Prepared for
Aeria Management Group (Bankstown Airport Pty Ltd)
ABN: 50 083 058 637

AECOM

Bankstown Airport Link Road Mixed Use Precinct

Construction and Operational Noise and Vibration Impact Assessment

22-Jul-2024
Bankstown Airport Link Road Mixed Use Precinct
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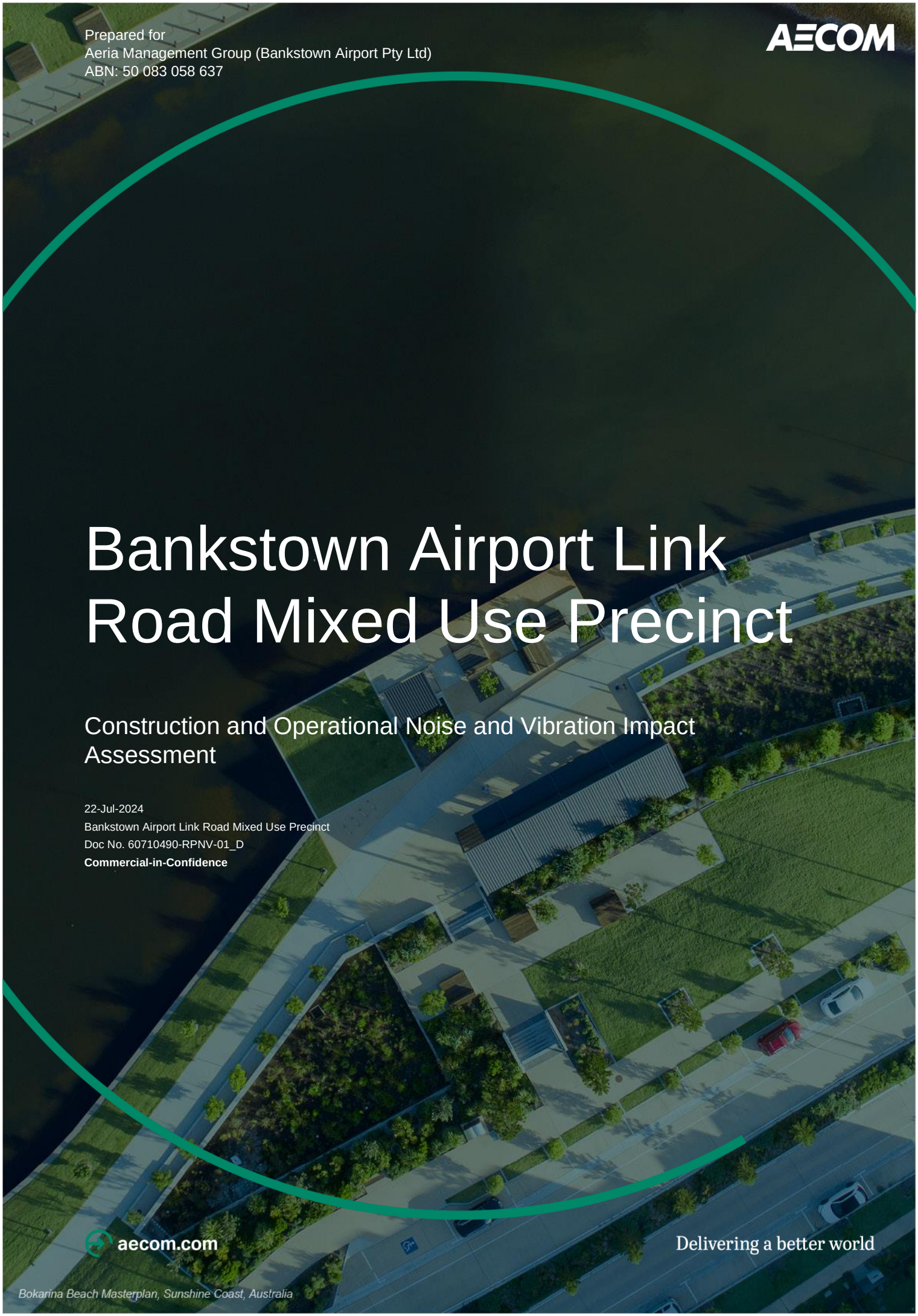

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Bokarina Beach Masterplan, Sunshine Coast, Australia

Bankstown Airport Link Road Mixed Use Precinct

Construction and Operational Noise and Vibration Impact Assessment

Client: Aeria Management Group (Bankstown Airport Pty Ltd)

ABN: 50 083 058 637

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Executive Summary

Bankstown Airport is Sydney's major general aviation airport. It is the third most active general aviation facility in Australia and the fifth most active overall. It caters for charter and private business flights, flight training, freight, emergency and aeromedical services and recreational flights. It operates on a 24/7 basis and currently averages around 220,000 movements per annum with capacity for up to 450,000.

The Link Road Mixed Used Precinct proposal is a development within the Airport that will provide a mix of commercial land uses designed to complement the airport and provide new retail, office and childcare opportunities for the local community. It is to be located at the periphery of the airport, and would also provide small-scale warehouse tenancies.

Aeria Management Group is proposing to submit an application for Major Development Plan (MDP) approval to the Minister for Infrastructure, Transport, Regional Development and Local Government (the Minister) for the development of the proposed Link Road Mixed Used Precinct.

Nearby noise and vibration sensitive receivers were identified and unattended noise measurements were completed to characterise the existing noise environment. The noise levels were used to establish construction Noise Management Levels and operational project noise trigger levels.

Construction noise and vibration

Construction scenarios for the proposal were developed in consultation with the Forge Venture Management project management team, with the proposed plant and equipment detailed within this report. Three distinct construction stages were used in a computer-based noise model to determine the potential construction noise generation. Construction impacts were then assessed at all receivers at various locations across the project area. The ICNG's NMLs are more stringent than the construction noise criteria outlined in the Airports Regulations, therefore ICNG's NMLs have been utilised as the design criteria for the proposal.

A conservative assessment predicts that 49 receivers within Georges Hall will experience noise levels above the NML for the Foundations construction scenario. Of these receivers, eight are expected to be highly affected. For the Site Establishment scenario, 28 receivers are expected to experience noise levels above the NML, with six of these expected to be highly affected. For the Frame and Façade construction scenario, 32 receivers are expected to experience noise levels above the NML, with eight of these expected to be highly affected.

Fourteen non-residential receivers are expected to exceed the construction NMLs for the highest impact construction scenario (Foundations). These receivers include Bankstown Montessori Pre-school, Georges River Grammar School, SUPA IGA Georges Hall, Georges Hall Community Centre, and St Martin's Anglican Church.

An assessment of the likely construction traffic movements cannot be conducted at this stage as existing traffic volumes along access routes are not yet available. A construction traffic assessment should be conducted at the detailed design stage.

The main source of vibration during construction would be the use of piling rigs during earthwork and structural works. Minimum working distances for vibration intensive construction work have been presented. Equipment size would be selected by the construction contractor accounting for the minimum working distances and the distance between the area of construction and the most affected sensitive receiver. If work needs to be carried out within minimum working distances, vibration monitoring would be carried out to manage potential structural damage.

Operational noise and vibration

An operational noise assessment was carried out in accordance with the EPA's *Noise Policy for Industry, 2017,* as required under Bankstown Airport Noise and Vibration Management Plan (NVMP). Likely operational scenarios during the daytime, evening and night-time were assessed at representative receiver locations near to the project area against the project noise trigger levels. In addition, likely maximum noise events from operational activities within the proposed warehousing area were used to assess sleep disturbance at all nearby residential assessment receivers.

Results show predicted operational noise emissions from the proposed site are compliant with the project noise trigger levels provided that the maximum equipment noise levels, traffic movements, noise barriers, and plans of management presented in this report are properly implemented. Noise mitigation strategies provided in this report are high level and should be verified at the detailed design stage.

An assessment of the likely operational road traffic was not conducted at this stage as existing traffic counts along access routes are not yet available. This operational road traffic noise assessment should be conducted at the detailed design stage in accordance with the EPA's *Road Noise Policy*.

Operation of the proposal is not predicted to generate any adverse vibration to nearby sensitive receivers.

Aircraft noise assessment

Based on the location of the precinct with respect to the most up-to-date Bankstown Airport 2039 ANEF chart, the location of the proposal indicates that the development would be 'acceptable' for light industrial and commercial usage and 'conditionally acceptable' for school (childcare centre) usage.

A maximum aircraft noise level of L_{Asmax} 72 dB has been predicted from general aviation aircraft to the site. Indicative Rw values and construction detail have been recommended for the proposed childcare centre. These recommendations should be verified during the detailed design stage, prior to construction. Other sensitive land uses for the site to be determined at a later stage should also be verified prior to construction.

1.0 Introduction

Bankstown Airport is Sydney's major general aviation airport. It is the third most active general aviation facility in Australia and the fifth most active overall. It caters for charter and private business flights, flight training, freight, emergency and aeromedical services and recreational flights. It operates on a 24/7 basis and currently averages around 220,000 movements per annum with capacity for up to 450,000.

Aeria Management Group is proposing to submit an application for Major Development Plan (MDP) approval to the Minister for Infrastructure, Transport, Regional Development and Local Government (the Minister) for the development of land in the north-east sector of Bankstown Airport.

The Bankstown Airport Link Road Mixed Use Precinct is located within the "*Airport Business Zone*" of Bankstown Airport and is currently a vacant site between Bankstown Montessori Pre School, SUPA IGA Georges Hall and Georges River Grammar School to the west, with residential properties to the north and east and the airport to the south.

The proposal will provide a mix of commercial land uses designed to complement the airport and provide new retail, office and childcare opportunities for the local community at the periphery of the airport, as well as small-scale warehouse tenancies.

Aeria Management Group (Bankstown Airport Proprietary Ltd) commissioned AECOM Australia Pty Ltd (AECOM) to conduct a construction and operational noise and vibration impact assessment for the Link Road Mixed Use Precinct to support the MDP approval process.

1.1 Scope of works

The scope of this acoustic assessment was to:

- Identify nearby noise sensitive receivers potentially affected by the construction and operation of the project.
- Establish construction and operational noise management levels based upon the measured background noise levels and the following documents:
  - Airports (Environment Protection) Regulations 1997
  - NSW Environmental Protection Authority (EPA) Noise Policy for Industry (NPfI)
  - EPA's NSW Road Noise Policy (RNP)
  - Bankstown Airport - Noise and Vibration Management Plan (NVMP), SMA-EN-BAL-PLN-000709
- Undertake a construction and operational noise impact assessment at nearby sensitive receivers, in accordance with Airports (Environment Protection) Regulations 1997, the NVMP, ICNG and NpfI.
- Undertake a construction and operational traffic noise assessment in accordance with the RNP;
- Consider aircraft noise impacts in accordance with Australian Standard AS 2021: 2015 *Acoustics – Aircraft Noise Intrusion – Building Siting and Construction* (AS 2021:2015)
- Consider potential operational and construction vibration impacts.
- Recommend indicative construction and operational noise mitigation measures if required to meet established noise management levels.

1.2 Relevant policies and guidelines

The following policies and guidelines are relevant for this assessment and have been utilised or referenced where appropriate:

- *Airports (Environment Protection) Regulations,* Office of Parliamentary Counsel, Canberra, 1997
- Bankstown Airport - Noise and Vibration Management Plan (NVMP), Bankstown Airport document number: SMA-EN-BAL-PLN-000709, 2019.
- *Interim Construction Noise Guideline* (ICNG), Department of Environment and Climate Change (DECC), 2009.
- *Assessing Vibration: a technical guideline* (AVATG), Department of Environment and Conservation (DEC), 2006.
- *NSW Road Noise Policy* (RNP), Department of Environment Climate Change and Water (DECCW), 2011.
- *Noise Policy for Industry (NPfI),* Environmental Protection Authority (EPA), 2017.
- Australian/New Zealand Standard AS/NZS IEC 61672.1:2019 *Electroacoustics - Sound level meters – Part 1: Specifications*, 2019.
- Australian Standard AS 2021:2015 *Acoustics – Aircraft noise intrusion – Building siting and construction,* 2015.

2.0 Noise and Vibration Criteria

2.1 Airports (Environment Protection) Regulations 1997

Bankstown Airport is regulated by the Commonwealth Government, and the noise and vibration emission requirements are based on Commonwealth Legislation. The *Airports (Environment Protection) Regulations 1997* (Airports Regulations) outlines Bankstown Airport's major obligations with respect to environmental matters at the Airport.

Table 1 presents a summary of the key acoustic requirements from the Airport Regulations applicable to this proposed development.

Table 1 Relevant Airports Regulations acoustic requirements

Reference	Subject	Provision
Part 2 – What is pollution or excessive noise		
2.04	What is offensive noise	1. Noise that is offensive occurs when noise is generated at a volume, or in a way, or under a circumstance, that, in the opinion of an airport environment officer, offensively intrudes on individual, community or commercial amenity. 2. In forming an opinion, an airport environment officer must have regard to: a. the volume, tonality and impulsive character (if any) of the noise; and b. the time of day, and duration, of the noise; and c. background noise levels at the time the noise is generated; and d. the location, in relation to the source of the noise, of: i. sensitive receptors; or ii. if there is no affected sensitive receptor—commercial receptors; and e. the excessive noise guidelines in Schedule 4 of the regulations. Note: Generation of excessive noise is not, of itself, an offence under the Regulations (refer to Schedule 4 – 1.01).

Reference	Subject	Provision
Part 4—Duties of operators of undertakings at airports		
4.06	General duty to prevent offensive noise occurring	1. The operator of an undertaking at an airport must take all reasonable and practicable measures: a. to prevent the generation of offensive noise from the undertaking; or b. if prevention is not reasonable or practicable—to minimise the generation of offensive noise from the undertaking. An operator of an undertaking at an airport is complying with that duty if the noise is not offensive or meets the guidelines in Schedule 4 of the regulations (or any local standard set by or authorised by the Minister).
Schedule 4—Excessive noise—guidelines		
Schedule 4 – 1.01	Purpose of Schedule	For subregulation 2.04 (2) of the Regulations, this Schedule sets out indicators of noise that is excessive. Note: Generation of excessive noise is not, of itself, an offence under the Regulations.
Schedule 4 – 2.02	Noise from construction, etc.	The $L_{A10\ (15\ min)}$ noise level generated from construction, maintenance or demolition of a building or other structure at an airport should not exceed 75 dB(A), at the site of a sensitive receptor.
Schedule 4 – 2.03	Noise from road traffic	Noise generated from road traffic on the site of an operator of an undertaking at an airport should not exceed: a. $L_{Aeq\ (24\ hour)}$ noise level of 60 dB(A) for a 24 hour period of measurement; and b. $L_{Aeq\ (8\ hour)}$ noise level of 55 dB(A), for an 8 hour period of measurement from 22:00 hours on a particular day to 06:00 hours on the following day.

The Airport Regulations provides general principles to be applied by the Airport's environment officer. In addition, the Airport Regulations provide noise emission criteria generated from construction, maintenance or demolition of a building or other structures at an airport.

2.2 NSW Government policies and guidelines

The key NSW Government policies and guidelines considered as part of this construction and operational noise and vibration impact assessment for Bankstown Airport Link Road Mixed Use Precinct are described in the following sections. These policies and guidelines are not statutory documents but may be referenced in instruments in relation to the assessment and management of construction and operational noise sources at the Airport.

It should be noted that the NSW Environment Protection Authority (EPA) has no role in regulating the noise and vibration generated by activities within Bankstown Airport.

2.2.1 Interim Construction Noise Guideline

The EPA's *Interim Construction Noise Guideline* (ICNG) is a NSW Government document that identifies ways to manage impacts of construction noise on residences and other noise sensitive land uses. It is the principal guideline for the assessment and management of construction noise in NSW and is used to establish construction noise management levels.

2.2.2 Noise Policy for Industry

Bankstown Airport Noise and Vibration Management Plan (NVMP), Section 6.4.2 *Masterplan noise management, nominates the* EPA's *Noise Policy for Industry* (NpfI) as the relevant guideline for

assessing operational noise from the ongoing upgrading and replacement of existing facilities at the Airport.

The NPfI is a NSW Government document that sets out guidelines for the assessment and control of industrial noise. The overall aim is to allow the need for industrial activities to be balanced with the desire for quiet in the community. The policy outlines processes to help strike a feasible and reasonable balance between the establishment and operation of industrial activities and the protection of the community from noise levels that are intrusive or unpleasant. The NPfI provides appropriate criteria for the assessment of ground-based Airport operational activities since these activities are characteristically industrial in nature.

2.2.3 Assessing Vibration: a technical guideline

The EPA's *Assessing Vibration: a technical guideline* (AVATG) is a NSW Government document that presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques.

2.2.4 NSW Road Noise Policy

The EPA's NSW Road Noise Policy (RNP) is a NSW Government document that aims to identify the strategies that address the issue of road traffic noise from new traffic-generating developments. The Road Noise Policy also defines criteria to be used in assessing the impact of such noise.

3.0 Existing Acoustic Environment

3.1 Site description

The proposed site is located on the northern side of Bankstown Airport, at the location of the existing Birdwood Reserve separated by Link Road to the south and Birdwood Road to the north. Residential premises are located directly adjoining the site to the east, and north across Birdwood Road. Industrial receivers within Bankstown airport are located to the south, whilst commercial and educational receivers (Georges River Grammar School) exist to the west, refer to Figure 1.

The acoustic environment is dominated by road traffic noise from Link Road and Birdwood, in addition to aircraft noise from Bankstown Airport.

3.2 Noise and vibration sensitive receivers

Noise and vibration sensitive receivers within the study area have been identified as residential, and non-residential properties using aerial photography and on-site surveying. Residential receivers surrounding the proposal area are mostly single storey residential dwellings. Given the localised location of the proposal and nearby sensitive receivers, all receivers have been considered in one noise catchment area (NCA). Non-residential receivers in the area include schools, community centres, places of worship, childcare centres, commercial premises, and industrial premises.

3.2.1 Representative receivers

Residential and non-residential receivers potentially affected by the construction and operation of the project have been identified and are shown in Figure 1.

The nearest residential receivers are located directly adjoining the site to the east. The nearest industrial receiver is located to the south of Link Road, approximately 45 metres from the site boundary. The nearest potentially impacted receivers assessed in the construction and operational noise assessment are listed in Table 2.

