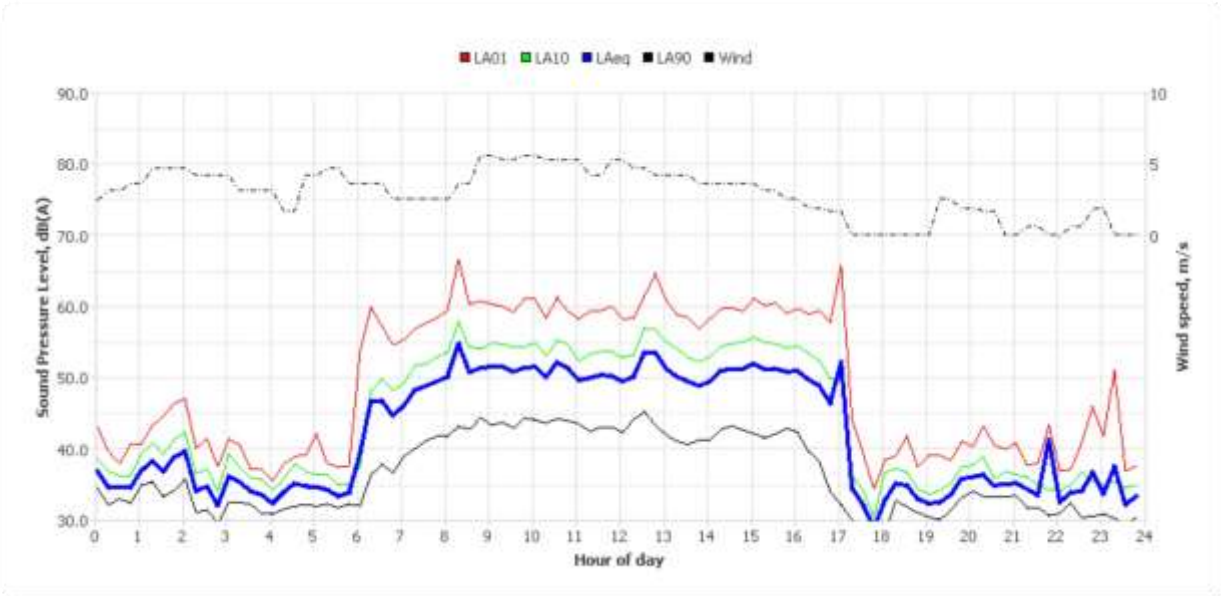
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

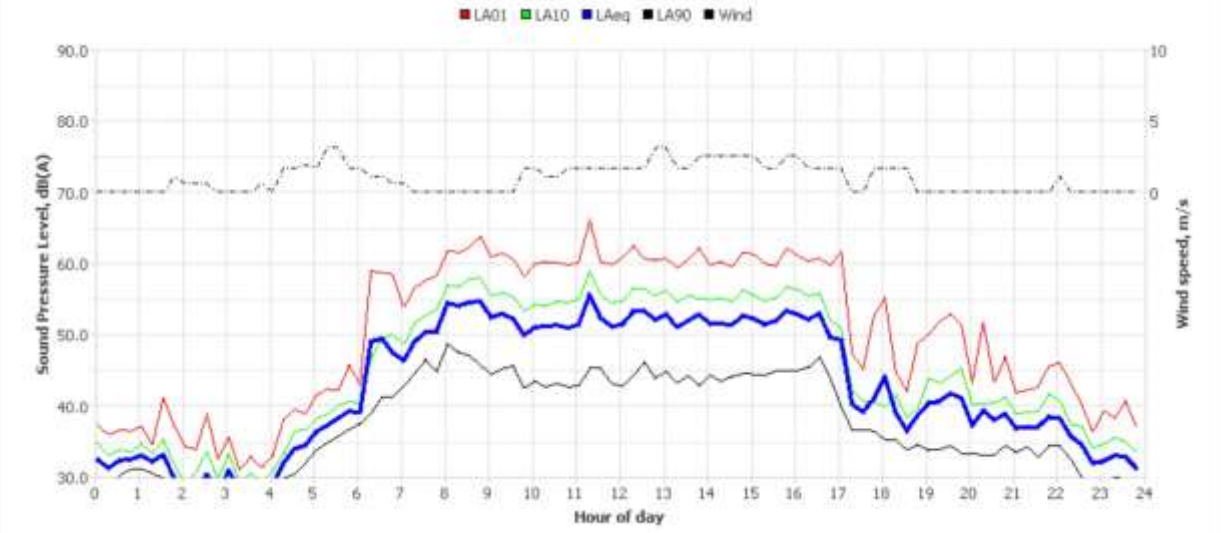
Logger Location	Logger Deployment Photo
	

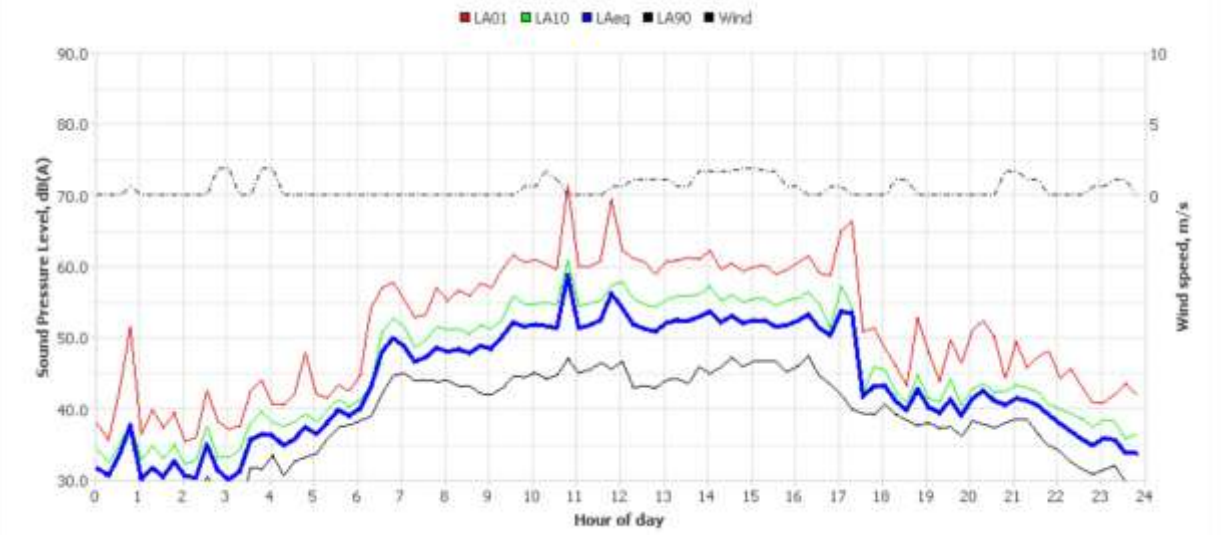

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

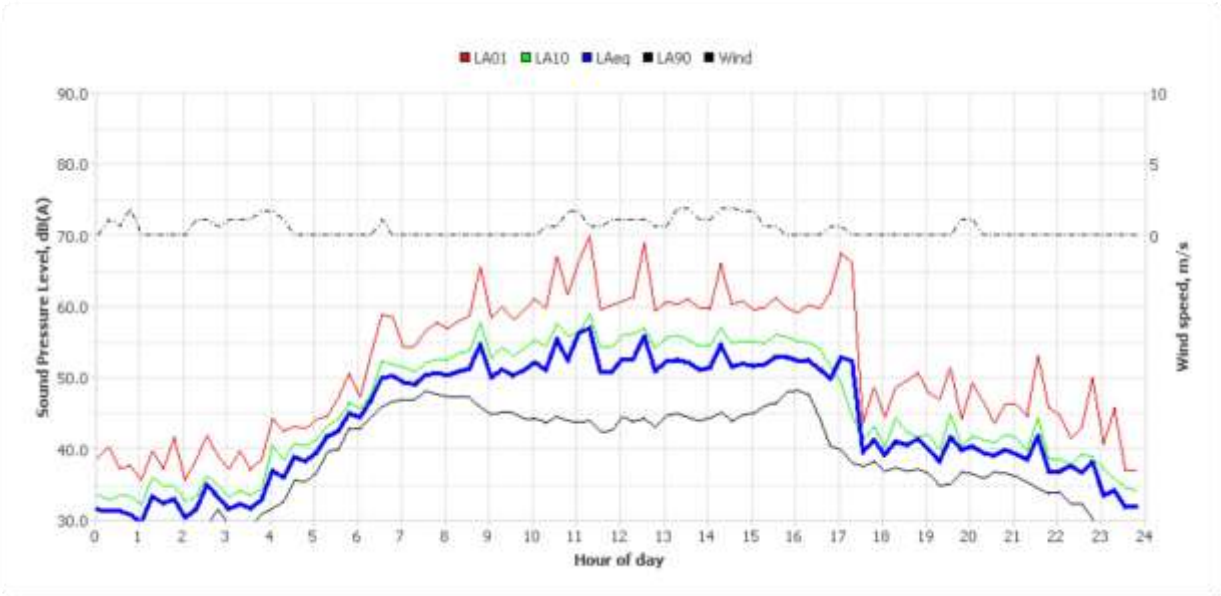

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

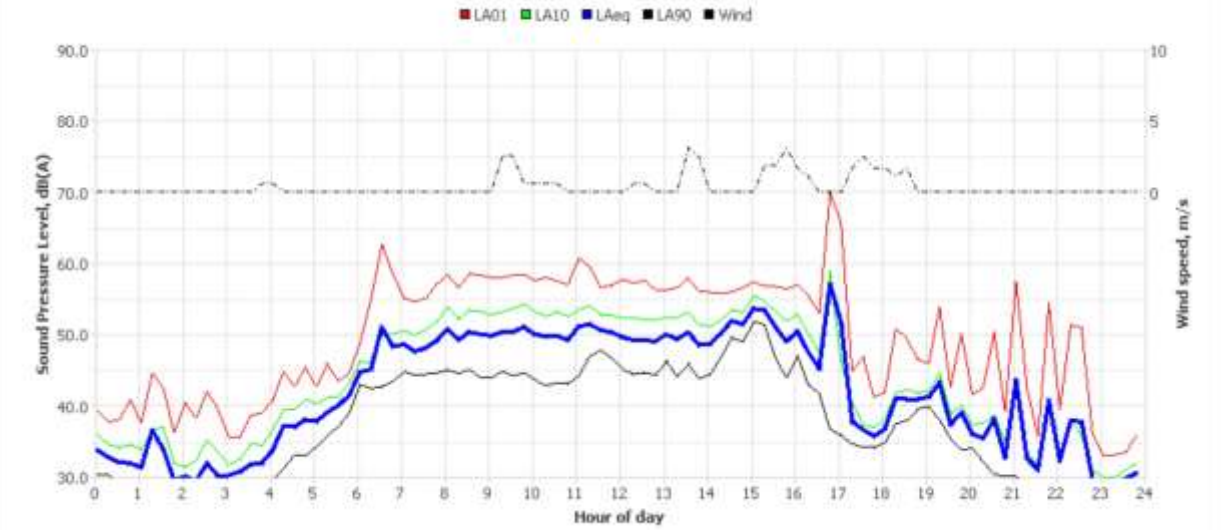

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

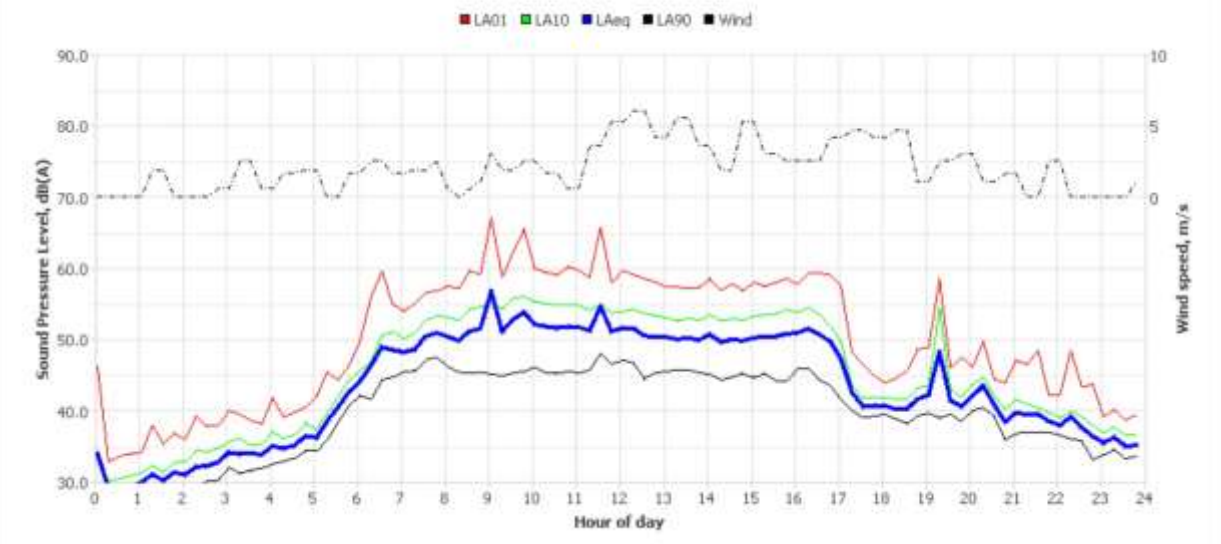

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

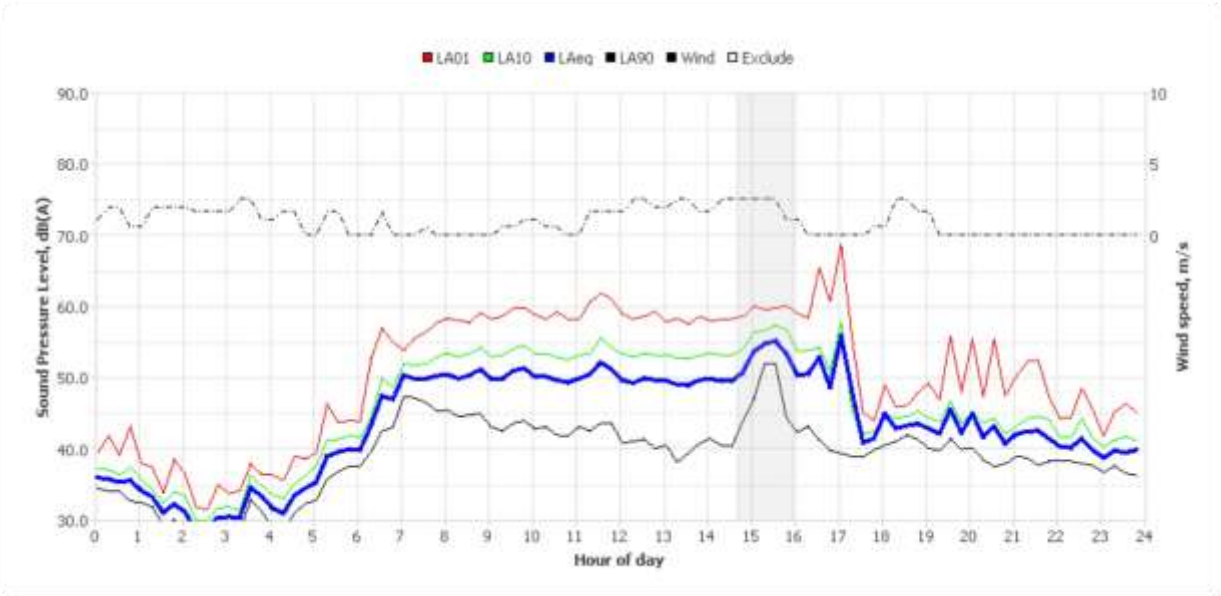

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

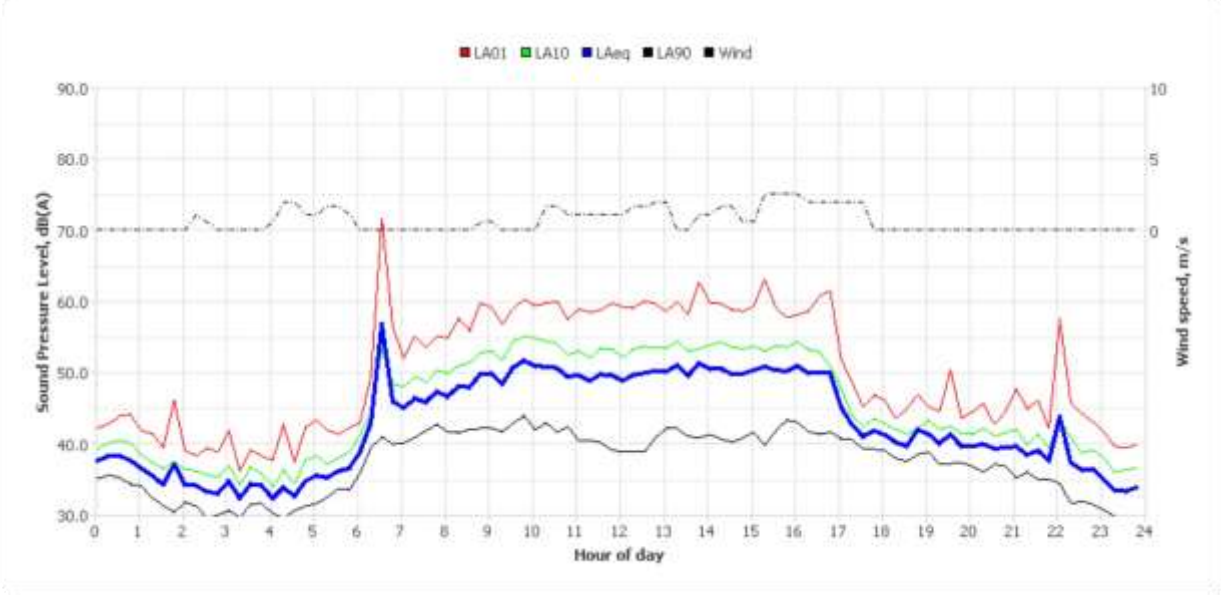

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

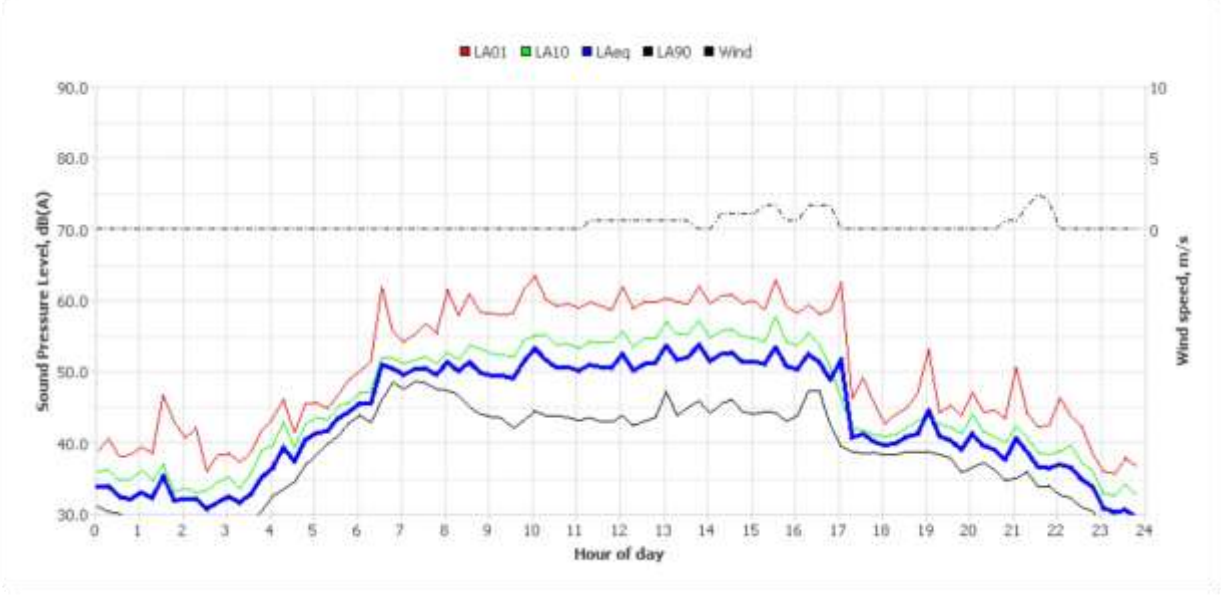

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

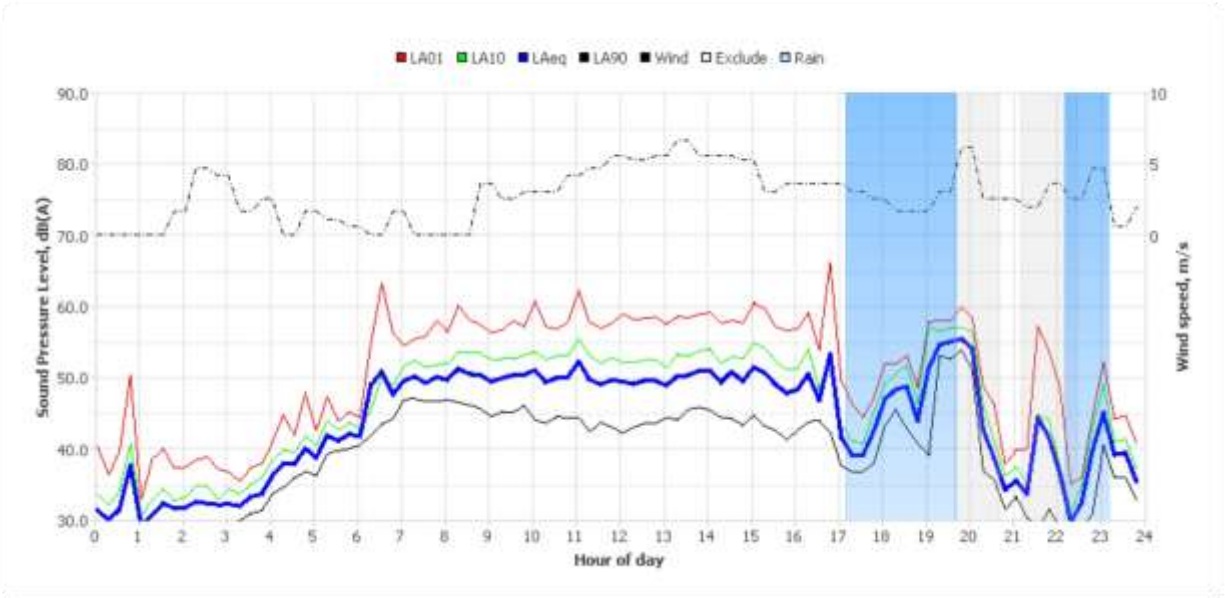

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

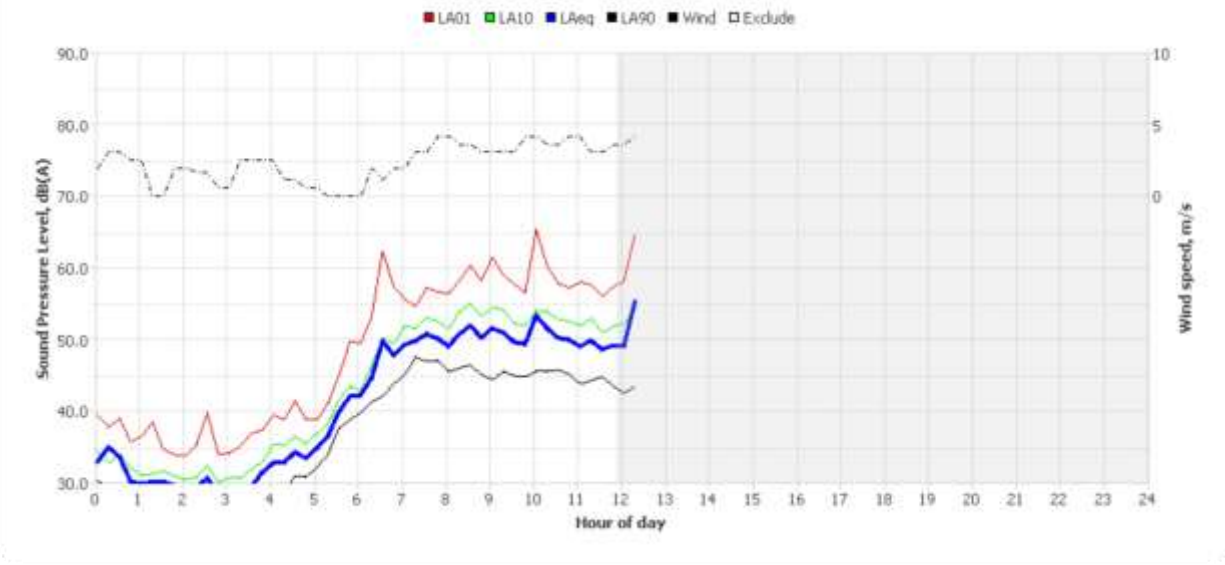

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

Noise Logger Report

181 Foxall Road, Kellyville

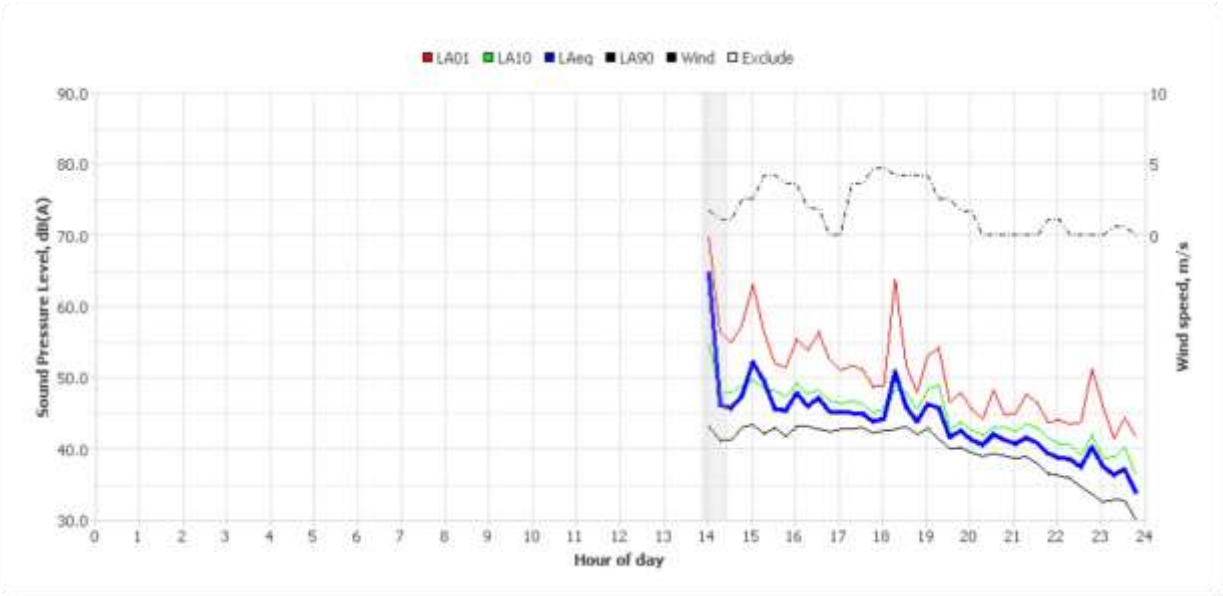
Item	Information
Logger Type	NL-52
Serial number	553967
Address	181 Foxall Road, Kellyville
Location	Front Yard
Facade / Free Field	Free field
Environment	Motorbike pass by 55 dBA. Local traffic audible 51- 53 dBA. Occasional bird calls and leaves rustling.

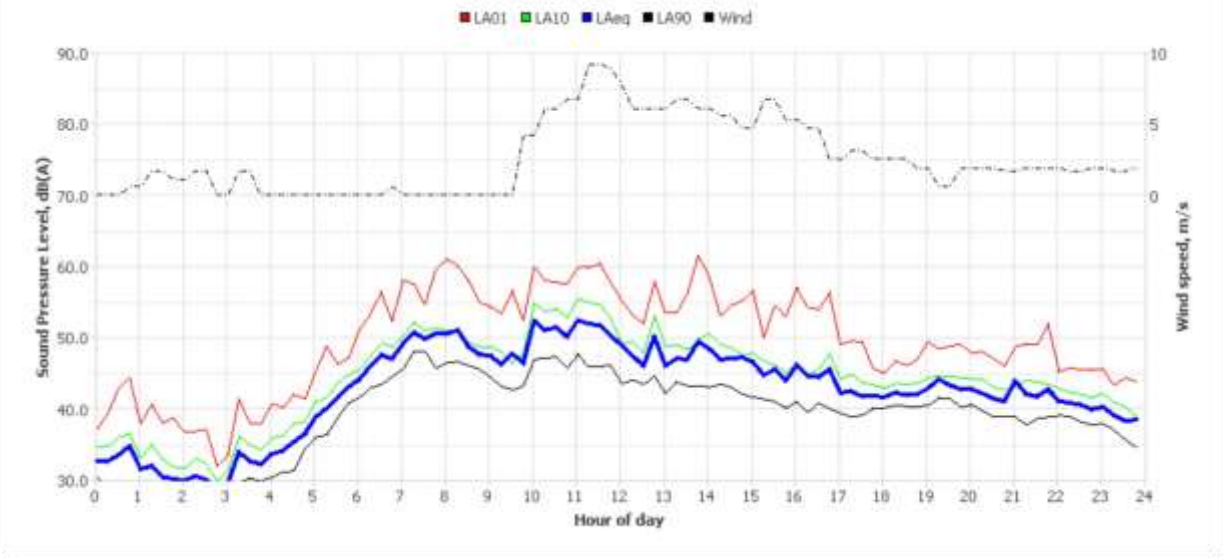
Measured noise levels

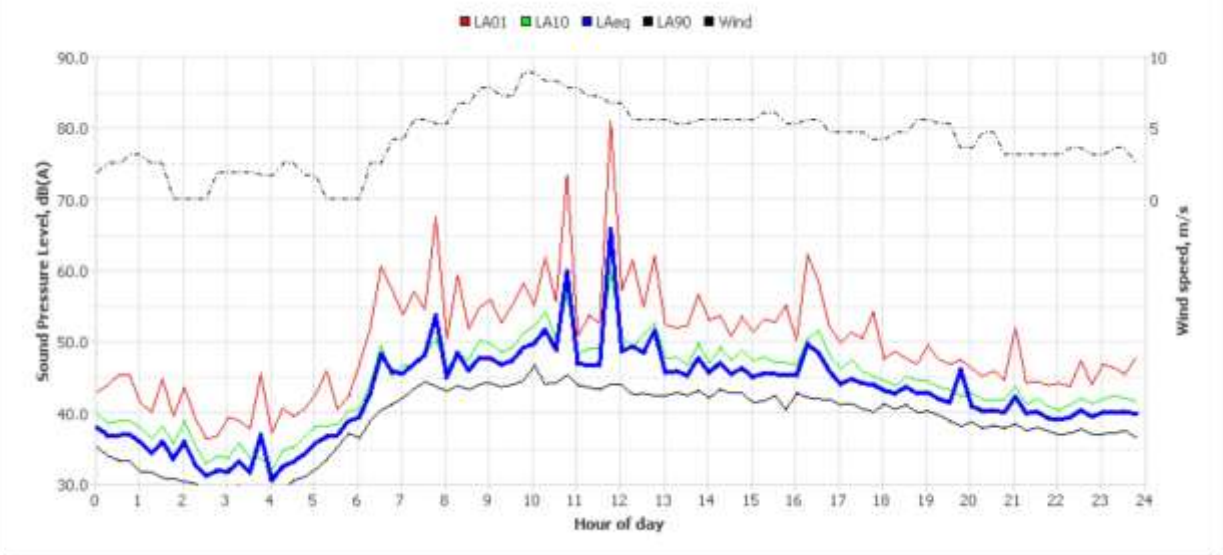
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu May 27 2021	47	44	38	-	38	-	46	38
Fri May 28 2021	48	42	40	-	39	27	46	40
Sat May 29 2021	45	42	39	-	-	29	43	39
Sun May 30 2021	45	38	38	-	34	28	44	38
Mon May 31 2021	44	43	38	32	32	27	44	38
Tue Jun 1 2021	45	43	41	36	37	26	45	41
Wed Jun 2 2021	47	41	39	34	34	27	46	39
Thu Jun 3 2021	48	41	39	38	30	24	47	39
Fri Jun 4 2021	47	43	41	40	38	27	46	41
Sat Jun 5 2021	44	42	38	35	37	25	43	38
Sun Jun 6 2021	45	40	37	32	34	29	44	37
Mon Jun 7 2021	45	40	39	37	35	26	44	39
Tue Jun 8 2021	49	-	43	-	-	-	49	43
Wed Jun 9 2021	50	-	40	-	-	-	50	40
Summary	**47**	**42**	**40**	**35**	**35**	**27**	**46**	**40**

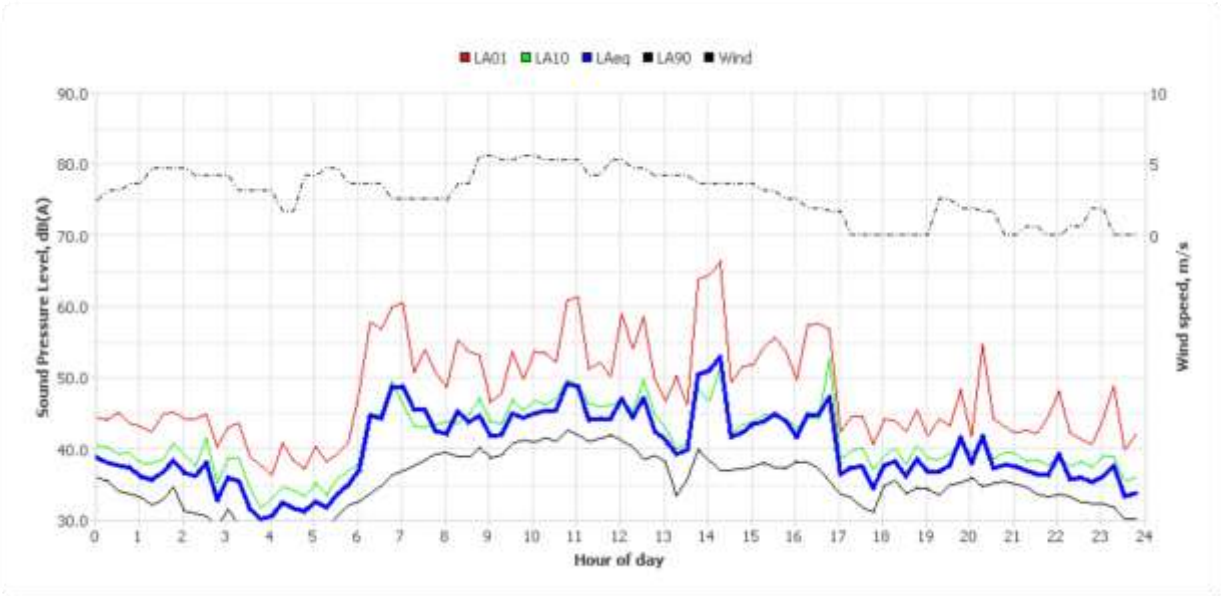
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

