NOISE MEASUREMENT SERVICES

PLANS AND DOCUMENTS referred to in the PDA DEVELOPMENT APPROVAL
Approval no: DEV2020/1105
Date: 20/05/2020

Queensland Government

Noise Assessment Report
Proposed Child Care Centre
15 Hercules Street
Hamilton, QLD 4007
(Lot 789 on SL5992)

Report No 4969BR1 12th March 2020

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Revision No	Issue Date	Revision Description	Author	Review
0	06/03/2020	Report	GR	MT
1	12/03/2020	New development plans	GR	

Copy No(s)	Rev No	Destination
1 pdf	1	Capital Transactions Pty Ltd
2	1	Noise Measurement Services

REPORT FOR **Capital Transactions Pty Ltd**

CONTACTS **Michael Watson**

Signed

Max Thorne
(Director)

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Contents

Executive Summary

This Report is in response to a request from Capital Transactions Pty Ltd for a noise impact assessment report for a proposed child care centre at 15 Hercules Street, Hamilton (Lot 789 on SL5992). The site is within the Northshore Urban Village precinct, as part of the Northshore Hamilton Priority Development Area. The proposal is to construct facilities for 132 children across two levels. Hours of operation are to be 7am to 7pm daily. The purpose of this Report is to assess potential noise impacts from proposed activities onto nearby sensitive uses with regards to the following standards and policy documents:

- *The Northshore Hamilton Urban Development Area Development Scheme 2009*
- *Brisbane City Plan 2014* – Child Care Centre Code
- *Brisbane City Plan 2014* – Noise Impact Assessment Planning Scheme Policy
- *Environmental Protection Act 1994*
- *Environmental Protection (Noise) Policy 2019*
- State and National Childcare Regulations
- Australian Standard AS1055:2018– *Acoustics: Description and measurement of environmental noise*

Conclusions

It is concluded that:

- Subject to the considerations and recommendations of this report, it is the opinion of this consultancy that expected activities at the site can comply with the requirements of the *Northshore Hamilton Urban Development Area Development Scheme*, and be otherwise compliant with relevant regulatory obligations.
- Noise emissions from childcare activities are forecast to meet criteria at all nearby noise sensitive uses. On this basis it is concluded that development can comply with the *Brisbane City Plan 2014*, and thereby meet the requirements of the *Northshore Hamilton Urban Development Area Development Scheme 2009.*
- The development plans show sleeping areas fully enclosed within the building envelope, not sharing an external façade. A high level of road traffic noise attenuation is predicted, thus providing suitable space for sleep and rest in accordance with State and National Regulations.
- The precise model(s) and siting of mechanical plant has not been determined at this Stage. Detailed plant noise assessment can be conducted – if required – at the Building Approval stage once these specifications can be determined. Due to the significant setback from noise sensitive uses, it is predicted that the relevant criteria will be readily achievable without additional acoustic treatment.

Recommendations

It is recommended that:

- The proposed child care centre be approved as compliant with the noise policies of the *Brisbane City Plan 2014,* and otherwise meeting relevant regulatory obligations.
- Mechanical plant be selected, installed and (if necessary) screened to not exceed 43 dB(A) at nearby noise sensitive uses. Due to the setback from residential neighbours, it is predicted that this criterion will be readily achievable without additional acoustic treatment.

1. Introduction

This Report is in response to a request from Capital Transactions Pty Ltd for a noise impact assessment report for a proposed child care centre at 15 Hercules Street, Hamilton (Lot 789 on SL5992). The site is within the Northshore Urban Village precinct, as part of the Northshore Hamilton Priority Development Area. The proposal is to construct facilities for 132 children across two levels. Hours of operation are to be 7am to 7pm daily. The purpose of this Report is to assess potential noise impacts from proposed activities onto nearby sensitive uses with regards to the following standards and policy documents:

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- *Environmental Protection (Noise) Policy 2019*
- State and National Childcare Regulations
- Australian Standard AS1055:2018 – *Acoustics: Description and measurement of environmental noise*

1.1 Site Location and Locale

The development site and locality are presented in the following **plates**. Development plans are presented in **Appendix A**, while terms and definitions used in this Report are found in **Appendix D**.

Plate 1: Showing the development site and locality (source: Google)

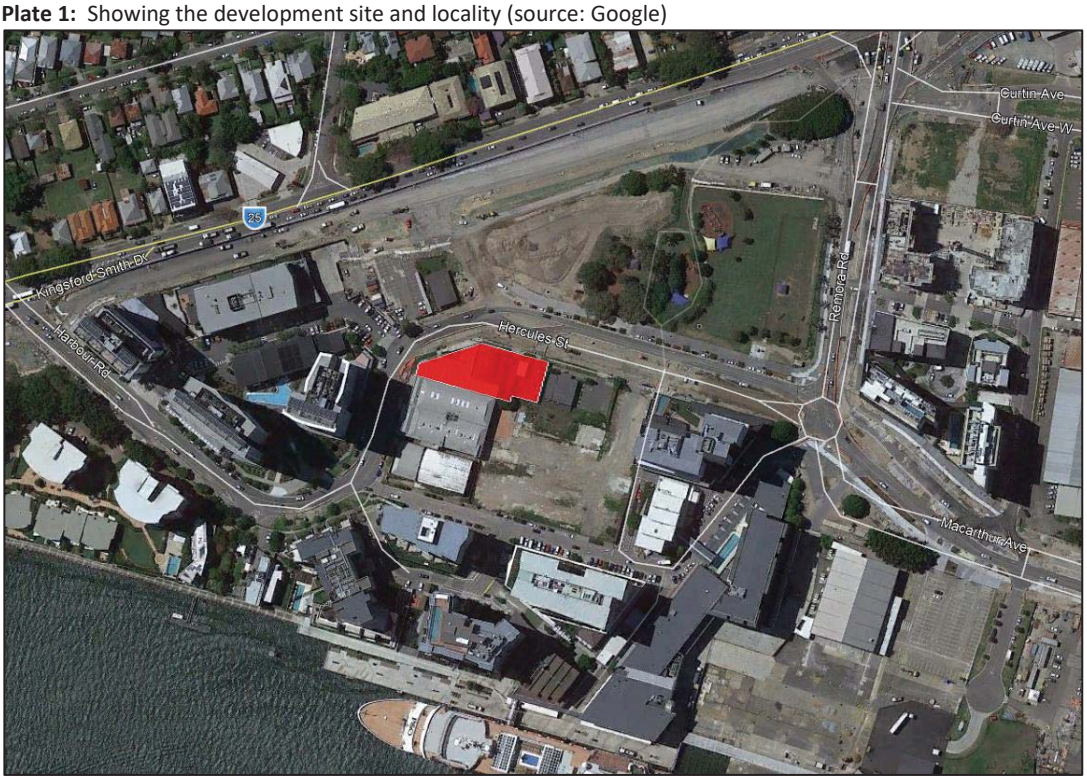


Plate 2: Showing zoning under the Northshore Hamilton Urban Development Area (Source: DSDMIP)

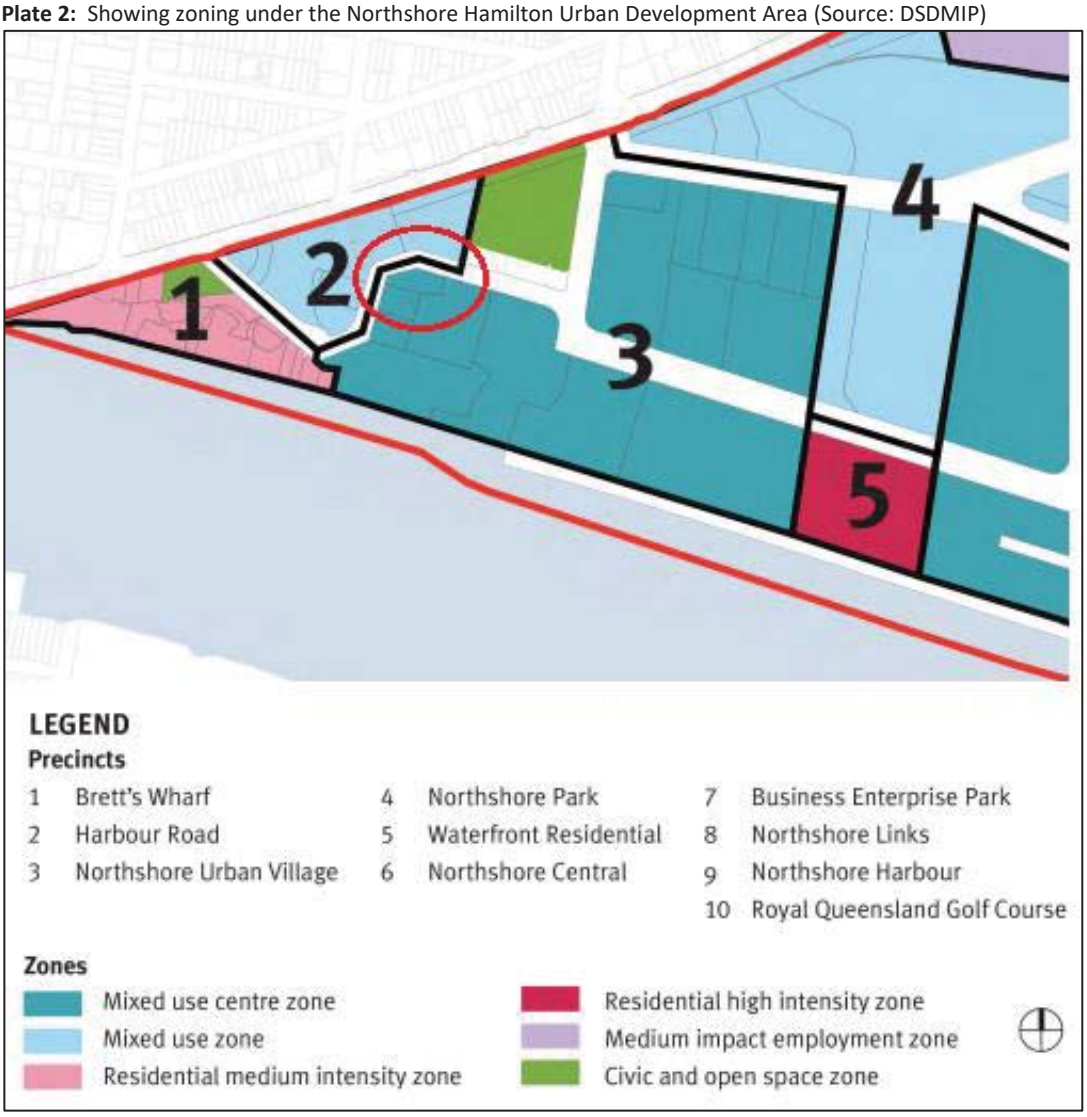


Plate 3: Showing the locale in an Emerging Community zone under the *Brisbane City Plan 2014* (source: BCC)