Figure 1 Site map showing NCAs, noise monitoring location, and representative receiver locations

Table 2 Nearest potentially impacted residential and non-residential receivers

Receiver number	Usage	Address
Residential receivers		
R1	Residential	179 Birdwood Road, Georges Hall
R2	Residential	173A Birdwood Road, Georges Hall
R3	Residential	531 Marion Street, Georges Hall
R4	Residential	533 Marion Street, Georges Hall
R5	Residential	192 Birdwood Road, Georges Hall
R6	Residential	203 Birdwood Rd, Georges Hall (upper floor level)
Non-residential receivers		
E1	Education	Bankstown Montessori Pre-school 179b Birdwood Road, Georges Hall
E2	Education	Georges River Grammar 53 Georges Crescent, Georges Hall
CO1	Community Centre	Georges Hall Community Centre 188 Birdwood Road, Georges Hall
W1	Place of Worship	St Martin's Anglican Church 176 Birdwood Road, Georges Hall
C1	Commercial	SUPA IGA Georges Hall 195 Birdwood Road, Georges Hall
I1	Industrial	Heliflite 121 Link Road, Bankstown Aerodrome
I2	Industrial	Transit Systems - Bankstown Bus Depot 127 Link Road, Bankstown Aerodrome

3.3 Noise monitoring

Ambient noise monitoring was conducted at one location within the study area in November 2023. This included both long term monitoring and short-term attended measurements.

3.3.1 Instrumentation

A Rion NL-52 noise logger was installed on the subject site (5012/DP1176822). The noise logging location is presented in Figure 1.
The sound level meter used to conduct attended noise measurements was a Bruel & Kjaer 2250 (Serial Number 3009329). All the acoustic instrumentation employed during the noise measurements comply with the requirements of Australian/New Zealand Standard AS/NZS IEC 61672.1:2019 *Electroacoustics - Sound level meters – Part 1: Specifications* and were calibrated prior to and after the monitoring session with a drift in calibration not exceeding ± 0.5 dB.

All instruments used were within their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period (i.e. calibration in the last 2 years).

3.3.2 Unattended continuous noise monitoring

Unattended noise monitoring was undertaken from 13 November 2023 to 22 November 2023 at one location considered to be representative of the noise sensitive receivers within the Project area.

A noise logger measures the noise level over the sample period and then determines L_{A1}, L_{A10}, $L_{A90,}$ and L_{Aeq} levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively.

The L_{A1} is indicative of maximum noise levels due to individual noise events. The L_{A90} is taken as the background noise level. The L_{Aeq} is essentially the energy averaged sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

The assessment background level (ABL) is established by determining the lowest tenth-percentile level of the L_{A90} noise data acquired over each period of interest. 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 duration. The RBL is representative of the average minimum background sound level, or simply the background level.

Graphical representations of the logging results are provided in Appendix B.

A summary of the measured L_{A90} background noise levels and existing L_{Aeq} ambient noise levels is presented in Table 3.

Table 3 Existing background and ambient noise levels, dB(A)

Measurement location	Rating background level			Ambient noise levels		
	Day[1]	Evening[1]	Night[1]	Day[1]	Evening[1]	Night[1]
NL1	45	39	36	58	51	51

Notes:

1. In accordance with the NPfI, time of day is defined as follows:
   Day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays
   Evening – the period from 6 pm to 10 pm.
   Night – the remaining periods.

3.3.3 Attended noise monitoring

Attended monitoring was conducted at the unattended monitoring location on 23 November 2023. Each measurement was conducted over a 15 minute period. Weather conditions were overcast on the day of monitoring, with light to moderate winds. The attended measurement data is presented in Table 4.

Table 4 Attended noise monitoring results

Monitoring location	Date	Time	Description	Measurements, dB(A)		
				$L_{A10,\ 15min}$	$L_{Aeq,\ 15min}$	$L_{90,\ 15min}$
NL1	23/11/23	12:27	• Traffic noise from Link Road and Birdwood Road dominant. • Children playing at nearby schools. • Trucks and car pass-bys over speed bumps on Link Road 50-56 dBA. • Helicopters passing over Birdwood Reserve 51 dB-65 dBA. • Helicopter above tarmac at the airport and helicopter flying over the reserve 81 dBA. • Windy weather conditions	79	64	49

4.0 Construction Noise and Vibration Criteria

4.1 Construction noise management levels

4.1.1 Airports Regulations

Schedule 4 – 2.02 of the Airports Regulations specifies the following provision for noise from construction activities:

> *The $L_{A10\ (15\ min)}$ noise level generated from construction, maintenance or demolition of a building or other structure at an airport should not exceed 75 dB(A), at the site of a sensitive receptor.*

For the purpose of comparison, the Airports Regulations criterion maybe presented as a L_{Aeq} level. This is considered reasonable as typically L_{Aeq} levels are approximately 3 dB(A) less than the L_{A10} levels for noise emissions from typical construction activities. Therefore, the Airports Regulations criterion is equivalent to $L_{Aeq\ (15\ min)}$ not to exceed 72 dB(A).

4.1.2 Interim Construction Noise Guideline

The EPA's Interim Construction Noise Guideline (ICNG) provides the basis for construction noise assessments in NSW and is used to establish construction noise management levels (NMLs).

The ICNG recommends that a quantitative assessment is carried out for all *'major construction projects that are typically subject to the EIA process'*. Additionally, the ICNG recommends that qualitative assessment is only used on short-term infrastructure maintenance works that are not likely to affect an individual or sensitive land use for more than three weeks in total. As the proposed works are expected to continue for a period of more than three weeks, and are within fairly close proximity to sensitive receivers, a quantitative assessments, based on 'reasonable' worst case construction scenarios, has been carried out for this work. Predicted construction noise levels at nearby receivers are compared to the levels provided in Section 4 of the ICNG.

Where an exceedance of the NMLs is predicted, the ICNG advises that receivers can be considered 'noise affected' and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially impacted residents of the nature of the works to be carried out, the expected noise level and duration, as well as contact details.

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

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

> *Feasible*
>
> *A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.*
>
> *Reasonable*
>
> *Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.*

Table 5 sets out management levels for noise at residences and how they are to be applied.

Table 5 Noise management levels at residences

Time of day	Management level, $L_{Aeq\ (15min)}$ 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(A)	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)	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Notes:

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

4.2 Construction hours

Construction hours are defined as follows in the ICNG:

- Standard hours: 7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday;
- Out of hours: before 7 am and after 6 pm Monday to Friday, before 8 am and after 1 pm Saturday, and all Sunday and public holidays.

No work is generally expected to be required outside of standard construction hours.

The construction works are proposed to be scheduled during in standard hours. Provided below are the applicable NMLs for this project, based on the RBLs in Table 3 and noise management levels in Table 5.

Table 6 Construction noise management levels at residential receivers (standard hours)

Noise management levels			
Receiver Type	RBL, $L_{A90, 15min}$	Noise management $L_{Aeq, 15min}$ dB(A)	Highly noise affected level $L_{Aeq, 15min}$ dB(A)
Residential	45	55	75

The NMLs for non-residential receivers are provided below. These NMLs apply only during the hours in which the properties are in use.

Table 7 Construction noise management levels for non-residential receivers

Noise management levels	
Land use	Management noise level $L_{Aeq, 15min}$ dB(A)
Industrial premises	75
Offices, retail outlets	70
Places of worship	55[1]
School	55[1]
Community centres	55[2]

Notes:

1. Based on an internal noise level of 45 dB outlined in the ICNG, where a conservative estimate of 10 dB has been assumed between internal and external noise levels.
2. Based on *AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors* indoor noise level for "Leisure centres and gaming. A conservative estimate of 10 dB has been assumed between internal and external noise levels.

4.2.1 Sleep disturbance

Where construction works are planned to extend over more than two consecutive nights, and where a quantitative assessment method is used, the analysis should cover the maximum noise level, and the extent of the number of times that the maximum noise level exceeds the RBL.

It is understood that works are not proposed to be conducted outside of standard construction hours; therefore a sleep disturbance assessment for construction is not required and therefore has not been conducted.

4.2.2 Construction road traffic noise criteria

The roads listed in Table 8 will likely be used by construction traffic. The road type and whether residential receivers are located on the road in that area are also indicated in Table 8. Construction vehicle routes are shown in Figure 2.

Table 8 Roads used by construction traffic

Road	Type	Residential receivers
Henry Lawson Drive	Arterial	Yes
Haig Avenue/Birdwood Road	Sub-arterial	Yes

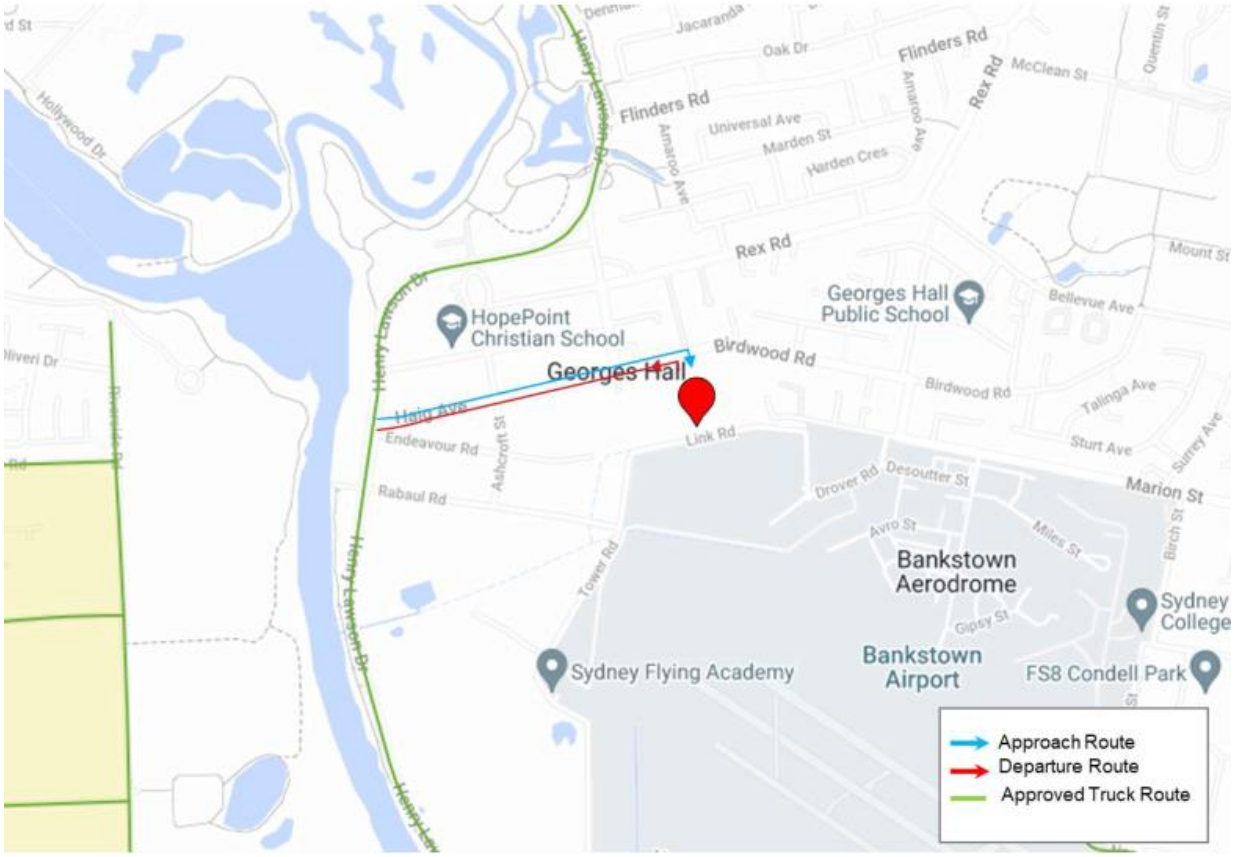

Figure 2 Construction vehicle route

4.2.3 Airports Regulations

Schedule 4 – 2.03 of the Airports Regulations provides on-site noise criteria for '*noise from road traffic noise*'. The Airports Regulations criteria do not specifically cover construction traffic noise on public roads.

4.2.4 NSW Road Noise Policy

Noise from construction traffic on public roads is not covered by the ICNG. However the ICNG does refer to the *Environmental Criteria for Road Traffic Noise*, now superseded by the *NSW Road Noise Policy (RNP)*, for the assessment of noise arising from construction traffic on public roads.

To assess noise impacts from construction traffic an initial screening test should be undertaken by evaluating whether existing road traffic noise levels will increase by more than 2 dB(A). 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 equal to or 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 in accordance with the RNP.

4.3 Construction vibration criteria

The relevant standards/guidelines for the assessment of construction vibration are summarised in Table 9.

Table 9 Standards / guidelines used for assessing construction vibration

Item	Standard/guideline
Structural damage	• Heritage structures – *German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures (DIN 4150)* • Non-heritage structures – *Evaluation and Measurement for Vibration in Buildings Part 2, (British Standard (BS) 7385:Part 2-1993)*
Human comfort (tactile vibration)	• *Assessing Vibration: A Technical Guideline*[1]
Human comfort (ground-borne noise)	• *Interim Construction Noise Guideline*

Notes:

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 NSW EPA 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 for example, a vibratory roller
- 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 a duration 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 such as from impact pile driving and jack hammers.

4.3.1 Structural damage

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

DIN 4150 and BS 7385-2 provide recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in

Table 10 and Table 11. DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits would not necessarily result in damage. Structural damage criteria for heritage items have been taken from DIN 4150, whilst criteria for commercial/residential items have been taken from BS 7385.

Table 10 Structural damage safe criteria (DIN 4150) for building vibration (Peak particle velocity)

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 (eg 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

Table 11 BS 7385-2: Transient vibration guide values for cosmetic damage

Group	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

4.3.2 Human comfort

Humans are sensitive to vibration such that they can detect vibration levels well below those required to cause any risk of damage to a building or its contents. Criteria to avoid annoyance are therefore more stringent than those to prevent structural damage.

4.3.2.1 Intermittent vibration

The assessment of intermittent vibration outlined in *Assessing Vibration: A Technical Guideline* 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	Day time		Night-time	
	Preferred	Max	Preferred	Max
Residences	0.20	0.40	0.13	0.26

4.3.2.2 Continuous and impulsive vibration

Acceptable levels of human exposure to continuous and impulsive vibration are dependent on the time of day and the activity taking place in the occupied space. *Assessing Vibration: A Technical Guideline* provides the preferred values for continuous and impulsive vibration. These are presented in Table 13.

There is low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values in Table 13. Situations exist where vibration above the preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short duration. Vibration levels above those indicated in Table 13 may be dealt with through negotiation with the regulator of the affected community.

Table 13 Peak particle velocity for continuous and impulsive vibration (mm/s)

Location	Assessment period	Preferred	Maximum
Continuous vibration			
Residences	Day Night	0.28 0.20	0.56 0.40
Impulsive vibration			
Residences	Day Night	8.60 2.80	17.0 5.60

5.0 Operational noise criteria

5.1.1 Airports Regulations

Schedule 4 – 2.03 of the Airports Regulation outlines criteria for noise generated from road traffic on-site. These criteria are presented as $L_{Aeq\ (24hour)}$ and $L_{Aeq\ (8\ hour)}$ noise metrics. The purpose of these criteria are to outline the noise limits for road traffic traversing internal roads within the airport. As the proposal does not possess any major internal roads, but rather carparks and loading docks, an $L_{Aeq,15min}$ criterion is more applicable to the project and has been adopted for on-site road traffic movements.

5.1.2 Noise Policy for Industry

The NPfI provides noise trigger levels for assessing the potential impact of noise from industry and includes a framework for considering feasible and reasonable noise mitigation measures. The assessment procedure for industrial noise sources has two components that must be considered:

- Controlling intrusive noise impacts in the short term for residences; and
- Maintaining noise level amenity for residences and other land uses.

5.1.2.1 Intrusive noise impacts

The NPfI states that the intrusiveness of an industrial noise source may generally considered acceptable if the level of noise from the source (L_{Aeq} level), measured over a 15 minute period, does not exceed the background noise level measured by more than 5 dB. The rating background level (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in Fact Sheet B of the NPfI. Adjustments are to be applied to the level of noise produced if the noise at the receiver contains annoying characteristics such as tonality or impulsiveness.

The project intrusiveness noise levels are presented in Table 14.

Table 14 Project intrusiveness noise levels

Land use	Time of day[1]	RBL, dB(A)	Intrusiveness noise level RBL + 5 ($L_{Aeq,15min}$)
Residential	Day	45	50
	Evening	39	44
	Night	36	41

Notes:

1. In accordance with the NPfI time of day is defined as follows :

   Day – the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays
   Evening – the period from 6 pm to 10 pm
   Night – the remaining periods.

5.1.2.2 Protecting noise amenity

To limit continuing increases in noise levels, the maximum ambient noise level resulting from all industrial noise sources in an area should not normally exceed the acceptable levels specified in Table 2.2 of the NPfI. As per the definitions of receiver types in Table 2.3 of the NPfI, residences within the assessment area have been classed as “urban”

The project amenity level for a project is equal to the recommended amenity level – 5 dB. In addition, the project amenity level is converted from a period to 15 minutes by adding 3 dB. Therefore, the relevant noise amenity level for each type of receiver is shown below in Table 15.

Table 15 Recommended L_{Aeq} noise levels from industrial noise sources.

Type of receiver	Indicative noise amenity area	Time of day	Recommended amenity noise level, $L_{Aeq\ (period)}$	Project amenity noise level, $L_{Aeq,15min}$
Residential	Urban	Day	60	58
		Evening	50	48
		Night	45	43
Active recreation	All	When in use	55	53
Place of worship - internal	All	Noisiest 1-hour period when in use	40	48[1]
Industrial premises	All	When in use	70	68
School classroom – internal	All	Noisiest 1-hour period when in use	40	48[1]
Commercial premises	All	When in use	65	63

Notes:

1. Based on an internal noise level outlined in the NPfI, where a conservative estimate of 10 dB has been assumed between internal and external noise levels based on windows being open for adequate natural ventilation.

5.1.2.3 Project noise trigger levels

The project noise trigger level is the lower (that is, the most stringent) value of the intrusiveness and amenity noise levels. Provided in Table 16 are the established project noise trigger levels for the assessment locations in close proximity to the development. Table 16 presents the project noise trigger levels for the day, evening and night-time periods.