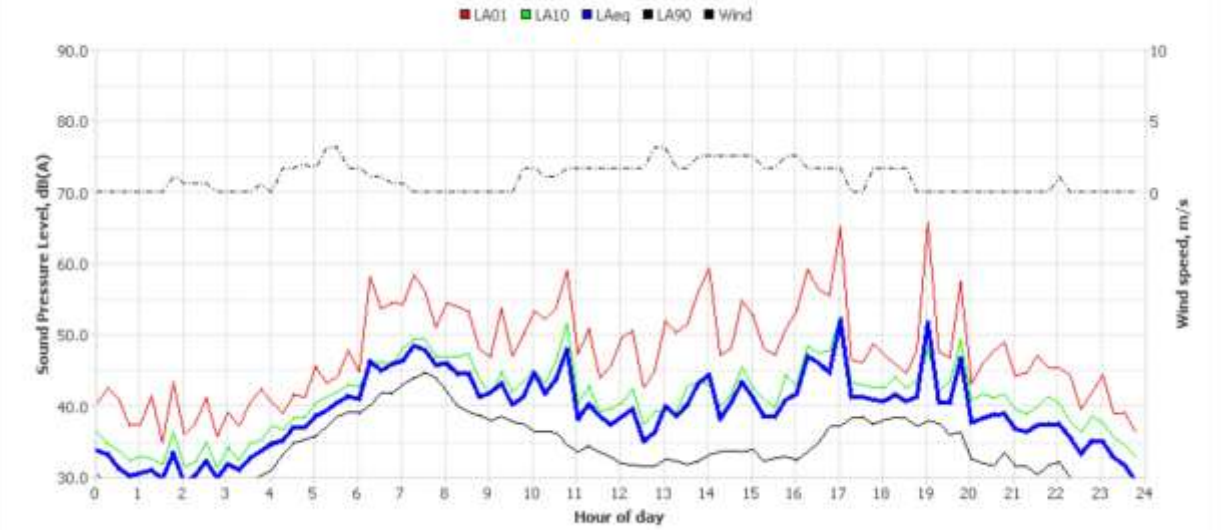
Logger Location	Logger Deployment Photo
	

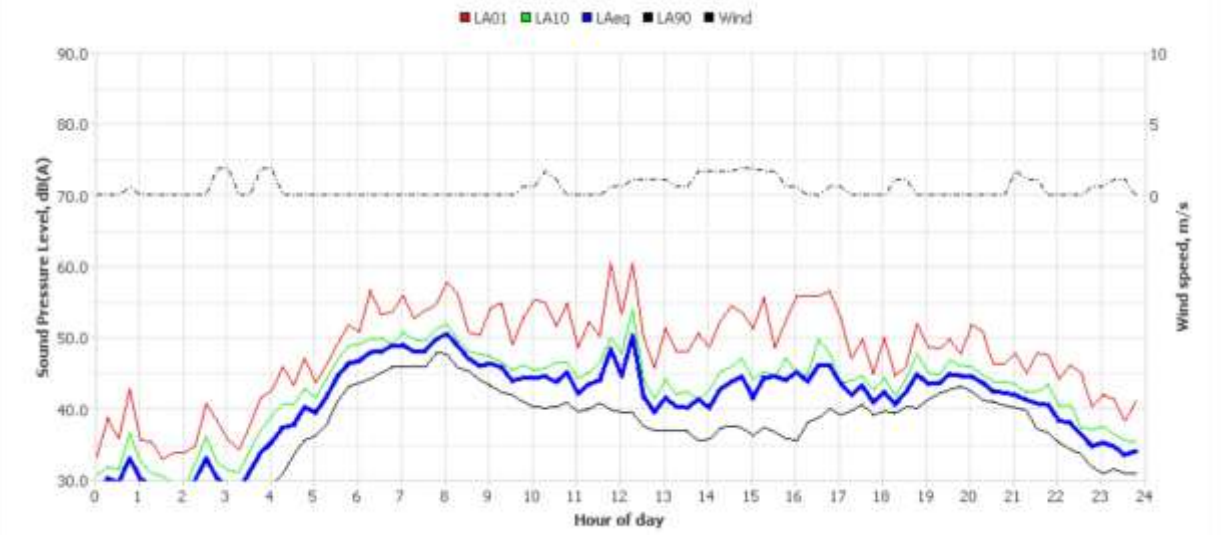

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

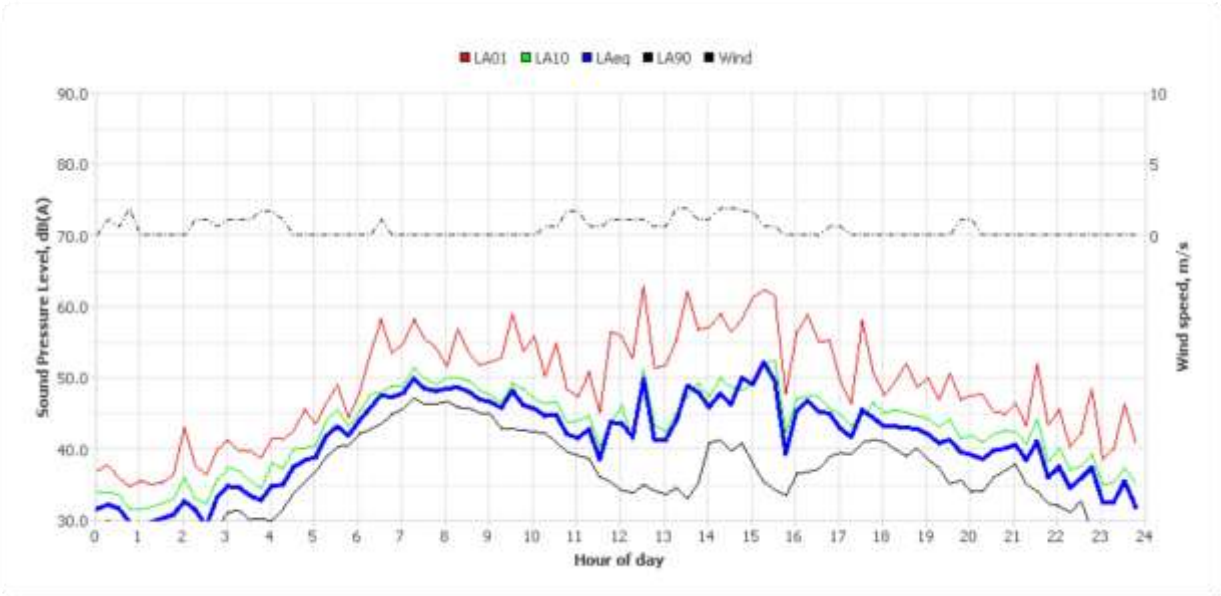

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

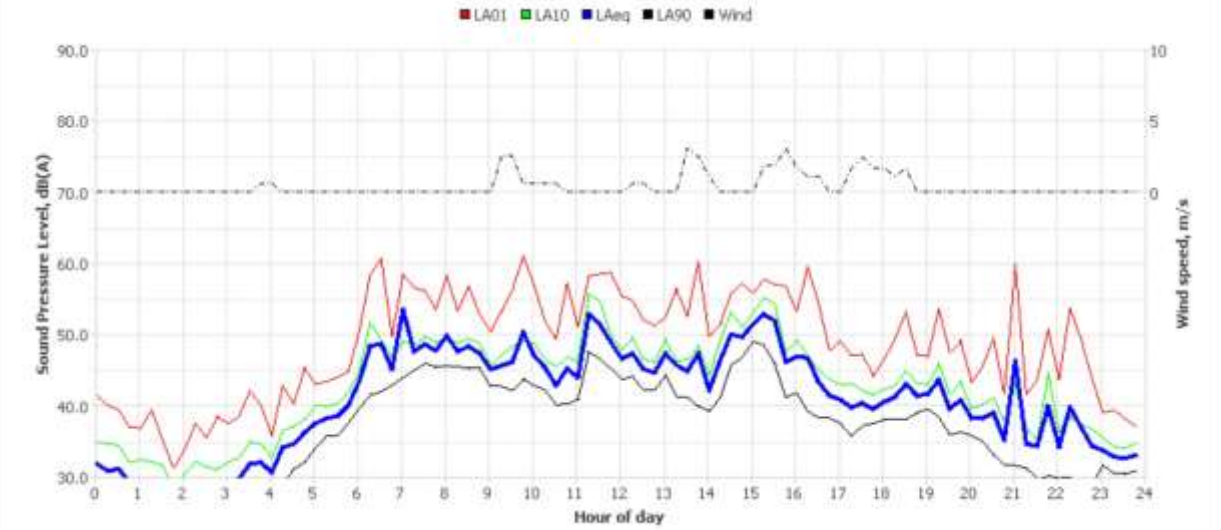

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

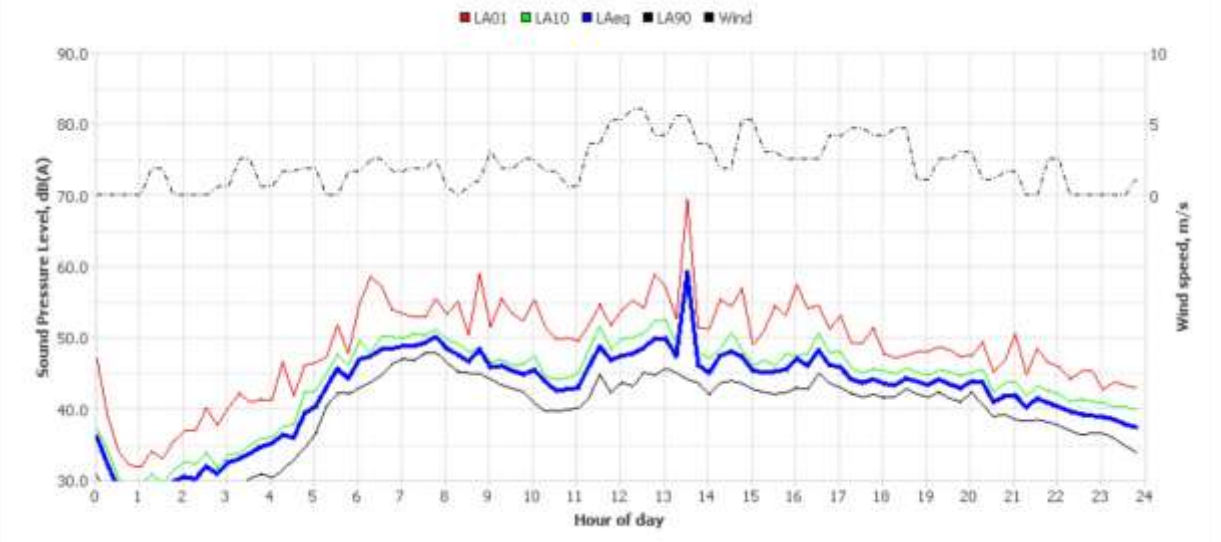

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

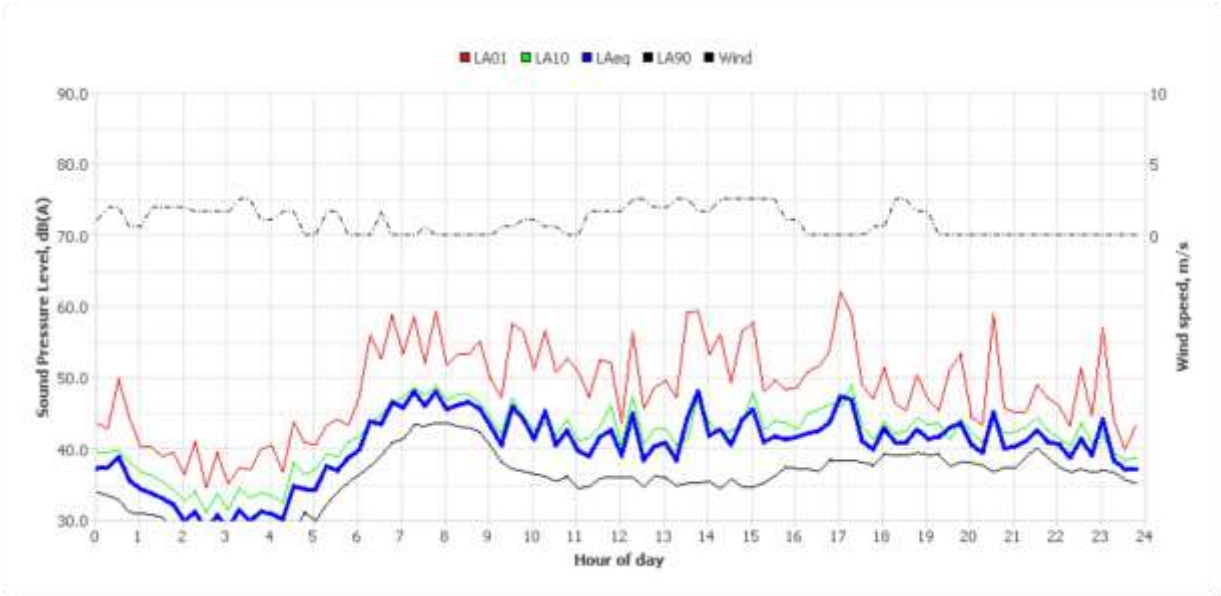

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

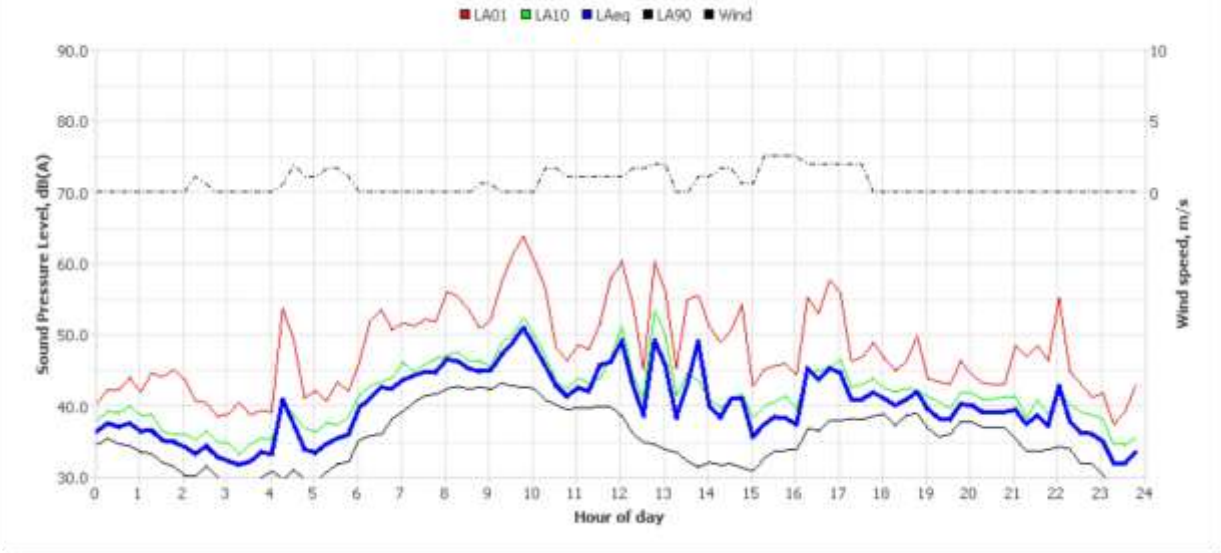

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

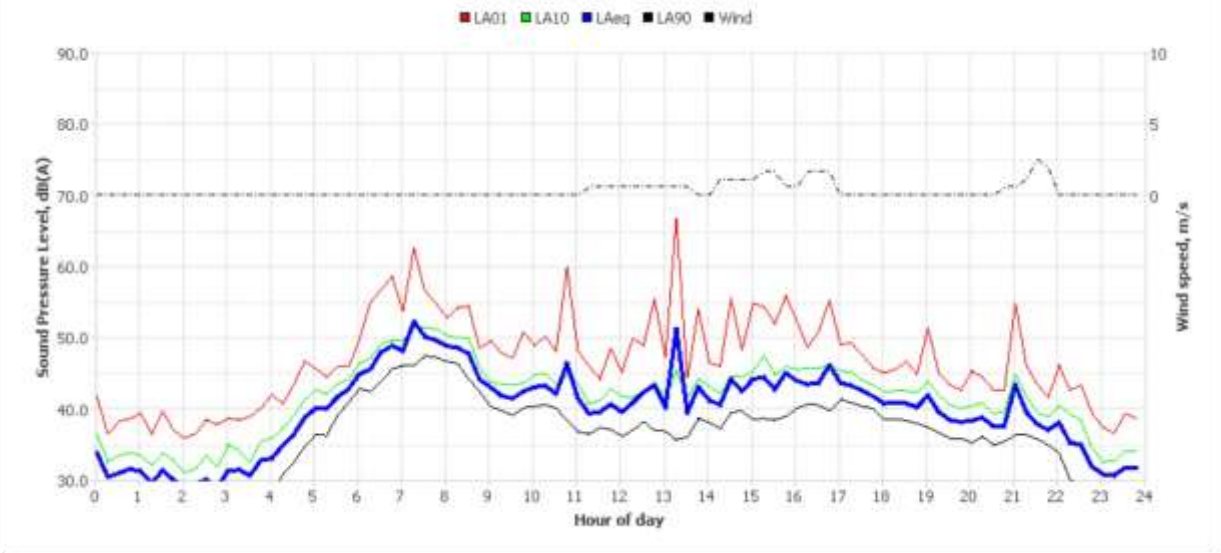

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

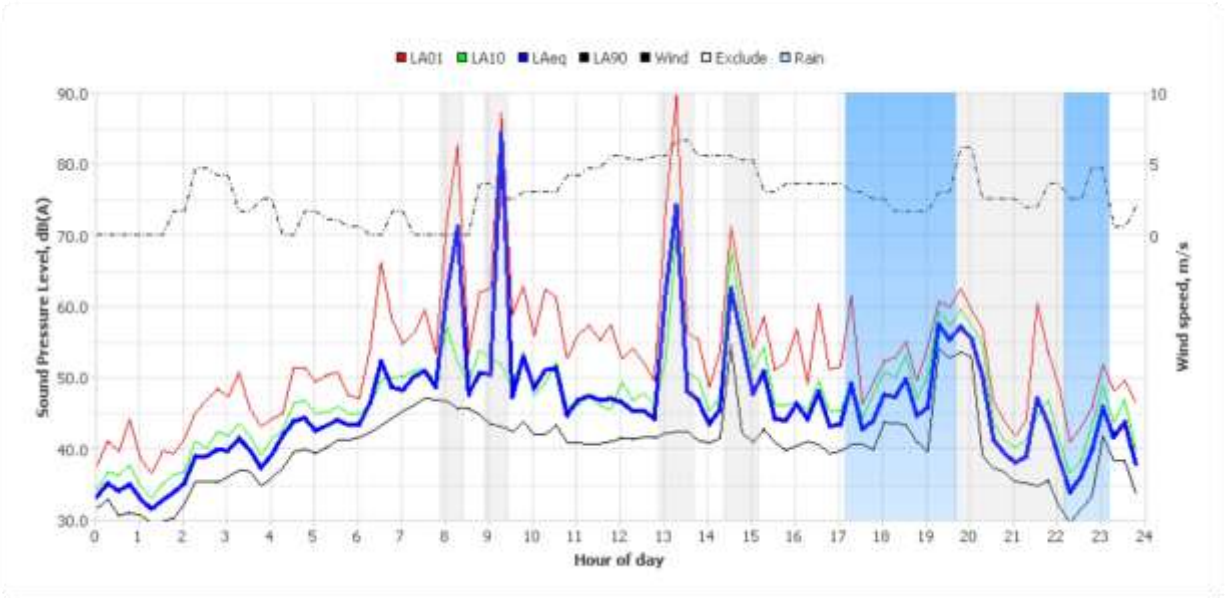

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

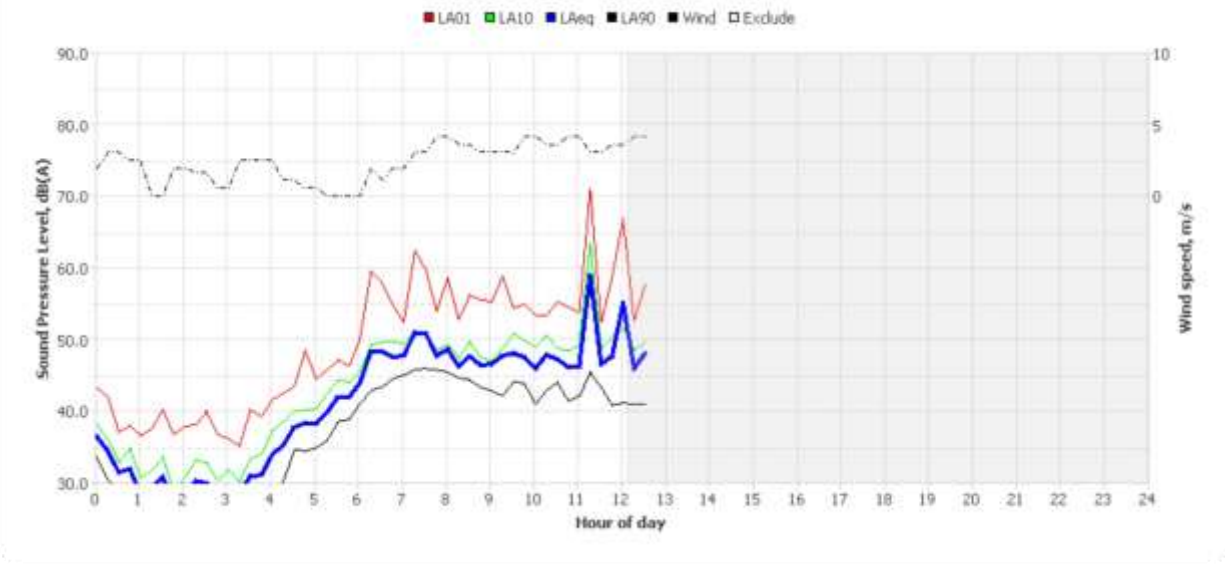

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

Noise Logger Report

Lot 151 DP869424, Kellyville

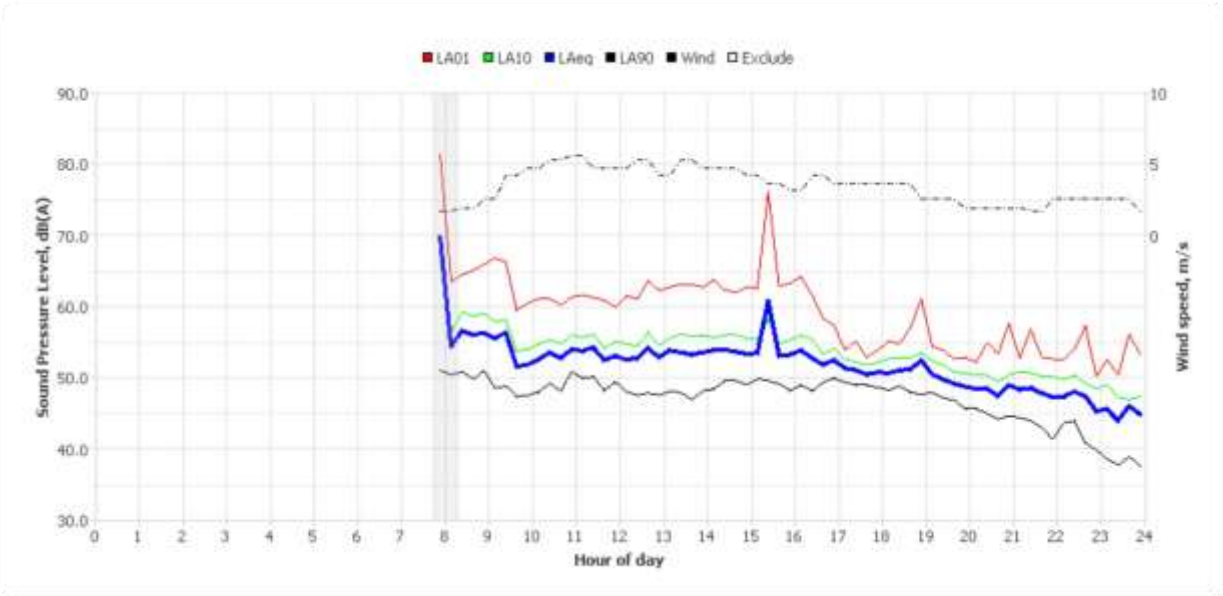
Item	Information
Logger Type	NL-52
Serial number	909519
Address	Lot 151 DP869424, Kellyville
Location	Lot 151 DP869424, Kellyville
Facade / Free Field	Free field
Environment	Ambient noise dominated by bird calls during the day 54 - 59 dBA. Whipbird 68 dBA. Distant road traffic noise on Glenhaven Road audible.

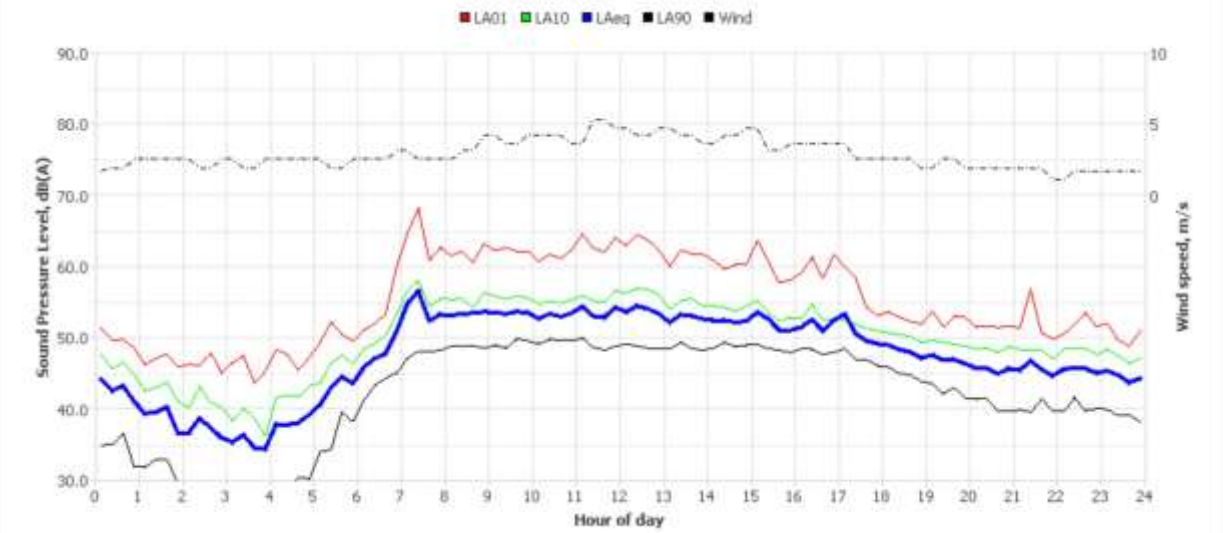
Measured noise levels

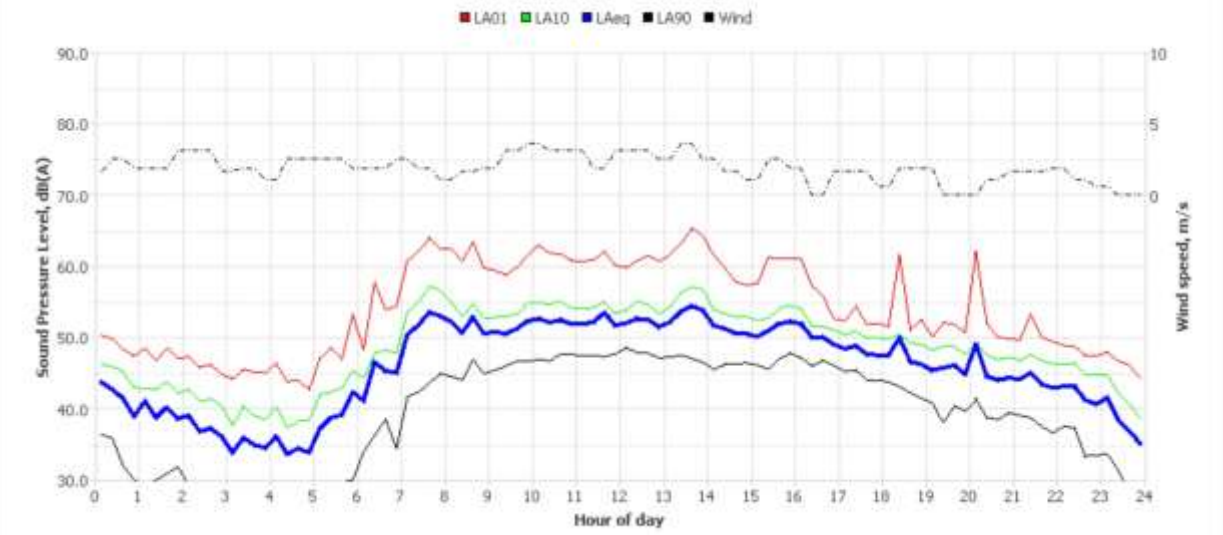
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Fri May 28 2021	54	49	46	-	43	-	53	46
Sat May 29 2021	53	47	43	48	40	28	52	43
Sun May 30 2021	52	46	40	44	38	26	51	40
Mon May 31 2021	54	49	44	46	40	25	53	44
Tue Jun 1 2021	53	48	44	45	42	25	52	44
Wed Jun 2 2021	54	49	45	45	42	26	53	45
Thu Jun 3 2021	53	48	44	47	39	24	52	44
Fri Jun 4 2021	54	50	45	47	43	29	53	45
Sat Jun 5 2021	54	49	44	48	43	26	53	44
Sun Jun 6 2021	54	47	42	47	40	29	53	42
Mon Jun 7 2021	54	49	44	46	42	26	53	44
Tue Jun 8 2021	53	52	46	46	-	-	53	46
Wed Jun 9 2021	53	-	46	-	-	-	53	46
Summary	**53**	**49**	**44**	**46**	**42**	**26**	**53**	**44**

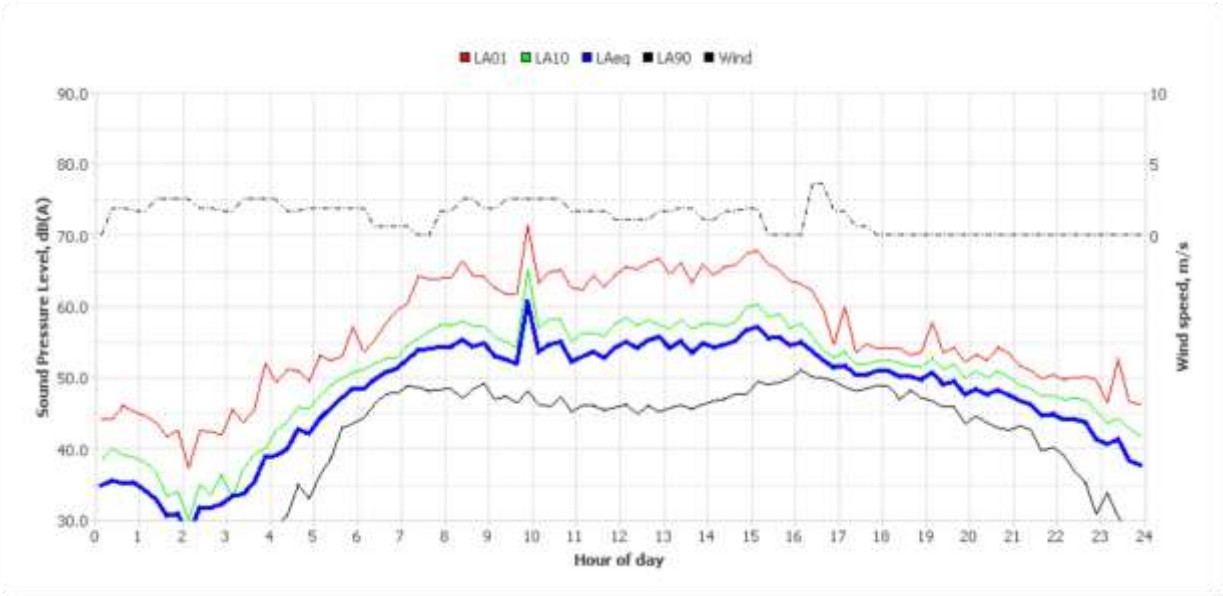
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