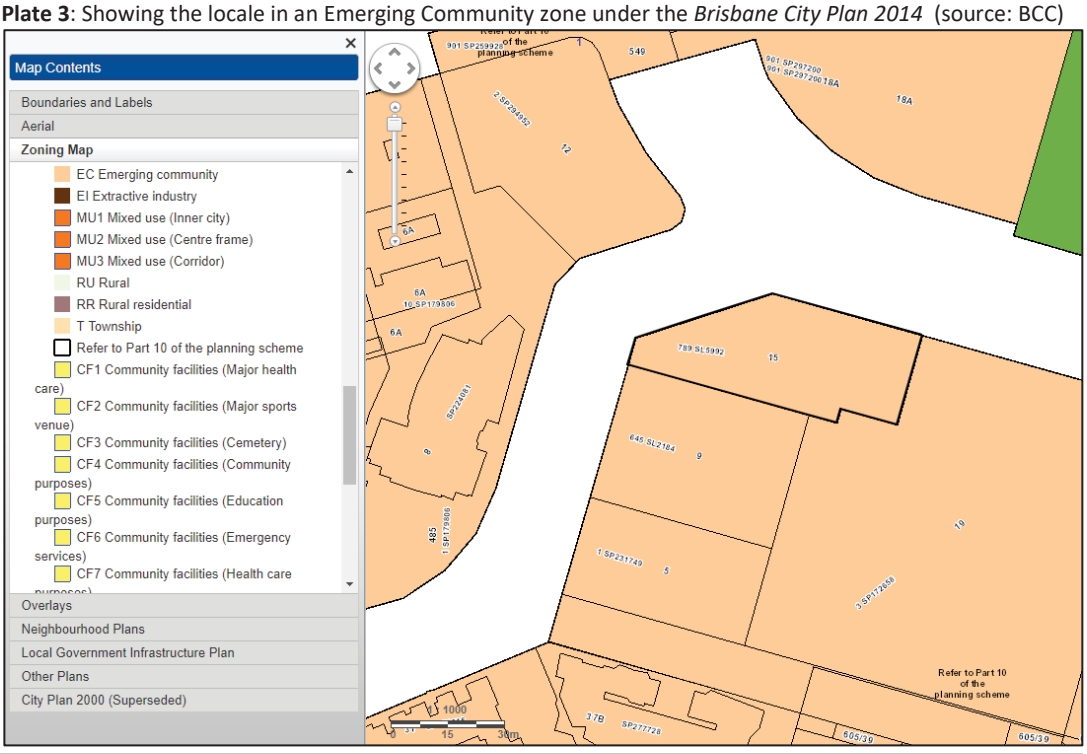


Plate 4: Showing the development site plan (source: Google, client)

1.2 Sensitive Receivers

The development site is directly adjacent to commercial properties, which are not considered to be noise sensitive. Assessment has been conducted to the nearest residential receivers – referred to as R1 to R5 in this Report – which are identified as the most potentially affected noise sensitive uses. Noise impacts have been calculated to the Third Floor of these residential buildings, representing the most exposed receivers. The locations of R1 to R5 are presented in **Plate 5** below.

Plate 5: Showing sensitive receivers R1 to R5

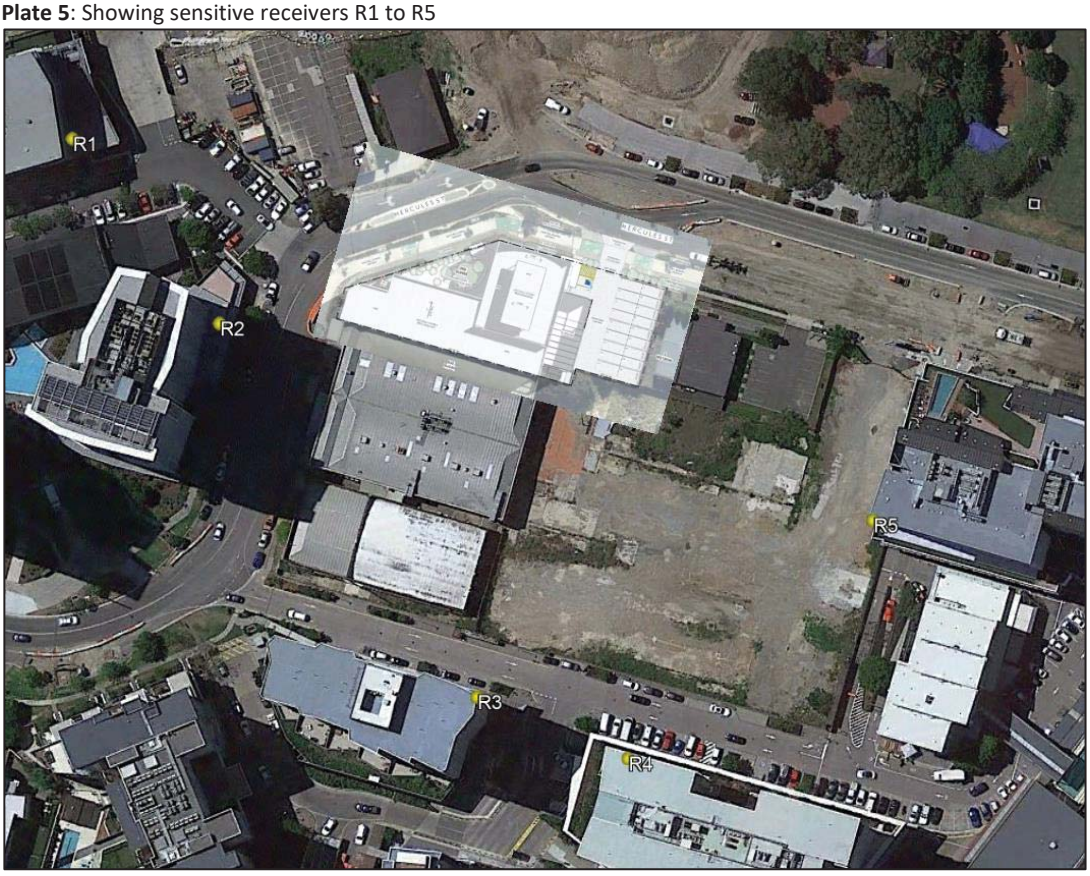


Table 1: Showing sensitive receivers R1 to R5 by UTM coordinates

Receiver	Address	UTM coordinates		Receiver Heights
		Easting	Southing	
R1	485 Kingsford Smith Drive	506651	6964938	10.8m
R2	485 Kingsford Smith Drive	506687	6964893	10.8m
R3	37B Harbour Road	506750	6964802	10.8m
R4	37C Harbour Road	506787	6964787	10.8m
R5	35 Hercules Street	506847	6964845	10.8m

2. Measurement of Ambient Noise Levels

2.1 Measurement Procedures

In order to assess the existing acoustic environment, an ambient noise survey was conducted on-site in June 2019. The environmental noise logger was installed at a location 3m from the northern boundary and 10m from the eastern boundary. The microphone was at a height of 5m and is considered free-field. The location is referred to as ML1 in this Report, and is presented below.

Plate 6: Showing location ML1

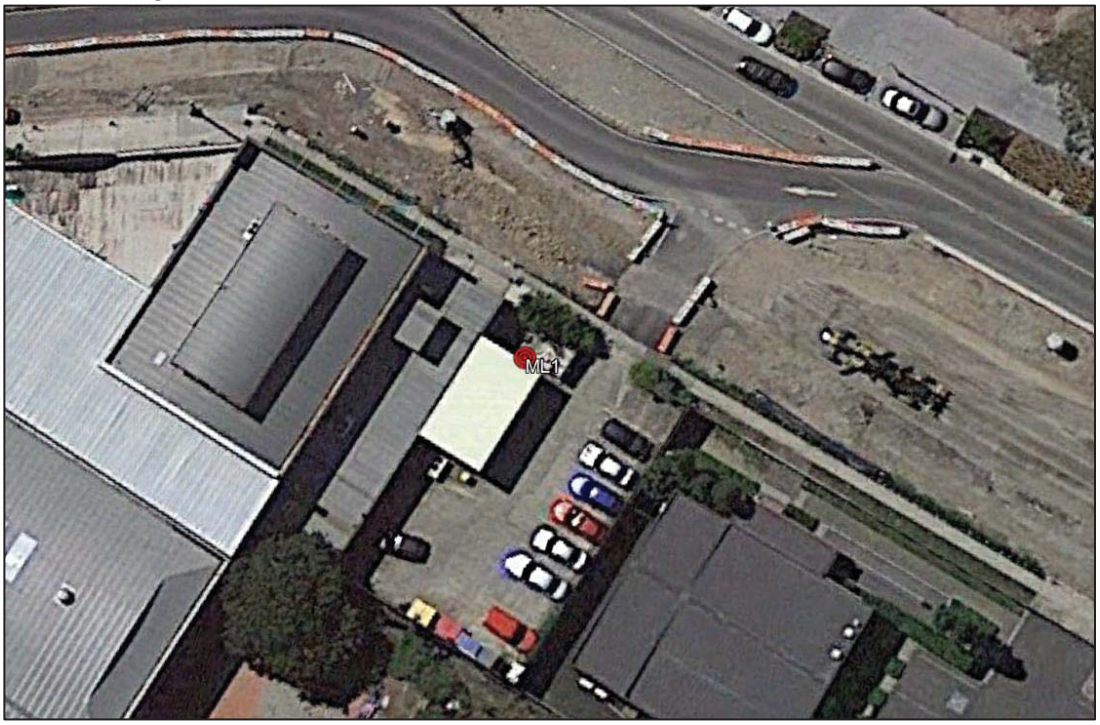


Photo 1: Showing location ML1 (source: NMS)

The operation of the sound level measuring equipment was field calibrated before and after each measurement session, and no significant drift from the reference signal was observed. All instrumentation used in this assessment holds a current calibration certificate from a certified NATA calibration laboratory. The following instruments were used to measure the ambient noise levels-

- 1 x Larson Davis 831 type 1environmental noise logger
- 1 x Quest CA-22 calibrator

2.2 Measurement Results

Ambient sound pressure levels were measured generally in accordance with Australian Standard AS1055:2018 - *Acoustics-Description and measurement of environmental noise*. Ambient noise levels were recorded at 15 minute intervals between the 13th and the 20th June 2019. Levels are presented graphically in **Figure 1** below, and in tabular format in **Table 1** following

