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Environmental Noise Impact Assessment

Proposed Mixed Use Commercial Development

58-62 Railway Parade, Granville, NSW

REPORT No
7857-1.1R

DATE ISSUED
14 December 2023

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Revision History

Report	Date	Prepared	Checked	Comment
Final	14/12/2023	Alexander Mendoza	Stephen Gauld	

Document 7857-1.1R, 49 pages plus attachments

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1.0 EXECUTIVE SUMMARY

A new three storey mixed-use development is proposed to be constructed at 58-62 Railway Parade, Granville, NSW (the Site). The Site is located on land zoned E1 – *Local Centre* under the Cumberland Local Environmental Plan (LEP) 2021.

The Site is bounded by a multi-storey commercial building to the south (Granville Police Station) and a single storey residential dwelling to the west. Two-storey commercial premises are also located to the east on the opposite side of Carlton Street.

Multi-storey residential apartment buildings are also located further to the west on Jamieson Street and to the northwest on the north side of Bridge Street with the T1, T2 and T7 train lines located within the intervening distance between the site and these residential areas.

The Site and nearby receptors are shown in Figure 1.

The proposal will involve the demolition of the existing Medical Centre at 62 Railway Parade and the construction of a new three storey mixed use commercial building over two levels of basement car parking accessed from Railway Parade. The existing heritage building at 58 Railway Parade is to be retained.

The ground floor of the new building will comprise of a medical centre and commercial/retail premises at ground level with a child care centre (the Centre) on Levels 1 and 2.

The Centre will include two outdoor play areas on Level 1 and another two on Level 2. The Centre will include a total of six indoor play areas, office, lobby, kitchen and amenities.

The basement level car park will have capacity for a total of 51 vehicles. Of these spaces, 2 are designated for the commercial/retail premises, 23 designated for visitors and staff of the medical centre and 26 designated for parents and staff of the child care centre.

The architectural drawings relied on for this assessment have been prepared by Zhinar Architects and are attached as Appendix C.

The Centre will have a total capacity for 120 children, comprising of:

- 0-2 years old – 40 children;
- 2-3 years old – 40 children; and
- 3-5 years old – 40 children.

The proposed hours of operation for the building are as follows:

Table 1 Proposed Hours of Operation

Operation	Weekdays	Saturday	Sunday
Commercial/Retail	7 am – 6 pm	8 am – 3 pm	8 am – 12 pm
Medical Centre	8 am – 6 pm	9 am – 12 pm	Closed
Child Care Centre	7 am – 6 pm	Closed	Closed

Nearby residential and commercial premises may be affected by the following sources of noise emission from the use of the building:

- People engaging in conversation within the outdoor seating area of the cafe
- Children playing both outside and inside on Levels 1 and 2 of the child care centre;
- Car park and additional on-road traffic generated by the commercial/retail premises, medical centre and child care centre;
- Vehicle movements within the rear loading dock area; and
- Mechanical plant serving the commercial/retail premises, medical centre and child care centre

Cumberland City Council requires an acoustic assessment to demonstrate that the noise impact from the various operations within the building will not adversely affect the acoustic amenity of nearby residential and commercial premises.

Acceptable noise limits for noise emission associated with the use of the commercial/retail premises and medical centre have been derived from the NSW Environment Protection Authority's (EPA) *Noise Policy for Industry.*

Acceptable noise limits for noise emission associated with the child care centre have been derived from the Association of Australasian Acoustical Consultants' (AAAC) '*Guideline for Child Care Centres Acoustic Assessment*' (the AAAC Guideline). Additionally, noise intrusion from the nearby train line and road traffic has been assessed to the indoor and outdoor play areas of the Centre with acceptable noise limits derived from the AAAC Guideline.

Acceptable noise limits for additional on-road traffic generation associated with the use of the building are derived from the EPA's *Road Noise Policy* (RNP).

In addition to the assessment of noise impacts to and from the building, vibration impacts from the train line on the building have also been assessed. Appropriate noise and vibration criteria have been derived from Australian Standard AS2107:2016 – *Acoustics – Recommended design sound levels and reverberation times for building interiors* and the NSW Department of Planning's *'Development Near Rail Corridors and Busy Roads – Interim Guideline'*.

Calculations show that, provided the recommendations in Section 8 are implemented, the levels of noise emission from the Centre and of intrusive noise and vibration upon the subject site will meet the acoustic requirements established in Section 5.11 for the various uses, and will therefore be acceptable.

2.0 CONSULTING BRIEF

Day Design Pty Ltd was engaged by Zhinar Architects on behalf of Dr Adel Soliman to assess the environmental noise impact from a proposed mixed use commercial development comprising a commercial/retail premises, medical centre and child care centre, to be constructed at 58-62 Railway Parade, Granville, NSW. Noise and vibration impact upon the subject site from nearby road and rail traffic have also been assessed.

This commission involves the following:

Scope of Work:

- Inspect the site and environs
- Measure the background noise levels at critical locations and times
- Establish acceptable noise level criterion
- Prepare a site plan identifying the development and nearby noise sensitive locations
- Quantify noise emissions from the various facets of the proposed development
- Quantify road and rail noise and vibration intrusion to the subject site
- Calculate the level of noise emission, taking into account building envelope transmission loss, screen walls and distance attenuation
- Provide recommendations for noise control
- Prepare an Environmental Noise Impact Assessment Report.

3.0 SITE AND DEVELOPMENT DESCRIPTION

3.1 Site Description

The Site is located on land zoned E1 – *Local Centre* under the Cumberland Local Environmental Plan (LEP) 2021.

The Site is bounded by a multi-storey commercial building to the south (Granville Police Station) and a single storey residential dwelling to the west. Multi-storey commercial premises are also located to the east on the opposite side of Carlton Street.

Multi-storey residential apartment buildings are also located further to the west on Jamieson Street and to the northwest on the north side of Bridge Street with the T1, T2 and T7 train lines located within the intervening distance between the site and these residential areas.

The Site and nearby receptors are shown in Figure 1.

The Site and the nearest noise sensitive receptors to the site are also shown in Figure 1 and are presented below in Table 2. Noise assessment RL heights for receptors and the surrounding area have been derived from survey drawings and topographical LiDAR data obtained from ELVIS Elevation and Depth service.

Table 2 Noise Sensitive Receptors

Receiver	Address	Location	Assessment RL	Direction from site
R1	2 Carlton St (Granville Police Station)	Ground level, North façade	20.96	South
		Level 1, North façade	24.46	
		Level 2, North facade	27.96	
R2	15 Jamieson St	Level 1, East façade	20.56	Southwest
		Level 2, East facade	24.06	
R3	70-72 Railway Pde	Level 1, South façade	19.37	West
		Level 2, South façade	21.87	
		Level 3, South façade	25.37	
R4A	64 Railway Pde	Ground level, front yard	16.08	West
R4B		Ground level, rear yard	16.89	
R4C		Ground level, East facade	16.65	
R5	10-12 Bridge St	Level 2, South façade	24.90	Northeast
		Level 4, South façade	31.90	
		Level 6, South façade	38.90	
R6	52 Railway Pde	Ground level, West facade	17.58	East
		Level 1, West facade	20.58	

As the noise sources on the Site are at varying distances from the receptors, specific distances between each noise source and receptor are used in all calculations. All distances are based upon the architectural drawings, satellite imagery and LiDAR data.

Figure 1 – Location Plan – 58-62 Railway Parade, Granville, NSW

3.2 Development Description

The proposal will involve the demolition of the existing Medical Centre at 58 Railway Parade and the construction of a new three storey mixed use commercial building over two levels of basement car parking accessed from Railway Parade. The existing heritage building at 62 Railway Parade is to be retained.

The ground floor of the new building will comprise of a medical centre and commercial/retail premises at ground level with a child care centre (the Centre) on Levels 1 and 2. It is not known what specific operations may utilise the commercial/retail premises at this stage, however for noise modelling assumptions we have assumed that a café or general retail shop may occupy this area.

The Centre will include two outdoor play areas on Level 1 and another two on Level 2. The Centre will include a total of six indoor play areas, office, lobby, kitchen and amenities.

The basement level car park will have capacity for a total of 51 vehicles. Of these spaces, 2 are designated for the commercial/retail premises, 23 designated for visitors and staff of the medical centre and 26 designated for parents and staff of the child care centre.

A loading dock area is proposed at the southern side of the site which will be accessed from the laneway. The loading dock area will accommodate small rigid vehicles (ie small trucks) for deliveries etc, it is not anticipated that large trucks will utilise this area.

The architectural drawings relied on for this assessment have been prepared by Zhinar Architects and are attached as Appendix C.

The Centre will have a total capacity for 120 children, comprising of:

- 0-2 years old – 40 children;
- 2-3 years old – 40 children; and
- 3-5 years old – 40 children.

The proposed hours of operation for the building are as follows:

Table 3 Proposed Hours of Operation

Operation	Weekdays	Saturday	Sunday
Commercial/Retail	7 am – 6 pm	8 am – 3 pm	8 am – 12 pm
Medical Centre	8 am – 6 pm	9 am – 12 pm	Closed
Child Care Centre	7 am – 6 pm	Closed	Closed

4.0 MEASURED NOISE LEVELS

Noise survey instrumentation used in this assessment is listed in Appendix A. A Glossary of Acoustical Terms is included as Datasheet AC108.

4.1 Measured Ambient Noise Levels

In order to assess the severity of a possible environmental noise problem in a residential area it is necessary to measure the ambient background noise level at the times and locations of worst possible annoyance. The lower the background noise level, the more perceptible the intrusive noise becomes and the more potentially annoying.

The background noise level should be measured at a location most representative of the potentially affected receptors, in the absence of any noise sources that may be associated with the proposed development.

As specified in Section 3.1 "Background Noise Monitoring" of the AAAC's *'Guideline for Child Care Centre Acoustic Assessment'*, where a consultant is unable to measure the background noise level at the most affected receiver locations, the consultant *'shall select another suitable and equivalent location. This measured representative noise environment should be used to establish relevant criteria for all sensitive receivers.'*

During our site inspection it was noted that the potentially *most affected sensitive receiver locations* were 'R1' – 'R6', as detailed in Section 3. Therefore, suitable and equivalent noise monitoring locations, Location 'A' and Location 'B' (see Figure 1) were selected to represent these *most affected sensitive receivers*.

The background noise in the area is mainly influenced by road traffic noise from the intersection of Railway Parade, Carlton Street and Bold Street which carries moderate traffic volumes including trucks and heavy vehicles. Additionally, noise from train movements on the T1, T2 and T7 rail lines also contribute to the existing acoustic environment.

An environmental noise monitor was placed on the rooftop of the existing medical centre on the north side of the building, in line with the north façade, from Wednesday 30 August to Wednesday 6 September 2023, to determine the Rating Background Level. The microphone height was approximately 1.5 metres above rooftop level, above the parapet wall. The microphone was fully exposed to road and rail noise with line of sight to nearby roads and the train line. This measured representative noise environment has been used to establish the relevant criteria for receptors that are elevated and/or exposed to road and rail noise.

An environmental noise monitor was also placed at ground level at the rear of the Heritage building from Wednesday 30 August to Wednesday 6 September 2023, to determine the Rating Background Level. The microphone height was approximately 1.5 metres above ground level. This location is fully shielded from traffic on the surrounding roads and train line with no line of sight. This measured representative noise environment has been used to establish the relevant criteria for receptors which are fully or partially shielded from traffic noise.

The results of the long term, unattended background noise survey at Location 'A' and Location 'B' during the early morning (6:30 am – 7 am) and day time (7 am – 6 pm) are shown in the attached Appendix B, and below in Table 4.

The Centre will not operate on weekends, therefore, ambient noise levels measured on weekends have been excluded from the RBL calculations in order to establish noise criteria for this facet of the building.

The medical centre will not operate on Sundays, therefore, ambient noise levels measured on Sundays have been excluded from the RBL calculations in order to establish noise criteria for this facet of the building.

We have assumed the commercial/retail premises will operate 7 days a week, therefore, ambient noise levels measured during weekdays and weekends have been included when calculating RBL's in order to establish noise criteria for this facet of the building.

Table 4 Ambient Background Levels – 58-62 Railway Parade, Granville

Noise Measurement Location	Time Period	L_{90} Rating Background Level	L_{eq} Noise Level
Weekdays only – *For establishing noise criteria for the Child Care Centre*			
Location 'A' Rooftop Level	Early Morning	**60**	n/a
	Day	**57**	**64**
Location 'B' Ground level	Early Morning	**51**	n/a
	Day	**48**	**55**
Weekdays and Saturday only – *For establishing noise criteria for the Medical Centre*			
Location 'A'	Day	**57**	**64**
Location 'B'	Day	**48**	**54**
Weekdays and Weekends – *For establishing noise criteria for the Commercial/Retail premises*			
Location 'A'	Day	**57**	**64**
Location 'B'	Day	**48**	**54**

Meteorological conditions during the measurement surveys typically consisted of clear skies with temperatures ranging from 7°C to 28°C. Periods of rainfall and/or wind speeds above 5 m/sec were recorded during the day during the measurement session. Noise level measurements adversely affected by weather conditions have been removed from calculations, where required[1]. Noise level measurements are considered reliable and representative of the background noise levels at all nearby receptor locations. The RBL's at Location 'A' and 'B' are considered to be representative of all residential and commercial receptors in the general area surrounding the subject site.

[1] *Section B1.3 of the EPA's NSW Noise Policy for Industry, under 'Exception' states, 're-monitoring may not be required, where monitoring contains weather-affected data, if it can be ascertained that the affected samples are not within the expected 'quieter' times of an assessment period (day/evening/night); that is, those time periods where the lowest 10th percentile background noise level might occur.'*

4.2 Measured Road and Rail Traffic Noise Levels

The subject site is exposed to road traffic noise from Railway Parade, Carlton Street and Bold Street which all intersect on the northeast side of the subject site. These roads carry moderate traffic volumes including trucks and heavy vehicles.

The subject site is also exposed to regular rail traffic on the T1, T2 and T7 train lines located approximately 40 metres to the north on the opposite side of Railway Parade.

Road and rail traffic comprise the dominant noise sources in the area. It is noted that the subject site is exposed to these intrusive noise sources, in particular, the outdoor play areas and facades of indoor play areas on L1 and L2.

The weekday $L_{Aeq,\ 1\ hour}$ noise levels measured at Locations 'A' and 'B' are also shown below in Table 5 and Table 6 respectively. It should be noted that, while the $L_{Aeq,\ 1\ hour}$ noise levels include all ambient noise in the acoustic environment, the existing acoustic environment was observed to be dominated by road and rail traffic noise in all areas across the subject site.

Table 5 Measured $L_{Aeq,\ 1\ hour}$ Road & Rail Traffic Sound Pressure Levels – Location 'A'

Time	$L_{Aeq,\ 1\ hour}$ Road Traffic Noise (dBA)					
	Wed 30/8	Thu 31/8	Fri 1/9	Mon 4/9	Tue 5/9	Wed 6/9
7 – 8 am	-	64	65	65	64	64
8 – 9 am	-	63	64	65	63	63
9 – 10 am	-	63	64	65	63	63
10 – 11 am	-	63	64	63	62	63
11 – 12 pm	64	62	67	63	63	62
12 – 1 pm	64	66	64	64	67	63
1 – 2 pm	62	63	66	63	62	63
2 – 3 pm	63	64	64	63	63	63
3 – 4 pm	63	65	63	64	63	66
4 – 5 pm	69	63	65	70	65	64
5 – 6 pm	66	65	64	64	64	64

Based on the long-term measurements at Location 'A', and the calculation method shown in Appendix B, Section B3 of the NSW Road Noise Policy for the 'overall $L_{Aeq,\ (1\ hour)}$' day time noise level is 65 dBA at Location 'A'.

The L_{eq} noise levels measured at Location 'A', are considered representative of the road and rail traffic noise levels at the façade in the northwest corner of the subject site which is closest and most exposed to the road intersection and the train lines.

It can be seen from Table 5 that road traffic noise levels in this location exceed the AAAC criterion for external noise within OPA's at all times. As such, noise controls are required to reduce road traffic noise levels within the OPA's at L1 and L2.

The weekday $L_{Aeq,\ 1\ hour}$ noise levels measured at Location 'B' are shown below in Table 6.

Table 6 Measured $L_{Aeq,\ 1\ hour}$ Road & Rail Traffic Sound Pressure Levels – Location 'B'

Time	$L_{Aeq,\ 1\ hour}$ Road Traffic Noise (dBA)					
	Wed 30/8	Thu 31/8	Fri 1/9	Mon 4/9	Tue 5/9	Wed 6/9
7 – 8 am	-	56	56	56	55	56
8 – 9 am	-	56	55	56	55	55
9 – 10 am	-	54	55	56	55	55
10 – 11 am	-	52	53	58	54	54
11 – 12 pm	-	54	55	54	53	53
12 – 1 pm	55	54	53	56	54	54
1 – 2 pm	54	53	55	55	54	53
2 – 3 pm	52	54	55	55	53	54
3 – 4 pm	54	56	54	55	54	57
4 – 5 pm	53	55	54	58	55	56
5 – 6 pm	53	55	55	56	55	56

Based on the long-term measurements at Location 'B', and the calculation method shown in Appendix B, Section B3 of the NSW Road Noise Policy for the 'overall $L_{Aeq,\ (1\ hour)}$' day time noise level is 56 dBA at Location 'B'.

The L_{eq} noise levels measured at Location 'B', are considered representative of areas which are shielded from nearby roads and the rail line.

The overall external road traffic noise level exceeds the AAAC criteria for external noise by 1 dB the day. Exceedances of up to 2 dB are typically not discernible for the average listener and considered to be negligible (refer Table 4.1 and 4.2 of the NPI). However, recommendations to reduce noise levels within indoor and outdoor play areas of the Centre are provided in Section 8.

5.0 ACOUSTIC CRITERIA

This Section presents the noise guidelines applicable to this proposal and establishes the project noise trigger levels.

5.1 Cumberland Council DCP

Cumberland Council in its Development Control Plan (DCP) provides guidance for planning commercial developments, including child care centres. Relevant sections from the DCP have been extracted below:

'3.11 Visual and acoustic privacy

Objectives

O1. Ensure new development achieves adequate visual and acoustic privacy levels for occupants, neighbouring residents, commercial buildings and private open spaces, through the provision of acoustic privacy design.

O2. Maximise outlook and views to the street and public spaces without compromising visual privacy.

O3. Minimise impacts from noise generating infrastructure.

Controls

Acoustic privacy

C3. Conflicts between noise, outlook and views are to be resolved by using design measures, such as double glazing, operable screened balconies and continuous walls to ground level courtyards, where they do not conflict with streetscape or other amenity requirements.

C4. Where commercial/office uses and residential uses are located adjacent to each other, air conditioning units, buildings entries and the design and layout of areas serving after hours uses shall be located and designed to minimise any acoustic conflicts.

C5. Developments shall be designed to minimise the impact of noise associated with uses whose hours may extend outside of normal business hours, including restaurants and cafes. Operation includes loading/unloading of goods/materials, and the use of plant and equipment at a proposed commercial premise.

C6. Mixed use developments shall be designed to locate driveways, carports or garages away from bedrooms.

C7. Mechanical plant must be visually and acoustically isolated from residential uses.

C8. New development shall comply with the provisions of the relevant acts, regulations, environmental planning instruments, Australian Standards and guidelines as applicable for noise, vibration and quality assurance. This includes:

- *Development Near Rail Corridors and Busy Roads, NSW Department of Planning, December 2008 – Interim Guidelines;*
- *NSW Noise Policy for Industry;*

- *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects; and*
- *NSW Road Noise Policy.*

3.12 Hours of operation

Objectives

Create vibrant centres by encouraging business activity.

Ensure the operation of commercial or retail uses does not cause undue disturbance to the amenity of surrounding residential areas.

Controls

C1. Where no existing hours of operation or conditions exist, the retail and/or commercial development are to operate within the following hours:

- *6.00 am to 10.00 pm Monday to Saturday and 9.00 am to 6.00 pm on a Sunday or a public holiday; or*
- *7.00 am to 9.00 pm Monday to Saturday and no operation on a Sunday or a public holiday, for development adjoining or is opposite a residential lot within a residential zone.*

C2. For hours extending outside the times identified in C1, applicants must demonstrate that noise, amenity and light impacts and crime prevention factors have been considered and addressed, through the submission of the following reports for assessment:

- *acoustic report (Note: for developments in town centres where there is no residential development within close proximity of the development site, Council may consider waiving the need for an acoustic report for hours of operation up to midnight);*
- *Crime Prevention Through Environmental Design (CPTED) report; and*
- *Plan of Management.*

3.19 Food and drink premises

Objective

Minimise potential adverse amenity impacts from food and drink premises.

Controls

C1. An acoustic report prepared by a suitably qualified acoustical consultant is to be undertaken if there is the potential for significant impacts from noise emissions from the food and drink premises on nearby residential or sensitive receivers, including those that may be located within the same building/development.

C6. All waste and recyclable material generated by the food and drink premises must be stored in a clearly designated, enclosed waste storage area with complies with AS4674 – Construction and Fitout of food premises. Commercial waste collections are to generally occur between 6:00 am and 10:00 pm where residential premises may be impacted.'

5.2 State Environmental Planning Policy (Transport and Infrastructure) 2021

The NSW Department of Planning and Environment (DoPE) published the State Environmental Planning Policy (SEPP) (Transport and Infrastructure) 2021 on 1 March 2022. The SEPP (Transport and Infrastructure) 2021 consolidates the previous SEPP (Educational Establishments and Child Care Facilities) 2017, along with other related SEPPs.

Chapter 3 of the SEPP, '*Educational establishments and child care facilities*', aims to establish consistent State-wide assessment requirements and design considerations for educational establishments and early education and care facilities to improve the quality of infrastructure delivered and to minimise impacts on surrounding areas. Section 3.27 of Chapter 3 of the SEPP states the following with regard to Local Council Development Control Plans that contain specific requirements, standards or controls related to Child Care Centres:

> *'3.27: Centre-based child care facility—development control plans*
>
> *(1) A provision of a development control plan that specifies a requirement, standard or control in relation to any of the following matters (including by reference to ages, age ratios, groupings, numbers or the like, of children) does not apply to development for the purpose of a centre-based child care facility—*
>
> *(a) operational or management plans or arrangements (including hours of operation),*
>
> *(b) demonstrated need or demand for child care services,*
>
> *(c) proximity of facility to other early childhood education and care facilities,*
>
> *(d) any matter relating to development for the purpose of a centre-based child care facility contained in:*
>
> *(i) the design principles set out in Part 2 of the Child Care Planning Guideline, or*
>
> *(ii) the matters for consideration set out in Part 3 or the regulatory requirements set out in Part 4 of that Guideline (other than those concerning building height, side and rear setbacks or car parking rates).*
>
> *(2) This section applies regardless of when the development control plan was made."*

5.2.1 NSW DoPE – Child Care Planning Guideline

The NSW DoPE published the Child Care Planning Guideline (CCPG) in August 2017 as a supplement to the SEPP (Educational Establishments and Child Care Facilities) 2017. The CCPG was then updated in September 2021.

The SEPP states that "*a consent authority must take into consideration this Guideline* (CCPG) *when assessing a development application (DA) for a centre-based child care facility.*" The SEPP also determines the Guideline "*will take precedence over a Development Control Plan (DCP), with some exceptions, where the two overlap in relation to a child care facility."*

The Guideline was introduced to *'assist industry to deliver early childhood education facilities that are of the highest standards'* and *'to align NSW planning controls with the National Quality Framework for early education and care, creating more certainty for developers and operators seeking service approval'.*

Section 3, *Matters for Consideration*, Subsection 3.5 Visual and acoustic Privacy, contains the following for consideration:

Objective: To minimise the impact of child care facilities on the acoustic privacy of neighbouring residential developments.

C22

A new development, or development that includes alterations to more than 50 percent of the existing floor area, and is located adjacent to residential accommodation should:

- *provide an acoustic fence along any boundary where the adjoining property contains a residential use. An acoustic fence is one that is a solid, gap free fence*
- *ensure that mechanical plant or equipment is screened by solid, gap free material and constructed to reduce noise levels eg acoustic fence, building or enclosure.*

C23

A suitably qualified acoustic professional should prepare an acoustic report which will cover the following matters:

- *Identify an appropriate noise level for a child care facility located in residential and other zones*
- *Determine an appropriate background noise level for outdoor play area during times they are proposed to be in use*
- *Determine the appropriate height of any acoustic fence to enable the noise criteria to be met.*

Subsection 3.6 Noise and air pollution, contains the following for consideration:

'Considerations

Objective: To ensure that outside levels on the facility are minimized to acceptable levels.

C24

Adopt design solutions to minimise the impacts of noise, such as:

- *creating physical separation between buildings and the noise source*
- *orienting the facility perpendicular to the noise source and where possible buffered by other uses*
- *using landscaping to reduce the perception of noise*
- *limiting the number and size of openings facing noise sources*
- *using double or acoustic glazing, acoustic louvres or enclosed balconies (wintergardens)*
- *using materials with mass and/or sound insulation or absorption properties, such as solid balcony balustrades, external screens and soffits*
- *locating cot rooms, sleeping areas and play areas away from external noise sources.'*

C25

An acoustic report should identify appropriate noise levels for sleeping areas and other non-play areas and examine impacts and noise attenuation measures where a child care facility is proposed in any of the following locations:

- *on industrial zoned land*
- *where the ANEF contour is between 20 and 25, consistent with AS2021:2000*
- *along a railway or mass transit corridor, as defined by State Environmental Planning Policy (Infrastructure) 2007*
- *on a major road or busy road*
- *other land that is impacted by substantial external noise.*

5.3 AAAC – Guideline for Child Care Centres Acoustic Assessment

The Association of Australasian Acoustical Consultants (AAAC) published the *Guideline for Child Care Centre Acoustic Assessment* (Guideline), in September 2020 to assist both AAAC members and local Councils to assess the noise impact from proposed child care centres both accurately and fairly (see www.aaac.org.au).