Table 16 Operational noise criteria

Noise catchment area	Assessment period	RBL (L_{A90}), dB(A)	Intrusive noise levels $L_{Aeq,\ 15min}$	Amenity noise levels $L_{Aeq,\ 15min}$	Project noise trigger levels $L_{Aeq,\ 15min}$
Residents	Day	45	50	58	50
	Evening	39	44	48	44
	Night	36	41	43	41
Active recreation	When in use	-	-	53	53
Place of worship	When in use	-	-	48	48
School classroom	Noisiest 1-hour period when in use	-	-	48	48
Commercial premises	When in use	-	-	63	63
Industrial premises	When in use	-	-	68	68

5.1.3 Tonality and NPfI modifying factors

The NPfI provides guidance and project noise trigger levels for assessing noise emissions from sources with “annoying characteristics” such as tonality, impulsiveness, intermittency, irregularity or dominant low-frequency content. Penalties of up to a maximum of 10 dB(A) may be applied where the subject noise has such characteristics at the receiver.

5.1.4 Maximum noise level assessment

The NPfI requires the potential for sleep disturbance to be assessed by considering maximum noise level events during the night-time period.

Where the subject development/premises night-time noise levels at a residential receiver location exceed the following screening levels:

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

a detailed maximum noise level even assessment should be undertaken.

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.

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 about 10 dB(A) 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 17.

Table 17 Night-time sleep disturbance criteria

Noise catchment area	Measured night-time RBL, $L_{A90,\ 15min}$	Sleep disturbance screening levels	
		Sleep disturbance screening level LA1(1 minute), dB(A)	Awakening reaction level LA1(1 minute), dB(A)
Residents	36	52	60-65

5.1.5 Operational road traffic noise criteria

The main roads providing access to the proposed precinct are:

Arterial roads

- Henry Lawson Drive

Sub-arterial roads

- Haig Avenue/Birdwood Road
- Tower Road/Link Road

Table 18 and Table 19 present the road traffic noise criteria from the RNP for land use developments with a potential to create additional traffic on existing freeways or motorways/ arterial roads or sub-arterial roads. The external noise criteria are applied 1 m from the external facade of the affected residential buildings.

Table 18 Road traffic noise criteria - arterial roads

Road category	Type of project/land use	Assessment criteria – dB(A)	
		Day (7 am–10 pm)	Night (10 pm–7 am)
Freeway/ arterial/ sub-arterial roads	3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq, (15\ hour)}$ 60 (external)	$L_{Aeq, (9\ hour)}$ 55 (external)

Table 19 Road traffic noise assessment criteria for non-residential land uses affected by proposed road projects and traffic generating developments

Existing sensitive land use	Assessment criteria – dB(A)	
	Day (7 am–10 pm)	Night (10 pm–7 am)
1. School classrooms	$L_{Aeq, (1\ hour)}$ 40 (internal) when in use	-
3. Places of worship	$L_{Aeq, (1\ hour)}$ 40 (internal) when in use	$L_{Aeq, (1\ hour)}$ 40 (internal) when in use

To assess noise impacts from traffic generated by the site, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels will increase by more than 2 dB. Where the predicted noise increase is 2 dB or less, then no further assessment is required. However, where the predicted noise level increase is equal to or greater than 2 dB, and the predicted road traffic noise level exceeds the road category specific criterion then noise mitigation should be considered for those receivers affected. The RNP does not require assessment of noise impact to commercial or industrial receivers.

6.0 Construction Noise and Vibration Impact Assessment

6.1 Construction stages and scheduling

Construction works to take place as part of the proposed are outlined in Table 20. These works were based on the information provided by Forge Venture Management.

For the construction noise impact assessment, three construction scenarios were considered. These scenarios are shown in Table 20. The modelled scenario includes all equipment that could be reasonably assumed to be operating at the same time for an entire 15 minute period. Table 21 shows the construction equipment for each construction scenario and their sound power levels.

Table 20 Construction stages and scheduling

Construction scenario	Activities	Timing
Site establishment and enabling works	• Site establishment • Services relocations • Bulk cut / fill and import	Daytime – Standard hours
Foundations	• Detailed earthworks / trim • Pouring of concrete	Daytime – Standard hours
Frame and façade	• Erection of structure on site • Pouring of concrete	Daytime – Standard hours

6.2 Plant and equipment levels

Table 21 presents the typical sound power levels of the construction equipment to be used in each modelled scenario. 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”, the UK Department for Environment, Food and Rural Affairs (DEFRA) “Update of noise database for prediction of noise on construction and open sites” noise database and AECOM’s noise database. It was assumed that equipment is modern and in good working order.

Table 21 Typical sound power levels of construction equipment

Equipment	Sound power level, dB(A)	Construction scenario		
		Site establishment and enabling works	Foundations	Frame and façade
Large excavator	98	●	●	
Backhoe	102	●		
Dump truck	95	●		
Franna crane	98		●	●
Vibratory roller	108	●		
Water carts	100	●		
Piling rig (bored)	112		●	
Concrete pump	106		●	●
Concrete truck	106		●	●
General hand tools	94			●
Large truck	108		●	●
Total construction scenario SWL		**110**	**115**	**112**

6.3 Noise modelling methodology

Noise levels due to the construction activities shown in Section 6.1 and 6.2 were predicted at nearby noise sensitive receivers using SoundPLAN 8.2 noise modelling software. The CONCAWE method was originally developed for predicting the long-distance propagation of noise from petrochemical complexes. It is especially suited to predicting noise propagation over large distances because it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise over large distances.

The noise model was created to represent ‘reasonable’ worst periods of construction works.

The following features were included in the noise model:

- Ground topography
- Ground absorption and reflection
- Receivers
- Construction noise sources.

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.

6.3.1 Construction modelling assumptions

The following assumptions were made in modelling all construction noise scenarios:

- For all construction scenarios all equipment would be operating at the same time, which is unlikely, and is a conservative assumption.

- Equipment was assumed to be operating at the closest point in the site to each receiver, in order to present the worst case scenario for each receiver. In reality the equipment would only be closest point to each receiver for a limited period of the durations presented in Table 20.
- Neutral atmospheric conditions i.e. relatively calm, no wind.

6.4 Predicted construction noise impacts

Predicted construction noise levels associated with the precinct are presented in Table 22. Construction noise contours calculated at 1.5 m above ground level are presented in Appendix C. These contours are indicative only and should not be referred to for noise levels at specific receivers; rather reference should be made to Table 22 and Table 23.

Considering the ICNG criteria is more stringent than the the Airport Regulations $L_{Aeq\ (15\ min)}$ 72 dB(A) criteria, only the ICNG NML criteria has been considered for the construction noise impact assessment.

6.4.1 Residential receivers

Table 22 Number of residential buildings where noise levels may exceed NMLs

Construction Scenario	Exceedance of NML (Daytime)			
	1-10 dB	11-20 dB	> 20 dB	Highly Noise Affected
Site establishment and enabling works	14	8	6	6
Foundations	29	12	8	8
Frame and façade	15	9	8	8

It can be seen in Table 22 that 49 receivers within Georges Hall will experience noise levels above the NML for the Foundations construction scenario. Of these receivers, eight are expected to be highly affected. For the Site Establishment scenario, 28 receivers are expected to experience noise levels above the NML, with six of these expected to be highly affected. For the Frame and Façade construction scenario, 32 receivers are expected to experience noise levels above the NML, with eight of these expected to be highly affected.

6.4.2 Other receivers

Table 23 presents the construction noise modelling results for non-residential properties which shows the number of properties where the NMLs are likely to be exceeded during their hours of use. It is important to consider that this assessment is representative of the worst case 15-minute period of construction activity, while the construction equipment is at the nearest location to each receiver location.

Table 23 Number of non-residential buildings where noise levels may exceed NMLs

Phase	Exceedance of NML		
	1-10 dB	11-20 dB	> 20 dB
Site establishment and enabling works	5	0	2
Foundations	10	2	2
Frame and façade	8	1	2

14 non-residential receivers are expected to exceed the construction NMLs for the peak construction scenario (Foundations). These receivers include Bankstown Montessori Pre-school, Georges River Grammar School, SUPA IGA Georges Hall, Georges Hall Community Centre, and St Martin's Anglican Church, Park.

6.4.3 Overlapping construction activities

While most construction activities are expected to occur at distinct scheduled times and at different locations, it is possible that noisy construction activities for the proposal may occur at the same time in close proximity to each other. In these cases, it is possible that an increase of up to 3 dB(A) of the highest noise level predicted for any construction stage may occur (assuming that at any one location equal noise levels from two stages of works are experienced). In this case, this increase is not expected to create any further exceedances in the noise management levels.

Overlapping construction stages and identification of any receivers subject to increased noise levels would be determined during detailed design. Any additional mitigation measures subsequently required would also be identified during detailed design.

6.5 Construction vibration

6.5.1 Minimum working distances

Construction vibration may be generated due to the vibration intensive equipment proposed to be used during some stages of work. The minimum working distances for these items of equipment from off-site receivers are shown in Table 24.

Table 24 Recommended minimum working distances for vibration intensive plant

Plant item	Rating/Description	Minimum working distance	
		Cosmetic damage (BS 7385) Light-framed structures	Human response (EPA's Vibration guideline)
Vibratory Roller	< 50 kN (Typically 1-2 t)	5 m	15 m
	< 100 kN (Typically 2-4 t)	6 m	20 m
	< 200 kN (Typically 4-6 t)	12 m	40 m
	< 300 kN (Typically 7-13 t)	15 m	100 m
	> 300 kN (Typically 13-18 t)	20 m	100 m
	> 300 kN (> 18 t)	25 m	100 m
Pile Boring	≤ 800 mm	2 m (nominal)	7 m

This is based on recommendations of the *Construction Noise and Vibration Guideline* and AECOM's previous project experience. 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. Equipment size would be selected by the construction contractor and would take into account the minimum working distances and the distance between the area of construction and the nearest receiver. If vibration intensive works are required within these minimum working distances, mitigation measures to control excessive vibration may be required.

6.5.2 Human comfort

Works undertaken within the human comfort minimum working distances may cause some people to experience annoyance and concern for cosmetic damage. Receivers located within the minimum distances for human comfort would be notified of the potential impacts as part of the notification of highly noise affected receivers.

6.5.3 Cosmetic damage

Table 24 presents minimum working distances to minimise the likelihood of cosmetic damage on buildings and structures, including heritage items. The non-Aboriginal and Aboriginal Heritage assessments prepared for the proposal do not identify any heritage items that are likely to be impacted by construction vibration, due to their distance from vibration intensive works.

Works undertaken within minimum working distances for cosmetic damage may cause damage to buildings. However, damage to heritage and other buildings is unlikely to occur when the management measures have been implemented appropriately. These measures include undertaking attended vibration measurements at the work site when work commences, to determine site specific minimum working distances. These measurements would be made progressively at distances outside the minimum working distances to ensure no structure damage occurs and would provide detailed information regarding the transmission of vibration to allow site specific safe working distances to be determined.

6.6 Construction traffic assessment

Construction traffic activities were based on *Bankstown Airport – Link Road Mixed Use Precinct Transport Impact Assessment Ref: 301351384, dated 1 December 2023* provided by Stantec (the traffic report). Construction traffic movements in this document were used to conservatively assess the following number of vehicle movements:

- 55 truck movements per daytime period (11-hour working day)
- 50 light vehicle movements per daytime period (11-hour working day)

Existing traffic counts along the proposed construction traffic routes are not available at this stage, therefore a full assessment of construction traffic impact cannot be undertaken. The traffic report however states that *Given the expected low construction traffic volumes and the proximity of the site to the arterial road network, it is anticipated that the construction traffic will not have a significant impact on the surrounding road network.* This should be verified at the detailed design stage when existing traffic counts around the site are available.

6.7 Construction noise and vibration safeguards

This section describes safeguards and management measures to address the potential impacts of the proposal identified in this assessment. These measures would be incorporated into the detailed design, construction and/or operation stages of the proposal where relevant.

Table 25 Draft noise management plan

Environmental safeguards	Responsibility	Timing
The noise and vibration impact assessment presented in this Technical Report should be re-evaluated based on the detailed design in order to confirm noise predictions and potential impacts as a result of the project.	Aeria Management Group	Pre-construction
A Construction Noise and Vibration Management Plan would be prepared as part of the Construction Environmental Management Plan. The CNVMP would identify: • all potential significant noise and vibration generating activities associated with the activity • noise and vibration sensitive receivers • measures to be implemented during construction to minimise noise and vibration impacts, such as restrictions on working hours, staging, placement and operation of work compounds, parking and storage areas, temporary noise barriers, haulage road maintenance and controlling the location and use of vibration generating equipment	Contractor	Pre-construction and construction

Environmental safeguards	Responsibility	Timing
• arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures.		
All sensitive receivers likely to be affected would be notified at least five days prior to commencement of any works associated with the scenario that may have an adverse noise or vibration impact. The notification would include details of: • the proposal • construction period and construction hours • contact information for proposal management staff • complaint and incident reporting and how to obtain further information.	Contractor	Construction
All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all relevant proposal specific and standard noise and vibration mitigation measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) • environmental incident procedures.	Contractor	Construction
Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Works generating high noise and/or vibration levels should be scheduled during less sensitive time periods.	Contractor	Construction
Where feasible and reasonable, high noise generating work (75 dB(A) L_{Aeq} at receiver) be carried out during standard construction hours and in continuous blocks of no more than three hours with at least one hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receiver.	Contractor	Construction
Where high noise generating activities (75 dB(A) L_{Aeq} at receiver) are required out of hours the following would be implemented: • equipment would be used prior to 10pm where feasible and reasonable • where the above cannot be achieved the equipment would be used prior to midnight where feasible and reasonable • it is not proposed to apply a three hour on and a one hour off respite approach in an effort to ensure that the use of such equipment is completed as early in the night as possible.	Contractor	Construction
The following would be implemented for deliveries to and from the Site: • loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers	Contractor	Construction

Environmental safeguards	Responsibility	Timing
• dedicated loading/unloading areas are to be shielded if close to sensitive receivers • delivery vehicles are to be fitted with straps rather than chains for unloading, wherever possible • construction site would be arranged to limit the need for reversing associated with regular/repeatable movements.		
Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work.	Contractor	Construction
In circumstances where the noise levels are predicted to exceed construction noise management levels after implementation of the general work practices, additional mitigation measures are required. These measures include the following: • monitoring • notification (letterbox drop or equivalent) • specific notifications • phone calls • individual briefings • respite Offers • respite Periods • duration Respite alternative Accommodation.	Contractor	Construction
Vibration intensive equipment size would be selected to avoid working within the structural damage minimum working distances. The use of less vibration intensive methods of construction or equipment would be considered where feasible and reasonable.	Contractor	Construction
Where vibration intensive works are proposed within minimum working distances, vibration monitoring should be undertaken to determine site specific minimum working distances and to ensure that appropriate thresholds are not exceeded. Monitoring would be carried out in conjunction with a visual inspection of the bridge to assess any potential vibration impacts.	Contractor	Pre-Construction
Where the use of vibration intensive equipment within the relevant minimum working distances cannot be avoided, prior to the commencement of vibration intensive work, a detailed inspection would be carried out and a written and photographic report prepared to document the condition of buildings and structures within the minimum working distances. A copy of the report would be provided to the relevant landowner or land manager.	Contractor	Pre-Construction
Review of equipment noise levels, locations, and potential frequency related penalties during Detailed Design.	Aeria Management Group	Pre-construction

7.0 Operational Noise Assessment

7.1 Assessment methodology

Noise emissions from the proposed warehouse, retail spaces, and childcare centre within the development were predicted to nearby receiver locations based upon typical operational noise from this type of development. The typical scenarios were modelled to assess the potential impact to nearby sensitive receiver locations and achieve the required project noise trigger presented in Section 0. The predicted noise levels are presented in section 7.12 for typical daytime, evening, and night-time operations.

7.2 Modelling

Noise levels from the proposed operation of the precinct developments have been predicted at nearby noise sensitive receivers using SoundPLAN 8.2 noise modelling software. The operational noise levels were predicted using an implementation of CONCAWE[1] algorithms in the SoundPLAN noise propagation software. The CONCAWE method is especially suited to predicting noise propagation over large distances because it accounts for a range of atmospheric conditions that can significantly influence the propagation of noise over large distances.

7.2.1 Meteorological conditions

Both standard and noise enhancing meteorological conditions were considered, with the following parameters:

Daytime/evening

- Standard meteorological conditions – Pasquill-Gillford stability category D with wind speed up to 0.5 m/s at 10 metres.
- Noise enhancing meteorological conditions – Pasquill-Gillford stability category D with wind speed up to 3 m/s at 10 metres.

Night-time

- Standard meteorological conditions – Pasquill-Gillford stability category D with wind speed up to 0.5 m/s at 10 metres.
- Noise enhancing meteorological conditions – Pasquill-Gillford stability category D with wind speed up to 3 m/s at 10 metres, and/or stability category F with winds up to 2 m/s at 10 metres.

Previous assessments have identified that the 3 m/s source to receiver wind meteorological condition predictions to be consistently between 0 dB to 1 dB higher than temperature inversion predictions. As such this report has limited the assessment of adverse conditions to the more conservative 3 m/s source to receiver wind meteorological condition.

The modelling includes:

- Ground topography;
- Buildings and structures;
- All identified noise producing items within the project site modelled as point or line sources where appropriate;
- All sources are modelled to assume a ‘reasonable’ worst case 15 minute period scenario; and
- Ground absorption.

[1] CONCAWE – The oil companies’ international study group for conservation of clean air and water – Europe (established in 1963) Report 4/81 “The propagation of noise from petroleum and petrochemical complexes to neighbouring communities”.

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 noise models take into account significant noise sources and locations, screening effects, receiver locations, ground topography and noise attenuation due to geometrical spreading, air absorption, ground absorption and the effects of the prevailing weather conditions. The noise model was based on ground topography, general site layouts and indicative plant equipment sound power levels.
All predicted noise levels are free field and 1.5 m above ground level at the most-affected point within a residential property boundary within 30 m of the nearest facade.

7.3 Noise producing operational equipment

This section discusses the typical sources of noise emission from this type of development. The activities are generally categorised into the following two groups:

- Steady-state or quasi steady-state noise, which is typically continuous and consistent noise. As the number of truck activities on the proposed site is assumed to be constant within each assessment period for the facility, the assessment considered noise from trucks as being quasi-steady state; and,
- Discrete noise, which occurs infrequently and for short durations of time. This type of noise includes forklift and truck reversing alarms, car door slams etc.

7.4 Building services plant noise

At this stage the specific tenancy usage within the site are not known. As such, a selection of typical mechanical plant based upon similar facilities were used. Mechanical plant servicing the offices, childcare centre, and retail spaces is to be included in the noise model. These plant items have been selected for modelling at this preliminary stage, and further detailed assessment of each site should be undertaken prior to construction. Noise from mechanical plant is considered to be steady state noise. The cumulative noise impact from the precinct was assessed against the project noise trigger levels outlined in Section 5.0.

