Prepared for
Sydney Water
ABN: 49 776 225 038

North West Treatment Hub

Noise and Vibration Assessment

09-May-2024
North West Treatment Hub
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North West Treatment Hub

Noise and Vibration Assessment

Client: Sydney Water

ABN: 49 776 225 038

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Executive Summary

A construction and operational Noise and Vibration Impact Assessment has been completed for the proposed growth upgrades of the North West Treatment Hub (NWH).

The NWTH program of works involves upgrades to the Riverstone Water Resource Recovery Facility (WRRF) and the Rouse Hill WRRF. The upgrades are considered in two stages;

- upgrades to meet current EPL requirements (including reducing nutrient loads in treated water, improve odour, to meet overflow requirements and improve water quality); and
- upgrades to cater for catchment growth.

This NVIA has been developed to support an Addendum REF (AREF) to the NWTH Growth Package REF. The AREF is being prepared to assess the revised scope of the Growth Package project. The proposed changes from the approved REF include the following:

Riverstone WRRF

- a new carbonisation plant and associated infrastructure including drying, heating and carbonisation systems, this will result in production of biochar rather than biosolids
- no expansion of existing anaerobic digestion and no upgrade to waste gas burners
- deletion of cogeneration unit.

Rouse Hill WRRF

- new dewatering and outloading building to cater for sludge treatment
- expansion of the construction footprint to include a compound site in 7 Money Close, Rouse Hill (5/-/DP1158760) and new access roads into the facility
- ongoing use of part of existing biological nutrient removal (BNR) treatment and existing aerobic digester.

Sludge transfer systems

- deletion of both sludge transfer pipelines (Rouse Hill WRRF to Riverstone WRRF, and Castle Hill WRRF to Rouse Hill WRRF).

This NVIA provides an updated assessment of all noise and vibration impacts associated with construction and operation of the Growth Package project, including the remaining original scope and the changes documented in the AREF.

Previous NVIA reports include:

- a report that considered upgrades to Castle Hill WRRF and Rouse Hill WRRF to meet the current EPL compliance requirements are considered in a previous report (60659367-RPNV-01_B, 13/07/2021).
- a report that considered plant upgrades to Riverstone WRRF and Rouse Hill WRRF to cater for growth in the catchment (60659367-RPNV-02_D, 22/02/2022).

The results and recommendations of this report supersede those presented in the previous NVIA prepared for the Growth Package REF. It should also be noted that this assessment considers the cumulative impacts of changes related to both the EPL Compliance Package and the Growth Package.

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 generally undertaken during standard construction hours. 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 significantly exceed the construction noise management levels at the closest noise sensitive receivers for the Riverstone WRRF and the Rouse Hill WRRF.

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 increase road traffic noise by more than 2 dB(A) at residential receivers on Bandon Road, Mile End Road and Withers Road. Measures to mitigate the impact of this noise increase are presented in Section 5.6.

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 Riverstone WRRF and Rouse Hill WRRF upgrades are predicted to comply with the operational noise criteria at all noise sensitive receivers, assuming recommended noise treatment options are implemented.

Operational road traffic noise

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

1.0 Introduction

1.1 Background information

Sydney Water's North West Treatment Hub (NWTH) comprises Castle Hill Water Resource Recovery Facilities (WRRF), Rouse Hill WRRF and Riverstone Wastewater WRRF. The NWTH provides wastewater servicing to Sydney's north west including the North West Growth Area (NWGA) and North West Urban Renewal Corridor along the new Metro North West Line.

In 2022, Sydney Water proposed NWTH upgrades to address rapid growth, meet future regulatory requirements and provide a solution that minimises impacts to the community and the environment. The proposed works included:

- upgrading at Rouse Hill WRRF and Riverstone WRRF
- constructing a new sludge transfer system between the three WRRFs to centralise solid treatment at Riverstone.

The potential environmental impacts and mitigation measures for these works were assessed under the NWTH Upgrades and Sludge Transfer System – Growth Package, July 2022 (approved REF).

Following this, Sydney Water identified an opportunity to diversify our methods for solids processing. A review of technology available for advanced processing of biosolids to reduce contaminants of concern found that carbonisation with upstream digestion, dewatering and drying was the preferred technology for the NWTH upgrade project.

An Addendum Review of Environmental Factors (ARRF) is being prepared to assess the revised scope of the Growth Package project. The proposed changes from the approved REF include the following:

Riverstone WRRF

- a new carbonisation plant and associated infrastructure including drying, heating and carbonisation systems, this will result in production of biochar rather than biosolids
- no expansion of existing anaerobic digestion and no upgrade to waste gas burners
- deletion of cogeneration unit.

Rouse Hill WRRF

- new dewatering and outloading building to cater for sludge treatment
- expansion of the construction footprint to include a compound site in 7 Money Close, Rouse Hill (5/-/DP1158760) and new access roads into the facility
- ongoing use of part of existing biological nutrient removal (BNR) treatment and existing aerobic digester.

Sludge transfer systems

- deletion of both sludge transfer pipelines (Rouse Hill WRRF to Riverstone WRRF, and Castle Hill WRRF to Rouse Hill WRRF).

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

This NVIA has been developed to support the AREF to the NWTH Growth Package project. It provides an updated assessment of all noise and vibration impacts associated with construction and operation of the Growth Package project, including the remaining original scope and the changes documented in the AREF.

Previous NVIA reports include:

- a report that considered upgrades to Castle Hill WRRF and Rouse Hill WRRF to meet the current EPL compliance requirements are considered in a previous report (60659367-RPNV-01_B, 13/07/2021).
- a report that considered plant upgrades to Riverstone WRRF and Rouse Hill WRRF to cater for growth in the catchment (60659367-RPNV-02_D, 22/02/2022).

The results and recommendations of this report supersede those presented in the previous NVIA prepared for the Growth Package REF. It should also be noted that this assessment considers the cumulative impacts of changes related to both the EPL Compliance Package and the Growth Package.

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 Guideline – Public Transport Infrastructure* (CNVG-PTI), Transport for NSW, 2023
- 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 north and east of the Riverstone WRRF. The closest receivers are approximately 320 m from the site.
- to the north-west, south-west and south-east of the Rouse Hill WRRF. 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 WRRF site.

The locations of the WRRFs and the noise catchment areas (NCAs) are 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 WRRFs. There are potential aboriginal heritage deposits (in soils) near the Rouse Hill WRRF, however, these would not be impacted by the proposal.

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 as part of the previous noise assessments for the project. 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.

It should be noted that the noise environment in each NCA has largely stayed the same over the last three years and therefore updated noise monitoring was not considered necessary.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of "*AS IEC 61672.1-2019 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 WRRF	43 Clyde Street, Vineyard	Rion NL52	00164396
2	2 – Rouse Hill WRRF	18 Nelson Road, Box Hill	Rion NL52	00164395
3	3 – Rouse Hill WRRF	Lot 2/DP 839874	Rion NL52	00175550

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 61672.1-2019 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 WRRF and Rouse Hill WRRF 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 WRRF	37	33	30[2]	57	45	47
2 – Rouse Hill WRRF	44	43	36	55	51	50
3 – Rouse Hill WRRF	41	35	30[2]	51	40	40

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 WRRF	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.
2 – Rouse Hill WRRF	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.
3 – Rouse Hill WRRF	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).

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 WRRF	Local traffic noise audible. Natural sounds such as wind and bird noise are also audible along with some construction noise.
2 – Rouse Hill WRRF	Dominated by traffic noise. Natural sounds such as wind and bird noise are also audible along with some animal noise.
3 – Rouse Hill WRRF	Natural sounds dominate. Also some distant construction noise.

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* (ICNG) 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 *Interim Construction Noise Guideline*. Where an exceedance of the management levels is predicted the *Interim Construction Noise Guideline* 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 ***Interim Construction Noise Guideline*** **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 *Interim Construction Noise Guideline*.

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 *Interim Construction Noise Guideline* 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 2	Day	44	54	49
	Evening	43	-	48
	Night	36	-	41
NCA 3	Day	41	51	46
	Evening	35	-	40
	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 *Interim Construction Noise Guideline* 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 2	36	51	65
NCA 3	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.

Bandon Rd, Riverstone and Withers Road, Rouse Hill provide the main access roads to the site. These roads are classified as sub-arterial roads and are listed in Table 9. The external noise criteria are applied one metre from the external façade of an affected building.

Table 9 Roads used by construction traffic

Road	Type	Residential receivers	Estimated existing Annual Average Daily Traffic (AADT)
Bandon Rd	Sub Arterial	Yes	> 2,000
Withers Road	Sub Arterial	Yes	> 2,000
Mile End 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-time 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 WRRFs have been included below, compliance within these NCAs implies compliance within NCAs which are located further from the WRRFs.

Table 13 Intrusive criteria

Location	Period	RBL (L_{A90}), dB(A)	Intrusive criteria (RBL+5), dB(A)
NCA 1 – Riverstone WRRF	Day	37	42
	Evening	33	38
	Night	30	35
NCA 2 – Rouse Hill WRRF	Day	44	49
	Evening	43	48
	Night	36	41
NCA 3 – Rouse Hill WRRF	Day	41	46
	Evening	35	40
	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.

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, 2 and 3	Suburban	Day	50	53
		Evening	40	43
		Night	35	38
School classroom[1]	All	Noisiest 1-hour period when in use	45[2]	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 2	Day	49
	Evening	43
	Night	38
NCA 3	Day	46
	Evening	40
	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 2	36	41	52
NCA 3	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.

The construction scenarios discussed below supersede those assumed in the previous NVIA that considered upgrades catering for growth in the catchment (60659367-RPNV-02_D, 22/02/2022).

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*, Part 1: Noise, 2009 including Amendment 1, 2014 and assume equipment is modern and in good working order.

Construction works are generally expected to be undertaken during standard construction hours only. Construction works for the Riverstone WRRF and Rouse Hill WRRF.

Table 17 Equipment sound power levels

Location	Equipment	Sound power level, dB(A)
Riverstone WRRF and Rouse Hill WRRF	Concrete Pumps	106
Riverstone WRRF and Rouse Hill WRRF	Concrete Trucks	106
Riverstone WRRF and Rouse Hill WRRF	Cranes	106
Riverstone WRRF and Rouse Hill WRRF	Dozers	109
Riverstone WRRF and Rouse Hill WRRF	Dump Trucks	107
Riverstone WRRF and Rouse Hill WRRF	EWPs	95
Riverstone WRRF and Rouse Hill WRRF	Excavator 20T or 30T	106
Riverstone WRRF and Rouse Hill WRRF	Jack Hammer	111
Riverstone WRRF and Rouse Hill WRRF	Road Pavers	105
Riverstone WRRF and Rouse Hill WRRF	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 8.2. 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. 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 not expected to exceed the noise management levels during standard hours at Riverstone WRRF and Rouse Hill WRRF at any receivers, with the exception of 6 Ashford Road, Vineyard where a minor exceedance (2 dB) is predicted.

Table 18 Rouse Hill WRRF 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	
NCA2	54	46	0	0	0	0
NCA3	51	49	0	0	0	0

Table 19 Riverstone WRRF 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	
NCA1	47	49	1	0	0	0

No non-residential receivers are predicted to be affected by the works

5.3.2 Summary of impacts outside of standard hours

No works are expected outside of standard hours. Should out-of-hours works be required during construction, the out -of-hours procedure would be followed which would include additional assessment and community notification as required.

5.4 Construction traffic assessment

The numbers of construction vehicle movements at Riverstone have been estimated to be up to 105 light and 20 heavy vehicles per hour during peak construction periods. Vehicles would access the Riverstone WRRF site by Bandon Road.

The numbers of construction vehicle movements at Rouse Hill have been estimated to be up to 150 light and 30 heavy vehicles per hour during peak construction periods. Vehicles would access the Rouse Hill WRRF site by Mile End Road, Money Close and Withers Road.

These vehicle movements are expected to coincide with the commuter peak traffic periods. It should also be noted that these are peak traffic volumes. Actual construction vehicle movements are expected to be less for large periods of the works.

For both the WRRFs the increase in road traffic noise levels could be greater than 2 dB(A) at residential receivers on Bandon Road, Mile End Road and Withers Road, see Table 20. Measures to mitigate the impact of this noise increase are presented in Section 5.6. There are no residential receivers on Money Place.

Table 20 Predicted maximum road traffic noise increase due to construction traffic

Road	Type	Residential receivers	Estimate maximum change in noise level, dB(A)
Bandon Road	Sub Arterial	Yes	2.5
Withers Road	Sub Arterial	Yes	3.4
Mile End Road	Sub Arterial	Yes	3.4

5.5 Construction vibration assessment

Vibration intensive works may include the use of Jackhammers at Riverstone and Rouse Hill.

The minimum working distances of these items of equipment from off-site receivers are shown in Table 21 which is based on recommendations of the TfNSW *Construction Noise and Vibration Guideline – Public transport Infrastructure* (CNVG-PTI). 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.

Table 21 Minimum working distances of vibration intensive equipment to be used during the Proposal

Plant	Rating/ description	Cosmetic damage	Human response
		Residential/ commercial	
Jackhammer	Hand held	1 m (nominal)	2 m

5.6 Construction mitigation measures

5.6.1 Construction Environment Management Plan

The construction environmental management plan (CEMP) 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 CEMP 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 22 presents the mitigation measures which should be considered as part of the CEMP.

The construction mitigation measures presented below supersede those in the previous NVIA that considered upgrades catering for growth in the catchment (60659367-RPNV-02_D, 22/02/2022).

Table 22 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.
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.

Action required	Safeguard details
Source controls [1]	
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.

Action required	Safeguard details
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. The scheduling and routing of vehicles should be considered to minimise impacts on nearby noise sensitive receivers. Vehicles should be adequately silenced before allowing them to access the sites.
Vibration safe working distances	If vibration intensive equipment is to be used within the minimum working distances for cosmetic damage to a sensitive receiver, as presented in Table 21, then a permanent vibration monitoring system should be installed.
Path controls [2]	
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.
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.
Community engagement	
Community engagement	Seek community views on the work via community meetings, websites and social media or any appropriate method. Community engagement must be carried out allowing sufficient time to ensure that views can be incorporated. The community engagement can be undertaken as part of the general environmental communications plan.
Works notification	Where complainant locations are likely to be affected by future works, project notifications would be provided no less than seven days before works are undertaken.
Noise complaint analysis	
Reviewed complaints	Noise complaints are to be reviewed at least every 6 months in accordance with the Sydney Water Noise Management Procedure.
Report complaints and improvements	Complaints are to be reported and managed in accordance with the Sydney Water Noise Management Procedure.

Action required	Safeguard details
Vibration monitoring	
Vibration monitoring	If vibration intensive equipment is to be used within the minimum working distances for cosmetic damage to a sensitive receiver, as presented in Table 21, then a vibration monitoring system should be installed.

Notes:

1 – Source controls are applied 'at the source' i.e. directly applied to plant and equipment to reduce noise and/or vibration from the work site.
2 – Path controls are applied in the path between the source and the receiver to reduce noise and/or vibration from the work site eg barriers, site shed placement

6.0 Operational noise

6.1 Noise modelling

In consultation with Sydney Water noise models have been prepared for the WRRFs for both the existing case and the upgraded using SoundPLAN Version 8.2.

The operational noise assessment presented below supersedes the assessment presented in the previous NVIA that considered upgrades catering for growth in the catchment (60659367-RPNV-02_D, 22/02/2022).

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

Existing noise sources were included in the noise models of the Riverstone WRRF and Rouse Hill WRRF. These sources were presented in the previous report that considered plant upgrades to WRRFs to cater for growth in the catchment (60659367-RPNV-02_D, 22/02/2022).

6.2.2 Noise model sound pressure levels – proposed noise sources

The equipment proposed to be included in the updated WRRFs are provided below in Table 23 and Table 24. All noise sources are located outside unless noted otherwise.

Table 23 Proposed equipment and sound power levels – Riverstone WRRF

Description	Number of	Operational time	Sound power level, L_{Aeq} dB(A)	Assumptions
Grit pump 3	1	Daytime only	75	Submerged
Mech primary motor	4	Daytime only	75	
Primary sludge pump 1	1	Day and Night	78	
Macerator 1	1	Day and Night	83	

Description	Number of	Operational time	Sound power level, L_{Aeq} dB(A)	Assumptions
Fine screen 1 motor 2	1	Daytime only	75	
Indirect evaporative cooler	1	Daytime only	96	
MBR WAS pump	2	Day and Night	76	
MBR permeate pump	4	Daytime only	86	
MBR tank drain pump	2	Daytime only	81	
MBR air scour blower	2	Daytime only	97	
MBR back pulse pump	2	Daytime only	81	
Chemical waste return pump	1	Day and Night	78	
UF feed pump	4	Daytime only	88	
CIP transfer pump	1	Daytime only	75	
UF backwash pump	3	Daytime only	79	
UF backwash blower	2	Daytime only	87	
UF CIP pump	2	Daytime only	78	
New digester feed pump	1	Daytime only	81	
Contrate treatment plant blower	1	Daytime only	89	
Contrate treatment plant blower	1	Day and Night	89	
Blower	4	Daytime only	93	
Thickened sludge pump	1	Daytime only	79	Inside a building
TWAS pump 3	1	Daytime only	79	Submerged
Scroll and bowl	1	Daytime only	100	
Biogas blower	1	Day and Night	87	
Biogas chiller	1	Day and Night	87	
Hot water circulating pump	2	Day and Night	81	Inside a building
Centrifuge feed pump	1	Daytime only	78	Submerged
MBR permeate pump	4	Daytime only	86	
RE pumps	1	Daytime only	88	Submerged
Foul air fan	1	Day and Night	90	
Blower	1	Daytime only	93	
Rotary screw compressor	1	Daytime only	80	Inside a building
RDTs	1	Daytime only	69	Inside a building
Band screens	2	Daytime only	80	
Dewatered sludge pump	2	Day and Night	80	
Dryer fans	48	Day and Night	73	Inside a steel dryer
Dryer extruder	2	Day and Night	70	

Description	Number of	Operational time	Sound power level, L_{Aeq} dB(A)	Assumptions
Dryer belt drive	4	Day and Night	70	Inside a building
Dryer outload conveyor	2	Day and Night	80	
Bucket elevator	2	Day and Night	80	
Dried sludge converor	3	Day and Night	80	
Gasifier feed conveyor	2	Day and Night	80	
Rotary valve	2	Day and Night	80	
Gasifier	2	Day and Night	85	Includes manufacturer supplied noise barriers
Biochar outloading screw	2	Day and Night	80	
Biochar outloading conveyor	3	Day and Night	80	
Recuperator fan	2	Day and Night	80	

Notes:

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

Table 24 Proposed equipment and sound power levels – Rouse Hill WRRF

Description	Number of	Operational time	Sound power level, L_{Aeq} dB(A)	Assumptions
Grit pump	2	Daytime only	83	
Primary screen	5	Daytime only	83	
Fan - OCF	2	Day and Night	80	
Fan – ventilation	1	Day and Night	83	
OCF blowdown pump (duty)	1	Day and Night	78	
RE pump	5	Day and Night	77	
Membrane aeration blower	6	Day and Night	88	Inside a building
Membrane aeration blower - blow off	6	Day and Night	95	Day – 6 operate for 2 min each in a 15 min period Night – 3 operate for 2 min each in a 15 min period
GAMMA 63 roof extraction fans	2	Day and Night	83	
GAMMA 63 roof extraction fans	2	Day and Night	76	
Dewatering building HVAC fan	2	Day and Night	76	
Was pump	4	Day and Night	83	

Description	Number of	Operational time	Sound power level, L_{Aeq} dB(A)	Assumptions
MBR permeate pump	12	Day and Night	88	Located in a concrete pit
MBR tank drain pump	2	Daytime only	73	
Blower	4	Day and Night	90	Inside a building
Blower - blow off	4	Day and Night	101	Day – 4 operate for 2 min each in a 15 min period Night – 2 operate for 2 min each in a 15 min period
MBR backpulse pump	3	Day and Night	83	
Chemical waste return pump	1	Daytime only	81	
BNR mixers	TBA	Day and Night	-	Submerged
MLR pumps	8	Day and Night	-	Submerged
MBR feed pumps	16	Day and Night	-	Submerged
Eduction compressed air	2	Day and Night	70	
Scum system	4	Day and Night	88	
Fine screen	1	Day and Night	78	
Dewatering centrifuges	2	Day and Night	94	Inside a building
Fan dewatering OCU	1	Day and Night	94	
Centrifuge feed pumps	2	Day and Night	88	Inside a building
Chemical storage dosing skids	18	Day and Night	89	
Truck outloading screw conveyor	2	Day and Night	83	
Outloading belt conveyor drive	1	Day and Night	83	
Dewatered sludge belt conveyor	1	Day and Night	83	

6.2.3 Noise treatment options

The following treatment options should be considered for the proposed noise sources. These treatment options supersede the options presented in the previous NVIA that considered upgrades catering for growth in the catchment (60659367-RPNV-02_D, 22/02/2022).

Table 25 Riverstone WRRF noise treatment options

Plant item	Treatment recommended
Foul air fan	Install attenuator to reduce the external sound power levels to those listed in Table 23.

Table 26 Rouse Hill WRRF noise treatment options

Plant item	Treatment recommended
Blowers and membrane aeration blowers	Install attenuator to reduce the external 'blow off' sound power levels to those listed in Table 24.

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 WRRFs on 27 May 2021. Based on these measurements and observations a SoundPLAN noise model of the WRRFs was developed. Table 27 and Table 28 show the modelled noise levels for the existing plants.

Table 27 Existing operational noise levels of the Riverstone WRRF

Location	Distance from proposal (m)	Sound pressure level, L_{Aeq} dB(A)	
		Daytime	Night-time
21 Clyde Street, Vineyard	550	32	32
6 Ashford Road, Vineyard	320	33	33
8 Dulwich Road, Vineyard	400	30	30
3 St James Road, Vineyard	400	30	30

Table 28 Existing operational noise levels of the Rouse Hill WRRF

Location	Distance from proposal (m)	Sound pressure level, L_{Aeq} dB(A)	
		Daytime	Night-time
20 Mailey Circuit, Rouse Hill	400	40	28
69 Mile End Road, Rouse Hill	350	32	20
133 Mile End Road, Rouse Hill	480	31	20
20 Outback Street, Box Hill	460	37	25

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 and Table 30. 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 Riverstone WRRF upgrade are compared to the *Noise Policy for Industry* criteria in Table 29. It can be seen that during the daytime the L_{Aeq} levels do not

exceed the trigger levels. During the night-time the L_{Aeq} levels either do not exceed the trigger levels or exceed by a negligible amount (≤2 dB) under adverse weather conditions only. The increase in noise level compared to the current situation is also presented in Table 29.

Table 29 Predicted operational noise levels due to the Proposal – Riverstone WRRF

Location	Distance from proposal (m)	Sound pressure level, L_{Aeq} dB(A)				
		Current	Proposed	Criteria	Exceed-ance	Increase
Daytime – Neutral weather						
21 Clyde Street Vineyard	550	32	33	42	-	1
6 Ashford Road Vineyard	320	33	36	42	-	3
8 Dulwich Road Vineyard	400	30	34	42	-	4
3 St James Road Vineyard	400	30	34	42	-	4
Night-time – Neutral weather						
21 Clyde Street Vineyard	550	32	31	35	-	-
6 Ashford Road Vineyard	320	33	34	35	-	1
8 Dulwich Road Vineyard	400	30	32	35	-	2
3 St James Road Vineyard	400	30	32	35	-	2
Daytime – Adverse weather						
21 Clyde Street Vineyard	550	34	37	42	-	3
6 Ashford Road Vineyard	320	36	39	42	-	3
8 Dulwich Road Vineyard	400	33	38	42	-	5
3 St James Road Vineyard	400	32	38	42	-	6
Night-time – Adverse weather						
21 Clyde Street Vineyard	550	34	34	35	-	-
6 Ashford Road Vineyard	320	36	37	35	2	1
8 Dulwich Road Vineyard	400	33	35	35	-	2
3 St James Road Vineyard	400	32	35	35	-	3

The predicted noise levels due to the proposed Rouse Hill WRRF upgrade are compared to the *Noise Policy for Industry* criteria in Table 30. It can be seen that during the daytime and the night-time the L_{Aeq} levels do not exceed the trigger levels.