Section 3 of the AAAC Guideline states the following in relation to noise generation from child care centres, while Section 5.0 states the following in relation to noise impact on children:

'3.2 Criteria - Residential Receptors

3.2.1 Outdoor Play Area

The noise impact from children at play in a child care centre differs from the domestic situation in that it is a business carried out for commercial gain, the number of children can be far greater than in a domestic situation and the age range of the children at the centre does not significantly vary over time as it would in a domestic situation. However, the noise from children is vastly different, in both character and duration, from industrial, commercial or even domestic machine noise. The sound from children at play, in some circumstances, can be pleasant, with noise emission generally only audible during the times the children play outside. Night time, weekend or public holiday activity is not typical and child care centres have considerable social and community benefit.

Base Criteria *– With the development of child care centres in residential areas, the background noise level within these areas can at certain times, be low. Thus, a base criterion of a contributed* $L_{eq,15min}$ *45 dB(A) for the assessment of outdoor play is recommended in locations where the background noise level is less than 40 dB(A).*

Background Greater Than 40 dB(A) *– The contributed* $L_{eq,15min}$ *noise level emitted from an outdoor play and internal activity areas shall not exceed the background noise level by more than 5 or 10 dB at the assessment location, depending on the usage of the outdoor play area. AAAC members regard that a total time limit of approximately 2 hours outdoor play per morning and afternoon period should allow an emergence above the background of 10 dB (ie background +10 dB if outdoor play is limited to 2 hours in the morning and 2 hours in the afternoon).*

Up to 4 hours (total) per day *– If outdoor play is limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed* $L_{eq,15min}$ *noise level emitted from the outdoor play shall not exceed the background noise level by more than 10 dB at the assessment location.*

More than 4 hours (total) per day *– If outdoor play is not limited to no more than 2 hours in the morning and 2 hours in the afternoon, the contributed* $L_{eq,\ 15min}$ *noise level emitted from the outdoor play area shall not exceed the background noise level by more than 5 dB at the assessment location.*

The assessment location is defined as the most affected point on or within any residential receiver property boundary. Examples of this location may be:

- *1.5 m above ground level;*
- *On a balcony at 1.5 m above floor level;*
- *Outside a window on the ground or higher floors.*

3.2.2 Indoor Play Area, Mechanical Plant, Pick up and Drop off

The cumulative $L_{eq,\ 15\ minute}$ noise emission level resulting from the use and operation of the child care centre, with the exception of noise emission from outdoor play discussed above, shall not exceed the background noise level by more than 5 dB at the assessment location as defined above. This includes the noise emission resulting from:

- *Indoor play;*
- *Mechanical plant;*
- *Drop off and pick up;*
- *Other activities/operations (not including outdoor play).*

3.2.3 Sleep Disturbance

The noise impact of staff arrivals, setup, cleaning or other on-site activities prior to 7 am or during night-time hours should be assessed at nearby residential premises. The L_{Amax} noise level emitted from vehicles arriving and parking, depending on the requirements of the state or territory where the centre is located shall not exceed the background noise level by more than 15 dB outside the nearest habitable room window.

3.3 Commercial Receptors

The cumulative $L_{eq,\ 15\ min}$ noise level emitted from the use and operation of the child care centre shall not exceed 65 dBA, from all activities (including indoor play), when assessed at the most affected point on or within any commercial property boundary.

3.4 Other Sensitive Receivers

Where appropriate, assessment should include consideration of noise emission to other sensitive uses including schools, hospitals, places of worship and parks (active and passive). Depending on the requirements of the state or territory where the centre is located, in the absence of applicable noise criteria for such a sensitive use, the cumulative $L_{eq,15min}$ noise level emitted from the use and operation of the child care centre shall not exceed 65 dB(A), from all activities (including outdoor play), when assessed at the most affected point on or within the sensitive property boundary, and shall not exceed 45 dB(A) internally, with windows or doors of the sensitive receiver open.

Section 5 of the AAAC Guideline states the following in relation to external noise impacts on children within Child Care Centres:

> ***5.1 Road, Rail Traffic and Industry***
>
> *The $L_{Aeq,1hr}$ noise level from road traffic, rail or industry at any location within the outdoor play or activity area during the hours when the Centre is operating should not exceed 55 dB(A).*
>
> *The $L_{Aeq,1hr}$ noise level from road traffic, rail or industry at any location within the indoor activity or sleeping areas of the Centre during the hours when the centre is operating shall be capable (with doors and/or windows closed) of achieving 40 dB(A) within indoor activity areas and 35 dB(A) in sleeping areas.'*

5.4 NSW Department of Planning – Development Near Rail Corridors and Busy Roads – Interim Guideline

5.4.1 Airborne Noise

The NSW Department of Planning published *'Development Near Rail Corridors and Busy Roads – Interim Guideline'* in 2008. The Guideline assists in the planning, design and assessment of development in, or adjacent to, rail corridors and busy roads. Table 3.1 – *Noise Criteria* found in Section 3.6.1 of this document, provides noise criteria for internal areas of child care centres. The information in this table, relevant to the proposal, is summarised in Table 7 below.

Table 7 Airborne Noise Criterion – Non-Residential Buildings

Type of Occupancy	Recommended Max Level - dBA
Educational Institutions including Child Care Centres	40

5.4.2 Vibration

In addition to airborne noise, the Guideline provides vibration criteria for application on development sites potentially affected by vibration generated by rail lines. Section 3.6.3 states the following guidance for setting appropriate vibration criteria;

> ***'3.6.3 vibration criteria***
>
> *Vibration levels such as the intermittent vibration emitted by trains should comply with the criteria in Assessing Vibration: a technical guideline (DECC 2006).*
>
> *The standards used for assessing the risk of vibration damage to structures are German Standard DIN 4150 Part 3 1999 and British Standard BS7385.2:1993. Human comfort is normally assessed with reference to the above British Standard or Australian Standard AS2670.2:1990.'*

Refer to Section 5.8 and 5.9 of this report for detailed descriptions of the criteria derived from these Standards.

5.5 NSW Environment Protection Authority – NSW Road Noise Policy

The NSW Road Noise Policy (RNP), in Section 2.3.1, sets out road traffic noise assessment criteria for residential land uses in Table 3. The information in that table is extracted below in Table 8.

Table 8 Road Traffic Noise Assessment Criterion - Residential

Road Category	Type of project/land use	Assessment Criteria – dB(A) Day (7 am – 10 pm)
Local roads	6. Existing residences affected by **additional traffic** on existing local roads generated by land use developments	$L_{Aeq, (1\ hour)}$ 55 (external)

5.6 NSW Noise Policy for Industry

The Environment Protection Authority (EPA) published their NSW Noise Policy for Industry (NPI) in October 2017. The NPI is specifically aimed at assessing noise from industrial noise sources scheduled under the Protection of the Environment Operations Act 1997 (POEO, 1997).

The NPI provides a useful framework to assess noise emission from an industrial premises to determine whether that premises produces intrusive or non-intrusive noise.

The noise limits set out in the NPI will be used as a guide in determining whether the level of noise emitted from the commercial/retail premises and medical centre is considered intrusive or not.

5.6.1 Amenity Criteria

Depending on the type of area in which the noise is being made, there is a certain reasonable expectancy for noise amenity. The NPI provides a schedule of recommended L_{eq} industrial noise levels that under normal circumstances should not be exceeded. If successive developments occur near a residential area, each one allowing a criterion of background noise level plus 5 dB, the ambient noise level will gradually creep higher.

The recommended L_{eq} noise levels shown in Table 9 are taken from Section 2.4, Table 2.2 of the NPI.

Table 9 Amenity Criteria

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{eq} Noise Level, dBA
			Acceptable
Residential	Urban Residential	Day	60
		Evening	50
		Night	45
Commercial	All	When in use	65

The L_{Aeq} is determined over a 15-minute period for the project intrusiveness noise level and over an assessment period (day, evening and night) for the project amenity noise level. This leads to the situation where, because of the different averaging periods, the same numerical value does not necessarily represent the same amount of noise heard by a person for different time periods. To standardise the time periods for the intrusiveness and amenity noise levels, the NPI assumes that the **$L_{Aeq, 15min}$** will be taken to be equal to the **$L_{Aeq, period}$ + 3 decibels (dB)**.

Compliance with the amenity criteria will limit ambient noise creep. Wherever the existing L_{eq} noise level from industrial noise sources approaches or exceeds the amenity criteria at a critical receptor location, the intrusive L_{eq} noise from the noise source in question must be reduced to a level that may be as much as 10 dB below the existing L_{eq} industrial noise level.

The acceptable $L_{Aeq, 15\ min}$ amenity criteria for urban residential areas is:

- (60 – 5 + 3 dB =) 58 dBA during the day; and
- (50 – 5 + 3 dB =) 48 dBA during the evening; and
- (45 – 5 + 3 dB =) 43 dBA during the night.

The acceptable L_{Aeq} amenity criteria for commercial receptors is:

- (65 – 5 + 3 dB =) 63 dBA when in use.

5.6.2 Intrusiveness Criteria

The EPA states in Section 2.3 of the NPI that the L_{eq} level of noise intrusion from broad-band industrial noise sources may be up to 5 dB above the L_{90} background noise level at a residential receptor without being considered intrusive.

The $L_{90, 15\ minute}$ Rating Background Level at Location 'A' was 57 dBA during the day.

The $L_{90, 15\ minute}$ Rating Background Level at Location 'B' was 48 dBA during the day.

Therefore, the acceptable L_{eq} noise intrusiveness criteria for the nearest residential areas are:

- (57 + 5 dB =) 62 dBA during the day for residential areas with direct line of sight to roads and rail corridors nearby; and
- (48 + 5 dB =) 53 dBA during the day for residential areas shielded from, or with indirect exposure to, nearby roads and rail corridors.

5.7 Australian Standard AS2107:2016

In order to establish appropriate noise criteria for road and rail traffic noise intrusion to the Medical Centre and commercial/retail premises, guidance is taken from Australian Standard AS2107:2016 – *Acoustics – Recommended design sound levels and reverberation times for building interiors.*

AS2107:2016 recommends internal noise levels and reverberation times for various areas within Health Buildings, general retail stores and Cafes to be as shown in Table 10 and have been adopted to establish appropriate internal noise level and reverberation time criteria for the main areas within the ground floor of the building.

Table 10 AS2107:2016 – Recommended Internal Noise Levels

Type of Occupancy	Design Sound Level ($L_{Aeq,\,t}$)	Design Reverberation Time (T)
Health Buildings		
Waiting Rooms & Reception Areas	40 – 50 dBA	<0.7 seconds
Consulting Rooms	40 – 45 dBA	0.4 – 0.6 seconds
Small Retail Stores (General)	<50 dBA	Minimised
Coffee Shops	40 to 50 dBA	Minimised

A standard building façade will typically provide up to 20-25 dB reduction of external noise with external windows/doors closed.

The north façade of the building is the most exposed to road and rail traffic noise. Based on the average measured external $L_{eq,\,1\ hour}$ noise level at Location 'A', (65 dBA during the day), the internal noise level is calculated to be 45 dBA, as a worst case for the most exposed areas on the ground floor of the building, and is below the AS2107:2016 noise criteria established in Table 10 above.

Intrusive road and rail traffic noise levels within less exposed areas of the building, such as internal rooms and rooms with no windows, will be lower and well below the noise criteria.

Therefore, no specific noise controls are required for any of the areas within the medical centre or commercial/retail premises. A standard building façade and glazed elements are sufficient to attenuate external noise to within acceptable levels. No further assessment of internal noise levels from road and rail traffic within the ground floor areas of the building is given in this report.

5.8 Vibration Dose Values – Human Exposure

The NSW EPA published '*Assessing Vibration: a technical guideline'* in February 2006. This guideline is based on the British Standard BS6472:1992 *"Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)."*

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. The guideline considers vibration from passing rail traffic as Intermittent Vibration. Table 2.4 of the guideline sets out qualitative limits for Vibration Dose Values to assess intermittent vibration and is replicated in Table 11 for application to all areas of the subject site.

Table 11 Vibration Dose Values (VDV) from Intermittent Vibration Sources

Receptor Location	Daytime	
	Preferred value ($m/s^{1.75}$)	Maximum value ($m/s^{1.75}$)
Offices, schools, educational institutions and places of worship	0.4	0.8

5.9 Vibration Guide Values for Structural Damage

The German Standard DIN 4150-Part 3 provides guideline values for vibration relating to structural damage, summarised in Table 12.

Table 12 Vibration Guide Values for Structural Damage

Type of building	Guideline Values for Velocity – mm/s			
	Vibration at the Foundations			Horizontal plane on highest floor – All frequencies
	< 10Hz	10 – 50Hz	50 – 100Hz[2]	
Commercial	20	20 – 40	40 – 50	40

[2] *At frequencies above 100Hz, the values given in this column may be used as minimum values.*

5.10 Measured Vibration Levels

The existing levels of vibration from train pass-bys on the adjacent railway were measured at the northern boundary of the subject site, 2-8 East Street Granville, on Friday 29 September 2023 between 1:29 pm and 2:05 pm. This location, being closest to the rail line, is considered to be representative of the subject site as a worst case vibration scenario.

The acceleration was measured from trains on the railway line with a maximum level of 0.0021 m/s^2. This equates to an estimated VDV (eVDV) of 0.006 $m/s^{1.75}$ per train (worst-case).

Based on the current train timetable, it is estimated that up to 68 passenger train pass-bys occur on the railway line adjacent to the subject site during the busiest hour, 665 train pass-bys during the day (7 am to 10 pm) and 140 at night (10 pm to 7 am). Using total train pass-bys for each time period, this results in an eVDV of 0.029 $m/s^{1.75}$ during the daytime and 0.019 $m/s^{1.75}$ at night.

The calculated day time and night time eVDV is well below the preferred values for both human comfort and structural damage for the development site and is therefore acceptable.

No specific controls are required to mitigate the level of vibration intrusion from the nearby train line. No further consideration is given to vibration impact in this report.

5.11 Project Specific Criteria

5.11.1 Child Care Centre

The noise criteria shown in Table 13 are applicable at each receptor location for noise emission from the Child Care Centre. Noise sources assessed under these criteria include the outdoor play areas, cumulative noise emission from the car park, indoor play areas and mechanical plant, sleep disturbance and additional on-road traffic. Noise criteria are based on long ambient noise measurements at Locations 'A' and 'B'.

The assessment location is defined as the most affected point on or within any receiver property boundary. Examples of this location may be:

- 1.5 m above ground level;
- On a balcony at 1.5 m above floor level;
- Outside a window on the ground or higher floors.

Table 13 Child Care Centre – Noise Emission Criteria for All Locations (R1 – R6)

Receptor	Noise Criteria for Child Care Centre Activities			
	Outdoor Play – $L_{eq,\ 15\ min}$ All Day Play	Car Park, Indoor Play & Mechanical Plant – $L_{eq,\ 15\ min}$	Sleep Disturbance - L_{max}	On-Road Traffic Noise – $L_{eq,\ 1\ hr}$
R1 – All Floors	65 dBA	65 dBA	n/a	n/a
R2 – All Floors	53 dBA	53 dBA	66 dBA	55 dBA
R3 – All Floors	53 dBA	53 dBA	66 dBA	
R4A – Front	62 dBA	62 dBA	75 dBA	55 dBA
R4B – Rear	53 dBA	53 dBA	66 dBA	
R5 – All Floors	62 dBA	62 dBA	75 dBA	55 dBA
R6 – All Floors	65 dBA	65 dBA	n/a	n/a

The noise criteria shown in Table 14 are applicable within indoor areas of the Child Care Centre.

Table 14 Child Care Centre – Noise Intrusion Criteria for Outdoor/Indoor Areas

Location	Noise Level ($L_{Aeq,\ 1\ hr}$)
Outdoor Play Areas	55 dBA
Indoor Playrooms	40 dBA
Sleeping Areas (Cot Room)	35 dBA

5.11.2 Medical Centre and Commercial/Retail Premises

The noise criteria shown in Table 15 are applicable at each receptor location for noise emission from the medical centre and commercial/retail premises. Noise sources assessed under these criteria include the outdoor eating areas, noise emission from the car park, people, mechanical plant, sleep disturbance and additional on-road traffic. Noise criteria are based on long ambient noise measurements at Locations 'A' and 'B'.

The assessment location is defined as the most affected point on or within any receiver property boundary. Examples of this location may be:

- 1.5 m above ground level;
- On a balcony at 1.5 m above floor level;
- Outside a window on the ground or higher floors.

Table 15 Medical Centre & Commercial/Retail - Noise Criteria for All Locations (R1 – R6)

Receptor	Noise Criteria for Medical Centre & Commercial/Retail Activities		
	Car Park, People & Mechanical Plant – $L_{eq,\ 15\ min}$	**Sleep Disturbance – L_{max}**	**On-Road Traffic Noise – $L_{eq,\ 1\ hr}$**
R1 – All Floors	65 dBA	n/a	n/a
R2 – All Floors	53 dBA	66 dBA	55 dBA
R3 – All Floors	53 dBA	66 dBA	
R4A – Front	62 dBA	75 dBA	55 dBA
R4B – Rear	53 dBA	66 dBA	
R5 – All Floors	62 dBA	75 dBA	55 dBA
R6 – All Floors	65 dBA	n/a	n/a

6.0 NOISE EMISSION

6.1 Child Care Centre - Children

The main sources of noise from the Centre will be as follows:

- Children playing both outside and inside;
- Cars entering and exiting the car park; and
- Mechanical plant serving the Centre.

Noise modelling is based on architectural drawings prepared by Zhinar Architects Pty Ltd shown attached as Appendix C.

The AAAC has presented a range of A-weighted sound power levels per child in Table 1 of its *'Guideline for Child Care Centre Acoustic Assessment'.* The sound power levels of each group are presented in Table 16 and have been adopted to assess noise emissions from children in this assessment.

Table 16 L_{eq} Sound Power Levels - Children Engaging in Active Play

Number and Age of Children	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
10 children, 0 to 2 years	**78**	54	60	66	72	74	71	67	64
10 children, 2 to 3 years	**85**	61	67	73	79	81	78	74	70
10 children, 3 to 5 years	**87**	64	70	75	81	83	80	76	72

In the notes to Table 1 of the AAAC's *Guideline*, where passive/quiet activities are engaged in by children, the noise generated by children is generally 6 dB lower than active play.

6.2 Car Park Noise Emission

Based on the RTA's '*Guide to Traffic Generating Developments*', we have assumed volumes of traffic generation from the use of the building.

In Section 3.11.1 – *Child Care Centres,* the RTA Guide specifies 0.8 peak (morning 7 am-9 am) vehicle trips per child for Child Care Centres (Long-day care). We have assumed, as a worst-case scenario, a flow of cars equivalent to 96 trips in 1 hour arriving or leaving the Centre in the morning peak. This is equivalent to 24 vehicle trips in a 15-minute period.

For the medical centre, we have assumed a worst case scenario of 10 vehicles per hour per 100 m^2 gross floor area as specified in Section 3.11.2 – *Extended Hours Medical Centres* of the RTA Guide. The medical centre is approximately 523 m^2 gross floor area, as such we have assumed a total of 52 vehicles per hour. This is equivalent to 13 vehicle trips in a 15-minute period.

There are no spaces within the basement car park specifically dedicated to patrons of the commercial/retail premises, however additional traffic for this component of the development has been included as a worst case. For the commercial/retail premises, we have assumed a worst case scenario of 60 vehicles per day per 100m^2 gross floor area as specified in Section 3.7.2 – *Restaurants* of the RTA Guide. The commercial/retail premises is approximately 50 m^2 gross floor area, as such we have assumed a total of 30 vehicles per day. This is equivalent to 4 vehicle trips per hour or 1 trip within in a 15-minute period.

Based on the aforementioned calculations derived from the RTA Guide for the various uses within the building, we have assumed a total of 152 total vehicle trips within the basement car park per hour as a worst case scenario. We have also assumed that one small truck will arrive and leave the loading dock area via the rear laneway within any given hour.

For the assessment of sleep disturbance and staff arriving during the early morning shoulder period between 6:30 am and 7 am, we have assessed the maximum noise impact of 6 staff arriving and parking in the ground level car park.

Additionally, we have assessed the maximum noise impact of a small truck movement within the ground floor loading dock area during the early morning period.

For the assessment of vehicular activity associated within the basement car park area, we have assumed vehicles will travel at a speed of 10 km/h moving in and out of the basement car park driveway and the truck out of the rear laneway/loading dock area.

For noise generated by on-road traffic, we have assumed vehicles will travel at a speed of 50 km/h as they approach or leave the site.

The Sound Exposure Level[2] (SEL) and L_{Amax} sound power level and spectra of vehicle noise is shown below in Table 17 and is based on previous measurements by Day Design.

Table 17 SEL & L_{Amax} Sound Power Levels – Car Park Noise

Description	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
SEL level of a car driving on an inclined (downhill) road at 10 km/h	**83**	91	89	83	81	77	72	70	64
SEL level of a car driving on an inclined (uphill) road at 10 km/h	**88**	96	94	86	85	83	79	76	70
SEL of car drive-by at approximately 50 km/h	**97**	99	97	94	93	95	87	77	70
SEL of small truck drive-by at approximately 10 km/h	**88**	92	88	84	83	84	79	76	70
L_{Amax} of car entering car park	**92**	98	92	90	88	88	83	80	76
L_{Amax} of small truck movement in loading dock	**108**	113	110	102	102	103	102	94	88

[2] *SEL is the total sound energy of a single noise event condensed into a one second duration.*

6.3 Mechanical Plant

The mechanical plant, including external air conditioning condensers, car park, kitchen and bathroom exhaust fans have not been selected at this stage. Therefore, a preliminary noise assessment will be based on typical units for the size of the development, with sound power levels from typical units installed for similar developments.

External air conditioning condensers and all ventilation fans serving the child care centre, commercial/retail premises and medical centre are assumed to be located at rooftop level.

Sound power levels used in the calculation of the noise contribution from the mechanical plant are shown in Table 18.

Table 18 L_{eq} Sound Power Levels – Mechanical Plant

Description	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Car park/Kitchen/Toilet exhaust fan[3] 1 of 2	**75**	73	72	70	76	70	64	54	43
Medium (double fan) Outdoor condenser unit[4] 1 of 4	**72**	69	67	67	69	70	56	51	45

We recommend a detailed analysis be carried out once the mechanical plant is selected and locations are finalised, prior to the issue of a Construction Certificate.

[3] *Spectral sound power level based on Fantech RDE1001DP6*
[4] *Spectral sound power level based on Daikin RZQ140LV1 outdoor condenser unit.*

6.4 Calculated Noise Levels – Child Care Centre

Knowing the sound power level of a noise source (See Table 16 to Table 18), the sound pressure level (as measured with a sound level meter) can be calculated at a remote location using suitable formulae to account for distance losses, sound barriers, etc.

Calculations include reductions for the acoustic screening provided by fences, assumed to have been constructed in accordance with recommendations specified in Section 8 and the proposed Centre building itself.

Calculations of noise emission from the indoor play areas include reductions for glazing and external doors within the façade. For the purposes of our calculations, we have assumed all glazing to be of standard construction (5 mm glass) and external windows and glazed doors are open whilst indoor play areas are in use as a worst case scenario.

Based upon a review of World Health Organization (WHO) data for average children heights, the notes to Table 1 of the *AAAC's Guideline* recommends a source height of 1 metre above ground level for all children.

All noise modelling calculations for noise generating components of the proposed Centre were performed within DGMR iNoise 2024 noise modelling software using noise propagation equations of ISO 9613-1 – '*Acoustics – Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere',* and ISO 9613-1 – '*Acoustics – Attenuation of sound during propagation outdoors. Part 2: Attenuation of sound during propagation outdoors. Part 2: General method of calculation'*.

Noise levels are calculated to all receptor locations as outlined in Table 2.

Table 19 shows the calculated $L_{eq,\,15\,min}$ noise levels at the receptor locations from outdoor play activities discussed previously, during the day time period. Noise levels are shown for noise emission from the use of the outdoor play areas on L1 and L2, inclusive of noise controls.

The distribution of child age groups within the outdoor play area assumed for noise modelling purposes is shown in Appendix D and H.

Table 20 to Table 22 shows the calculated $L_{eq,\,15\,min}$ noise levels at the residential receptors from vehicle movements in the car park and driveway, indoor play activities and the operation of mechanical plant, during the day time period.

Table 23 shows the calculated $L_{eq,\,1\,hour}$ noise levels at the receptor locations from additional on-road traffic generated by vehicle movements during the day time period.

Table 24 shows the calculated L_{max} noise levels at the residential receivers from staff vehicles arriving at the site during the early morning shoulder period between 6:30 am and 7 am.

Noise contours are shown in Appendices D-G for each facet of noise emission at ground – L2 as described above. Specific noise levels are shown at multiple levels for each receptor location in all noise contour charts. For clarity, noise levels for receptors with multiple floors are shown from ground to the highest floor, separated by a forward slash, ie R1: 25/27/28.

6.4.1 Outdoor Play Area Noise Levels

The calculated $L_{eq,\ 15\ min}$ noise levels from activity within the outdoor play areas (OPA's) at each receptor location at ground floor (GF) and balconies/windows on upper levels (L1 – L3) are shown in Table 19.

Using AAAC sound power levels for children in active play, as established in Table 16, the calculated noise levels at each receptor location were determined by evenly distributing all 120 children across the various outdoor play areas on L1 and L2 as can be seen in Appendices D and H.

Calculations also assume that the noise control recommendations specified in Section 8 have been implemented into the design and management of the Centre, including boundary fences and acoustic barriers and management of child numbers in the outdoor play areas (Refer Sections 8.1 and 8.3)

Table 19 Calculated L_{eq} Noise Levels - Outdoor Play (Up to 120 Children)

Receptor Location	Calculated Noise Level - $L_{eq,\ 15\ min}$	Noise Criterion - $L_{eq,\ 15\ min}$	Compliance (Yes/No)
R1 – L1	44 dBA	65 dBA	Yes
R1 – L2	51 dBA	65 dBA	Yes
R1 – L3	53 dBA	65 dBA	Yes
R2 – L1	43 dBA	53 dBA	Yes
R2 – L2	47 dBA	53 dBA	Yes
R3 – L1	44 dBA	53 dBA	Yes
R3 – L2	46 dBA	53 dBA	Yes
R3 – L3	47 dBA	53 dBA	Yes
R4A – GF	42 dBA	62 dBA	Yes
R4B – GF	46 dBA	53 dBA	Yes
R5 – L2	36 dBA	62 dBA	Yes
R5 – L4	38 dBA	62 dBA	Yes
R5 – L6	40 dBA	62 dBA	Yes
R6 – GF	38 dBA	65 dBA	Yes
R6 – L1	42 dBA	65 dBA	Yes

The calculated $L_{eq,\ 15\ min}$ levels of noise from all 120 children playing outdoors in OPA1 – OPA4 across L1 and L2, are summarised in Table 19 for each receptor location. With the aforementioned assumptions, the calculated levels of noise emission children during outdoor play activities, indicate that the noise criterion is met at all receptor locations.