If either the number of plant items increases, or the assumed sound power level is higher than that of the individual proposed unit to be used in the development, then a reassessment of the potential noise impacts is recommended.

The mechanical plant proposed with associated sound power levels are presented in Table 26 below.

Table 26 Mechanical plant quantity and sound power levels

Mechanical plant designation	Quantity	Overall sound power level, dB(A)	Octave band frequency – Hz, dB							
			63	125	250	500	1000	2000	4000	8000
AC condenser unit (Enclosure limited to 65dBA)	1 per office tenancy, 1 per retail tenancy, 2 per childcare centre	65	46	57	59	65	56	55	53	51
Toilet exhaust fan	1 per office tenancy, 2 per childcare centre	66	56	56	63	59	61	61	58	46
Kitchen Exhaust fan	1 per food and drink premises (25% of retail premises)	70	67	68	65	67	65	64	52	46

7.5 Truck and forklift noise levels

The noise levels presented in Table 27 were used for trucks and forklifts as part of the warehouse operations. Noise data was based on measurements conducted at a similar nearby industrial site located at 430 Marion Street, Bankstown.

Table 27 Truck and forklift sound power levels

Source description ($L_{Aeq, 15\ minute}$)	Overall sound power level, dB(A)	Octave band frequency – Hz, dB							
		63	125	250	500	1000	2000	4000	8000
Typical Heavy Rigid Vehicle idling	91	90	88	86	86	87	83	78	72
Typical Heavy Rigid Vehicle manoeuvring and entering/leaving	98	106	95	91	90	93	93	90	81
Typical forklift	92	97	88	90	88	87	85	74	66

7.6 Retail premise noise levels

The noise levels presented in Table 28 were used for the food and drink premises proposed as part of the development. A normal male vocal effort was utilised for patrons within outdoor seating areas as the areas are proposed to be low capacity and will not require patrons to speak with a raised vocal effort. Male mean vocal effort was utilised for the assessment as a conservative case.

Table 28 Retail premises sound power levels

Source description ($L_{Aeq, 15\ minute}$)	Overall sound power level, dB(A)	Octave band frequency – Hz, dB						
		125	250	500	1000	2000	4000	8000
Normal vocal effort (male)	66	54	64	66	60	56	52	47

7.7 Carpark noise levels

The noise levels presented in Table 28 were used for car park noise sources traversing the site.

Table 29 Carpark premises sound power levels

Source description	Noise metric	Overall sound power level, dB(A)
Car moving at 10 km/h, engine igniting, 2 car doors slamming	$L_{Aeq, 15\ minute}$	83

7.8 Childcare centre noise sources

The noise levels presented in Table 27 were used for noise sources specific to the proposed childcare centre. Effective sound power levels for groups of children playing was referenced from the *Association of Australian Acoustical Consultants (AAAC) Guideline for Child Care Centre Acoustic Assessment V3.*

Table 30 Childcare centre sound power levels

Source description ($L_{Aeq, 15\ minute}$)	Overall sound power level, dB(A)	Octave band frequency – Hz, dB							
		63	125	250	500	1000	2000	4000	8000
10 children playing – 0 to 2 years	78	54	60	66	72	74	71	67	64
10 children playing – 2 to 3 years	85	61	67	73	79	81	78	74	70
10 children playing – 3 to 5 years	87	64	70	75	81	83	80	76	72

The proposed age breakdown of the childcare centre is as follows:

- 30 children aged 0-2 years old
- 25 children aged 2-3 years old
- 65 children aged 3-5 years old

7.9 Traffic movements

The breakdown of car and truck movements has been provided by Stantec as apart of the traffic report and a request for further information. Traffic movements within into the site via both the Birdwood Road entrance, and Link Road entrance are given in Table 31. These values were rounded up to the nearest whole number.

Table 31 Summary of traffic volumes provided in traffic report

Carpark entrance	Daytime peak, 1 hour		Daytime peak, 15 minutes		Night-time peak, 1 hour		Night-time peak, 15 minutes	
	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Birdwood Road	150	-	38	-	159	-	40	-
Link Road	84	20	21	5	84	20	21	5

Using the information in Table 31, a reasonable worst-case light and heavy vehicle movements was assumed for the warehouses, retail, office, and childcare centre operating within the proposed development. This information is provided below in Table 32.

Table 32 Assumed peak period on-site vehicle movements for proposed development

Site	Daytime truck movements (15 mins)	Night-time truck movements (15 mins)	Daytime car movements (15 mins)	Night-time car movements (15 mins)
Office/Retail (Birdwood Road)	0	0	14	19
Childcare Centre (Birdwood Road	0	0	24	21
Southern carpark (Link Road)	5	5	21	21

The following information and assumptions are also relevant as part of the noise impact assessment:

- Upon arriving at the site, the truck drivers must turn their engines off whilst waiting. In this assessment it has been assumed that the same number of trucks that enter the site will idle for 5 minutes then turn off their engines once they have pulled into the allocated loading dock position;
- Forklifts are assumed to be outside the building for 7 minutes in every 15 minutes when loading and unloading trucks; and
- No truck re-fuelling facilities are located on site.

7.9.1 Reversing alarms

It was assumed that forklifts would be fitted with broadband type alarms, whilst trucks were assumed to have tonal reversing alarms.

7.10 Hours of operation

This assessment has been based upon 24 hour operation of the warehouse facilities. The childcare centre is assessed to operate during the daytime only, whilst retail and food and drink premises are assessed to operate during the daytime and evening periods.

7.11 Operational scenarios

As the operations of the warehouses, retails spaces, and offices are not currently known, a reasonable worst case 15 minute period was assessed against the project noise trigger levels for daytime, evening and night-time operations. The 15-minute operation for each individual warehouse was assumed to be roughly the same. It was assumed that L_{Aeq} noise sources from the proposed warehouse developments would be relatively similar during the evening and night periods. The childcare centre is proposed to operate from 7am to 7pm at the latest, whilst half of the proposed retail premises are assumed to be food and drink premises with outdoor seating. For daytime, evening and night-time scenarios, the following noise modelling was undertaken:

Daytime scenario

1. Office mechanical plant (1x condenser unit and 1x toilet exhaust fan per office tenancy);
2. Trucks idling outside of 20% of warehouse tenancies. Trucks are assumed to only idle for 5 minutes out of a standard 15 minute period;
3. Truck movements, from Table 32 during a 15 minute period;
4. One forklift for every two warehouses. Operating around loading areas for 7 minutes of the 15 minute period;
5. Light vehicle movements from Table 32 during a 15 minute period;
6. 50% of children from 2-3 years and 50% of children from 3-5 years age bracket playing outdoors
7. Retail mechanical plant, 1x condenser unit per tenancy, 1x kitchen exhaust fan for 25% of retail tenancies
8. Childcare centre mechanical plant, 2x condenser units, 2x toilet exhaust fans; and
9. Food and drink premises 10x patrons in each outdoor dining area, 50% speaking with normal vocal effort;

Evening scenario

1. Office mechanical plant (1x condenser unit and 1x toilet exhaust fan per office tenancy);
2. Trucks idling outside of 20% of warehouse tenancies;
3. Truck movements, from Table 32 during a 15 minute period. Trucks are assumed to only idle for 5 minutes out of a standard 15 minute period;

4. One forklift for every two warehouses. Operating around loading areas for 7 minutes of the 15 minute period;
5. Light vehicle movements from Table 32 during a 15 minute period;
6. Retail mechanical plant, 1x condenser unit for 50% of retail tenancies, 1x kitchen exhaust fan for 50% of retail tenancies; and
7. Food and drink premises 10x patrons in each outdoor dining area, 50% speaking with normal vocal effort;

Night scenario

1. Office mechanical plant (1x condenser unit and 1x toilet exhaust fan per office tenancy);
2. Trucks idling outside of 20% of warehouse tenancies. Trucks are assumed to only idle for 5 minutes out of a standard 15 minute period;
3. Truck movements, from Table 32 during a 15 minute period;
4. One forklift for every two warehouses. Operating around loading areas for 7 minutes of the 15 minute period; and
5. Light vehicle movements from Table 32 during a 15 minute period;

7.12 Predicted operational noise impacts

7.12.1 L_{Aeq} noise levels

Predicted noise levels and environmental noise limits for the precinct are presented in Table 33, Table 34, and Table 35.

Noise barriers as proposed in the architectural drawings have been considered in the base design scenario:

- Noise barrier totalling 5 metres along the eastern and southern boundary of the CCC outdoor play area
- Noise barrier totalling 2.1 metres along the northern and western boundary of the CCC outdoor play area
- Operable noise barrier and gate for the entrance to the fire brigade access corridor and north-eastern boundary to a height of 7 metres
- Noise barrier along the western extent of the site to a height of 5 metres

Noise barrier locations are shown in Figure 3. A graphical representation of results is shown in Appendix D.

Table 33 Noise levels at all representative receiver locations during daytime

Receiver	EPA's Npfl Project noise trigger levels, dB(A)	Neutral conditions		Worst case meteorological conditions	
		Result	Exceedance (EPA's NPfl)	Result	Exceedance (EPA's NPfl)
R1	50	45	-	45	-
R2	50	40	-	42	-
R3	50	34	-	36	-
R4	50	36	-	38	-
R5	50	49	-	50	-
R6	50	45	-	47	-
E1	48	48	-	48	-
E2	48	41	-	41	-
CO1	53[1]	44	-	45	-
W1	48	39	-	41	-
C1	63	50	-	51	-
I1	78	49	-	51	-
I2	78	47	-	49	-
RE1	53	42	-	42	-

Notes:

1. Local community centre assessed as "Active Recreation" under the EPA's Noise Policy for Industry

Table 34 Noise levels at all representative receiver locations during evening

Receiver	EPA's Npfl Project noise trigger levels, dB(A)	Neutral conditions		Worst case meteorological conditions	
		Result	Exceedance (EPA's NPfl)	Result	Exceedance (EPA's NPfl)
R1	44	42	-	43	-
R2	44	40	-	41	-
R3	44	34	-	35	-
R4	44	36	-	38	-
R5	44	47	**3**	48	**4**
R6	44	42	-	43	-
CO1[1]	53[1]	44	-	44	-
W1	48	38	-	40	-
C1	63	50	-	50	-

Notes:

1. Local community centre assessed as "Active Recreation" under the EPA's Noise Policy for Industry

Table 35 Noise levels at representative residential receiver locations during night-time

Receiver	EPA's Npfl Project noise trigger levels, dB(A)	Neutral conditions		Worst case meteorological conditions	
		Result	Exceedance (EPA's NPfl)	Result	Exceedance (EPA's NPfl)
R1	41	40	-	41	-
R2	41	40	-	41	-
R3	41	34	-	35	-
R4	41	36	-	38	-
R5	41	38	-	39	-
R6	41	37	-	38	-

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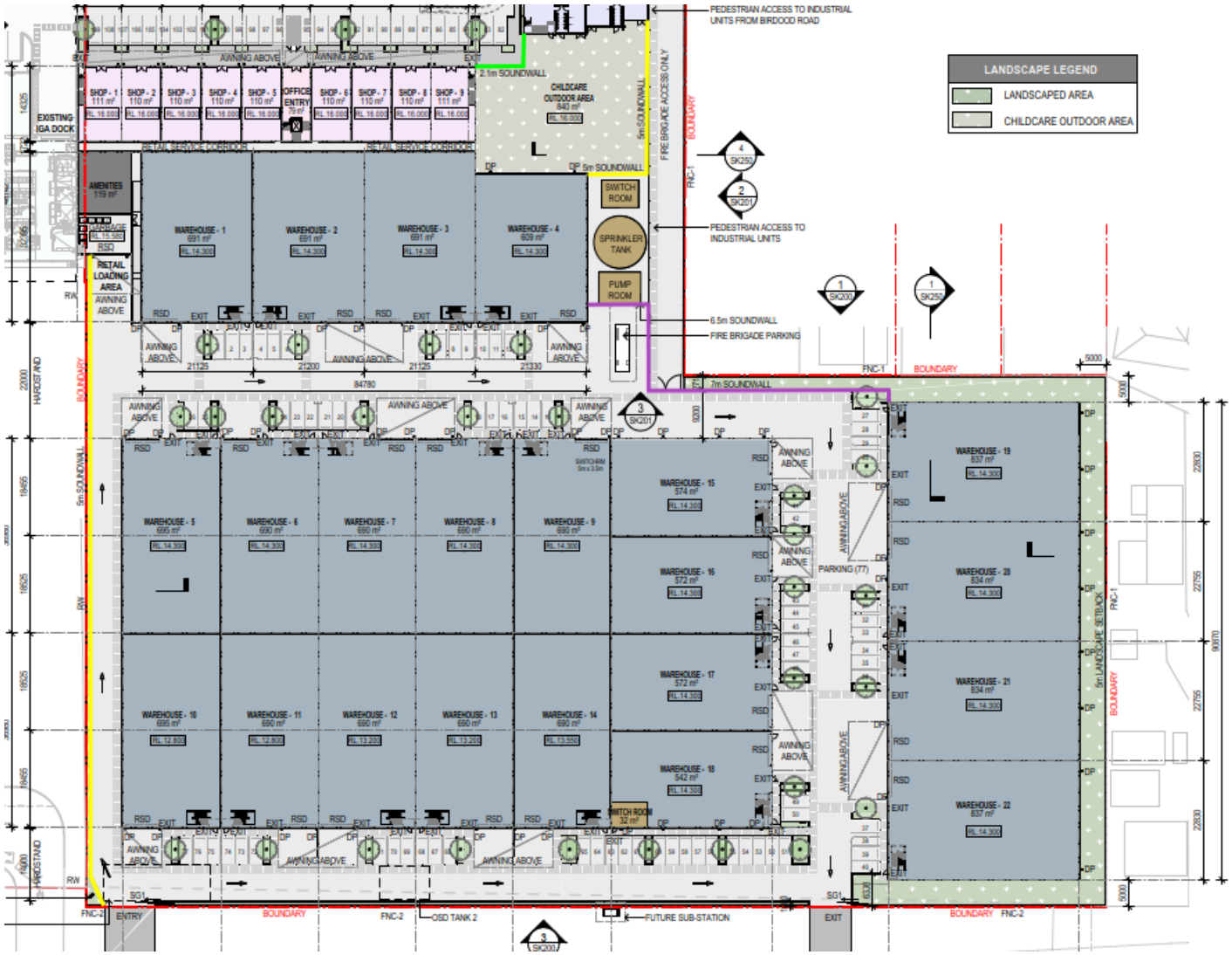


Figure 3 Proposed noise barrier locations

7.12.2 Discussion of results and proposed noise treatment

The operation of the precinct was assessed against the project noise trigger levels. The predicted noise levels at each representative receiver were found to be below the project noise trigger levels at all receivers for the daytime and night-time scenarios for all operational scenarios.

The operation of the precinct during the evening period was found to exceed the evening project noise trigger levels at receiver R5 (192 Birdwood Road, Georges Hall). Receiver R5 is located directly across the road from the site. The exceeding noise level during the evening period is due to vehicle movements within the proposed carpark, primarily due to the use of the proposed childcare centre. As a worst-case scenario this assessment considers all PM childcare centre vehicle movements occurring within the same 15 minute period after 6:00 pm. This is a highly conservative assumption as it is expected that most childcare centre pickups will be spread out across the afternoon and early evening.

In addition to this, traffic noise levels along Birdwood Road and therefore the existing background noise levels during the 6 pm to 7 pm period, will be higher than what is presented in this report for the standard EPA NPfI “evening” period (6 pm to 10 pm). As predicted noise levels generated from the carpark would be lower, and the noise criteria would be less stringent during the early evening, the predicted exceedance at receiver R5 during the evening scenario is deemed acceptable. A plan of management should be implemented, instructing drivers of heavy vehicles to turn off their engines immediately once they have parked to reduce idling truck noise. The use of reverse alarms should also be limited where possible.

The total number of children to occupy the childcare centre outdoor play area should be limited as outlined in Section 7.8.

Provided equipment and activity noise levels are limited to what has been assumed in Section 7.11 of this report, compliance to the EPA’s project noise trigger levels are predicted for all operational scenarios during the daytime, evening and night-time periods. Equipment noise levels, a plan of management, and on-site activities should be verified by a qualified acoustic consultant prior to construction.

7.12.3 Annoying characteristics correction

As the actual operations of the tenants are not currently known, a detailed assessment of tonality and NPfI modifying factors was not included within this assessment.

During the Development Application (DA) and design phase of each individual lot, an assessment of the potential for individual sites to produce noise containing tonality, impulsiveness, intermittency, irregularity or dominant low-frequency content should be undertaken.

7.12.4 Sleep disturbance

The operation of the trucks and forklifts are identified as the noise sources with the greatest potential for causing sleep disturbance, through the use of air brakes and reversing beepers. The predicted $L_{A1\ (1\ minute)}$ noise levels were based upon attended measurements undertaken during previous noise assessments at similar facilities. The mechanical plant associated with the warehouse operations is a relatively constant noise source, and as such there would not be a significant variation between the L_{AFmax} and $L_{Aeq\ (15\ minute)}$ noise levels.

An assessment of a typical truck operations was undertaken, with reversing beepers modelled with a L_{AFmax} sound power level of 110 dB(A), and air brake events modelled with a L_{AFmax} sound power level of 116 dB(A). These were assessed to determine the impact on nearby residential receiver locations.

The night-time sleep disturbance assessment was undertaken under noise-enhancing meteorological conditions, and the results are presented in Table 36.

Table 36 Predicted LA1 noise levels at representative sensitive receiver locations during night-time

Receiver[1]	Criteria		Predicted L_{AFmax} with worst case meteorological conditions	
	Screening Level	Awakening Reaction	Result	Exceed
R1	52	60 - 65	50	-
R2	52	60 - 65	52	-
R3	52	60 - 65	41	-
R4	52	60 - 65	41	-
R5	52	60 - 65	45	-
R6	52	60 - 65	37	-

Notes:

1. Only residential receivers were assessed for sleep disturbance.

The results of the sleep disturbance assessment show that the predicted L_{AFmax} does not exceed the screening level and/or awakening criteria for nearby residential receiver locations.