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

Location	Distance from proposal (m)	Sound pressure level, L_{Aeq} dB(A)				
		Current	Proposed	Criteria	Exceed-ance	Increase
Daytime – Neutral weather						
20 Mailey Circuit, Rouse Hill	400	40	41	49	-	1
69 Mile End Road, Rouse Hill	350	32	37	46	-	5
133 Mile End Road, Rouse Hill	480	31	35	46	-	4
20 Outback Street, Box Hill	460	37	39	49	-	2
Night-time – Neutral weather						
20 Mailey Circuit, Rouse Hill	400	28	33	38	-	5
69 Mile End Road, Rouse Hill	350	20	32	35	-	12
133 Mile End Road, Rouse Hill	480	20	30	35	-	10
20 Outback Street, Box Hill	460	25	32	38	-	7
Daytime – Adverse weather						
20 Mailey Circuit, Rouse Hill	400	43	44	49	-	1
69 Mile End Road, Rouse Hill	350	35	40	46	-	5
133 Mile End Road, Rouse Hill	480	34	38	46	-	4
20 Outback Street, Box Hill	460	40	42	49	-	2
Night-time – Adverse weather						
20 Mailey Circuit, Rouse Hill	400	32	36	38	-	4
69 Mile End Road, Rouse Hill	350	23	35	35	-	12
133 Mile End Road, Rouse Hill	480	23	34	35	-	11
20 Outback Street, Box Hill	460	28	36	38	-	8

6.3.3 Sleep disturbance results

The sleep disturbance noise levels associated with the typical operation of the proposed Riverstone WRRF upgrade were predicted at nearby receivers under calm meteorological conditions and worst case weather conditions. The results are presented in Table 31 and Table 32. It can be seen the L_{Amax} and L_{Aeq} levels from the operation of the facility comply with the project sleep disturbance criteria.

Table 31 Predicted night-time L_{Amax} operational noise levels and sleep disturbance criteria – Riverstone WRRF

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	32	52	-
3 St James Road, Vineyard	400	32	52	-
Night-time – Adverse weather				
21 Clyde Street, Vineyard	550	34	52	-
6 Ashford Road, Vineyard	320	37	52	-
8 Dulwich Road, Vineyard	400	35	52	-
3 St James Road, Vineyard	400	35	52	-

Table 32 Predicted night-time L_{Aeq} operational noise levels and sleep disturbance criteria – Riverstone WRRF

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	32	40	-
3 St James Road, Vineyard	400	32	40	-
Night-time – Adverse weather				
21 Clyde Street, Vineyard	550	34	40	-
6 Ashford Road, Vineyard	320	37	40	-
8 Dulwich Road, Vineyard	400	35	40	-
3 St James Road, Vineyard	400	35	40	-

The sleep disturbance noise levels associated with the typical operation of the proposed Rouse Hill WRRF upgrade were predicted at nearby receivers under calm meteorological conditions and worst case weather conditions. The results are presented in Table 33 and Table 34. It can be seen the L_{Amax} and L_{Aeq} levels from the operation of the facility comply with the project sleep disturbance criteria.

Table 33 Predicted night-time L_{Amax} operational noise levels and sleep disturbance criteria – Rouse Hill WRRF

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	34	52	-
69 Mile End Road, Rouse Hill	350	36	52	-
133 Mile End Road, Rouse Hill	480	31	52	-
20 Outback Street, Box Hill	460	33	52	-
Night-time – Adverse weather				
20 Mailey Circuit, Rouse Hill	400	37	52	-
69 Mile End Road, Rouse Hill	350	38	52	-
133 Mile End Road, Rouse Hill	480	35	52	-
20 Outback Street, Box Hill	460	37	52	-

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

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	34	41	-
69 Mile End Road, Rouse Hill	350	36	40	-
133 Mile End Road, Rouse Hill	480	31	40	-
20 Outback Street, Box Hill	460	33	41	-
Night-time – Adverse weather				
20 Mailey Circuit, Rouse Hill	400	37	41	-
69 Mile End Road, Rouse Hill	350	38	40	-
133 Mile End Road, Rouse Hill	480	35	40	-
20 Outback Street, Box Hill	460	37	41	-

6.3.4 Other noise sensitive receivers

A childcare centre, commercial properties and two places of worship are located within 400 m of the Rouse Hill WRRF. Predicted noise levels at the childcare centre, the 2 places of worship and the closest commercial receiver are presented in Table 35 below. No exceedances of the criteria are predicted.

Table 35 Predicted operational noise levels due to the Proposal – Rouse Hill WRRF

Location	Distance from proposal (m)	Sound pressure level, L_{Aeq} dB(A)		
		Proposed	Criteria	Exceedance
Daytime – Neutral weather				
Rouse Hill Mussullah (Place of Worship)	400	41	53	-
Fit Kidz Learning Centre (Childcare)	300	37	53	-
Glory Mountain Church (Place of Worship)	100	48	53	-
8 Money Close Rouse Hill (Commercial)	50	53	68	-
Daytime – Adverse weather				
Rouse Hill Mussullah (Place of Worship)	400	44	53	-
Fit Kidz Learning Centre (Childcare)	300	39	53	-
Glory Mountain Church (Place of Worship)	100	51	53	-
8 Money Close Rouse Hill (Commercial)	50	55	68	-

6.3.5 Discussion

An exceedance is predicted at the Riverstone WRRF during the night-time under adverse weather conditions, at one residential receiver. 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 levels, and the exceedances are negligible (less than 2 dB).

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

No exceedances of the sleep disturbance criteria are predicted as a result of the Proposal at the WRRFs.

6.4 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 WRRF. In total there will be 20 truck movements per day at both Riverstone WRRF and Rouse Hill WRRF. The existing traffic flow on Bandon 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).

The NWTH program of works involves upgrades to the Rouse Hill water recycling plant WRRF and Riverstone WRRF. The upgrades are considered in two stages;

- Upgrades to meet current EPL requirements (including reducing nutrient loads in treated water, improve odour, to meet overflow requirements and improve water quality); and
- Upgrades to cater for catchment growth.

This NVIA has been developed to support an Addendum REF to the NWTH Growth Package REF. The Addendum REF is being prepared to assess the revised scope of the Growth Package project, the proposed changes from the approved REF include the following:

Riverstone WRRF

- A new carbonisation plant and associated infrastructure including drying, heating and carbonisation systems, this will result in production of biochar rather than biosolids
- No expansion of existing anaerobic digestion and no upgrade to waste gas burners
- Deletion of cogeneration unit.

Rouse Hill WRRF

- New dewatering and outloading building to cater for sludge treatment
- Expansion of the construction footprint to include a compound site in 7 Money Close, Rouse Hill (5/-/DP1158760) and new access roads into the facility
- Ongoing use of part of existing biological nutrient removal (BNR) treatment and existing aerobic digester.

Sludge transfer systems

- Deletion of both sludge transfer pipelines (Rouse Hill WRRF to Riverstone WRRF, and Castle Hill WRRF to Rouse Hill WRRF).

This NVIA provides an updated assessment of all noise and vibration impacts associated with construction and operation of the Growth Package project, including the remaining original scope and the changes documented in the AREF.

Previous NVIA reports include:

- A report that considered upgrades to Castle Hill WRRF and Rouse Hill WRRF to meet the current EPL compliance requirements are considered in a previous report (60659367-RPNV-01_B, 13/07/2021).
- A report that considered plant upgrades to Riverstone WRRF and Rouse Hill WRRF to cater for growth in the catchment (60659367-RPNV-02_D, 22/02/2022).

The results and recommendations of this report supersede those presented in the previous NVIA prepared for the Growth Package REF. It should also be noted that this assessment considers the cumulative impacts of changes related to both the EPL Compliance and the Growth Package.

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.

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 significantly exceed the construction noise management levels at the closest noise sensitive receivers for the Riverstone WRRF or Rouse Hill WRRF.

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 noise is expected increase road traffic noise by more than 2 dB(A) at residential receivers on Bandon Road, Mile End Road and Withers Road. Measures to mitigate the impact of this noise increase are presented in Section 5.6.

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. Noise levels have been assessed in accordance with the *Noise Policy for Industry.* The Riverstone WRRF and Rouse Hill WRRF upgrades are predicted to comply with the operational noise criteria at all noise sensitive receivers, assuming recommended noise treatment options are implemented.

7.2.2 Operational road traffic noise

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

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

NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Noise Sources

N

0 20 40 Meters

AECOM

New Plant

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NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Noise Sources

N

0 20 40 Meters

AECOM

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New Plant

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Appendix C

Noise Logging

Noise Logger Report

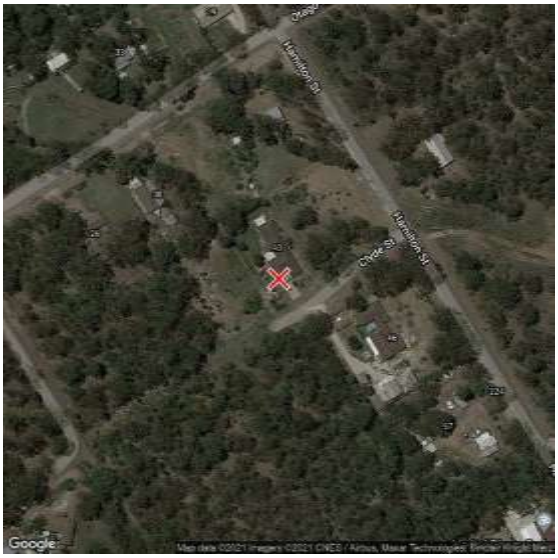
43 Clyde Street, Vineyard

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.