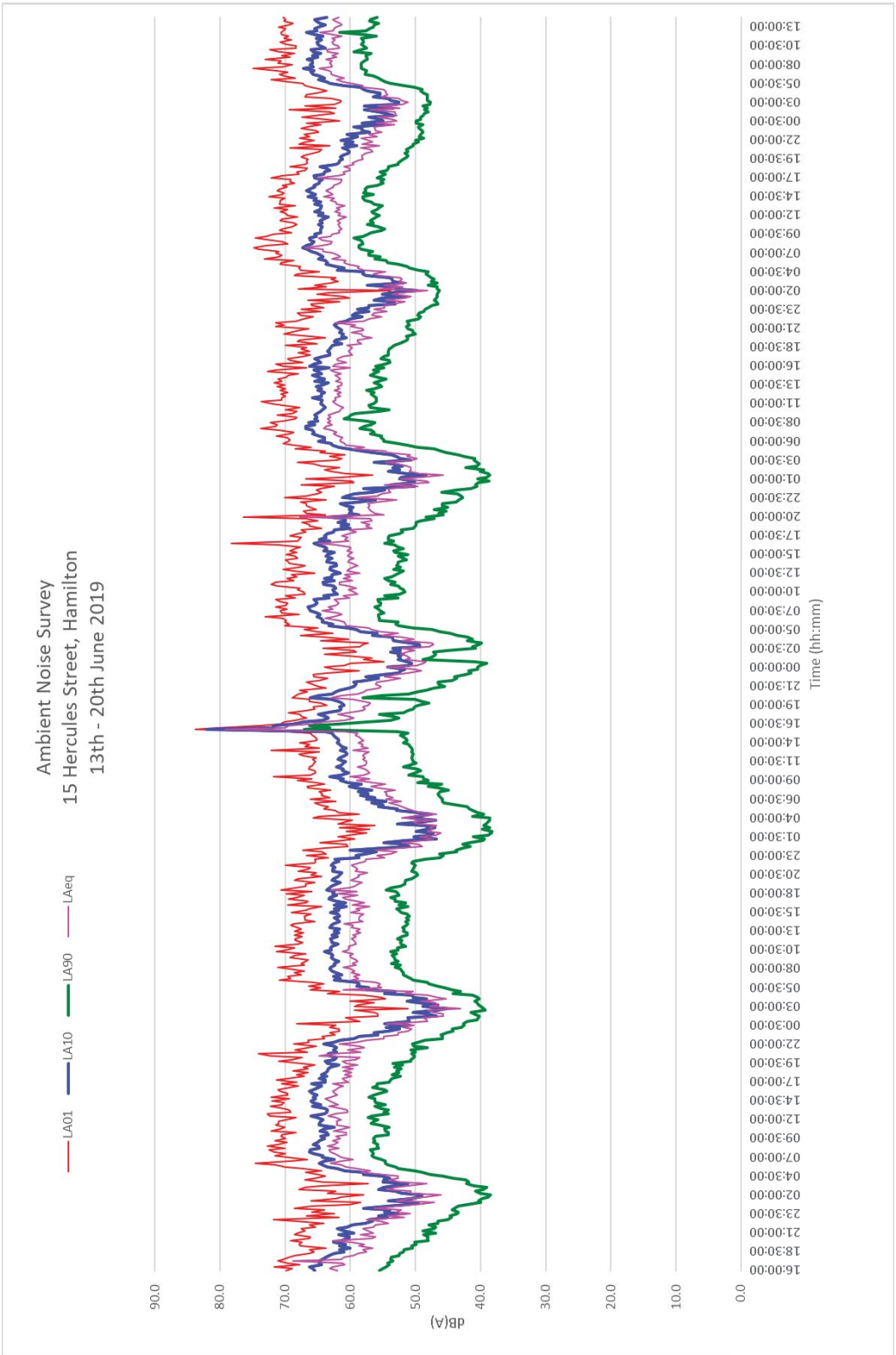


Figure 1: Ambient noise levels at ML1, 13th – 20th June 2019. Levels are in dB(A), free-field

Table 1: Average ambient noise levels at ML1, 13th – 20th June 2019. Levels are in dB(A), free-field

Day	Date	Period	L_{01}	L_{10}	L_{90}	L_{eq}
Thursday	13th / 20th June	7:00am – 6:00pm	71.3	64.5	56.0	62.4
		6:00pm – 10:00pm	68.8	58.4	46.6	56.9
		10:00pm – 7:00am	69.5	58.0	50.1	57.2
Friday	14th June	7:00am – 6:00pm	72.2	64.8	55.5	62.0
		6:00pm – 10:00pm	71.5	63.0	51.3	60.6
		10:00pm – 7:00am	69.5	56.0	45.0	56.0
Saturday	15th June	7:00am – 6:00pm	69.6	62.4	52.2	59.5
		6:00pm – 10:00pm	69.9	62.5	51.4	59.7
		10:00pm – 7:00am	67.4	54.0	43.8	54.5
Sunday	16th June	7:00am – 6:00pm	72.0	63.4	52.7	65.6
		6:00pm – 10:00pm	68.6	62.0	50.1	58.7
		10:00pm – 7:00am	65.6	53.2	42.4	53.5
Monday	17th June	7:00am – 6:00pm	71.3	63.8	53.5	61.0
		6:00pm – 10:00pm	67.5	60.9	48.2	59.5
		10:00pm – 7:00am	70.0	55.6	45.3	56.2
Tuesday	18th June	7:00am – 6:00pm	71.9	64.9	56.3	62.2
		6:00pm – 10:00pm	70.8	62.0	51.8	59.4
		10:00pm – 7:00am	69.6	56.3	44.1	56.3
Wednesday	19th June	7:00am – 6:00pm	72.7	65.2	56.7	62.8
		6:00pm – 10:00pm	68.6	61.4	51.8	58.6
		10:00pm – 7:00am	70.5	57.7	49.2	57.0
Arithmetic Average		**Day**	**72**	**64**	**55**	**62**
		Evening	**69**	**61**	**50**	**59**
		Night	**69**	**56**	**46**	**56**

The levels presented above include measured noise from all sources in the locality, including road traffic, railway activity and meteorology. Road traffic noise was observed to be the dominant source in the locality, and the levels presented above are considered to be consistent with an acoustic environment generally controlled by road traffic noise.

The Rating Background Levels (RBL) at ML1 have been calculated in accordance with the BCC *Noise Impact Assessment Planning Scheme Policy,* and are presented in **Table 2** below.

Table 2: Rating Background Levels (RBL) at ML1.

Location	Day (7am – 6pm)	Evening (6pm – 10pm)	Night (10pm – 7am)
ML1	52	50	40

3. Noise Criteria and Limits

3.1 Northshore Hamilton Urban Development Area Development Scheme

The site is within the Northshore Hamilton Urban Development Area, and the proposed development is therefore subject to considerations under the *Northshore Hamilton Urban Development Area Development Scheme*. Relevant acoustic guidance under the Scheme is reproduced below:

> " **General noise requirements**
>
> The design, siting and layout of development must address noise impacts and where necessary incorporate appropriate noise mitigation measures.
>
> Development is to achieve acceptable noise levels for noise sensitive uses in affected areas[12].
>
> An acoustic report will be required to evaluate and address potential noise impacts and recommend appropriate noise mitigation measures.
>
> [12] Refer to the *Environmental Protection (Noise) Policy 2008*. "

It is noted that the scheme does not mandate specific assessment criteria, and instead references the *Environmental Protection (Noise) Policy 2008*. This policy has been subsequently superseded by the *Environmental Protection (Noise) Policy 2019*, although the acoustic quality objectives (discussed below) are identical between the two versions. The current policy has been considered, representing current State policy.

The *Environmental Protection (Noise) Policy 2019* (EPP Noise 2019) establishes acoustic quality objectives (AQO) to protect or enhance stated environmental values. The environmental values to be enhanced or protected under the policy are the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and the qualities of the acoustic environment that are conducive to human health and well-being, including ensuring a suitable acoustic environment for individual's to sleep, study and learn, to be involved in recreation including relaxation and conversation; and the qualities of the acoustic environment that are conducive to protecting the amenity of the community.

Table 3: *Environmental Protection (Noise) Policy 2019* Acoustic Quality Objectives (in part)

Type of Occupancy / Activity	**Recommended Acoustic Quality Objective**		
	LAeq,adj,1hr	LA10,adj,1hr	LA01,adj,1hr
Dwelling, outdoors, daytime & evening	50	55	65
Dwelling, indoors, daytime & evening	35	40	45
Dwelling, indoors, night-time	30	35	40

It is noted that the Acoustic Quality Objectives (AQO) are to be progressively achieved over the long term, to meet the stated purpose of the Noise Policy:

(a) identifying environmental values to be enhanced or protected; and

(b) stating acoustic quality objectives for enhancing or protecting the environmental values; and

(c) providing a framework for making consistent, equitable and informed decisions about the acoustic environment.

Noise management strategies are required to the extent it is reasonable to do so. It is therefore concluded that the AQO are not intended to be necessarily limiting criteria, as reasonableness and equity are fundamental precepts of the policy.

It is furthermore understood that the policy is not intended to override specific Council noise policies, and that application of relevant Council noise criteria (where formally established) are considered to satisfy the policy intent of protecting environmental values within a consistent and equitable framework.

Due to significant noise from transport infrastructure in the locality (which is explicitly not assessed under EPP Noise 2019), the existing acoustic environment is in substantial exceedance of the AQO. Application of the AQO as limiting criteria is therefore not considered a reasonable design methodology in this case. However, the *Brisbane City Plan 2014* does provide specific criteria for assessment of emissions from child care centres.

It is therefore concluded that application of Brisbane City Council noise emission criteria satisfies the policy intent of the *Environmental Protection (Noise) Policy 2019*, and thereby meet the general noise requirements of the *Northshore Hamilton Urban Development Area Development Scheme.*

3.2 Brisbane City Council City Plan 2014

The *City Plan 2014* provides guidance and criteria for assessment of child care noise emissions through the Child Care Centre Code (part 9.4.3), which is reproduced (in part) in **Table 4** below.

Table 4: *Brisbane City Plan 2014* – Child Care Centre Code (in part)

Performance Outcomes	Acceptable Outcomes
PO10 Development is of a nature and scale which does not result in noise emissions that exceed the following criteria: (a) $L_{Aeq,adj,T}$ emitted from the development is not greater than the rating background level plus 3 at the sensitive use. Where T is: (a) Day (7am to 6pm): 11 hr; (b) Evening (6pm to 10pm): 4 hr; (c) Night (10pm to 7am): 9hr. Where $L_{Aeq,adj,T}$ is the A-weighted equivalent continuous sound pressure level during measurement time T, adjusted for tonal and impulsive noise characteristics, determined in accordance with the methodology described in the Noise impact assessment planning scheme policy. **Note**—Rating background level is to be determined in accordance with the methodology described in the Noise impact assessment planning scheme policy. **Note**—A noise impact assessment report prepared in accordance with the methodology described in the Noise impact assessment planning scheme policy can assist in demonstrating achievement of this performance outcome.	**AO10.1** Development provides a 2m high acoustic fence and a minimum 2m wide landscaped buffer along any boundary adjoining land in a zone in the Residential zones category. **AO10.2** Development ensures mechanical plant or equipment is acoustically screened from adjoining sensitive uses. Note—Mechanical plant includes generators, motors, compressors and pumps, for example air-conditioning, refrigeration or coldroom motors. **AO10.3** Development does not operate before 7am or after 7pm

With reference to the Rating Background Levels measured at ML1, the applicable noise limits as per Performance Outcome **PO10** are as follows:

- 55 dB(A) $L_{eq,adj,7am-6pm}$
- 53 dB(A) $L_{eq,adj,6pm-10pm}$
- 43 dB(A) $L_{eq,adj,10pm-7am}$

3.3 State and Commonwealth Regulation

Regulation 81 of the Education and Child Care National Regulations requires that: "The approved provider of an education and care service must take reasonable steps to ensure that the needs for sleep and rest of children being educated and cared for by the service are met, having regard to the ages, development stages and individual needs of the children." It is noted that the Brisbane City Plan 2014 does not mandate internal noise criteria for child care centres, and that the *Environmental Protection (Noise) Policy 2019* is not applicable to road traffic noise.