Noise contours at ground - Level 2 during the use of the outdoor play areas, are shown in Appendix D1-D3 for children engaged in outdoor play activities.

6.4.2 Cumulative Noise Level - Indoor Play Area, Car Park and Mechanical Plant

Calculations assume all 120 children are playing inside are distributed evenly throughout the indoor play areas and that noise controls specified in Section 8 have been implemented into the management of each indoor play area.

Calculations assume that boundary fences and acoustic barriers have been constructed in accordance with the recommendations specified in Section 8.3.

The basement carpark is shared between the child care centre, medical centre and commercial/retail premises. As a worst case scenario, we have included all vehicle movements associated with the use of the child care centre, medical centre and commercial/retail premises. As such, noise emission will be lower from each individual operation therefore, compliance under this scenario will ensure compliance from all operations within the building.

As specific items of mechanical plant have not yet been selected, noise level calculations for mechanical plant assume the sound power levels shown in Table 18.

Cumulative noise levels have been calculated at the assessment points for each of the receptor locations. The highest noise levels for indoor play, car park use and mechanical plant are summarised in Table 20 Table 22 at the nearest affected point at ground level (GF), and balconies/windows on upper levels where applicable. Specific noise levels at each location can be seen in Appendix E.

Table 20 $L_{eq,\ 15\ min}$ Noise Levels – Indoor Play, Car Park and Mechanical Plant (R1)

Receptor Location	Calculated Noise Level L_{eq} (15 min)	Noise Criterion L_{eq} (15 min)	Compliance (Yes/No)
R1 – Commercial			
- Car park	GF – 16 dBA		
	L1 – 16 dBA		
	L2 – 17 dBA		
- Indoor Playrooms	GF – 34 dBA		
	L1 – 34 dBA		
	L2 – 31 dBA		
- Mechanical Plant	GF – 27 dBA		
	L1 – 34 dBA		
	L2 – 41 dBA		
Cumulative Noise Level	GF – 35 dBA	65 dBA	Yes
	L1 – 37 dBA		Yes
	L2 – 41 dBA		Yes

Table 21 $L_{eq,\ 15\ min}$ Noise Levels – Indoor Play, Car Park and Mechanical Plant (R2-R4A)

Receptor Location	Calculated Noise Level Leq (15 min)	Noise Criterion Leq (15 min)	Compliance (Yes/No)
R2 – Residential			
- Car park	L1 – 18 dBA		
	L2 – 23 dBA		
- Indoor Playrooms	L1 – 32 dBA		
	L2 – 35 dBA		
- Mechanical Plant	L1 – 28 dBA		
	L2 – 28 dBA		
Cumulative Noise Level	L1 – 34 dBA	53 dBA	Yes
	L2 – 36 dBA		Yes
R3 – Residential			
- Car park	L1 – 17 dBA		
	L2 – 19 dBA		
	L3 – 21 dBA		
- Indoor Playrooms	L1 – 36 dBA		
	L2 – 39 dBA		
	L3 – 40 dBA		
- Mechanical Plant	L1 – 28 dBA		
	L2 – 29 dBA		
	L3 – 30 dBA		
Cumulative Noise Level	L1 – 36 dBA	53 dBA	Yes
	L2 – 40 dBA		Yes
	L3 – 41 dBA		Yes
R4A – Residential - Car park - Indoor playrooms - Mechanical plant	 GF – 29 dBA GF – 28 dBA GF – 24 dBA		
Cumulative Noise Level	GF – 32 dBA	62 dBA	Yes

Table 22 $L_{eq,\ 15\ min}$ Noise Levels – Indoor Play, Car Park and Mechanical Plant (R4B-R6)

Receptor Location	Calculated Noise Level Leq (15 min)	Noise Criterion Leq (15 min)	Compliance (Yes/No)
R4B – Residential			
- Car park	GF – 24 dBA		
- Indoor playrooms	GF – 33 dBA		
- Mechanical plant	GF – 30 dBA		
Cumulative Noise Level	GF – 35 dBA	53 dBA	Yes
R4C – Residential			
- Car park	GF – 23 dBA		
- Indoor playrooms	GF – 31 dBA		
- Mechanical plant	GF – 30 dBA		
Cumulative Noise Level	GF – 34 dBA	53 dBA	Yes
R5 – Residential			
- Car park	L2 – 25 dBA		
	L4 – 26 dBA		
	L6 – 27 dBA		
- Indoor Playrooms	L2 – 36 dBA		
	L4 – 36 dBA		
	L6 – 36 dBA		
- Mechanical Plant	L2 – 25 dBA		
	L4 – 28 dBA		
	L6 – 29 dBA		
Cumulative Noise Level	L2 – 37 dBA	62 dBA	Yes
	L4 – 37 dBA		Yes
	L6 – 38 dBA		Yes
R6 – Commercial			
- Car park	GF - 16 dBA		
	FF - 17 dBA		
- Indoor Playrooms	GF - 43 dBA		
	FF - 43 dBA		
- Mechanical Plant	GF - 26 dBA		
	FF - 29 dBA		
Cumulative Noise Level	GF - 43 dBA	65 dBA	Yes
	FF - 43 dBA		Yes

The calculated cumulative $L_{eq,\ 15\ min}$ levels of noise from the general operation of the Centre are summarised in Table 20 to Table 22 at each receptor location. With the aforementioned assumptions, the calculated cumulative levels of noise from the Centre indicate that the noise criterion is met at all receptor locations. Compliance at these receptor locations ensures compliance at all other locations which are further away and/or shielded by buildings and other structures.

Noise contours at ground – Level 2 for cumulative noise emissions from the Centre (indoor play, mechanical plant and vehicle movements) are shown in Appendix E1-E3.

6.4.3 On-Road Traffic

The external $L_{eq,\ 1\ hour}$ noise levels at the most affected residential receptor locations 'R2', 'R3', 'R4A'-'R4B', from noise associated with on–road traffic throughout the day, including one assumed small truck movement in the rear laneway within any given hour, is calculated to be as shown below in Table 23. Receptors 'R2' and 'R3' are multi-storey residential buildings; for brevity only the highest noise levels are shown. Specific noise levels at each level of these buildings are shown for ground to Level 2 in Appendix F1-F3.

Table 23 Calculated $L_{eq,\ 1\ hour}$ Noise Levels – On – Road Traffic

Receiver Location	Calculated Noise Level – $L_{eq,\ 1\ Hour}$	Noise Criterion - $L_{eq,\ 1\ Hour}$	Compliance (Yes/No)
R2 – Residential (Level 2)	Vehicles – 39 dBA	55 dBA	Yes
	Truck – 38 dBA	55 dBA	Yes
	Total – 42 dBA	55 dBA	Yes
R3 – Residential (Level 3)	Vehicles – 43 dBA	55 dBA	Yes
	Truck – 40 dBA	55 dBA	Yes
	Total – 45 dBA	55 dBA	Yes
R4A – Residence (Front yard)	Vehicles – 54 dBA	55 dBA	Yes
	Truck – 22 dBA	55 dBA	Yes
	Total – 54 dBA	55 dBA	Yes
R4B – Residential (South façade)	Vehicles – 43 dBA	55 dBA	Yes
	Truck – 31 dBA	55 dBA	Yes
	Total – 43 dBA	55 dBA	Yes

The calculated external noise levels from on–road traffic generated by the development are below the noise criteria established in Section 5.10 and are therefore acceptable. It should be noted that any additional road traffic noise generated by the use of the building is considered to be insignificant given the level of road and rail traffic noise in the existing acoustic environment during the day time period.

Noise contours at ground – Level 2 for $L_{eq,\ 1\ hour}$ noise emissions from vehicle movements during the day time (7 am – 6 pm) are shown in Appendix F1A-F3A and small truck movements to and from the loading dock are shown in Appendix F1B-F3B.

6.4.4 Sleep Disturbance

It is proposed that the Centre will accept children from 7 am. It is assumed that five staff members will arrive prior to 7 am, to prepare for the arrival of the children, with more staff and parents arriving after 7 am. In order to assess the potential for sleep disturbance from vehicles we have considered noise emission from staff vehicles arriving between 6.30 am and 7 am and entering the basement car park and also small truck movements within the rear loading dock area.

As shown in the architectural drawings, the basement level car park is accessed from Railway Parade on the north side of the site. The loading dock is accessed from the rear laneway on the south side of the site.

To assess potential sleep disturbance at the nearest, most affected residential receptors, the calculated L_{AFmax} noise levels at the nearest affected residential receptor locations to the basement car park driveway and loading dock are shown in Table 24 below.

Table 24 Calculated L_{AFmax} Noise Levels – Sleep Disturbance

Receptor and Description	Calculated Noise Level - L_{max}	Noise Criterion - L_{max}	Compliance (Yes/No)
R2 – L2			
- Car pulling into driveway	32 dBA	68 dBA	Yes
- Truck movement in loading dock	58 dBA		Yes
R3 – L3			
- Car pulling into driveway	35 dBA	68 dBA	Yes
- Truck movement in loading dock	60 dBA		Yes
R4A – GF			
- Car pulling into driveway	46 dBA	68 dBA	Yes
- Truck movement in loading dock	55 dBA		Yes
R4C – GF			
- Car pulling into driveway	33 dBA	68 dBA	Yes
- Truck movement in loading dock	67 dBA		Yes

As can be seen in Table 24, the calculated level of noise emission from staff arriving prior to 7 am will comply with the sleep disturbance criteria established in Section 5.6 at the nearest residential receptor locations and is therefore considered acceptable. Compliance at these receptor locations ensures compliance at all other locations which are further away and/or shielded by buildings and other structures.

It can be seen in Table 24 that L_{max} noise levels from small truck movements within the loading dock area comply with the sleep disturbance criteria. Compliance at this receptor locations ensures compliance at all other locations which are further away and/or shielded by buildings and other structures.

It should be noted that the noise contribution from individual staff vehicles or a small truck movement in the loading dock area is considered to be insignificant given the level of traffic noise in the existing acoustic environment during the early morning period.

Noise contours at ground – Level 2 for L_{AFmax} noise emissions from staff vehicle movements during the early morning are shown in Appendix G1A-G3A and small truck movements in the loading dock are shown in Appendix G1B-G3B.

6.5 Calculated Noise Levels – Café Outdoor Seating

There is potential for the commercial/retail premises to be occupied by a café with an outdoor seating area. To assess any potential noise impacts from an outdoor seating area, noise emission from people talking outside has been modelled to the nearest receptor locations R1-R6 to be as shown in Table 25.

For noise assessment, calculations assume that a total of 30 people will be seated outdoors outside the café. Of these 30 people, we have assumed 20% will be talking with a raised voice, 30% talking with normal vocal effort and 50% will be listening or not talking.

Table 25 Calculated L_{eq} Noise Levels – Café Outdoor Seating (Up to 30 People)

Receptor Location	Calculated Noise Level - $L_{eq, 15\ min}$	Noise Criterion - $L_{eq, 15\ min}$	Compliance (Yes/No)
R1 – L1	15 dBA	65 dBA	Yes
R1 – L2	15 dBA	65 dBA	Yes
R1 – L3	15 dBA	65 dBA	Yes
R2 – L1	8 dBA	53 dBA	Yes
R2 – L2	10 dBA	53 dBA	Yes
R3 – L1	14 dBA	53 dBA	Yes
R3 – L2	18 dBA	53 dBA	Yes
R3 – L3	20 dBA	53 dBA	Yes
R4A – GF	31 dBA	62 dBA	Yes
R4B – GF	17 dBA	53 dBA	Yes
R5 – L2	30 dBA	62 dBA	Yes
R5 – L4	31 dBA	62 dBA	Yes
R5 – L6	31 dBA	62 dBA	Yes
R6 – GF	29 dBA	65 dBA	Yes
R6 – L1	31 dBA	65 dBA	Yes

The calculated $L_{eq, 15\ min}$ levels of noise from up to 30 people within an outdoor seating area of a café at ground level of the building are summarised in Table 25 for each receptor location. With the aforementioned assumptions, the calculated levels of noise emission from this area indicate that the noise criterion is met at all receptor locations.

No specific noise controls are required for outdoor seating areas where the capacity of the outdoor eating area is limited to 30 people. However, as a general guide for planning, the level of noise emission will increase by 3 dB for every doubling of capacity, eg 30 to 60 people = +3 dB, 60 to 120 people = +3 dB. Given the calculated noise levels with 30 people are well below the noise criterion, it can be surmised that significant additional capacity can be added whilst still being compliant with the noise criterion.

Noise contours at ground – Level 2 for $L_{eq, 1\ hour}$ noise emissions from people talking within an outdoor seating area during the day time (7 am – 6 pm) are shown in Appendix H1-H3.

7.0 CHILD CARE CENTRE NOISE INTRUSION

7.1 Indoor Playrooms and Sleeping Areas

The average measured external $L_{eq,\ 1\ hour}$ noise level at Location 'A' was 65 dBA during the day. However, once the building has been constructed, with the recommended acoustic barriers implemented into the design of the building as specified in Section 8.2, the external road and rail noise levels will be reduced due to shielding, particularly for north and west facing facades of the indoor play areas.

Based on the external road and rail $L_{eq,\ 1\ hour}$ noise levels measured at Location 'A', the external $L_{eq,\ 1\ hour}$ road and rail noise levels have been calculated at the facades of Indoor Playrooms 1-6 on L1 and L2.

A standard building façade will provide up to 10 dB reduction of external noise with windows open and 20-25 dB reduction with external windows and doors closed. The internal noise levels within Indoor Playrooms 1-6 with windows open (WO) and windows closed (WC) have been calculated to be as shown in Table 26.

Table 26 Calculated $L_{eq,\ 1\ hour}$ Road & Rail Noise Levels – Indoor Playrooms

Indoor Playroom Location	Calculated External Noise Level – $L_{eq,\ 1\ Hr}$	Calculated Internal Noise Level – $L_{eq,\ 1\ Hr}$		Noise Criterion – $L_{eq,\ 1\ Hr}$	Compliance (Yes/No)	
		WO	WC		WO	WC
Playroom 1 (L1)	40 dBA	32 dBA	17-22 dBA	40 dBA	Yes	Yes
Playroom 2 (L1)	41 dBA	32 dBA	17-22 dBA	40 dBA	Yes	Yes
Playroom 3 (L1)	Up to 64 dBA[5]	54 dBA	39-44 dBA	40 dBA	**No**	Yes
Playroom 4 (L2)	Up to 61 dBA [6]	51 dBA	36-41 dBA	40 dBA	**No**	Yes
Playroom 5 (L2)	45 dBA	36 dBA	26 dBA	40 dBA	Yes	Yes
Playroom 6 (L2)	45 dBA	36 dBA	26 dBA	40 dBA	Yes	Yes

It can be seen from Table 26 that the internal noise level within Indoor Playrooms 3 and 4 exceed the internal noise criterion with windows open. As such, external windows and doors should be closed when these areas are in use.

Internal noise levels within all other Indoor Playrooms are below the internal noise criterion with windows open. Additionally, the cot room is contained within the building with no external windows or walls. Internal road traffic noise levels will be below the noise criterion.

[5] *Up to 64 dBA at the east façade as a worst case. 51 dBA is calculated at the north glazed door.*
[6] *Up to 61 dBA at the east façade as a worst case. 53 dBA is calculated at the north glazed door.*

No specific noise controls are required for the cot room or Indoor Playrooms 1,2, 5 or 6. Noise contours for the entire OPA area on L1 and L2, including noise levels at each facade of the indoor playrooms, are shown in Appendix I1 and I2.

7.2 Outdoor Play Areas

The OPA's on L1 and L2 of the building are exposed to road and rail traffic noise from the surrounding roads and rail line nearby. Based on the average measured external $L_{eq,\ 1\ hour}$ noise level at Location 'A', noise levels across the outdoor play areas have been calculated.

External noise intrusion within the OPA's from road and rail traffic during the day time varies due to distance and varying degrees of shielding within the OPA. The highest noise levels calculated within the L1 and L2 OPA's are summarised and shown in Table 27.

Calculations assume that the noise controls specified in Section 8 have been satisfactorily implemented into the design of the building.

Table 27 Calculated $L_{eq,\ 1\ hour}$ Road & Rail Noise Levels – Outdoor Play Areas

OPA Location	Calculated Noise Level – $L_{eq,\ 1\ Hour}$	Noise Criterion - $L_{eq,\ 1\ Hour}$	Compliance (Yes/No)
Level 1 – OPA 1 (North)	Up to 49 dBA	55 dBA	Yes
Level 1 – OPA 2 (Northeast)	Up to 53 dBA	55 dBA	Yes
Level 2 – OPA 3 (North)	Up to 49 dBA	55 dBA	Yes
Level 2 – OPA 4 (Northeast)	Up to 53 dBA	55 dBA	Yes

With the aforementioned assumptions, it can be seen from Table 27 that the external road and rail noise levels within the OPA's on L1 and L2 are below the noise criterion and is acceptable.

Noise contours for the entire OPA area on L1 and L2 are shown in Appendix I1 and I2.

8.0 NOISE CONTROL RECOMMENDATIONS

8.1 Management Plan

8.1.1 Commercial/Retail Premises and Medical Centre

We recommend that the commercial/retail premises and Medical Centre management implement a Noise Management Plan that should include, but not be limited to, the following:

- Deliveries and/or commercial waste collections occurring within the rear loading dock should be scheduled to take place between 6 am and 10 pm in accordance with the time periods specified in Section 3.1.2 of the Cumberland Council DCP.

8.1.2 Child Care Centre

We recommend the Centre's management implement a Noise Management Plan that should include, but not be limited to, the following:

- Ensuring all staff and parents are provided with a copy of the Centre's Noise Management Plan and its implications for them during their time at the Centre.
- The name and contact details of the Centre's Manager should be clearly displayed at the front of the building to ensure neighbours can contact that person at any time the Centre is operating.
- Ensuring a sufficient number of educators are provided to supervise children within the outdoor play areas to discourage unnecessarily loud activities.
- Carers/staff should be educated to control the level of their voice while outdoors.
- Facilitating children's small group play when outside, and encouraging educators to engage in children's play and facilitate friendships between children.
- Crying children should be comforted as quickly as possible and moved indoors.
- Staff arriving prior to 7 am should park in the basement car park within the designated child care staff parking areas.
- External windows and doors to Indoor Playrooms 3 and 4 should be closed when these rooms are in use. Windows and doors may remain open for all other Indoor Playrooms.

8.1.3 Permissible Outdoor Play Scenarios

To be implemented in conjunction with the recommendations in Sections 8.1 and 8.2.

In order for OPA's 1 and 2 (for 0-3's) and OPA's 3 and 4 (for 2-5's) to be used all day, the maximum number of children in these OPA's at any one time must be limited to the following:

- Up to 40 children, 0-2 years old within OPA-1; *and*
- Up to 20 children, 2-3 years old within OPA-2; *and*
- Up to 40 children, 3-5 years old within OPA-3; *and*.
- Up to 20 children, 2-3 years old within OPA-4.

Staff to child ratios shall be maintained as stipulated in the National Quality Framework (NQF).

8.2 Sound Barrier Fences

8.2.1 Child Care Centre

The sound barrier fences on Levels 1 and 2, as shown in Appendix C, should be constructed from an impervious material such as sheet metal, masonry, lapped-and-capped timber, clear polycarbonate, toughened glass, a proprietary modular system or a combination, free from holes or gaps.

In order to reduce noise emission from the site to nearby residential and commercial receptors and/or reduce road traffic noise intrusion into the child care centre on Levels 1 and 2, we recommend the following barrier heights and locations:

- Construct acoustic barriers on the perimeter of OPA-1 and OPA-2 on Level 1 to a minimum height of 1.39 metres above the FFL of Level 1.
- Construct a downturn section, such as a solid lintel or concrete with glazing extension, to extend a minimum of 600 mm below the L2 slab. Refer Section A architectural drawings, attached as Appendix C for detail.
- Construct acoustic barriers on the perimeter of OPA-3 and OPA-4 on Level 2 to a minimum height of 1.39 metres above the FFL of Level 2.

8.2.2 Site Boundary Fences

- Construct acoustic barriers on the west boundary of the site to a height of 2.1 metres above ground level from the south building line of the existing Heritage building to the south site boundary.

The location and heights of sound barrier fences are shown in Appendix C.

8.3 Mechanical Plant & Equipment – Construction Certificate

The specifications for the mechanical plant have not yet been selected for this development. For typical mechanical plant and equipment with sound power levels not exceeding those listed in Table 18, it is reasonable and feasible to acoustically treat the associated plant area (enclosures, absorptive lining, etc) or equipment itself so that noise will not impact the neighbouring properties.

For the purposes of noise assessment, it is assumed that all external AC condenser unit/s and any exhaust fans or exhaust fan discharge vents/cowls will be installed at rooftop level.

In these locations, we recommend that the total maximum sound power level for all external AC condenser units is 85 dBA.

We recommend that the total maximum sound power level for all exhaust fans/discharge vents is selected and/or attenuated such that is it is no greater than 82 dBA.

Rooms within the child care centre are to be ventilated to the standards set out in clause F6D6 of the Building Code of Australia and Australian Standards AS1668.2.

We recommend that a review of mechanical plant be conducted at Construction Certificate stage when items of mechanical plant and installation locations have been finalised.

8.4 External Glazing

8.4.1 Indoor Playrooms

With external windows and doors to Indoor Playrooms 3 and 4 closed, it can be seen from Section 6.2.5 that internal road traffic noise levels are below the internal noise criterion within Indoor Playrooms is met with standard glazing thicknesses.

However, to ensure the necessary noise reduction is achieved from the external glazing, we recommend that all operable window and door frames should have acoustic seals fitted, such as Schlegel 'Q-lon' or rubber bulb seals, to ensure there are no gaps through which noise can leak through.

8.5 Construction Disclaimer

Recommendations made in this report are intended to resolve acoustical problems only. We make no claims of expertise in other areas of building construction and therefore the recommended noise controls should be implemented into the building design in consultation with other specialists to ensure they meet the structural, fire, thermal or other aspects of building construction.

We encourage clients to check with us before using materials or equipment that are alternative to those specified in our Acoustical Report.

The integrity of acoustic structures is very dependent on installation techniques. Therefore, the use of contractors that are experienced in acoustic construction is encouraged.

9.0 CONCLUSION

Day Design Pty Ltd was engaged by Zhinar Architects on behalf of Dr Adel Soliman to assess the environmental noise impact from a proposed mixed use commercial development comprising a commercial/retail premises, Medical Centre and Child Care Centre, to be constructed at 58-62 Railway Parade, Granville, NSW. Noise and vibration impact upon the subject site from road and rail traffic have also been assessed against relevant standards and planning instruments.

Calculations show that, provided the noise control recommendations made in Section 8 of this report are implemented, the level of noise emitted by the proposed mixed use commercial development at 58-62 Railway Parade, Granville, NSW, will meet the acceptable noise level requirements of the Association of Australasian Acoustical Consultants' *Guideline for Child Care Centres Acoustic Assessmen*t and the Environmental Protection Authority's *NSW Road Noise Policy* and *Noise Policy for Industry,* as detailed in Section 5 of this report and is considered acceptable.

Measurements and calculations also show that, provided the noise control recommendations made in Section 7 of this report are implemented, the level of road and rail traffic noise and vibration intrusion onto the site will meet the requirements of the Association of Australasian Acoustical Consultants' *Guideline for Child Care Centres Acoustic Assessment*, and Australian Standard AS2107:2016, the NSW Department of Planning's *'Development Near Rail Corridors and Busy Roads – Interim Guideline'* be considered acceptable.