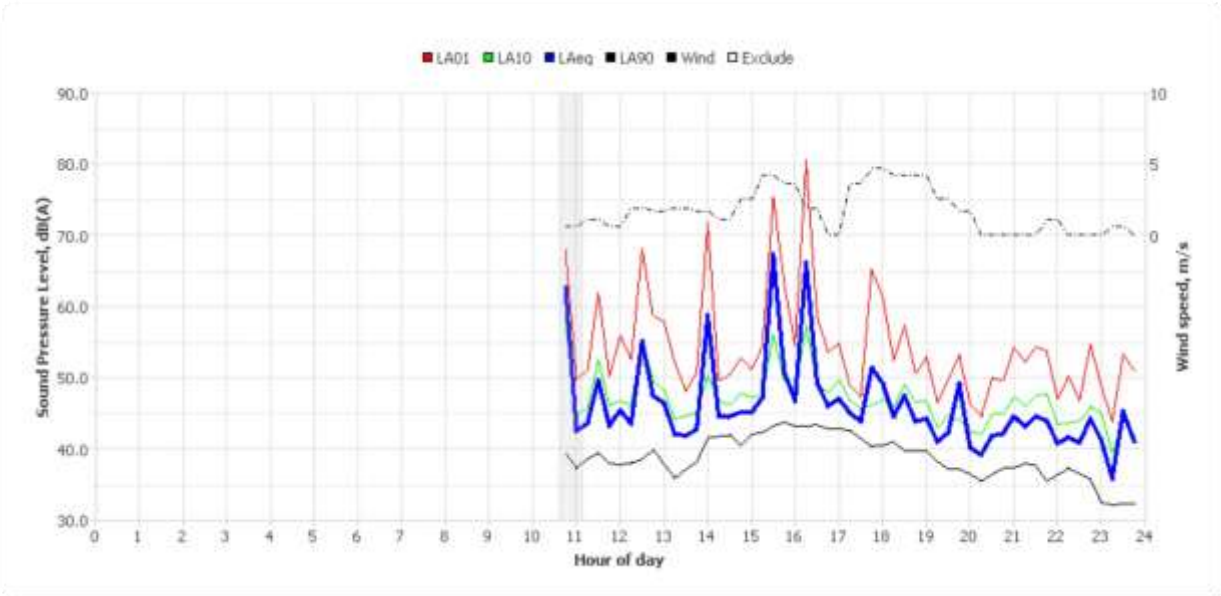
Measured noise levels

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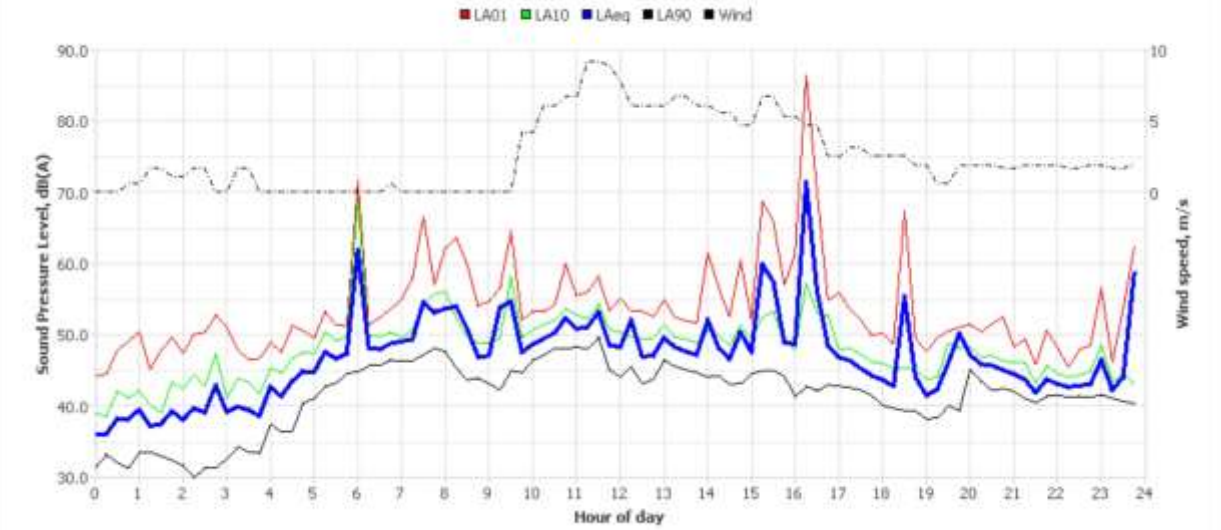
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day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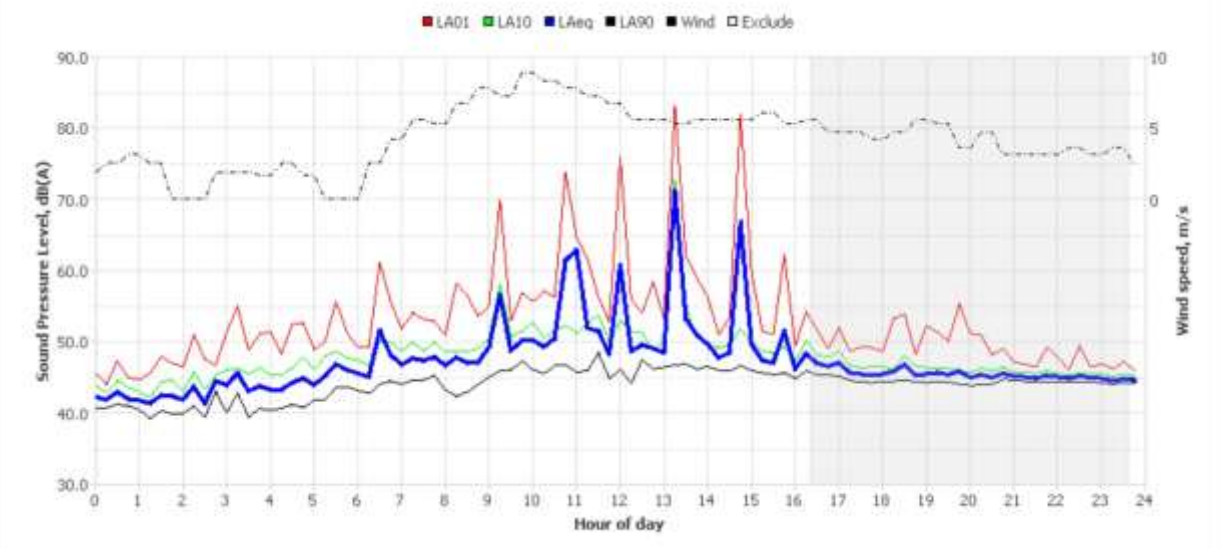
Hour of day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Wind speed, m/s
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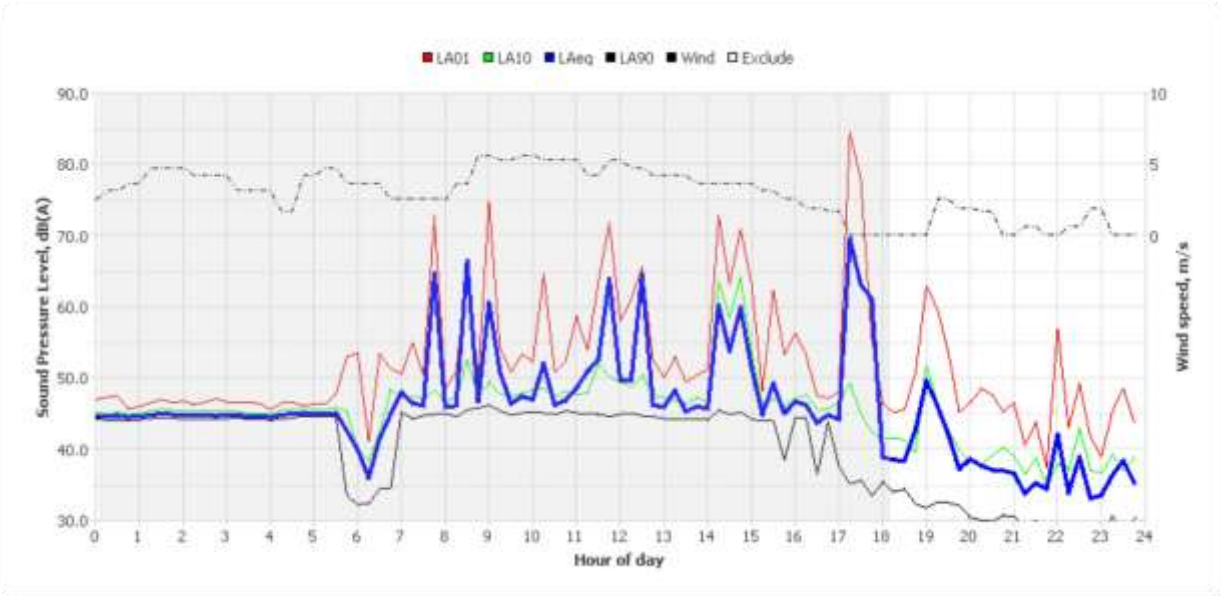
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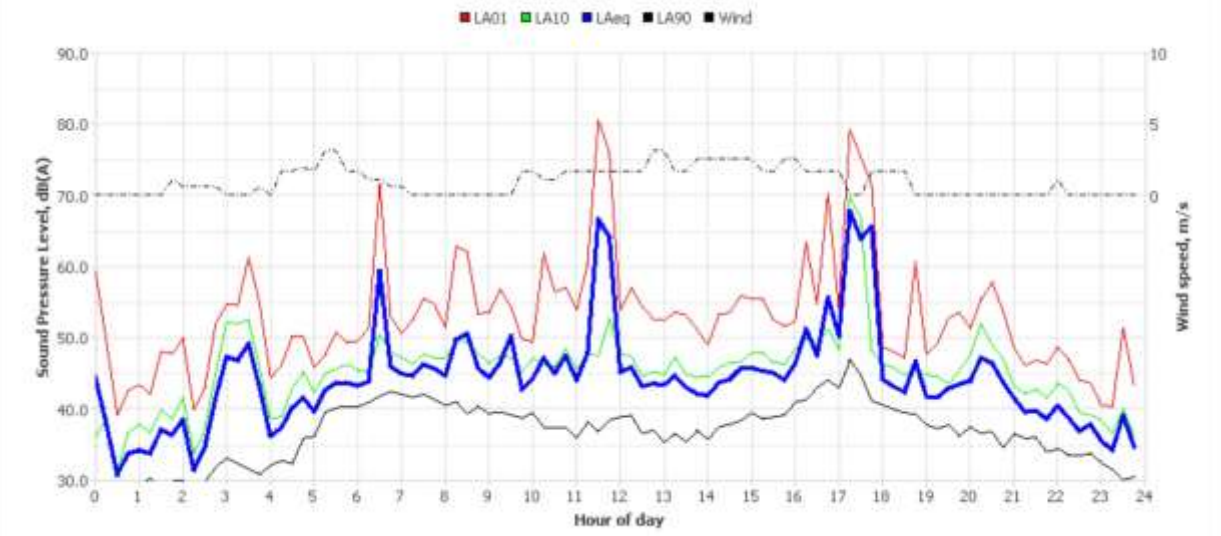
Wind speed, m/s
Hour of day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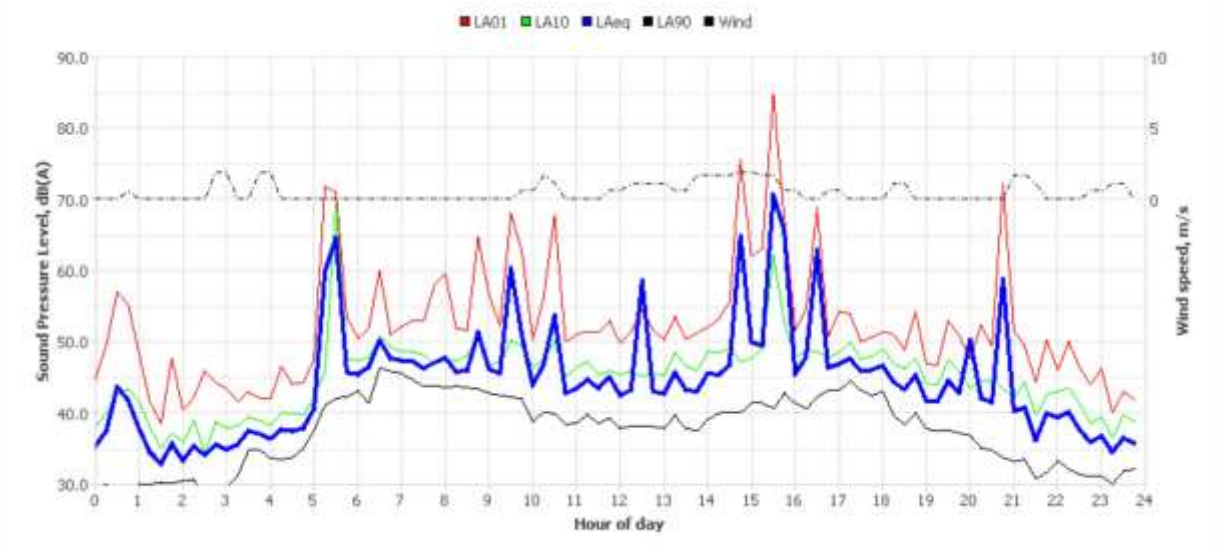
Wind speed, m/s
Hour of day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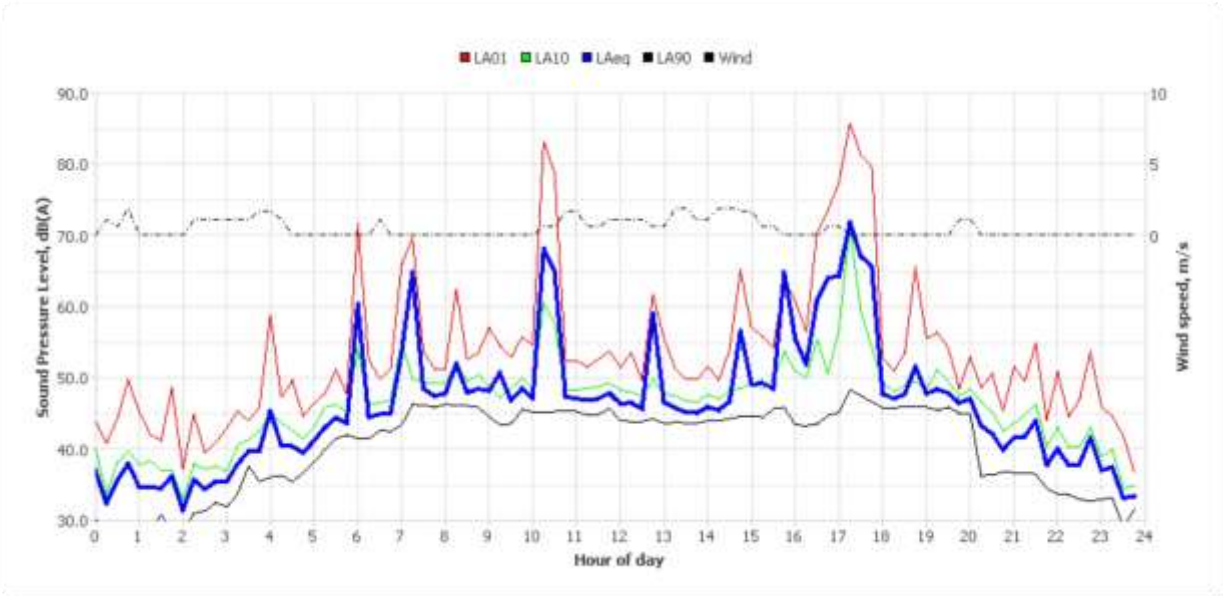
Wind speed, m/s
Hour of day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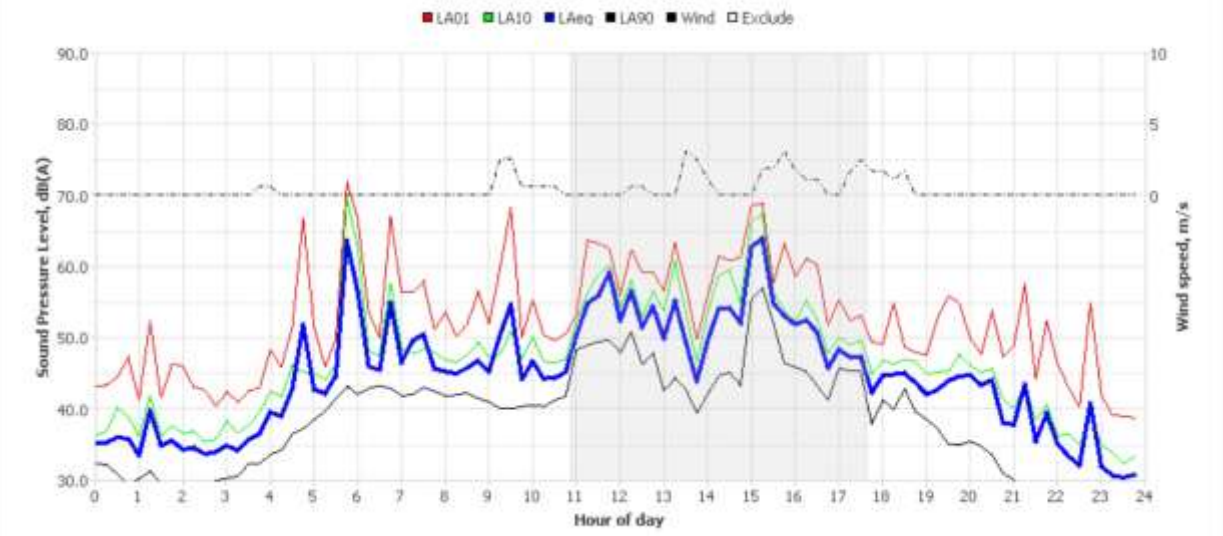
Wind speed, m/s
Hour of day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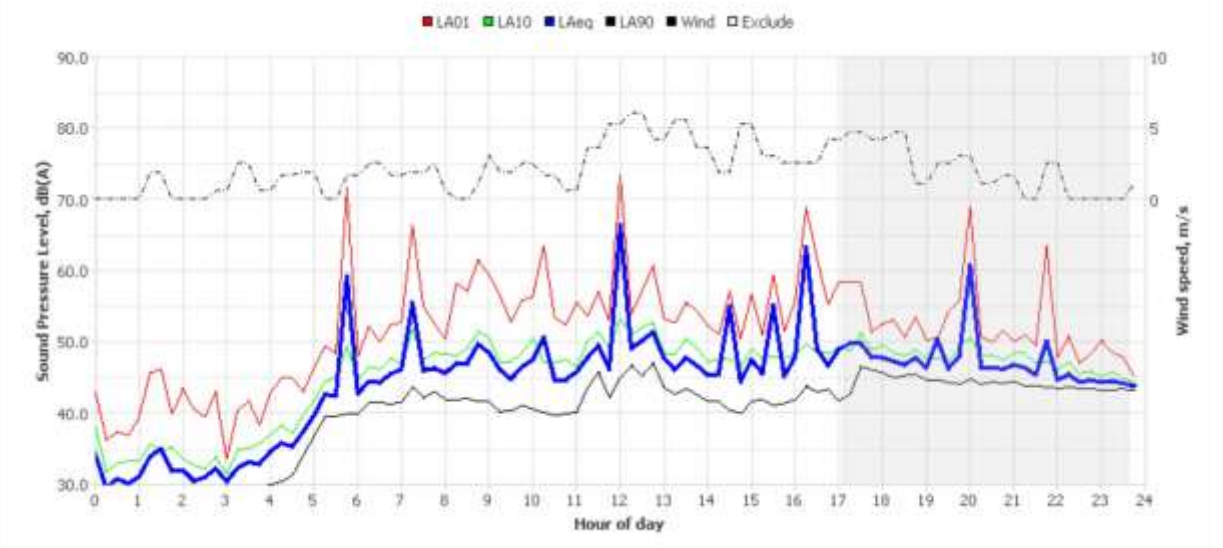
Wind speed, m/s
Hour of day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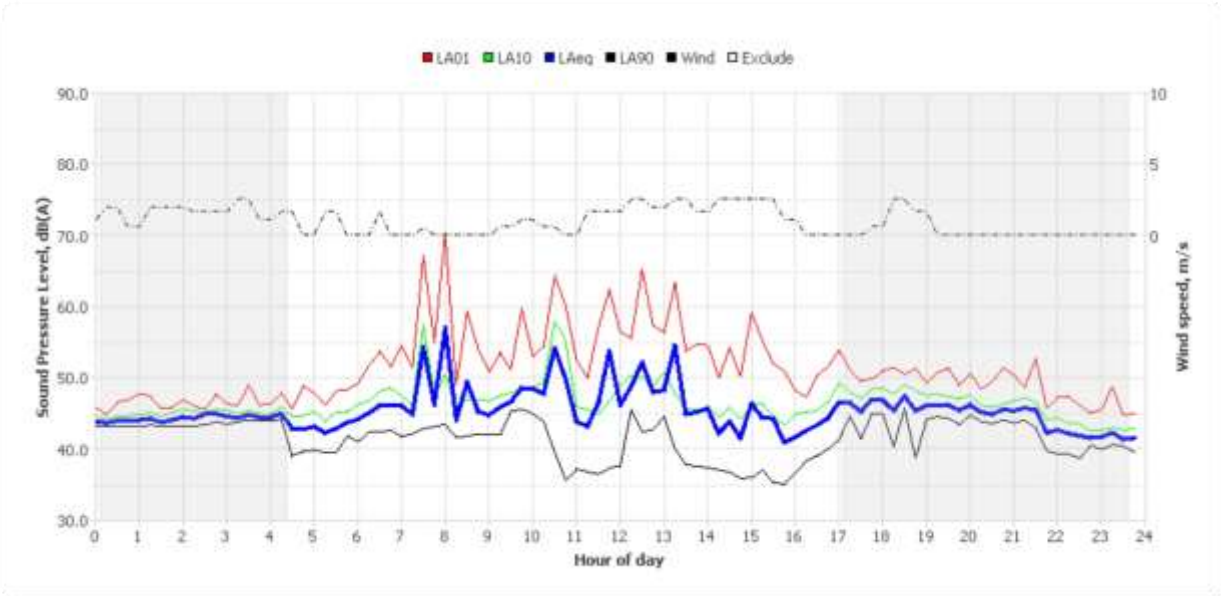
Wind speed, m/s
Hour of day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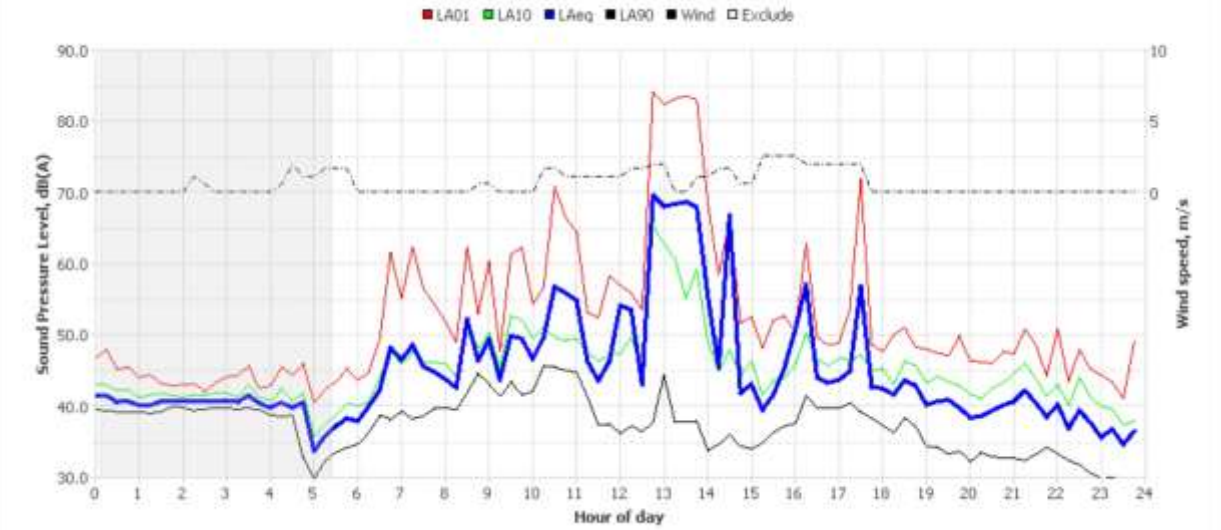
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day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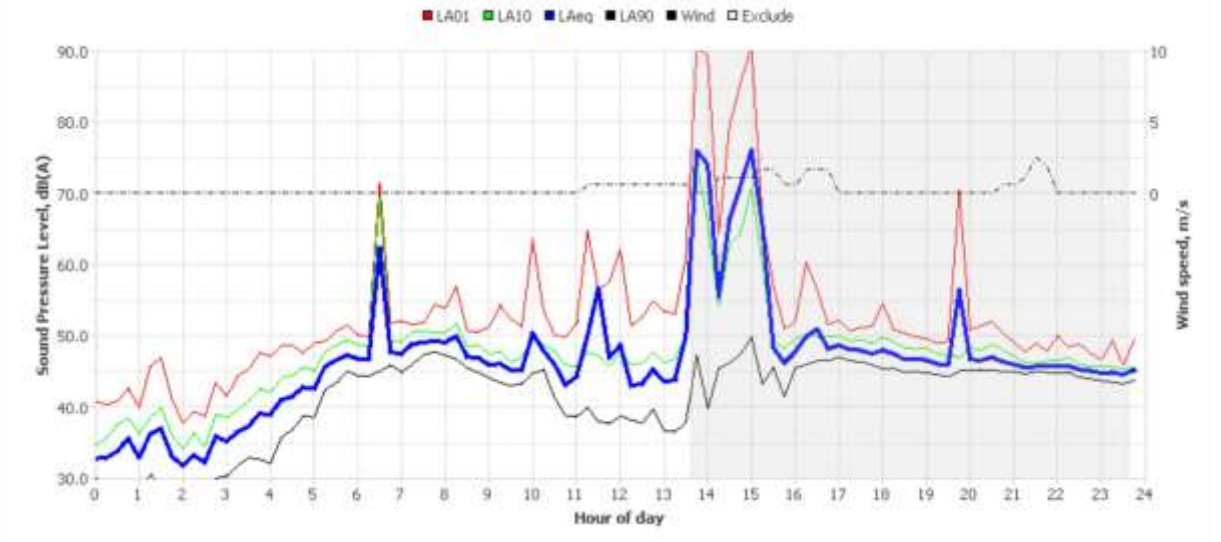
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day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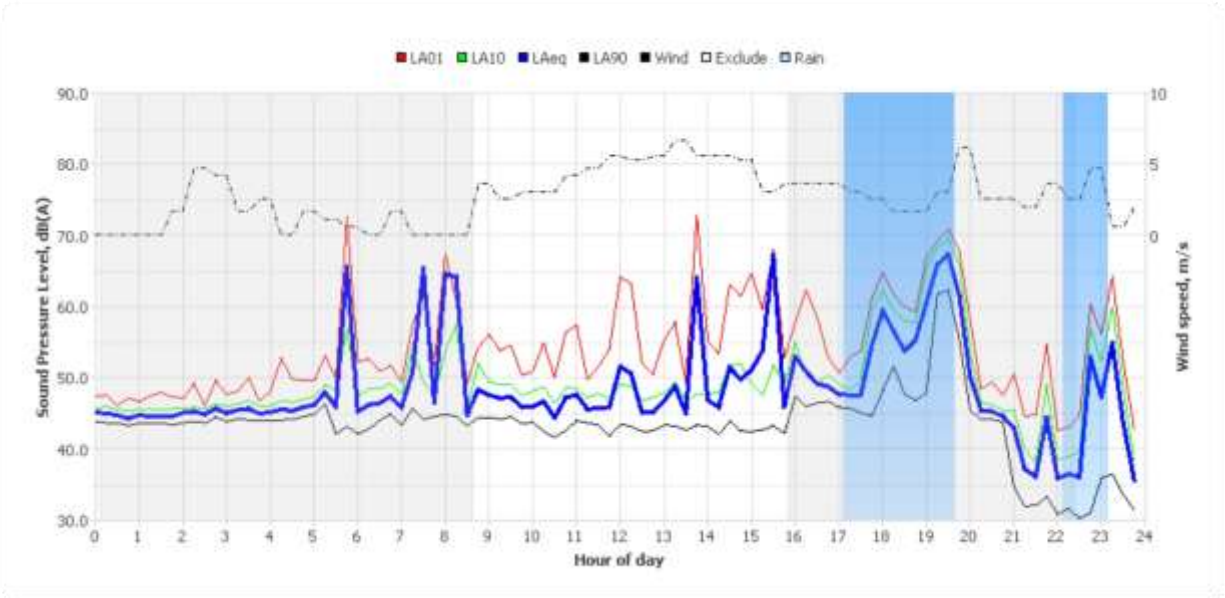
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day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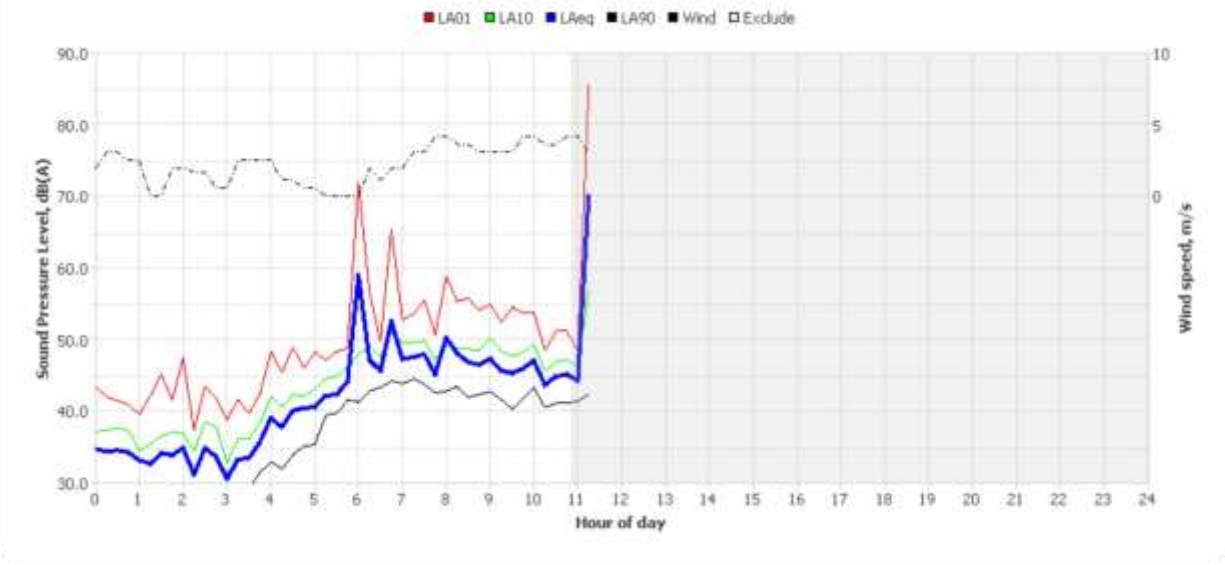
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


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

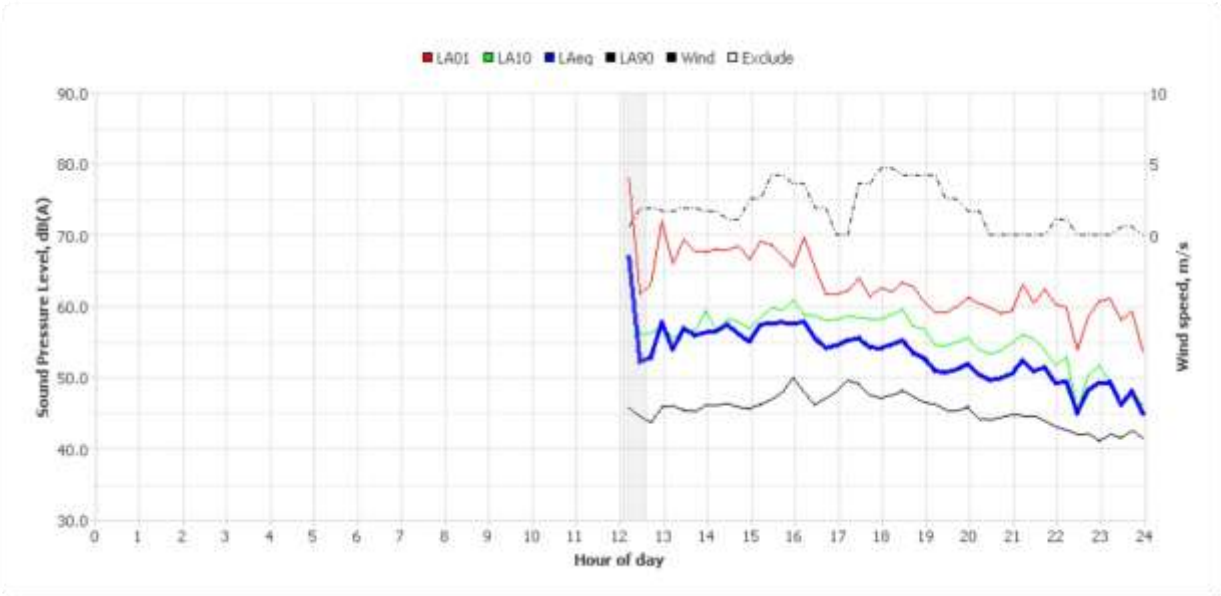
Item	Information
Logger Type	NL-52
Serial number	164395
Address	18 Nelson Road, Box Hill
Location	Back Yard
Facade / Free Field	Free field
Environment	Ambient noise dominated by road traffic on Nelson Road 48 - 55 dBA. Horse, sheep, chickens, roosters and 3 dogs roaming freely and contribute to the ambient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

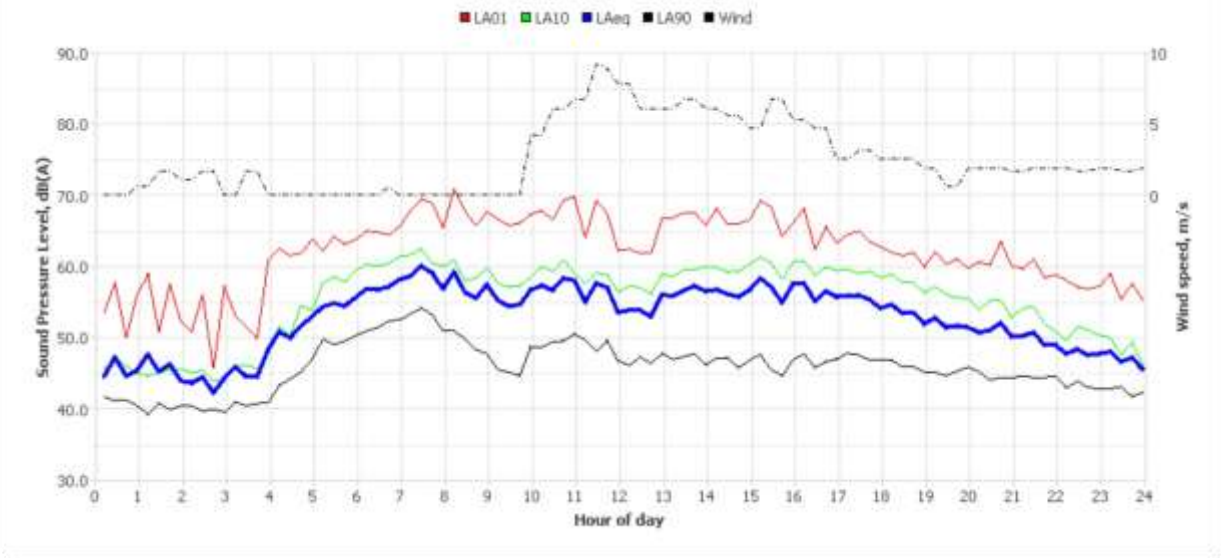
Measured noise levels

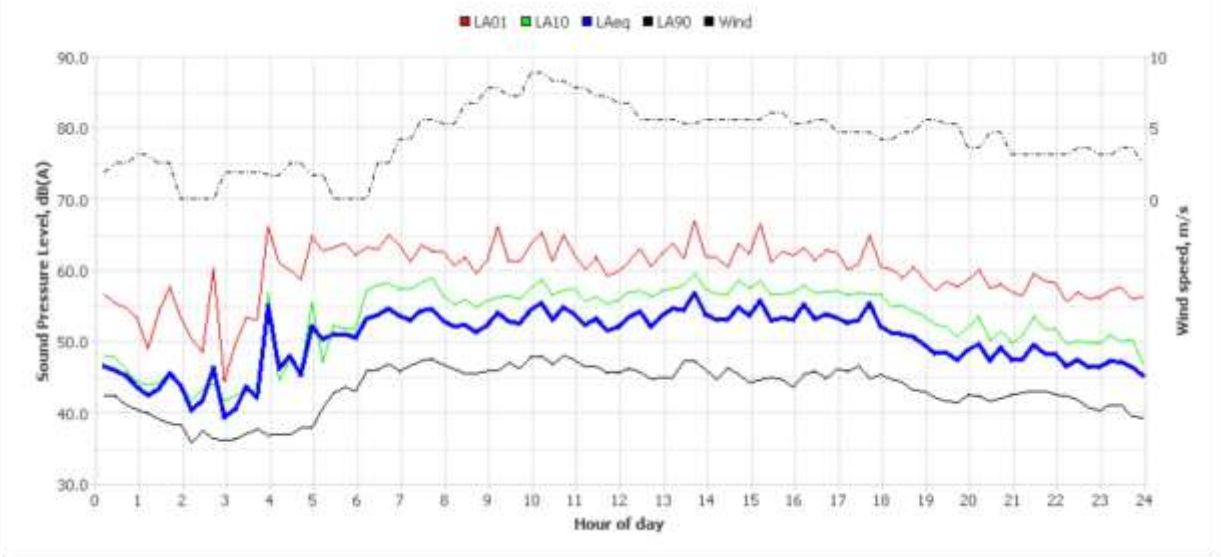
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu May 27 2021	56	52	48	-	44	-	55	48
Fri May 28 2021	57	52	51	-	44	40	55	51
Sat May 29 2021	53	49	49	-	-	36	51	49
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**

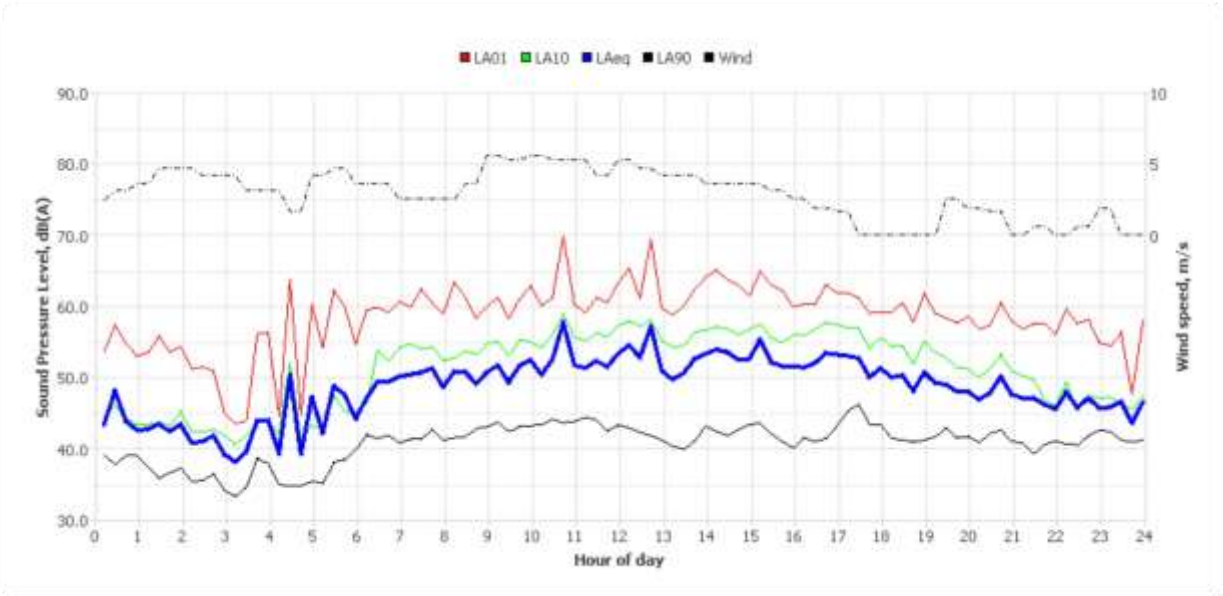
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