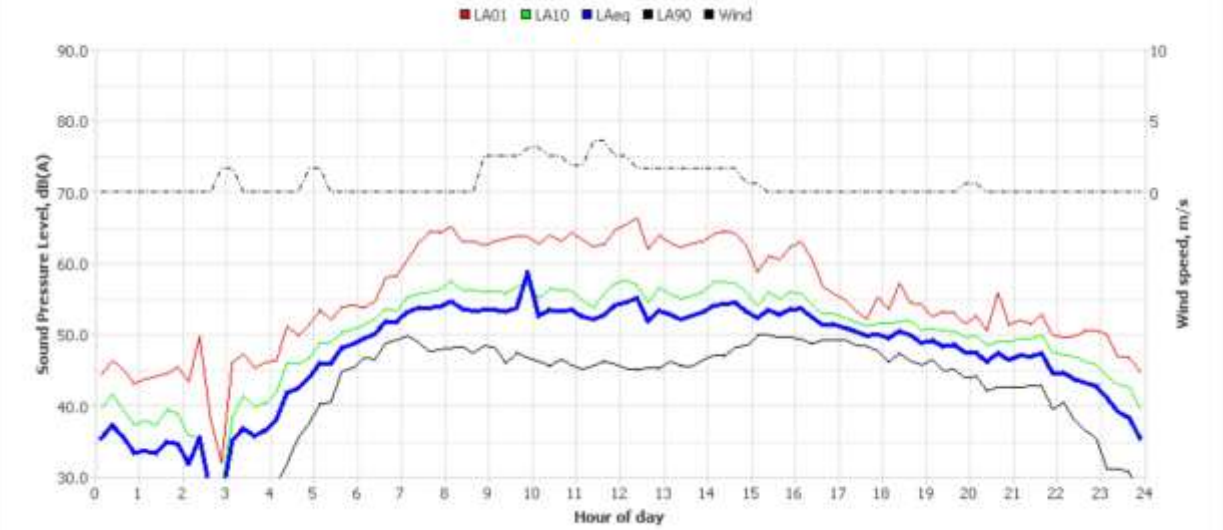
Logger Location	Logger Deployment Photo
	

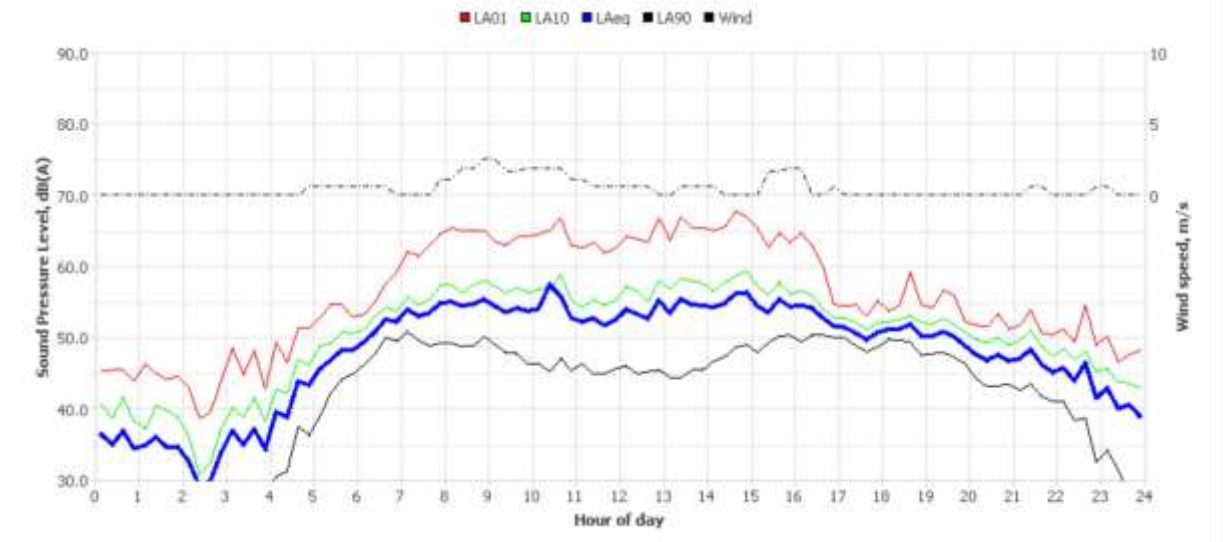

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

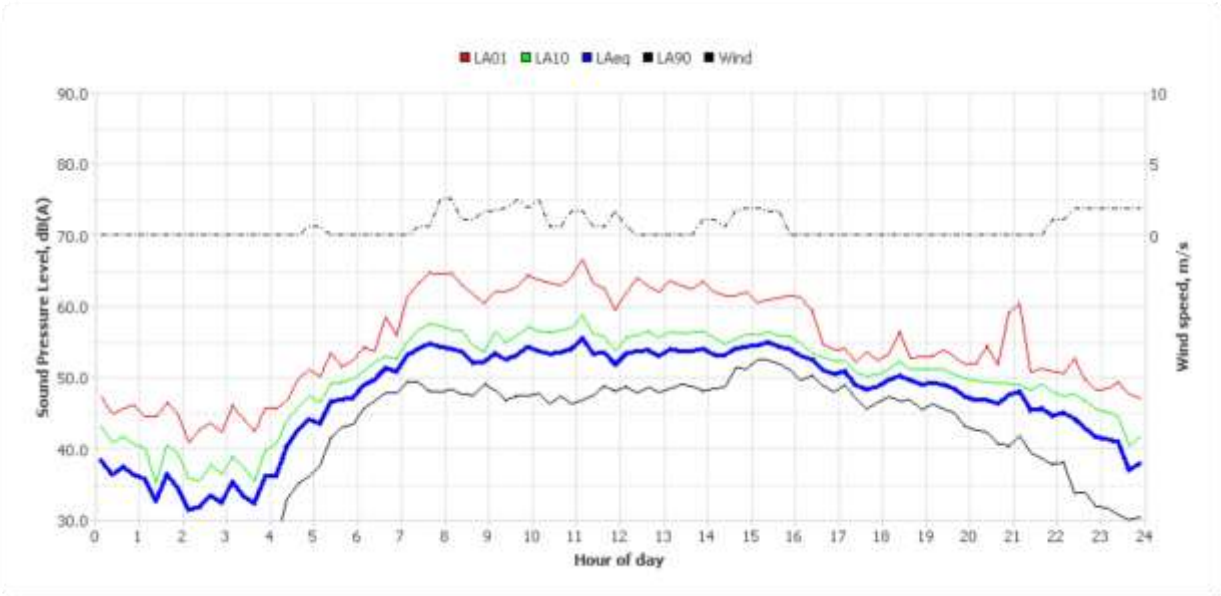

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

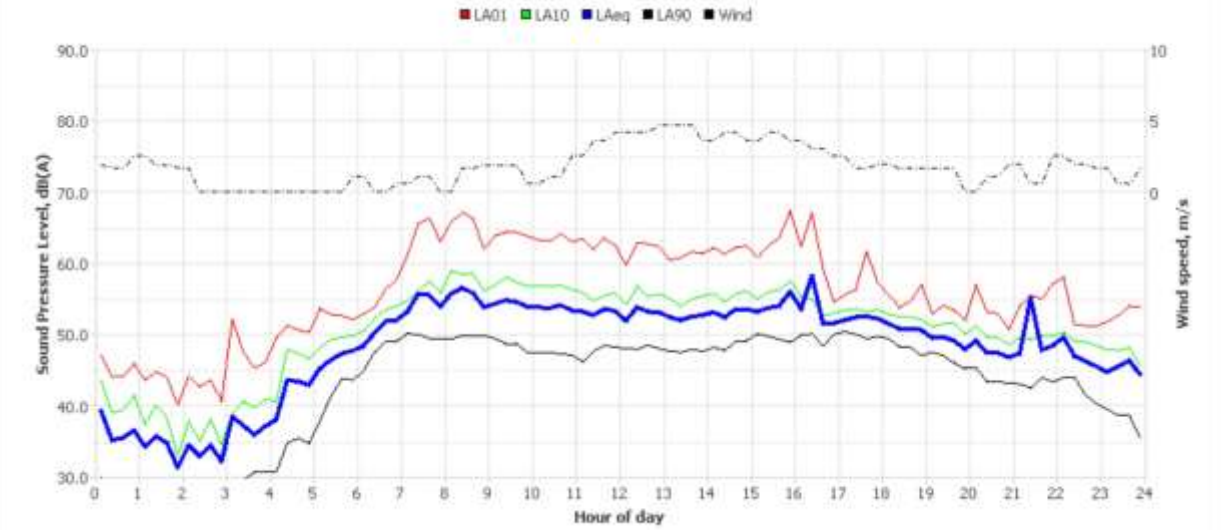

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

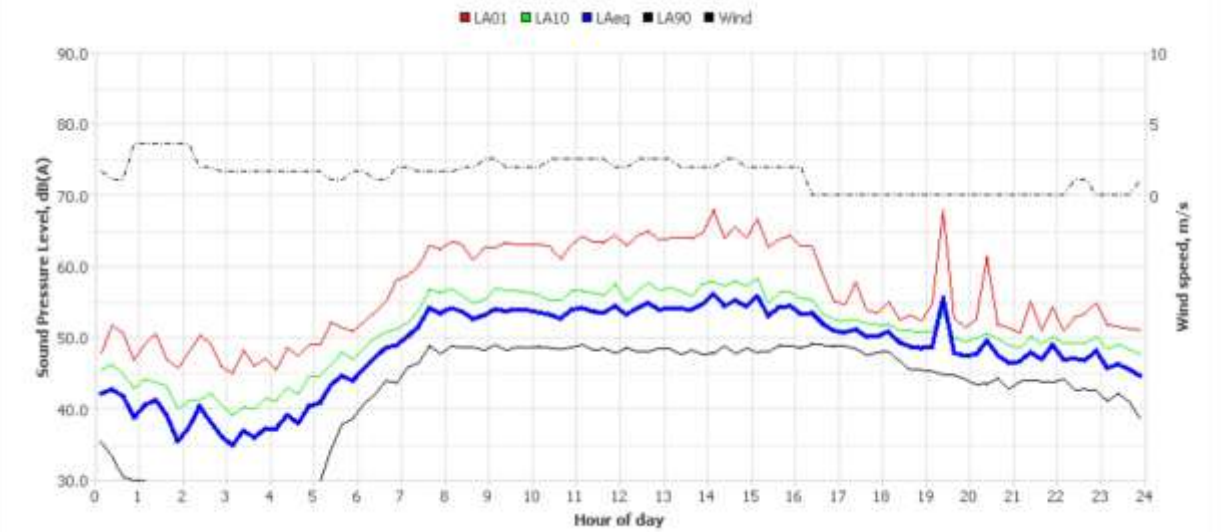

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

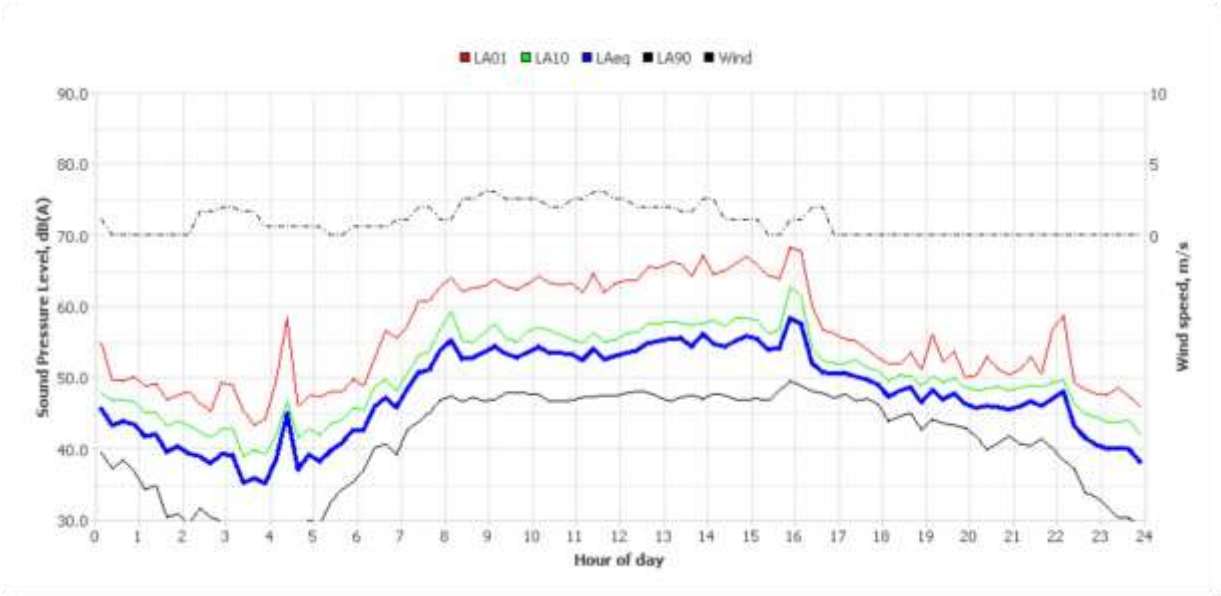

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

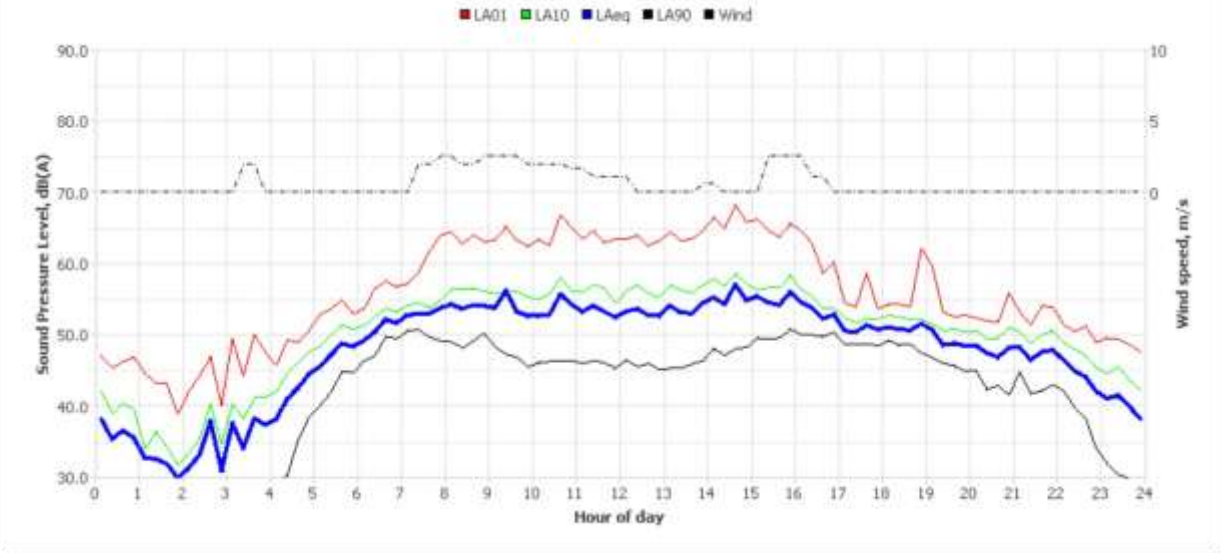

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

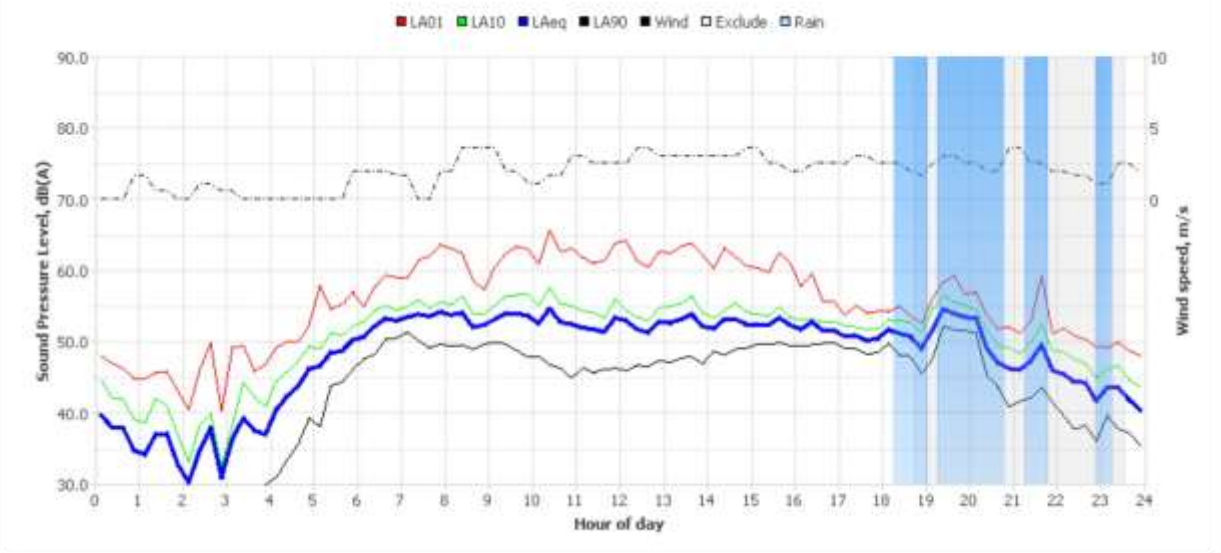

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

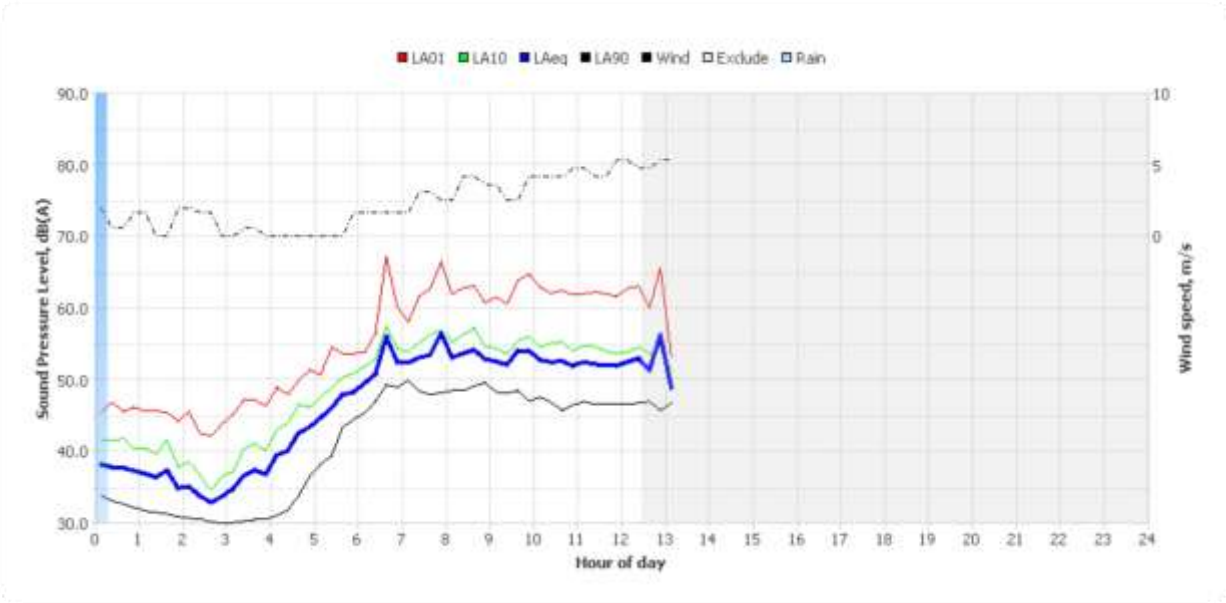

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01
LA10
LAeq
LA90
Wind
Exclude
Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day
90.0
80.0
70.0
60.0
50.0
40.0
30.0
10
5
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Noise Logger Report

19 Woodstream Crescent, Kellyville

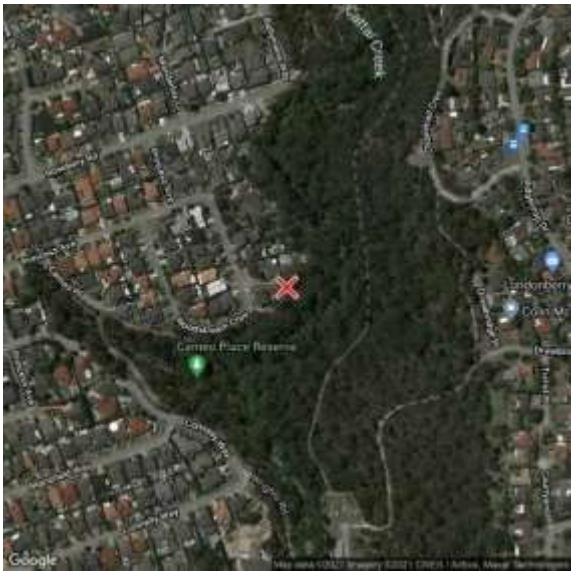
Item	Information
Logger Type	NL-52
Serial number	175537
Address	19 Woodstream Crescent, Kellyville
Location	Back Yard
Facade / Free Field	Free field
Environment	Ambient noise dominated by bird calls during the day. Rustling leaves and barking dogs also audible at the property. Bird calls 50 - 53 dBA

Measured noise levels

Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu May 27 2021	46	47	39	-	37	-	47	39
Fri May 28 2021	49	44	48	39	40	32	48	48
Sat May 29 2021	49	45	38	39	35	33	48	38
Sun May 30 2021	48	41	38	35	33	29	47	38
Mon May 31 2021	51	40	37	32	33	29	49	37
Tue Jun 1 2021	47	41	36	33	35	28	46	36
Wed Jun 2 2021	49	41	39	32	33	29	48	39
Thu Jun 3 2021	49	43	36	-	35	27	47	36
Fri Jun 4 2021	49	43	39	38	37	33	48	39
Sat Jun 5 2021	50	46	37	33	36	31	49	37
Sun Jun 6 2021	49	37	37	33	33	31	48	37
Mon Jun 7 2021	50	39	37	32	34	29	49	37
Tue Jun 8 2021	48	-	36	35	-	-	48	36
Wed Jun 9 2021	48	-	37	-	-	-	48	37
Summary	**49**	**43**	**40**	**33**	**35**	**29**	**48**	**40**

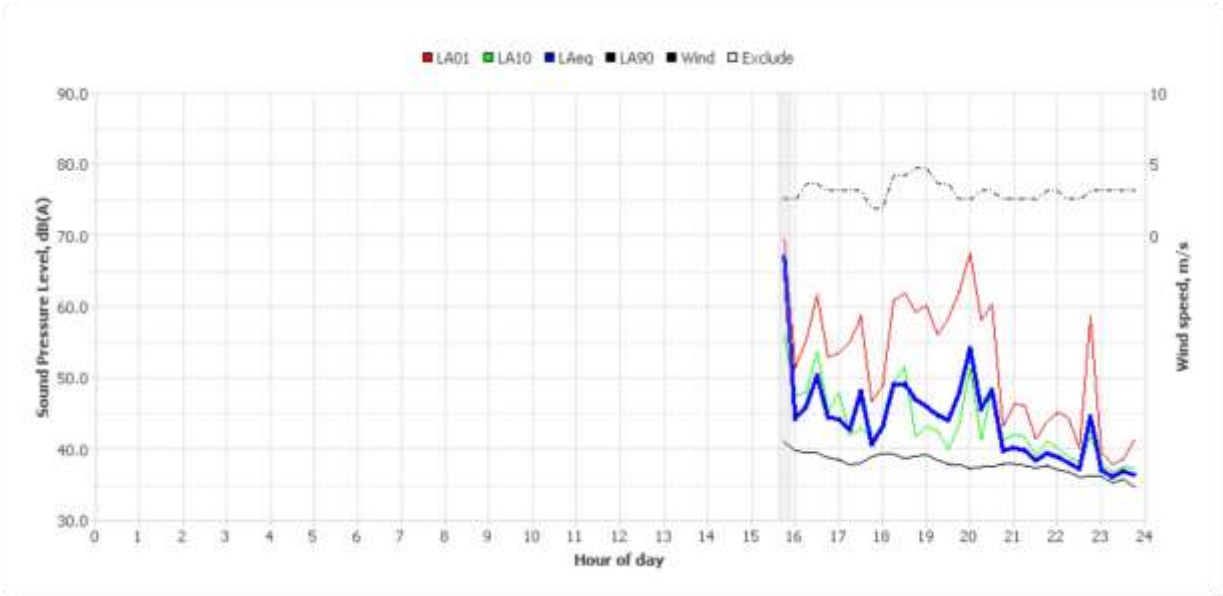
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