Alexander Mendoza, MDesSc (Audio & Acoustics), MAAS

Acoustical Engineer

for and on behalf of Day Design Pty Ltd

AAAC MEMBERSHIP

Day Design Pty Ltd is a member company of the Association of Australasian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

APPENDICES

Appendix A – Instrumentation
Appendix B – Ambient Noise Survey
Appendix C – Architectural Drawings & Barrier Heights
Appendix D – $L_{eq,\ 15\ min}$ Noise contours at GF – L2; Outdoor Play
Appendix E – $L_{eq,\ 15\ min}$ Noise Contours at GF – L2; Car park, Indoor Play and Mechanical Plant
Appendix F – $L_{eq,\ 1\ hour}$ Noise Contours at GF; On-Road Traffic
Appendix G – L_{max} Noise Contours at GF; Sleep Disturbance
Appendix H – $L_{eq,\ 15\ min}$ Noise Contours at GF – L2; Café Outdoor Seating
Appendix I – $L_{eq,\ 1\ hour}$ Road & Rail Noise Contours within L1 and L2 OPA's
AC108-1 to 4 – Glossary of Acoustical Terms

NOISE SURVEY INSTRUMENTATION

Noise level measurements and analysis in this report were made with instrumentation as follows:

Table A1 Noise Survey Instrumentation

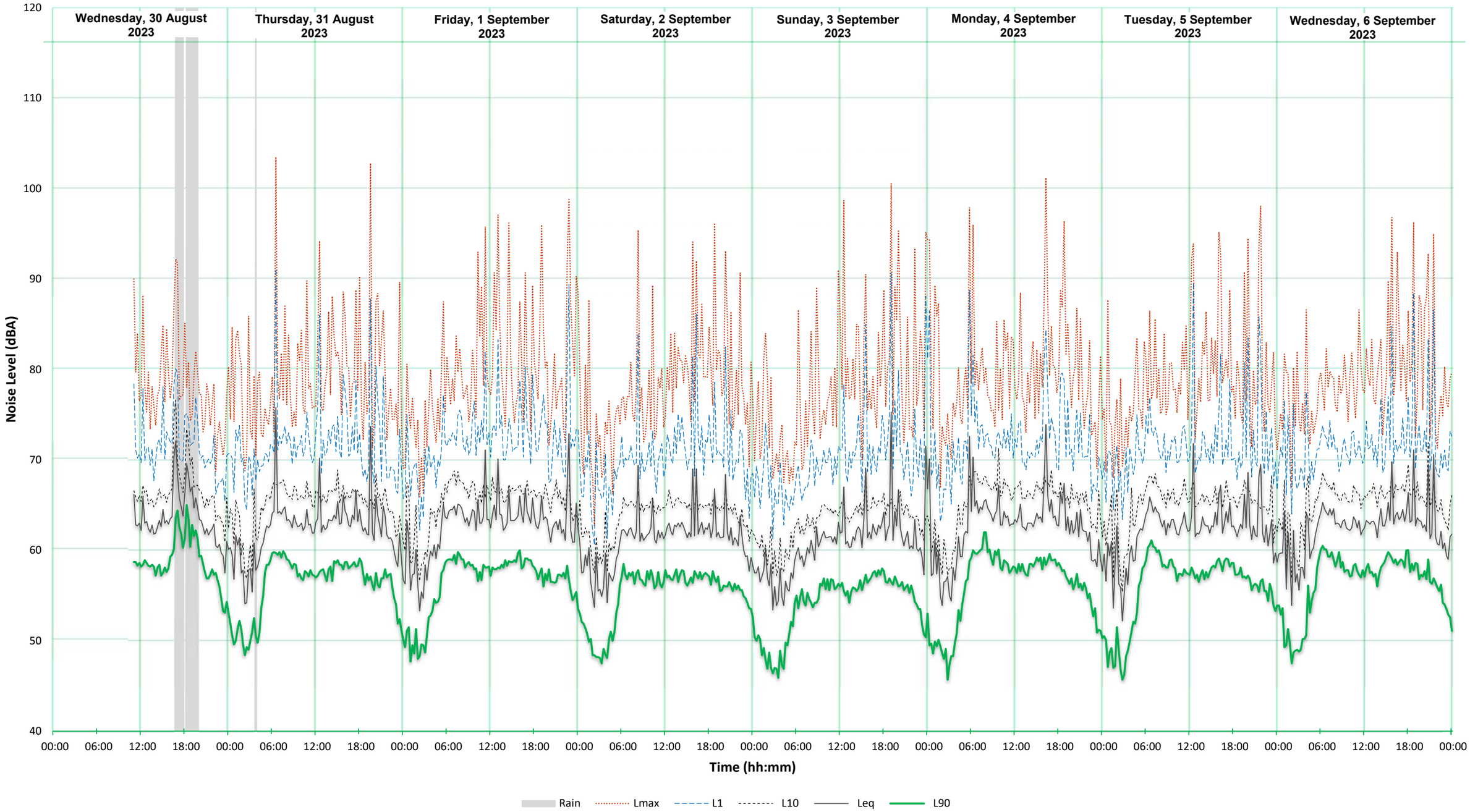
Description	Model No	Serial No
Infobyte Noise Logger (Type 2)	iM4	117
Condenser Microphone 0.5" diameter	MK 250	117
NTI Audio XL2 – DD17	NTi XL2	A2A-20814-E0
0.5" Microphone Capsule	MC2230	A23397
Preamplifier	MA220	10910
Acoustical Calibrator	B&K 4231	2095415
Modular Precision Sound Analyser	B&K 2270	2690243
Condenser Microphone 0.5" diameter	B&K 4189	3022960
Condenser Microphone 0.5" diameter	B&K 4189	2631564
Condenser Microphone 0.5" diameter	B&K 4189	2791662
Modular Precision Sound Analyser	B&K 2270	3010781
Condenser Microphone 0.5" diameter	B&K 4189	3044649
Condenser Microphone 0.5" diameter	B&K 4189	2791662
Accelerometer	B&K 4370	1228153
Accelerometer Calibrator	B&K 4294	2602961
Modular Precision Sound Analyser	B&K 2250	2690243
Acoustical Calibrator	B&K 4231	2721949
Modular Precision Sound Analyser	B&K 2270	2644584
Condenser Microphone 0.5" diameter	B&K 4189	2638722
Acoustical Calibrator	CAL200	3646

An environmental noise logger is used to continuously monitor ambient noise levels and provide information on the statistical distribution of noise during an extended period of time. The NTi XL2 noise monitor is Type 1 precision environmental noise monitor. The Infobyte Noise Monitor iM4 #117 is a Type 2 precision environmental noise monitor. Both monitors meet all the applicable requirements of AS1259 for an integrating-averaging sound level meter.

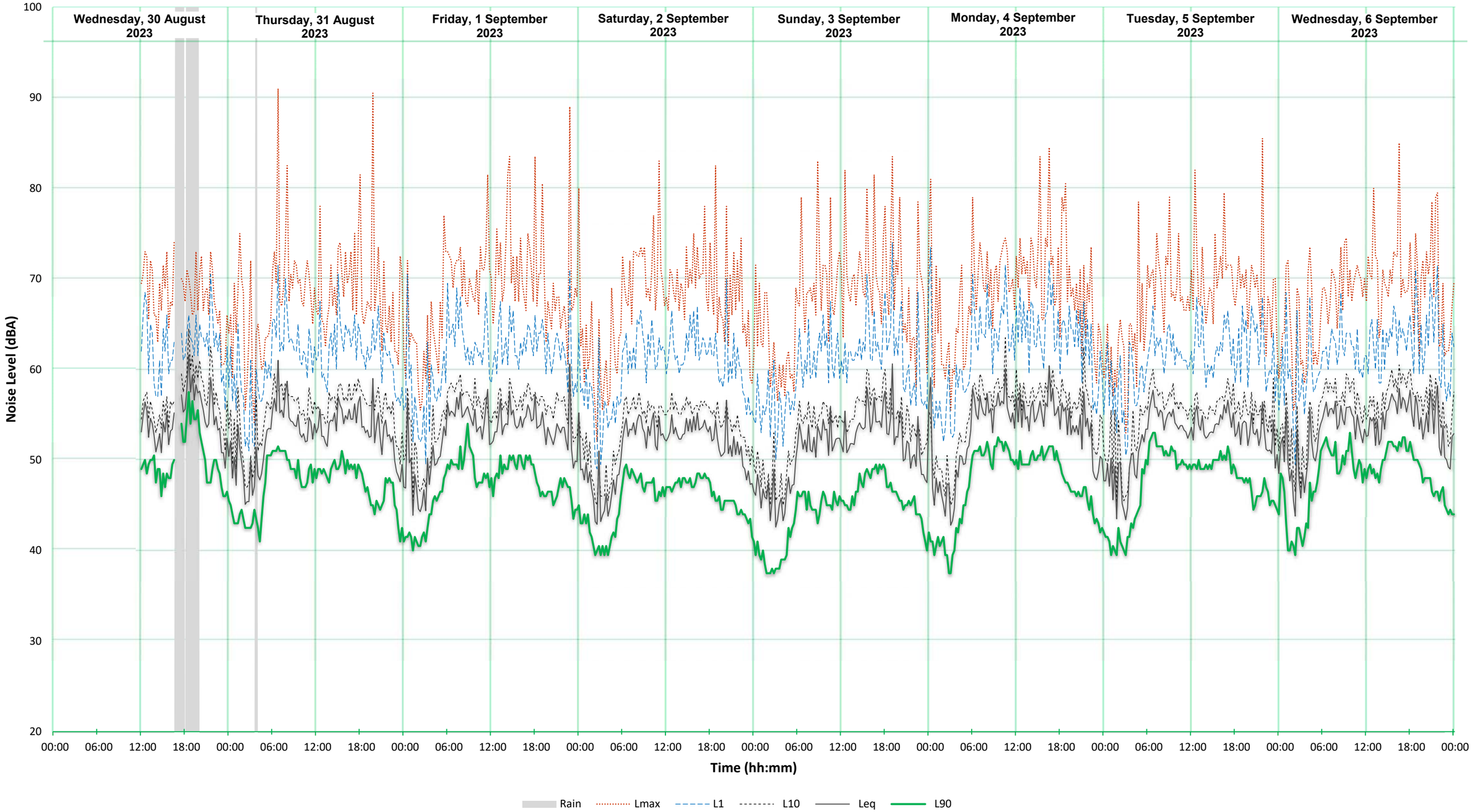
The B&K 2270/2250 is a real-time precision integrating sound level meter with octave and third octave filters, that sample noise at a rate of 8 samples per second and provides L_{eq}, L_{10} and L_{90} noise levels using both Fast and Slow response and L_{peak} noise levels on Impulse response time settings. The meter is frequency weighted to provide dBA, dBC or Linear sound pressure level readings as required.

All instrument systems had been laboratory calibrated using instrumentation traceable to Australian National Standards and certified within the last two years thus conforming to Australian Standards. The measurement system was also field calibrated prior to and after noise surveys. Calibration drift was found to be less than 0.5 dB for attended measurements and less than 1 dB during unattended measurements. No adjustments for instrument drift during the measurement period were warranted.

Located at Rooftop - 62 Railway Pde, Granville, NSW



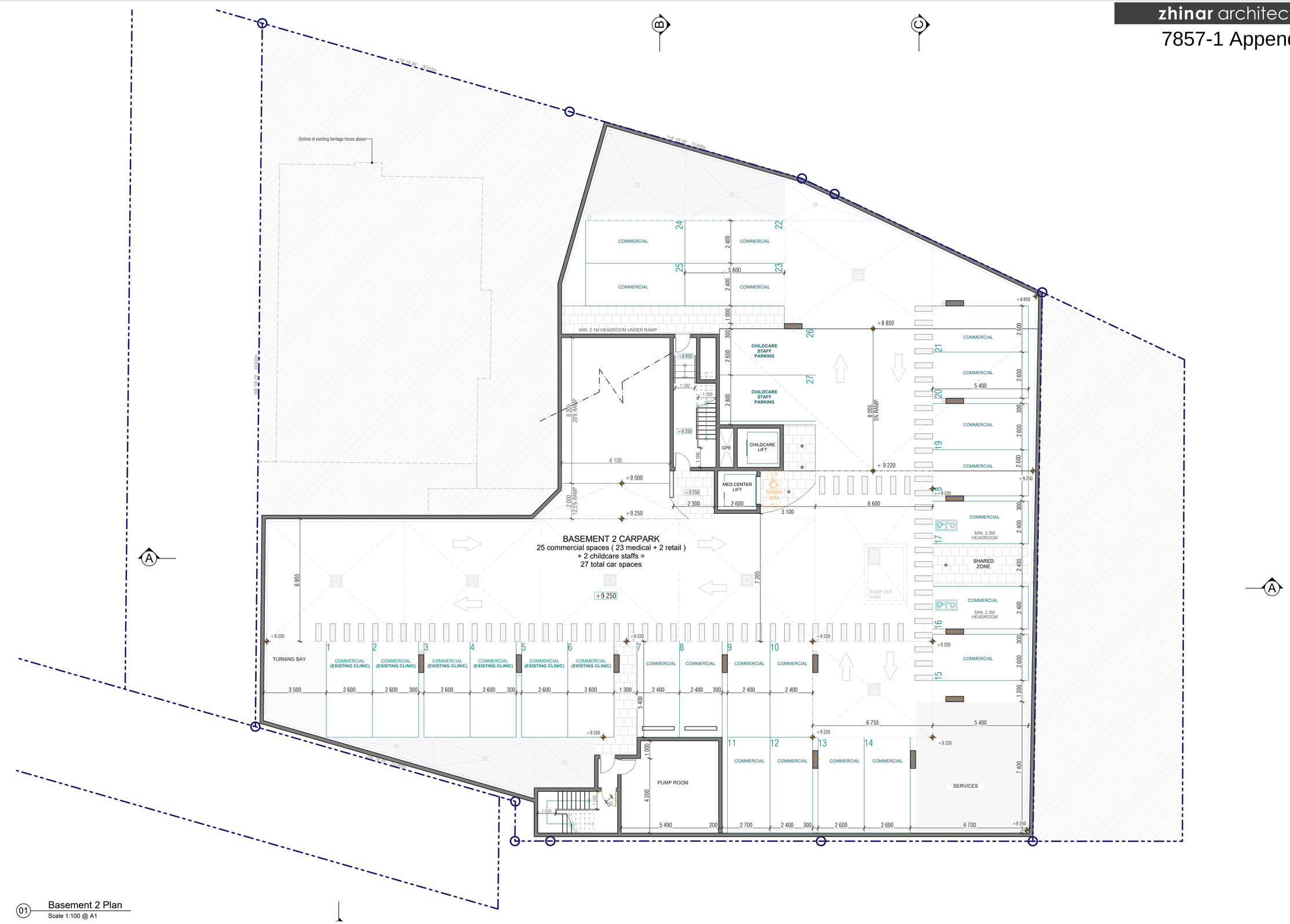
Located at Rear Yard, 62 Railway Parade, Granville, NSW



Development Application

Mixed Use Commercial

58-62 Railway Pde GRANVILLE NSW 2142



01 Basement 2 Plan
Scale 1:100 @ A1

A	ISSUED TO CONSULTANTS FOR COORDINATION	11/12/2023	YT	AM
ISSUE	AMENDMENT	DATE	DRAWN	CHECKED

Print Date: Monday, 11 December 2023 10:02 AM

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GENERAL NOTES

Figured dimensions shall be taken in preference to scaling. Drawing to be read in conjunction with information on first page. Check all dimensions and levels on site before commencing work or ordering materials. All existing ground lines & trees location are approximate, therefore to be verified on-site by the builder. Any discrepancies to be verified back to Zhinar Architects before proceeding. All workmanship and materials shall comply with all relevant codes, ordinances, Australian Standards and manufacturer's instructions. Unless noted 'Issued for Construction', drawing not to be used for construction.

NORTH

PROJECT STATUS
Development Application

SHEET TITLE
Basement 2 Plan

DESIGNED:	DRAWN:	COMMENCED:	SCALE:	PRINT:
AM	YT	Feb 2023	1:100 @ A1 Sheet 1:200 @ A3 Sheet	

L.G.A : Cumberland City Council

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PROJECT NAME
Mixed Use Commercial
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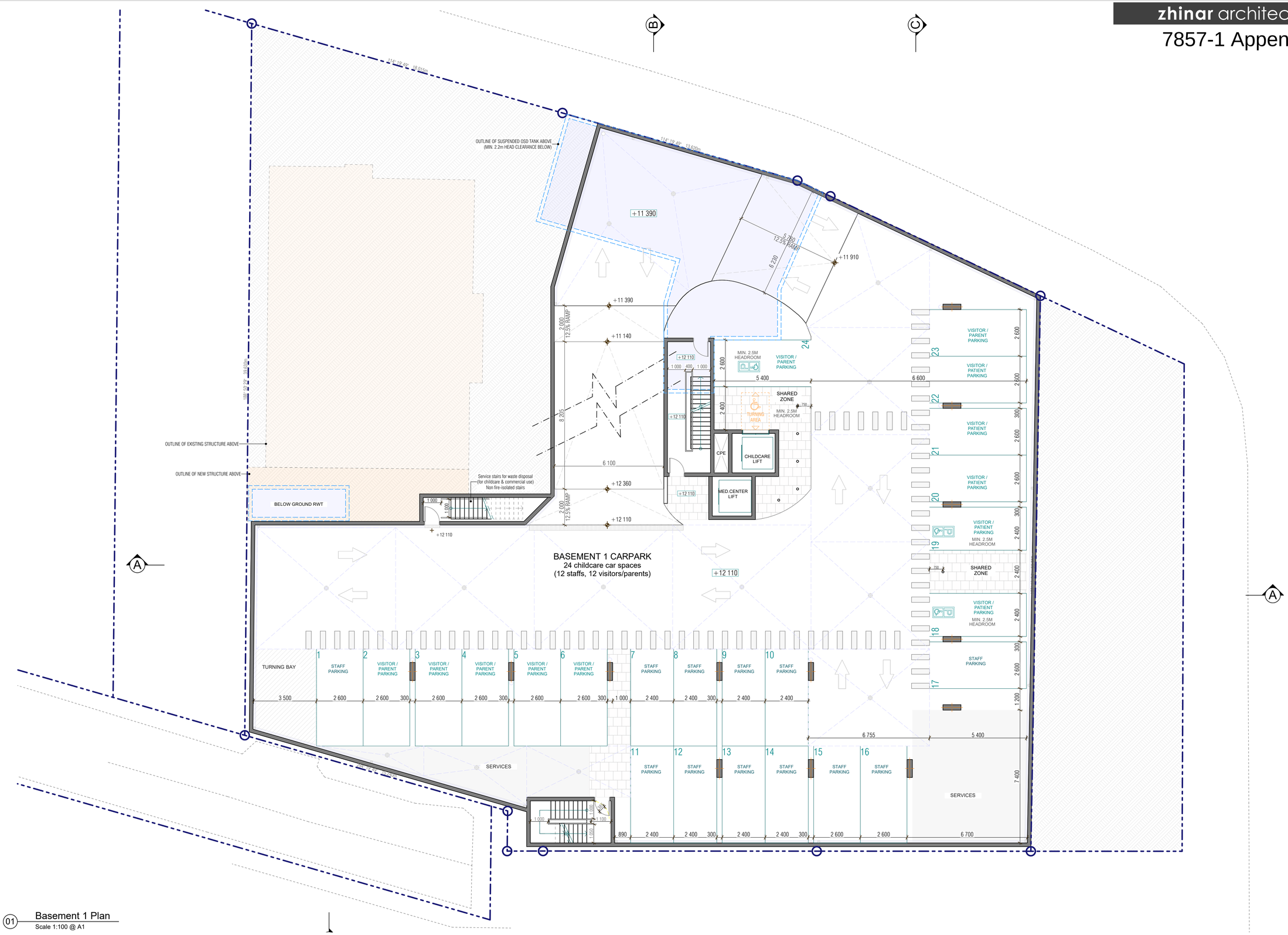
JOB No. 08797
DRAWING No. DA.04
ISSUE A



01 Basement 1 Plan
Scale 1:100 @ A1

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PROJECT STATUS
Development Application

SHEET TITLE
Basement 1 Plan

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DRAWING No. DA.05
ISSUE A

zhinar architects

7857-1 Appendix C

Acoustic Barrier Heights

- 1.39 m above FFL
- 1.8m above ground level
- 2.1m above ground level

NO. 64
EXISTING BRICK HOUSE
TILED ROOF

RAILWAY PARADE

EXISTING POWER POLE TO BE RELOCATED

EXISTING SIGN TO BE RELOCATED

EXISTING 1.8m METAL FENCE TO BE RETAINED AS PER ACOUSTIC REQ.

PROVISION FOR EXTERNAL SUBSTATION

EXISTING CLINIC
(HERITAGE HOUSE)
158 m2

CONSULTATION ROOM 01
CONSULTATION ROOM 02
MEDICAL STORAGE
PROCEDURE & TREATMENT ROOM
TOILET
KITCHEN
TOILET
STAFF ROOM
RECEPTION / WAITING ROOM
LAUNDRY

FIRE ATTENUATION SCREEN TO WINDOW TO BCA COMPLIANCE

AWNING OUTLINE ABOVE

Service stairs for waste disposal (for childcare & commercial use) Non fire-isolated stairs

NEW 2.1m METAL FENCE TO BE CONSTRUCTED AS PER ACOUSTIC REQ.

CAFE & CHILDCARE WASTE ROOM

WSA TO BE CONNECTED TO SEWER & HAVE A CONNECTION OF HOT & COLD WATER FOR CLEANING

TRUCK TURNING BAY AREA

TURNING AREA

1:15 RAMP 1:14

5.000 RAMP 1:14

AUTOMATIC DOOR

BUILDING OUTLINE ABOVE

WASTE TRUCK LOADING BAY

PROCEDURE ROOM + SCRUB AREA ALLOWANCE

MEDICAL CENTER
485.53 m²

STORAGE ROOM
CLEANING ROOM
MEDICAL EQUIPMENT ROOM
STERILIZATION ROOM
MEDICAL DISPOSAL ROOM
CHANGE ROOM

MEDICAL WASTE ROOM

WSA TO BE CONNECTED TO SEWER & HAVE A CONNECTION OF HOT & COLD WATER FOR CLEANING

LANE

5.000 2.5% RAMP

3.465 MAX 12.5% RAMP

10.345 20% RAMP

HYD.BOOSTER

STEP & LIP FREE TRANSITION

Min. 850c single slide door Provision of recessed floor track Provide lip free access

BUILDING OUTLINE ABOVE

2.1M HEADROOM UNDER STAIRS

MAIN LOBBY
17.60 m²

RECEPTION

AUTOMATIC DOOR

COMMERCIAL / RETAIL
50.00 m²

CPE

FIRE-RATED LIFT

MED.CENTER LIFT

AIRLOCK

ADMIN.

WC ACCESSIBLE

CONSULTING ROOM 1
CONSULTING ROOM 2
CONSULTING ROOM 3
CONSULTING ROOM 4

FEMALE TOILET
UNISEX ACC
MALE TOILET

CARLTON ST

01 Ground Floor
Scale 1:100 @ A1

ISSUE	AMENDMENT	DATE	DRAWN	CHECKED
A	ISSUED TO CONSULTANTS FOR COORDINATION	11/12/2023	YT	AM

Print Date: Monday, 11 December 2023 10:02 AM

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GENERAL NOTES

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NORTH

PROJECT STATUS
Development Application

SHEET TITLE
Ground Floor Plan

DESIGNED: AM | DRAWN: YT | COMMENCED: Feb 2023 | SCALE: 1:100 @ A1 Sheet, 1:200 @ A3 Sheet | PRINT:

L.G.A : Cumberland City Council

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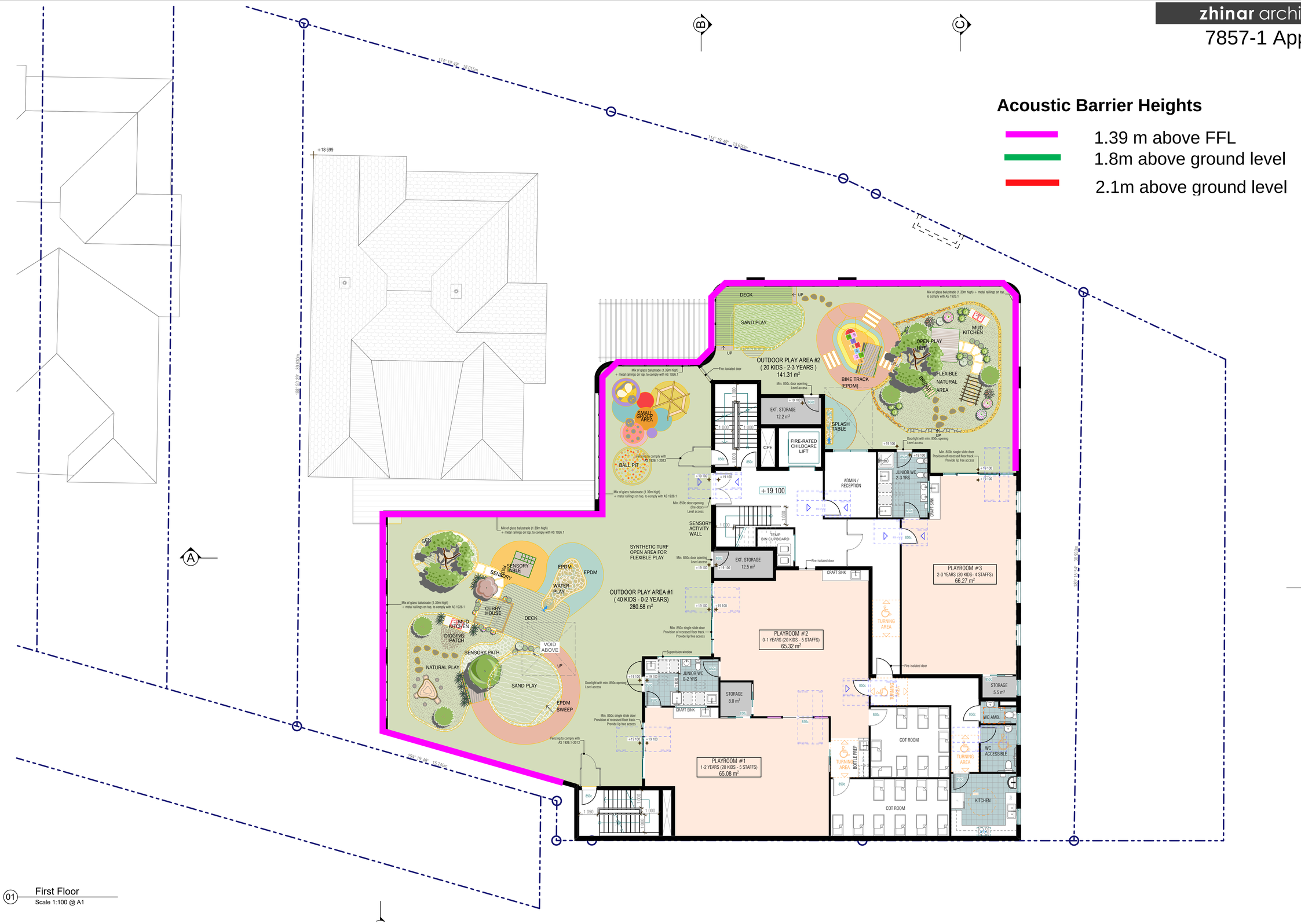
28 495 869 790 / abn

PROJECT NAME
Mixed Use Commercial
58-62 Railway Pde
GRANVILLE NSW 2142

JOB No. 08797 | DRAWING No. DA.06 | ISSUE A

Acoustic Barrier Heights

- 1.39 m above FFL
- 1.8m above ground level
- 2.1m above ground level



01 First Floor
Scale 1:100 @ A1

ISSUE	AMENDMENT	DATE	DRAWN	CHECKED
A	ISSUED TO CONSULTANTS FOR COORDINATION	11/12/2023	YT	AM

Print Date: Monday, 11 December 2023 10:02 AM

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NORTH

PROJECT STATUS
Development Application

SHEET TITLE
Level 1 Plan

DESIGNED: AM | DRAWN: YT | COMMENCED: Feb 2023 | SCALE: 1:100 @ A1 Sheet, 1:200 @ A3 Sheet | PRINT:

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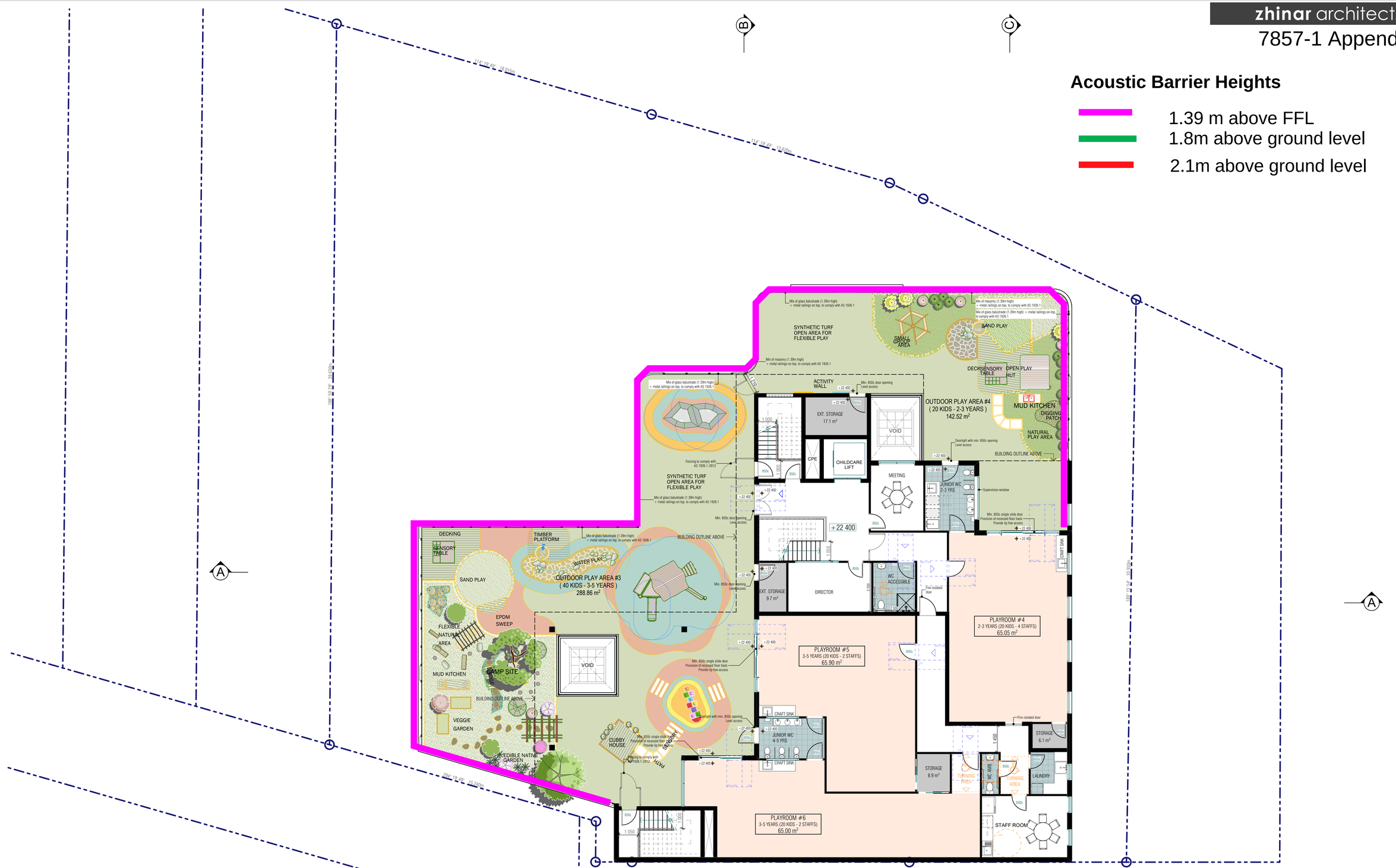
PROJECT NAME
Mixed Use Commercial
58-62 Railway Pde
GRANVILLE NSW 2142

JOB No. 08797 | DRAWING No. DA.07 | ISSUE A

Acoustic Barrier Heights

- 1.39 m above FFL
- 1.8m above ground level
- 2.1m above ground level



01 Second Floor
Scale 1:100 @ A1

ISSUE	AMENDMENT	DATE	DRAWN	CHECKED
A	ISSUED TO CONSULTANTS FOR COORDINATION	11/12/2023	YT	AM

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NORTH

PROJECT STATUS
Development Application

SHEET TITLE
Level 2 Plan

DESIGNED:	DRAWN:	COMMENCED:	SCALE:	PRINT:
AM	YT	Feb 2023	1:100 @ A1 Sheet 1:200 @ A3 Sheet	

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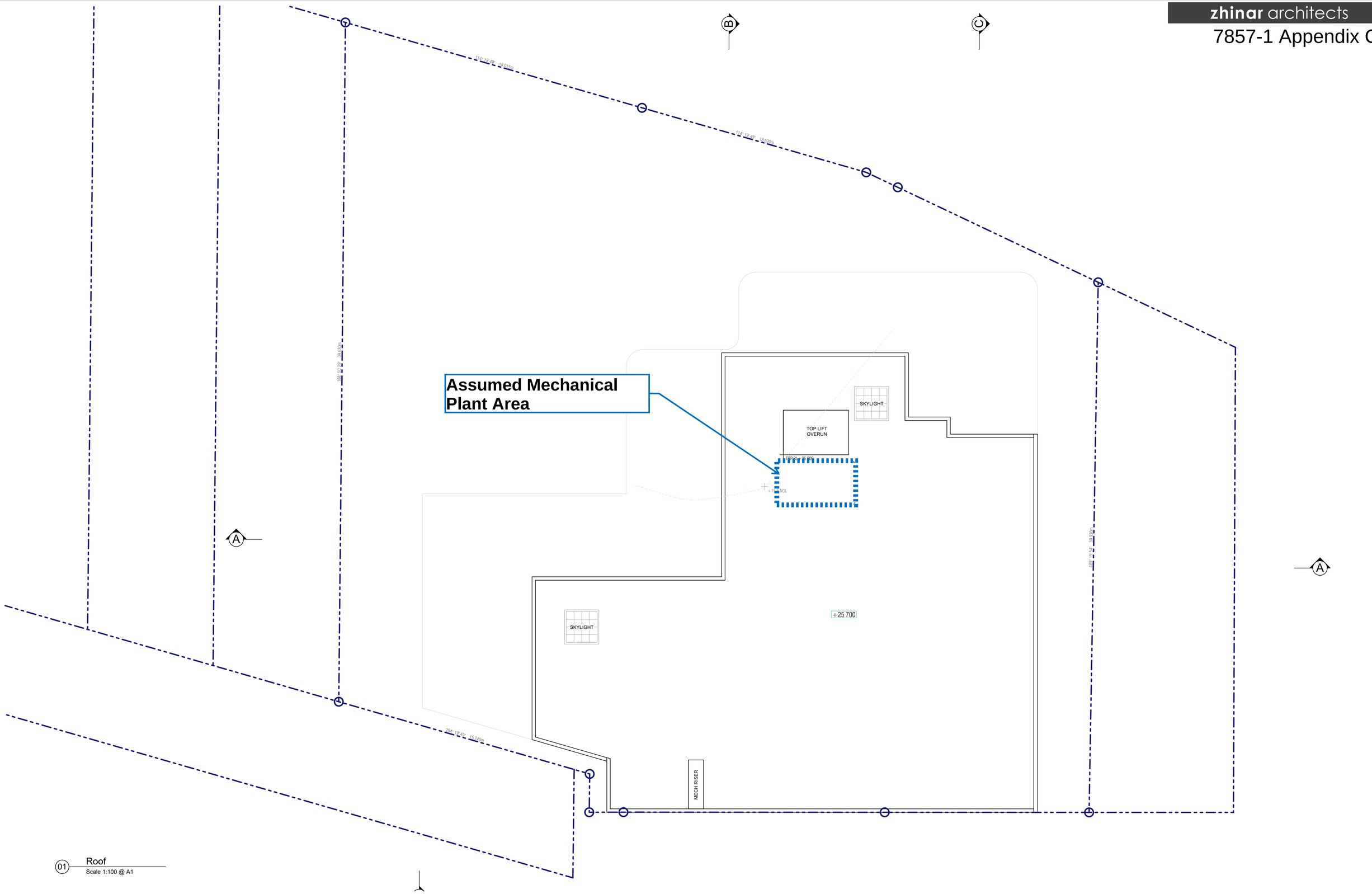
PROJECT NAME
Mixed Use Commercial
58-62 Railway Pde
GRANVILLE NSW 2142

JOB No. 08797
DRAWING No. DA.08
ISSUE A



01 Roof
Scale 1:100 @ A1

ISSUE	AMENDMENT	DATE	DRAWN	CHECKED
A	ISSUED TO CONSULTANTS FOR COORDINATION	11/12/2023	YT	AM

Print Date: Monday, 11 December 2023 10:03 AM

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NORTH

PROJECT STATUS
Development Application
7857-1 Appendix C

SHEET TITLE
Roof Plan

DESIGNED:	DRAWN:	COMMENCED:	SCALE:	PRINT:
AM	YT	Feb 2023	1:100 @ A1 Sheet 1:200 @ A3 Sheet	

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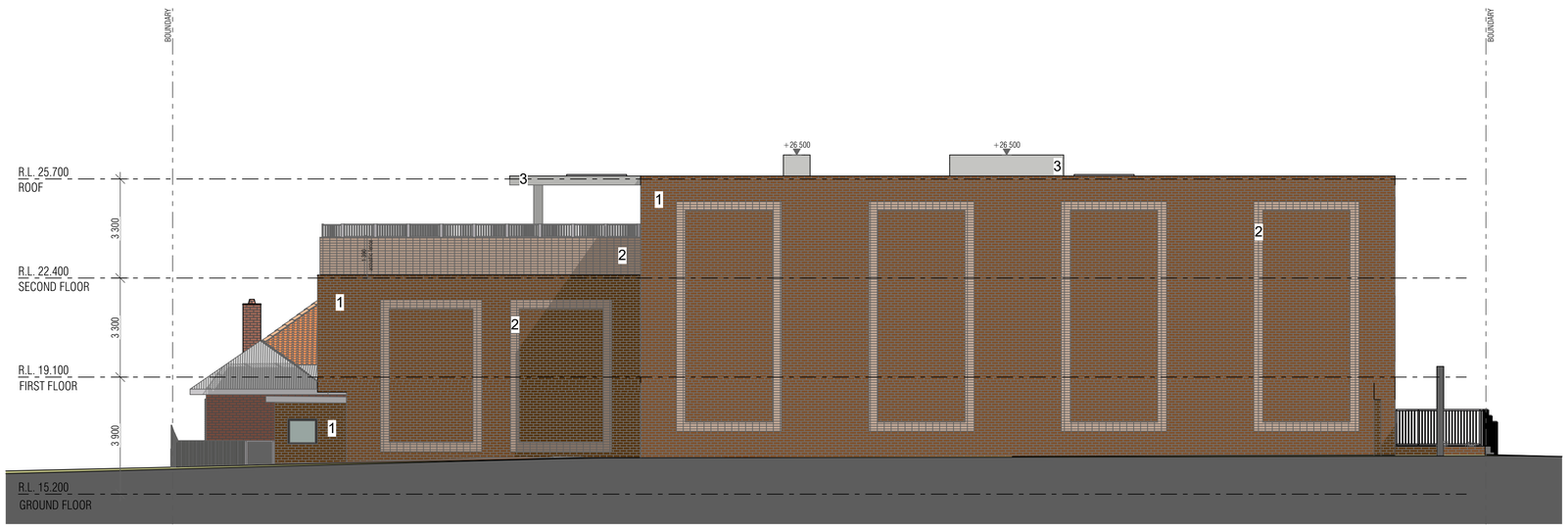
PROJECT NAME
Mixed Use Commercial
58-62 Railway Pde
GRANVILLE NSW 2142

JOB No. 08797
DRAWING No. DA.09
ISSUE A

01 North Elevation
Scale 1:100 @ A1



02 South Elevation
Scale 1:100 @ A1

MATERIAL SCHEDULE

1. Brick Face 01
   BOWRAL - 'Gertrudis Brown' *O.S.A

2. Brick Face 02
   BOWRAL - 'Simmental Silver' *O.S.A

3. Paint Render 01
   DULUX (Acratex / smooth grain)
   'Grey Pebble Quarter' *O.S.A

4. Door /window frames
   DULUX powdercoat 'Surfmist' *O.S.A

5. Acoustic barrier (transparent)
   Single glazed view aperture acrylic/perspex/PC *O.S.A

*O.S.A : Or Similar Approved

DISCLAIMER :
Colour use may vary from the original brushout. Colours need to be confirmed before painting.

ISSUE	AMENDMENT	DATE	DRAWN	CHECKED
A	ISSUED TO CONSULTANTS FOR COORDINATION	11/12/2023	YT	AM

Print Date: Monday, 11 December 2023 10:03 AM
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NORTH

PROJECT STATUS
Development Application

SHEET TITLE
North & South Elevations

DESIGNED:	DRAWN:	COMMENCED:	SCALE:	PRINT:
AM	YT	Feb 2023	1:100 @ A1 Sheet 1:200 @ A3 Sheet	

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PROJECT NAME
Mixed Use Commercial
58-62 Railway Pde
GRANVILLE NSW 2142

JOB No. 08797
DRAWING No. DA.10
ISSUE A

01 East Elevation
Scale 1:100 @ A1

02 West Elevation
Scale 1:100 @ A1

MATERIAL SCHEDULE

1. Brick Face 01
   BOWRAL - 'Gertrudis Brown'
   *O.S.A

2. Brick Face 02
   BOWRAL - 'Simmental Silver'
   *O.S.A

3. Paint Render 01
   DULUX (Acratex / smooth grain)
   'Grey Pebble Quarter'
   *O.S.A

4. Door /window frames
   DULUX powdercoat 'Surfmist'
   *O.S.A

5. Acoustic barrier (transparent)
   Single glazed view aperture acrylic/perspex/P

   *O.S.A

*O.S.A : Or Similar Approved

DISCLAIMER :
Colour use may vary from the original brushout. Colours need to be confirmed before painting.

ISSUE	AMENDMENT	DATE	DRAWN	CHECKED
A	ISSUED TO CONSULTANTS FOR COORDINATION	11/12/2023	YT	AM

Print Date: Monday, 11 December 2023 10:03 AM

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NORTH

PROJECT STATUS
Development Application

SHEET TITLE
East & West Elevations

DESIGNED:	DRAWN:	COMMENCED:	SCALE:	PRINT:
AM	YT	Feb 2023	1:100 @ A1 Sheet 1:200 @ A3 Sheet	

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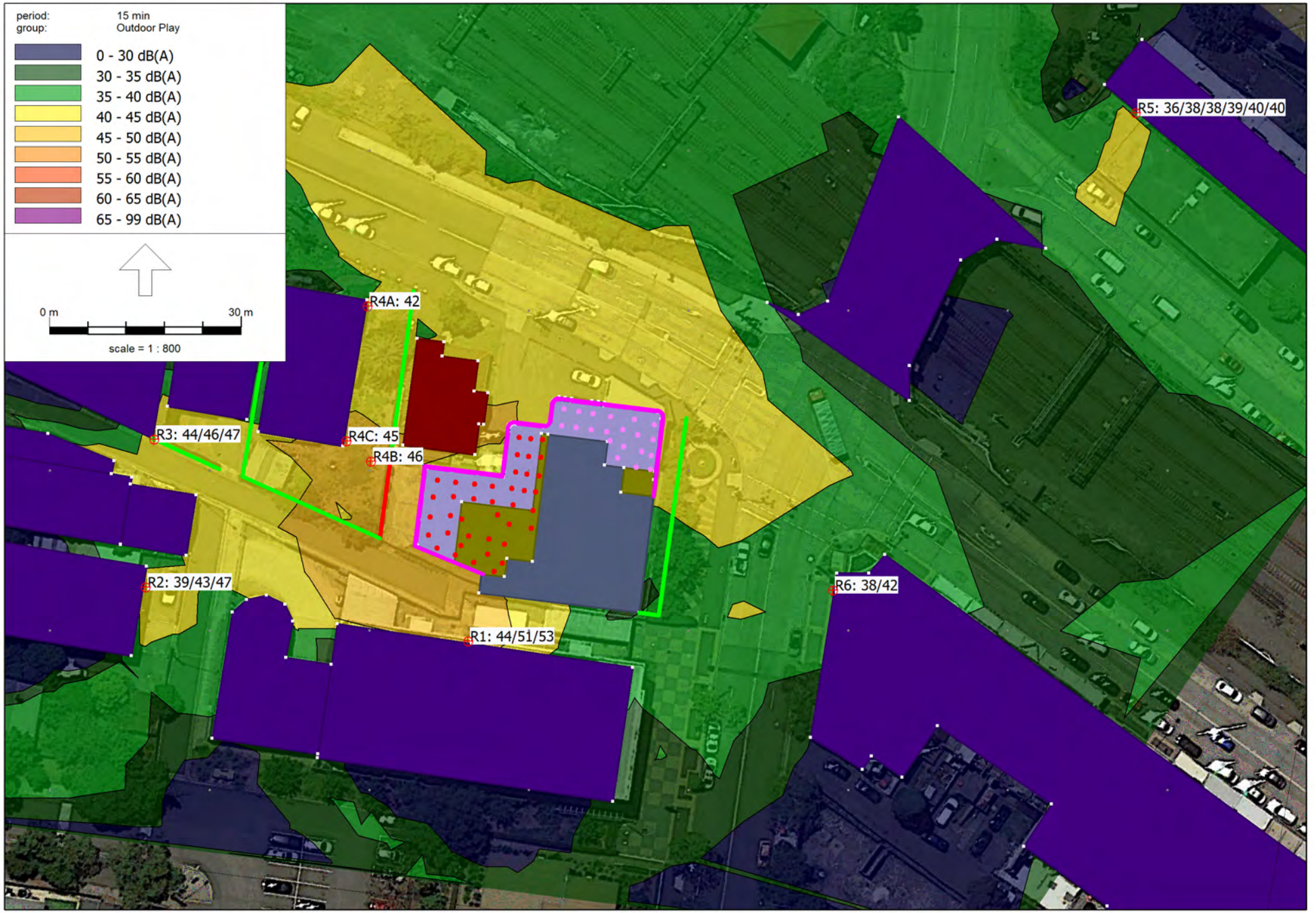
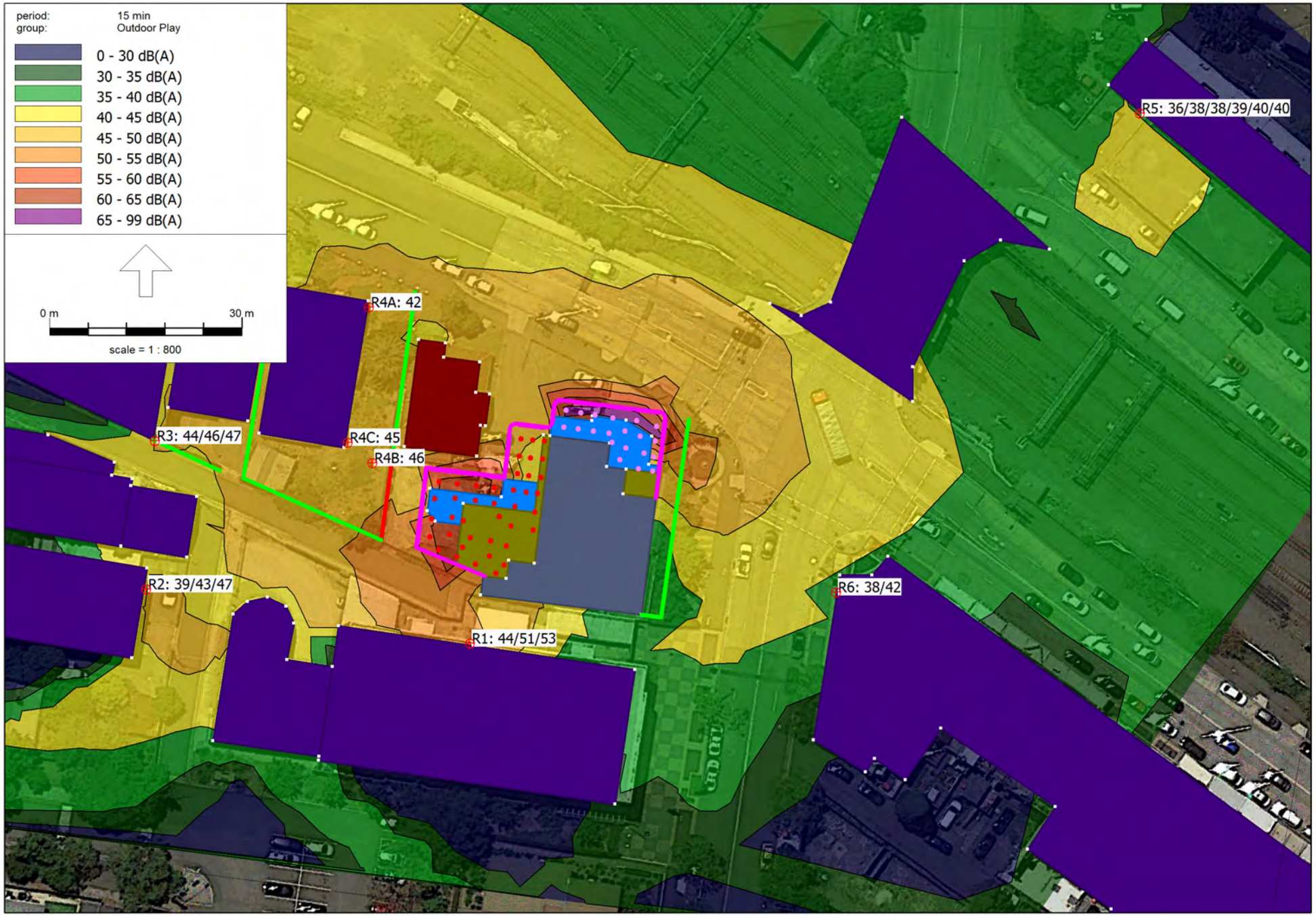
PROJECT NAME
Mixed Use Commercial
58-62 Railway Pde
GRANVILLE NSW 2142

JOB No. 08797
DRAWING No. DA.11
ISSUE A

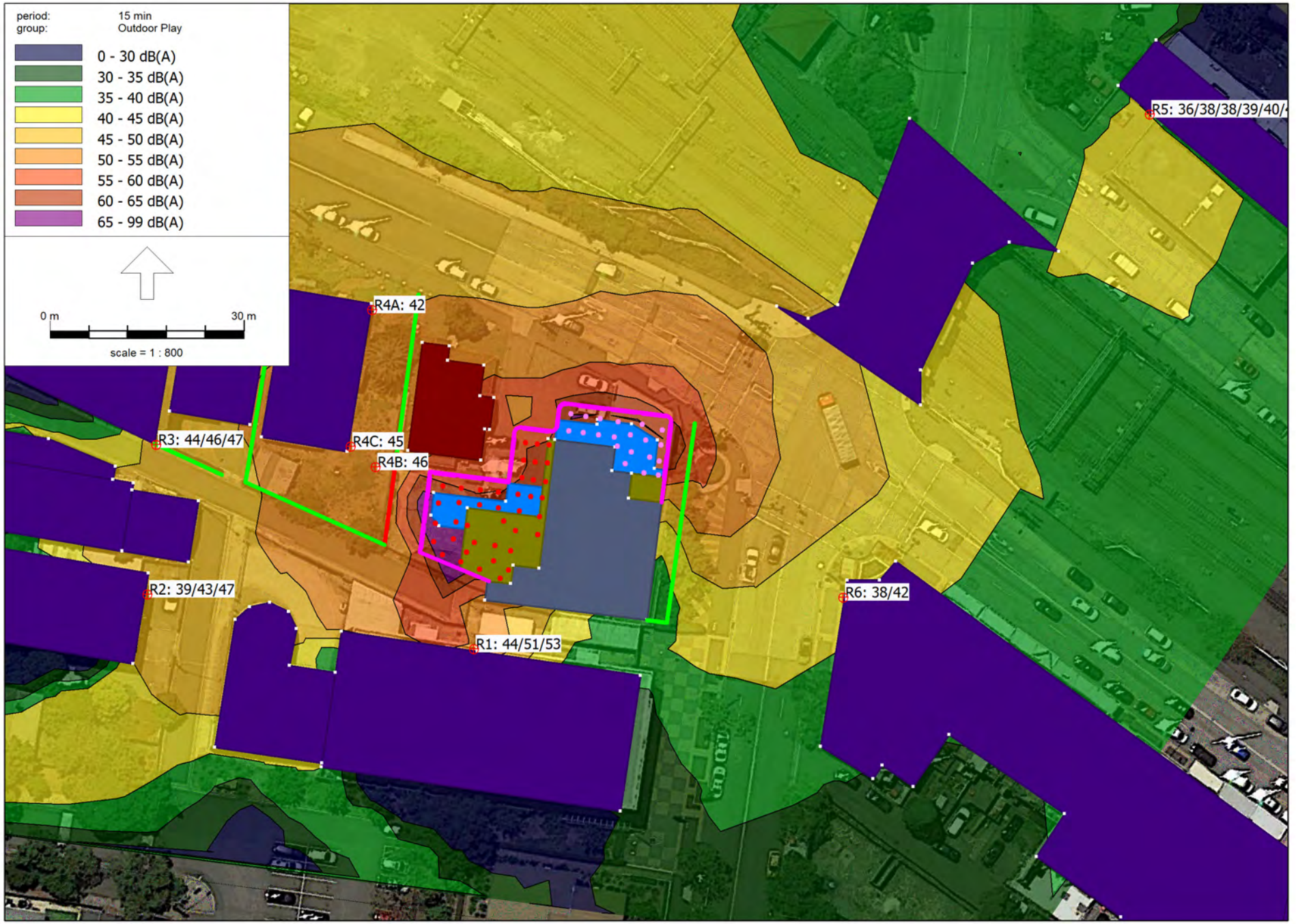
Leq, 15 min - Ground Level: Outdoor Play Areas. Up to 120 Children.