It is however noted that the development plans show a sleeping area that is wholly internal, and does not share a façade with the external building envelope. Accordingly, a high level of noise attenuation can be expected to this cot room, and it is predicted that suitable levels of internal amenity for sleep and rest will be readily achievable without additional acoustic treatment.

The State and Commonwealth Regulations represent an ongoing requirement that should be addressed through the management and operators of child care services. Accordingly, it is not the intent of acoustic design to be prescriptive as to how these requirements should be interpreted and fulfilled. Instead, the purpose of acoustic design is to ensure the provision of appropriately attenuated sleeping areas to enable reasonable and appropriate management strategies.

3.4 Air Conditioning - Noise Emissions – EPA 1994

It is expected that the development will incorporate mechanical plant (such as air conditioning) although the precise model(s) and siting are yet to be determined. Plant noise emission requirements are set out under the *Environmental Protection Act 1994*; in that Act noise from air conditioning must not exceed the following noise levels when measured as the LA_{90} dB(A) level over a period of 15 minutes at an affected building:

- Between 10pm and 7am: 3 dB(A) above the background level
- From 7am to 10pm: 5 dB(A) above the background level

With reference to the lowest (most stringent) Rating Background Level at ML1, this amounts to a noise limit of 43 dB(A) L_{eq}. To ensure compliance with both Council and State requirements – noting that the *Environmental Protection Act 1994* represents an ongoing legal obligation – is recommended that plant be installed and maintained to not exceed this criterion.

It is nonetheless noted that the site is at significant setback from noise sensitive uses, and significant noise impacts from mechanical plant are not envisioned. Detailed plant noise assessment can be conducted – if required – once the specific model(s) and installation of plant can be determined. Due to the significant setbacks, it is predicted that the relevant criteria will be readily achievable without any additional acoustic treatments.

4. Noise Impact Assessment

4.1 Noise Sources

The following have been identified as sources of potentially intrusive noise emissions:

- Car park vehicle activity
- Children at outdoor play
- Deliveries / rubbish collection
- External mechanical plant

The precise model(s) and siting of mechanical plant has not been determined at this Stage. Detailed plant noise assessment can be conducted – if required – at the Building Approval stage once these specifications can be determined. Due to the significant setback from noise sensitive uses, it is predicted that the relevant criteria will be readily achievable without additional acoustic treatment.

Potential noise emissions from the remaining sources have been forecast to sensitive receivers R1 – R5 using the environmental noise model presented in **Appendix B**. Design sound power levels – as modelled – are presented in **Table 5** below. Discussion and assessment of noise impacts from these sources is presented in the following **Sections**.

Table 5: Showing design sound power levels

Name	Sound Power Levels in dB(Z)								Total in dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2 kHz	4 kHz	8 kHz	
Vehicle movements	80.5	87.4	81.1	78.5	81	82.8	78.8	75.9	**87.5**
Delivery loading/unloading	69.3	73.7	74.6	79.3	79.5	73.6	69.8	64.3	**82.5**
22 playing children ages 3-6	74.6	69.5	72.0	81.6	84.4	87.2	87.4	87.5	**93.4**
15 playing children ages 2-3	70.0	74.9	77.4	79.0	79.8	81.6	82.8	83.9	**88.8**
12 playing children ages 0-2	67.0	61.9	64.4	75.0	73.8	73.6	74.8	71.9	**80.8**
Sound Pressure Levels at 1m									
Vehicle movements	72.7	79.6	73.3	70.7	73.2	75.0	71.0	68.1	**79.8**
Delivery loading/unloading	61.5	65.9	66.8	71.5	71.7	65.8	62.0	56.5	**74.7**
23 playing children ages 3-6	66.8	61.7	64.2	73.8	76.6	79.4	79.6	79.7	**85.6**
15 playing children ages 3-6	62.2	67.1	69.6	71.2	72.0	73.8	75.0	76.1	**81.0**
12 playing children ages 0-2	59.2	54.1	56.6	67.2	66.0	65.8	67.0	64.1	**73.0**

4.2 Vehicle Movements

Vehicle activity to and from the car park area is expected to be intermittent, with periods of relative inactivity interspersed with periods of heightened activity, particularly during morning 'drop-offs' and evening 'pick-ups'. Noise emissions have been modelled as a moving line source, based upon the median of the range of sound power levels proposed in the *Association of Australian Acoustical Consultants Guideline for Child Care Centre Acoustic Assessment, 2.0*. Calculations assume 53 movements during a one hour period, representing half of the 7am – 9am peak as per the NSW Road Traffic Authority – *Guide to Traffic Generating Developments v2.0*. Emissions have been modelled assuming an average speed of 25 km/hr, and a source height of 1.5m (representing dominant engine noise as low speeds). Continuous peak activity has been assumed throughout the entire assessment periods as an additional conservative assumption.

The moving line source locations – as modelled – are presented in **Plate 7** below, with results from the environmental noise calculations presented along with criteria in **Table 6** following.

Plate 7: Showing vehicle moving line source locations, as modelled

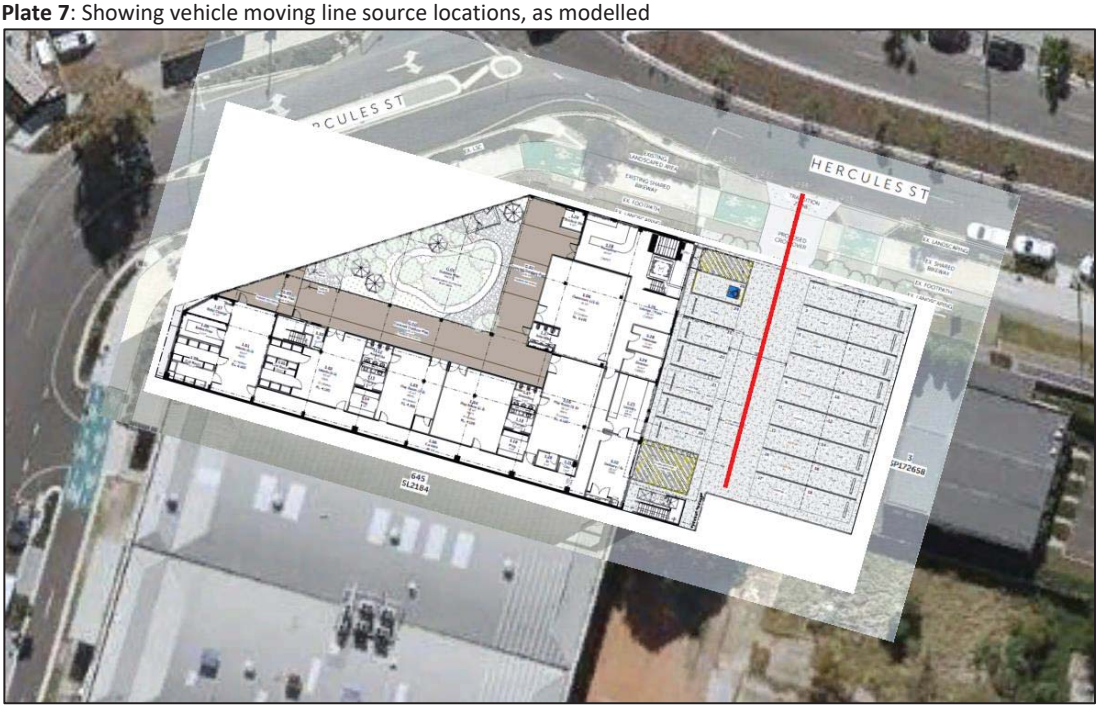


Table 6: Noise emission forecasts and criteria, vehicle movements. Levels are in dB(A) $L_{eq,adj}$

Receiver	Forecast	Criteria			Assessment
		Day	Evening	Night	
R1	2	55	53	43	Pass
R2	5	55	53	43	Pass
R3	26	55	53	43	Pass
R4	25	55	53	43	Pass
R5	28	55	53	43	Pass

As shown above, noise from vehicle activity is forecast to be readily compliant at all nearby sensitive uses.

4.3 Outdoor Play Activities

Potential noise emissions from outdoor play activities have been forecast assuming all children playing simultaneously, based upon the highest of the range of sound power levels proposed in the Association of Australasian Acoustical Consultants' *Guideline for Child Care Centre Acoustic Assessment v2.0*.

Outdoor play has been conceptualised as a series of nominal point sources, representing the central focal points of dynamic play activities. Noise from internal activities will be substantively contained within the building envelope, and will generate significantly lower noise impacts. Forecasts assume continuous activity, and the modelled $L_{Aeq,1hr}$ can therefore be taken as representative of $L_{Aeq,adj,T}$. This represents a significantly conservative assumption, as significant periods of inactivity – or lesser activity – will occur throughout the assessment period(s).

Point sources have been calculated by playroom/classroom according to the formula as presented in the guideline:

- Effective Sound Power Level for 'n' children = Effective Sound Power Level for 10 children + 10 log (n/10)

Breakout from the Level 1 play areas have been modelled assuming acoustically transparent façades at the windows and louvres. As some degree of attenuation can be expected from propagation through a fully open window or louvre, this is considered a conservative methodological assumption that will – to some degree – over state potential noise impacts.

The location of point source – as modelled – are presented in **Plate 8** and **Plate 9** below, with results from the environmental noise model presented along with criteria in **Table 7** following.