7.13 Operational road traffic noise assessment

The impact of additional vehicles operating on public roads during the operational phase of the project is to be assessed separately. As existing traffic counts on nearby site access roads are not yet available, an operational road traffic noise assessment cannot be conducted at this stage. Noise impact of additional vehicles on nearby public roads should be assessed at a more advanced design stage when existing traffic counts are available.

8.0 Aircraft Noise Assessment

8.1 Aircraft noise – Land-use acceptability

AS 2021:2015 provides a standard for use in land use planning, and the siting and construction of buildings in the vicinity of airports. The application of AS 2021:2015 is intended to provide guidance for land-use and for building constructions to mitigate aircraft noise in the vicinity of airports. In some areas, assessment using AS 2021:2015 is explicitly required through local and/or state planning policy.

8.2 Australian Standard AS 2021:2015

AS 2021:2015 contains detailed guidelines for assessing maximum levels of aircraft noise intrusion based on the location of a building with respect to Australian Noise Exposure Forecast (ANEF) contours. The ANEF contours provide a guide to annualised daily noise exposure, based on forecast aircraft movements, noise levels, frequency, time of day and available flight paths. The suitability of the site for a given building type is then ranked as either:

- Acceptable
- Conditionally acceptable
- Unacceptable

Based on the acceptability of the site for the proposed building use, AS 2021:2015 provides further detailed procedures to determine the noise reduction required of the building construction to control and satisfy maximum internal noise levels due to aircraft flyovers.

For a school (e.g. childcare centre, light industrial building type (e.g. warehouses) and commercial building type (e.g. retail/office), the conditions for site acceptability in relation to ANEF zoning is listed in Table 1.

Table 37 Building site acceptability based on ANEF zones (AS 2021)

Building type	ANEF zone of site		
	Acceptable	Conditionally acceptable	Unacceptable
School[1]	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF

Notes:

1. Proposed childcare centre to be considered a school for the purposes of this assessment. School study areas and residential sleeping areas both require an indoor design sound level no more than L_{ASMax} 50 dB, therefore this will be adopted for the childcare centre.

Where a location is deemed ‘acceptable’, no further assessment is required.

Where the location of a building type is deemed ‘conditionally acceptable’, aircraft noise levels expected across the site should be predicted or measured using a methodology provided in the standard, in order to assess constructions necessary to achieve internal sound design levels. This process may also be applied to individual spaces within a building (e.g. office spaces within an industrial building), if desired, even if the building type as a whole is considered acceptable.

8.3 Site assessment

Figure 4 presents the location of the Link Road Precinct with respect to the most up-to-date Bankstown Airport 2039 ANEF chart. Figure 4 indicates that the proposed site is located between the ANEF 20 and ANEF 25 contour. In this case, commercial and light industrial uses for the proposed site (warehouses, offices, retail) are all deemed “acceptable” so no further aircraft noise intrusion assessment is required. The childcare centre land use however is deemed conditionally acceptable, therefore noise impact from nearby aircraft operations should be assessed.

At this stage, the final usage and location of commercial spaces, offices, etc. have not been finalised. As such, during the design development of these spaces, it is recommended that aircraft noise levels across the site should be predicted or measured using a methodology provided in AS 2021:2015 if there are other land uses proposed that would be considered aircraft noise sensitive. At this stage a high level assessment of aircraft noise intrusion has been provided for the proposed childcare centre considering it is only conditionally acceptable based on its location. Indicative façade treatment has been provided for the childcare centre as required. The predictions and recommendations provided for aircraft noise intrusion should be verified and developed further during the detailed design stage.

8.4 Aircraft noise intrusion

Aircraft noise was determined to be L_{ASMax} 72 dB at each building façade from general aviation aircraft utilising the Bankstown Airport fixed wing training circuit flight paths. Considering noise ingress through each façade and roof of the building, required Rw values and indicative treatment are provided in order to achieve the aircraft noise insulation criteria given in AS 2021:2015.

Recommended indicative construction systems for building envelope required to meet established acoustic criteria for noise intrusion are presented in Table 38.

Bankstown Airport 2039 ANEF chart with site location

Site Boundary — ANEF 2039

Figure 4 Details of Bankstown Airport 2039 ANEF chart, with location of the proposed development

Table 38 Indicative construction systems for Child care Centre building envelope

Element	Rw[1]	Indicative construction[2]	Comments
External walls (Light weight)	Rw 45	6mm Fibre Cement cladding / 92mm steel stud with minimum 75mm thick 14kg/m^3 insulation / 13mm standard plasterboard	
External walls (Masonry)	Rw 58	110mm brick / 92mm steel stud with minimum 75mm thick 14kg/m3 insulation / 13mm standard plasterboard	
Glazing	Rw 32-36	6.38mm or 10.38mm laminated glass in fixed or sliding configuration	Fixed configuration may be required to achieve proposed Rw value. Other configurations should be checked for low frequency insulating properties.
External Doors	Rw 32	44mm solid core door with with Raven RP38 and RP24 Seals or equivalent	Any glazing inserts on solid core doors to match that of glazing requirements
Roof/ceiling	Rw 45	Sheet metal roof / ceiling cavity of approximately250mm depth or greater with 75mm 14kg/m^3 insulation / 13mm standard plasterboard ceiling	

Notes:

1. High level predicted Rw required to achieve an internal noise level of L_{ASMax} 50 dB.
2. Indicative construction to be verified at the detailed design stage.

Acoustic treatment requirements to control noise intrusion from Birdwood Road and operational activities from the Precinct to the proposed Childcare have been reviewed. The acoustic treatment recommended to control aircraft noise intrusion, refer to Table 38, should be sufficient to control other external noise intrusion sources, i.e. road traffic on Birdwood Road and operational activities associated with the proposed Bankstown Airport Link Road Mixed Use Precinct. Acoustic treatment options for other external noise sources should be verified at the detailed design stage.

9.0 Conclusion

This report presents the results of an operational noise and vibration impact assessment for the proposed Link Road Mixed Use Precinct.

This acoustic assessment details the appropriate environmental criteria, the likely environmental noise levels from the construction and operation of the precinct, and a discussion of the compliance of these activities with the relevant criteria.

Construction noise and vibration

Construction scenarios for the proposal were developed in consultation with the Forge Venture Management project management team, and the proposed equipment has been detailed within this report. Three distinct construction stages were used in a computer-based noise model to determine the potential impact of construction noise. Construction impacts were then assessed at all receivers at various locations across the project area. The ICNG's NMLs are more stringent than the construction noise criteria outlined in the Airports Regulations, therefore the ICNG's NMLs have been utilised as the design criteria for the proposal.

A conservative assessment predicts that 49 receivers within Georges Hall will experience noise levels above the NML for the Foundations construction scenario. Of these receivers, eight are expected to be highly affected. For the Site Establishment scenario, 28 receivers are expected to experience noise levels above the NML, with six of these expected to be highly affected. For the Frame and Façade construction scenario, 32 receivers are expected to experience noise levels above the NML, with eight of these expected to be highly affected.

Fourteen non-residential receivers are expected to exceed the construction NMLs for the peak construction scenario (Foundations). These receivers include Bankstown Montessori Pre-school, Georges River Grammar School, SUPA IGA Georges Hall, Georges Hall Community Centre, and St Martin's Anglican Church, Park.

An assessment of the likely construction traffic movements cannot be conducted at this stage as existing traffic volumes along access routes are not yet available. A construction traffic assessment should be conducted at the detailed design stage.

The main source of vibration during construction would be the use of piling rigs during earthwork and structural works. Minimum working distances for vibration intensive construction work have been presented. Equipment size would be selected by the construction contractor accounting for the minimum working distances and the distance between the area of construction and the most affected sensitive receiver. If work needs to be carried out within minimum working distances, vibration monitoring would be carried out to manage potential structural damage.

Operational noise and vibration

An operational noise assessment was carried out in accordance with the EPA's *Noise Policy for Industry, 2017* (NPfI) as required under Bankstown Airport Noise and Vibration Management Plan (NVMP). Likely operational scenarios during the daytime, evening and night-time were assessed at representative receiver locations near to the project area against the project noise trigger levels. In addition, likely maximum noise events from operational activities around the proposed warehouse buildings were used to assess sleep disturbance at all nearby assessment residential receivers.

Results show predicted operational noise emissions from the proposed site are compliant with the project noise trigger levels provided that the maximum equipment noise levels, traffic movements, noise barriers, and plans of management presented in this report are properly implemented. Noise mitigation strategies provided in this report are high level and should be verified at the detailed design stage.

An assessment of the likely operational road traffic was not conducted at this stage as existing traffic counts along access routes are not yet available. This operational road traffic noise assessment should be conducted at a more advanced design stage in accordance with the EPA's NSW Road Noise Policy (RNP).

Operation of the proposal is not predicted to generate any adverse vibration to nearby sensitive receivers.

Aircraft noise assessment

Based on the location of the precinct with respect to the most up-to-date Bankstown Airport 2039 ANEF chart, the location of the proposal indicates that the development would be ‘acceptable’ for light industrial and commercial usage and ‘conditionally acceptable’ for school (childcare centre) usage.

A maximum aircraft noise level of L_{Asmax} 72 dB has been predicted from general aviation aircraft to the site. Indicative Rw values and construction detail have been recommended for the proposed childcare centre. These recommendations should be verified during the detailed design stage, prior to construction. Other sensitive land uses for the site to be determined at a later stage should also be verified prior to construction.

Appendix A

Acoustic Terminology

Appendix A Acoustic Terminology

The following is a brief description of acoustic terminology used in this report.

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 [Leq]	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.
Lmax	The maximum sound pressure level measured over the measurement period
Lmin	The minimum sound pressure level measured over the measurement period
L10	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L10.

L90	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L90.
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 L90 sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The Leq 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.
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

Unattended Noise Monitoring Summaries

Noise Logger Report

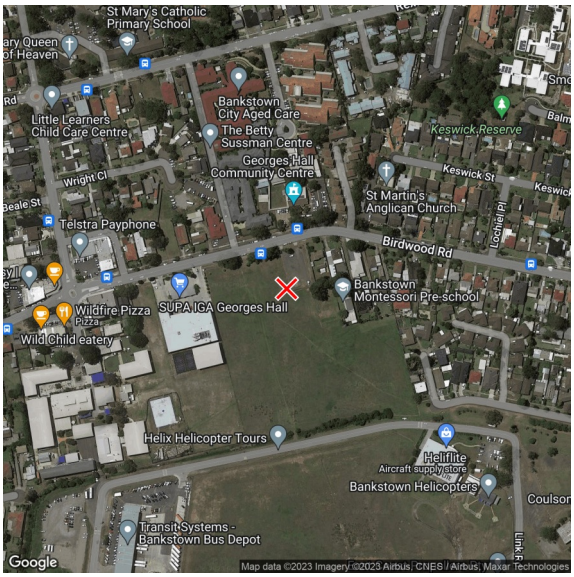
5012/DP1176822, Georges Hall

Item	Information
Logger Type	NL-52
Serial number	898334
Address	5012/DP1176822, Georges Hall
Location	North-eastern end of site
Facade / Free Field	Free field
Environment	Traffic noise from Link Road and Birdwood Road dominant. Children playing at nearby schools.Trucks and car pass-bys over speed bumps on Link Road - 50-56dBA. Helicopters passing over Birdwood Reserve - 51dB-65dBA. Helicopter above tarmac at the airport and helicopter flying over the reserve 81dBA. Windy weather conditions

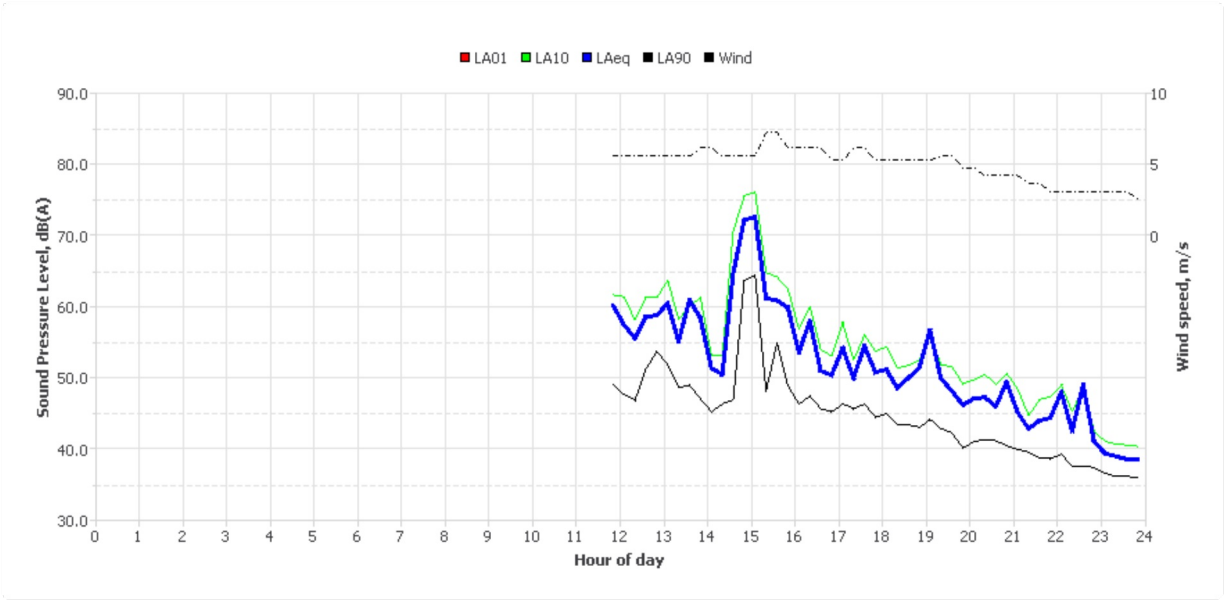
Measured noise levels

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
Mon Nov 13 2023	65	49	44	-	39	-	62	44
Tue Nov 14 2023	57	51	49	45	40	35	56	49
Wed Nov 15 2023	56	52	50	-	39	36	55	50
Thu Nov 16 2023	58	48	49	-	-	-	56	49
Fri Nov 17 2023	57	50	50	-	-	-	56	50
Sat Nov 18 2023	54	52	47	-	-	37	53	47
Sun Nov 19 2023	52	51	45	-	39	36	52	45
Mon Nov 20 2023	54	52	52	42	40	39	53	52
Tue Nov 21 2023	56	51	57	45	41	36	55	57
Wed Nov 22 2023	58	51	49	-	-	38	57	49
Summary	**58**	**51**	**51**	**45**	**39**	**36**	**56**	**51**

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
	

Monday, 13 Nov 2023



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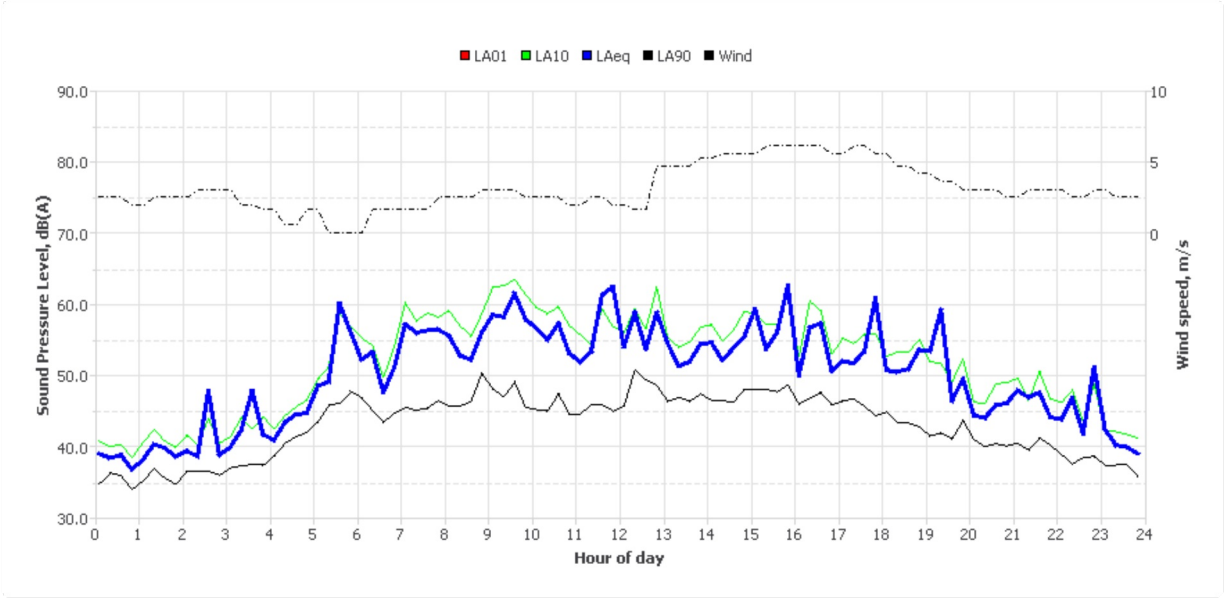
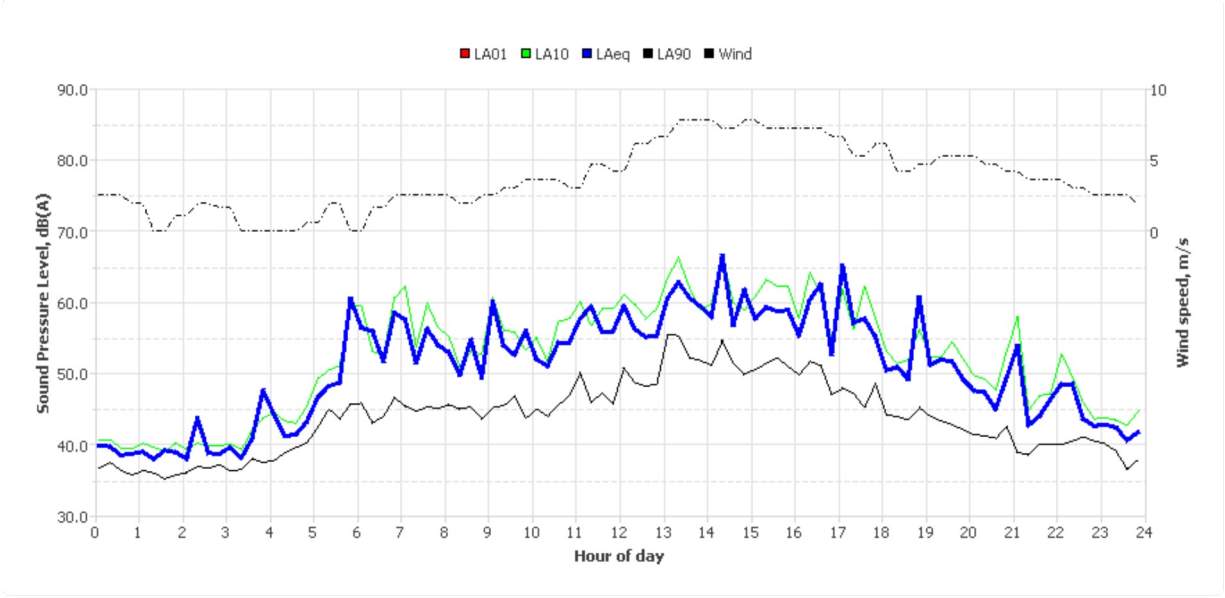
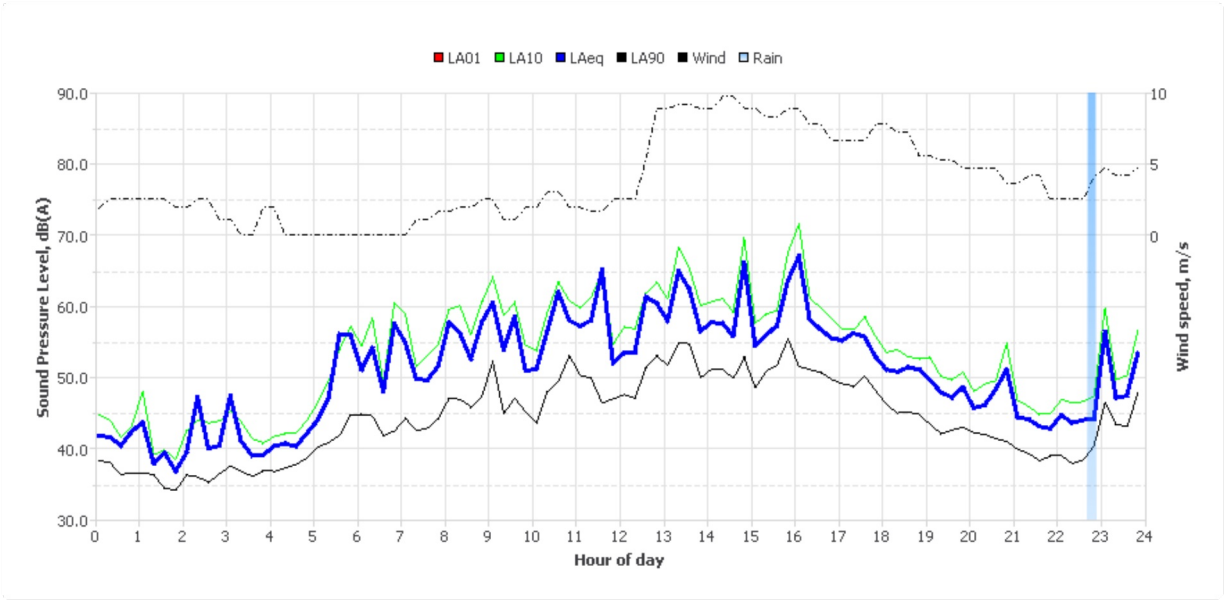