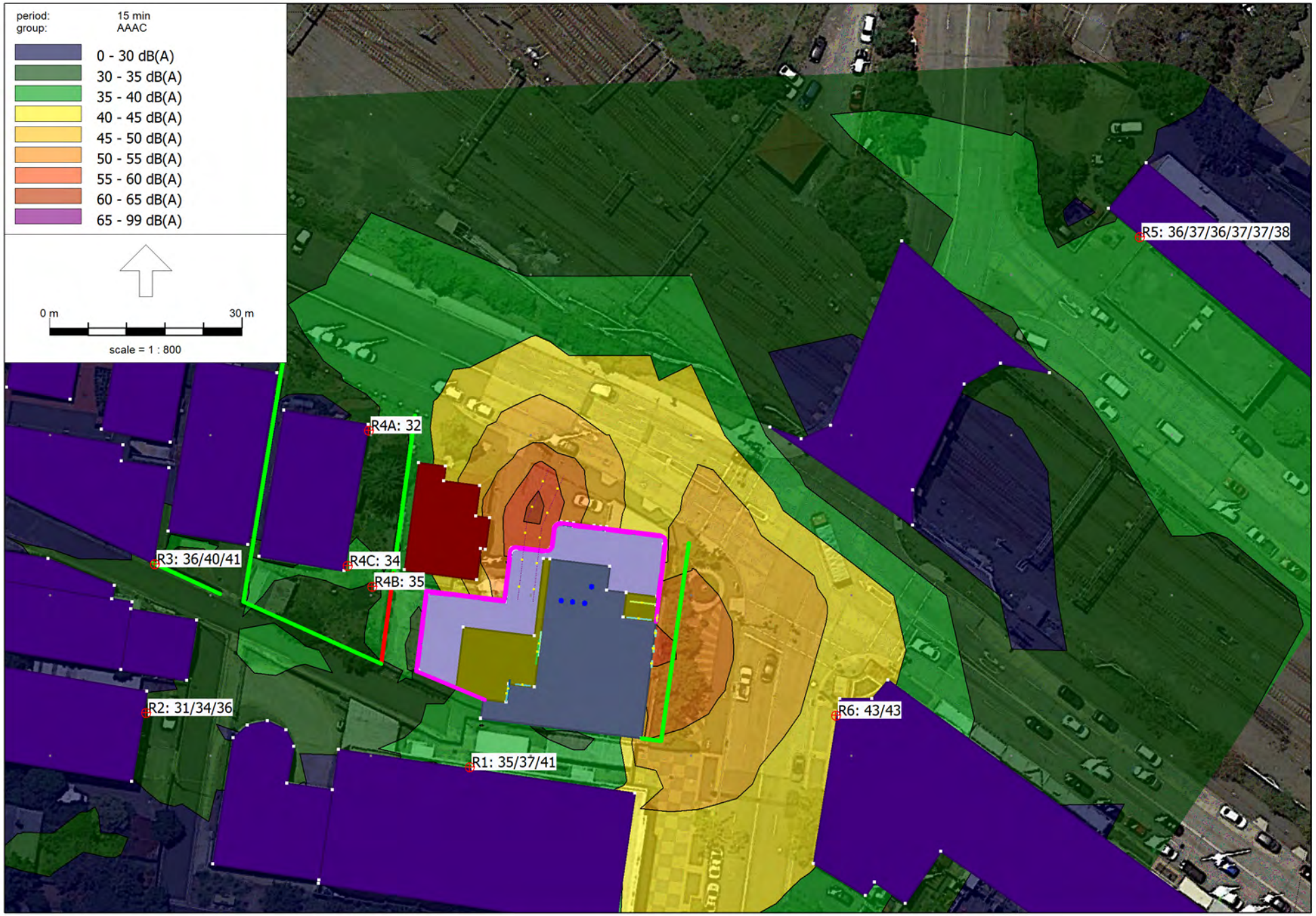
Leq, 15 min - First Floor Level (4.5m above NGL): Outdoor Play Areas. Up to 120 Children.



Leq, 15 min - Second Floor Level (7m above NGL): Outdoor Play Areas. Up to 120 Children.

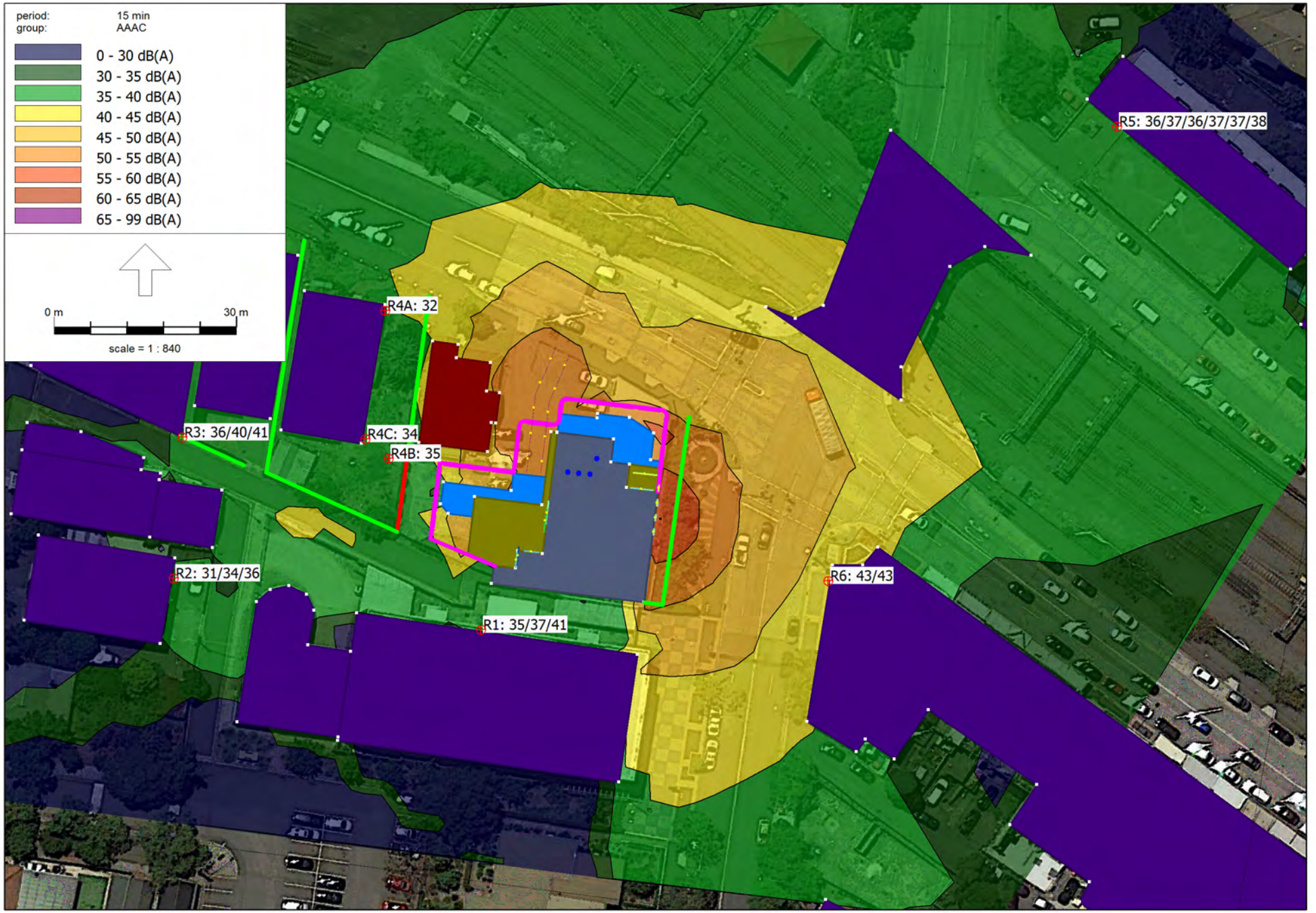


Leq, 15 min - Carpark, Indoor Play & Mechanical Plant.

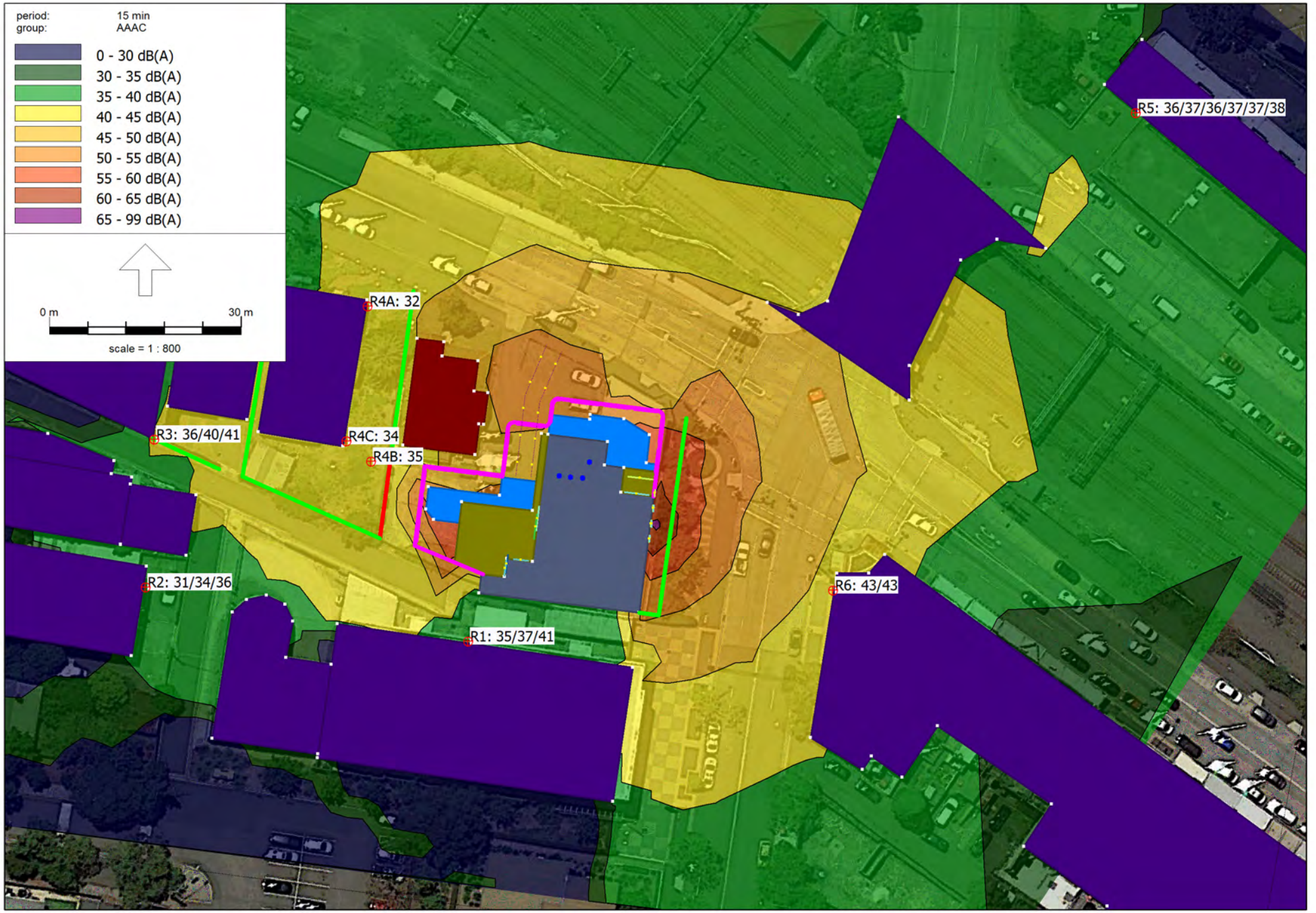


ISO 9613, [7857-1 - 7857-1 Overall Site 1.5m (Issue A Drawings)] , iNoise V2024 Enterprise Licensed to Day Design Pty Ltd - Australia

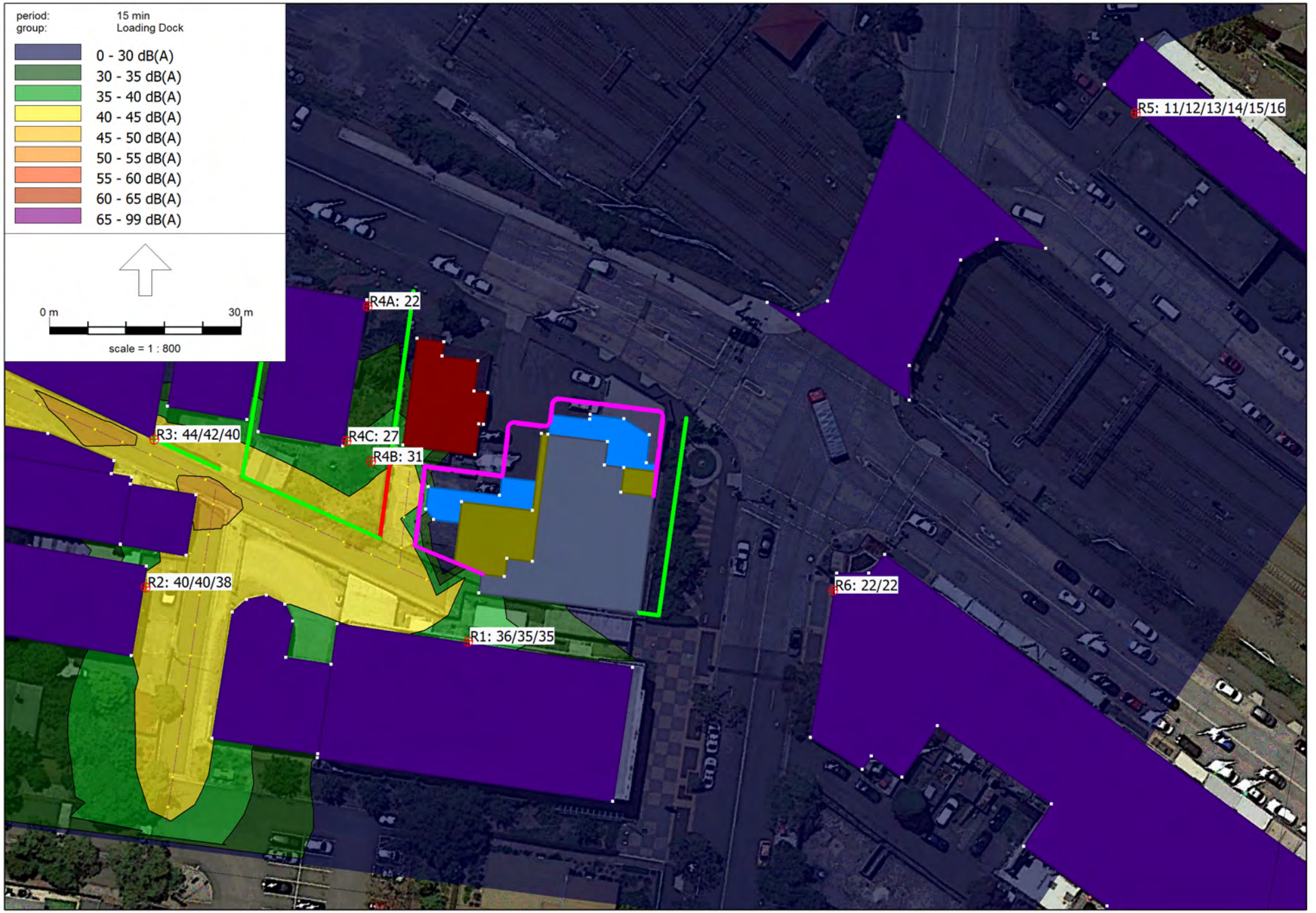
Leq, 15 min - First Floor Level (4.5m above NGL): Carpark, Indoor Play & Mechanical Plant



Leq, 15 min - Second Floor Level (7m above NGL): Carpark, Indoor Play & Mechanical Plant.

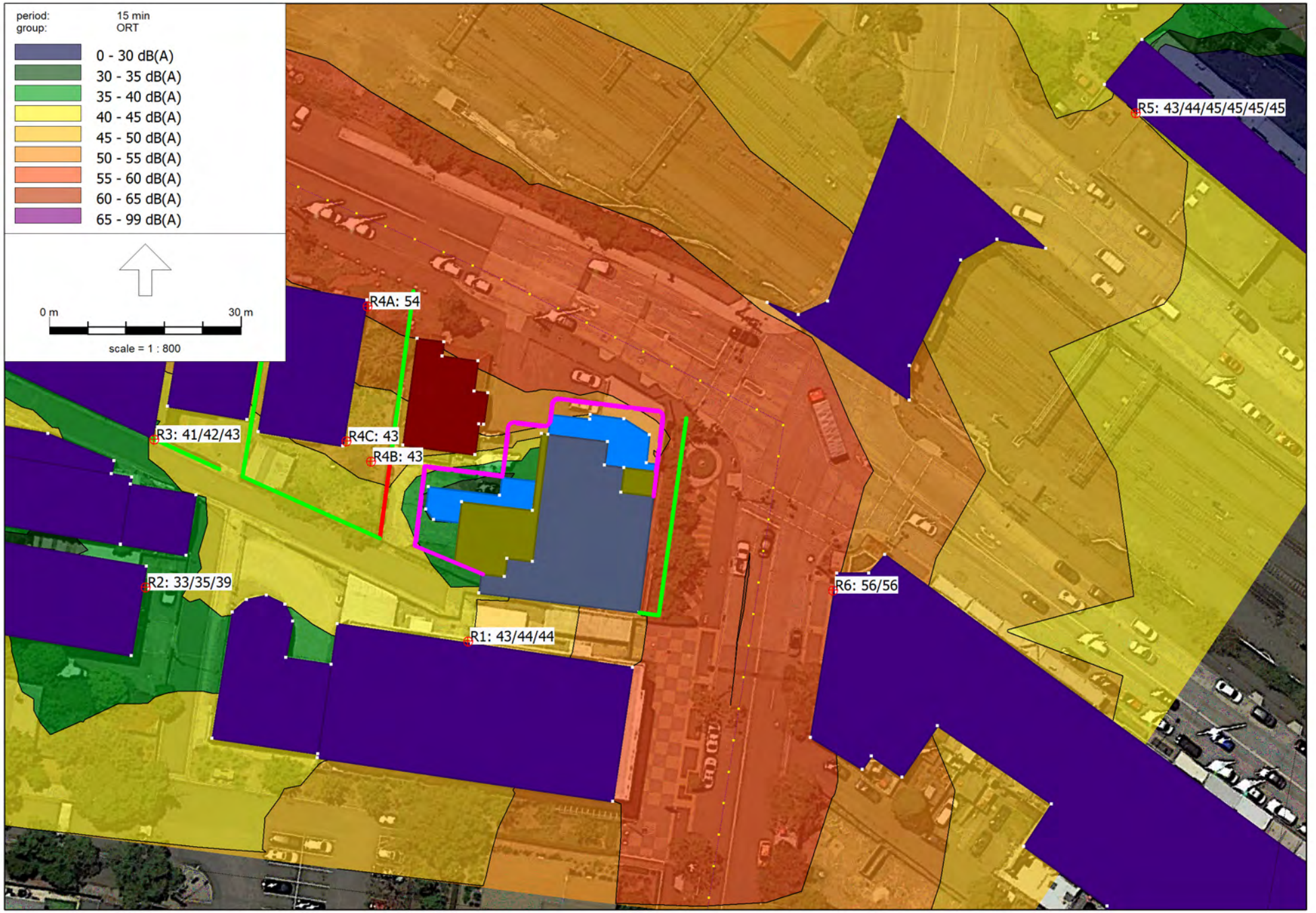


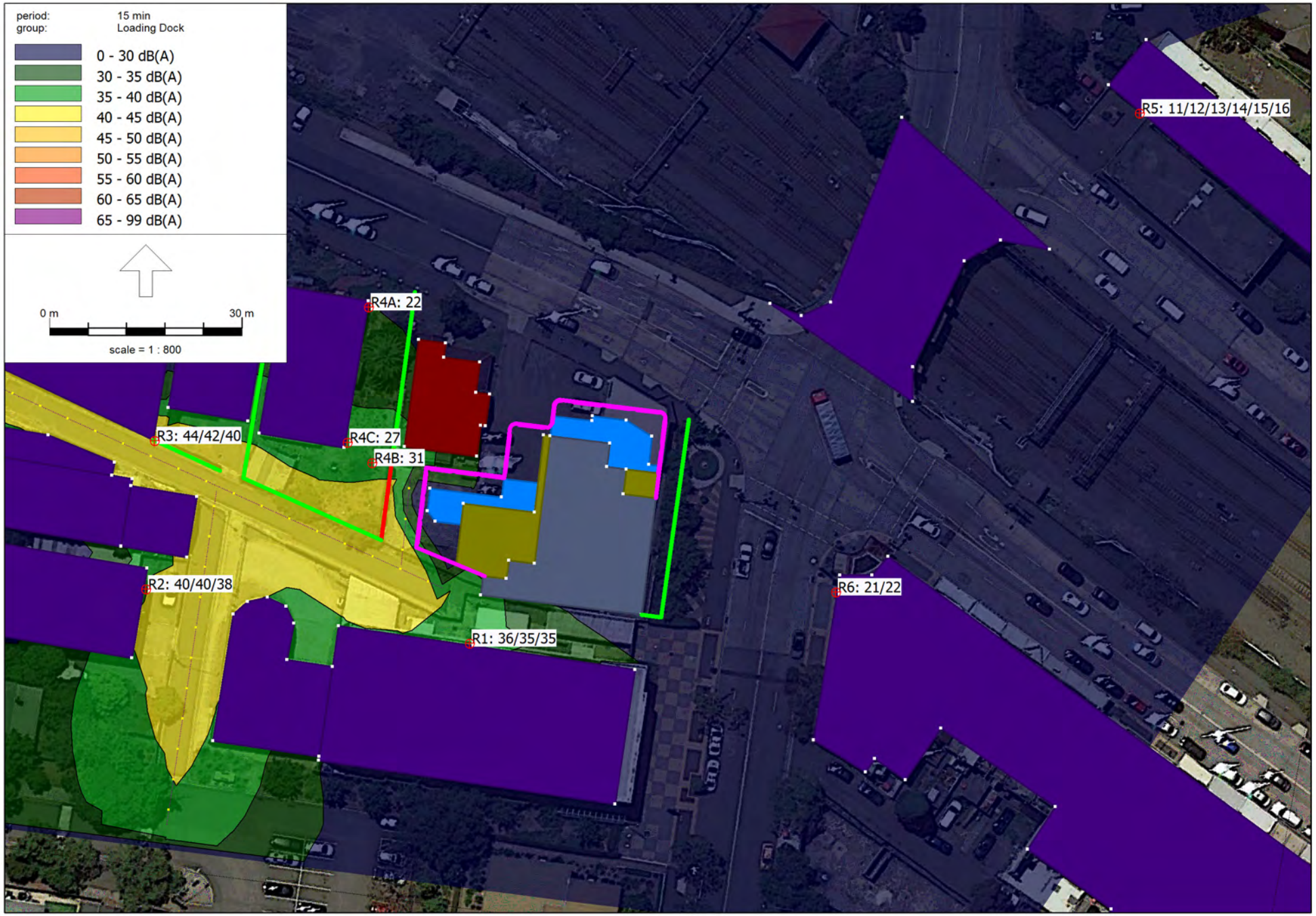
Leq, 1 hour - First Floor Level (4.5m above NGL): On Road Traffic (Vehicles)



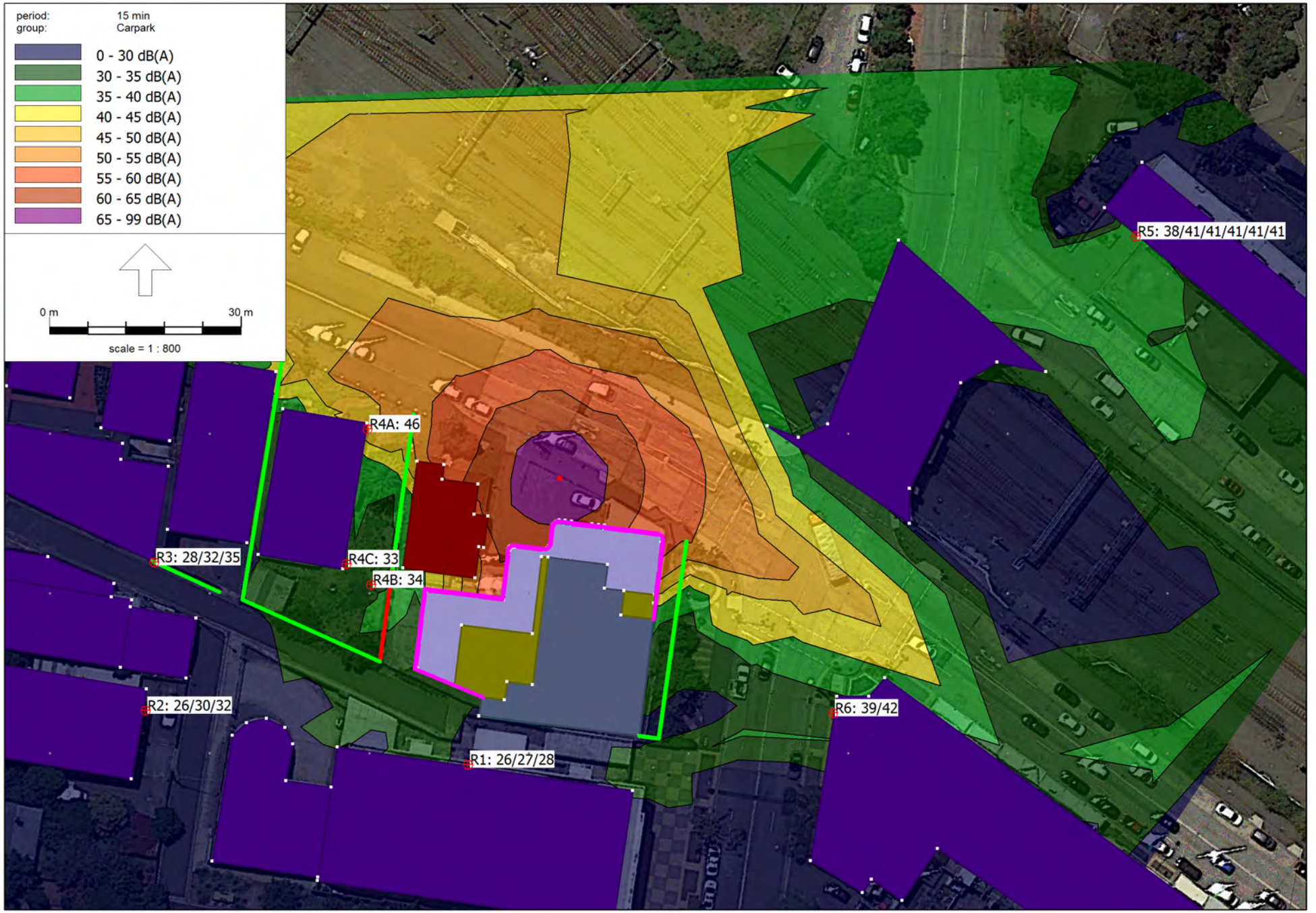
ISO 9613, [7857-1 - 7857-1 Overall Site 4.5m (Issue A Drawings)] , iNoise V2024 Enterprise Licensed to Day Design Pty Ltd - Australia