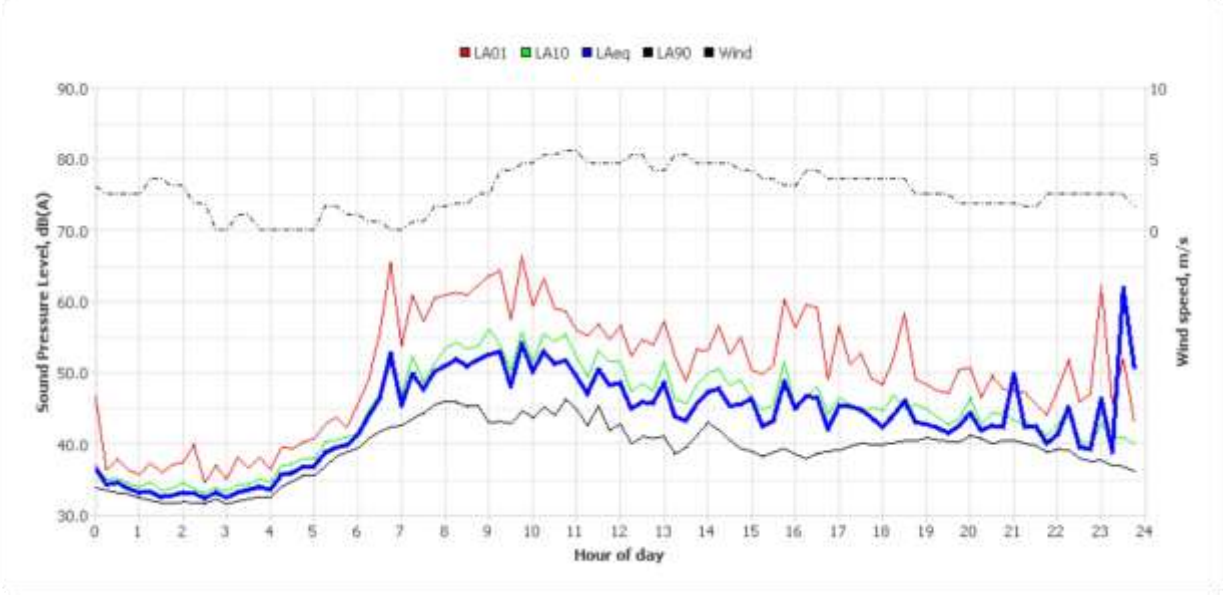
Logger Location

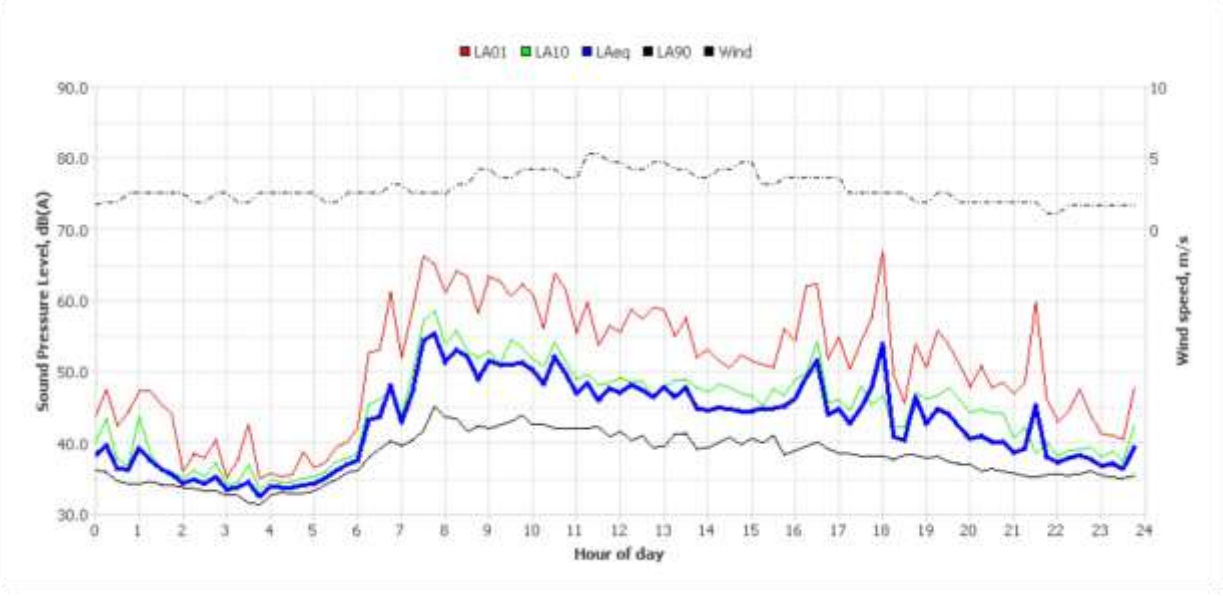


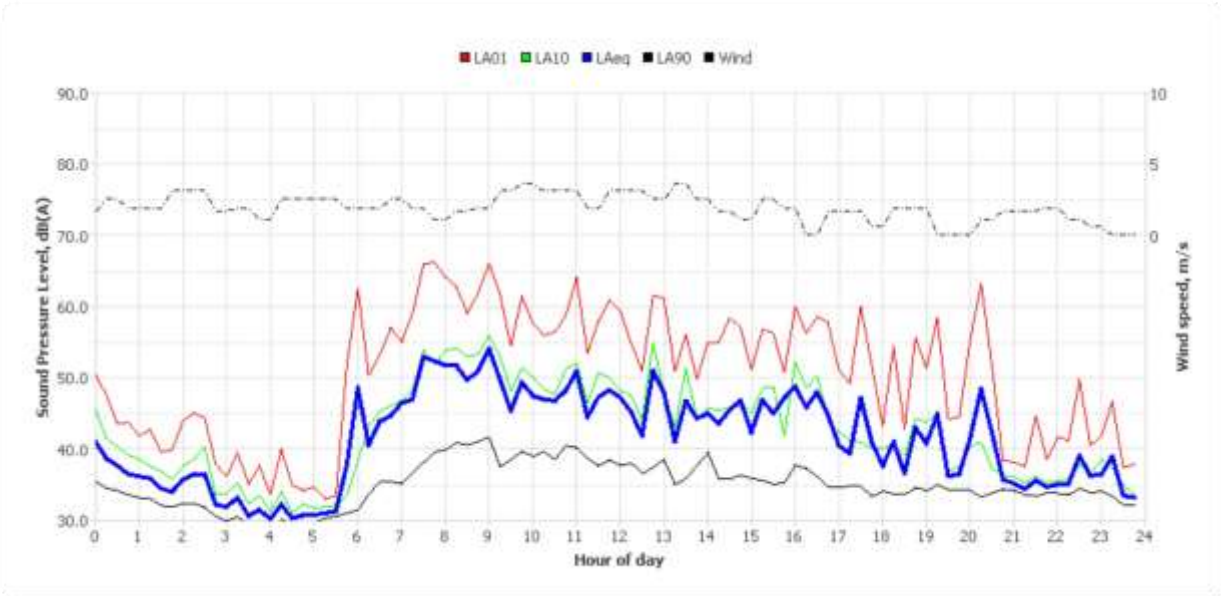
19 Woodstream Crescent, Kellyville

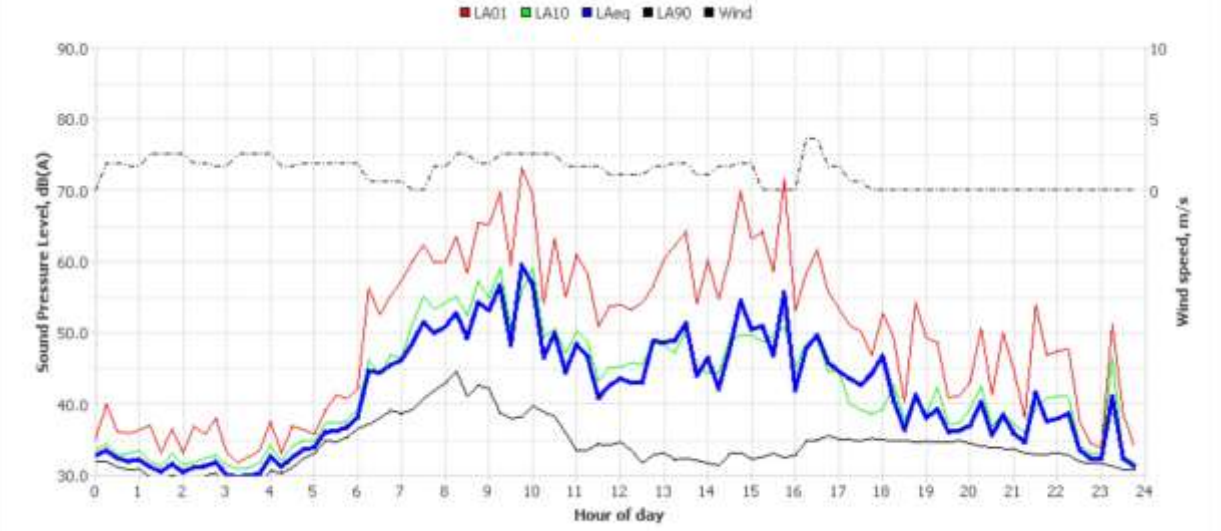
Logger Deployment Photo

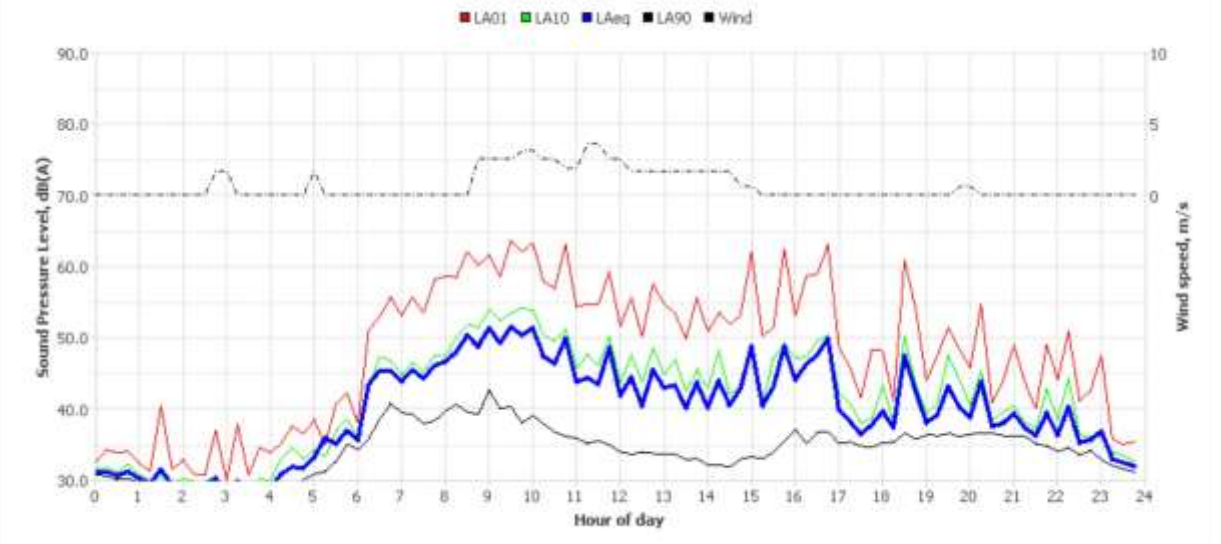

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

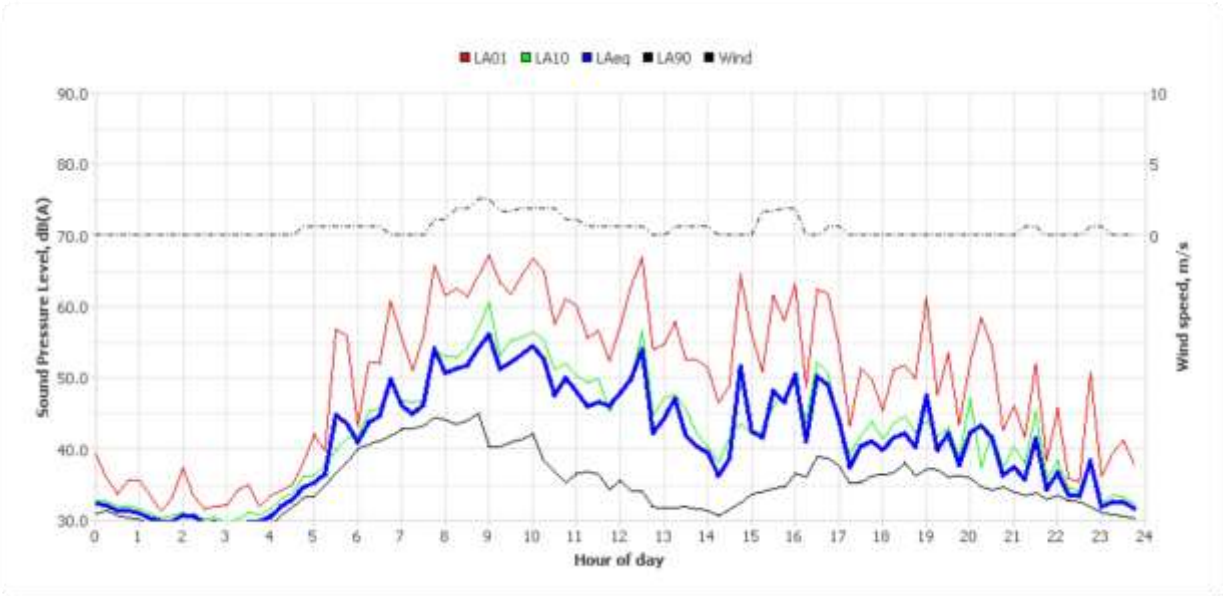

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

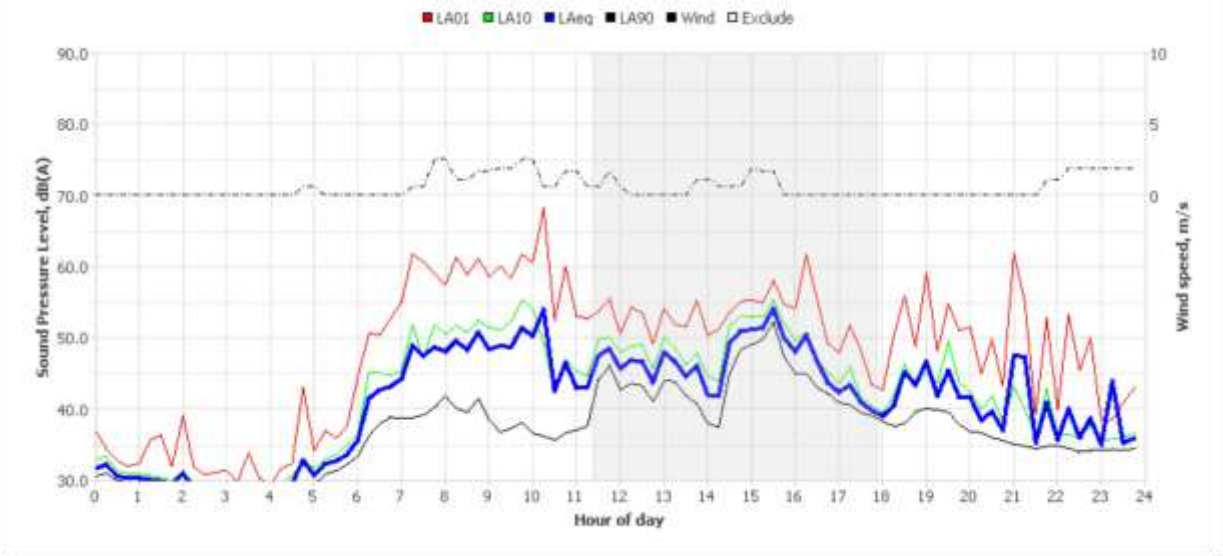

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

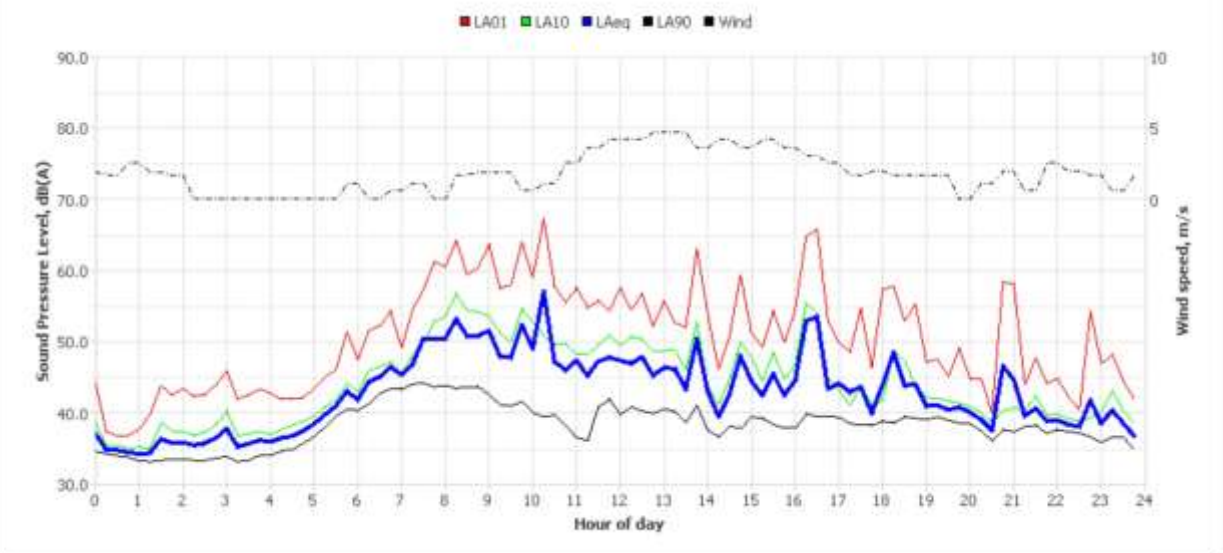

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

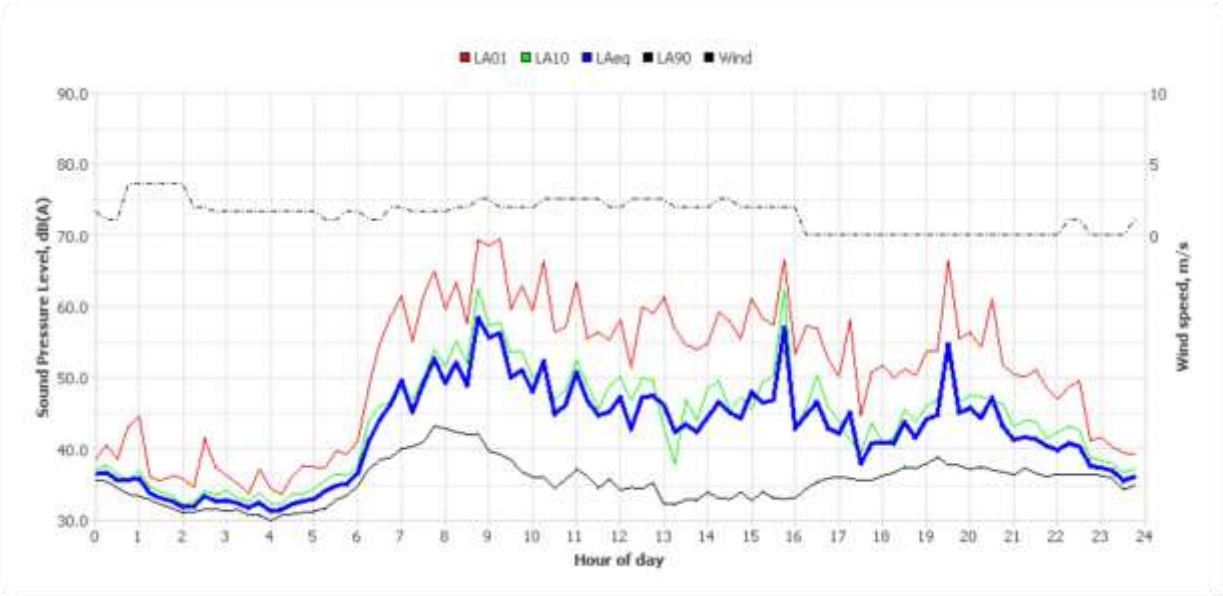

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

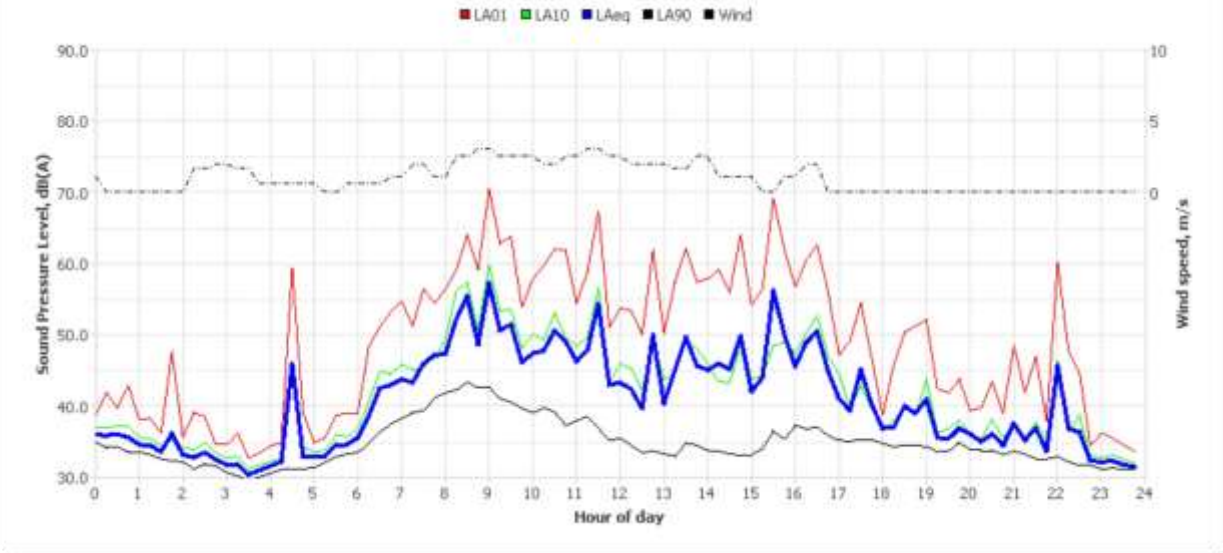

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

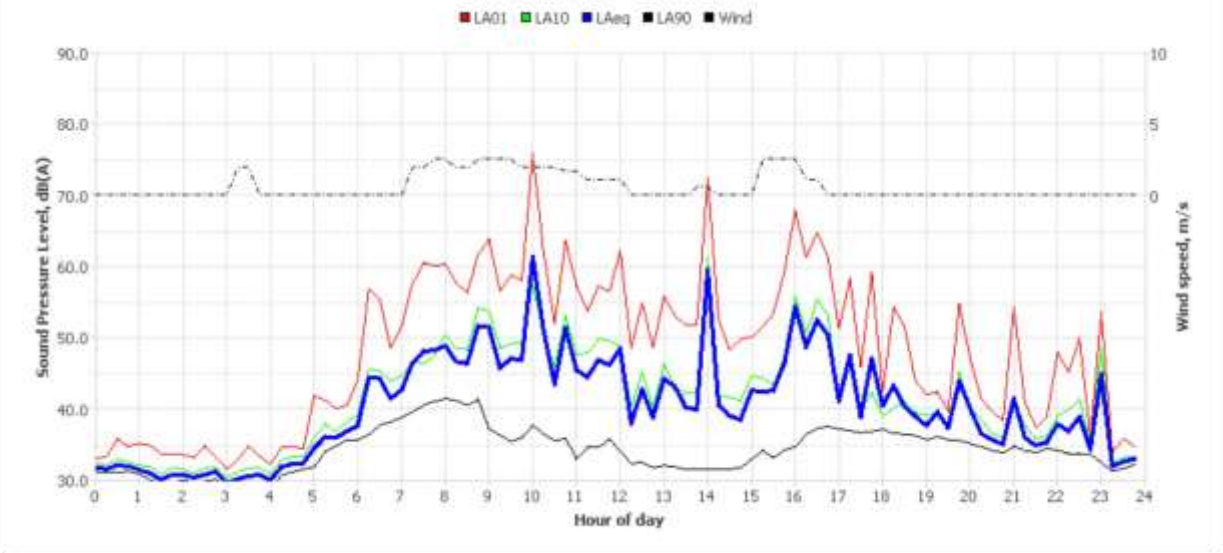

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

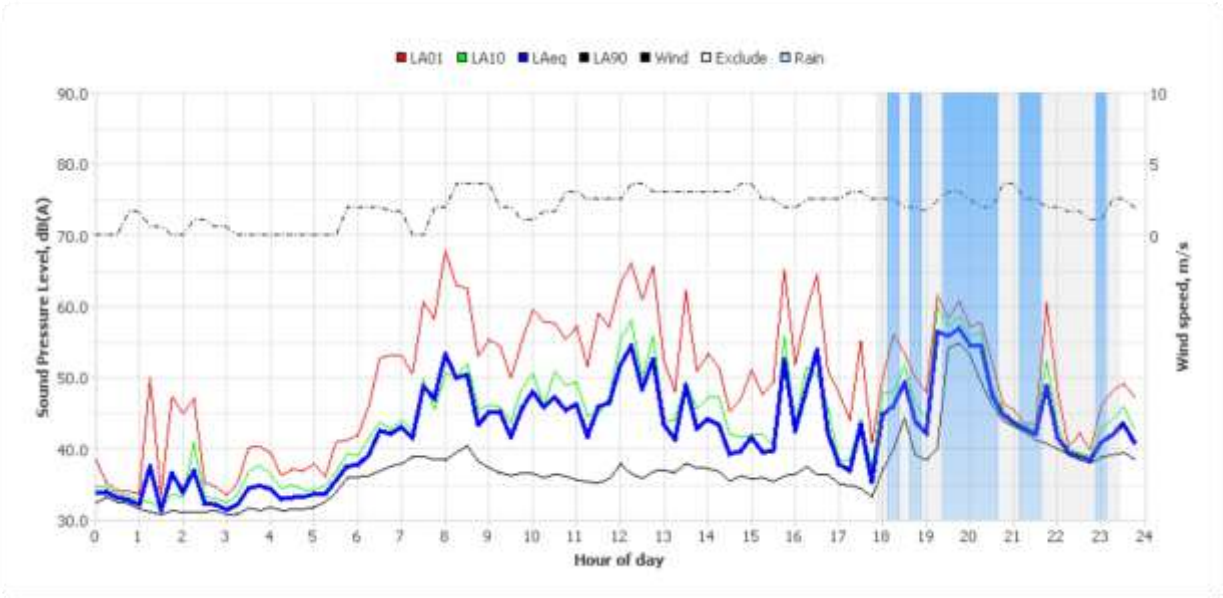

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

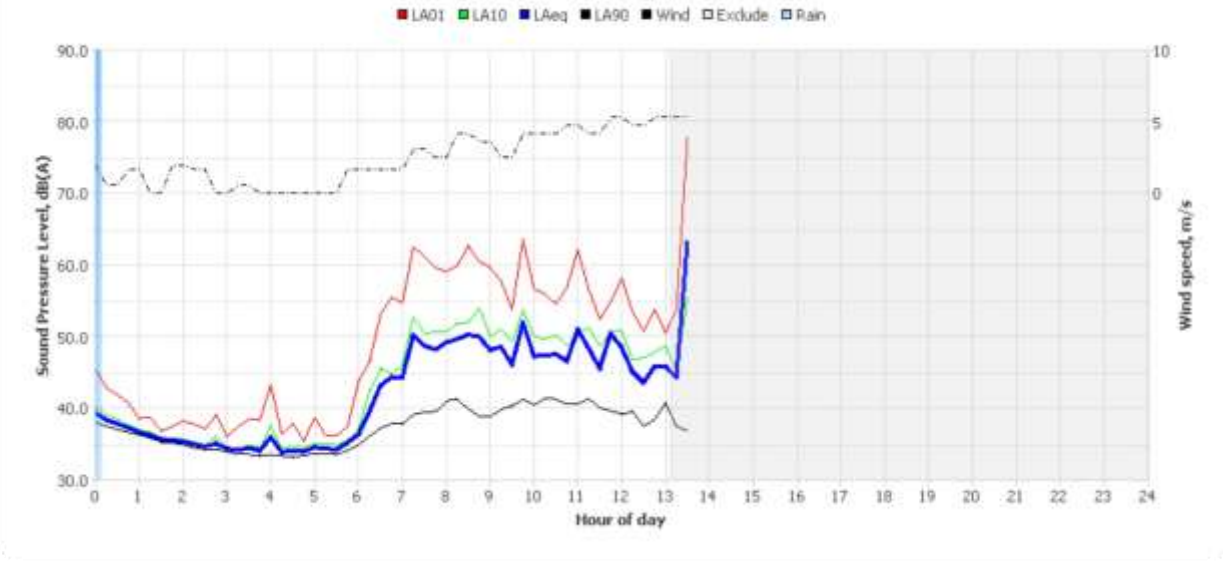

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

Noise Logger Report

15 Knightsbridge Place, Castle Hill

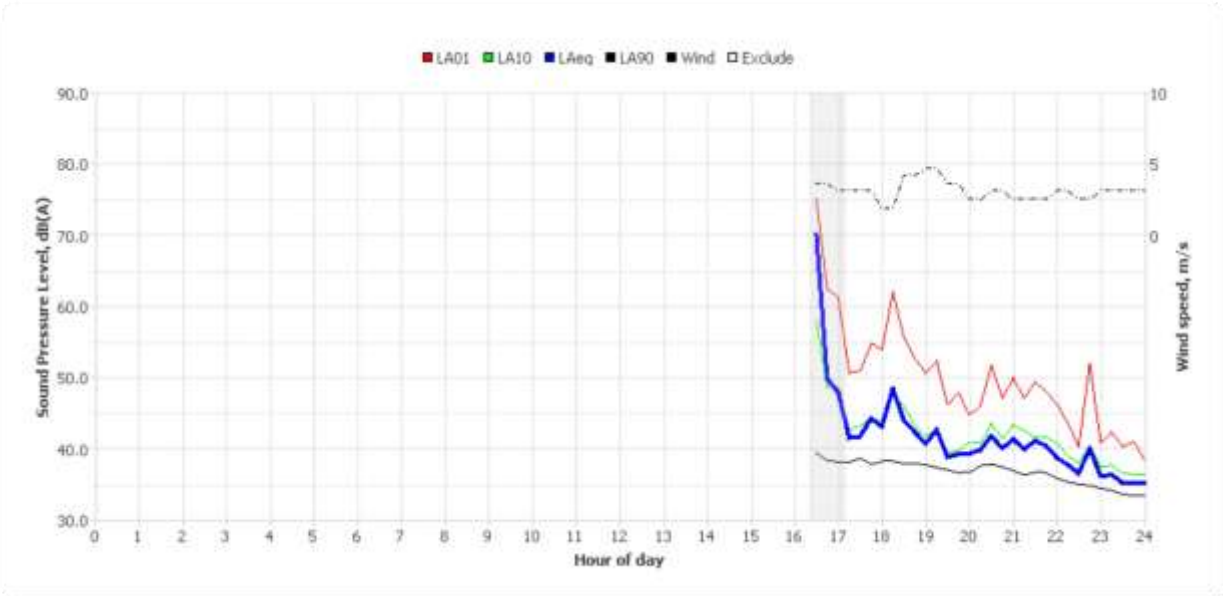
Item	Information
Logger Type	NL-52
Serial number	164393
Address	15 Knightsbridge Place, Castle Hill
Location	Front Yard
Facade / Free Field	Free field
Environment	Ambiet noise dominated by local road traffic and bird calls. Bird calls 54 - 61 dBA. Car pass by 50 dBA.

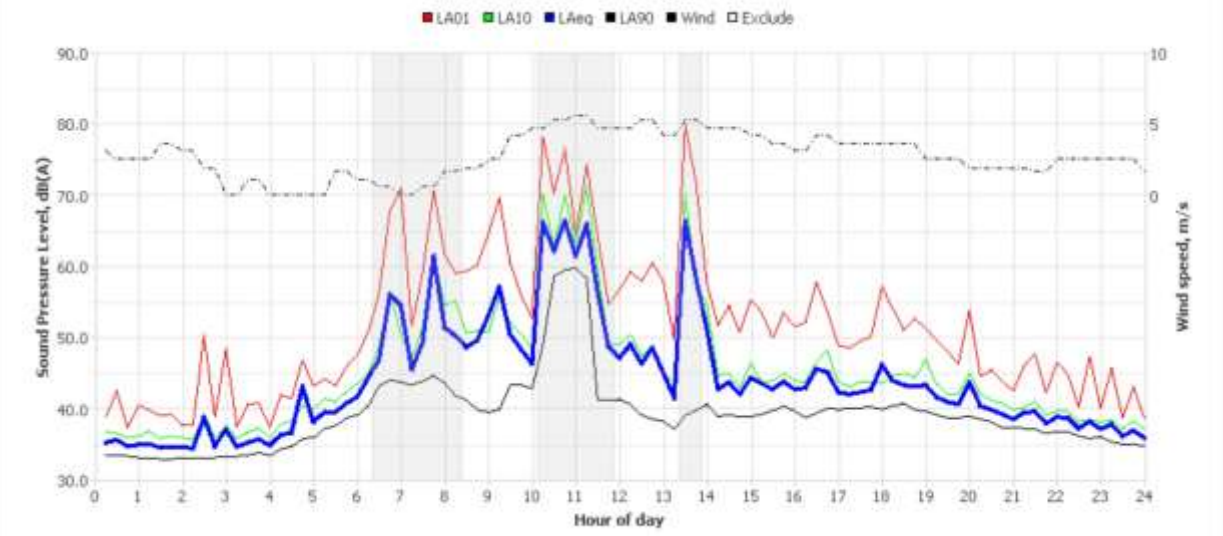
Measured noise levels

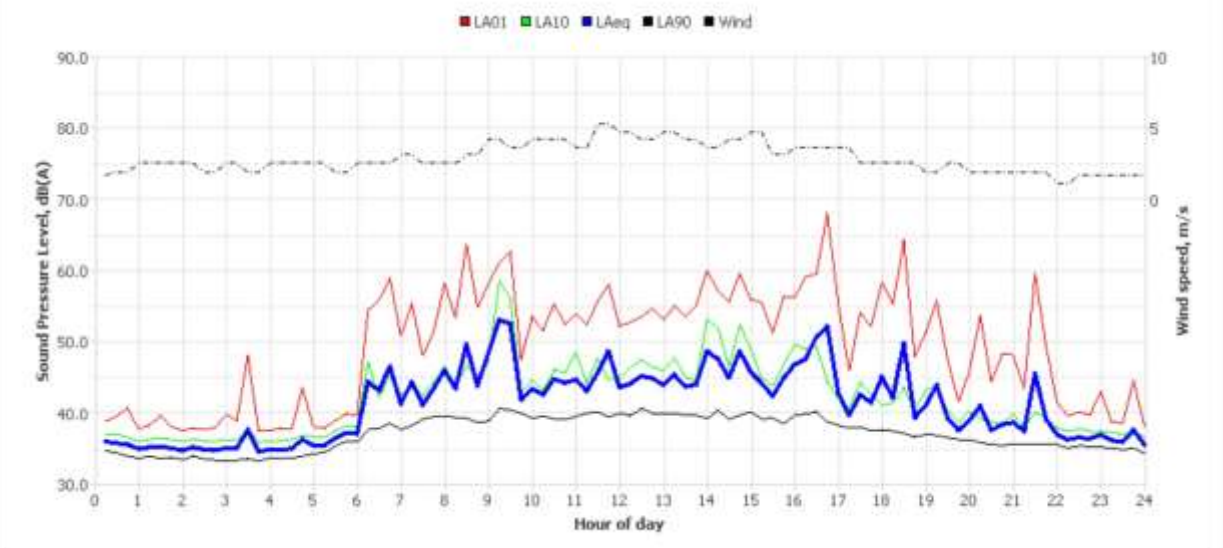
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu May 27 2021	43	42	37	-	36	-	42	37
Fri May 28 2021	48	41	38	-	37	33	47	38
Sat May 29 2021	46	42	38	38	36	33	46	38
Sun May 30 2021	45	40	38	36	34	33	44	38
Mon May 31 2021	47	41	38	29	33	29	46	38
Tue Jun 1 2021	46	42	42	31	33	22	45	42
Wed Jun 2 2021	44	42	42	29	32	23	44	42
Thu Jun 3 2021	44	40	41	-	26	22	43	41
Fri Jun 4 2021	47	42	42	35	35	24	46	42
Sat Jun 5 2021	44	41	36	30	34	25	44	36
Sun Jun 6 2021	48	40	37	29	31	25	47	37
Mon Jun 7 2021	43	39	39	28	31	23	42	39
Tue Jun 8 2021	44	33	41	33	-	23	44	41
Wed Jun 9 2021	45	-	39	-	-	-	45	39
Summary	**46**	**41**	**39**	**30**	**33**	**25**	**45**	**39**

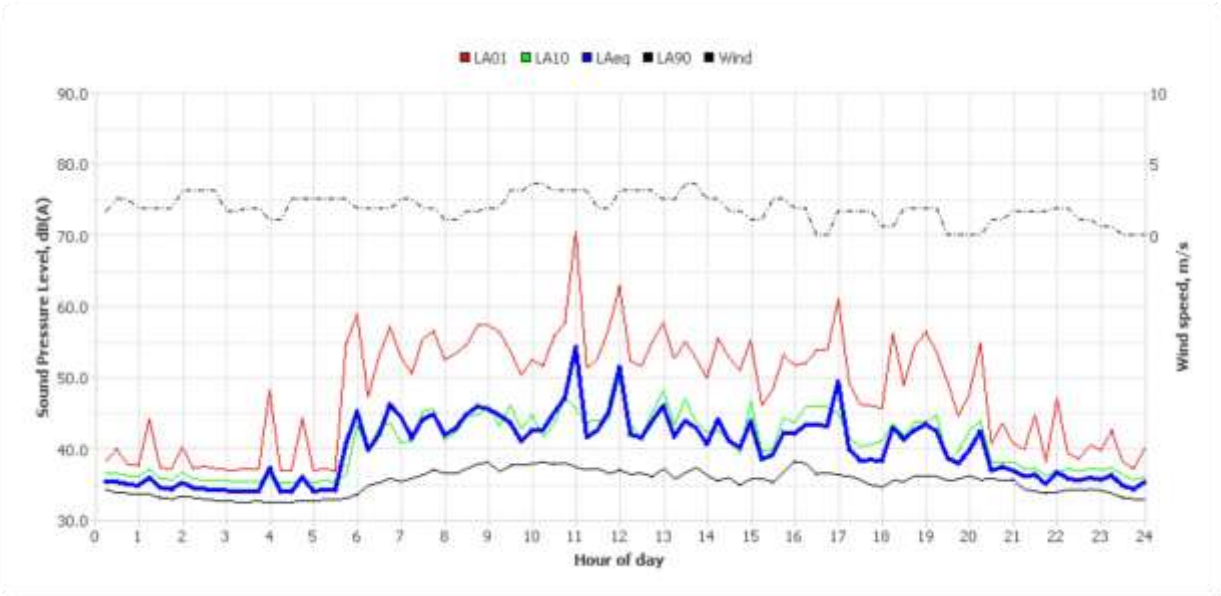
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