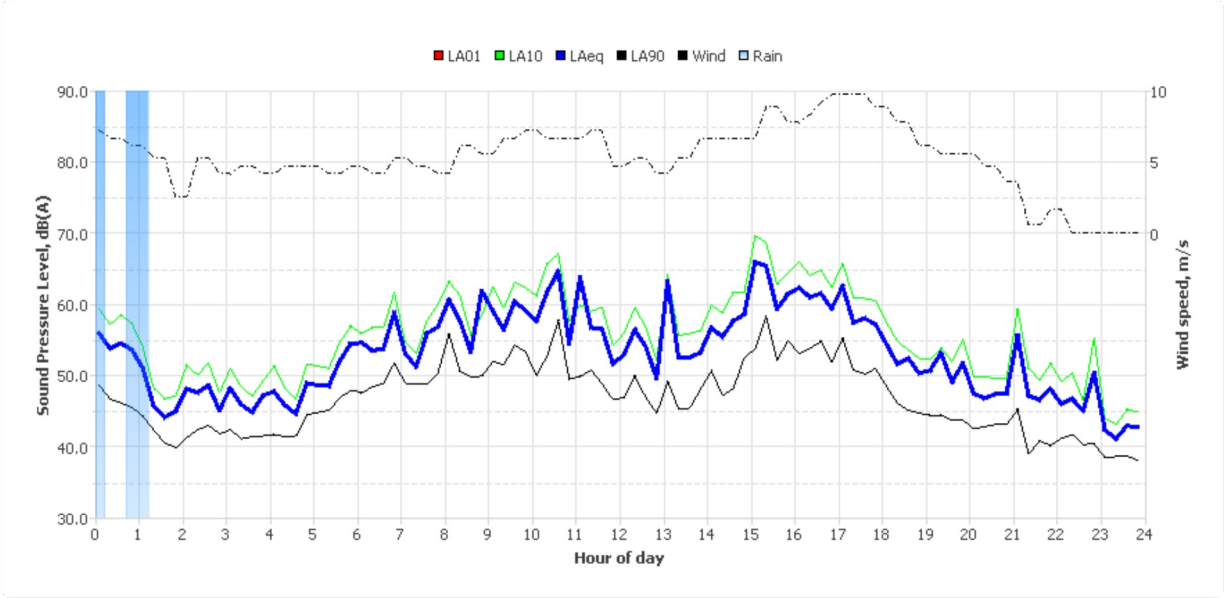
Wednesday, 15 Nov 2023



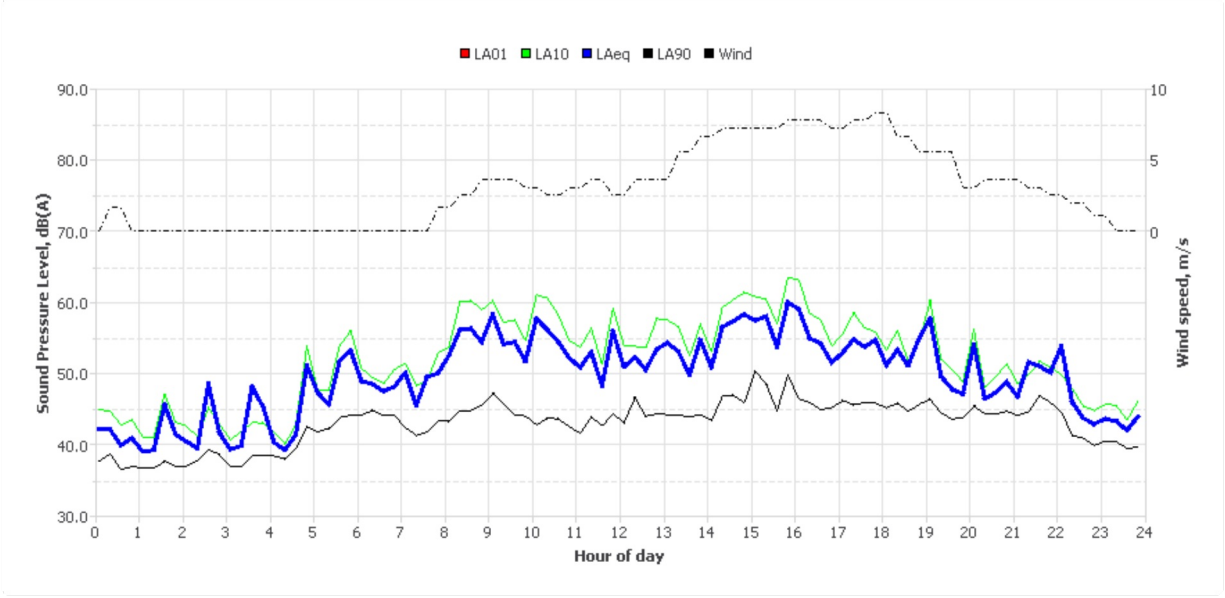
Thursday, 16 Nov 2023



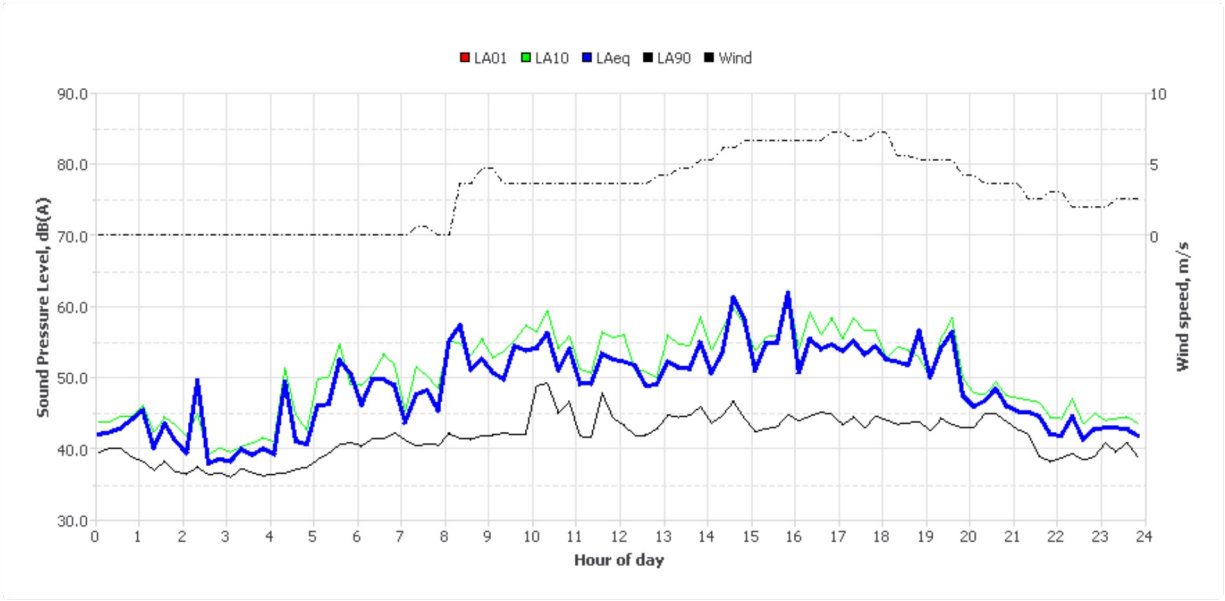
Friday, 17 Nov 2023



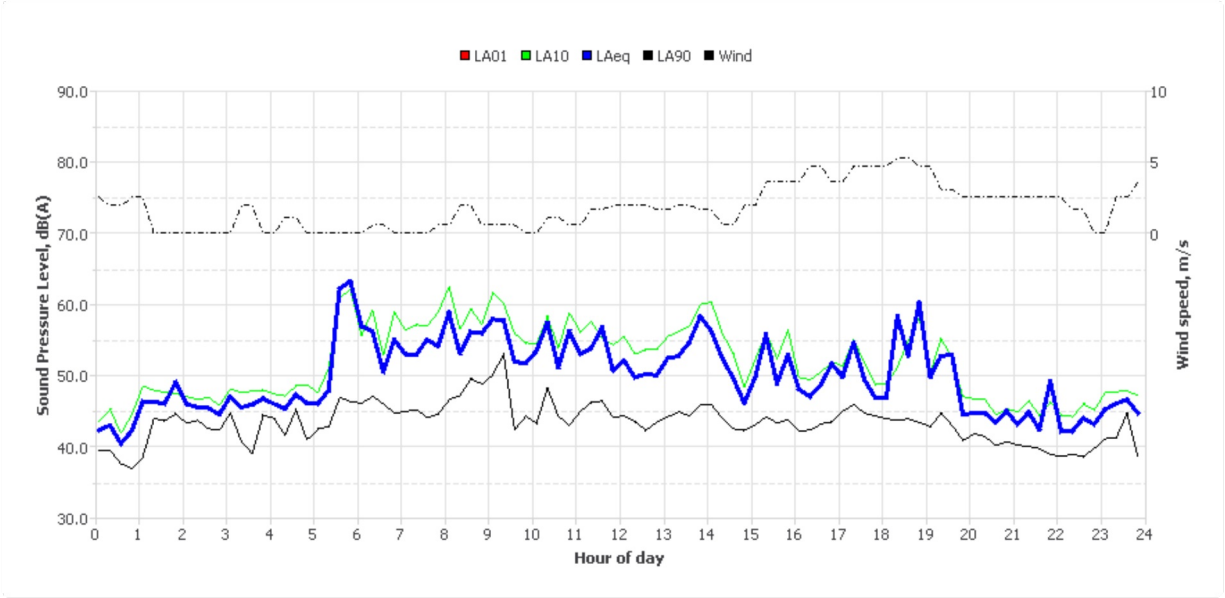
Saturday, 18 Nov 2023



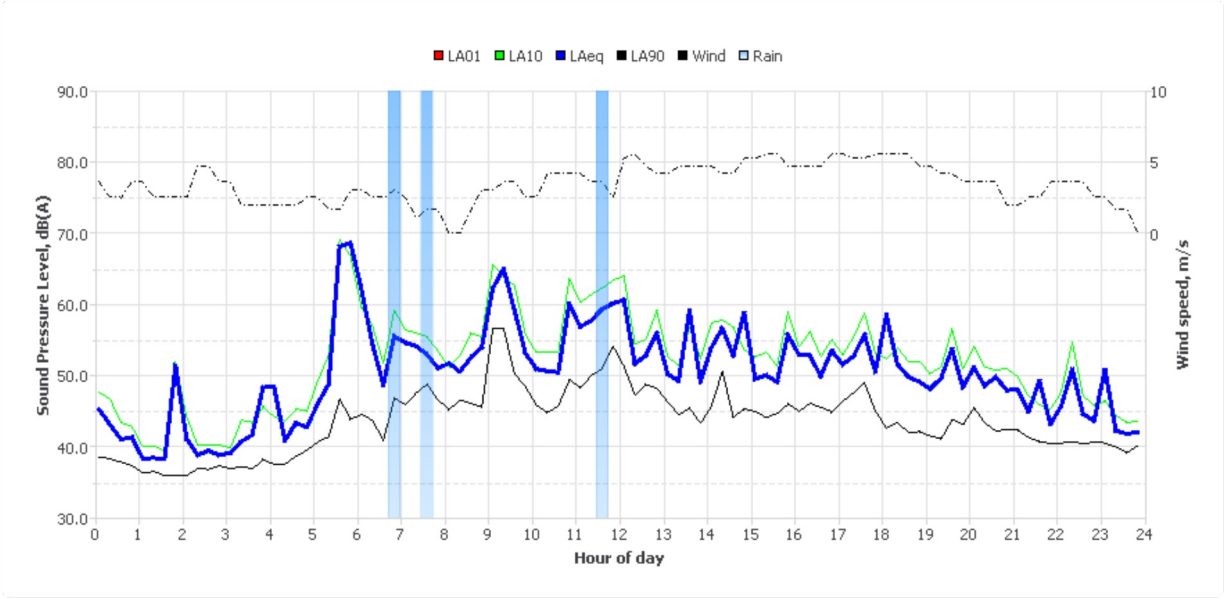
Sunday, 19 Nov 2023



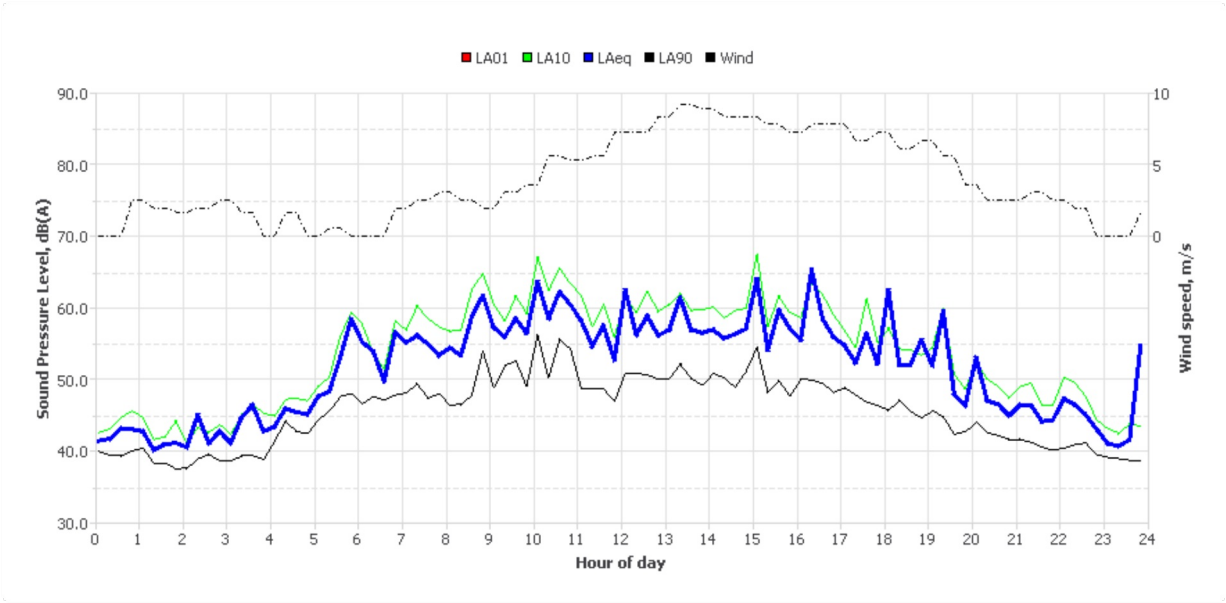
Monday, 20 Nov 2023



Tuesday, 21 Nov 2023

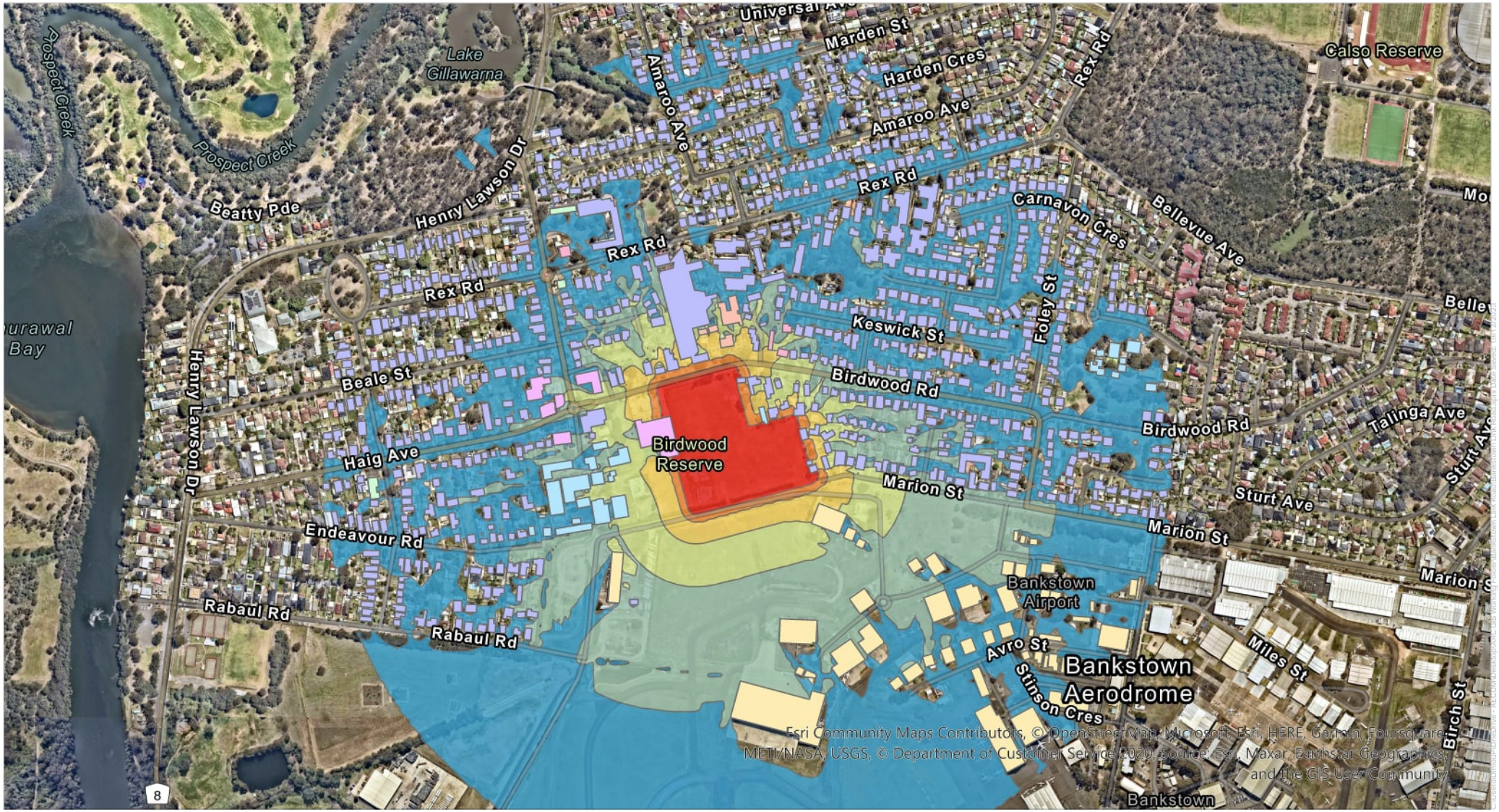


Wednesday, 22 Nov 2023



Appendix C

Construction Noise Contour Maps



Bankstown Airport Link Road Mixed Use Precinct Construction Noise Contours - Scenario 1

Predicted Noise Level L_{Amax} dB

30 40 50 60 70 80

- Childcare Centre
- Commercial
- Community
- Education
- Industrial
- Place of Worship
- Residential

N

0 125 250 Meters

Bankstown Airport Link Road Mixed Use Precinct
Construction Noise Contours - Scenario 2

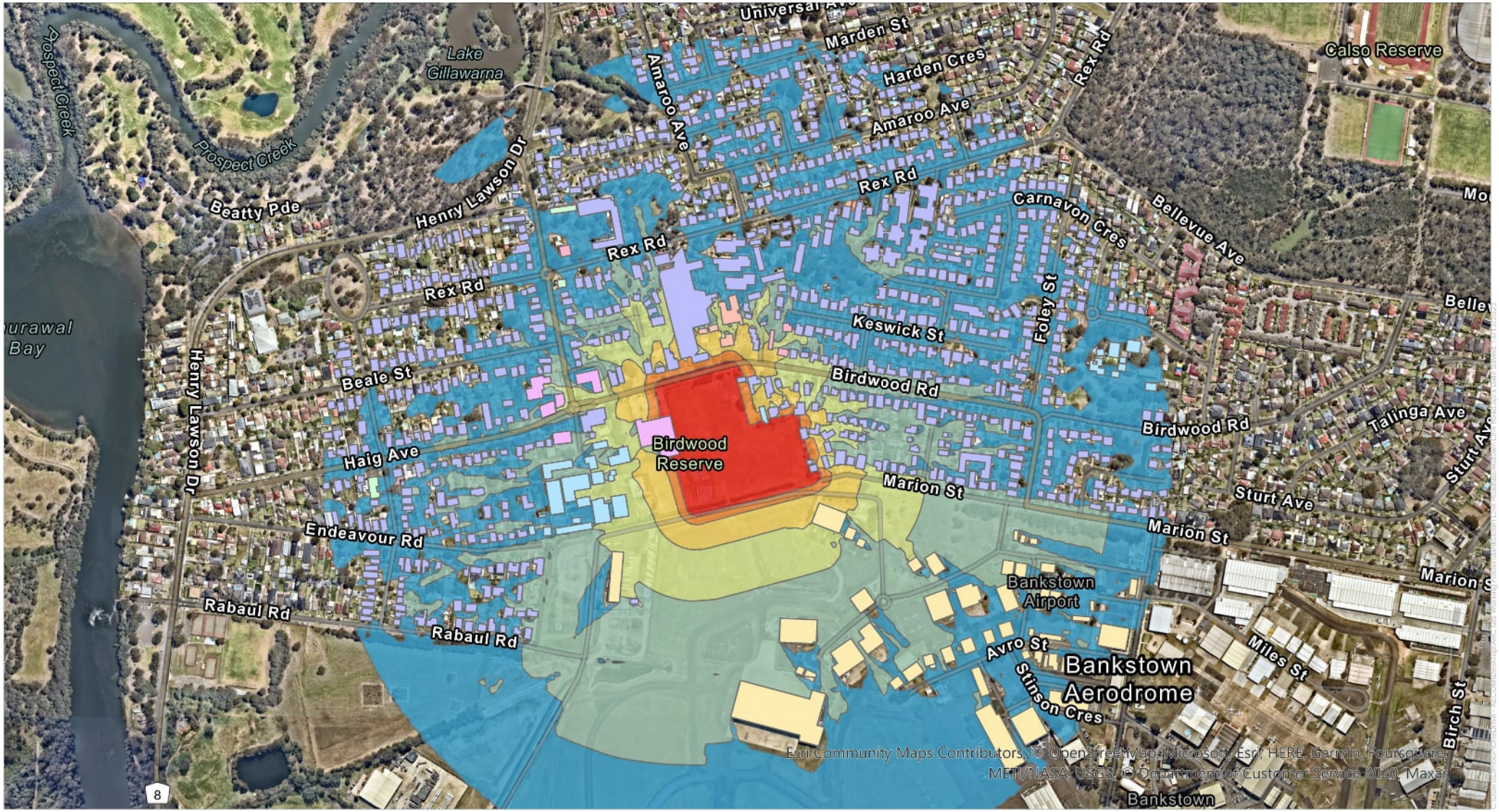
Predicted Noise Level L_{Amax} dB

30 40 50 60 70 80

- Childcare Centre