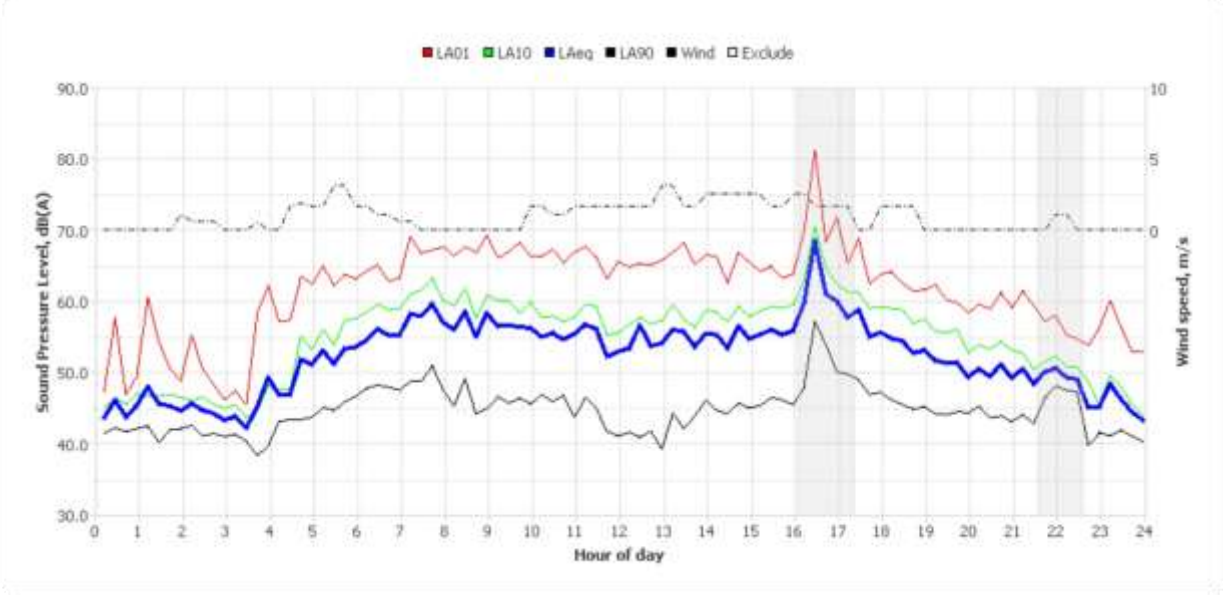
Logger Location	Logger Deployment Photo
 18 Nelson Road, Box Hill	

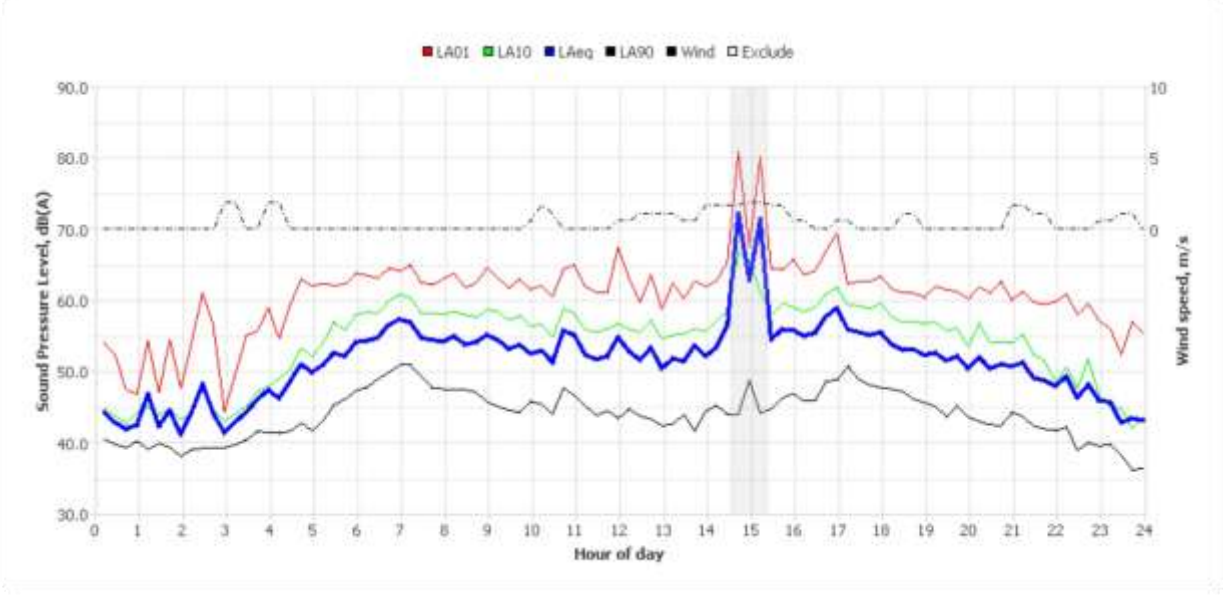

LA01 LA10 LAeq LA90 Wind Exclude
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


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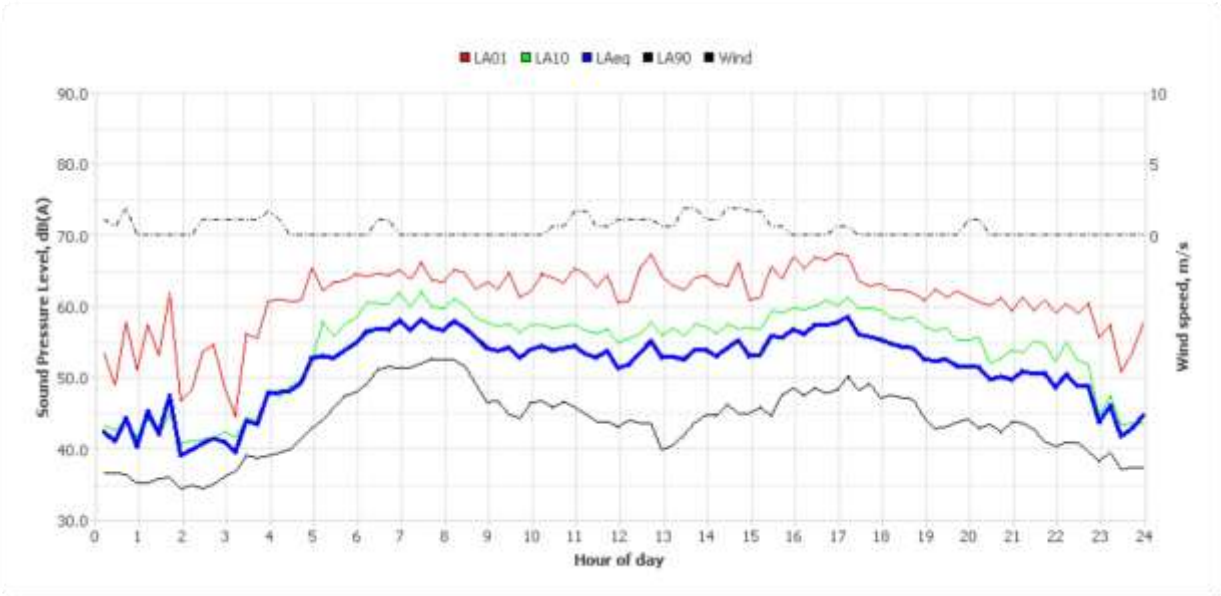
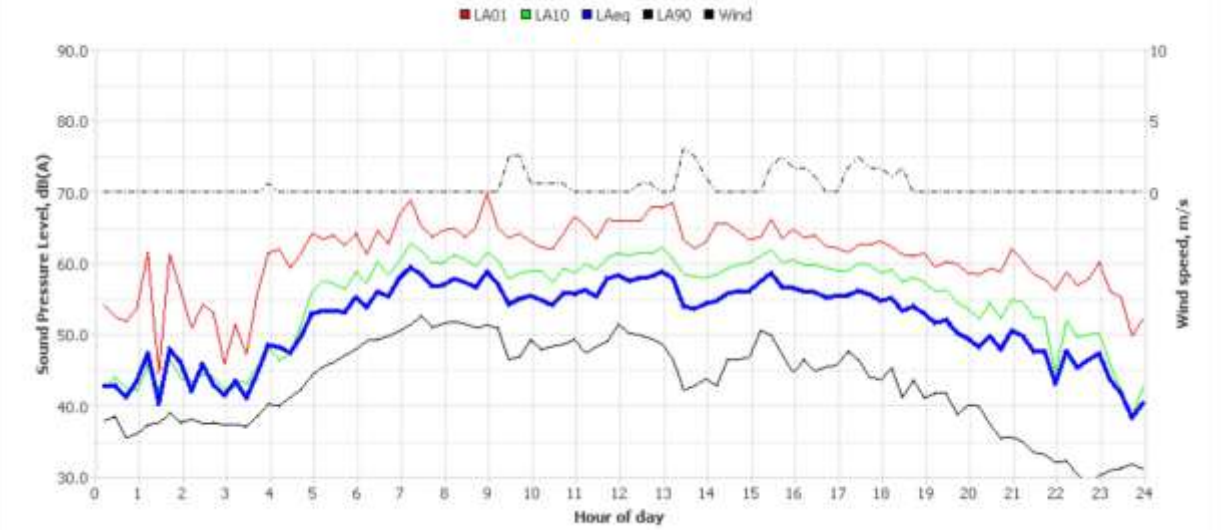
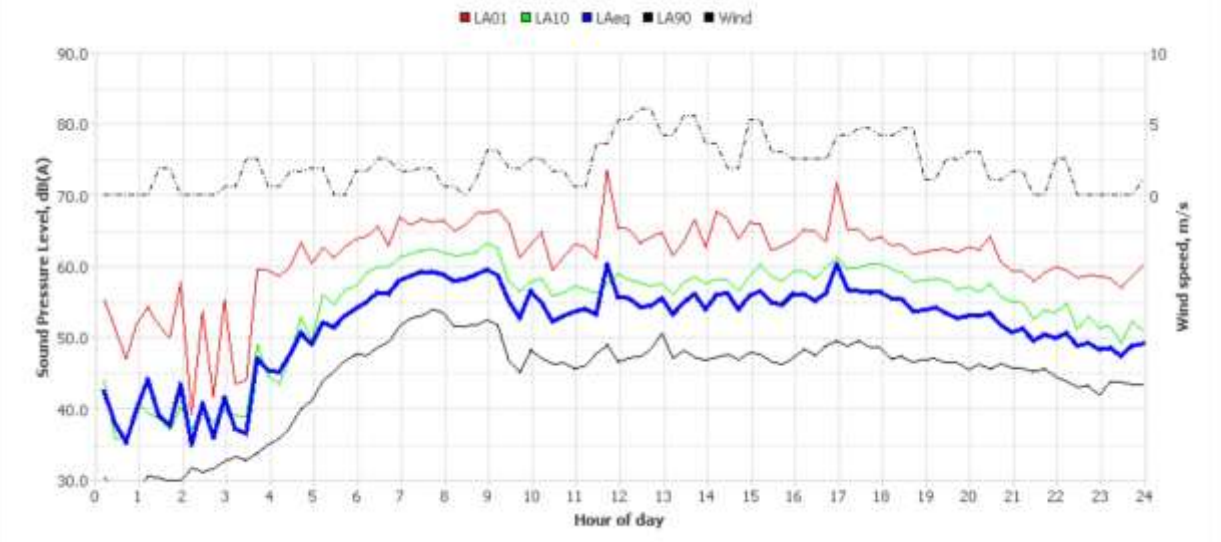
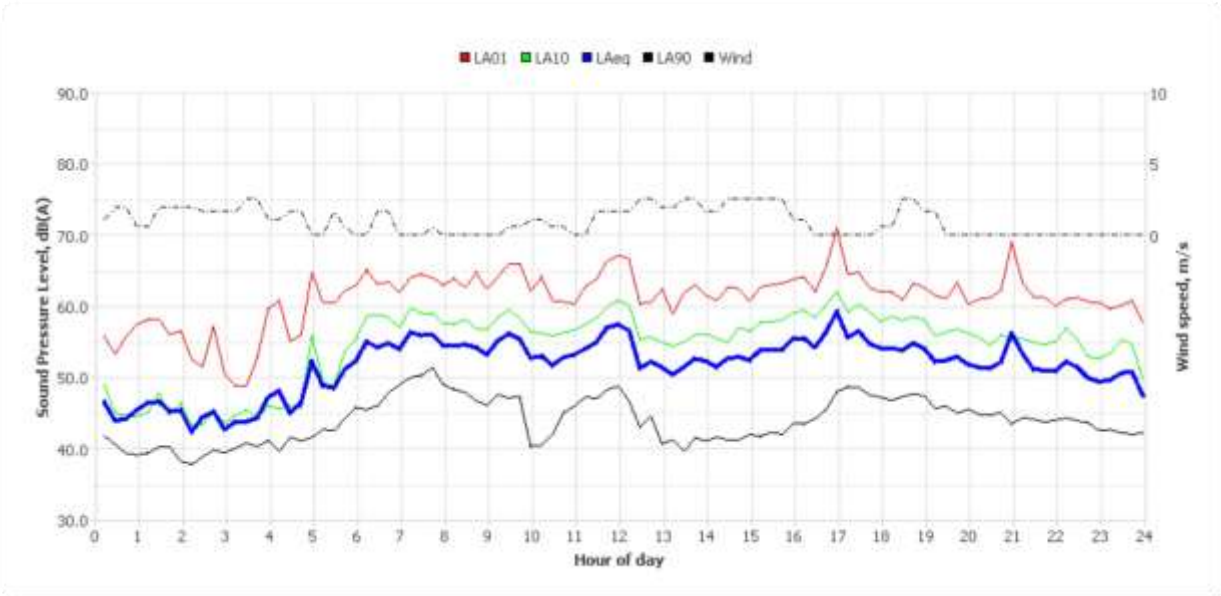
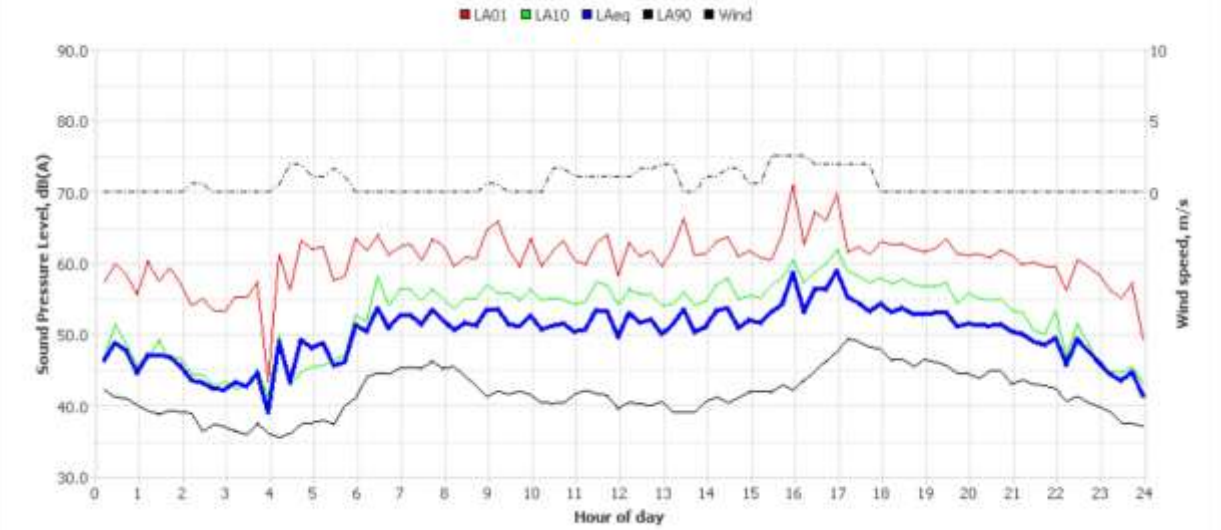
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


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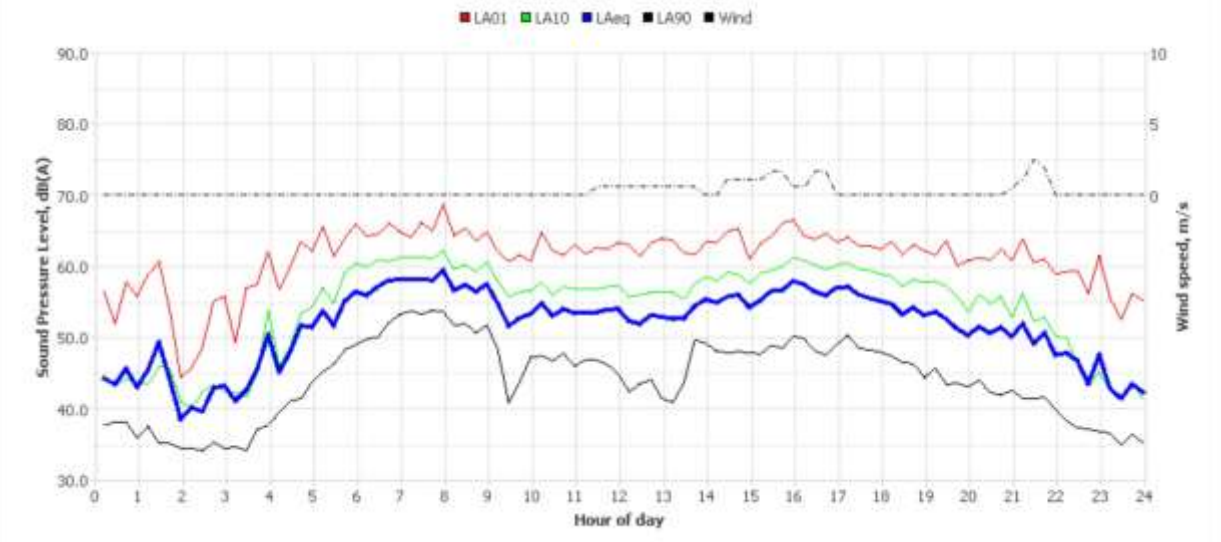
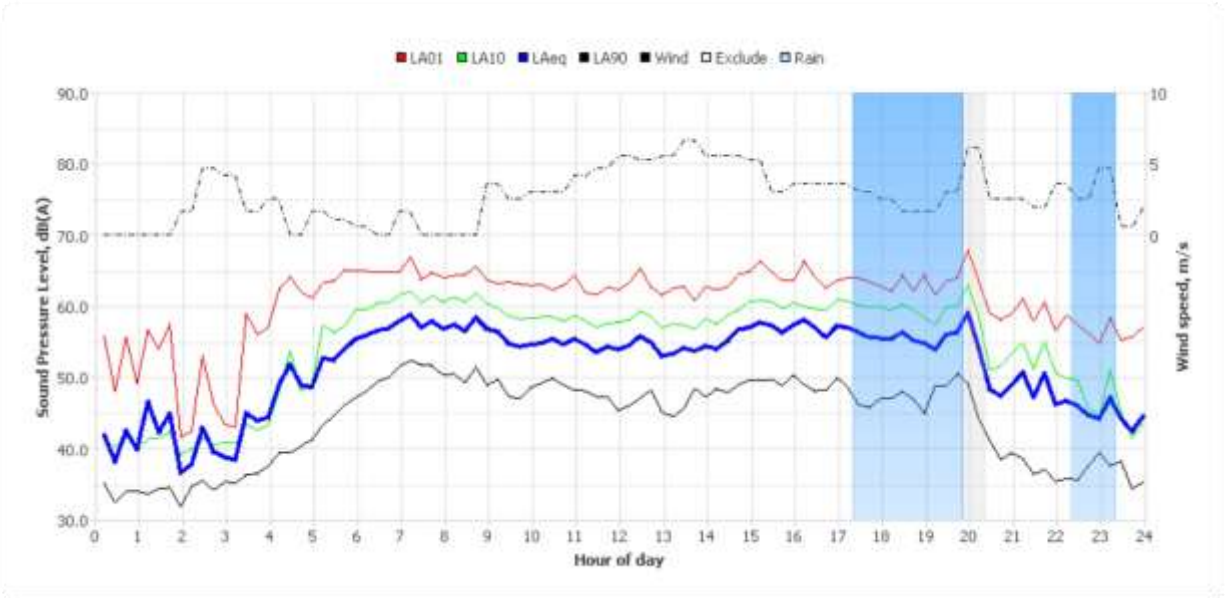
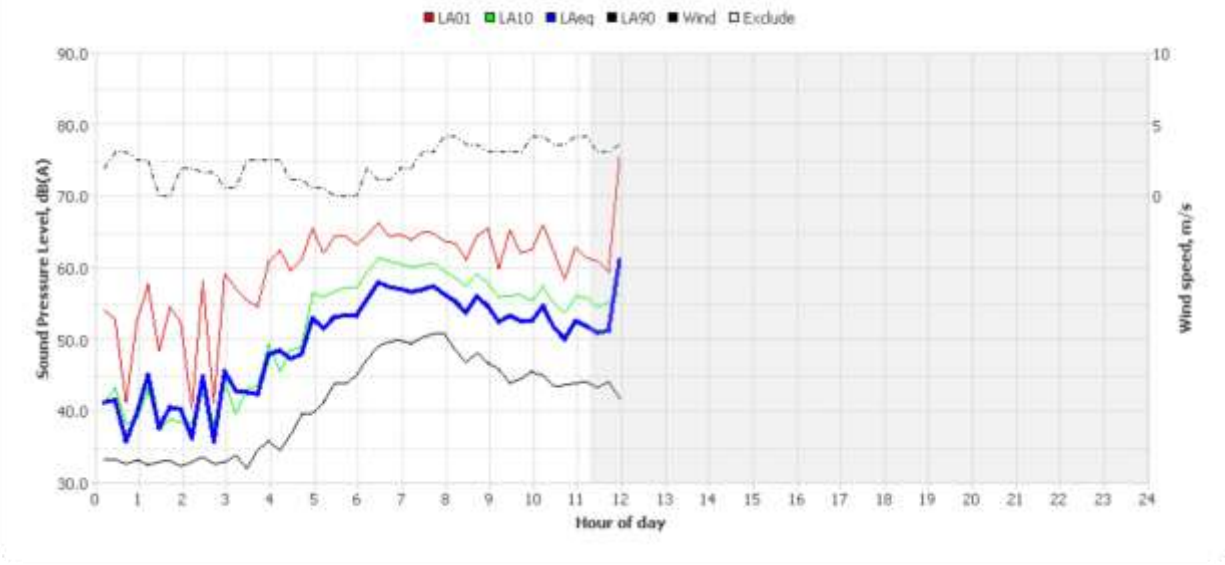
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


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

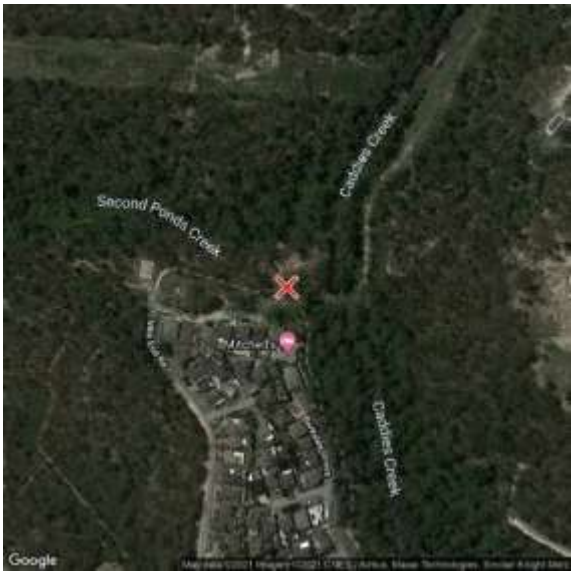
Lot 2 DP839874, The Hills Shire

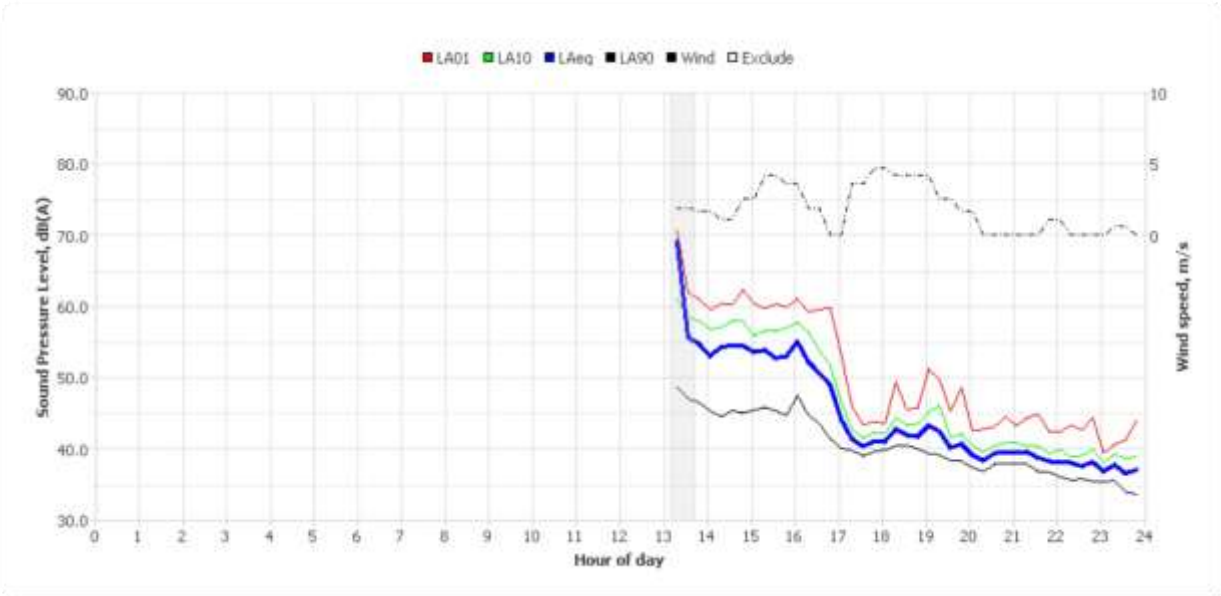
Item	Information
Logger Type	NL-52
Serial number	175550
Address	Lot 2 DP839874, The Hills Shire
Location	Lot 2 DP839874
Facade / Free Field	Free field
Environment	Ambient noise levels dominated by bird calls during the daytime 51 dBA. Distant construction noise audible (hammering and drilling) 56 dBA.