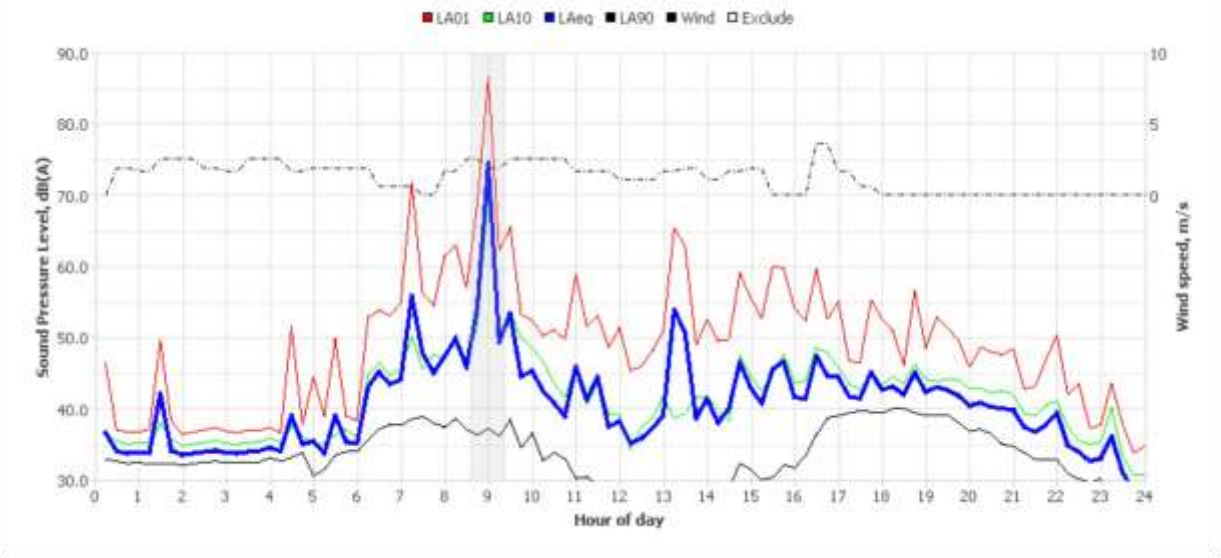
Logger Location	Logger Deployment Photo
	
15 Knightsbridge Place, Castle Hill	

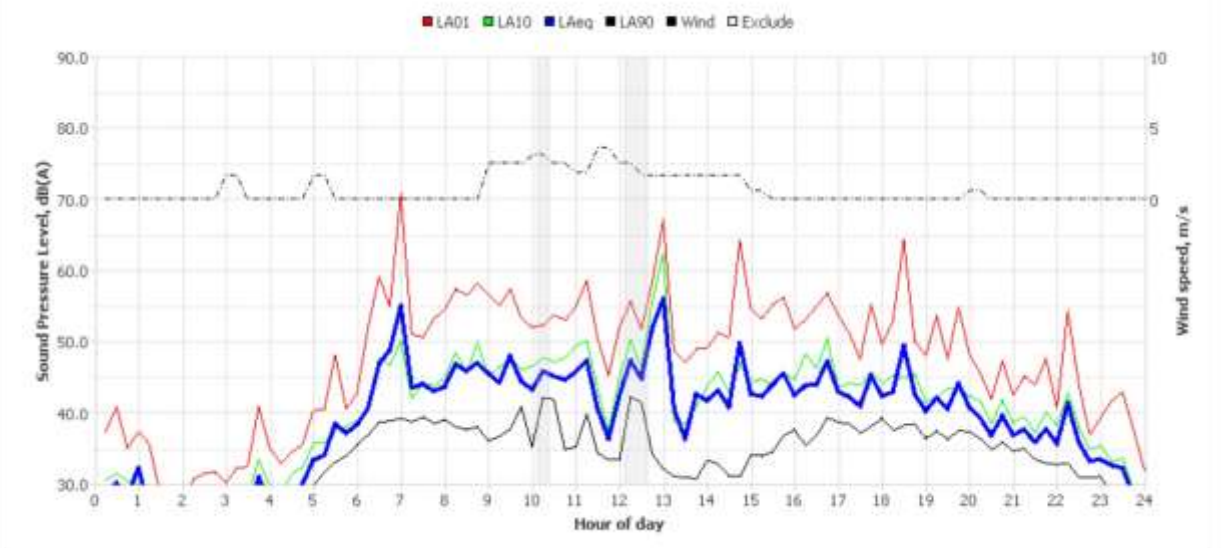

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

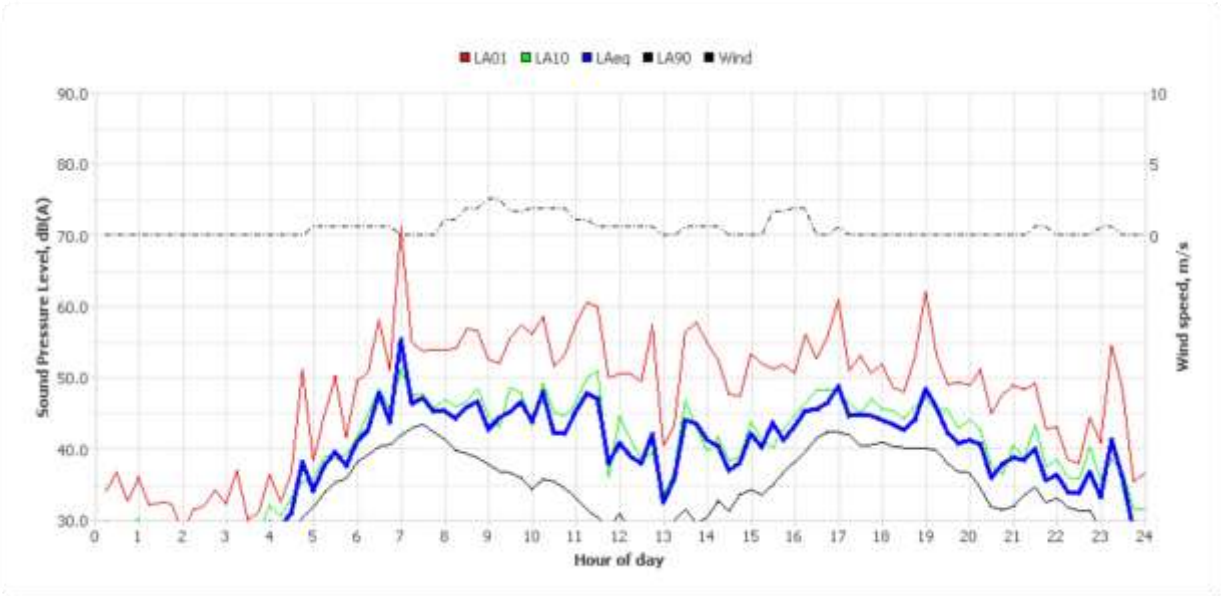

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

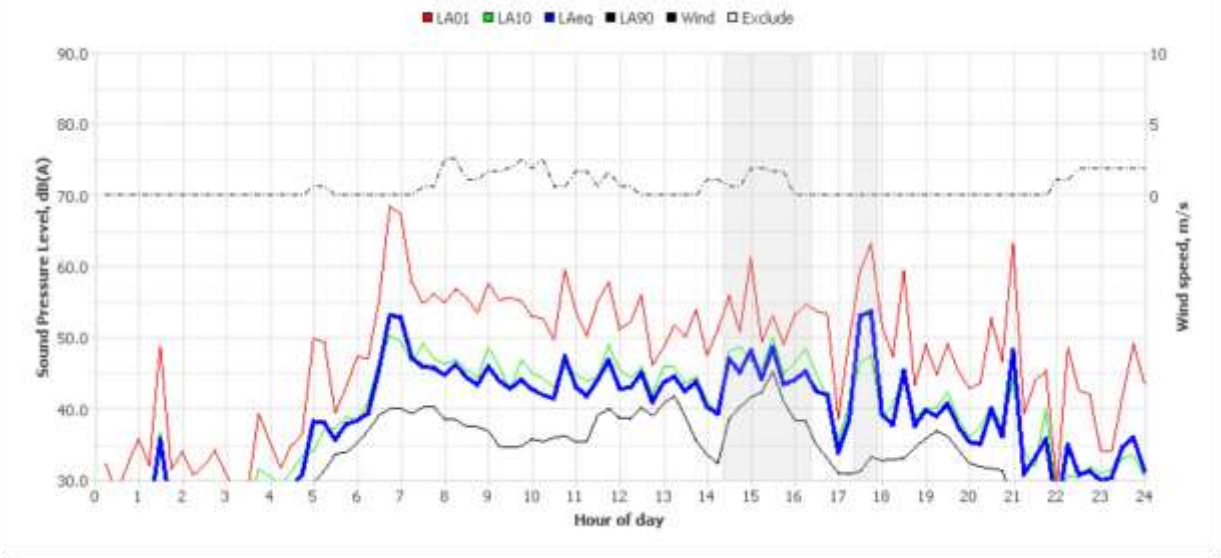

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

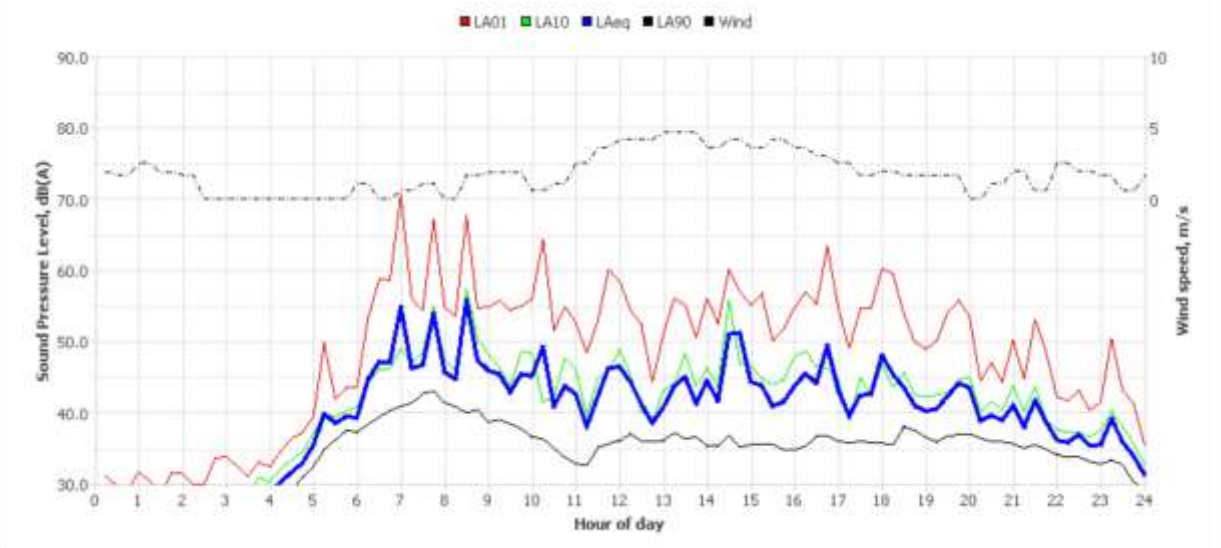

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

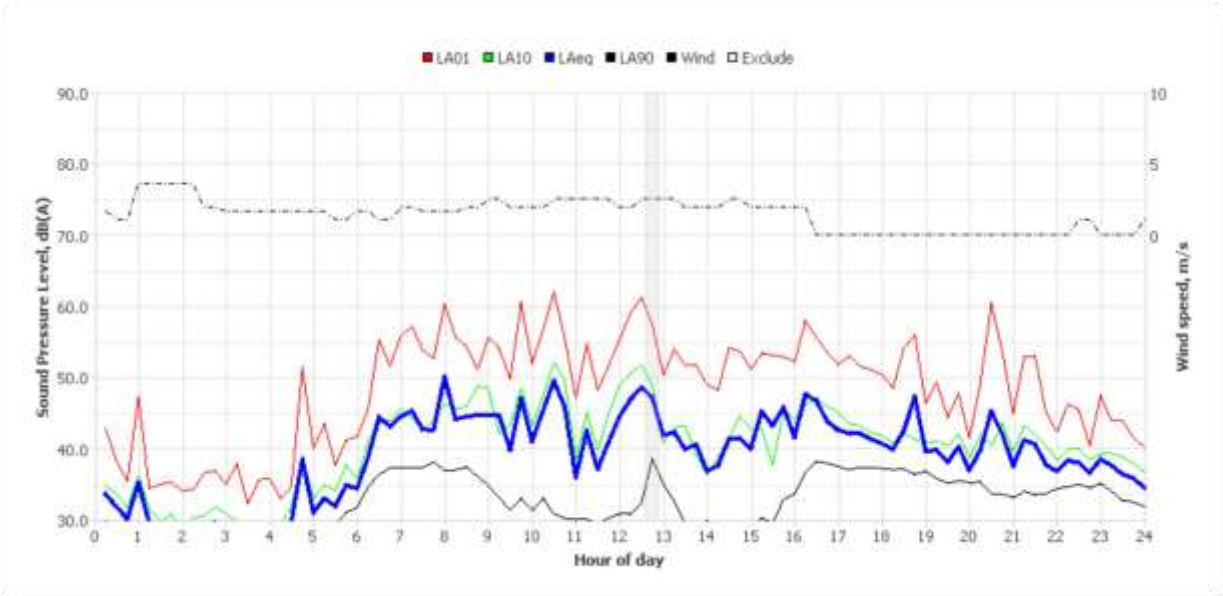

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

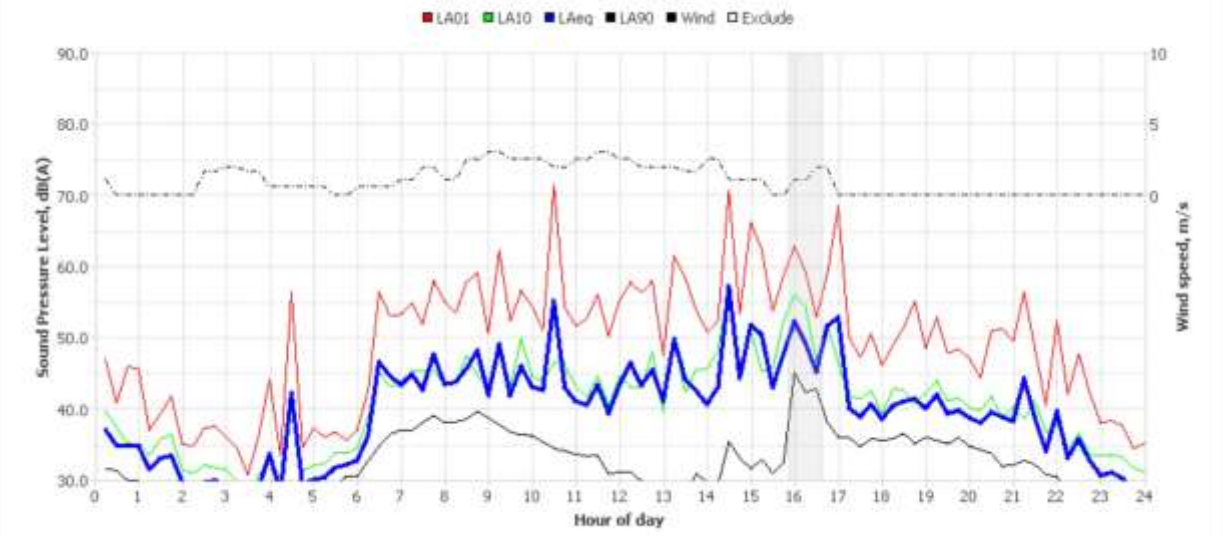

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

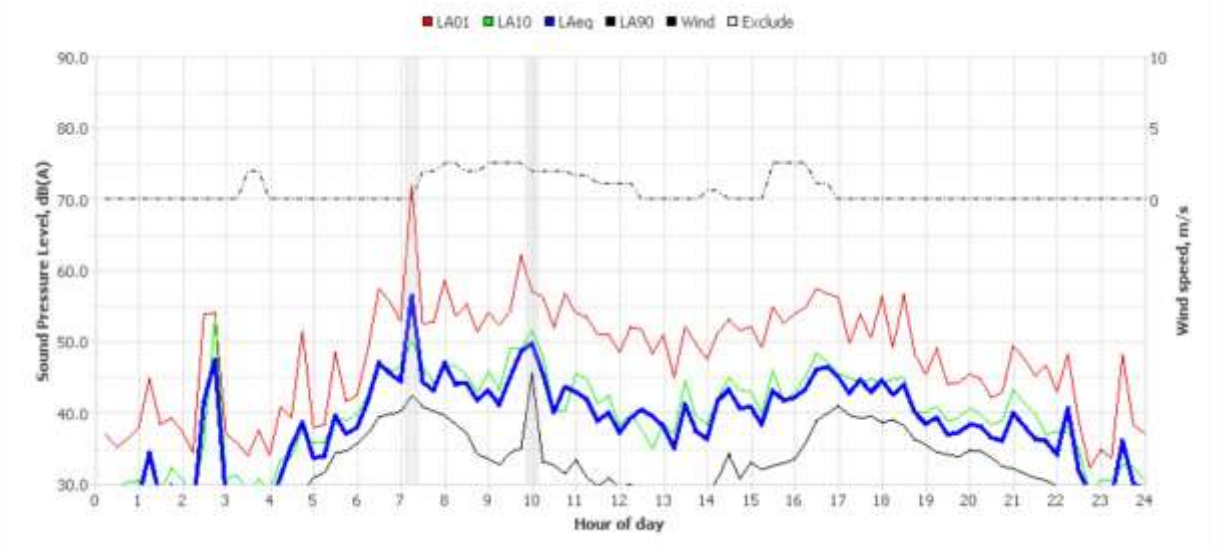

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

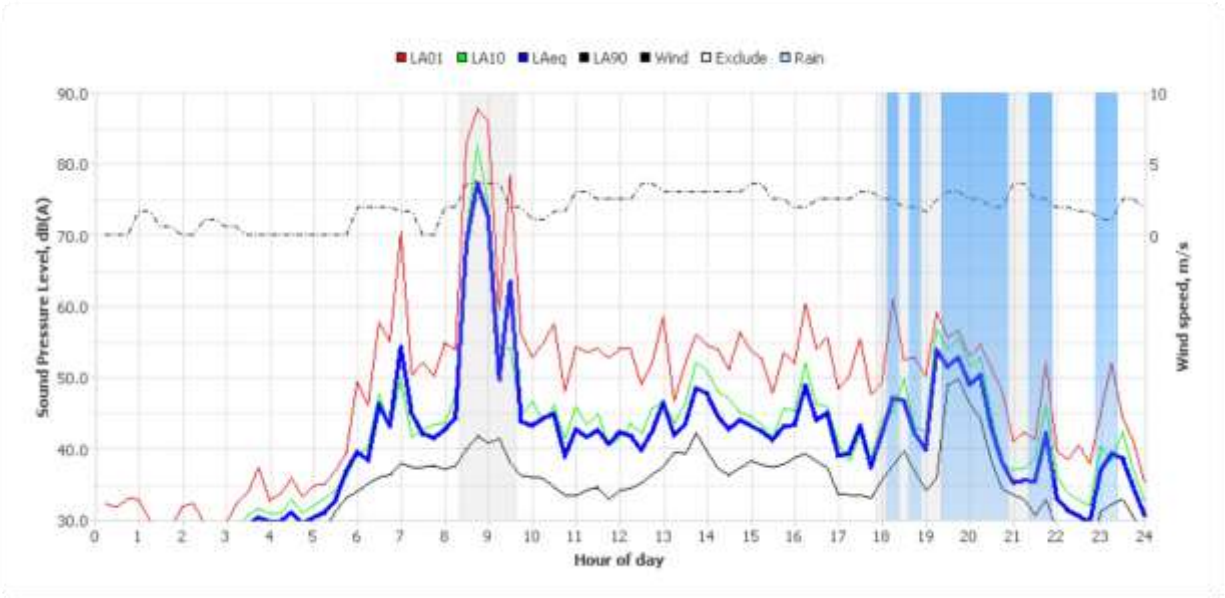

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

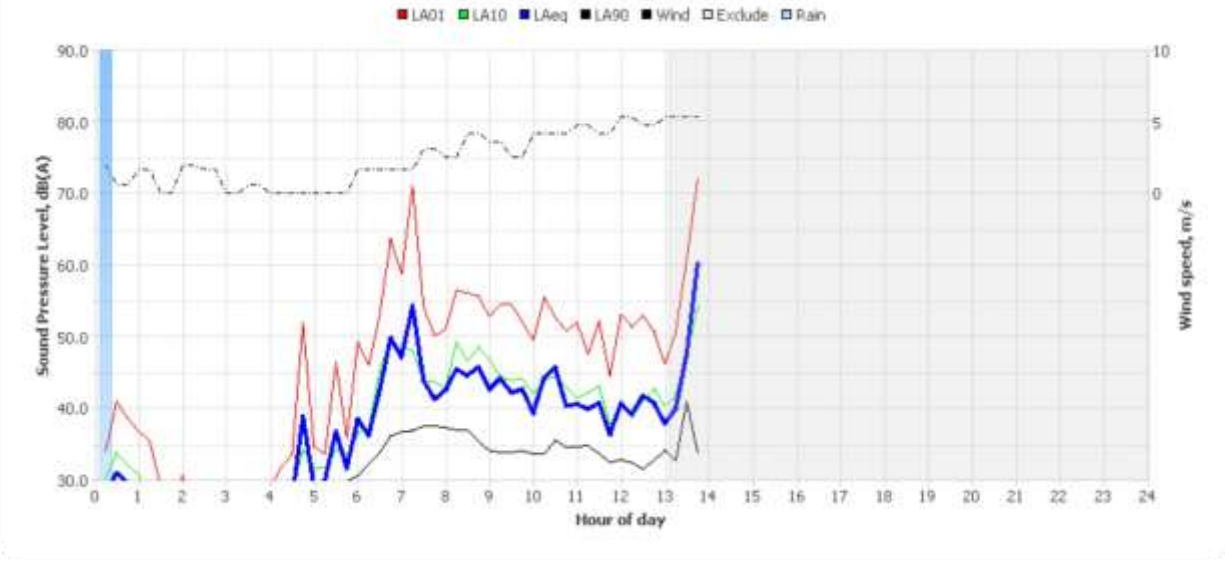

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

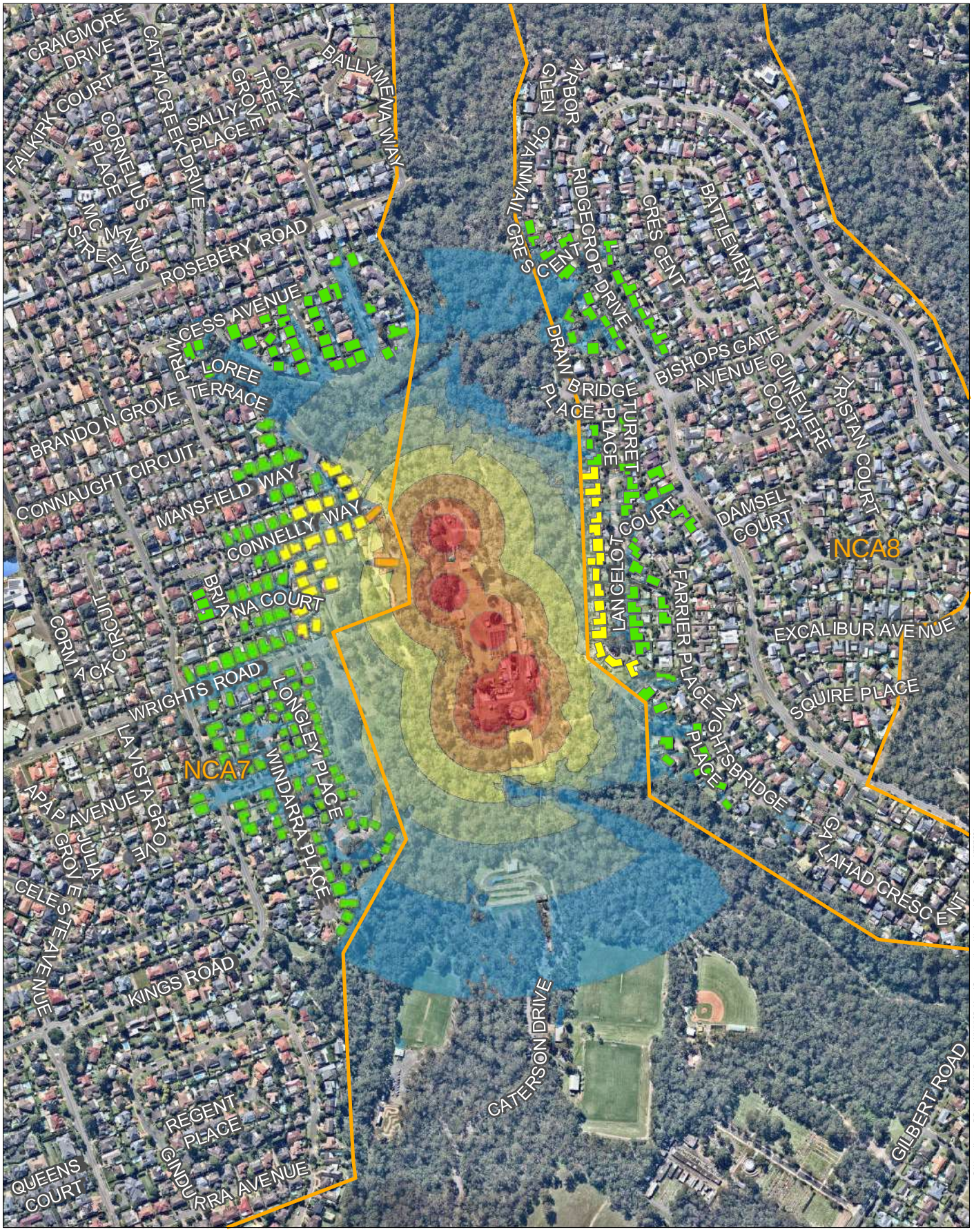

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


LA01 LA10 LAeq LA90 Wind Exclude Rain
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

Appendix D

Construction Noise Contour Plots



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Earthworks

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

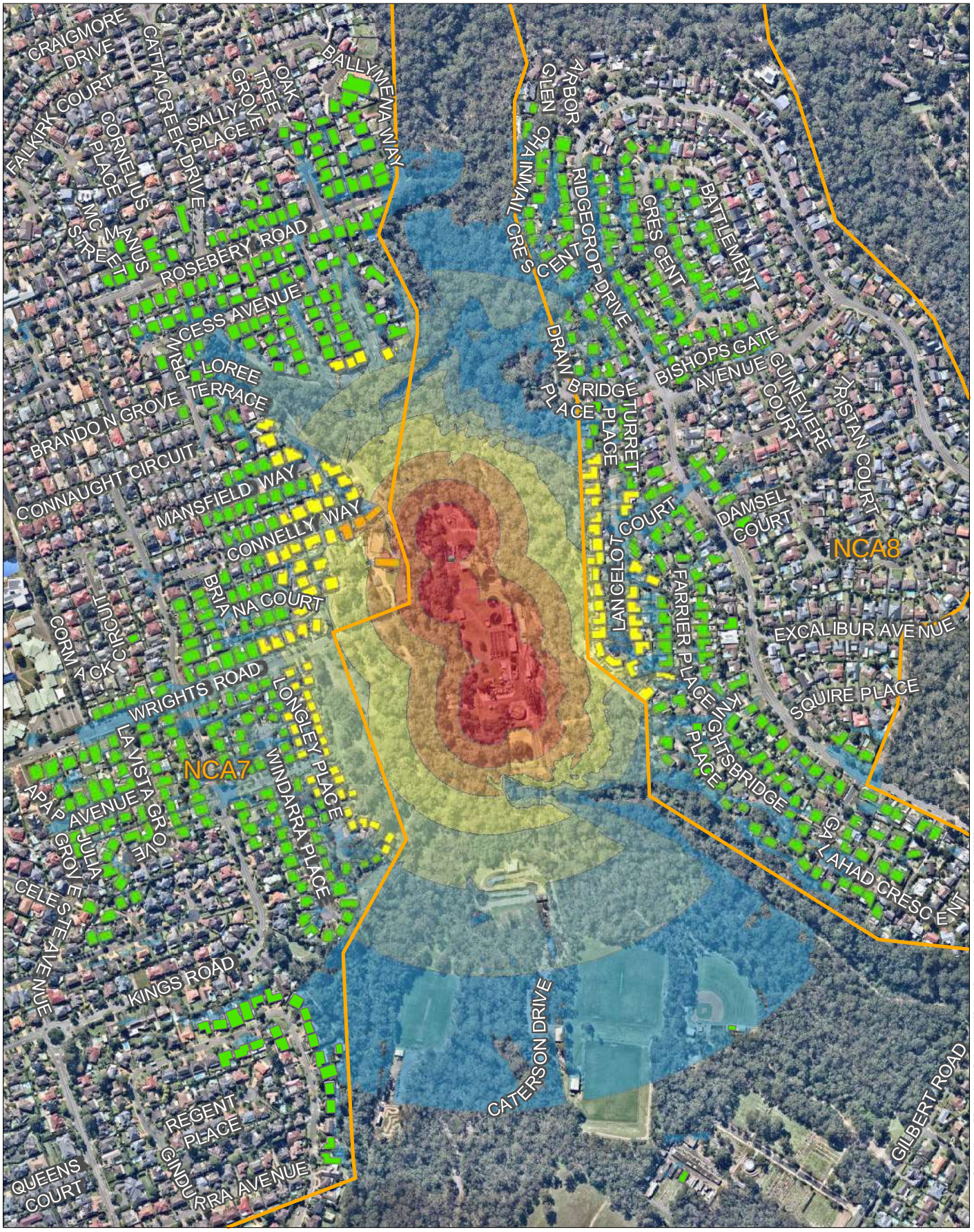
Exeedance above NML

<0 1 - 10 11 - 20 >20

N 0 100 200 Meters

AECOM

Source:



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Sheet Piling or Rock Breaking

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

Exeedance above NML

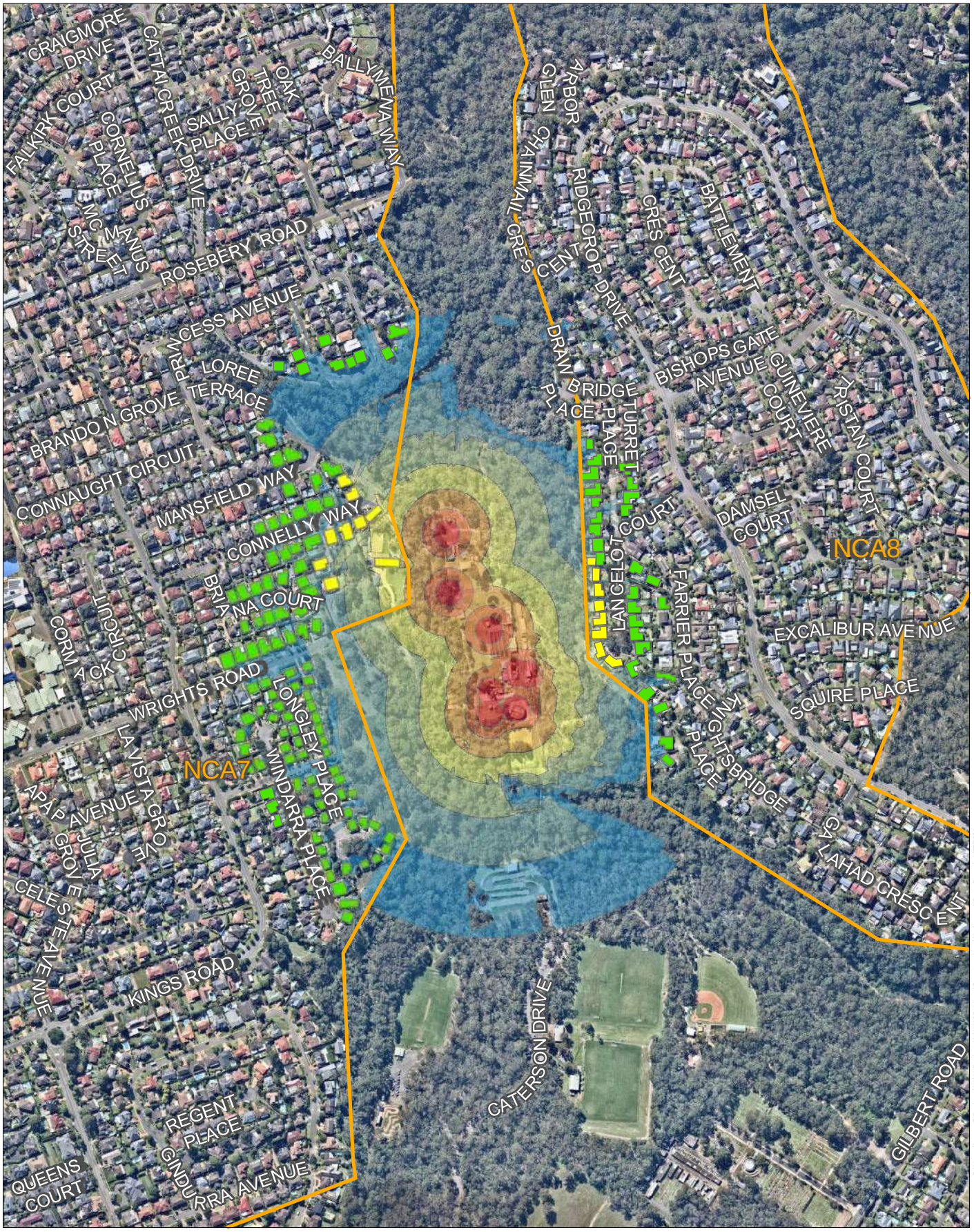
< 0 | 1 - 10 | 11 - 20 | > 20

N

0 100 200 Meters

AECOM

Source:



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Lifting

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

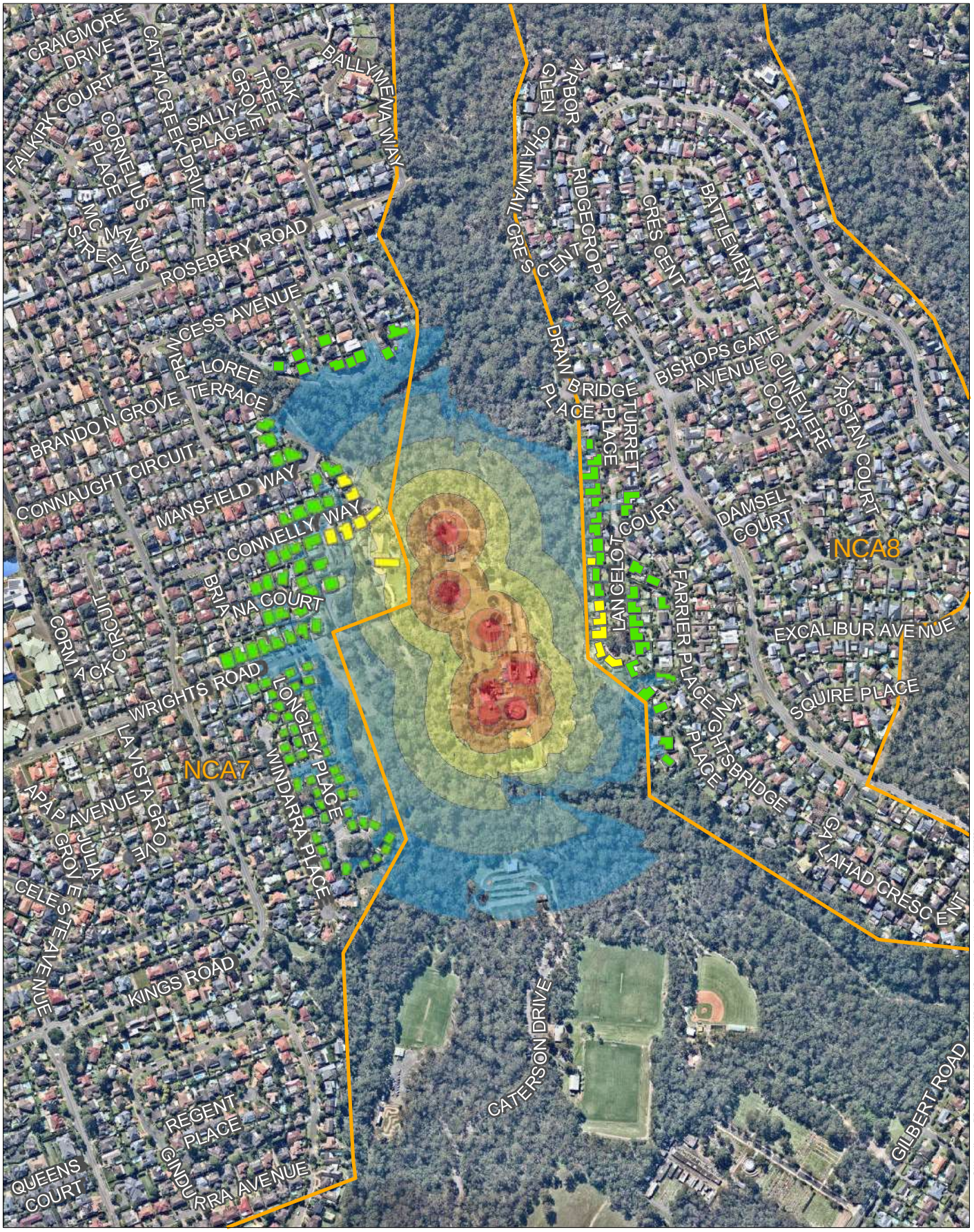
Exeedance above NML

<0 1 - 10 11 - 20

N 0 100 200 Meters

AECOM

Source:



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Concreting

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

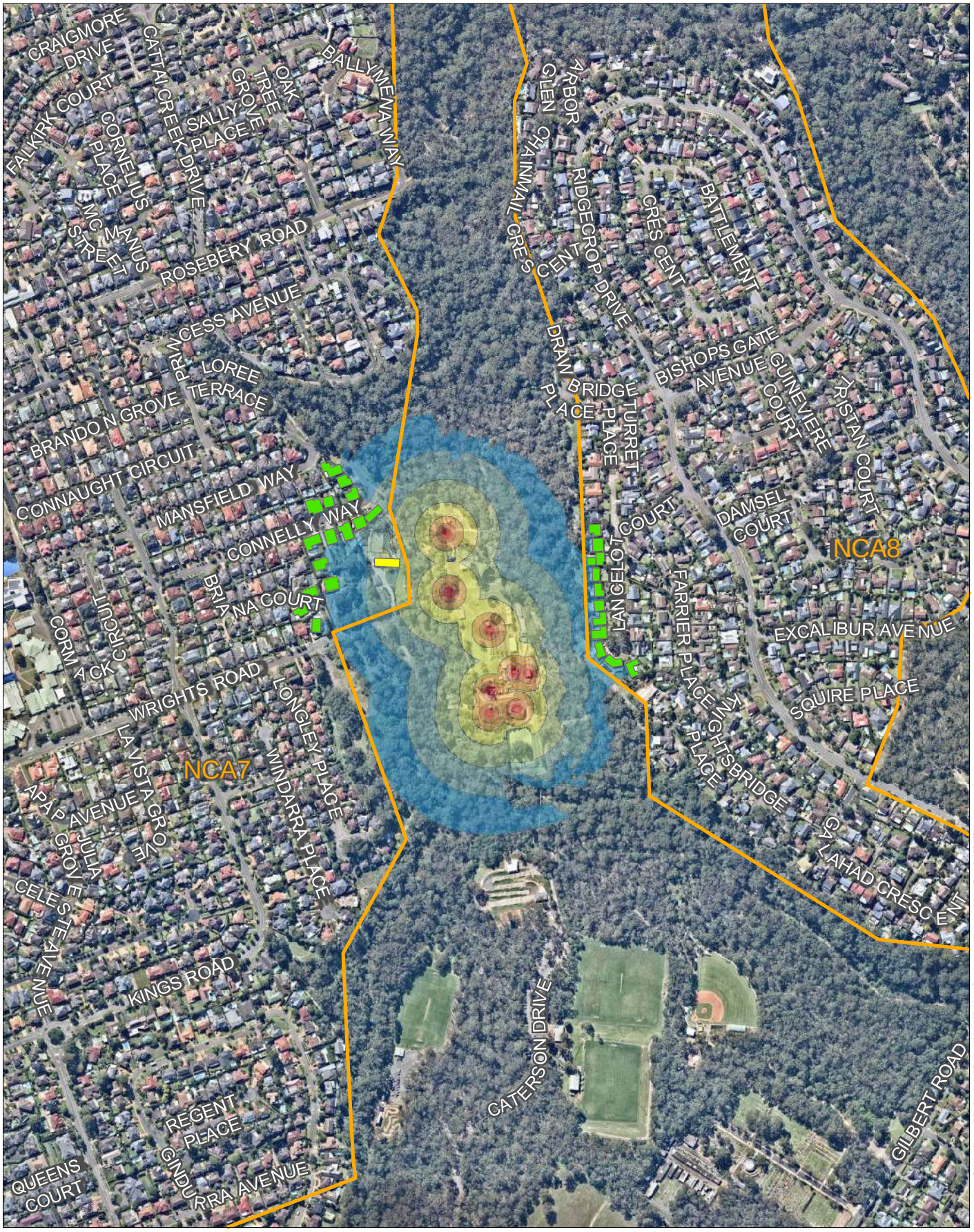
Exeedance above NML

< 0 1 - 10 11 - 20

N 0 100 200 Meters

AECOM

Source:



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Assembly and Cladding

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

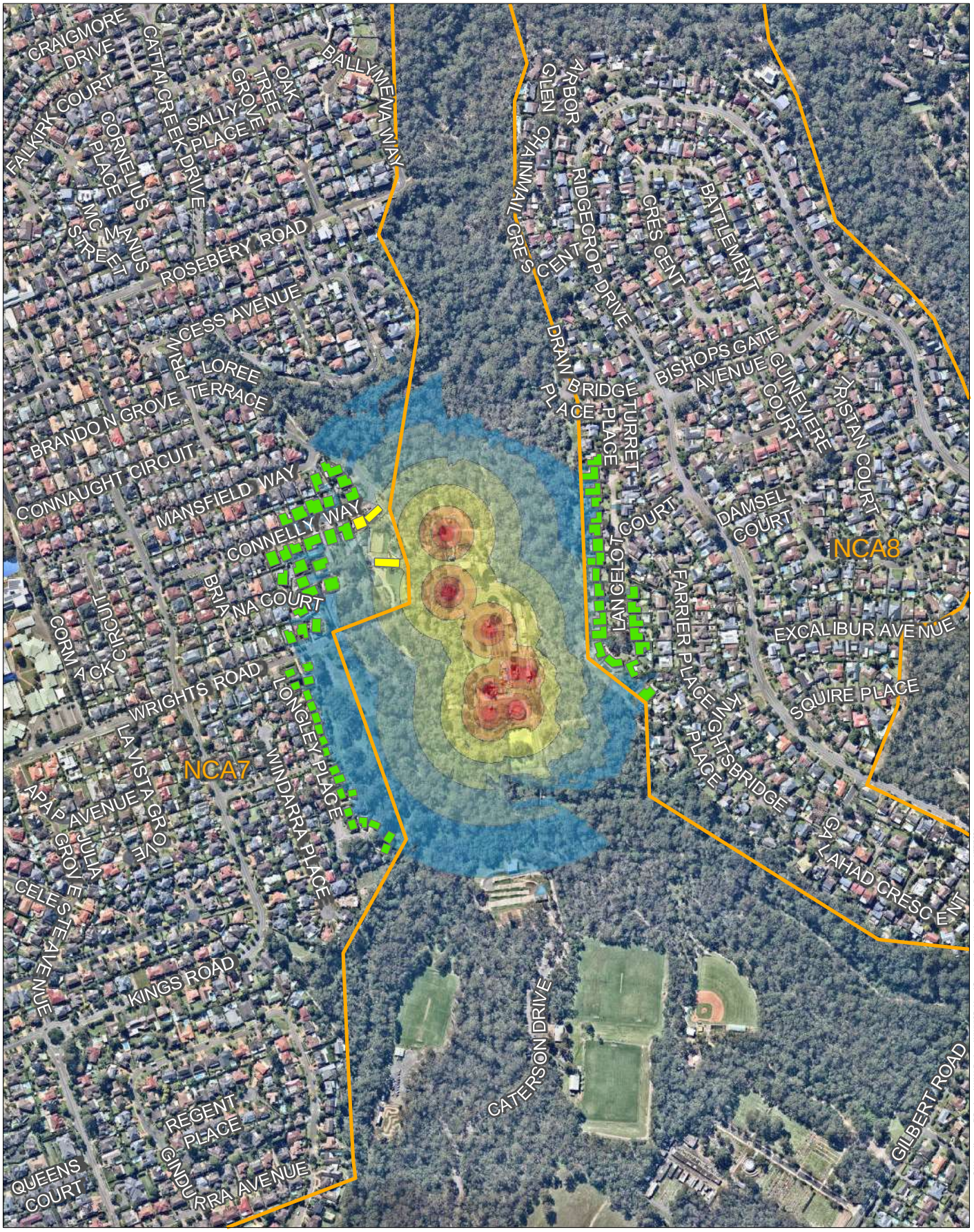
Exeedance above NML

<0 1-10 11-20

N 0 100 200 Meters

AECOM

Source:



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Pipe Installation

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

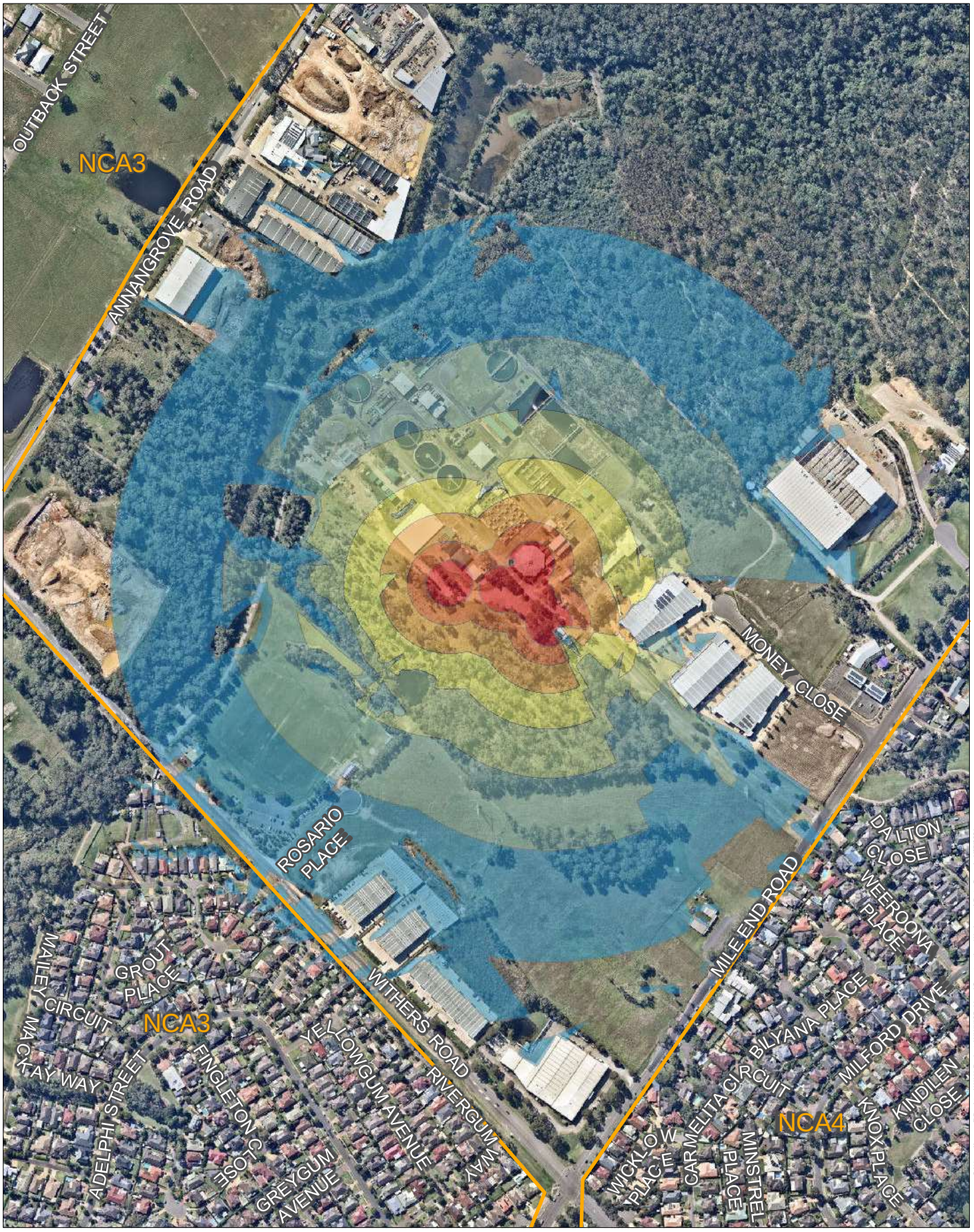
Exeedance above NML

<0 1-10 11-20

N 0 100 200 Meters

AECOM

Source:



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Earthworks

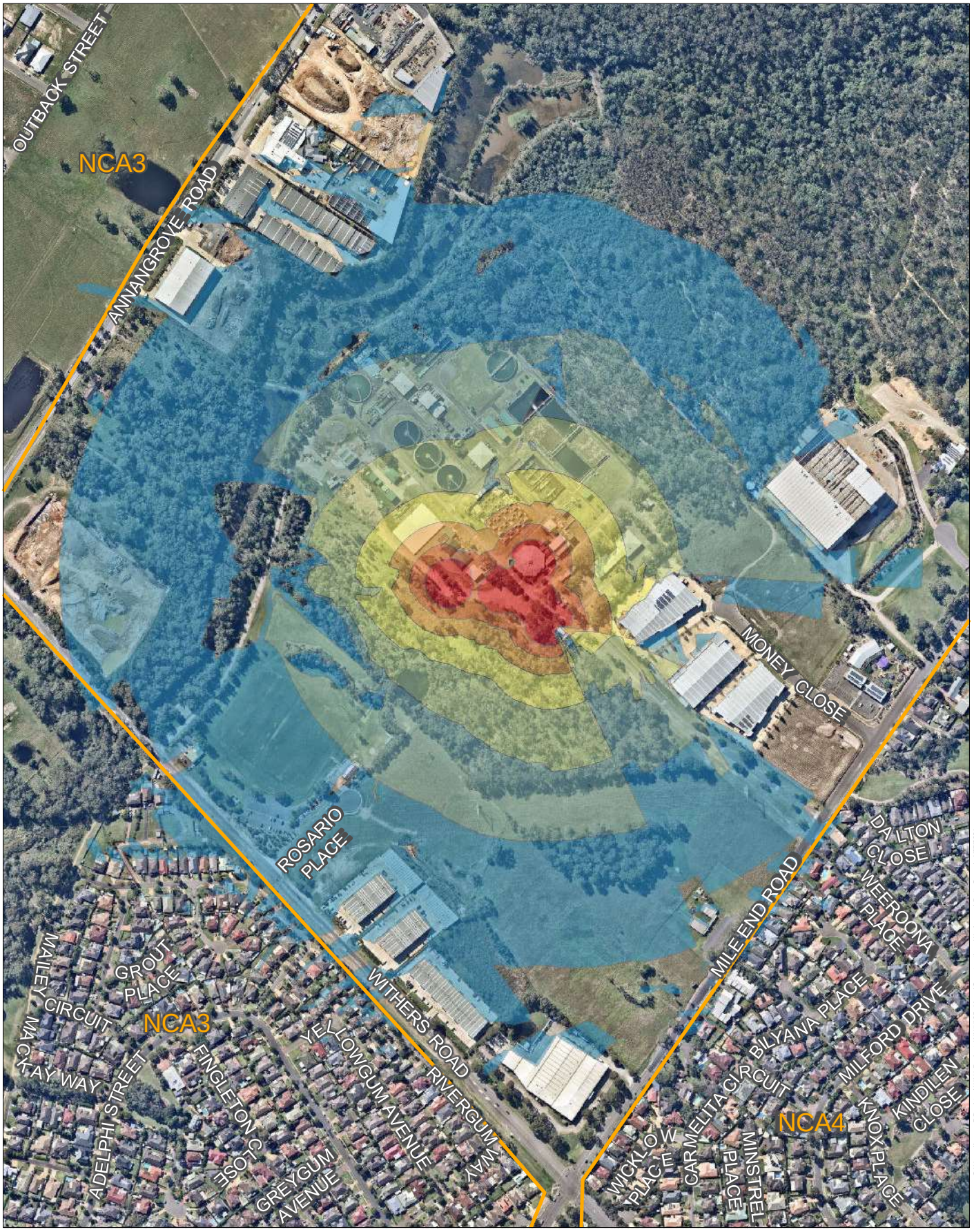
Meters
0 90 180

AECOM

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

Source:



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Sheet Piling or Rock Breaking

Sound Pressure Level, L_{Aeq} dBA

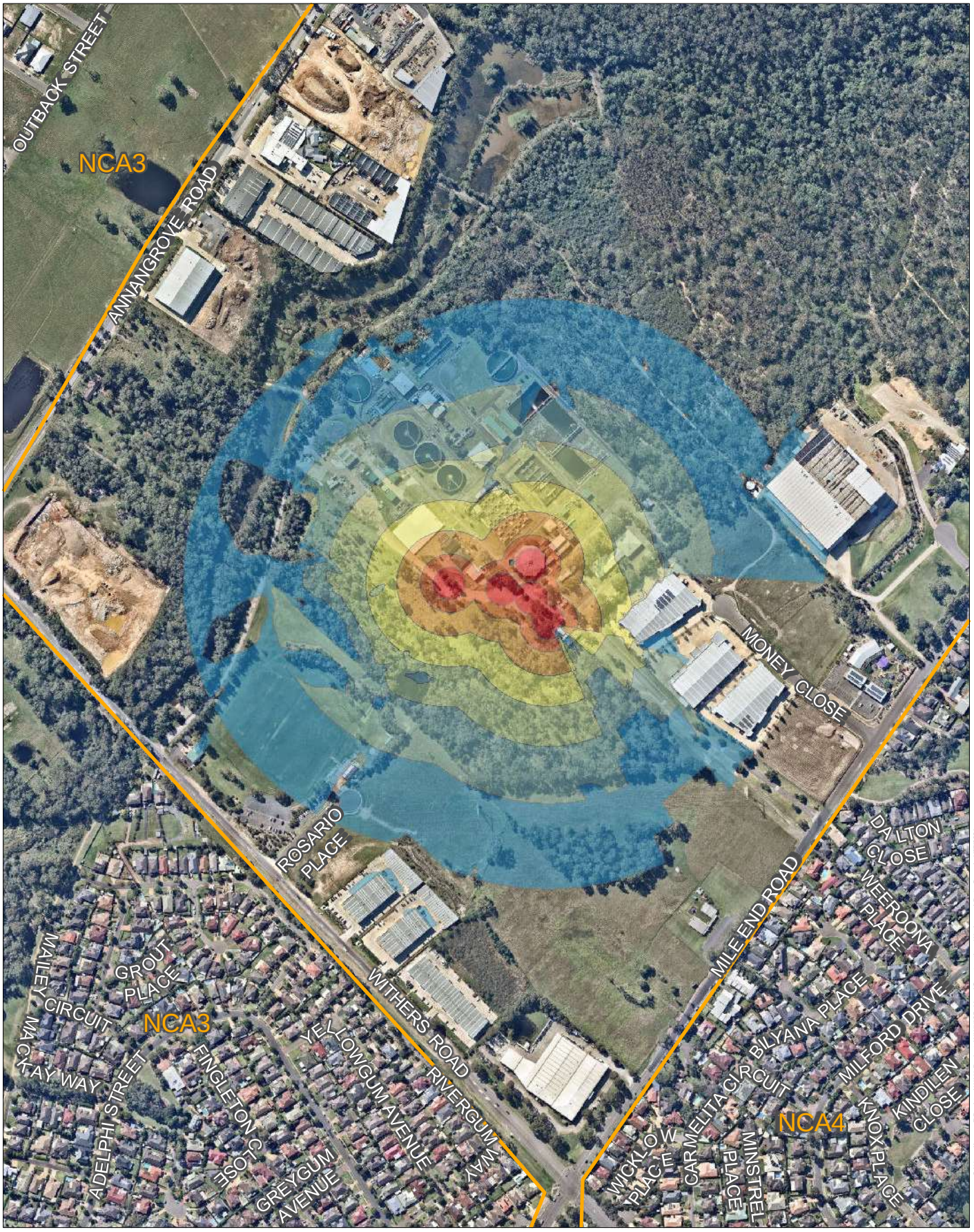
45 50 55 60 65 70 75

N

0 90 180 Meters

AECOM

Source:



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Lifting

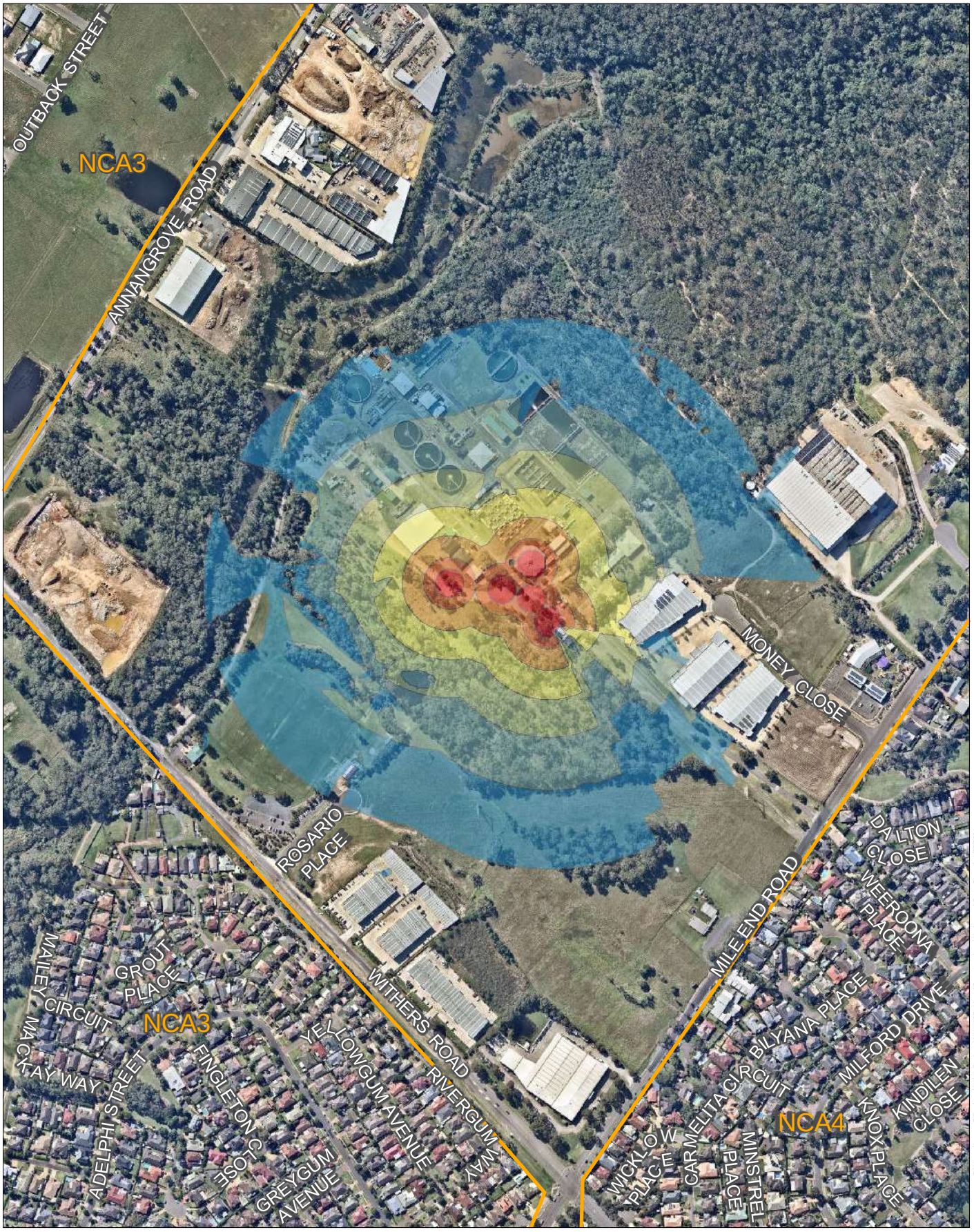
Meters
0 90 180

AECOM

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

Source:



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Concreting

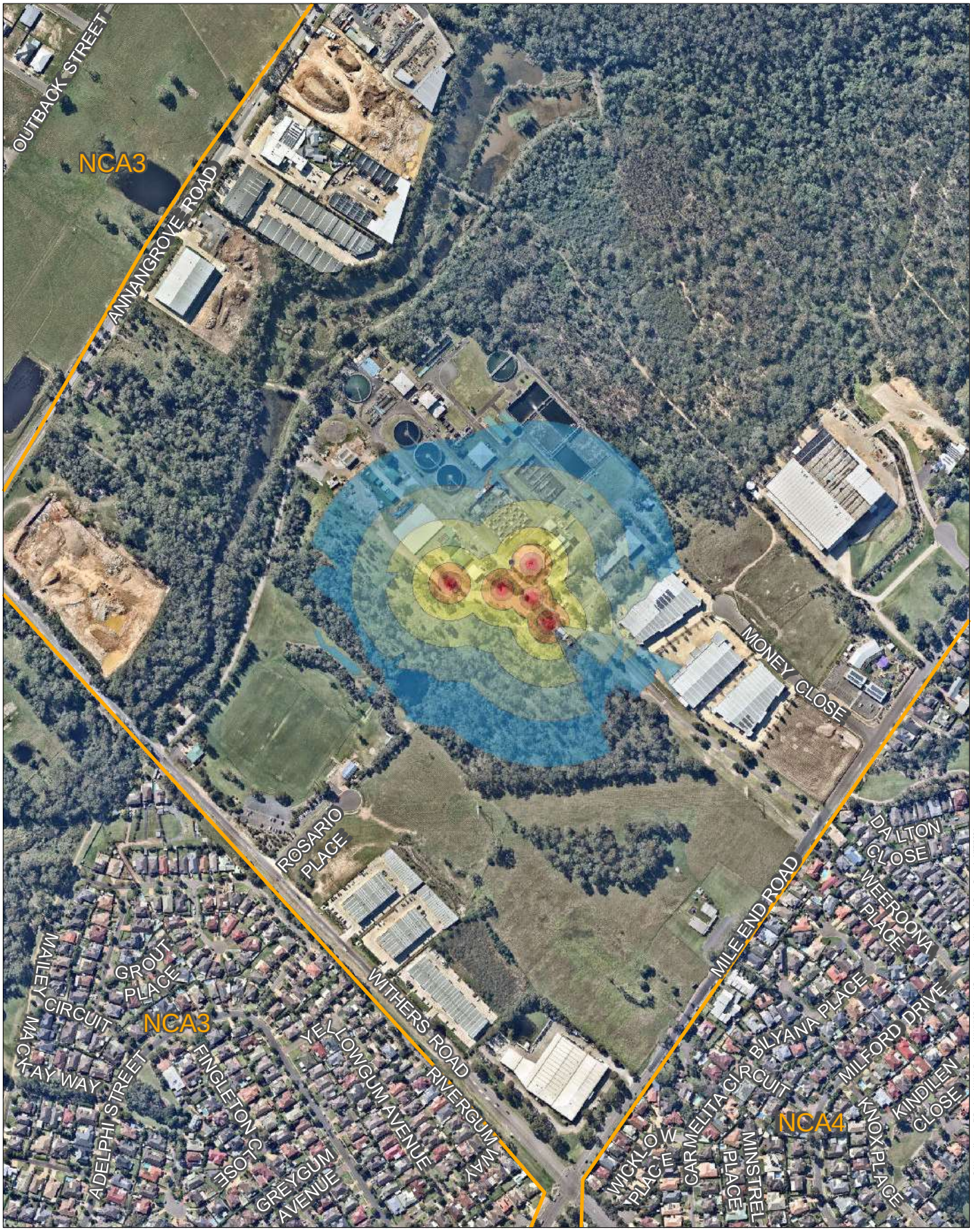
Meters
0 90 180

AECOM

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

Source:



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Assembly and Cladding

N

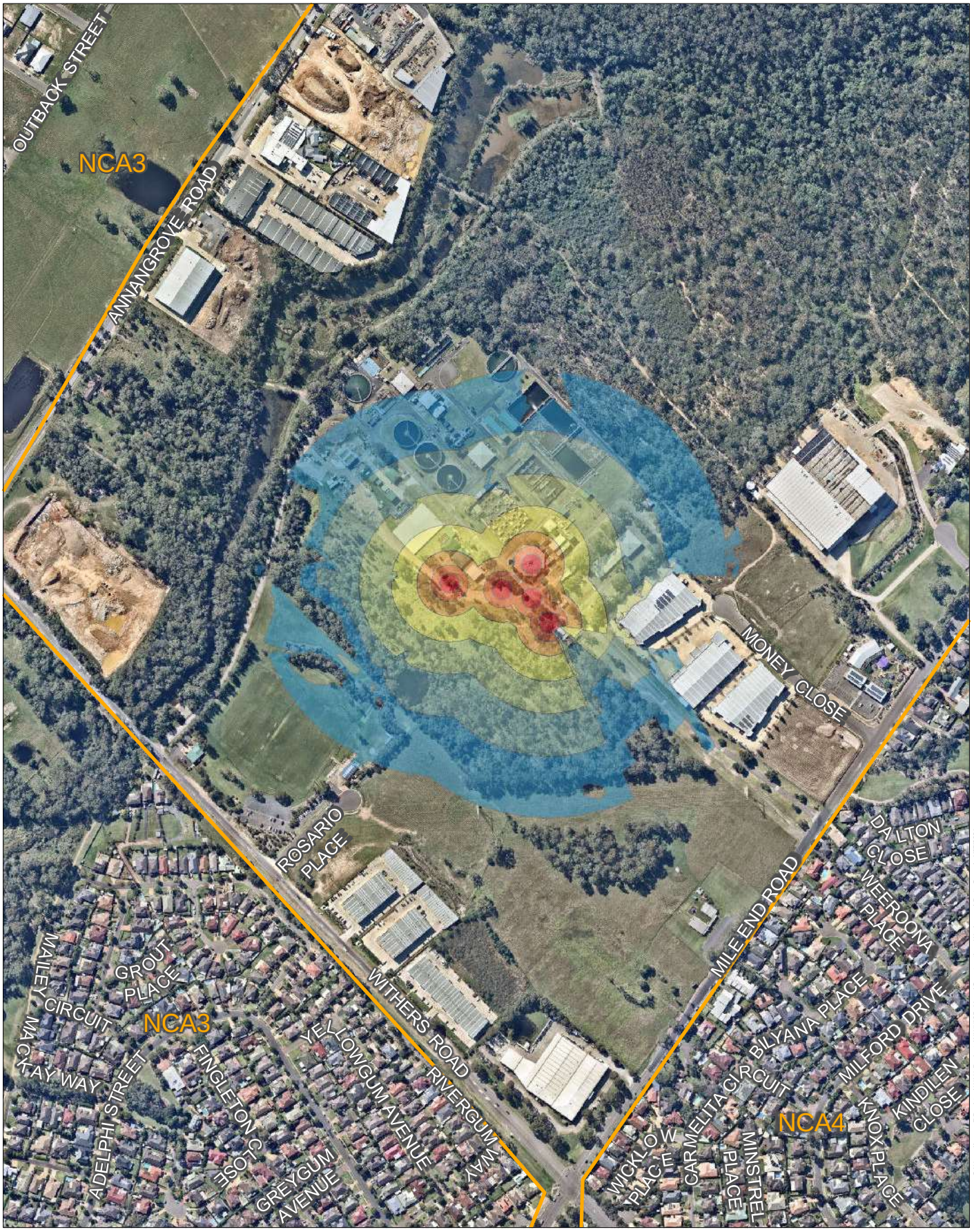
0 90 180 Meters

AECOM

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

Source:



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Pipe Installation

N

0 90 180 Meters

AECOM

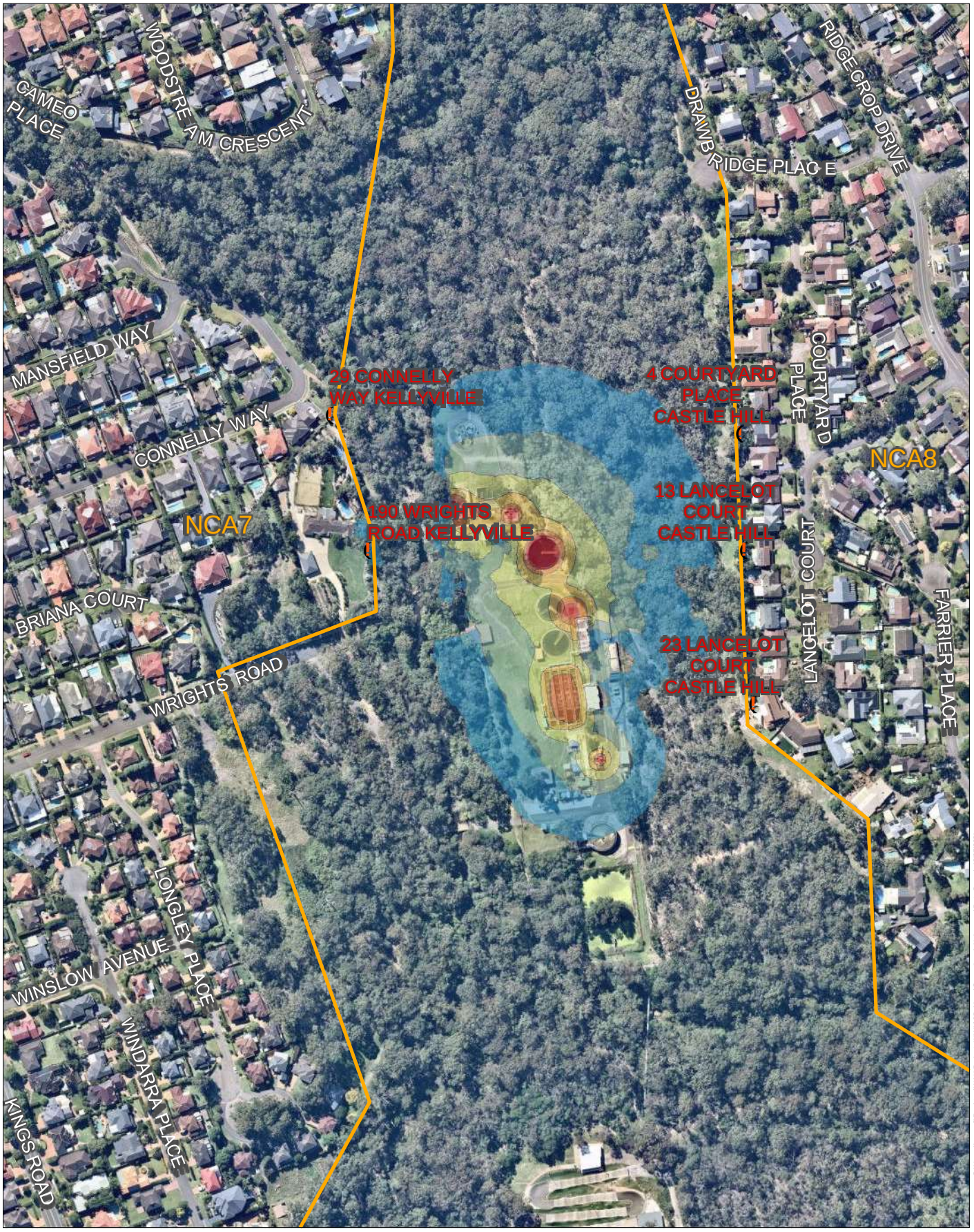
Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

Source:

Appendix E

Operational Noise Contour Plots



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Daytime - Existing - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