Plate 8: Showing outdoor play noise source locations, as modelled, Ground Floor

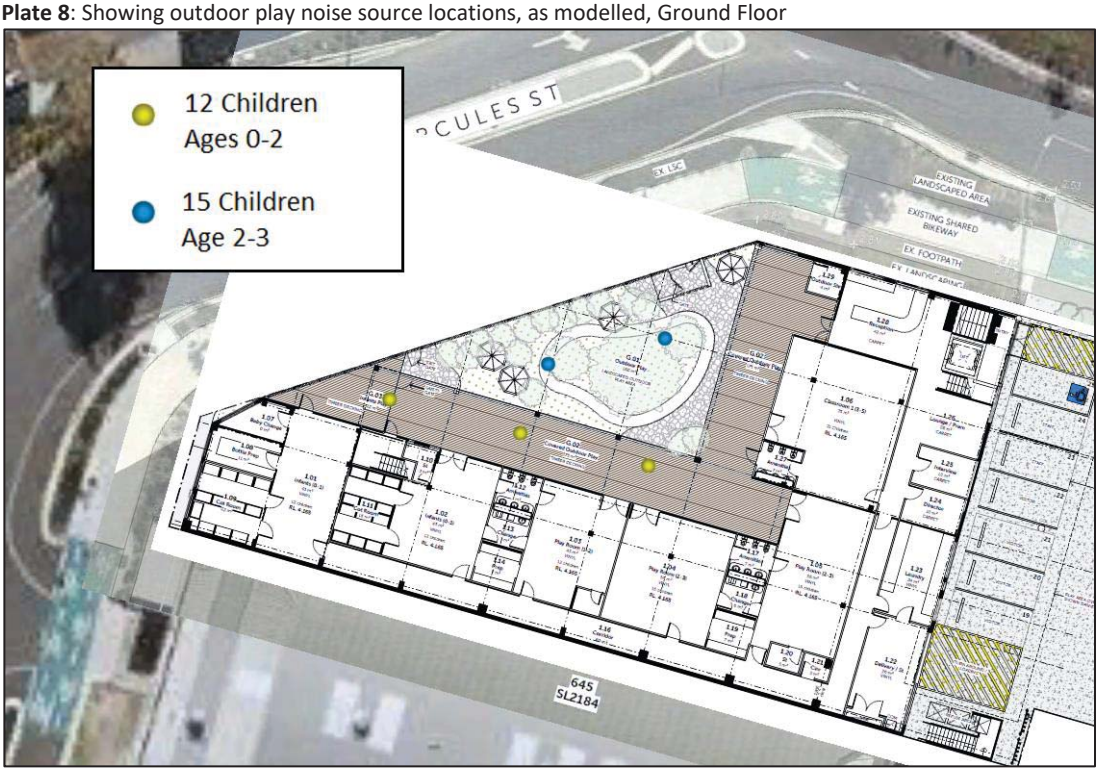


Plate 9: Showing outdoor play noise source locations, as modelled, First Floor

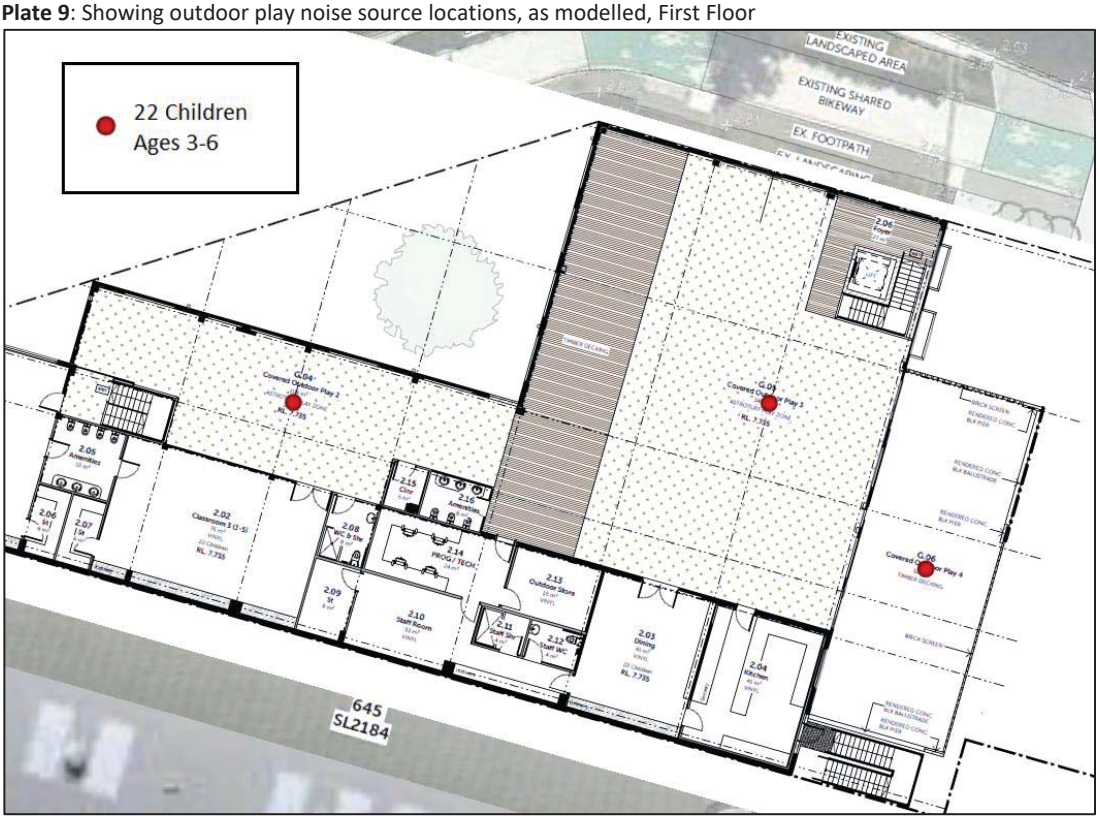


Table 7: Noise emission forecasts and criteria, Outdoor Play (combined floors). Levels are in dB(A) $L_{eq,adj}$

Receiver	Forecast	Criteria			Assessment
		Day	Evening	Night	
R1	43	55	53	43	Pass
R2	33	55	53	43	Pass
R3	26	55	53	43	Pass
R4	41	55	53	43	Pass
R5	43	55	53	43	Pass

As shown above, noise emissions from outdoor play are forecast to meet criteria at all receivers. As activities are not proposed during the night period, it is concluded that the proposed development can readily meet the relevant noise emissions limits.

4.4 Deliveries / Rubbish Collection

The development plans show a loading area at the south-western corner of the car park. Frequent deliveries to the site are not envisioned, and will occur sporadically throughout the day. Similarly, on site rubbish collection (if envisioned) would only occur for a brief period, and therefore represent minimal emissions as expressed through the $L_{Aeq,adj,T}$ descriptor (where T = at least 4hr).

These factors notwithstanding, potential emissions have been calculated assuming continuous activity throughout the assessment periods (although this is not proposed), and the forecast $L_{Aeq,1hr}$ can therefore be taken as representative of the $L_{Aeq,adj,T}$. Sound power levels for a 13m refrigerated truck have been modelled (which includes engine noise, reversing alarms, unloading activity and mobile refrigeration plant), as calculated from Harwood, M, "*Carrying out noise assessments for proposed supermarket developments*", **ACOUSTICS 2008**, Geelong.

The noise source location – as modelled – is presented in **Plate 10** below, with results of the environmental noise calculations presented with criteria in **Table 8** following.

Plate 10: Showing delivery/rubbish collection noise point source location, as modelled

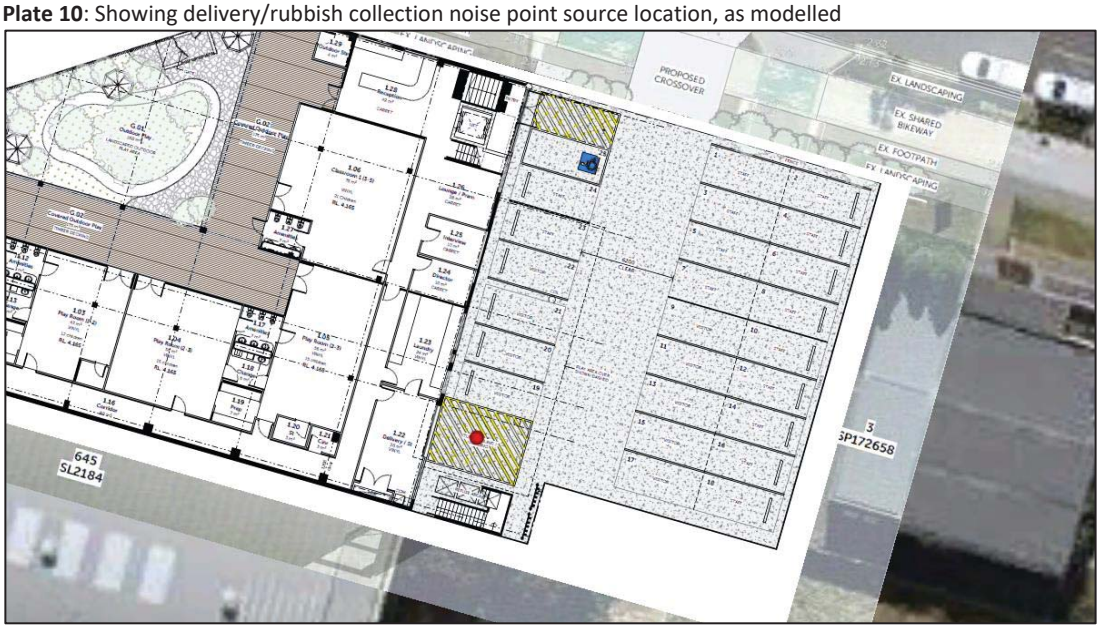
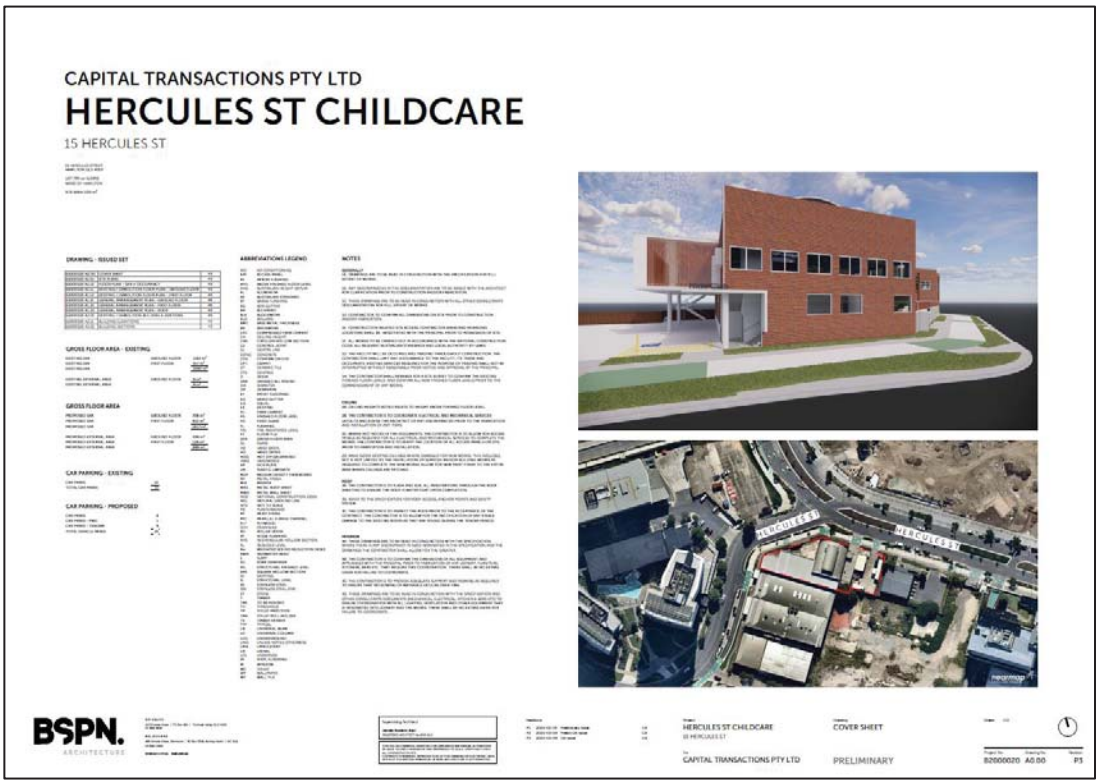


Table 9: Noise emission forecasts and night time criteria, truck deliveries. Levels are in dB(A) $L_{eq,adj}$

Receiver	Forecast	Criteria			Assessment
		Day	Evening	Night	
R1	7	55	53	43	Pass
R2	11	55	53	43	Pass
R3	33	55	53	43	Pass
R4	32	55	53	43	Pass
R5	33	55	53	43	Pass

As shown above, emissions from deliveries and rubbish collection are forecast to be readily compliant with criteria at all receivers.