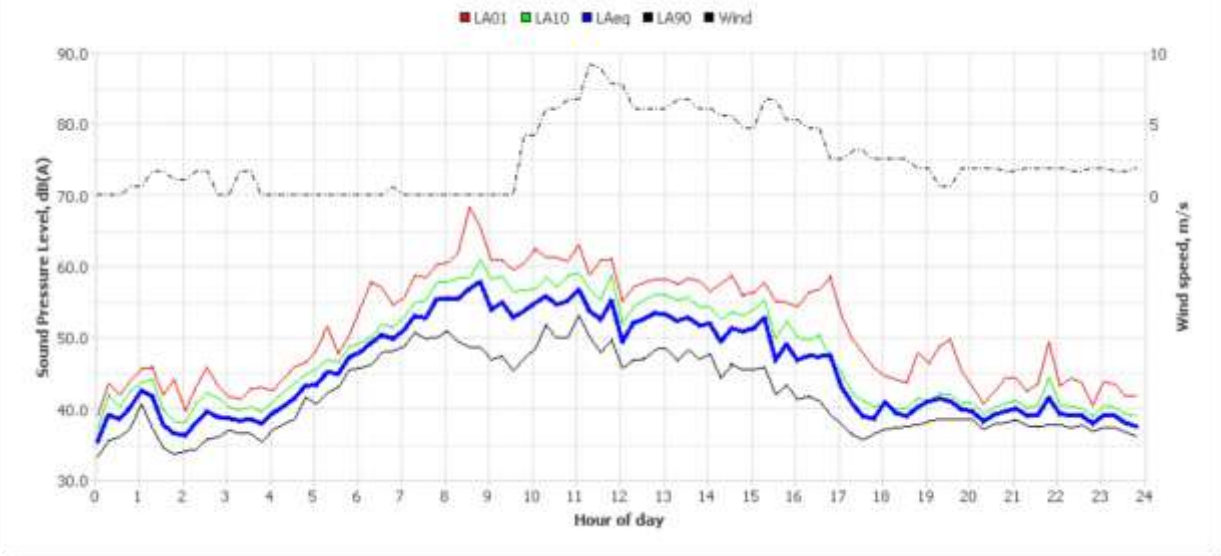
Measured noise levels

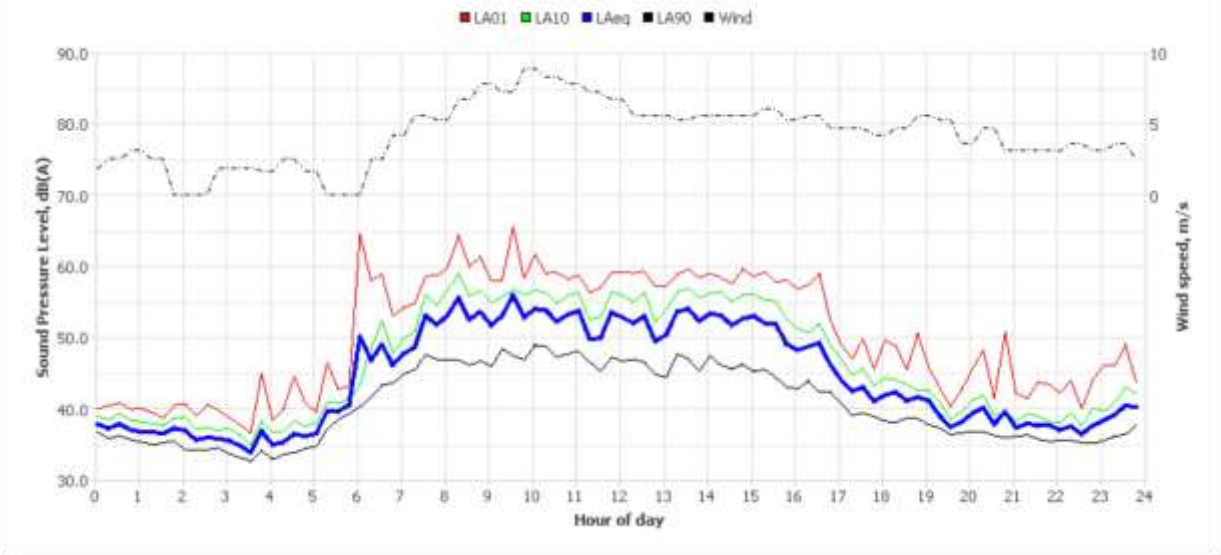
Logging Date	$L_{Aeq,day}$ 7am-6pm	$L_{Aeq,evening}$ 6pm-10pm	$L_{Aeq,night}$ 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	$L_{Aeq,15hr}$ 7am-10pm	$L_{Aeq,9hr}$ 10pm-7am
Thu May 27 2021	52	41	38	-	37	-	50	38
Fri May 28 2021	53	40	43	-	37	34	51	43
Sat May 29 2021	45	40	41	-	-	34	42	41
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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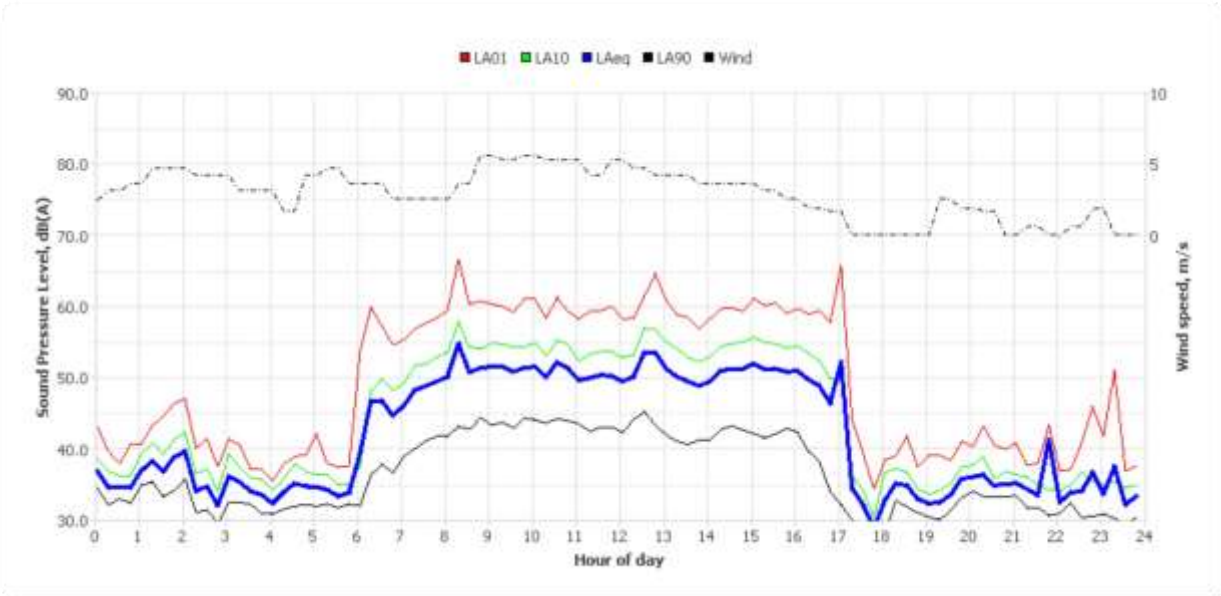
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day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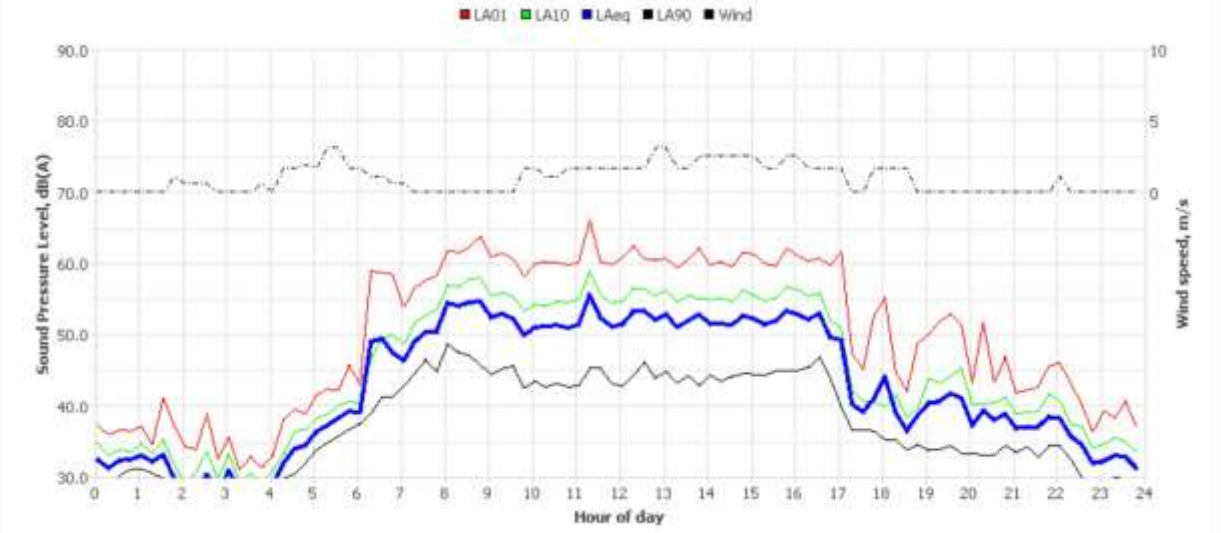
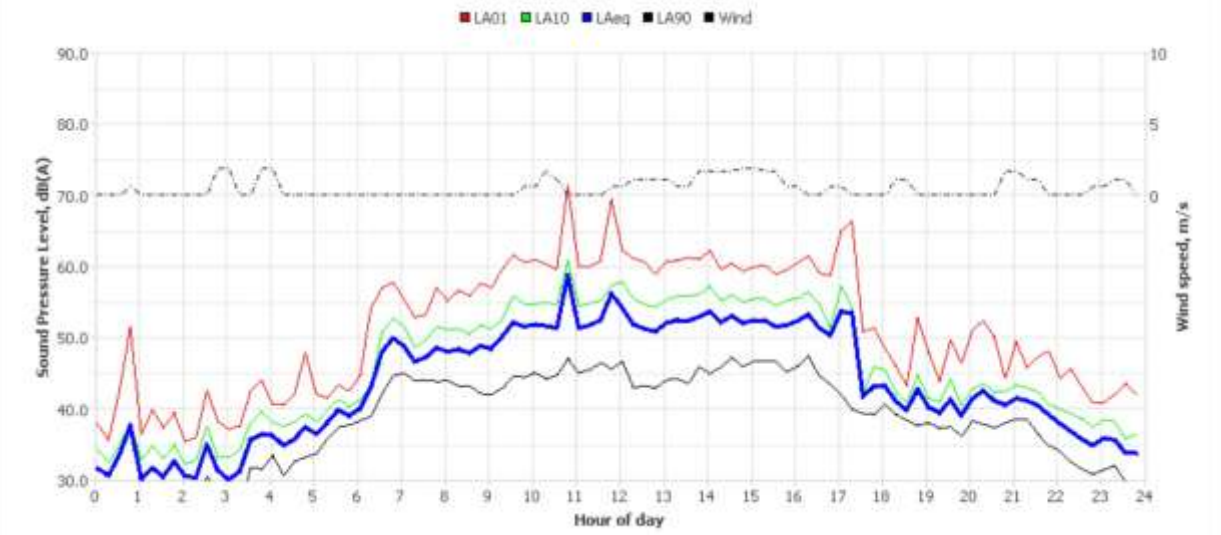
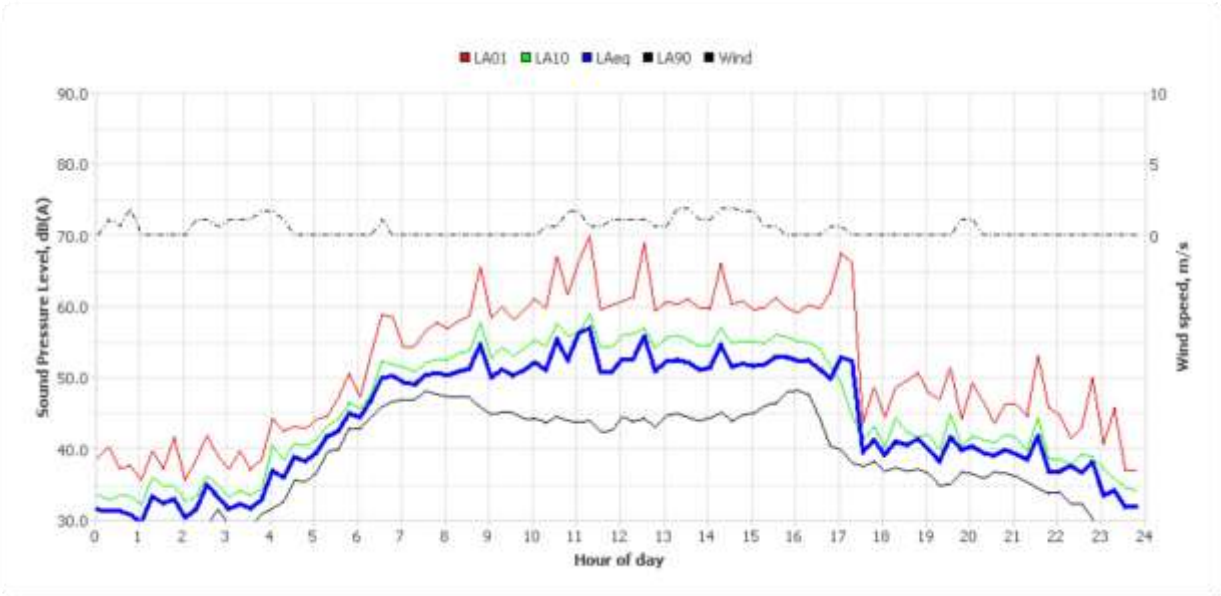
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


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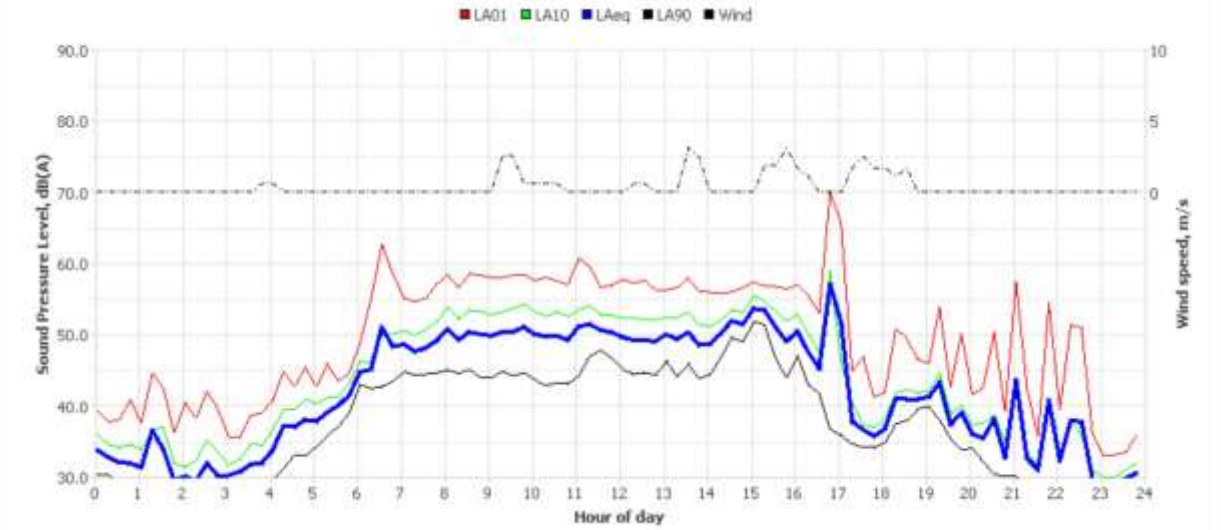
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day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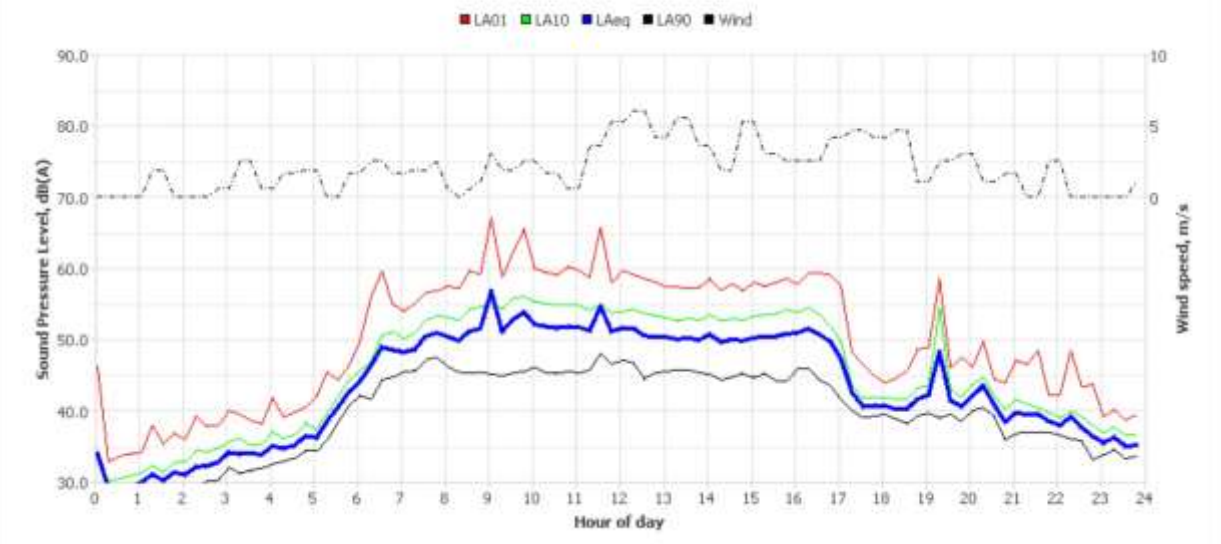
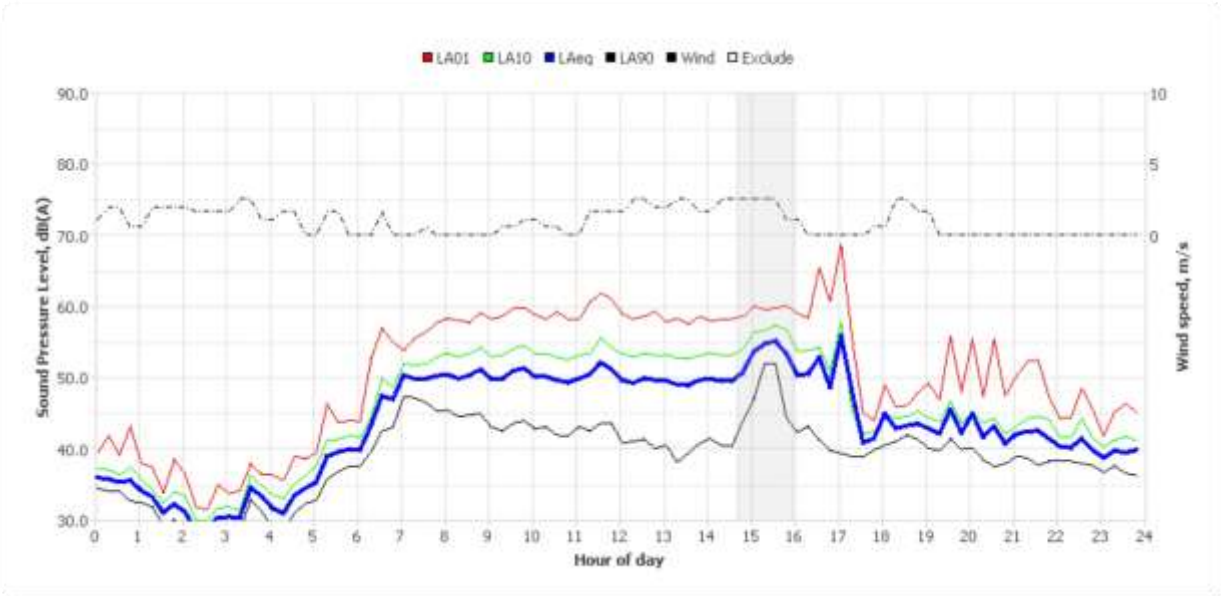
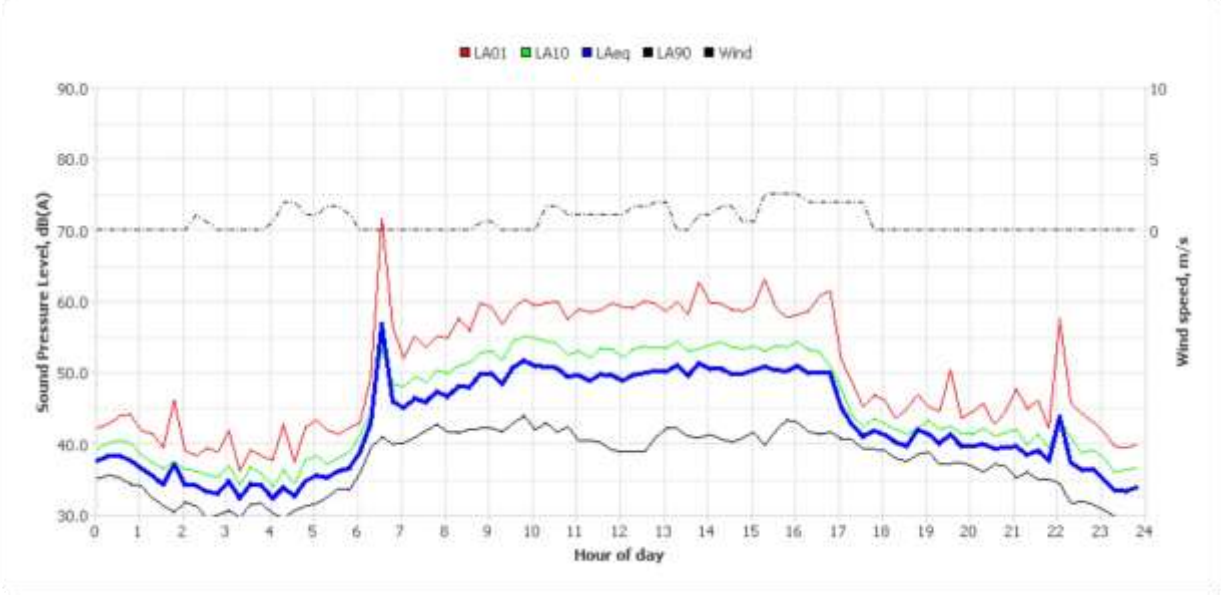
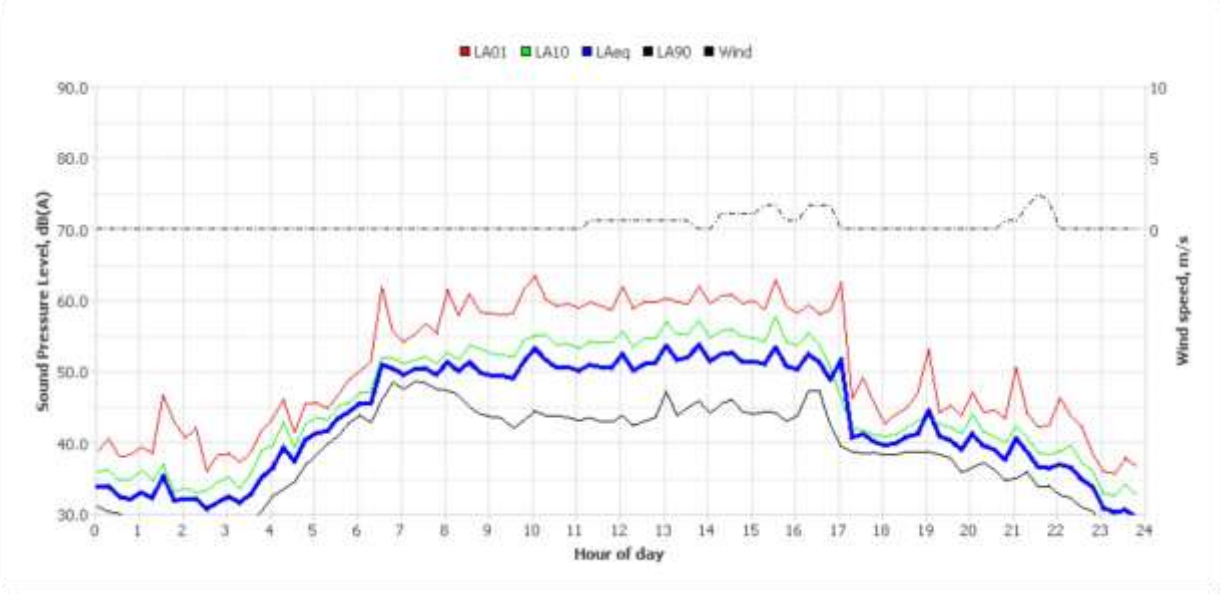
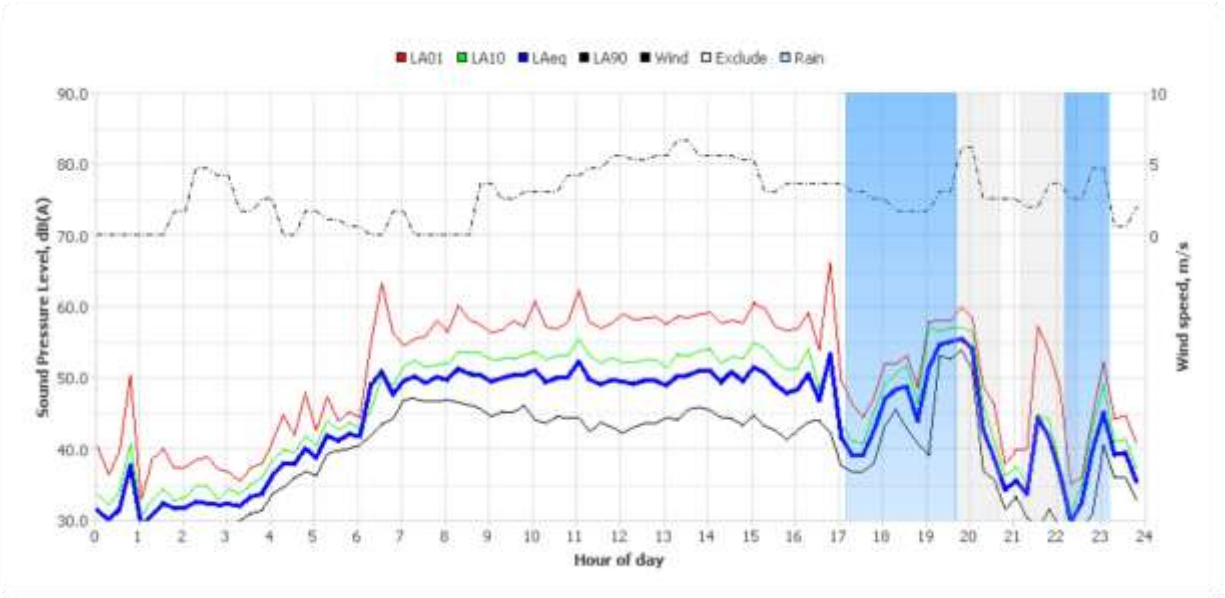
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day