Leq, 1 hour - First Floor Level (7m above NGL): On Road Traffic (Vehicles)

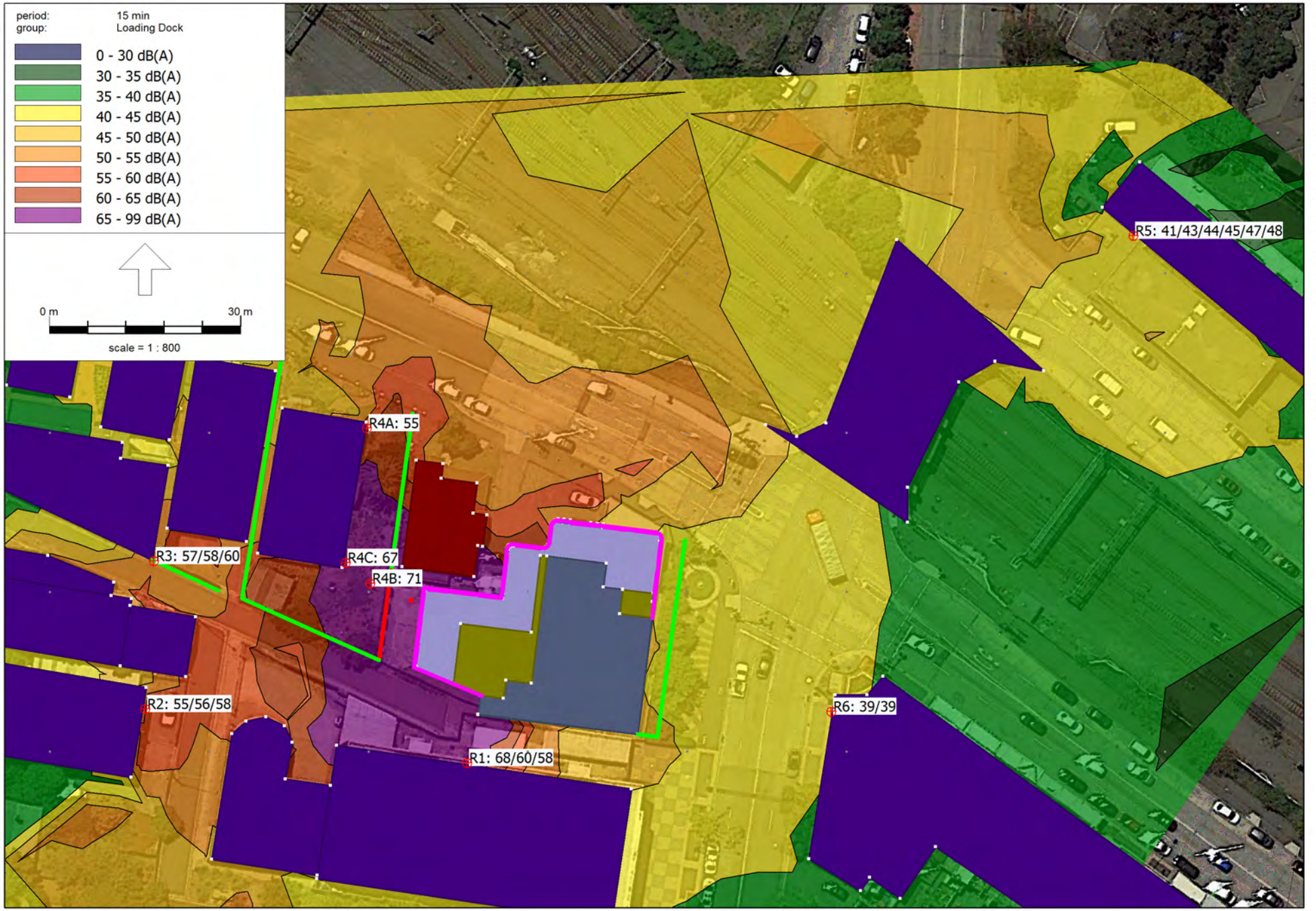




Lmax - Ground Level. Sleep Disturbance (Vehicles Entering Carpark)

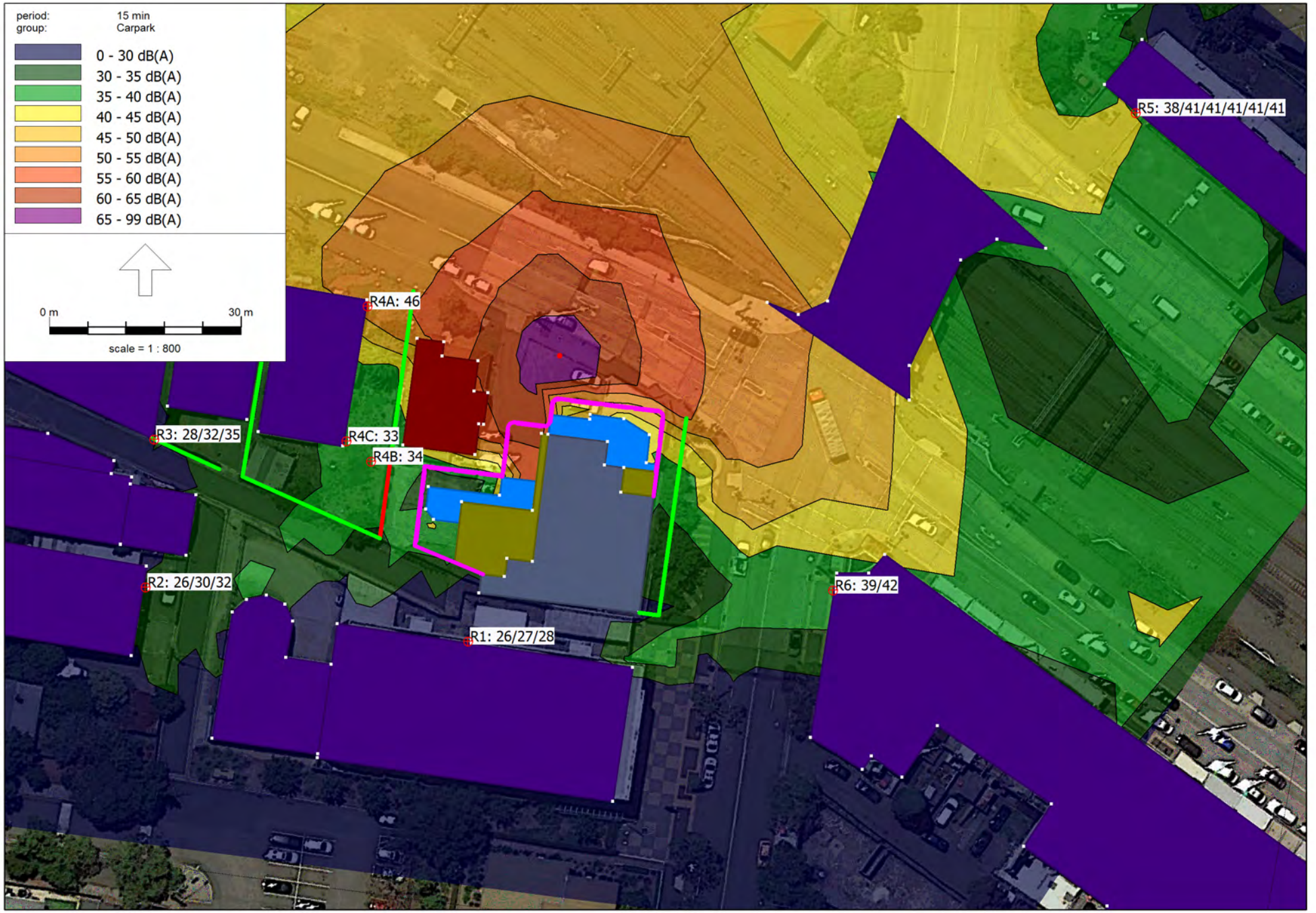


Lmax - Ground Level. Sleep Disturbance (Loading Dock)

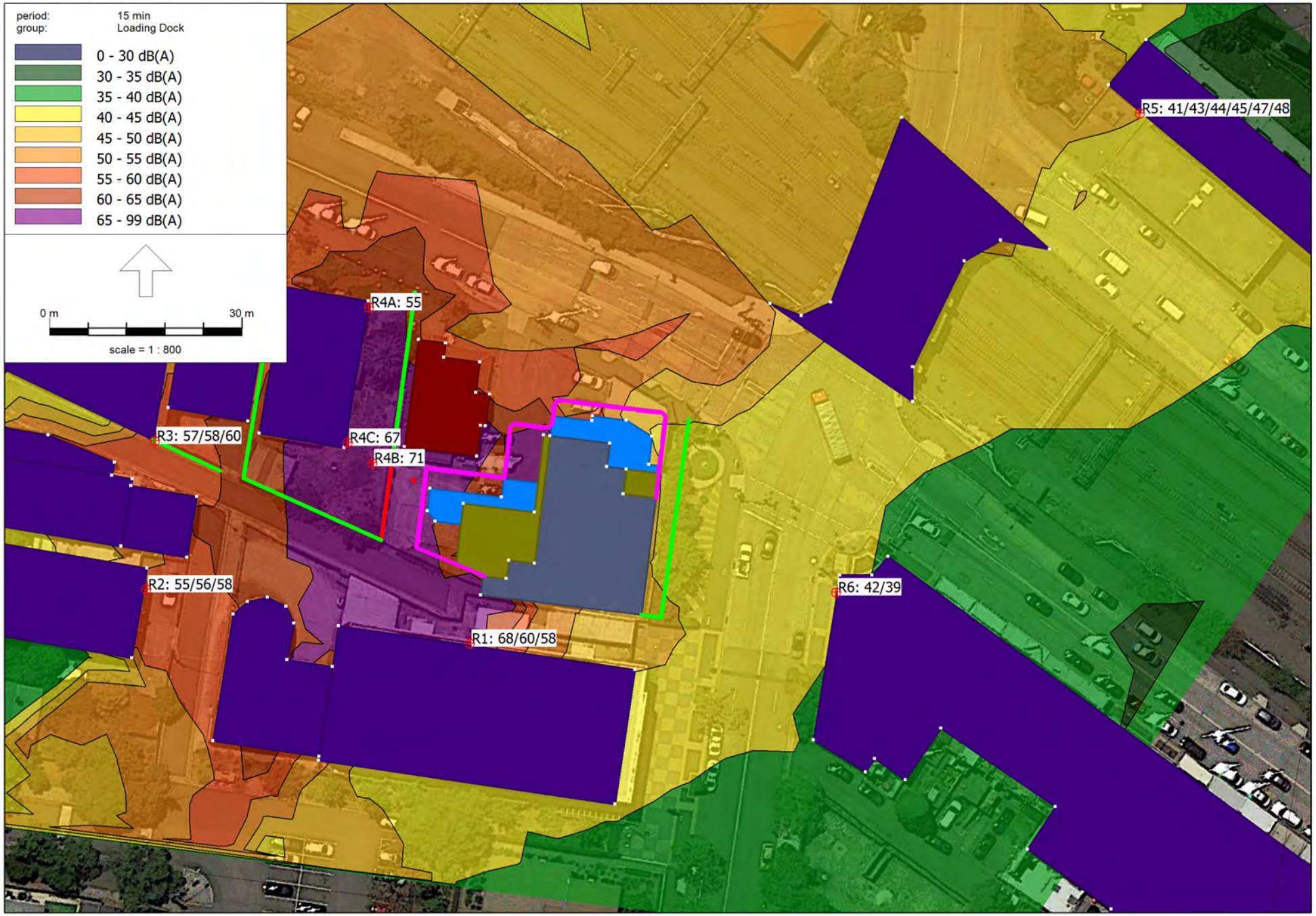


ISO 9613, [7857-1 - 7857-1 Overall Site 1.5m (Issue A Drawings)] , iNoise V2024 Enterprise Licensed to Day Design Pty Ltd - Australia

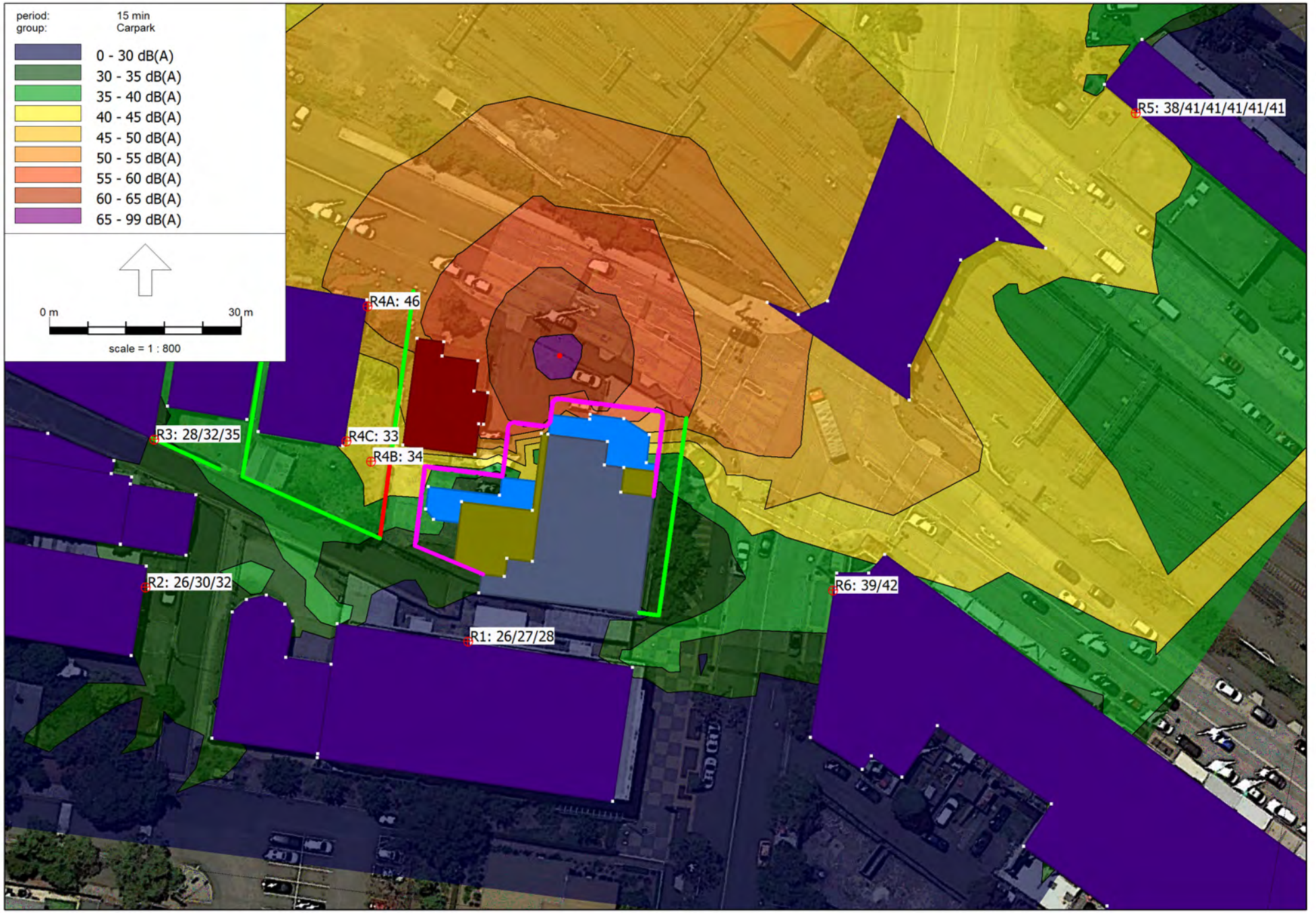
Lmax - Sleep Disturbance (First Floor Level - 4.5m above NGL): Staff Vehicles Entering Carpark.



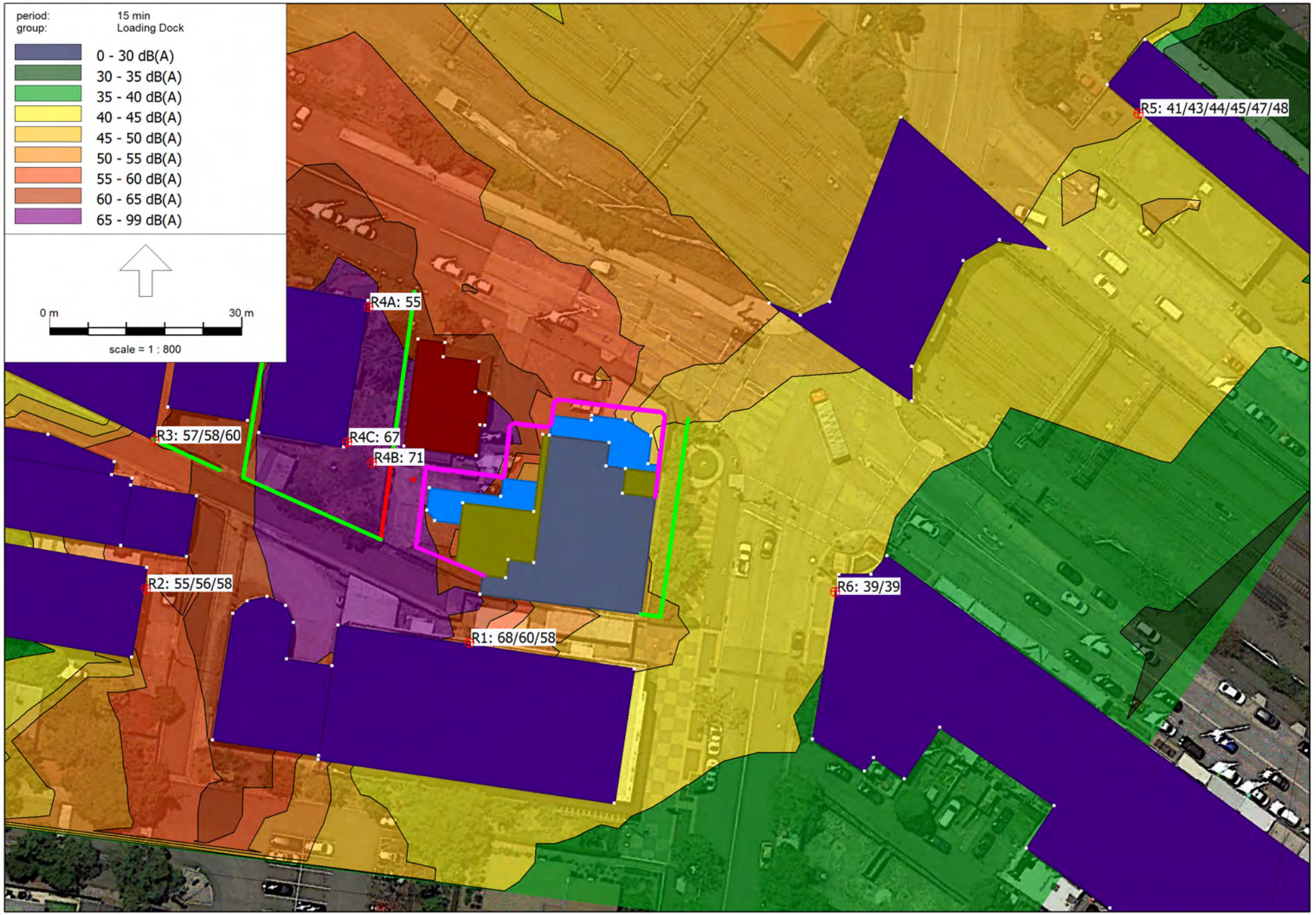
Lmax - Sleep Disturbance (First Floor Level - 4.5m above NGL): Loading Dock



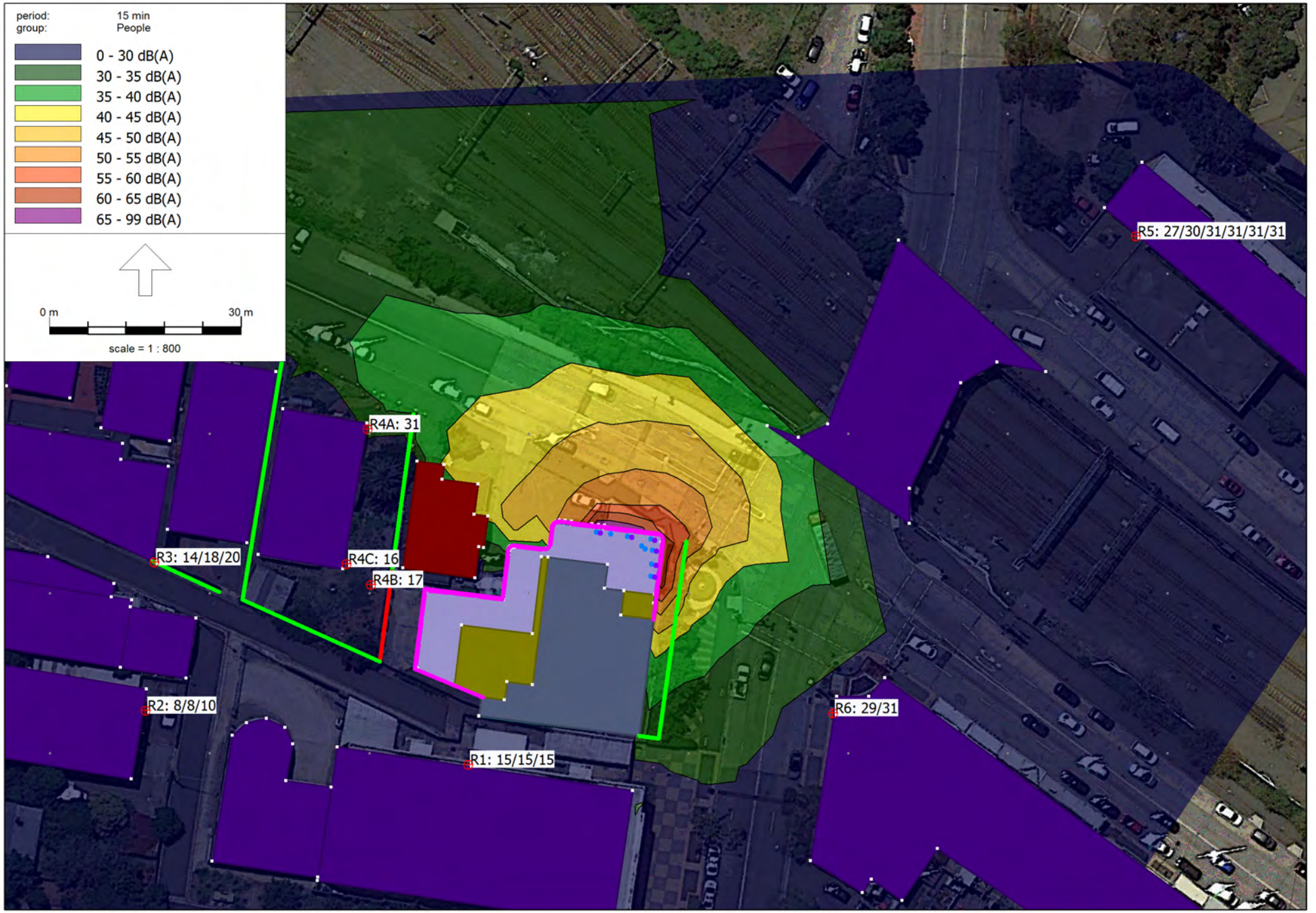
Lmax - Sleep Disturbance (Second Floor Level - 7m above NGL): Staff Vehicles Entering Carpark.