Appendix A: Plans


CAPITAL TRANSACTIONS PTY LTD

HERCULES ST CHILDCARE

15 HERCULES ST

BSPN. ARCHITECTURE

HERCULES ST CHILDCARE

COVER SHEET

CAPITAL TRANSACTIONS PTY LTD

PRELIMINARY

B2000020 A0.00 P3

BSPN. ARCHITECTURE

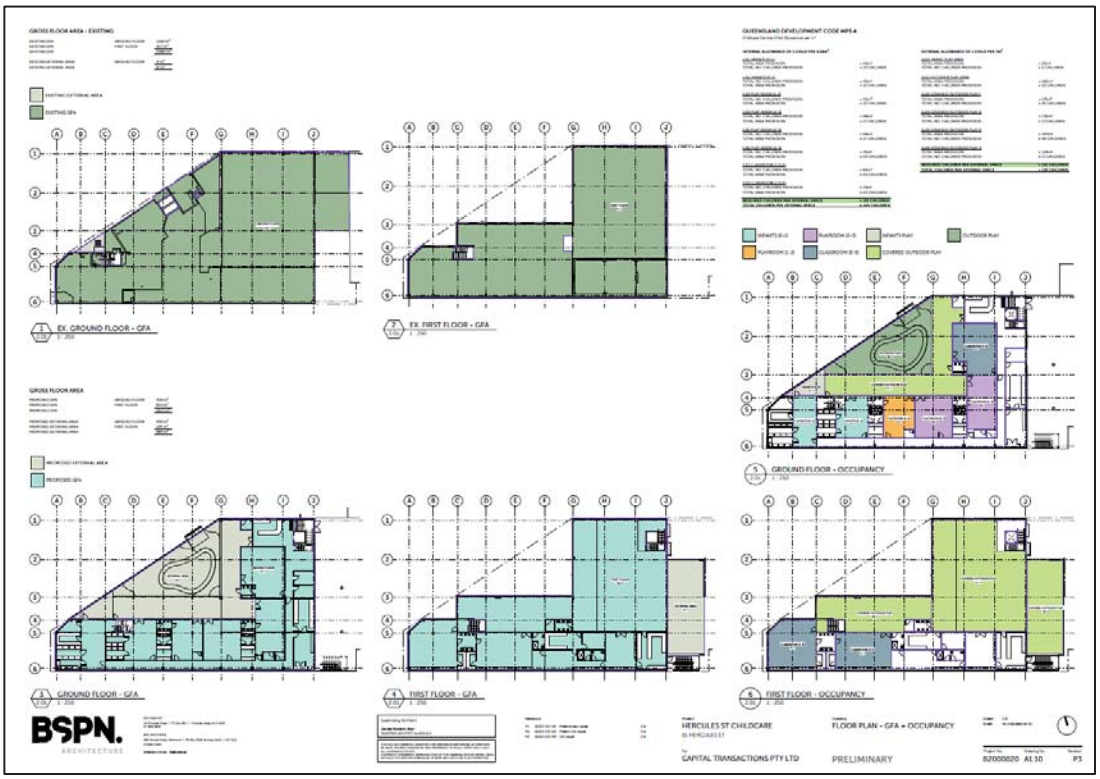
HERCULES ST CHILDCARE

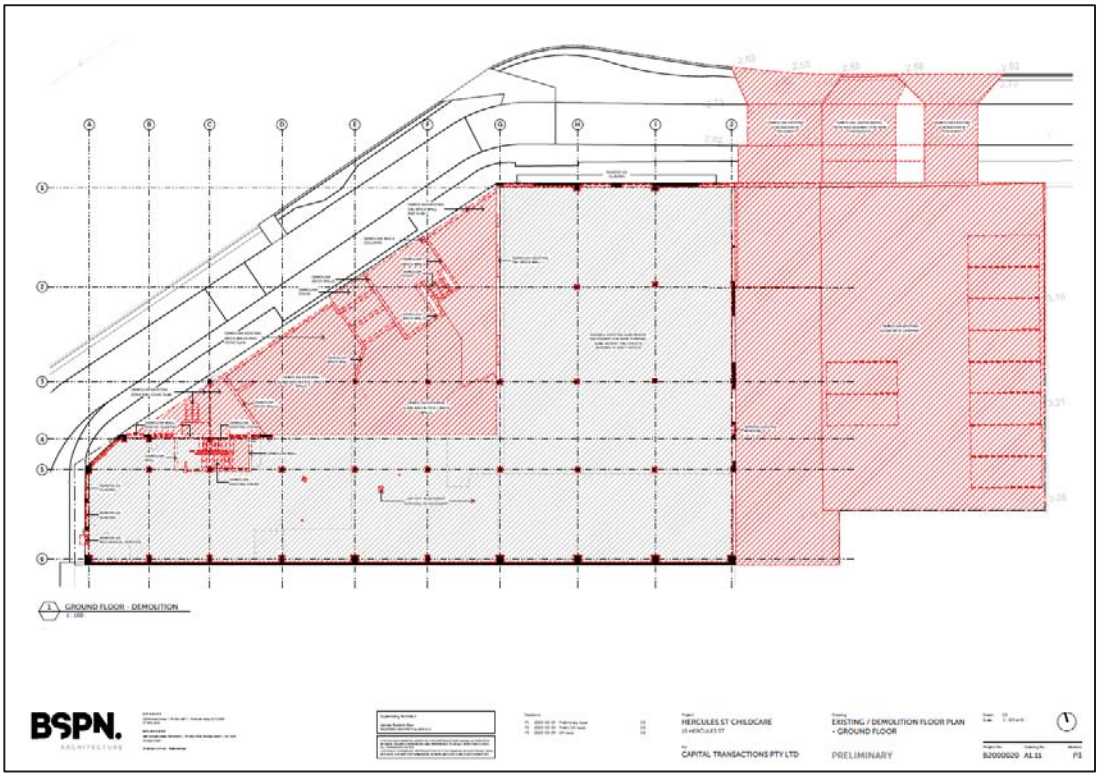
SITE PLANS

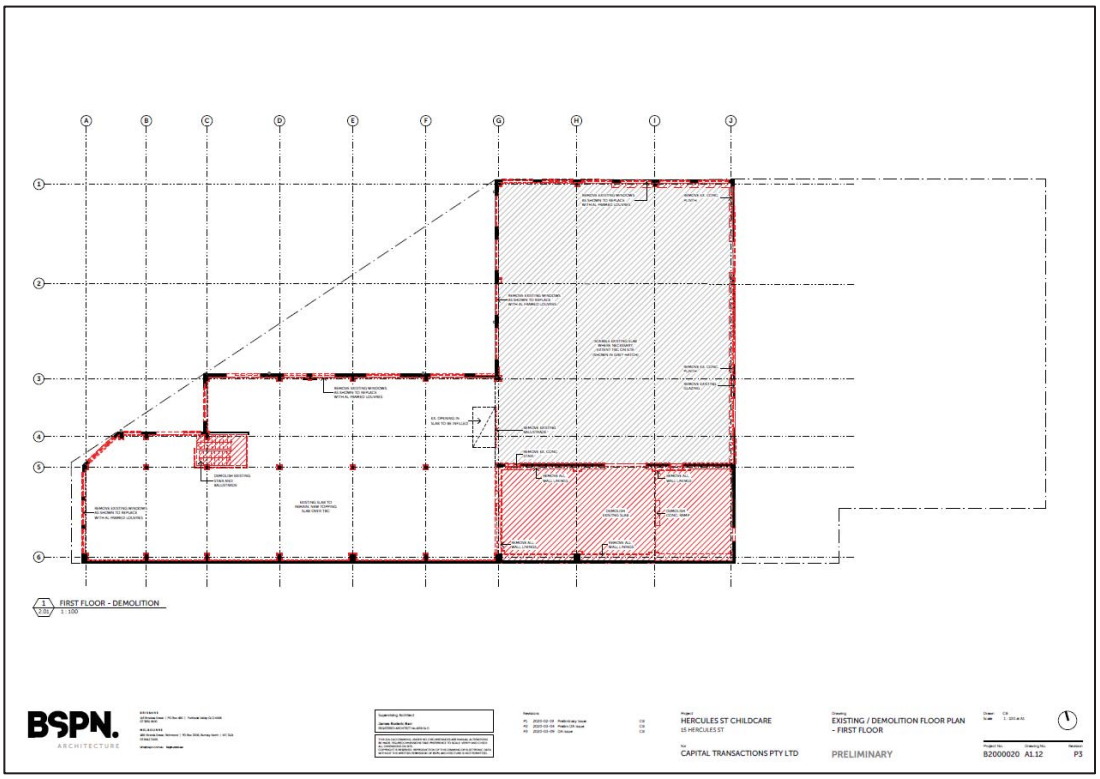
CAPITAL TRANSACTIONS PTY LTD

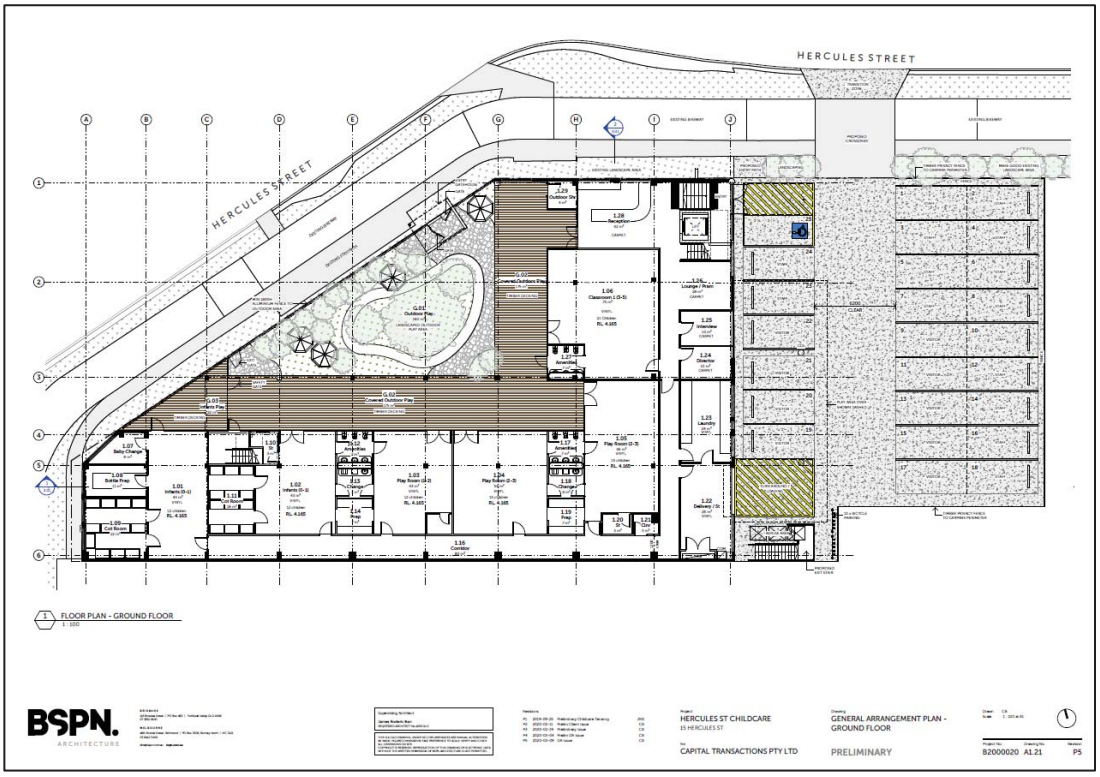
PRELIMINARY

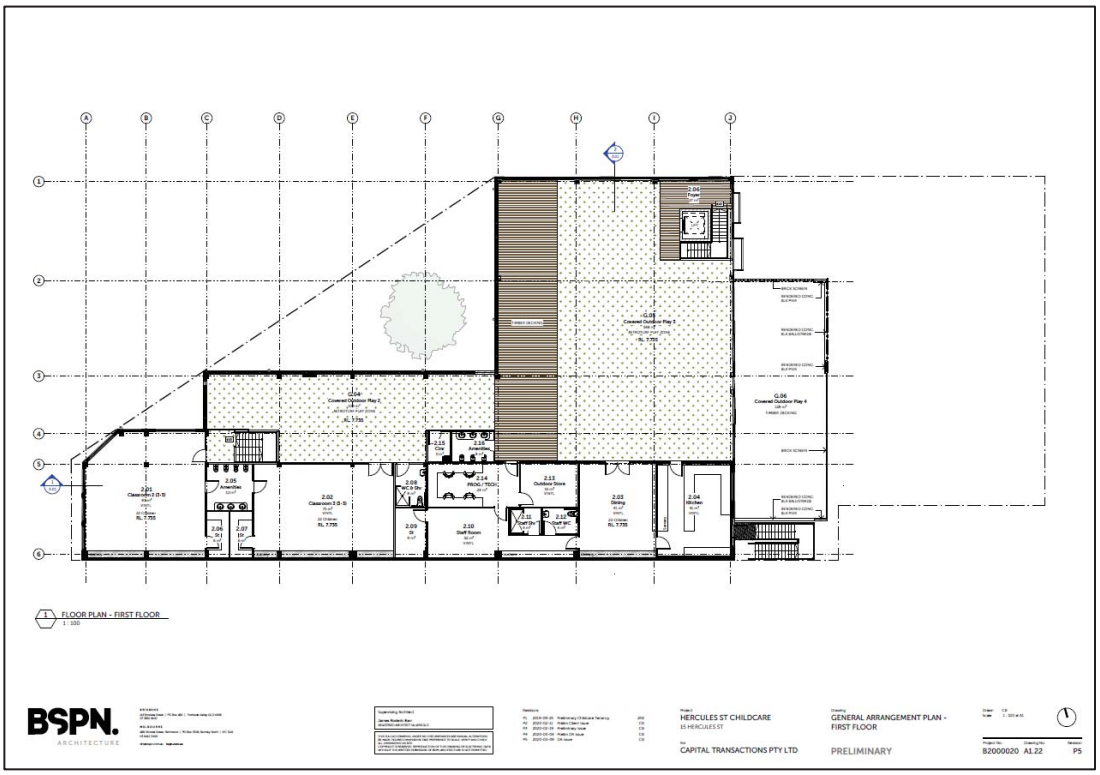
B2000020 A1.01 P3

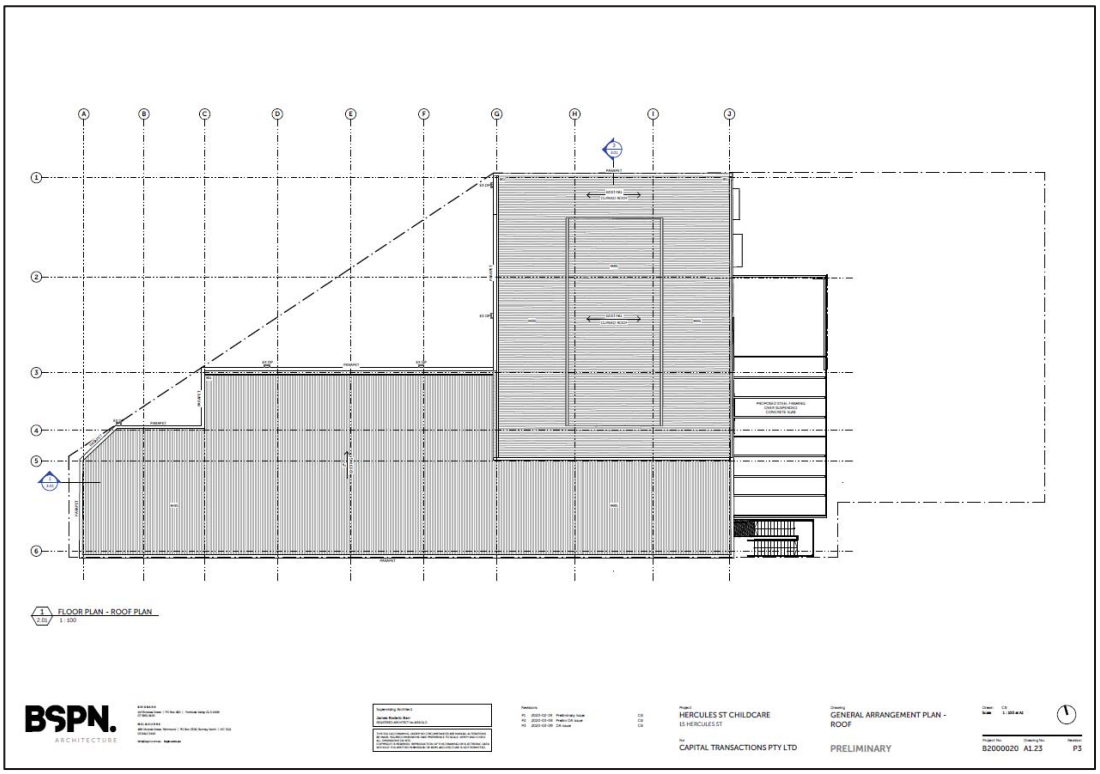

GROSS FLOOR AREA - EXISTING