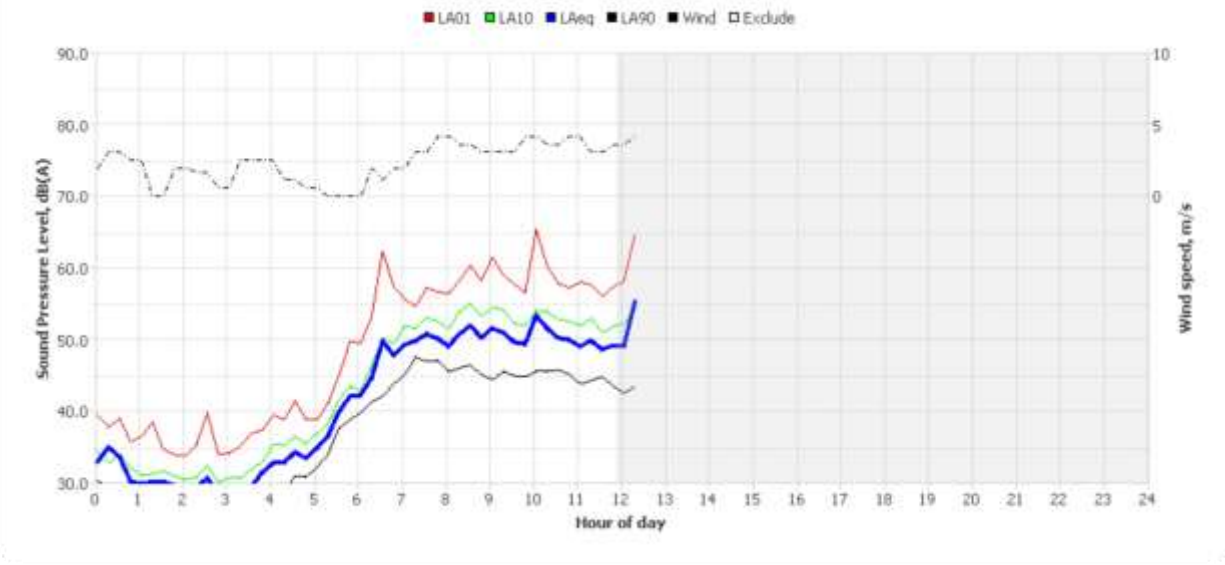

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


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

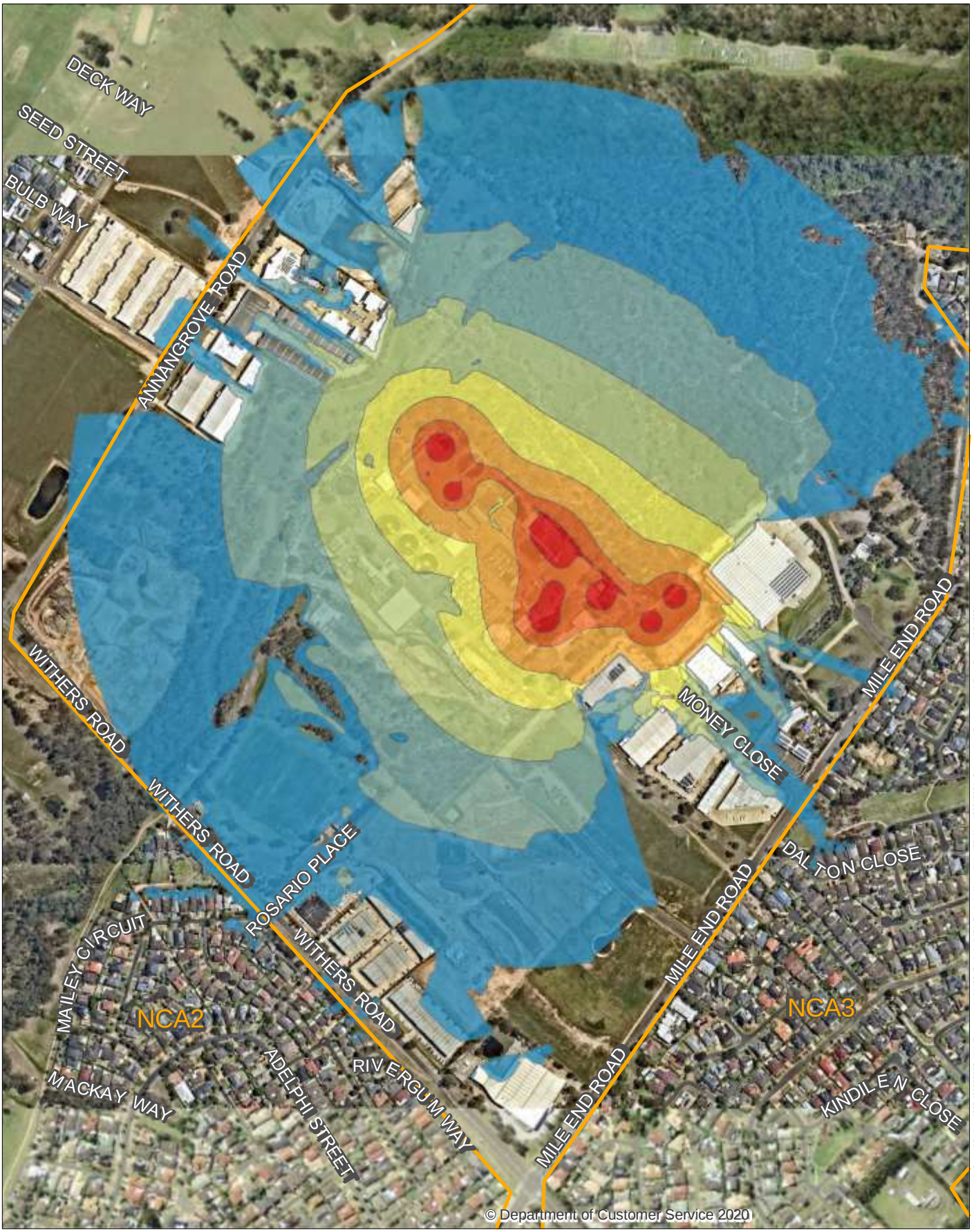

LA01 LA10 LAeq LA90 Wind
Sound Pressure Level, dB(A)
Wind speed, m/s
Hour of day


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

Appendix D

Construction Noise Contour Plots



NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Construction Works

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

N

0 100 200 Meters

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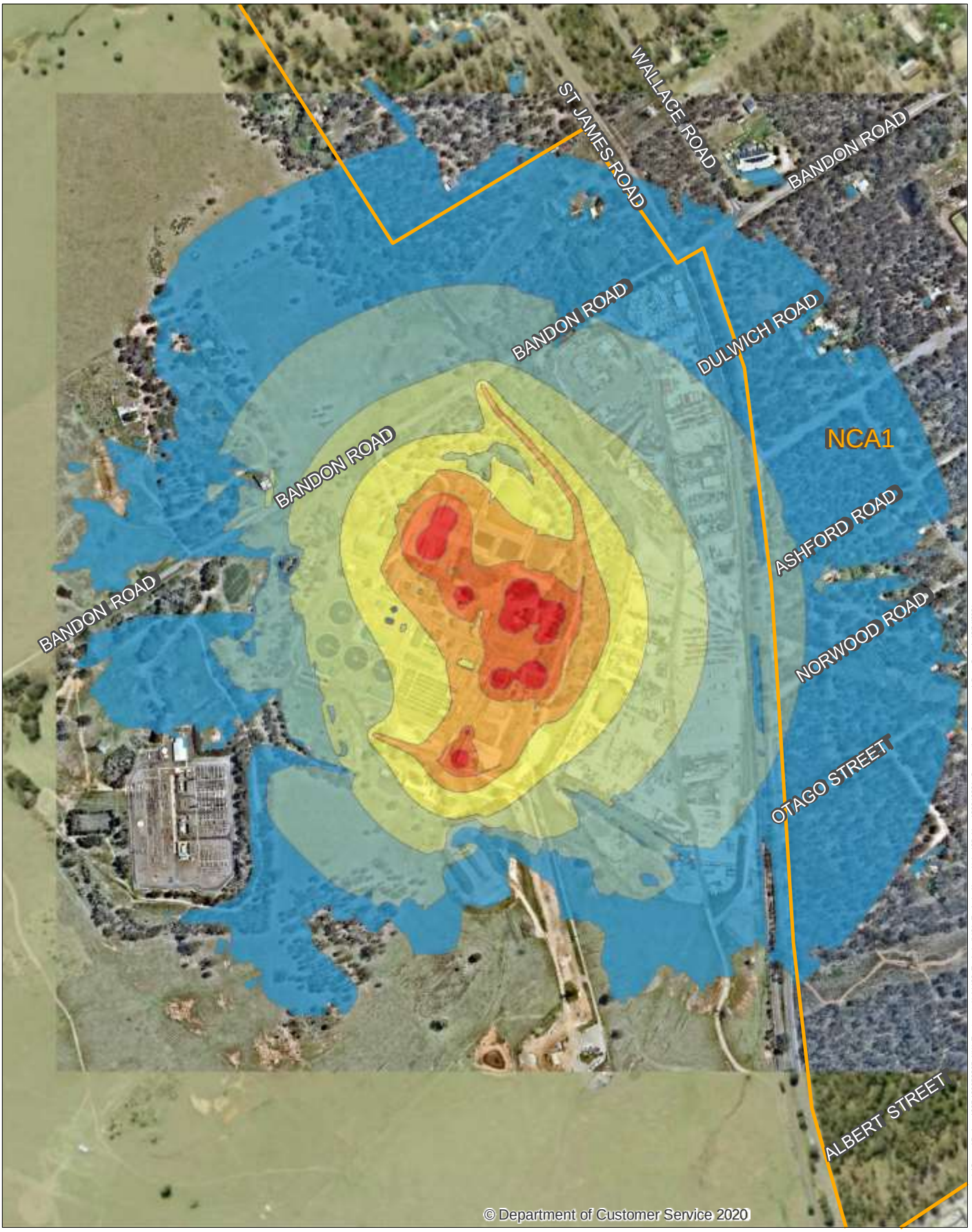

NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Construction Works

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70 75

N 0 100 200 Meters

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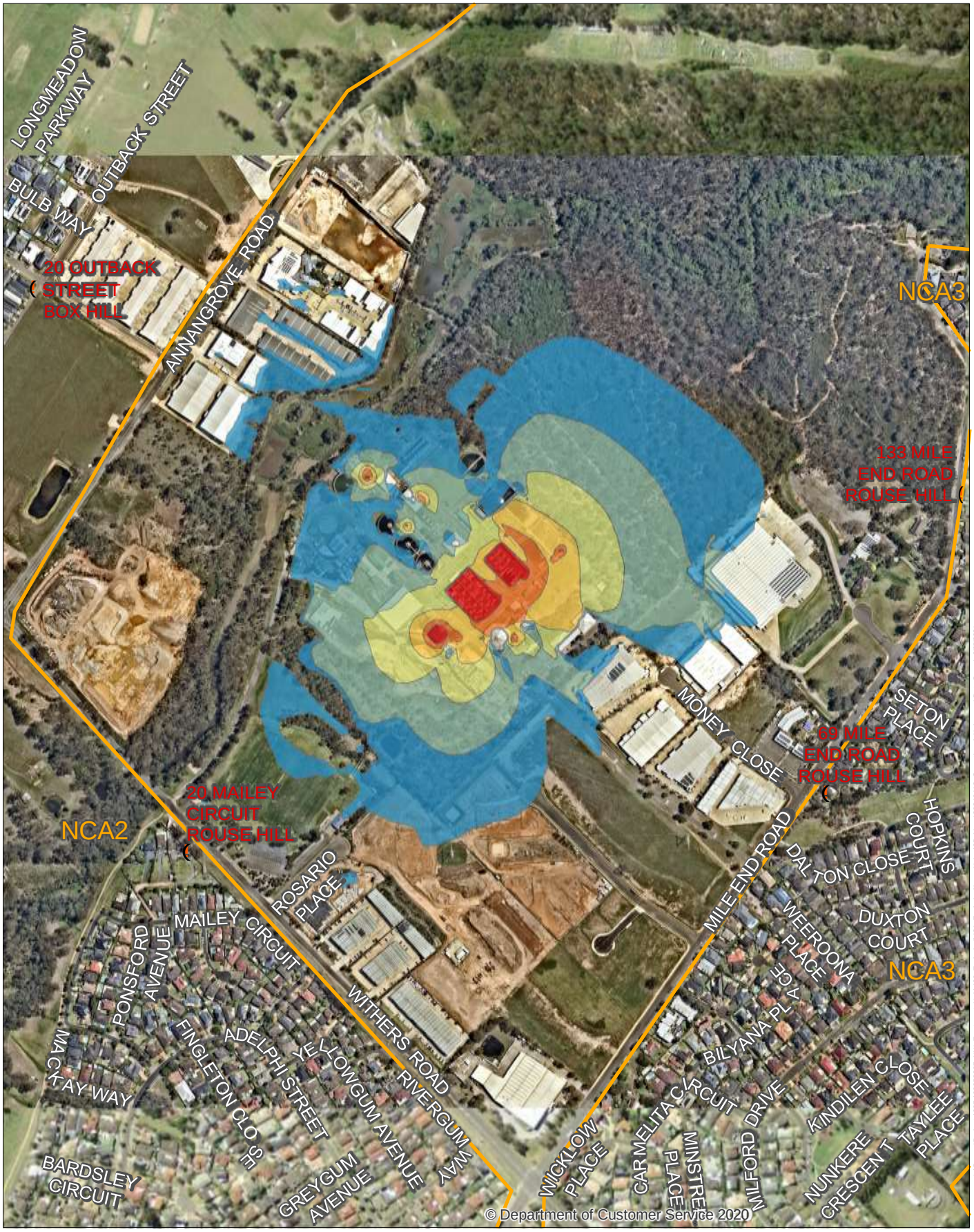
Appendix E

Operational Noise Contour Plots



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

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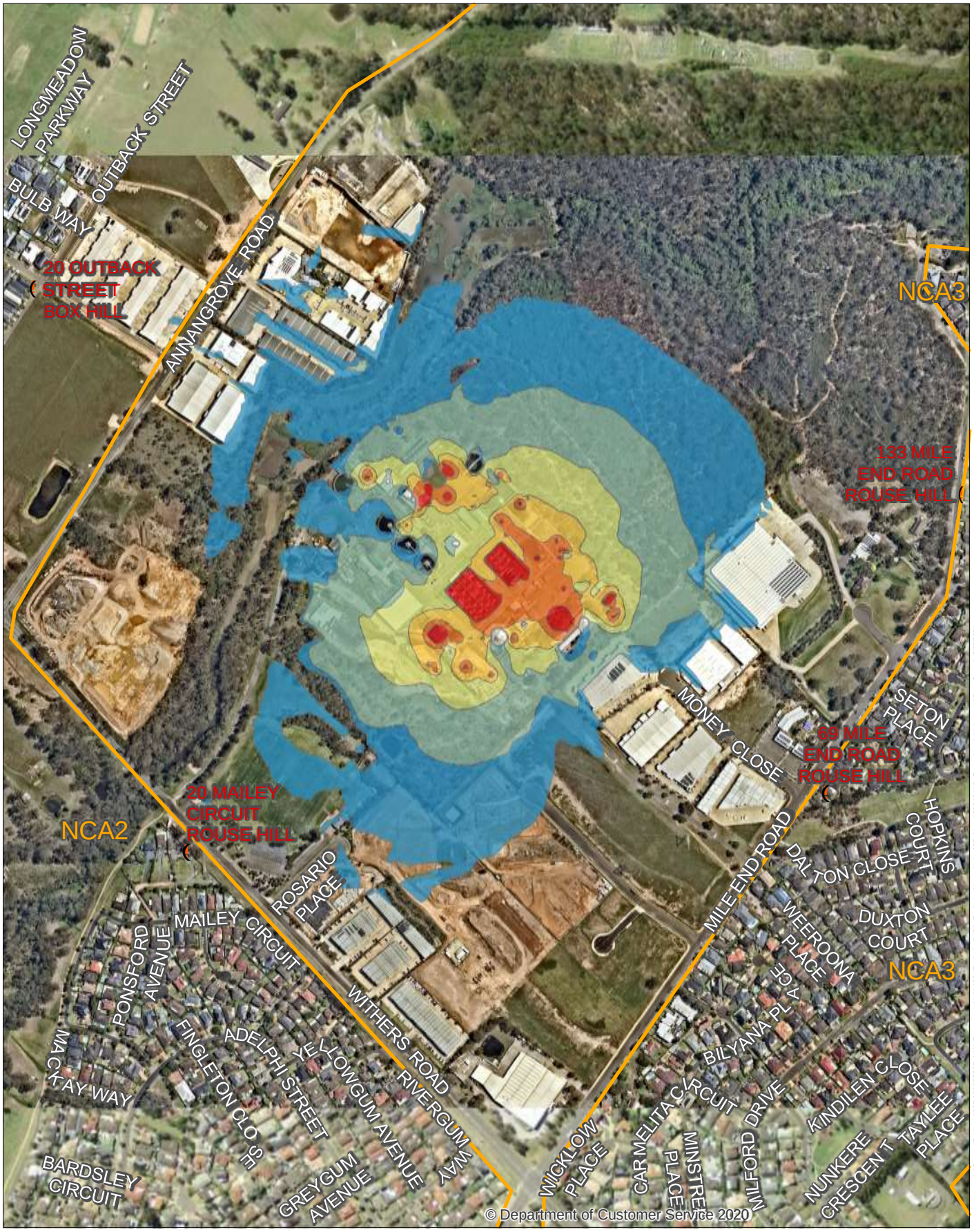

NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Daytime - Updated - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70

N

0 100 200 Meters

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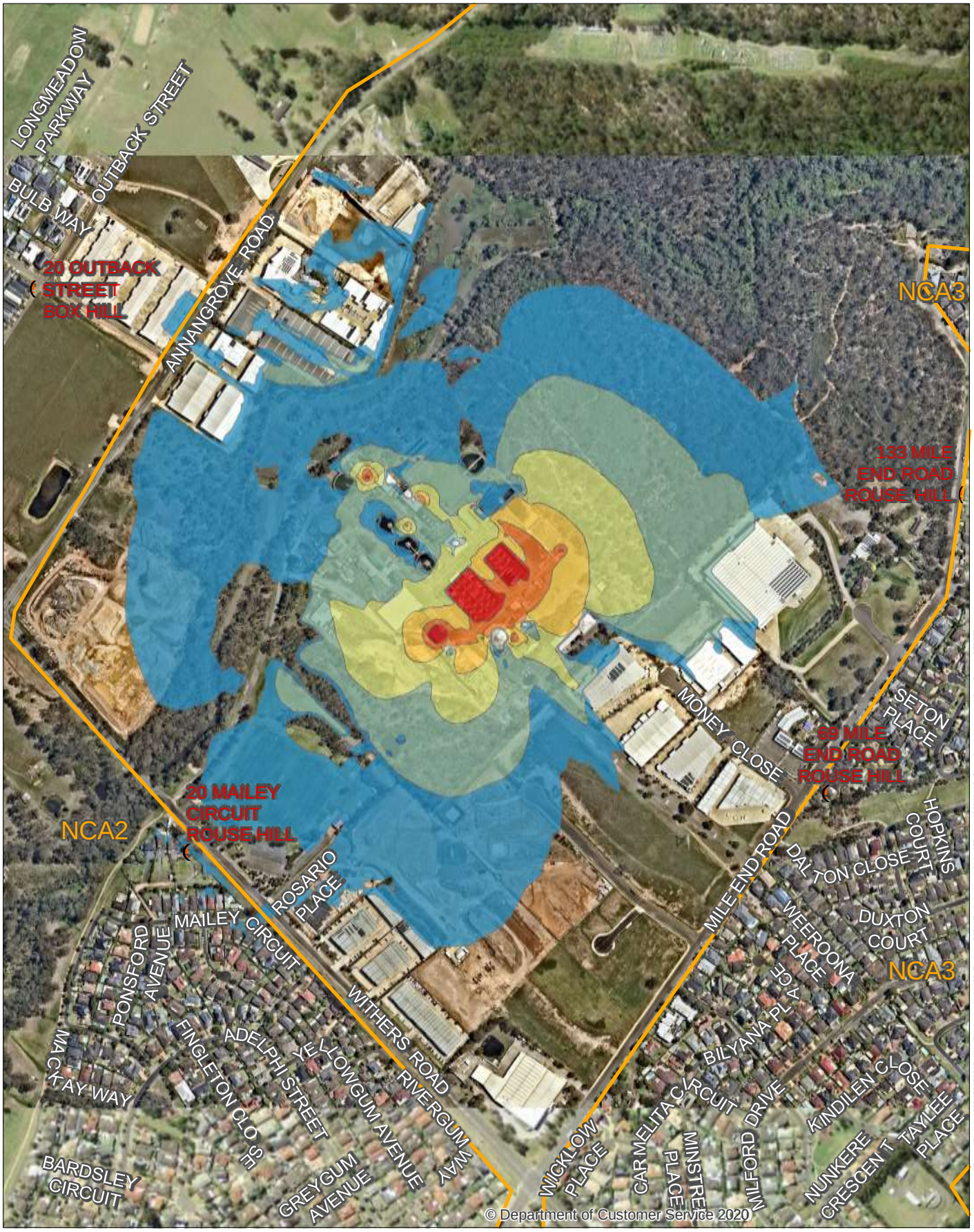

NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Daytime - Existing - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70

N

0 100 200 Meters

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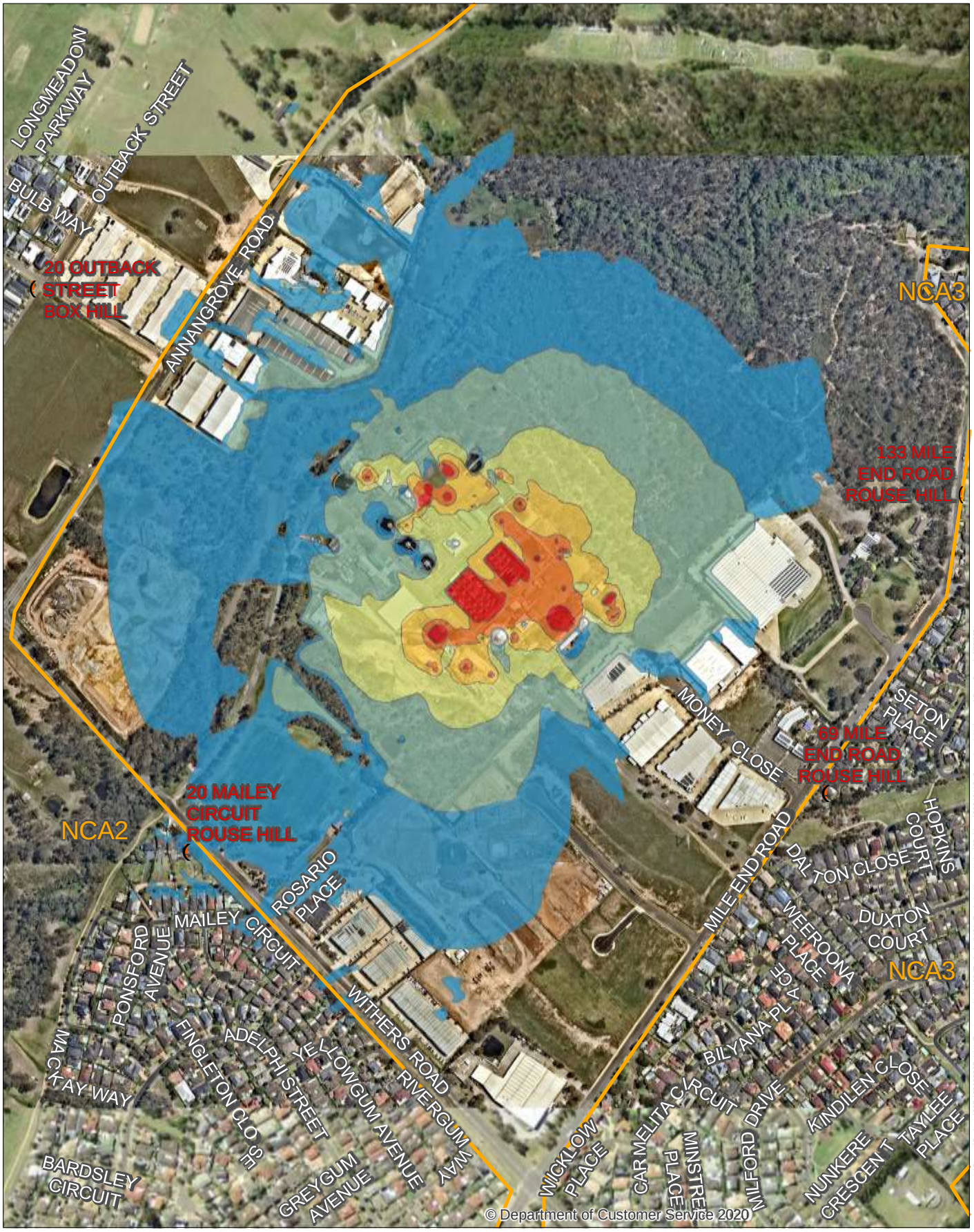

NORTH WEST TREATMENT HUB PROJECT

Rouse Hill WRP - Daytime - Updated - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70

N

0 100 200 Meters

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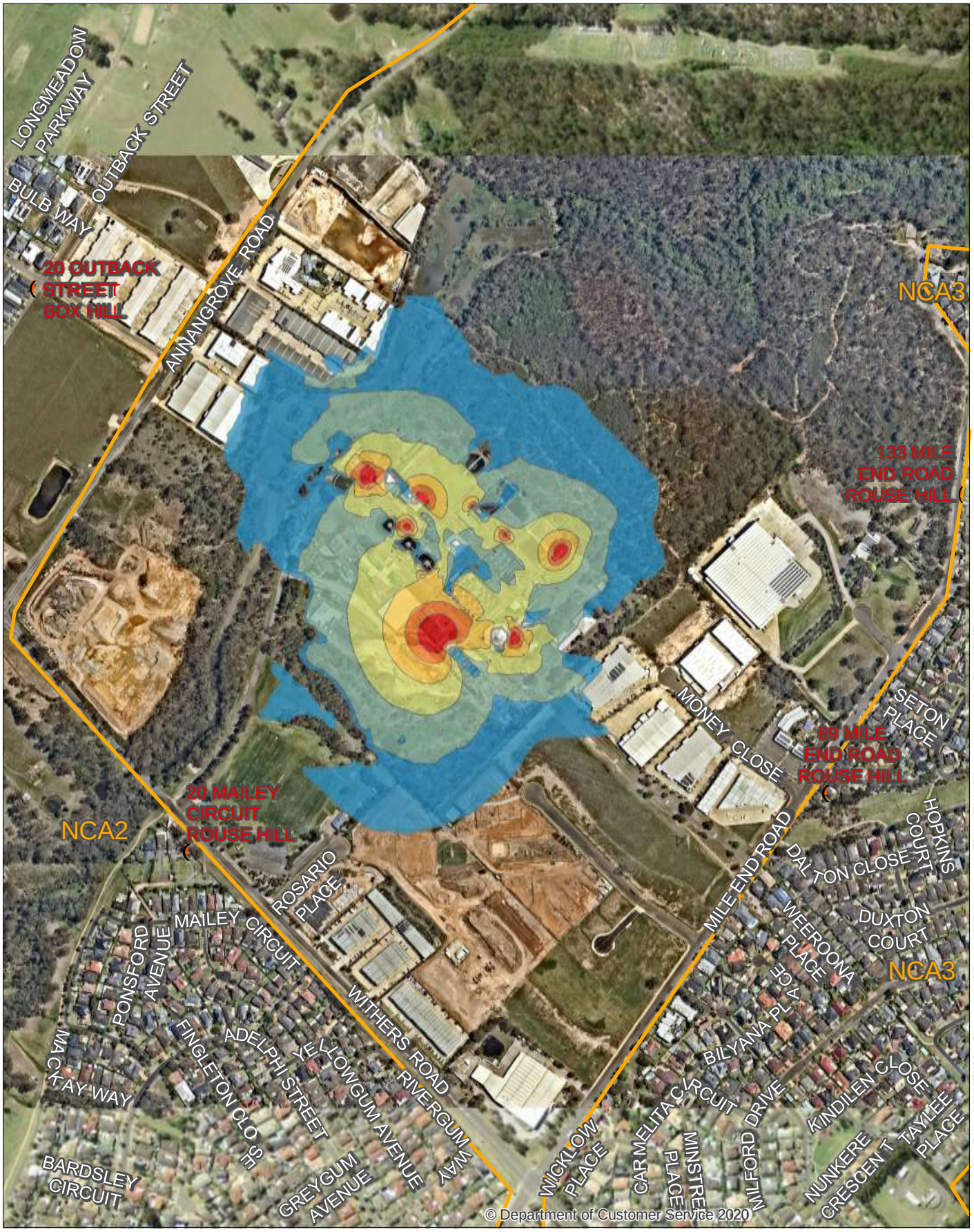

NORTH WEST TREATMENT HUB PROJECT

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

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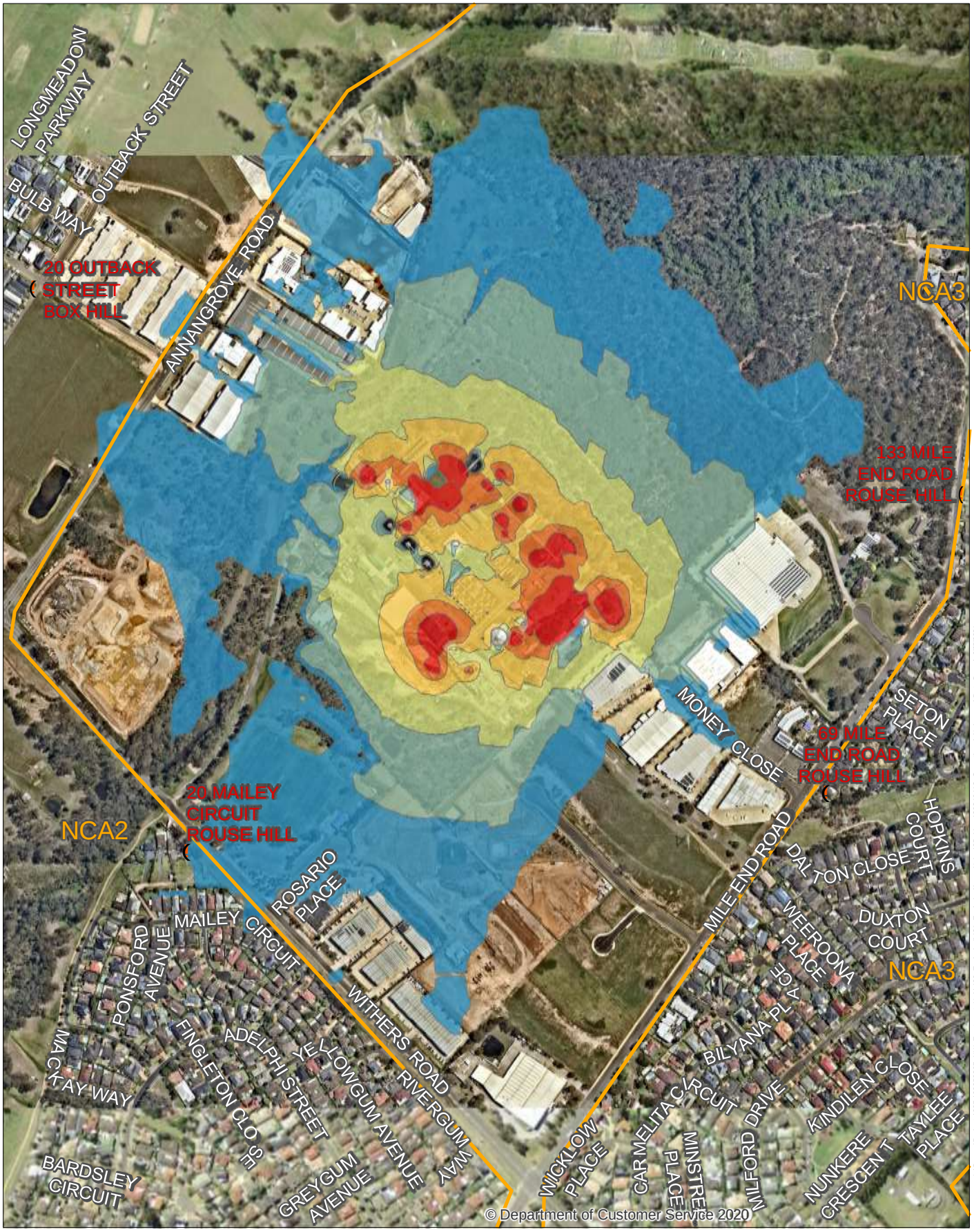

NORTH WEST TREATMENT HUB PROJECT

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

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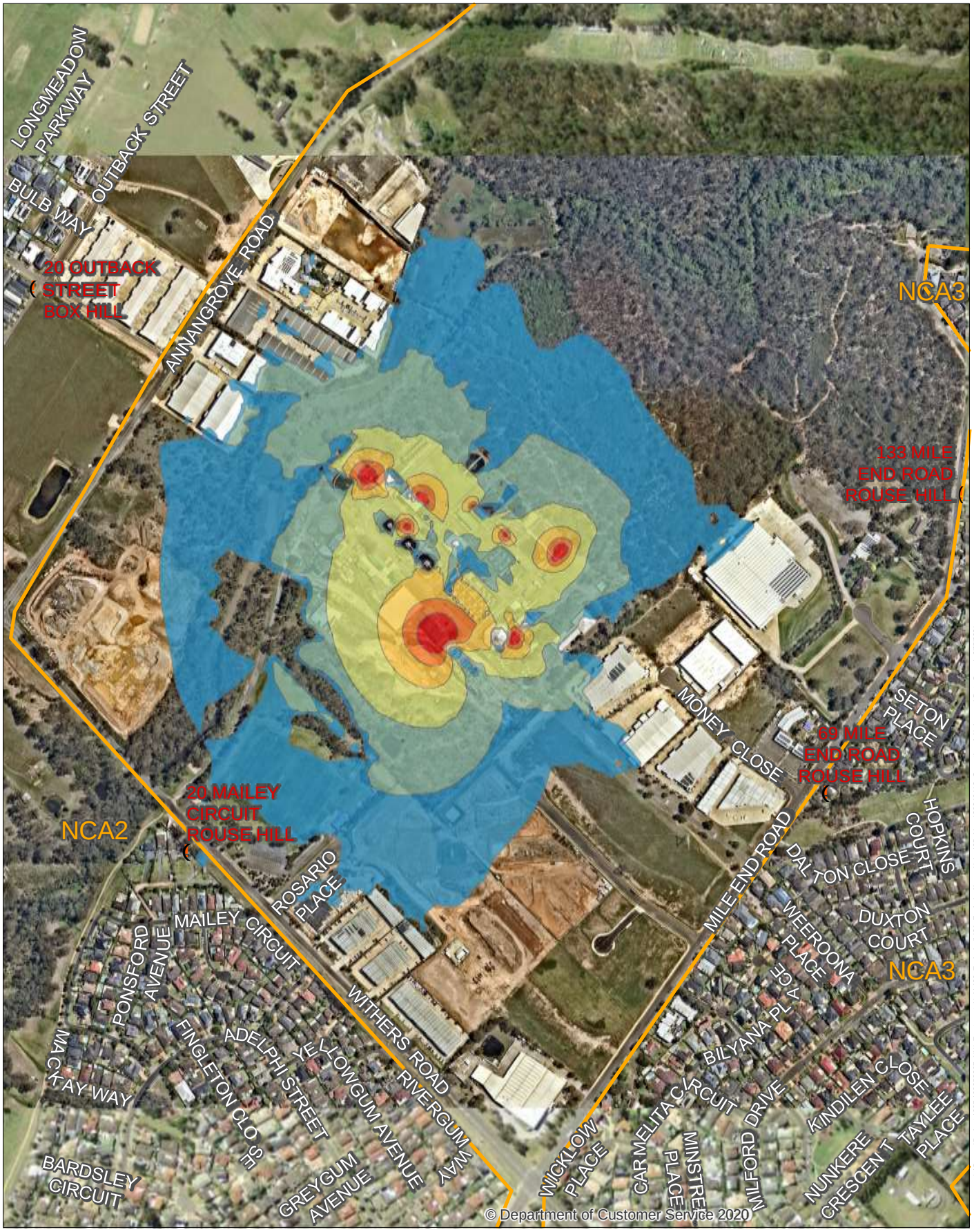

NORTH WEST TREATMENT HUB PROJECT

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

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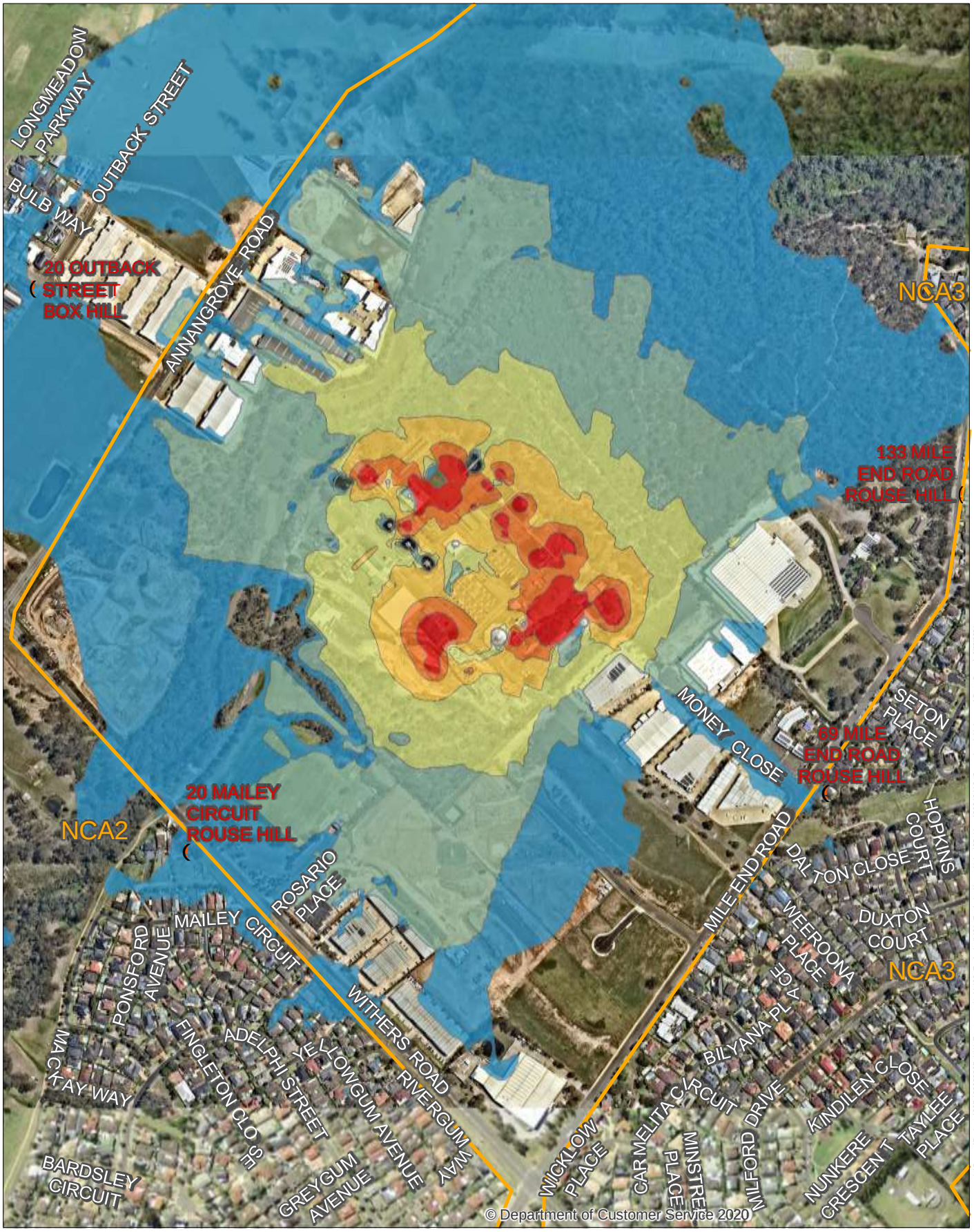

NORTH WEST TREATMENT HUB PROJECT

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

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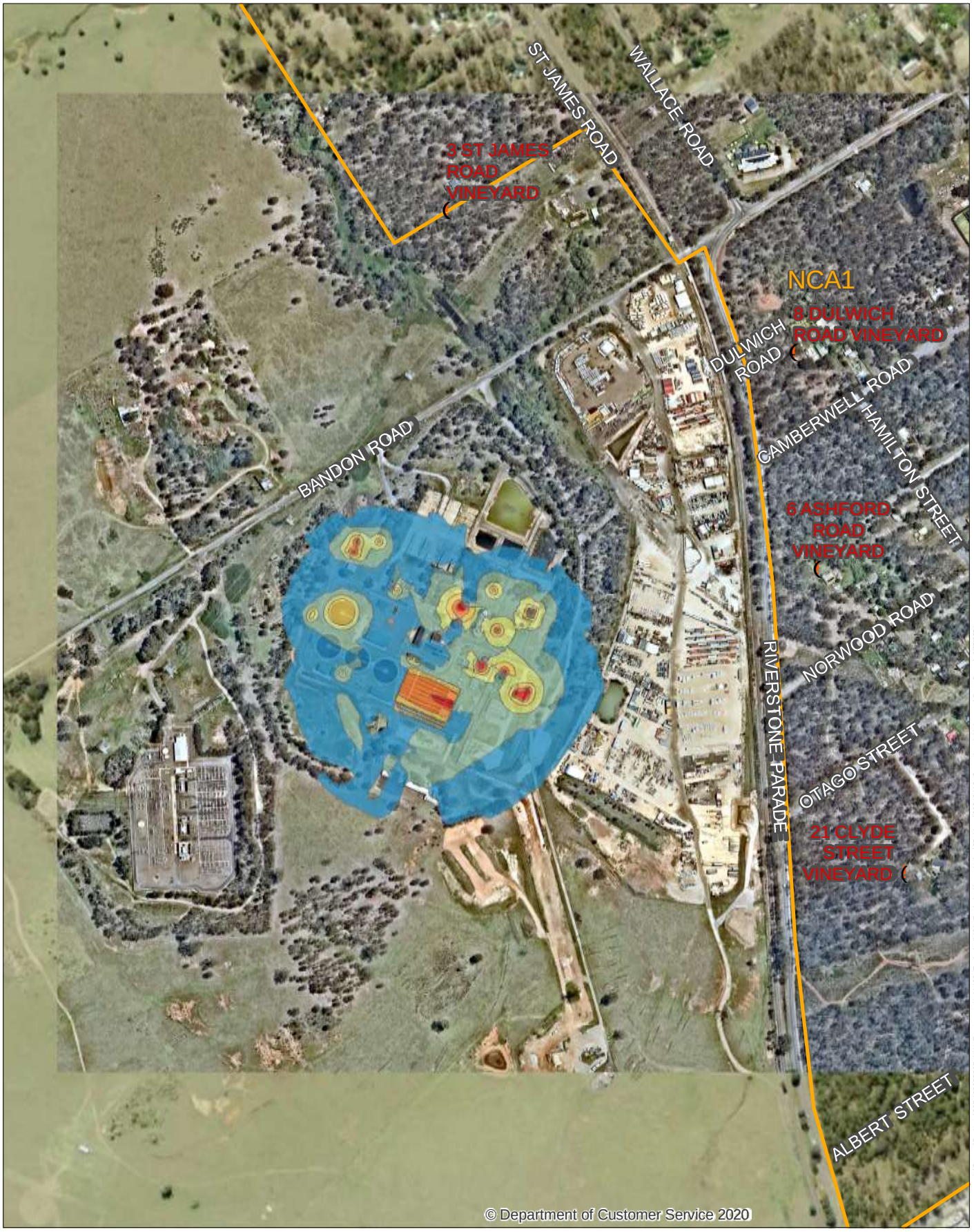

NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Day - Existing - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70

N

0 100 200 Meters

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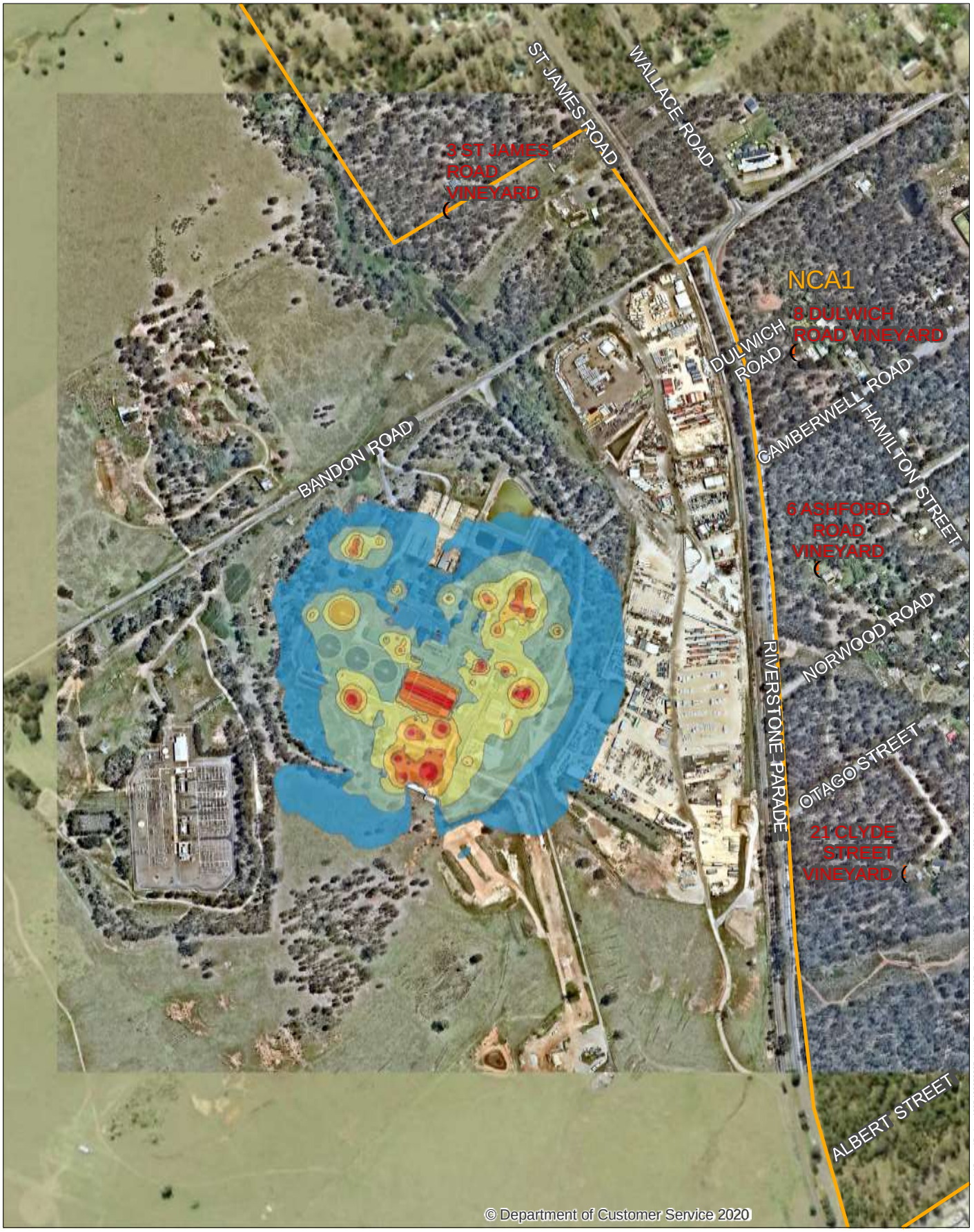

NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Day - Updated - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70

N

0 100 200 Meters

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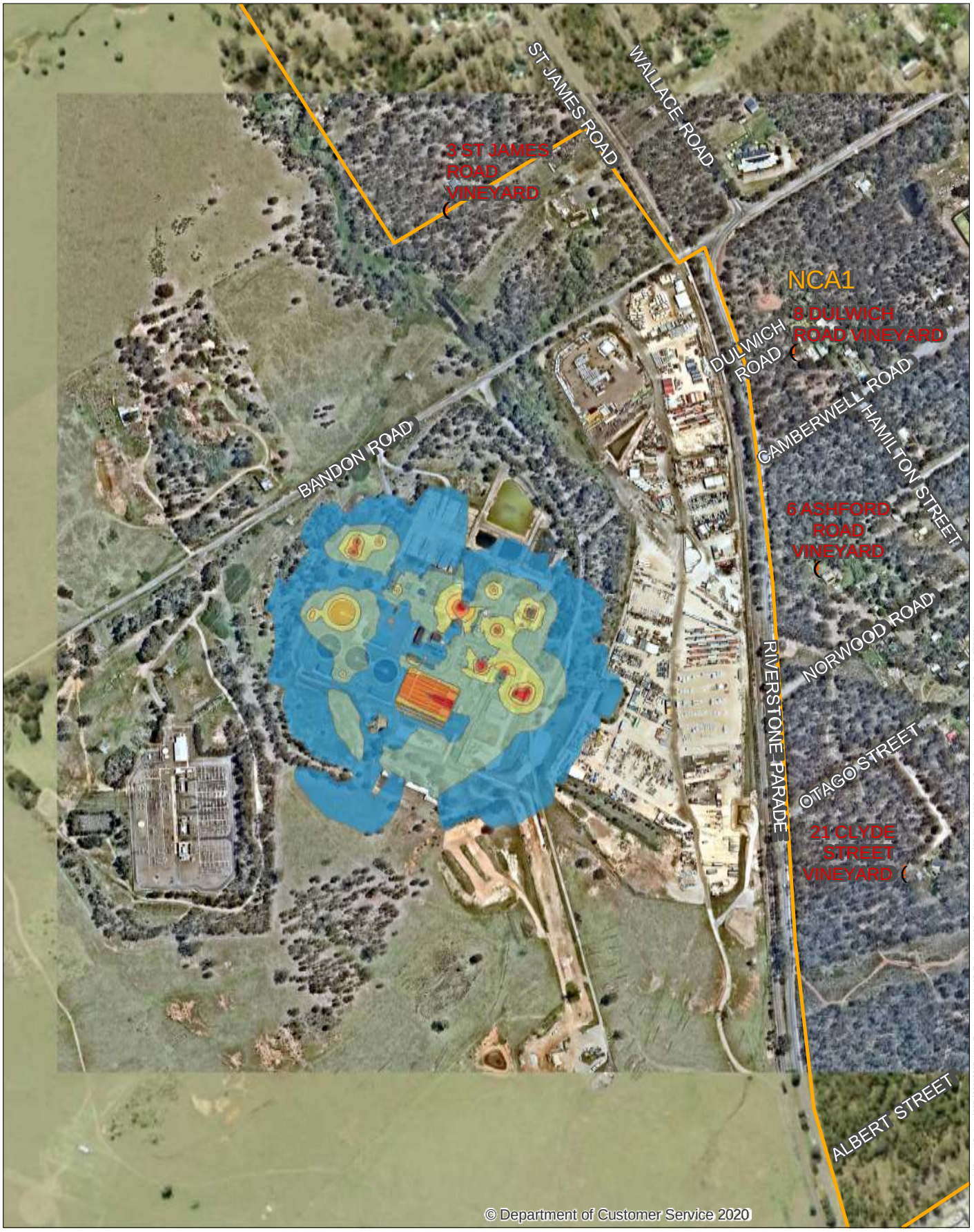

NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Day - Existing - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70

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0 100 200 Meters

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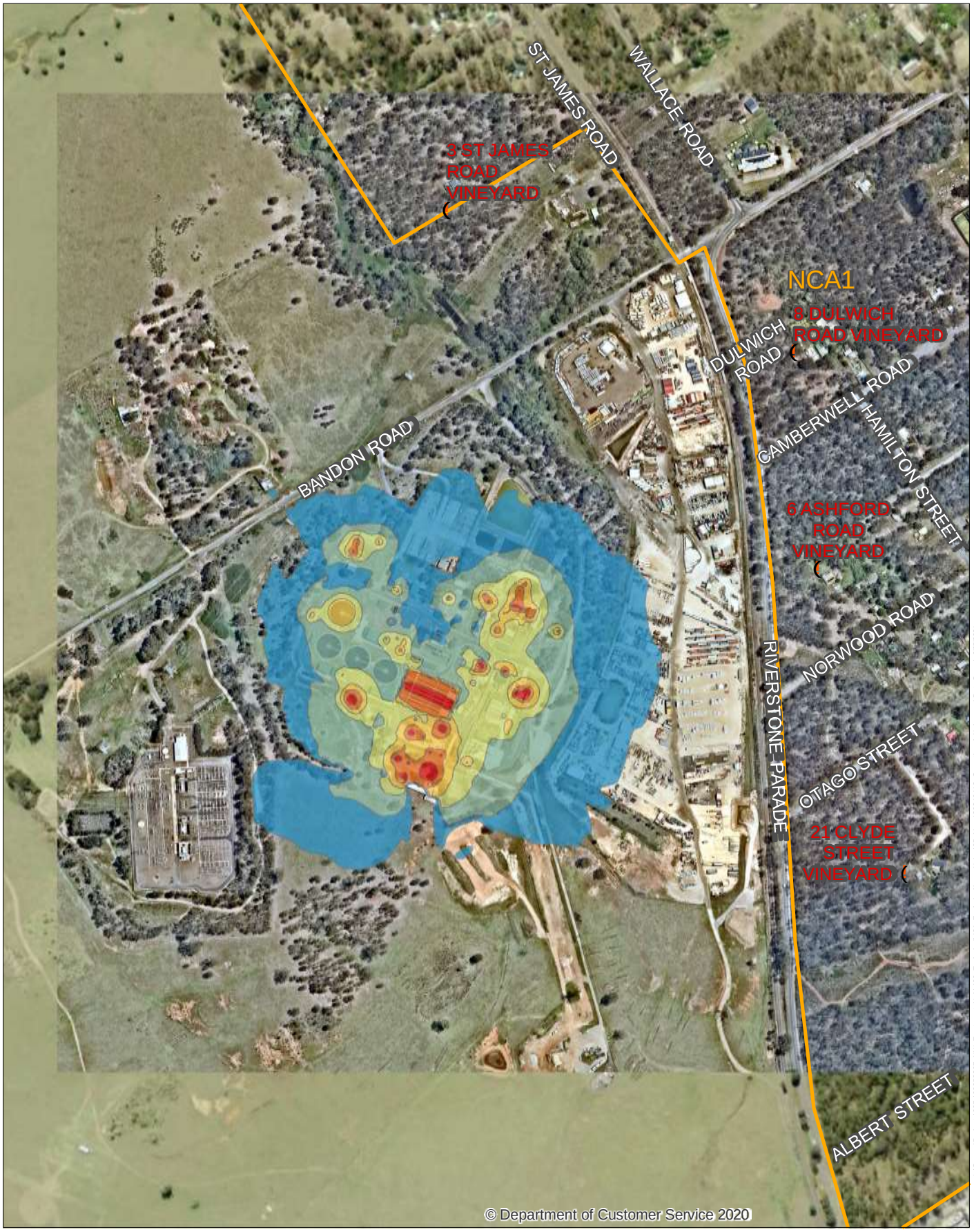

NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Day - Updated - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

45 50 55 60 65 70

N

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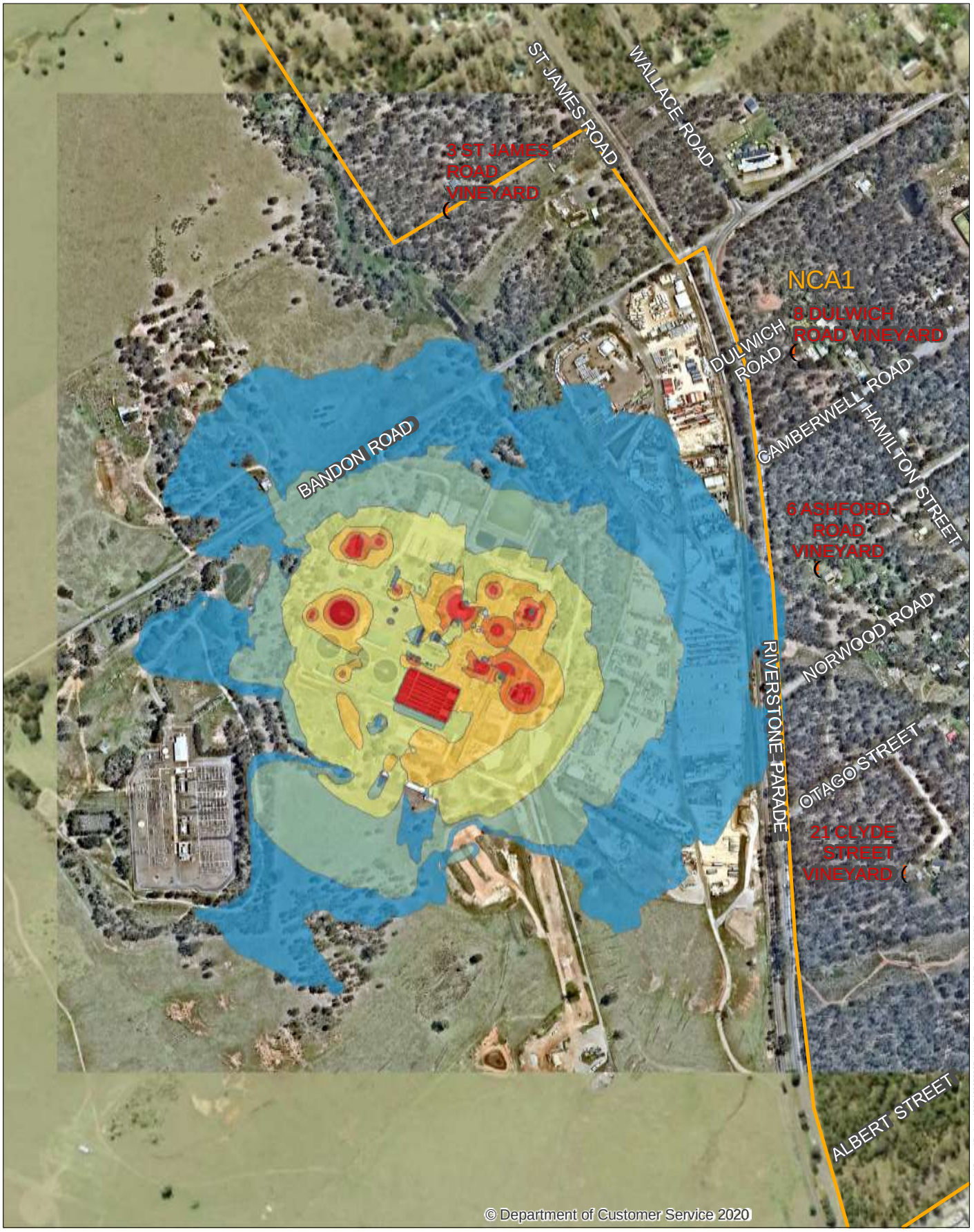

NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Night - Existing - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

35 40 45 50 55 60

N

0 100 200 Meters

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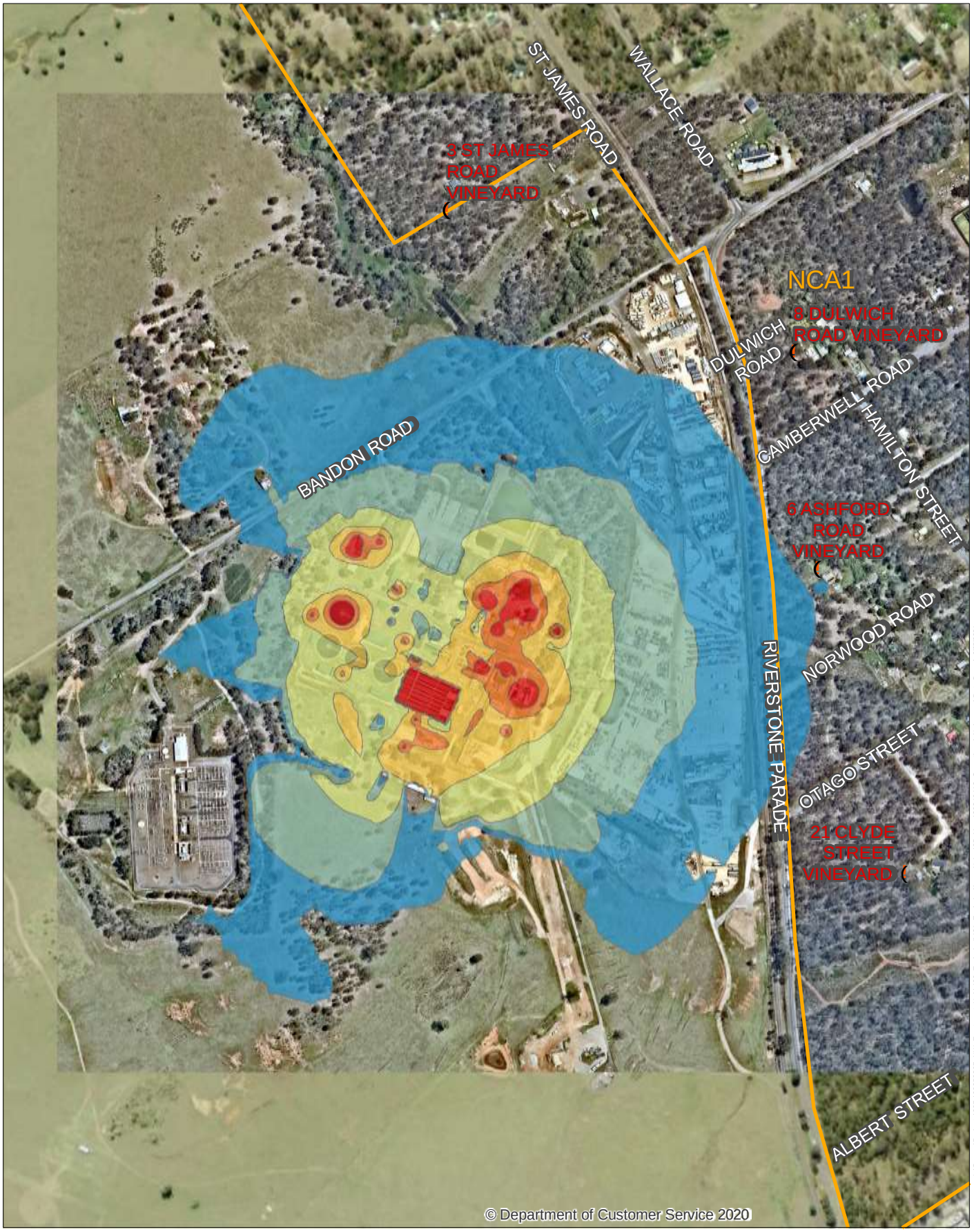

NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Night - Updated - Neutral Weather

Sound Pressure Level, L_{Aeq} dBA

35 40 45 50 55 60

N 0 100 200 Meters

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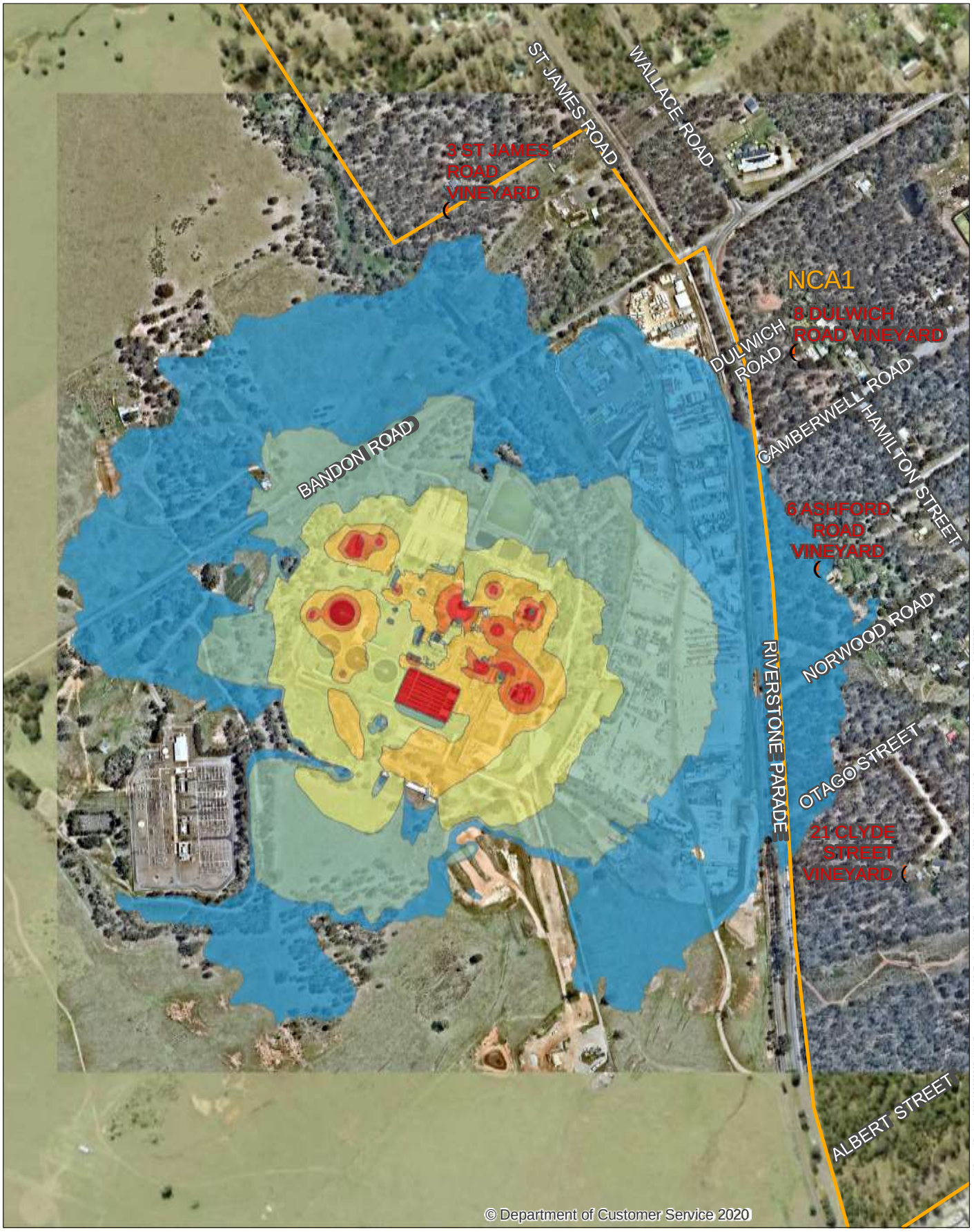

NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Night - Existing - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

35 40 45 50 55 60

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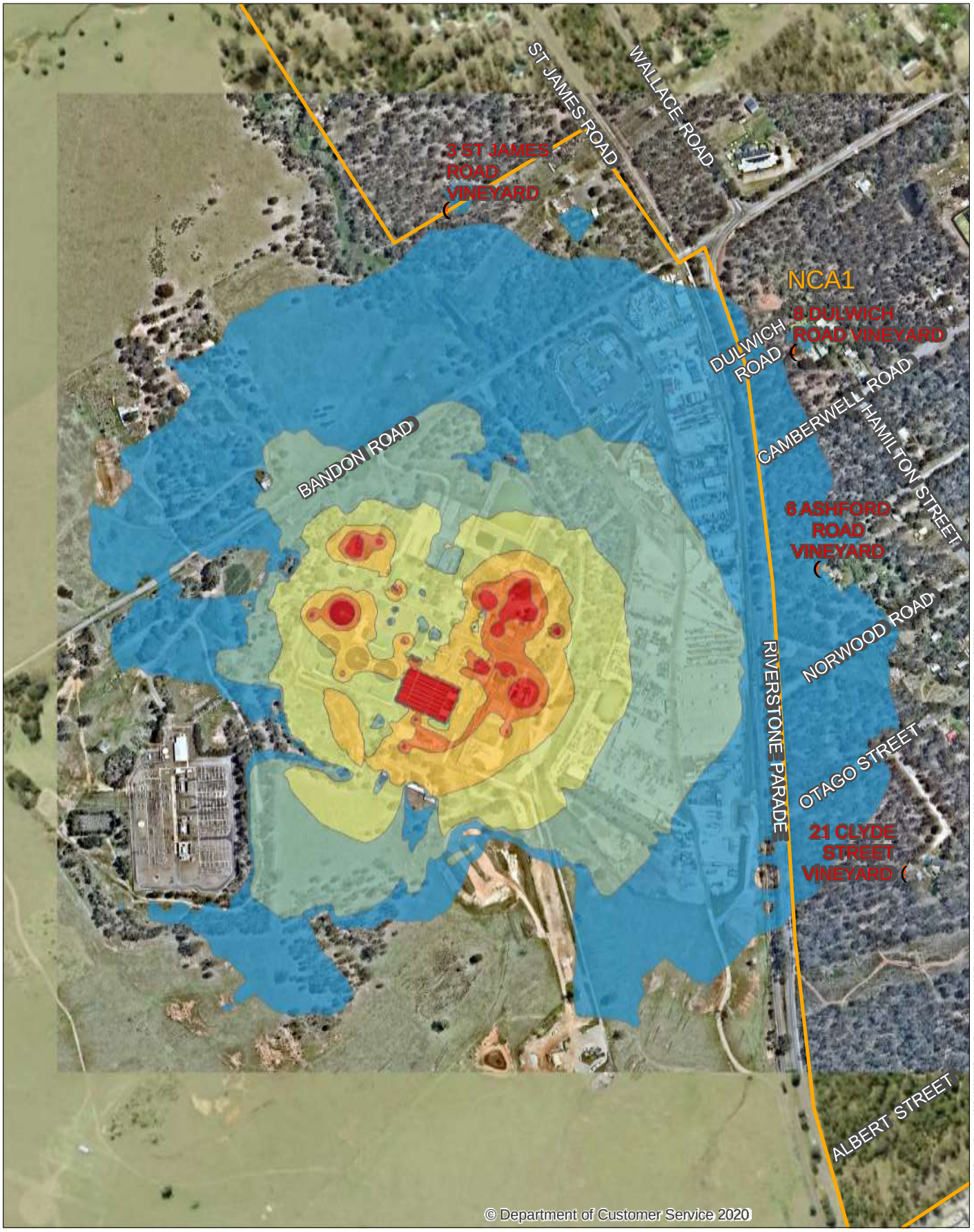

NORTH WEST TREATMENT HUB PROJECT

Riverstone WWTP - Night - Updated - Adverse Weather

Sound Pressure Level, L_{Aeq} dBA

35 40 45 50 55 60

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