- Commercial
- Community
- Education
- Industrial
- Place of Worship
- Residential

N

0 125 250 Meters



Bankstown Airport Link Road Mixed Use Precinct Construction Noise Contours - Scenario 3

Predicted Noise Level L_{Amax} dB

30 40 50 60 70 80

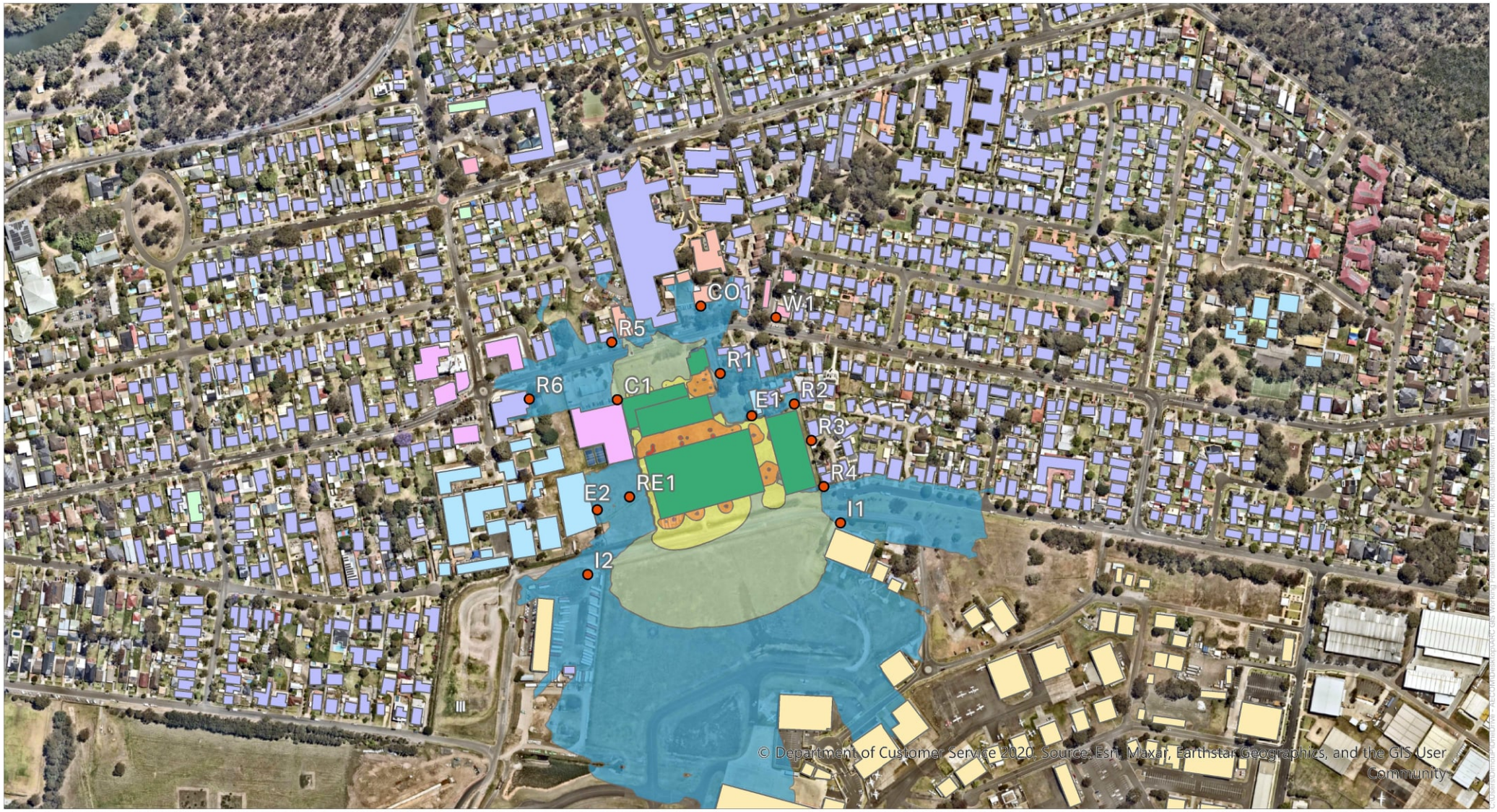
- Childcare Centre
- Commercial
- Community
- Education
- Industrial
- Place of Worship
- Residential

N

0 125 250 Meters

Appendix D

Operational Noise Contour Maps



Bankstown Airport Link Road Mixed Use Precinct
Operational Noise Contours - Daytime
(Standard Weather)

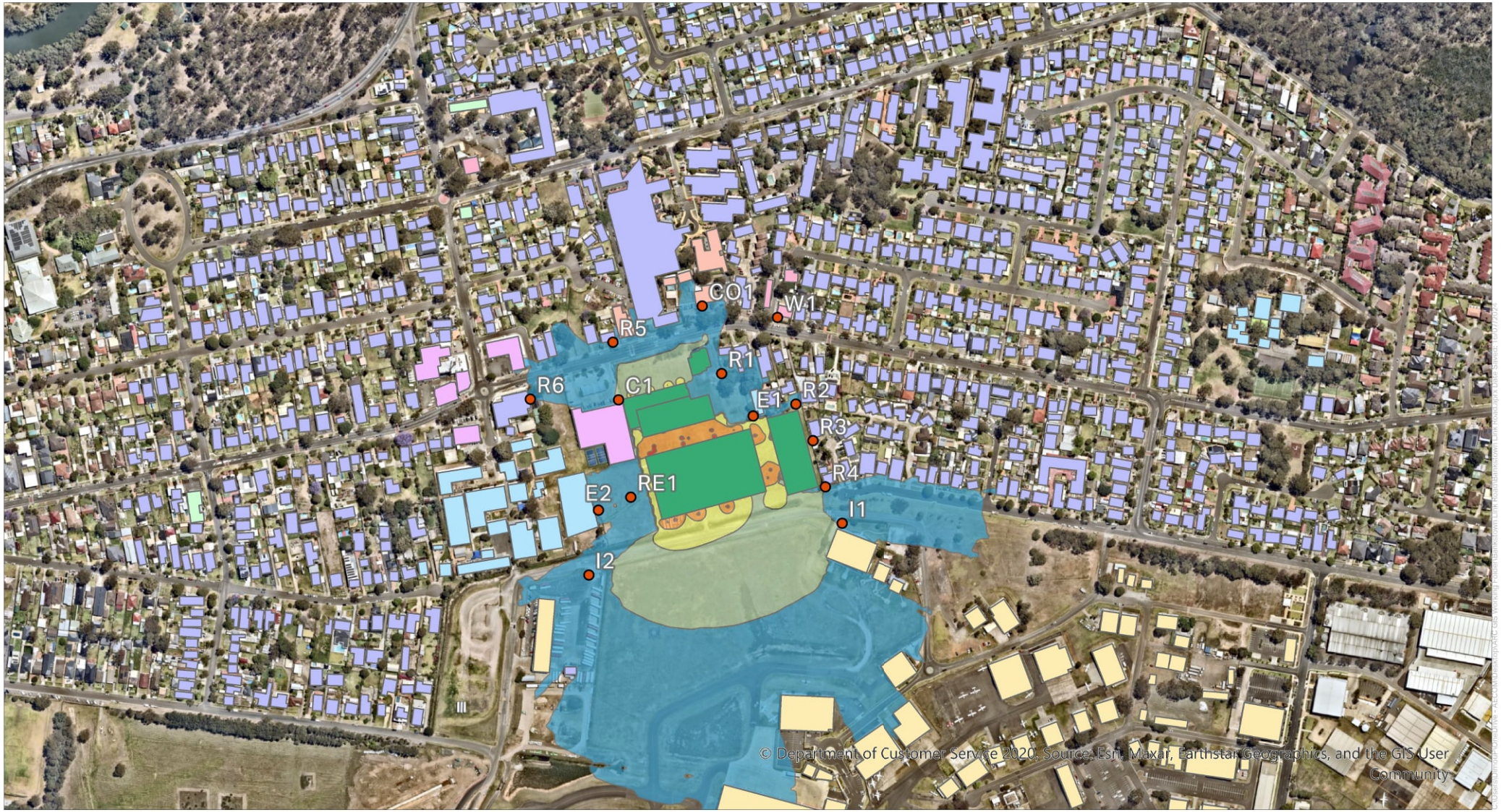
Predicted Noise Level $L_{Aeq,15min}$ dB

40 50 60 70 80

- Childcare Centre
- Commercial
- Community
- Education
- Industrial
- Place of Worship
- Residential
- Assessment Receiver

N

0 80 160 Meters



Bankstown Airport Link Road Mixed Use Precinct
Operational Noise Contours - Evening
(Standard Weather)

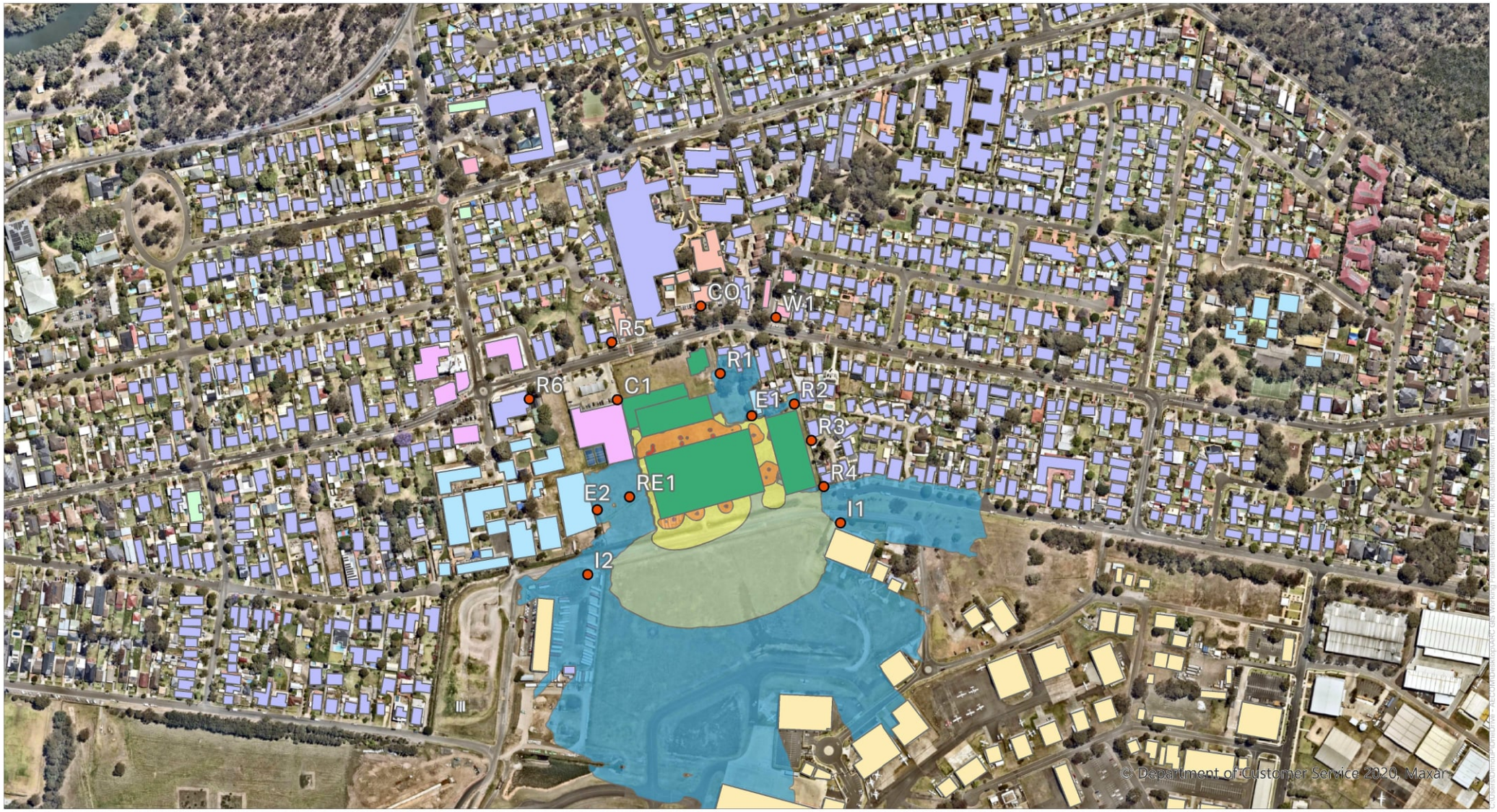
Predicted Noise Level $L_{Aeq,15min}$ dB