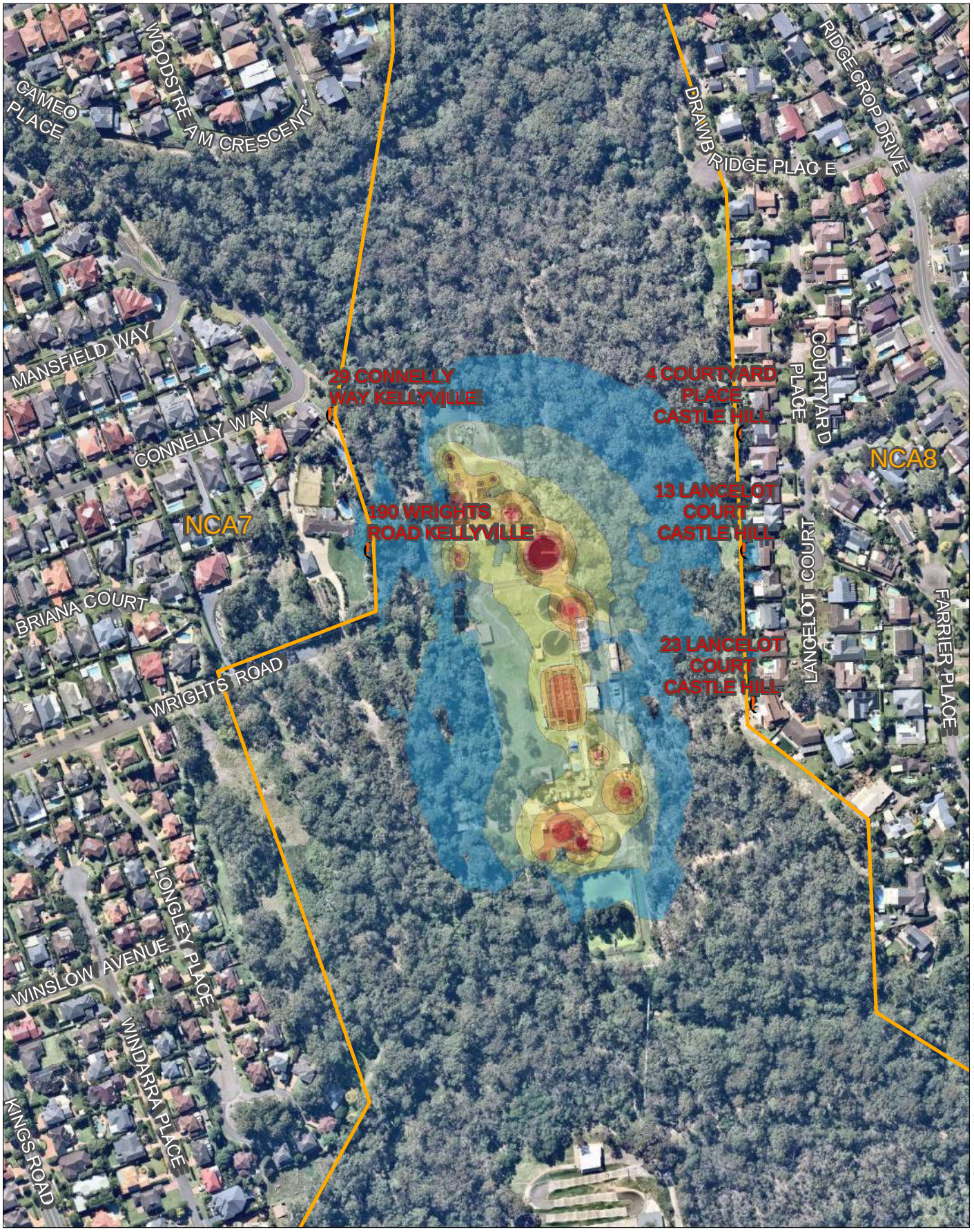
40 45 50 55 60 65

N

0 50 100 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Daytime - Updated - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

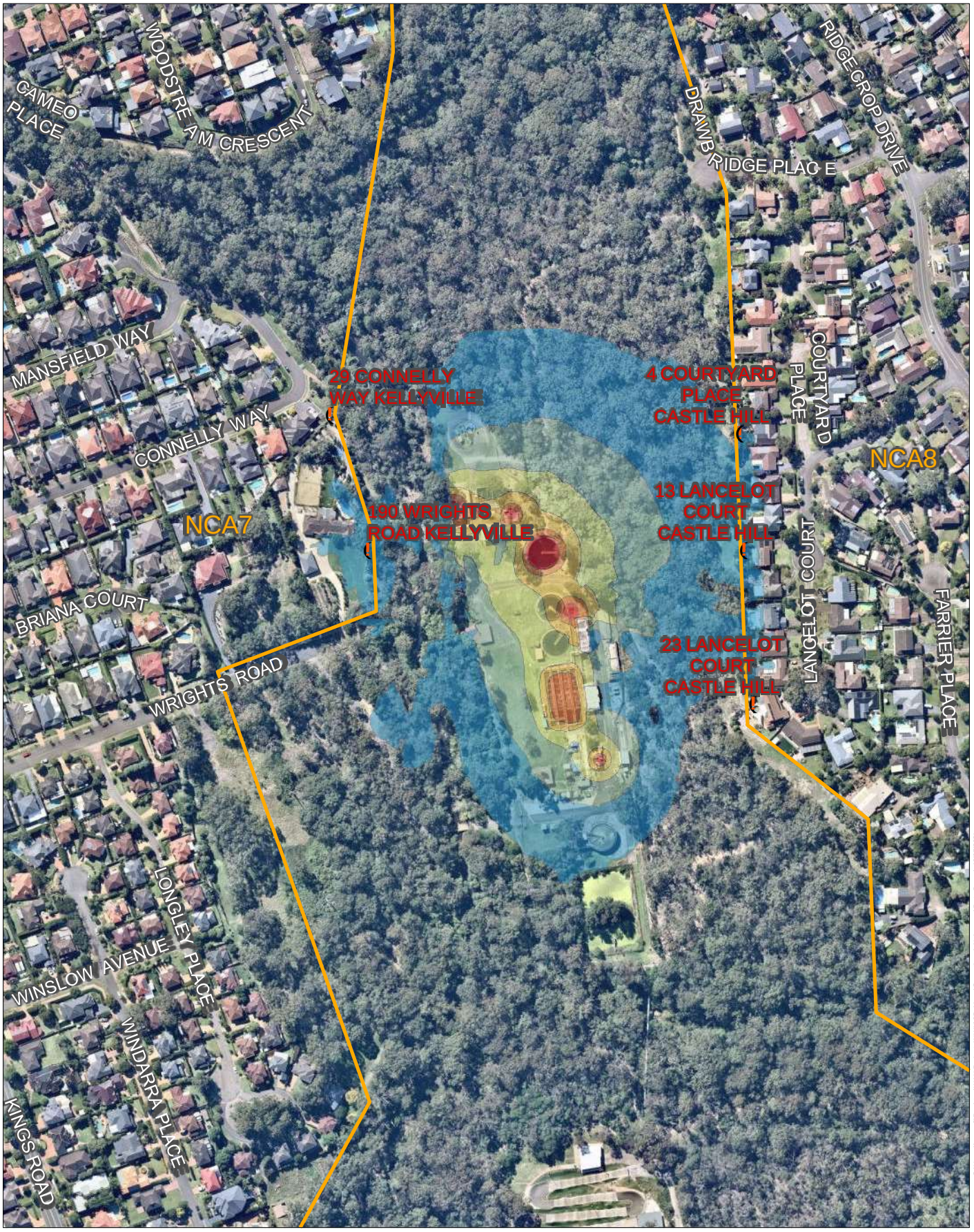
40 45 50 55 60 65

N

0 50 100 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Daytime - Existing - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

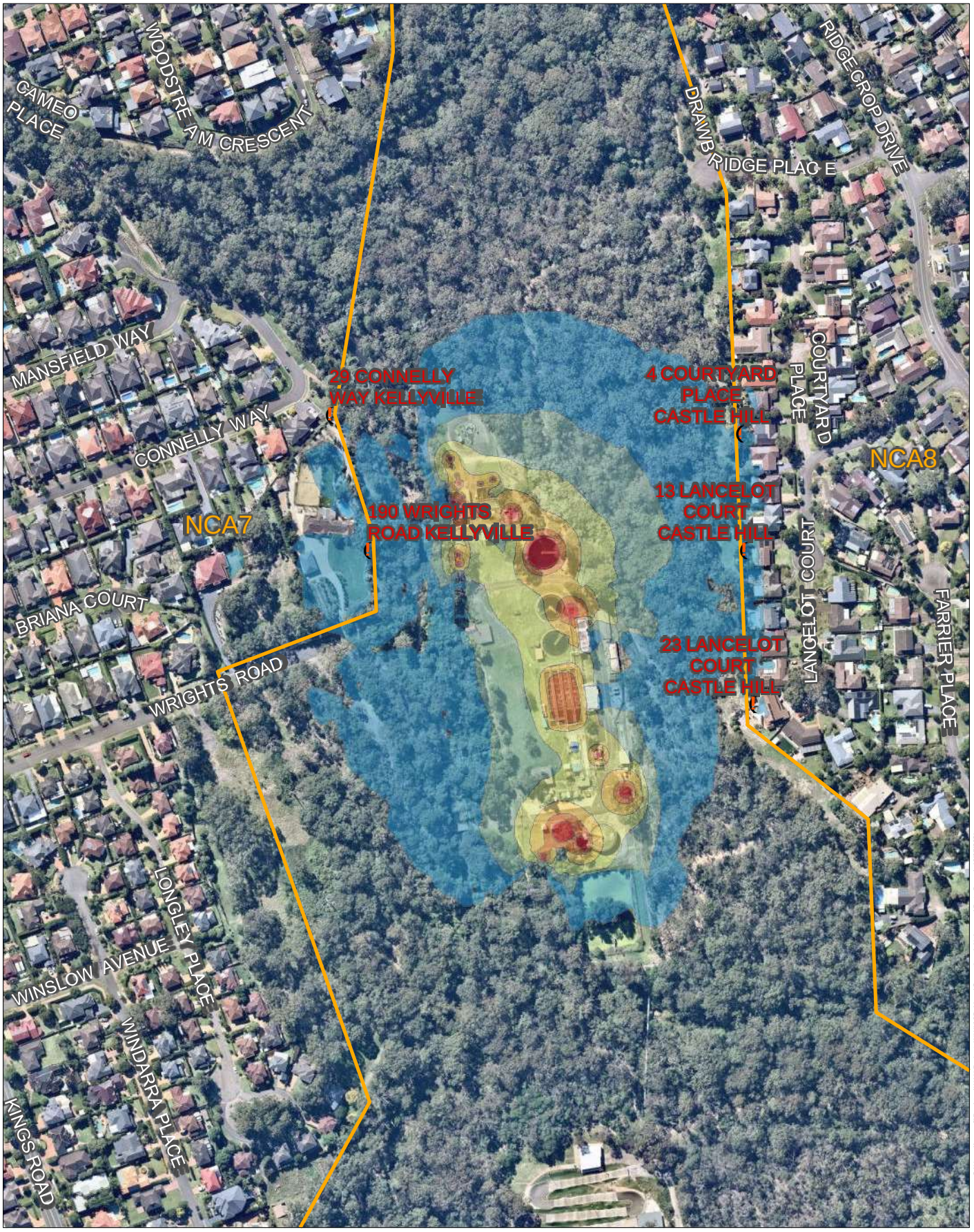
40 45 50 55 60 65

N

0 50 100 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Daytime - Updated - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

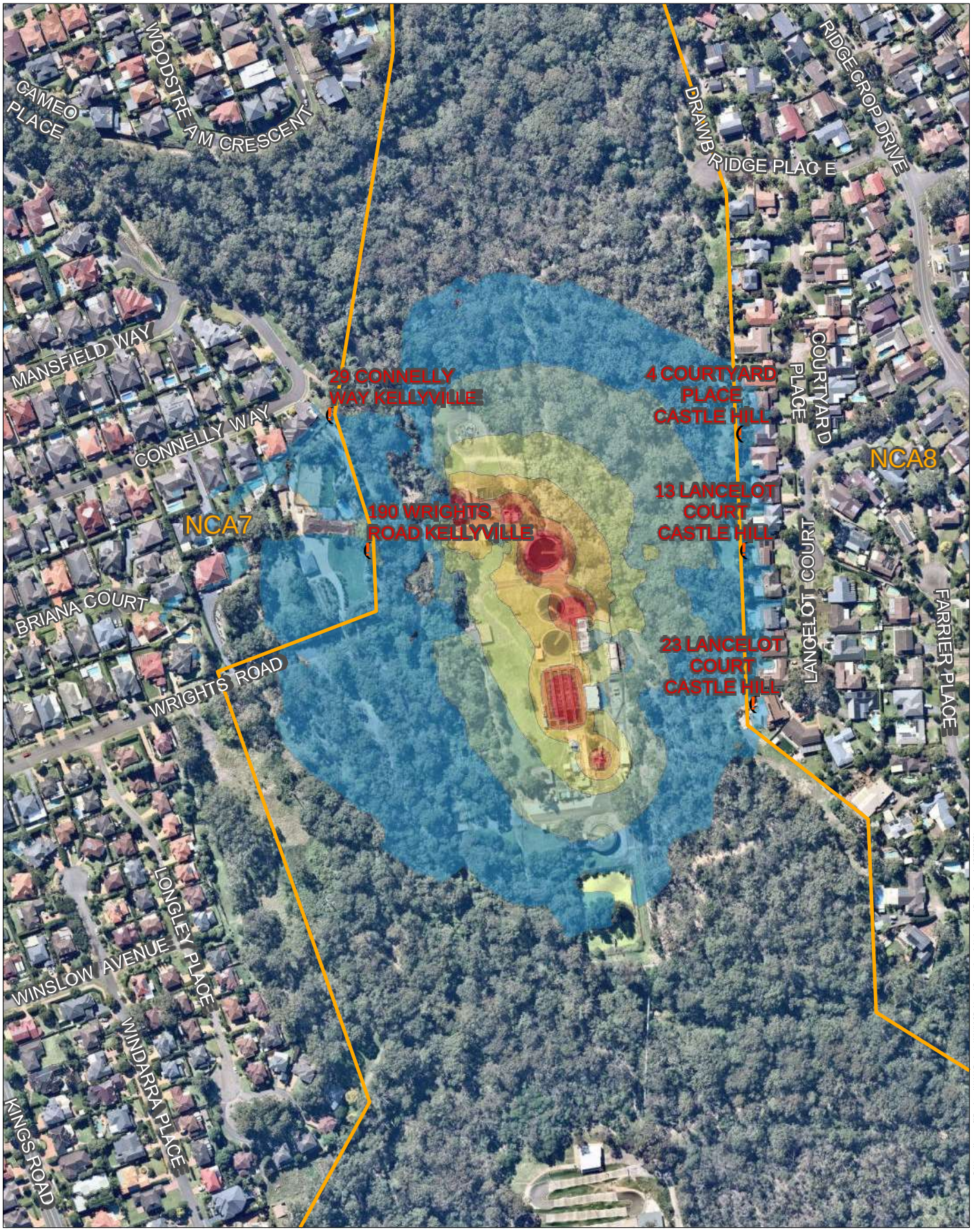
40 45 50 55 60 65

N

0 50 100 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Night time - Existing - Neutral Weather

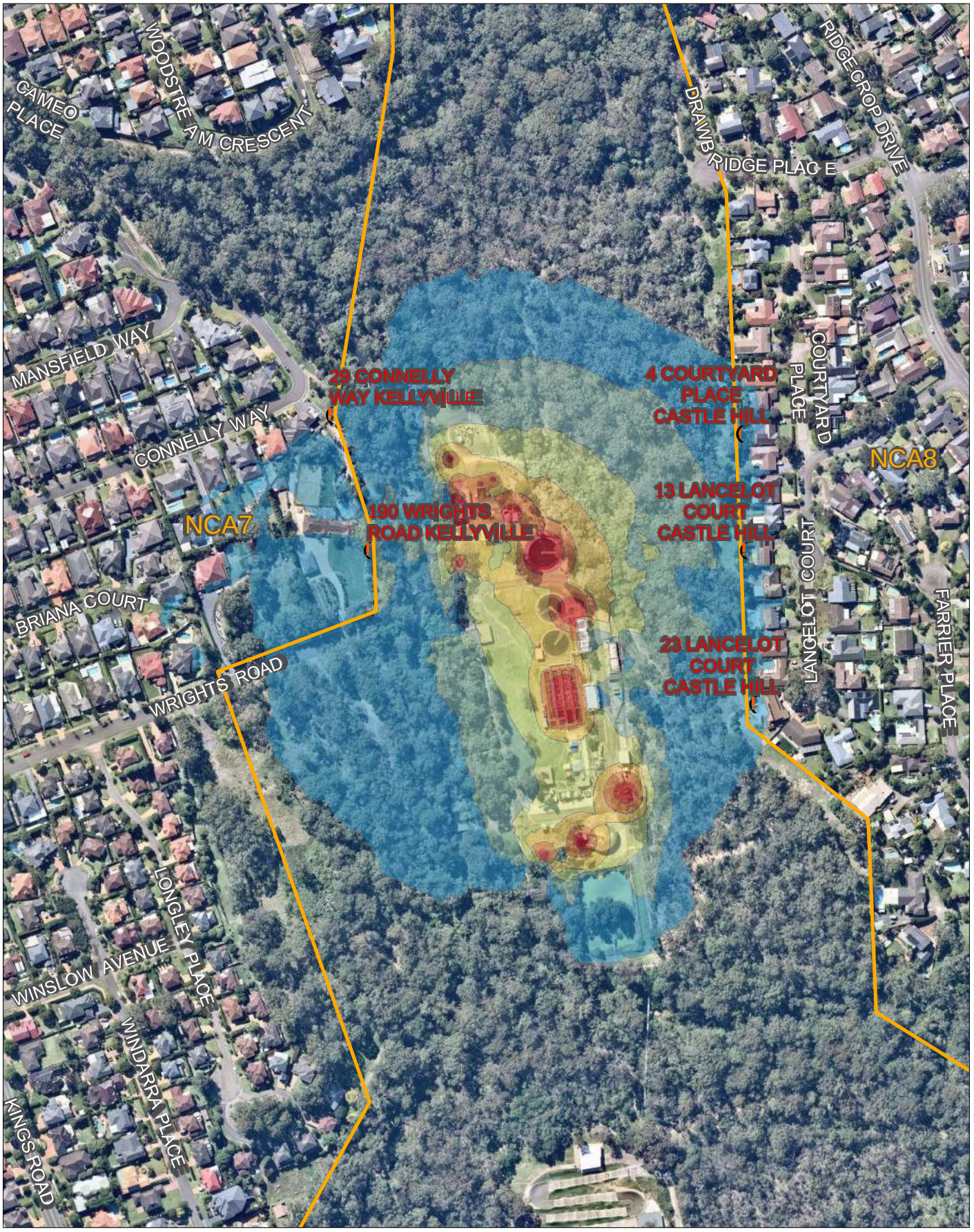
Sound Pressure Level, L_{Aeq} dBA

35 40 45 50 55 60

N

0 50 100 Meters

AECOM



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Night time - Updated - Neutral Weather

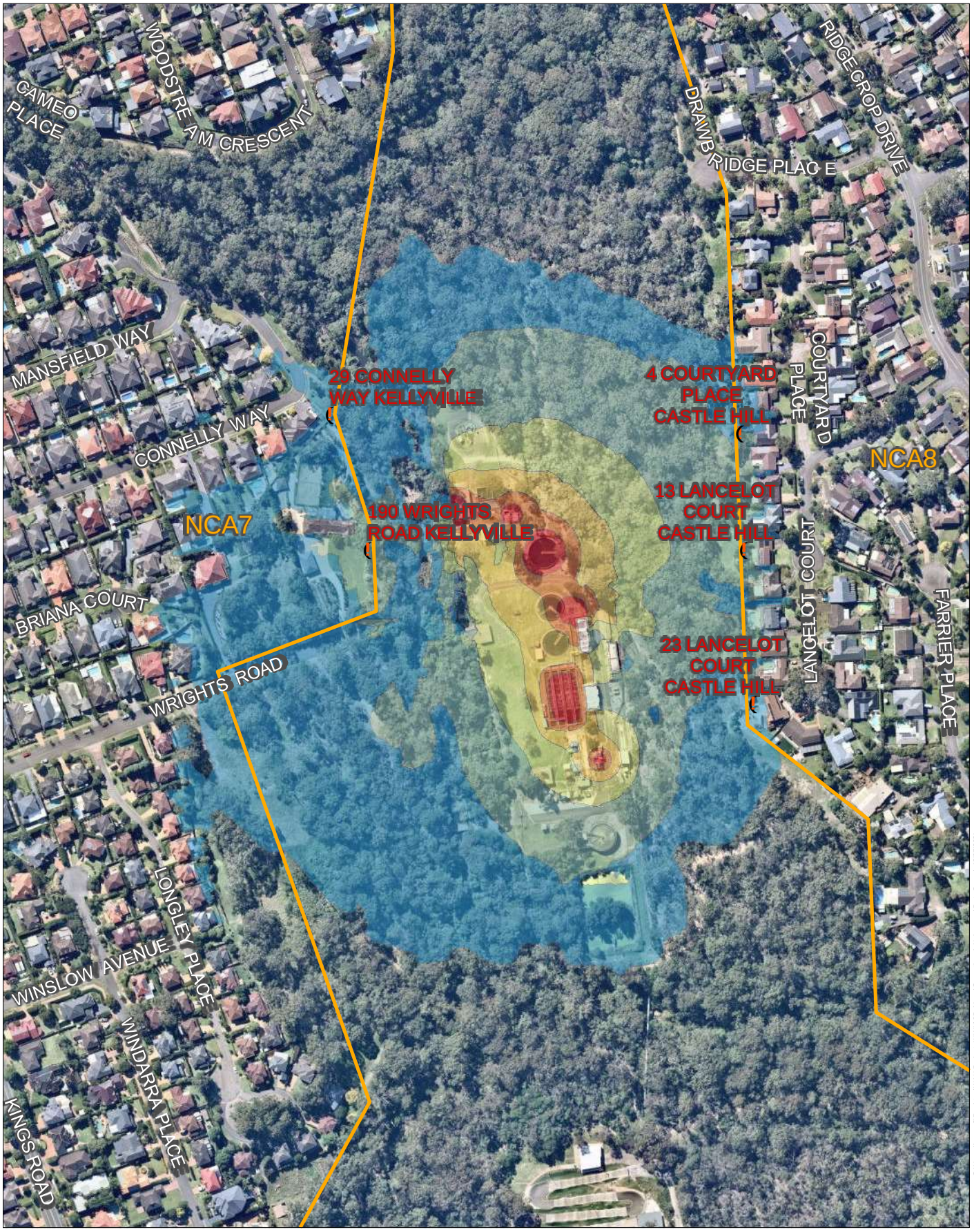
Sound Pressure Level, L_{Aeq} dBA

35 40 45 50 55 60

N

0 50 100 Meters

AECOM



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Night time - Existing - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

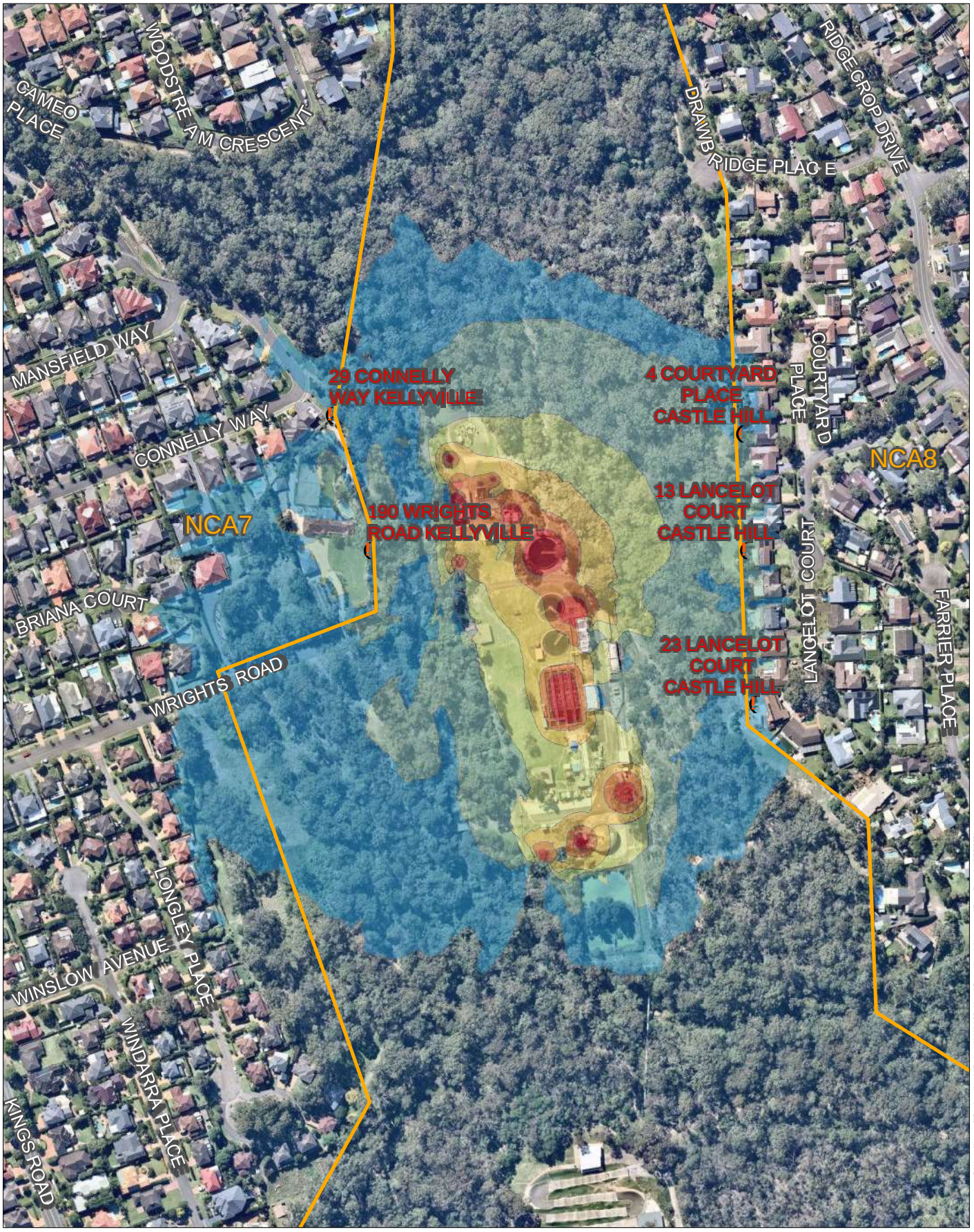
35 40 45 50 55 60

N

0 50 100 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Castle Hill WRP - Night time - Updated - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

35 40 45 50 55 60

N

0 50 100 Meters

AECOM

Source: © NearMap 2021

NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Daytime - Existing - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

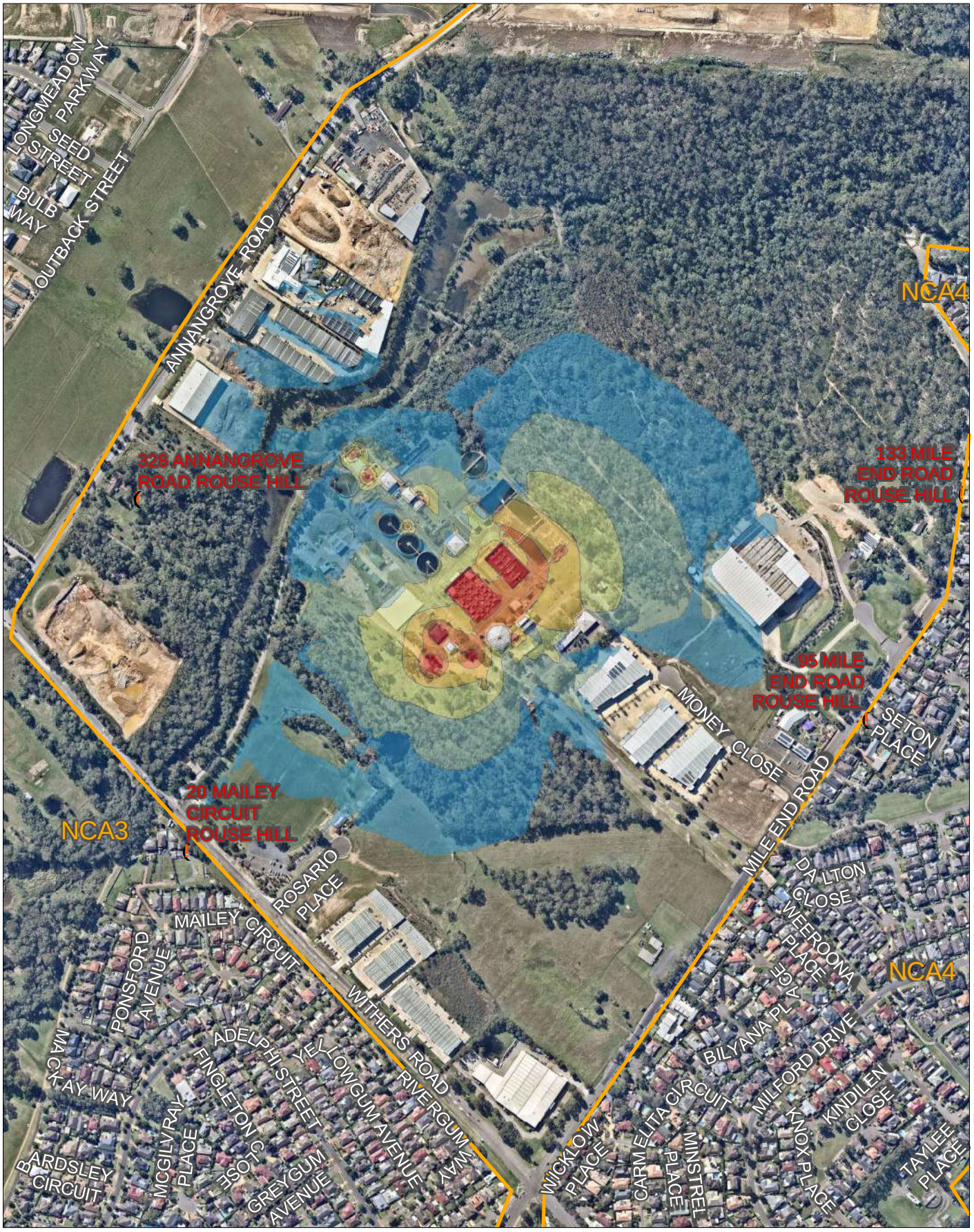
45 50 55 60 65 70

N

0 100 200 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Daytime - Updated - Neutral Weather

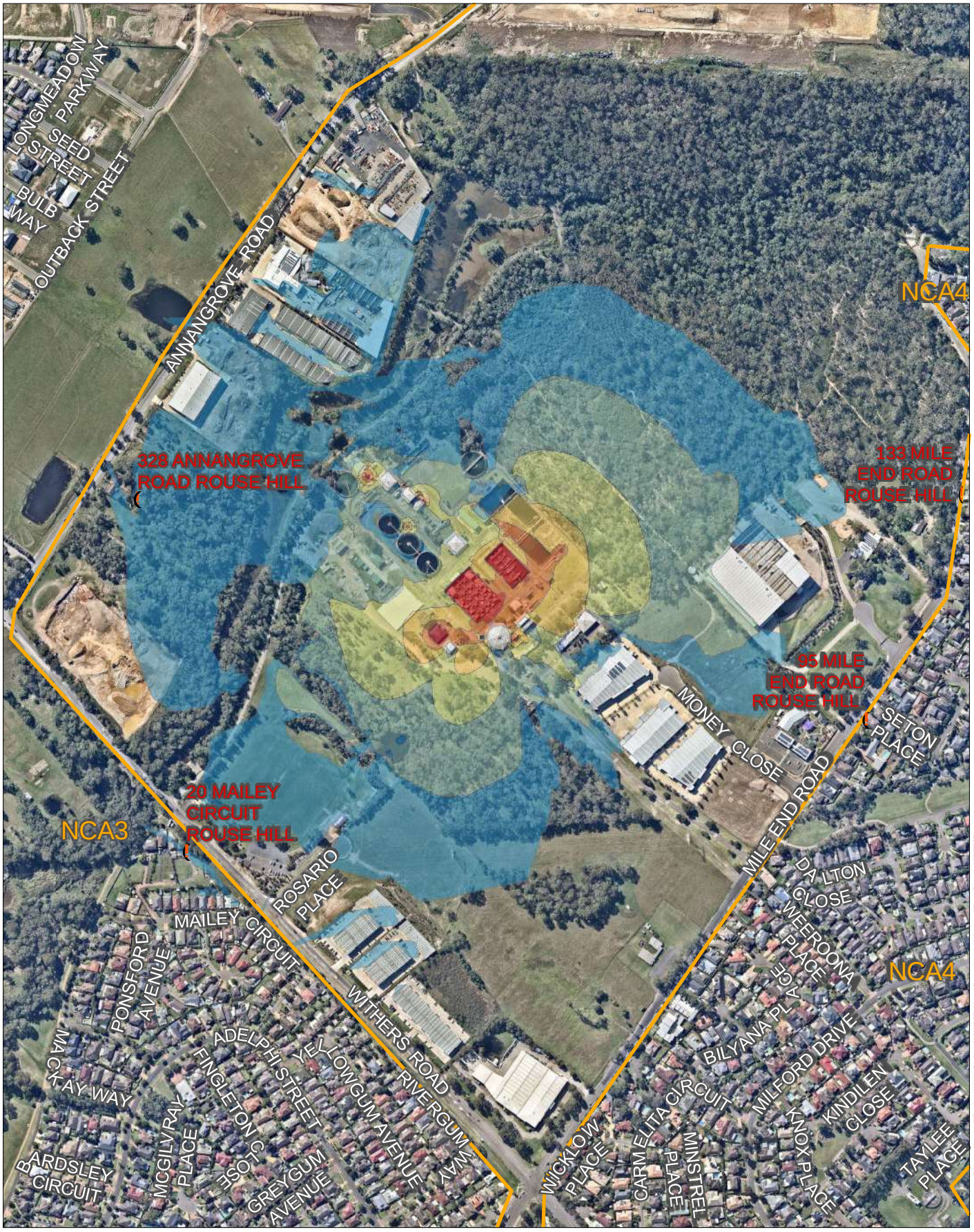
Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70

N

0 100 200 Meters

AECOM



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Daytime - Existing - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