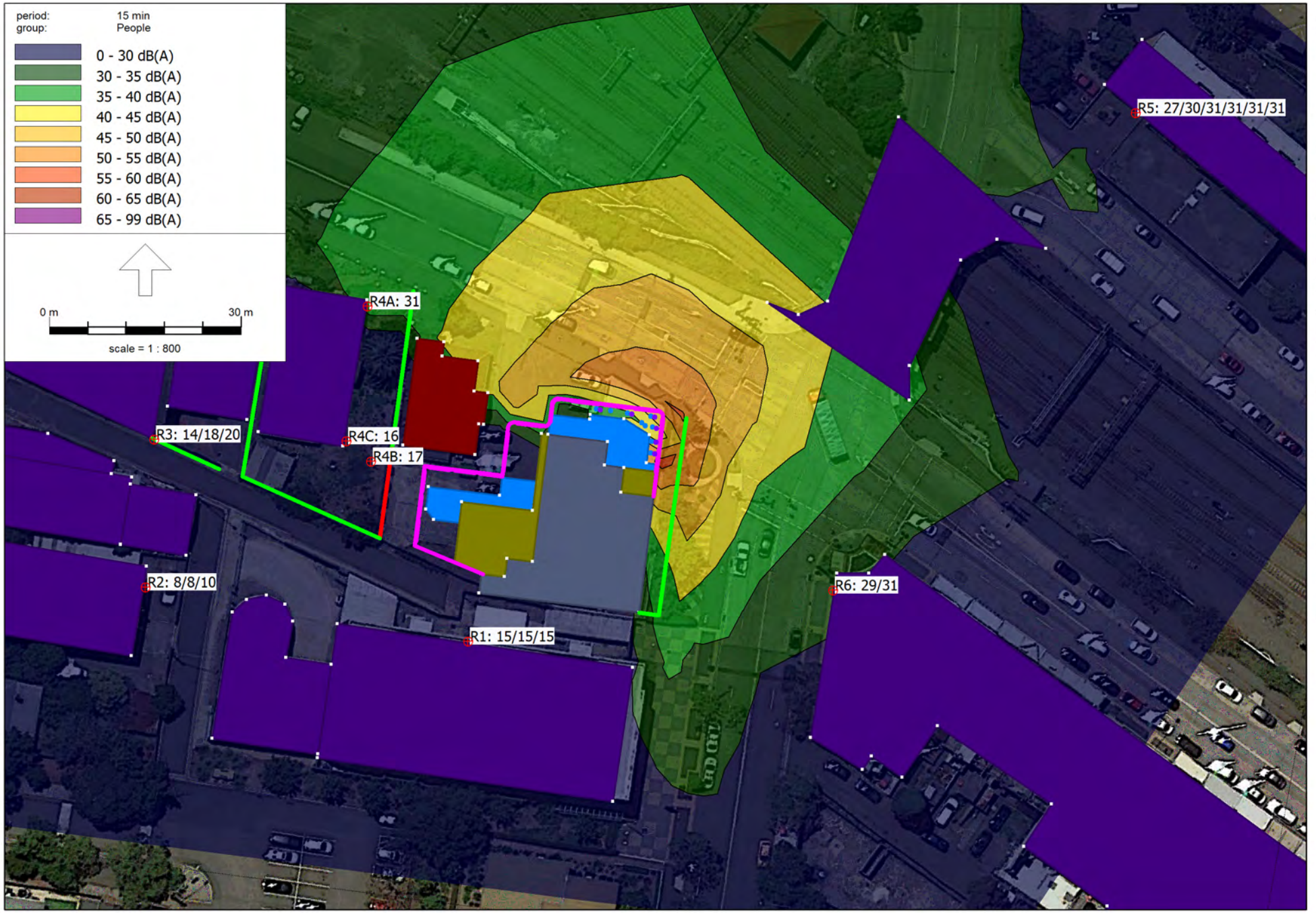
Leq, 1 hour - Sleep Disturbance (Second Floor Level - 7m above NGL): Loading Dock.



Leq, 15 min - Outdoor Seating Area (30 People)

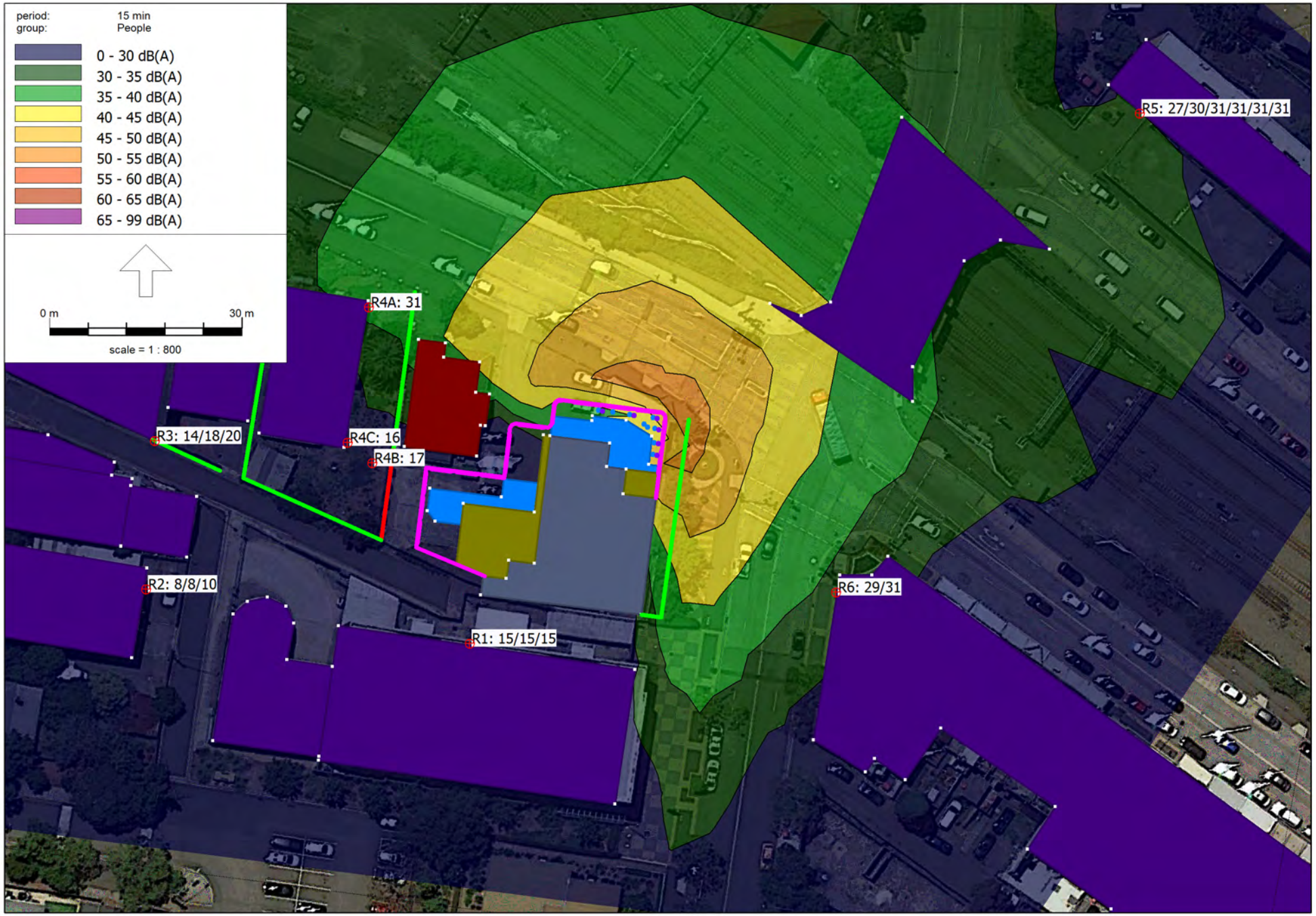


Leq, 15 min - Outdoor Seating Area w/30 people. First Floor Level (4.5m above NGL)



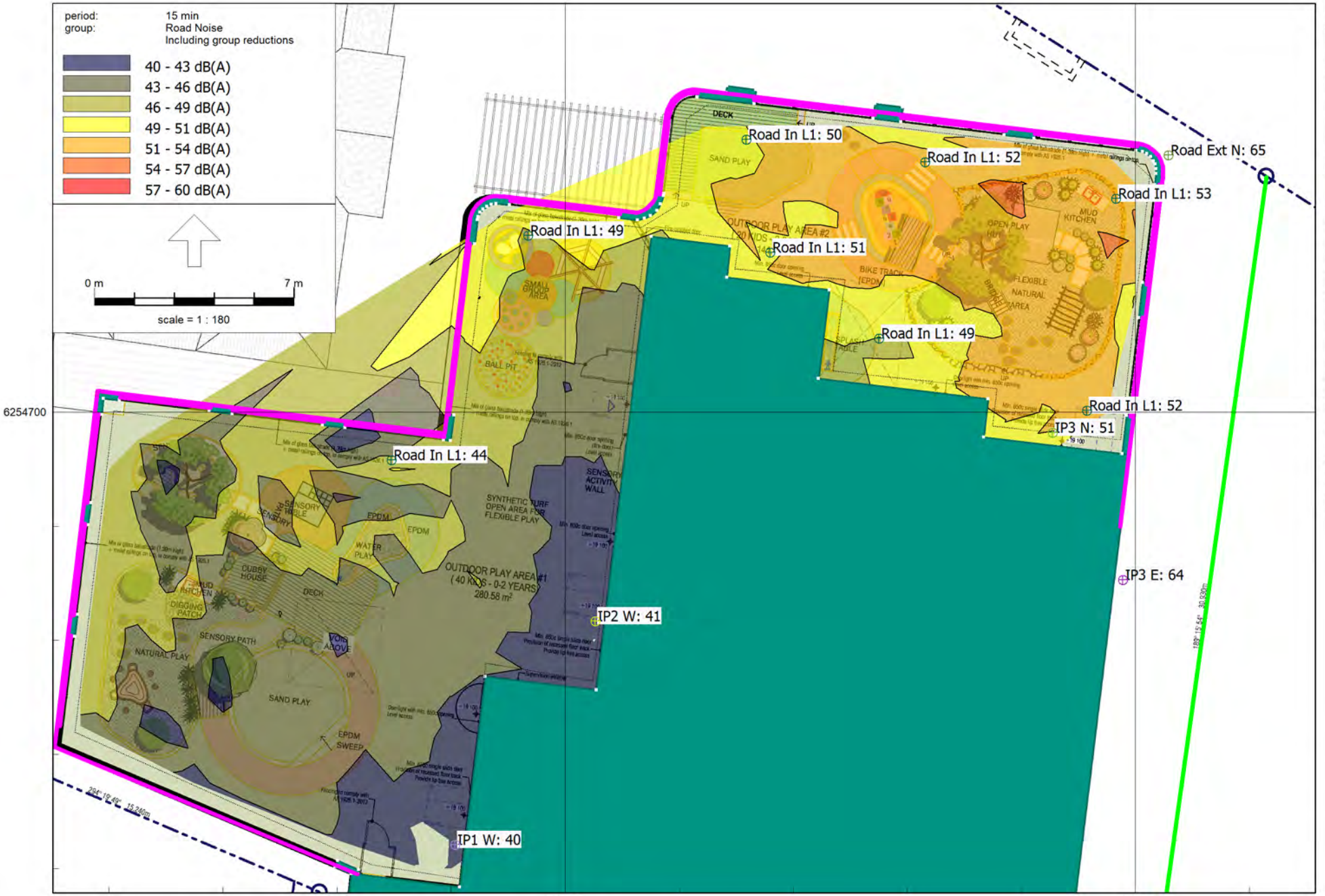
ISO 9613, [7857-1 - 7857-1 Overall Site 4.5m (Issue A Drawings)] , iNoise V2024 Enterprise Licensed to Day Design Pty Ltd - Australia

Leq, 15 min - Outdoor Seating Area w/30 people. Second Floor Level (7m above NGL).



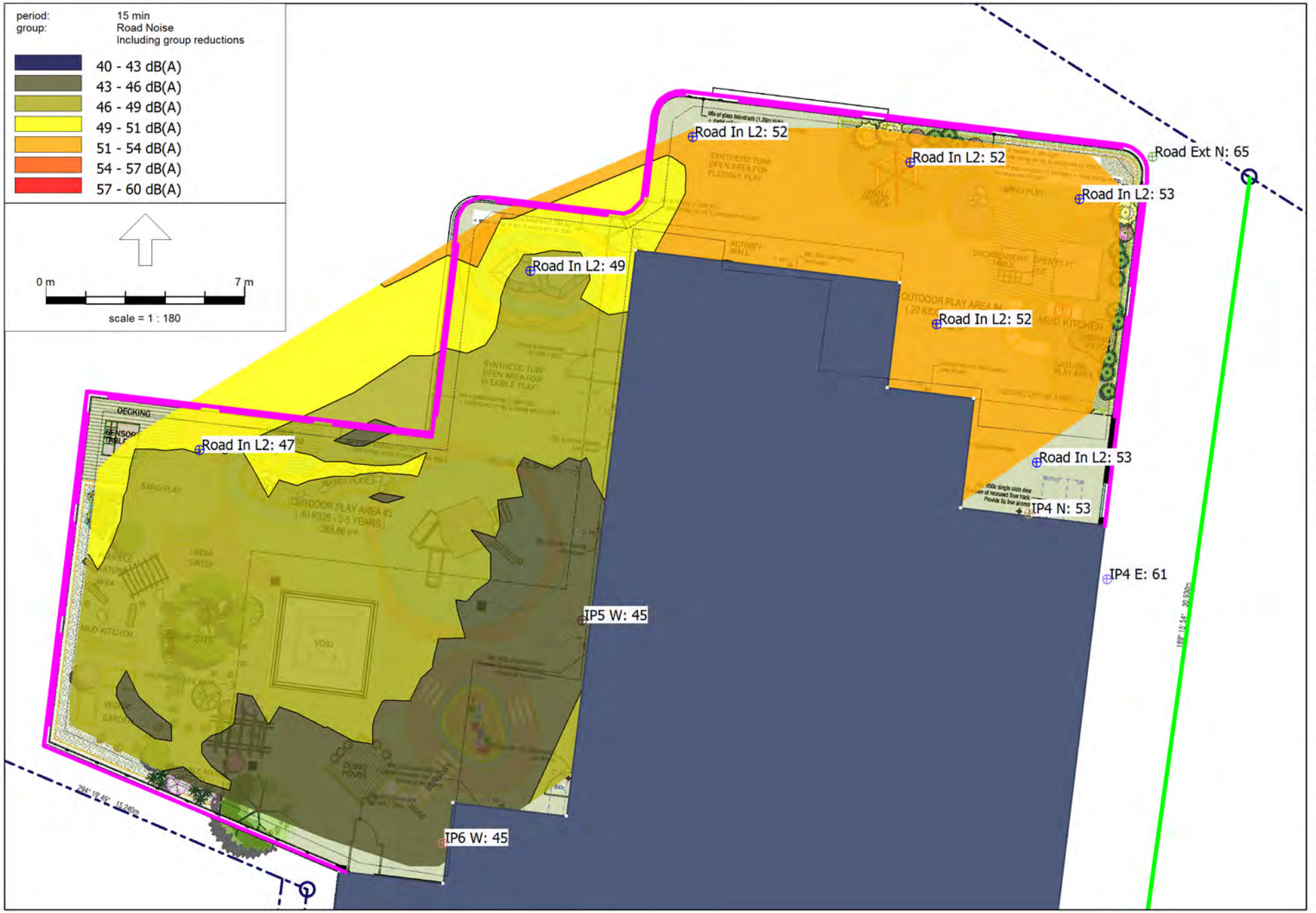
ISO 9613, [7857-1 - 7857-1 Overall Site 7m (Issue A Drawings)] , iNoise V2024 Enterprise Licensed to Day Design Pty Ltd - Australia

Leq, 1 hour - Road & Rail Noise Intrusion. Level 1 Outdoor Play Areas.



ISO 9613, [7857-1 - 7857-1 L1 OPA Contours (Issue A Drawings)] , iNoise V2024 Enterprise Licensed to Day Design Pty Ltd - Australia

Leq, 1 hour - Road & Rail Noise Intrusion. Level 2 Outdoor Play Areas.



ISO 9613, [7857-1 - 7857-1 L2 OPA Contours (Issue A Drawings)] , iNoise V2024 Enterprise Licensed to Day Design Pty Ltd - Australia

GLOSSARY OF ACOUSTICAL TERMS

ACOUSTICAL – Pertaining to the science of sound, including the generation, propagation, effects and control of both noise and vibration.

AMBIENT NOISE – The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including road traffic, factories, wind in the trees, birds, insects, animals, etc.

AUDIBLE – means that a sound can be heard. However, there are a wide range of audibility grades, varying from "barely audible" to "just audible", "clearly audible" and "prominent". Chapter 83 of the NSW Environment Protection Authority – Environmental Noise Control Manual (1985) states:
"noise from a particular source might be offensive if it is clearly audible, distinct from the prevailing background noise and of a volume or character that a reasonable person would be conscious of the intrusion and find it annoying or disruptive".

It follows that the word "audible" in an environmental noise context means "clearly audible".

BACKGROUND NOISE LEVEL – Silence does not exist in the natural or the built-environment, only varying degrees of noise. The Background Noise Level is the average minimum dBA level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by cicadas, lawnmowers, etc. It is quantified by the L_{A90} or the dBA noise level that is exceeded for 90 % of the measurement period (usually 15 minutes).

- **Assessment Background Level (ABL)** is the single figure background level representing each assessment period – day, evening and night (ie three assessment background levels are determined for each 24hr period of the monitoring period). Determination of the assessment background level is by calculating the tenth percentile (the lowest tenth percent value) of the background levels (L_{A90}) for each period (refer: NSW Industrial Noise Policy, 2000).
- **Rating Background Level (RBL)** as specified by the Environment Protection Authority is the overall single figure (L_{A90}) background noise level representing an assessment period (day, evening or night) over a monitoring period of (normally) three to seven days.

  The RBL for an assessment period is the median of the daily lowest tenth percentile of L_{90} background noise levels.

  If the measured background noise level is less than 30 dBA, then the Rating Background Level (RBL) is considered to be 30 dBA.

DECIBEL – The human ear has a vast sound-sensitivity range of over a thousand billion to one. The decibel is a logarithmic unit that allows this same range to be compressed into a somewhat more comprehensible range of 0 to 120 dB. The decibel is ten times the logarithm of the ratio of a sound level to a reference sound level. See also Sound Pressure Level and Sound Power Level.

Decibel noise levels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dBA, and another similar machine is placed beside it, the level will increase to 53 dBA, not 100 dBA. Ten similar machines placed side by side increase the sound level by 10 dBA, and one hundred machines increase the sound level by 20 dBA.

dBA – The human ear is less sensitive to low frequency sound than high frequency sound. We are most sensitive to high frequency sounds, such as a child's scream. Sound level meters have an inbuilt weighting network, termed the dBA scale, that approximates the human loudness response at quiet sound levels (roughly approximates the 40 phon equal loudness contour).

However, the dBA sound level provides a poor indication of loudness for sounds that are dominated by low frequency components (below 250 Hz). If the difference between the "C" weighted and the "A" weighted sound level is 15 dB or more, then the NSW Industrial Noise Policy recommends a 5 dBA penalty be applied to the measured dBA level.

dBC – The dBC scale of a sound level meter is similar to the dBA scale defined above, except that at high sound intensity levels, the human ear frequency response is more linear. The dBC scale approximates the 100 phon equal loudness contour.

EQUIVALENT CONTINUOUS NOISE LEVEL, L_{Aeq} – Many noises, such as road traffic or construction noise, vary continually in level over a period of time. More sophisticated sound level meters have an integrating electronic device inbuilt, which average the A weighted sound pressure levels over a period of time and then display the energy average or L_{Aeq} sound level. Because the decibel scale is a logarithmic ratio the higher noise levels have far more sound energy, and therefore the L_{Aeq} level tends to indicate an average which is strongly influenced by short term, high level noise events. Many studies show that human reaction to level-varying sounds tends to relate closely to the L_{Aeq} noise level.

FREE FIELD – This is a sound field not subject to significant reflection of acoustical energy. A free field over a reflecting plane is usually outdoors with the noise source resting on hard flat ground, and not closer than 6 metres to any large flat object such as a fence or wall; or inside an anechoic chamber.

FREQUENCY – The number of oscillations or cycles of a wave motion per unit time, the SI unit being the Hertz, or one cycle per second.

IMPACT ISOLATION CLASS (IIC) – The American Society for Testing and Materials (ASTM) has specified that the IIC of a floor/ceiling system shall be determined by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The IIC is a number found by fitting a reference curve to the measured octave band levels and then deducting the sound pressure level at 500 Hz from 110 decibels. Thus the higher the IIC, the better the impact sound isolation.

IMPACT SOUND INSULATION ($L_{nT,w}$) – Australian Standard AS ISO 717.2 – 2004 has specified that the Impact Sound Insulation of a floor/ceiling system be quantified by operating an ISO 140 Standard Tapping Machine on the floor and measuring the noise generated in the room below. The Weighted Standardised Impact Sound Pressure Level ($L_{nT,w}$) is the sound pressure level at 500 Hz for a reference curve fitted to the measured octave band levels. Thus the lower $L_{nT,w}$ the better the impact sound insulation.

IMPULSE NOISE – An impulse noise is typified by a sudden rise time and a rapid sound decay, such as a hammer blow, rifle shot or balloon burst.

INTRUSIVE NOISE LEVEL, L_{Aeq} – The level of noise from a factory, place of entertainment, etc. in NSW is assessed on the basis of the average maximum noise level, or the $L_{Aeq\ (15\ min)}$. This is the energy average A weighted noise level measured over any 15 minute period.

LOUDNESS – The degree to which a sound is audible to a listener is termed the loudness. The human ear perceives a 10 dBA noise level increase as a doubling of loudness and a 20 dBA noise increase as a quadrupling of the loudness.

MAXIMUM NOISE LEVEL, L_{Amax} – The rms maximum sound pressure level measured on the "A" scale of a sound level meter during a noise survey is the L_{Amax} noise level. It may be measured using either the Fast or Slow response time of the meter. This should be stated.

NOISE RATING NUMBERS – A set of empirically developed equal loudness curves has been adopted as Australian Standard AS1469-1983. These curves allow the loudness of a noise to be described with a single NR number. The Noise Rating number is that curve which touches the highest level on the measured spectrum of the subject noise. For broadband noise such as fans and engines, the NR number often equals the dBA level minus five.

NOISE – Noise is unwanted sound. Sound is wave motion within matter, be it gaseous, liquid or solid. "Noise includes sound and vibration".

NOISE REDUCTION COEFFICIENT – See: "Sound Absorption Coefficient".

OFFENSIVE NOISE - (Reference: Dictionary of the Protection of the Environment Operations Act 1997). *"Offensive Noise means noise:*

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or likely to be harmful to) a person who is outside the premise from which it is emitted, or

(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances prescribed by the regulations."

PINK NOISE – Pink noise is a broadband noise with an equal amount of energy in each octave or third octave band width. Because of this, Pink Noise has more energy at the lower frequencies than White Noise and is used widely for Sound Transmission Loss testing.

REVERBERATION TIME, T_{60} – The time in seconds, after a sound signal has ceased, for the sound level inside a room to decay by 60 dB. The first 5 dB decay is often ignored, because of fluctuations that occur while reverberant sound conditions are being established in the room. The decay time for the next 30 dB is measured and the result doubled to determine the T_{60}. The Early Decay Time (EDT) is the slope of the decay curve in the first 10 dB normalised to 60 dB.

SOUND ABSORPTION COEFFICIENT, α – α Sound is absorbed in porous materials by the viscous conversion of sound energy to heat energy as the sound waves pass through it. Sound is similarly absorbed by the flexural bending of internally damped panels. The fraction of incident energy that is absorbed is termed the Sound Absorption Coefficient, α. An absorption coefficient of 0.9 indicates that 90 % of the incident sound energy is absorbed. The average α from 250 to 2000 Hz is termed the Noise Reduction Coefficient (NRC).

SOUND ATTENUATION – If an enclosure is placed around a machine, or a silencer is fitted to a duct, the noise emission is reduced or attenuated. An enclosure that attenuates the noise level by 30 dBA, reduces the sound energy by one thousand times.

SOUND EXPOSURE LEVEL (SEL) – The total sound energy of a single noise event condensed into a one second duration or in other words it is an L_{eq} (1 sec).

SOUND PRESSURE LEVEL, L_p – The level of sound measured on a sound level meter and expressed in decibels, dB, dBA, dBC, etc. $L_p = 20 \times \log (P/P_o)$ ... dB

where P is the rms sound pressure in Pascal and P_o is a reference sound pressure of 20 µPa. L_p varies with distance from a noise source.

SOUND POWER LEVEL, L_w – The Sound Power Level of a noise source is an absolute that does not vary with distance or with a different acoustic environment.

$L_w = L_p + 10 \log A$ ... dB, re: 1pW,
where A is the measurement noise-emission area in square metres in a free field.

SOUND TRANSMISSION CLASS (STC) – An internationally standardised method of rating the sound transmission loss of partition walls to indicate the decibels of noise reduction of a human voice from one side to the other. (Refer: Australian Standard AS1276 – 1979)

SOUND TRANSMISSION LOSS – The amount in decibels by which a random sound is reduced as it passes through a sound barrier. A method for the measurement of airborne Sound Transmission Loss of a building partition is given in Australian Standard AS1191 - 2002.

STATISTICAL EXCEEDENCE SOUND LEVELS, L_{A90}, L_{A10}, L_{A1}, etc – Noise which varies in level over a specific period of time (usually 15 minutes) may be quantified in terms of various statistical descriptors:

The L_{A90} is the dBA level exceeded for 90 % of the time. In NSW the L_{A90} is measured over periods of 15 minutes, and is used to describe the average minimum or background noise level.

The L_{A10} is the dBA level that is exceeded for 10 % of the time. In NSW the L_{A10} measured over a period of 10 to 15 minutes. It was until recently used to describe the average maximum noise level, but has largely been replaced by the L_{Aeq} for describing level-varying noise.

The L_{A1} is the dBA level that is exceeded for 1 % of the time. In NSW the L_{A1} may be used for describing short-term noise levels such as could cause sleep arousal during the night.

STEADY NOISE – Noise, which varies in level by 6 dBA or less, over the period of interest with the time-weighting set to "Fast", is considered to be "steady". (Refer AS 1055.1 1997)

WEIGHTED SOUND REDUCTION INDEX, R_w – This is a single number rating of the airborne sound insulation of a wall, partition or ceiling. The sound reduction is normally measured over a frequency range of 100 to 3,150 Hertz and averaged in accordance with ISO standard weighting curves (Refer AS/NZS 1276.1:1999).

Internal partition wall $R_w + C$ ratings are frequency weighted to simulate insulation from human voice noise. The $R_w + C$ is always similar in value to the STC rating value. External walls, doors and windows may be $R_w + C_{tr}$ rated to simulate insulation from road traffic noise. This is normally a lower number than the STC rating value.

WHITE NOISE – White noise is broadband random noise whose spectral density is constant across its entire frequency range. The sound power is the same for equal bandwidths from low to high frequencies. Because the higher frequency octave bands cover a wider spectrum, white noise has more energy at the higher frequencies and sounds like a hiss.