40 50 60 70 80

- Childcare Centre
- Commercial
- Community
- Education
- Industrial
- Place of Worship
- Residential
- Assessment Receiver

N

0 80 160 Meters



Bankstown Airport Link Road Mixed Use Precinct
Operational Noise Contours - Night
(Standard Weather)

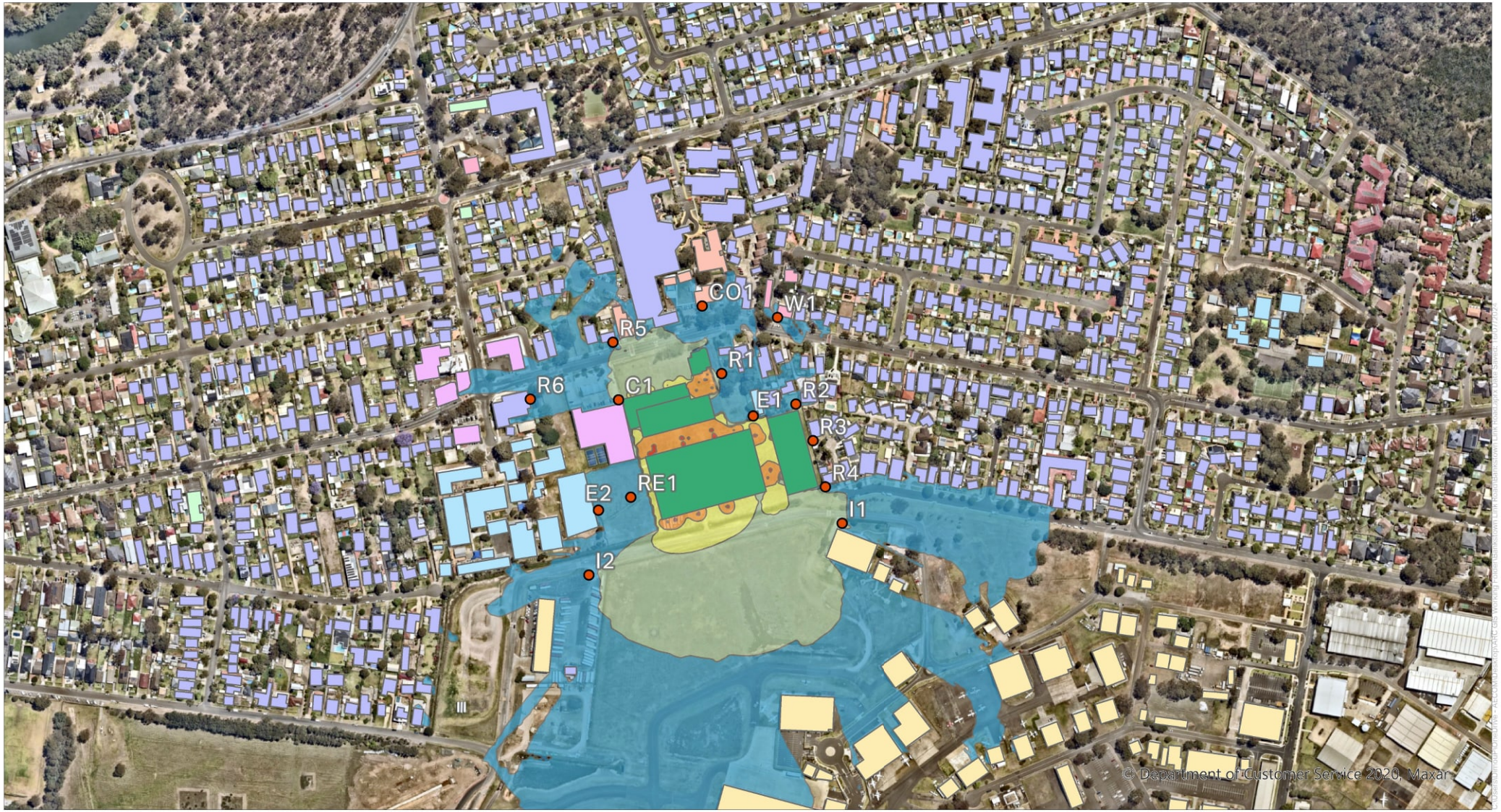
Predicted Noise Level $L_{Aeq,15min}$ dB

40 50 60 70 80

- Childcare Centre
- Commercial
- Community
- Education
- Industrial
- Place of Worship
- Residential
- Assessment Receiver

N

0 80 160 Meters



Bankstown Airport Link Road Mixed Use Precinct
Operational Noise Contours - Daytime
(Noise Enhancing Weather)

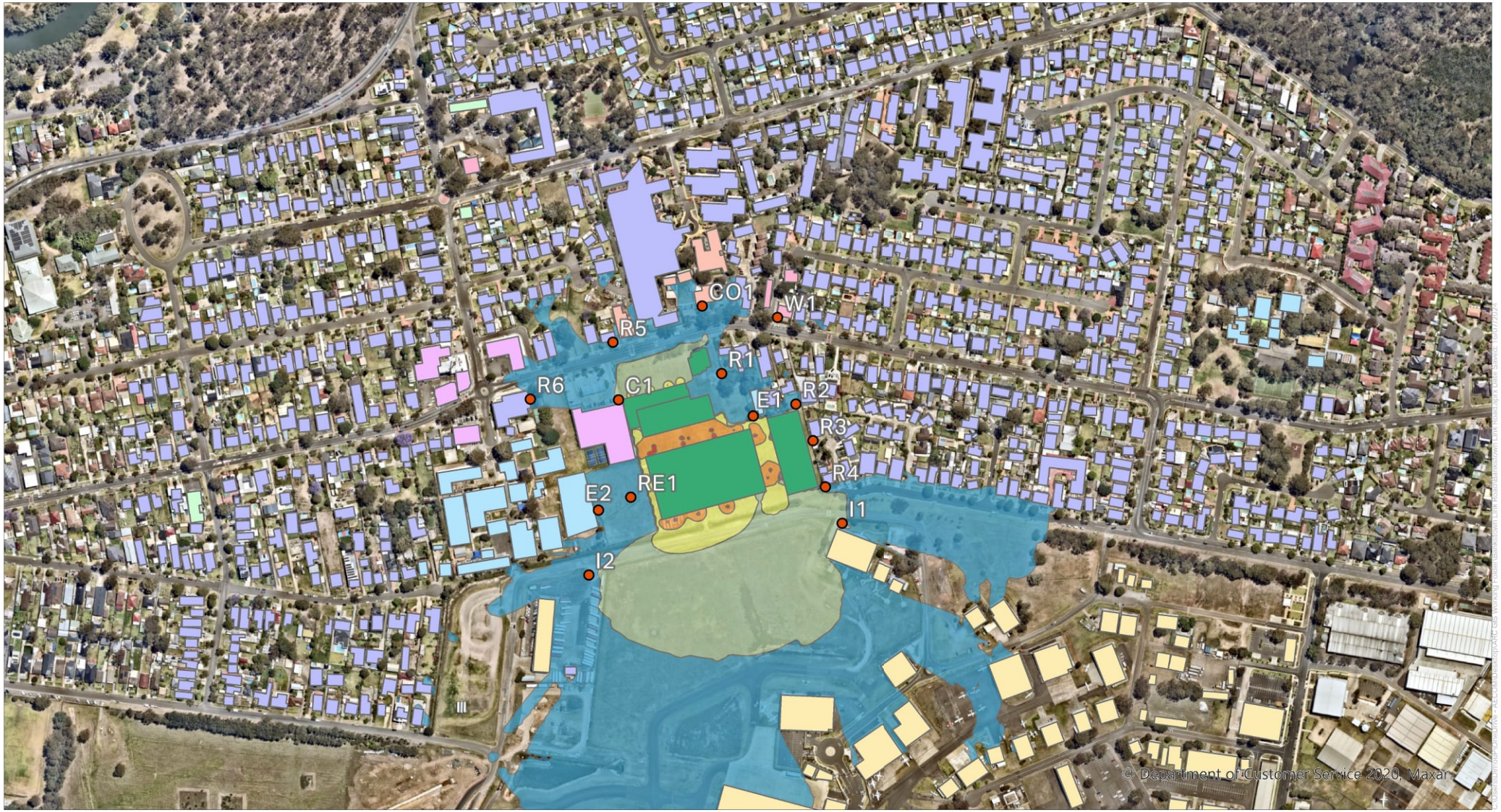
Predicted Noise Level $L_{Aeq,15min}$ dB

40 50 60 70 80

- Childcare Centre
- Commercial
- Community
- Education
- Industrial
- Place of Worship
- Residential
- Assessment Receiver

N

0 80 160 Meters



Bankstown Airport Link Road Mixed Use Precinct
Operational Noise Contours - Evening
(Noise Enhancing Weather)

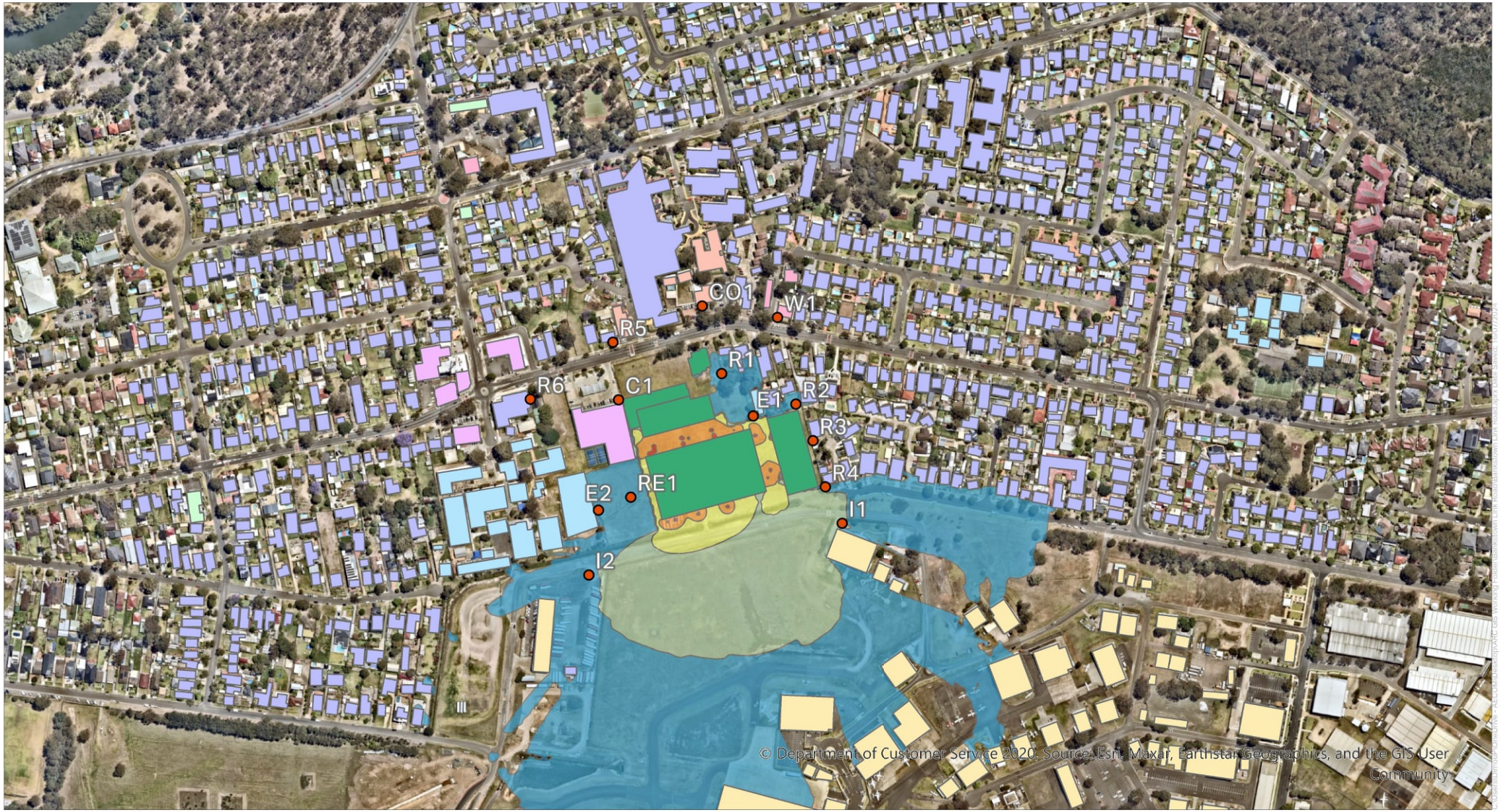
Predicted Noise Level $L_{Aeq,15min}$ dB

40 50 60 70 80

- Childcare Centre
- Commercial
- Community
- Education
- Industrial
- Place of Worship
- Residential
- Assessment Receiver

N

0 80 160 Meters



Bankstown Airport Link Road Mixed Use Precinct
Operational Noise Contours - Night
(Noise Enhancing Weather)

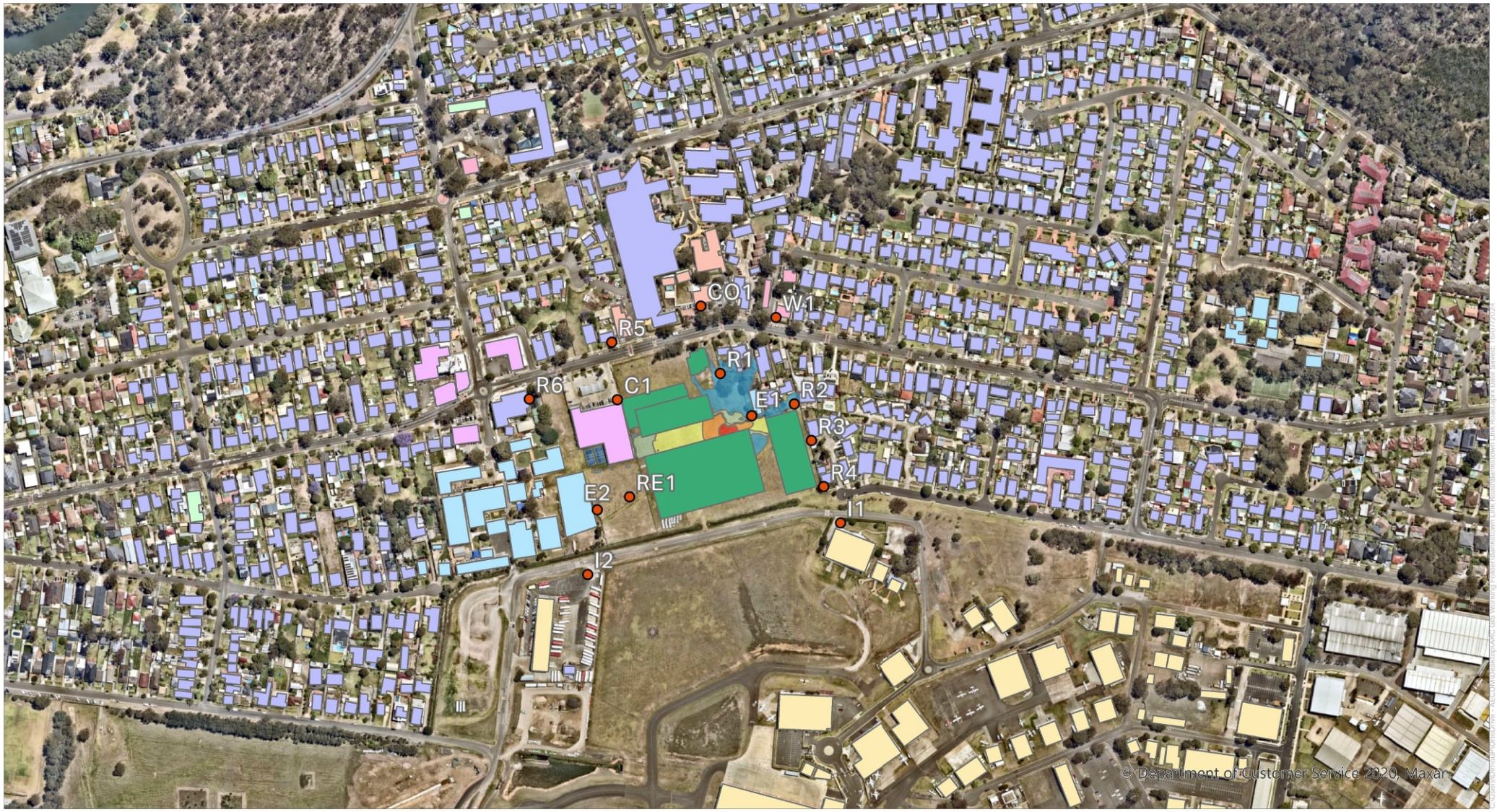
Predicted Noise Level $L_{Aeq,15min}$ dB

40 50 60 70 80

- Childcare Centre
- Commercial
- Community
- Education
- Industrial
- Place of Worship
- Residential
- Assessment Receiver

N

0 80 160 Meters



Bankstown Airport Link Road Mixed Use Precinct
Operational Noise Contours - Sleep Disturbance
(Noise Enhancing Weather)

Predicted Noise Level $L_{A,1min}$ dB

50 60 70 80 90

- Childcare Centre
- Commercial
- Community
- Education
- Industrial
- Place of Worship
- Residential
- Assessment Receiver

N

0 80 160 Meters