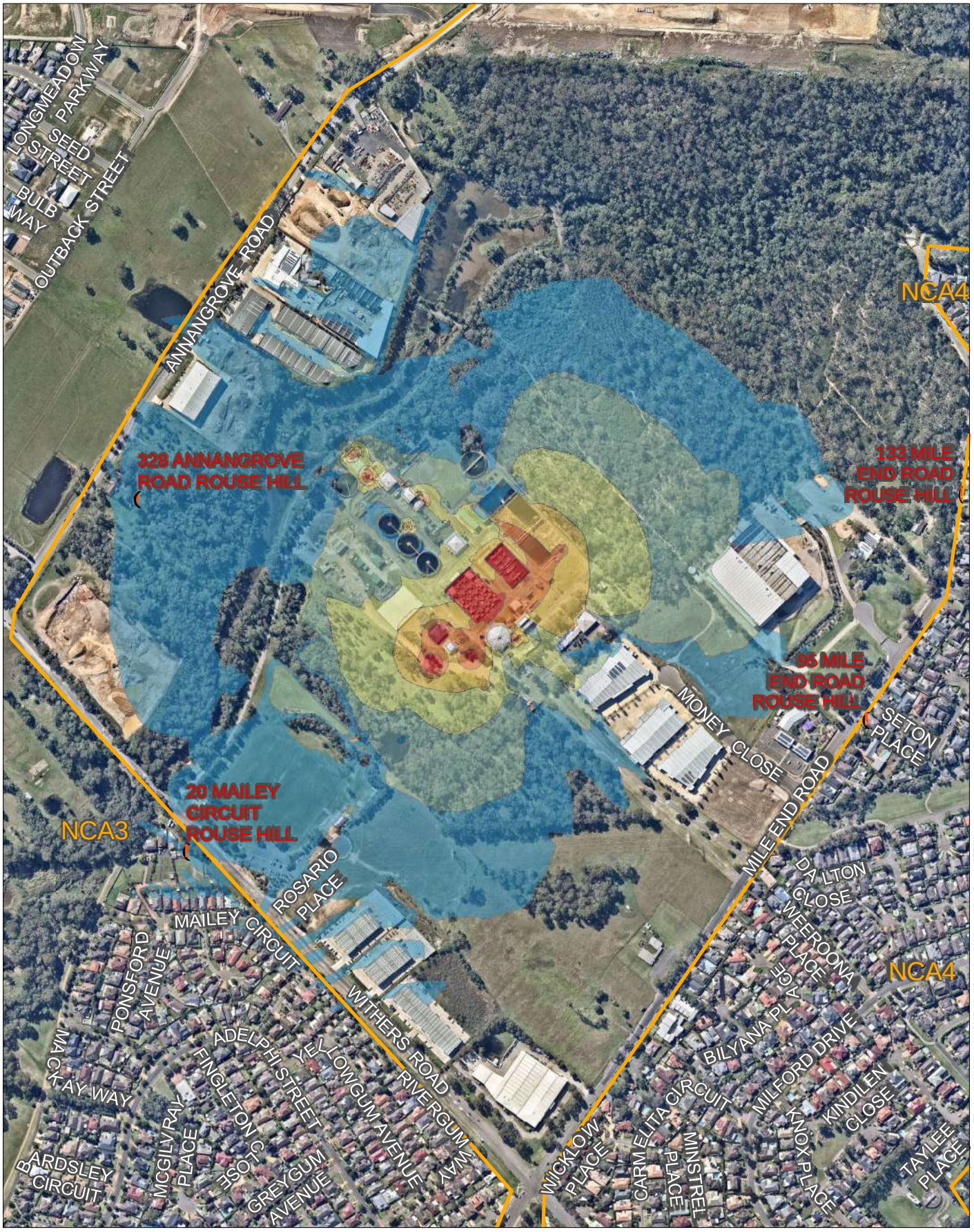
45 50 55 60 65 70

N

0 100 200 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Daytime - Updated - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

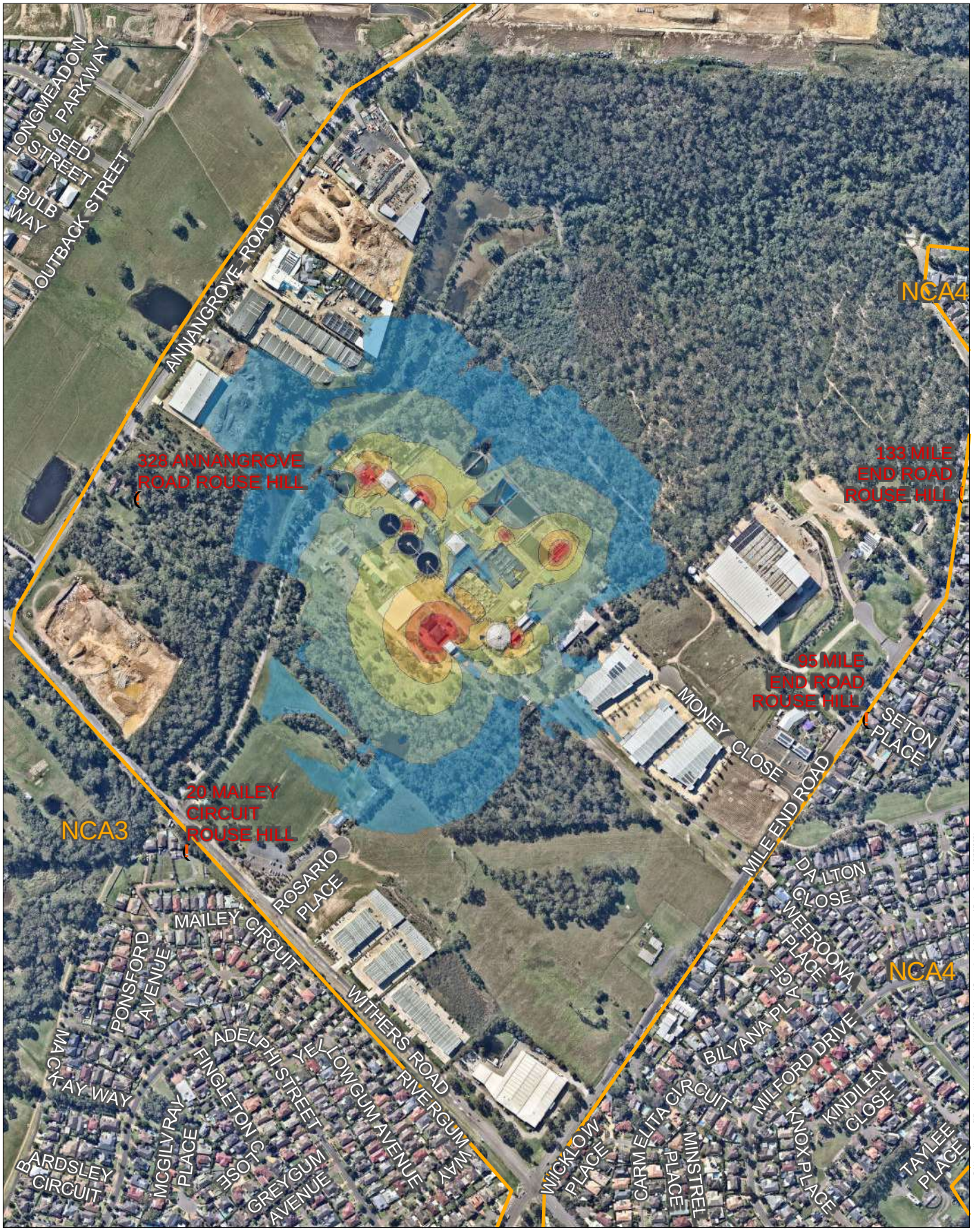
45 50 55 60 65 70

N

0 100 200 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Night time - Existing - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

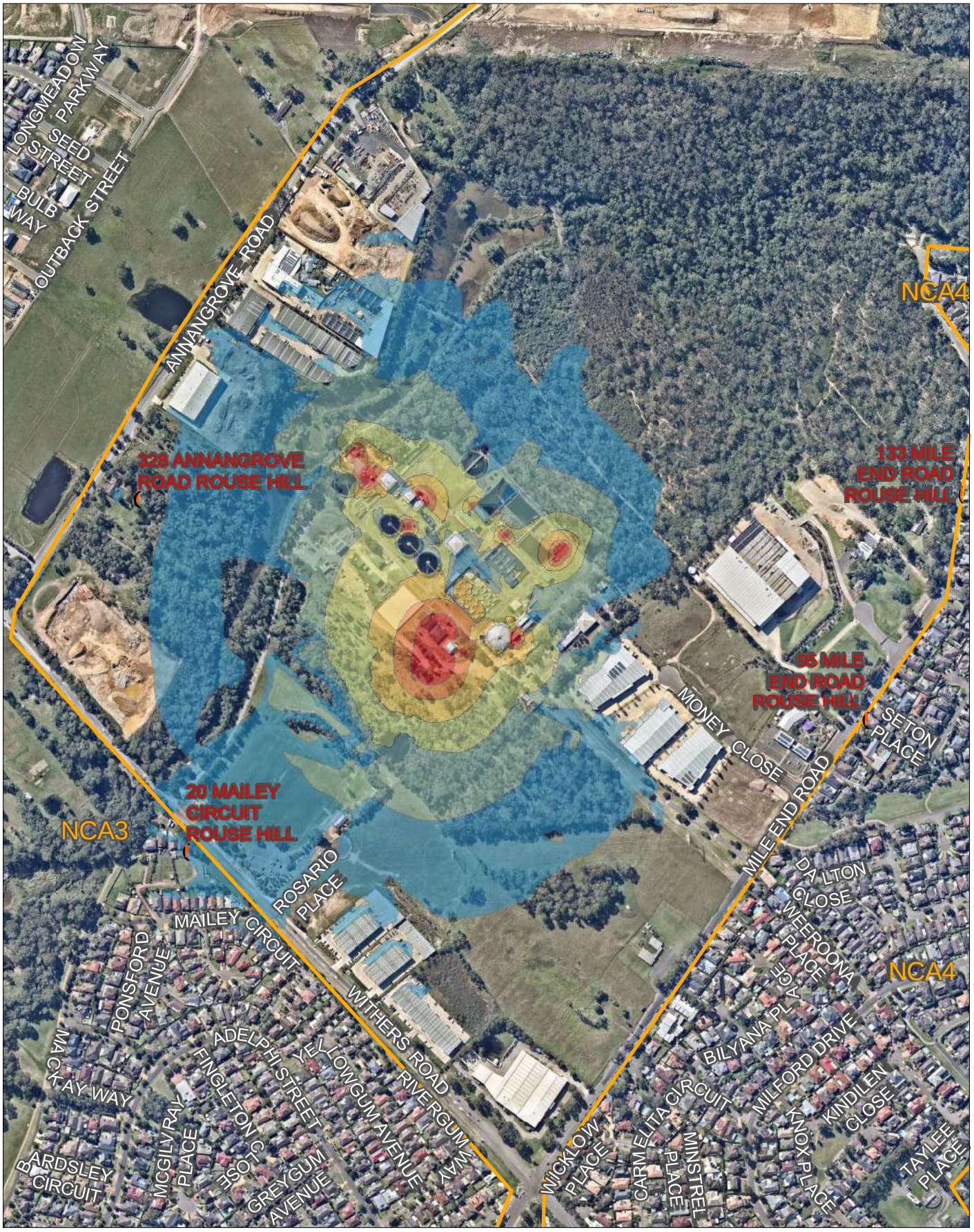
35 40 45 50 55 60

N

0 100 200 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Night time - Updated - Neutral Weather

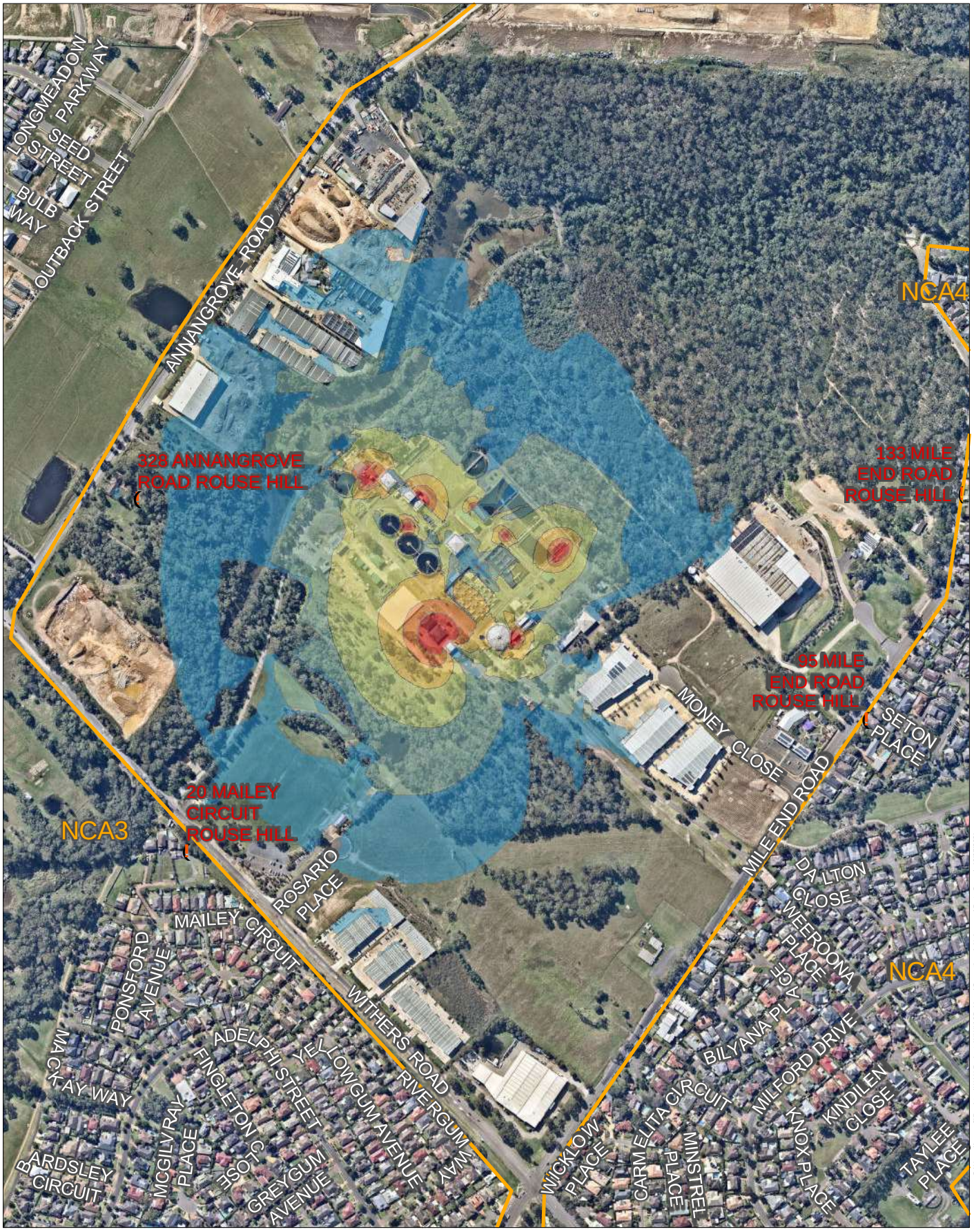
Sound Pressure Level, L_{Aeq} dBA

35 40 45 50 55 60

N

0 100 200 Meters

AECOM



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Night time - Existing - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

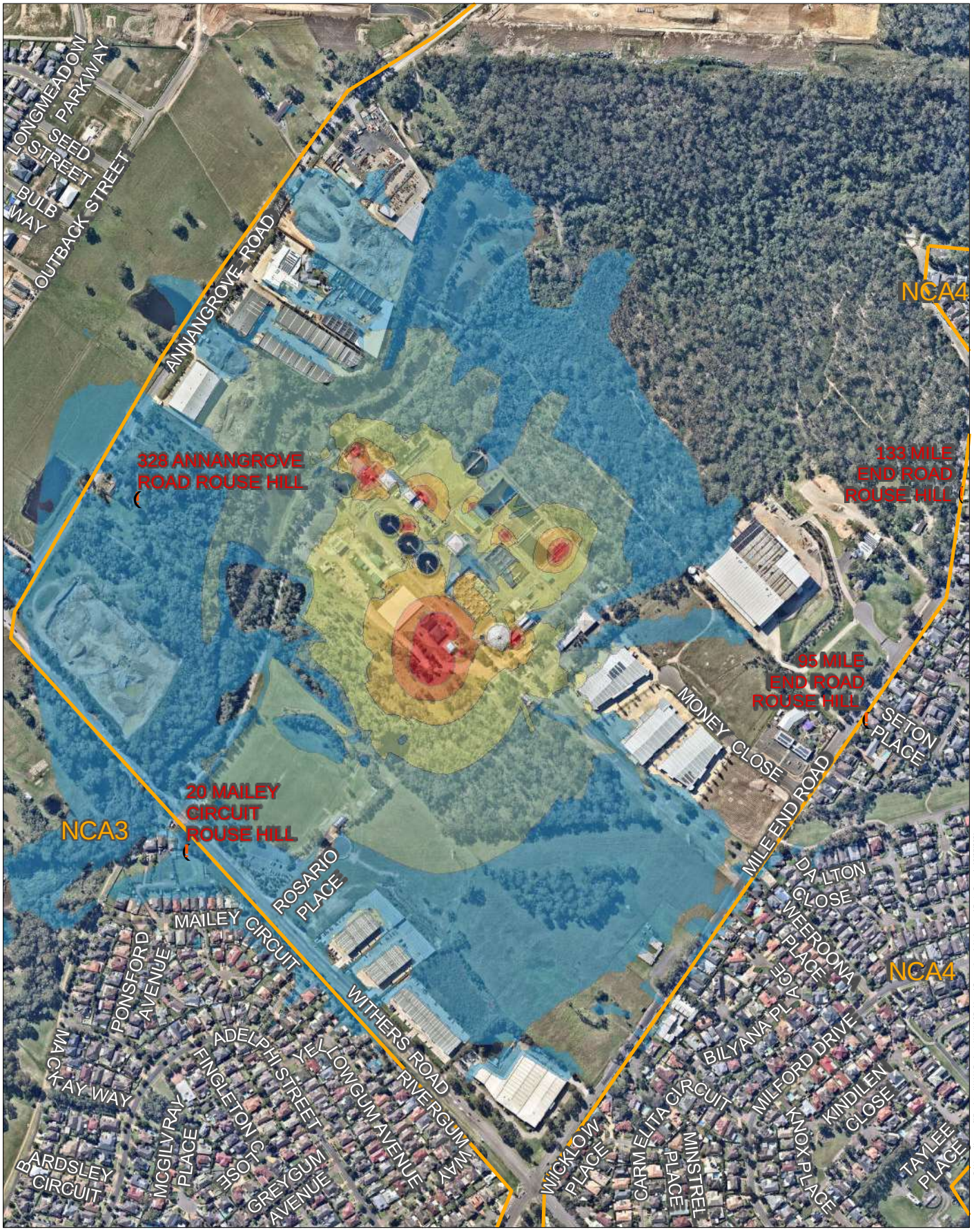
35 40 45 50 55 60

N

0 100 200 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Night time - Updated - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

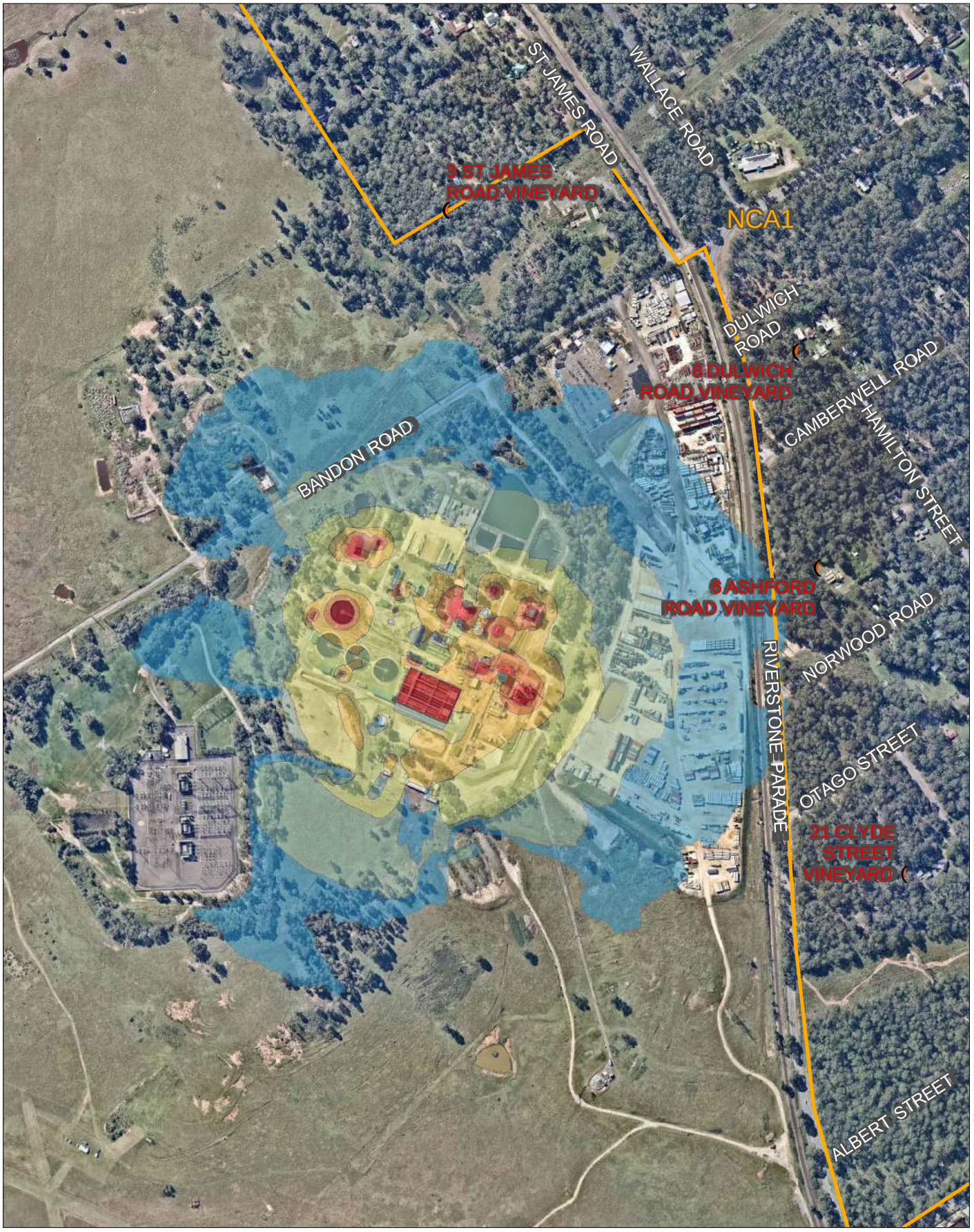
35 40 45 50 55 60

N

0 100 200 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Day & Night - Existing - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

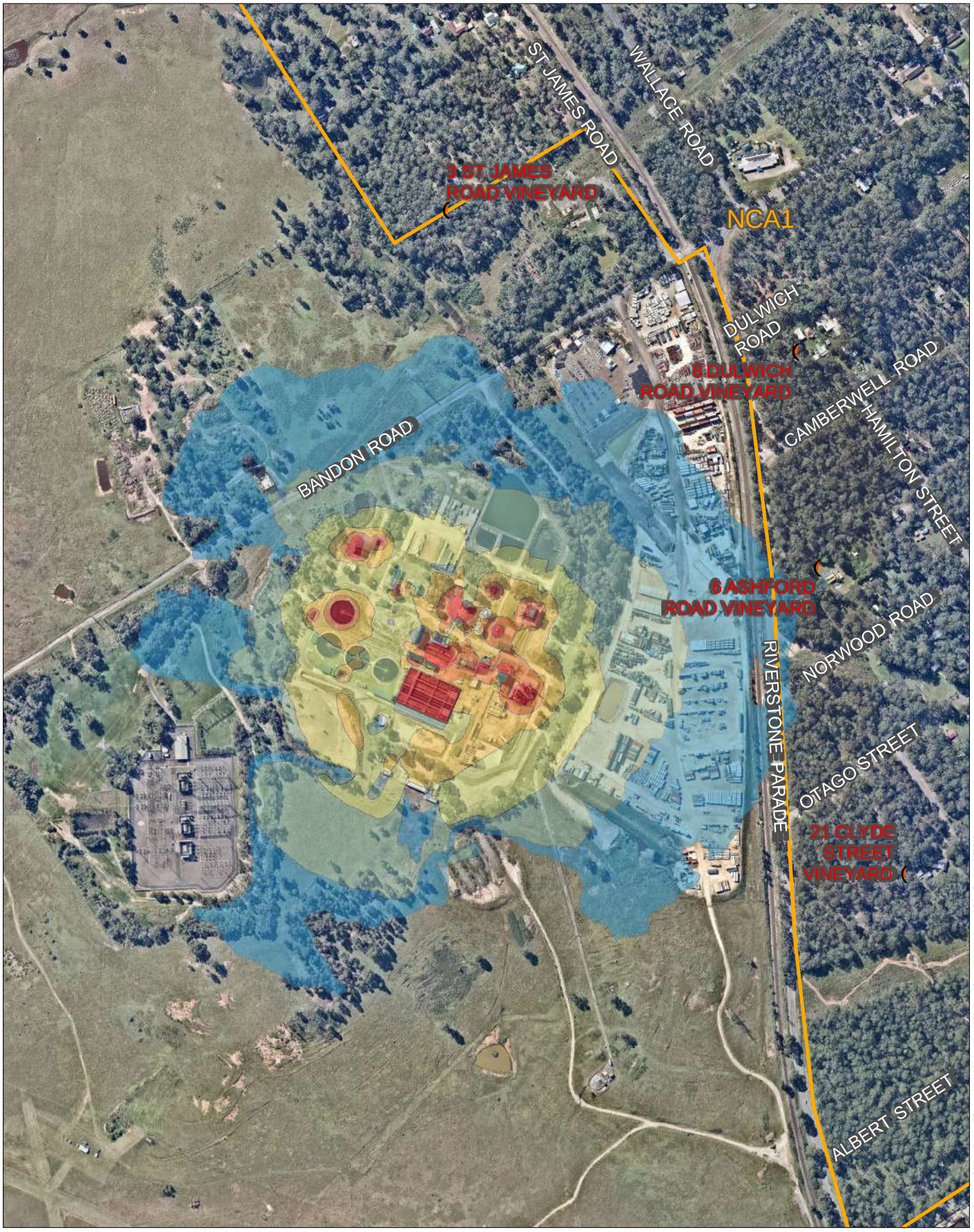
35 40 45 50 55 60

N

0 100 200 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Day & Night - Updated - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

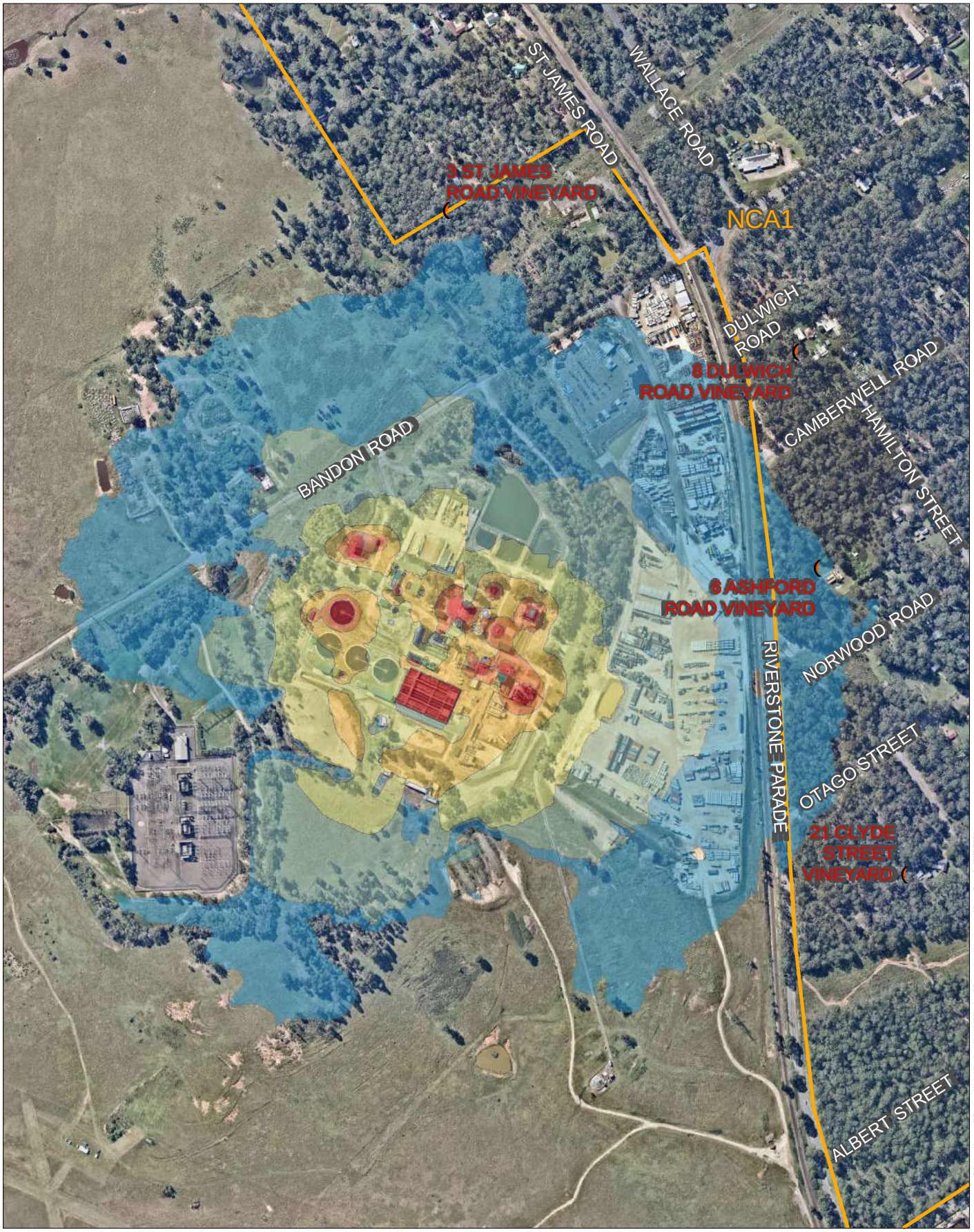
35 40 45 50 55 60

N

0 100 200 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Day & Night - Existing - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

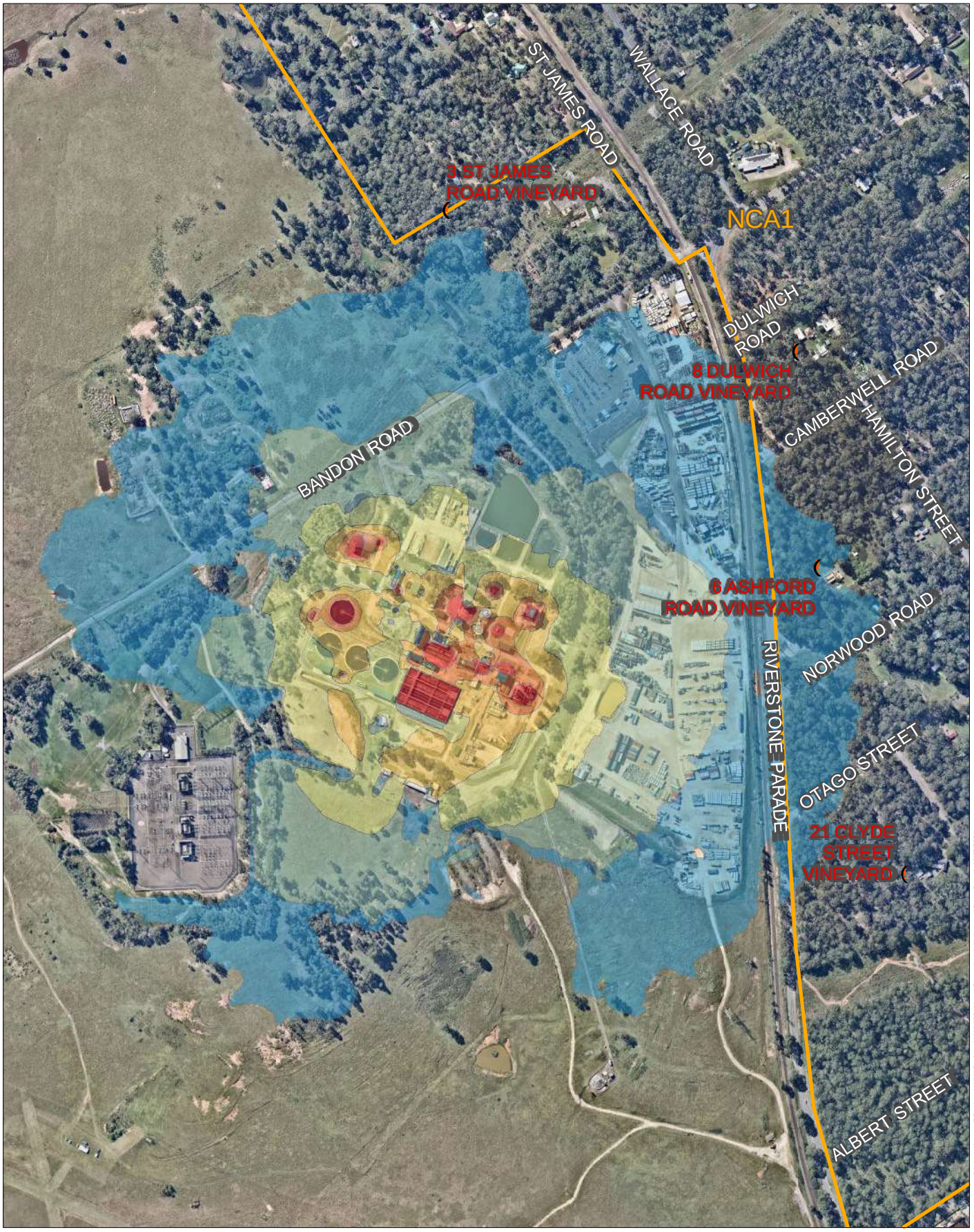
35 40 45 50 55 60

N

0 100 200 Meters

AECOM

Source: © NearMap 2021



NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Day & Night - Updated - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

35 40 45 50 55 60

N

0 100 200 Meters

AECOM

Source: © NearMap 2021