QUEENSLAND DEVELOPMENT CODE MP5.4
1 EX. GROUND FLOOR - GFA
2 EX. FIRST FLOOR - GFA
GROSS FLOOR AREA
5 GROUND FLOOR - OCCUPANCY
3 GROUND FLOOR - GFA
4 FIRST FLOOR - GFA
6 FIRST FLOOR - OCCUPANCY
BSPN.
ARCHITECTURE
HERCULES ST CHILDCARE
15 HERCULES ST
FLOOR PLAN - GFA + OCCUPANCY
CAPITAL TRANSACTIONS PTY LTD
PRELIMINARY
B2000020 A1.10 P3

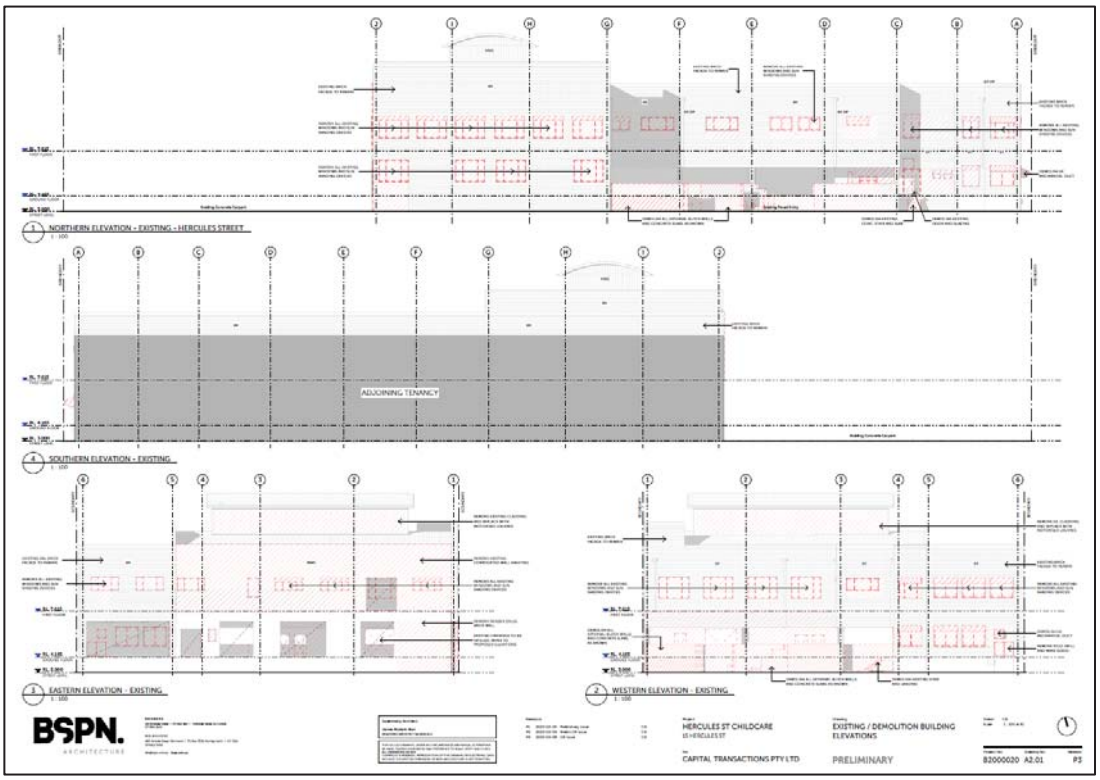

1 GROUND FLOOR - DEMOLITION
BSPN.
ARCHITECTURE
HERCULES ST CHILDCARE
15 HERCULES ST
EXISTING / DEMOLITION FLOOR PLAN - GROUND FLOOR
CAPITAL TRANSACTIONS PTY LTD
PRELIMINARY
B2000020 A1.11 P3

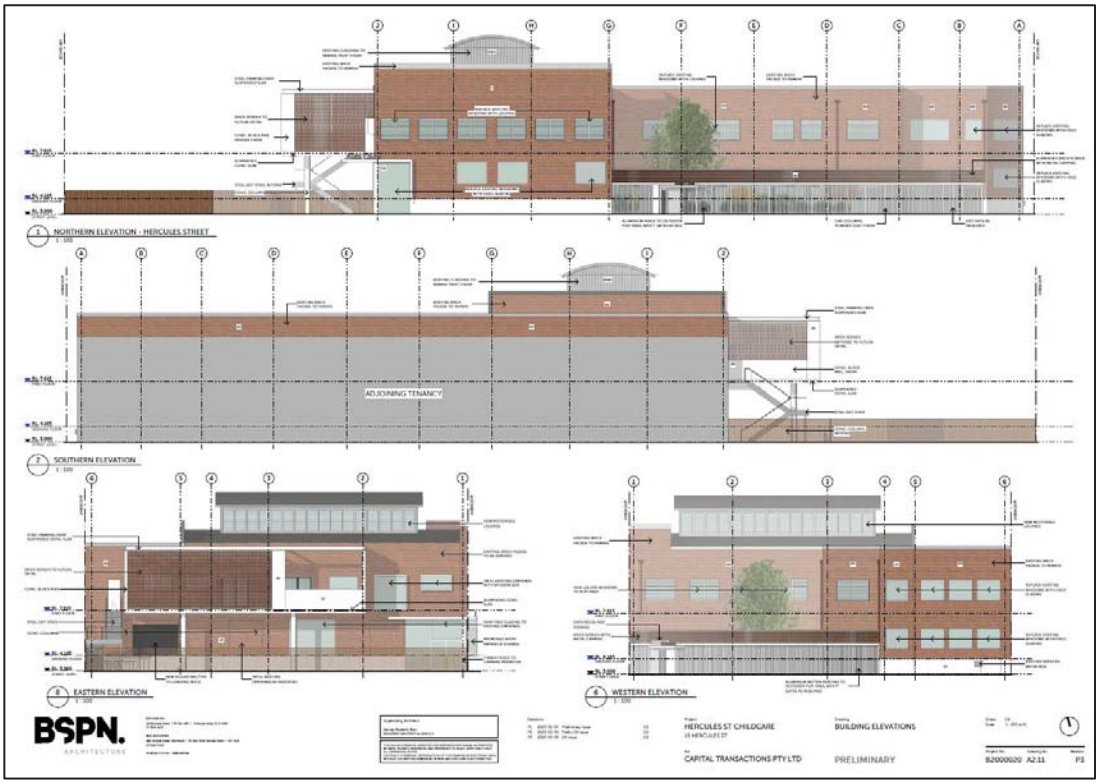

FIRST FLOOR - DEMOLITION
1 : 100
BSPN. ARCHITECTURE
HERCULES ST CHILDCARE
15 HERCULES ST
CAPITAL TRANSACTIONS PTY LTD
EXISTING / DEMOLITION FLOOR PLAN - FIRST FLOOR
PRELIMINARY
B2000020 A1.12 P3

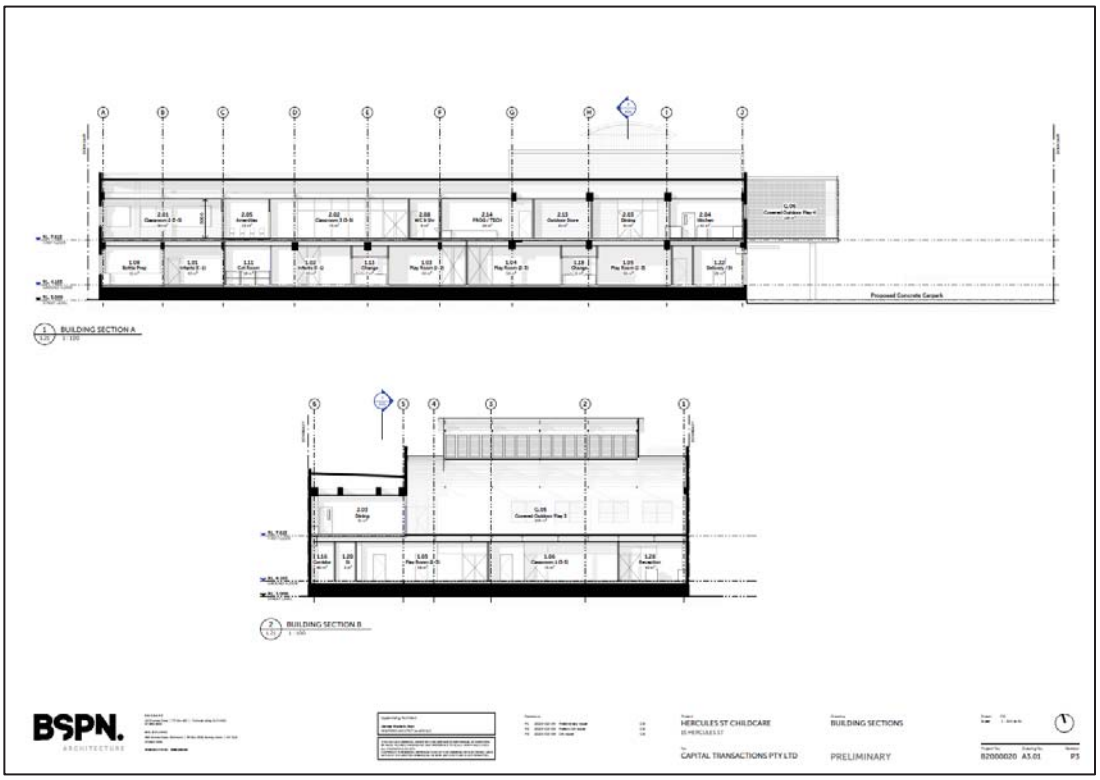

HERCULES STREET
HERCULES STREET
FLOOR PLAN - GROUND FLOOR
1 : 100
BSPN. ARCHITECTURE
HERCULES ST CHILDCARE
15 HERCULES ST
CAPITAL TRANSACTIONS PTY LTD
GENERAL ARRANGEMENT PLAN - GROUND FLOOR
PRELIMINARY
B2000020 A1.21 P5


FLOOR PLAN - FIRST FLOOR
1 : 100
BSPN.
ARCHITECTURE
HERCULES ST CHILDCARE
15 HERCULES ST
CAPITAL TRANSACTIONS PTY LTD
GENERAL ARRANGEMENT PLAN - FIRST FLOOR
PRELIMINARY
B2000020 A1.22 P5


FLOOR PLAN - ROOF PLAN
1 : 100
BSPN.
ARCHITECTURE
HERCULES ST CHILDCARE
15 HERCULES ST
CAPITAL TRANSACTIONS PTY LTD
GENERAL ARRANGEMENT PLAN - ROOF
PRELIMINARY
B2000020 A1.23 P3


NORTHERN ELEVATION - EXISTING - HERCULES STREET
ADJOINING TENANCY
SOUTHERN ELEVATION - EXISTING
EASTERN ELEVATION - EXISTING
WESTERN ELEVATION - EXISTING
BSPN.
HERCULES ST CHILDCARE
EXISTING / DEMOLITION BUILDING ELEVATIONS
CAPITAL TRANSACTIONS PTY LTD
PRELIMINARY
B2000020 A2.01 P3


NORTHERN ELEVATION - HERCULES STREET
ADJOINING TENANCY
SOUTHERN ELEVATION
EASTERN ELEVATION
WESTERN ELEVATION
BSPN.
HERCULES ST CHILDCARE
BUILDING ELEVATIONS
CAPITAL TRANSACTIONS PTY LTD
PRELIMINARY
B2000020 A2.11 P3


BUILDING SECTION A
BUILDING SECTION B
BSPN.
HERCULES ST CHILDCARE
BUILDING SECTIONS
CAPITAL TRANSACTIONS PTY LTD
PRELIMINARY

Appendix B: Environmental Noise Model

Noise predictions been prepared with PEN3D, a software program implementing a prediction model based on the method described in Bies & Hansen, *ISO 9613-2 (1996) Acoustics – Attenuation of sound propagation outdoors Part 2: General Method of Calculation* and *CONCAWE.* The model takes into account meteorological factors, and predictions assume neutral conditions. The basic equation adopted is-

$$Lp = Lw - 20 \log10(r) - 10\log10(4\pi) + AE$$

Where:

- Lp is the sound pressure level at an observer
- Lw is the sound power level of the source
- 20 log10r - 10log10(4PI) is the Distance attenuation (spherical)
- AE is the excess attenuation factors and is determined as the sum of the contributions

All prediction models have limits to their accuracy of prediction. This is due to the inherent nature of the calculation algorithms that go into the design of the models, the assumptions made in the implementation of the model, and the availability of good source sound power data. Various researchers have suggested that an un-calibrated model has an accuracy of ±5 dB while a calibrated model has an accuracy of ±2 dB. ISO 9613-2 has an estimated accuracy for broadband noise of ±3 dB at 1000 metres. Calibration means that the model has been established with reference to measured sound levels at a receiver, known source levels and tightly defined propagation variables. Alternatively a series of predictions with different programs but the same assumption variables can be used for verification purposes.

Topographic data was sourced from Geosciences Australia, with floor heights sourced from development plans. Design sound power levels are presented in **Table B1** below, with results from the environmental noise calculations presented following.

Table B1: Showing design sound power levels

Name	Sound Power Levels in dB(Z)								Total in dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2 kHz	4 kHz	8 kHz	
Vehicle movements	80.5	87.4	81.1	78.5	81	82.8	78.8	75.9	**87.5**
Delivery loading/unloading	69.3	73.7	74.6	79.3	79.5	73.6	69.8	64.3	**82.5**
22 playing children ages 3-6	74.6	69.5	72.0	81.6	84.4	87.2	87.4	87.5	**93.4**
15 playing children ages 2-3	70.0	74.9	77.4	79.0	79.8	81.6	82.8	83.9	**88.8**
12 playing children ages 0-2	67.0	61.9	64.4	75.0	73.8	73.6	74.8	71.9	**80.8**
Sound Pressure Levels at 1m									
Vehicle movements	72.7	79.6	73.3	70.7	73.2	75.0	71.0	68.1	**79.8**
Delivery loading/unloading	61.5	65.9	66.8	71.5	71.7	65.8	62.0	56.5	**74.7**
23 playing children ages 3-6	66.8	61.7	64.2	73.8	76.6	79.4	79.6	79.7	**85.6**
15 playing children ages 3-6	62.2	67.1	69.6	71.2	72.0	73.8	75.0	76.1	**81.0**
12 playing children ages 0-2	59.2	54.1	56.6	67.2	66.0	65.8	67.0	64.1	**73.0**

Table B2: Receiver point calculations, vehicle movements. Levels are in dB(A) $L_{eq,1hr}$

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code: 4969B
Project Description: Noise assessment of 15 Hercules Street, Hamilton
File:D:\IZ Drive\4969 15 Hercules Street, Hamilton - residential mixed use\Model\4969B vehicles.PEN
Thursday 05 Mar, 2020 at 13:05:17

Environmental Calculations (Moving Line Source)

All moving line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.
Noise level results include the Leq (1 hour) of all noise sources
Meteorology :Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m) Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)
Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Noise Level (dB(A))
R1	506651.0	6964938.0	10.8	1.6
R2	506687.0	6964893.0	10.8	5.0
R3	506750.0	6964802.0	10.8	26.2
R4	506787.0	6964787.0	10.8	25.3
R5	506847.0	6964845.0	10.8	27.6

Table B3: Receiver point calculations, outdoor play, Ground Floor. Levels are in dB(A) $L_{eq,1hr}$

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code: 4969B
Project Description: Noise assessment of 15 Hercules Street, Hamilton
Thursday 12 Mar, 2020 at 11:52:31

Environmental Calculations

All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.
Noise level results are the logarithmic addition of all the noise sources Noise level results incorporate the incoherent ground reflection algorithm
Meteorology :Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m) Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)
Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1	506651.0	6964938.0	10.8	3.4	40.5
R2	506687.0	6964893.0	10.8	3.0	24.2
R3	506750.0	6964802.0	10.8	3.0	16.1
R4	506787.0	6964787.0	10.8	3.0	14.7
R5	506847.0	6964845.0	10.8	3.0	16.1

Table B4: Receiver point calculations, outdoor play, First Floor. Levels are in dB(A) $L_{eq,1hr}$

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code: 4969B
Project Description: Noise assessment of 15 Hercules Street, Hamilton
File:D:\IZ Drive\4969 15 Hercules Street, Hamilton - residential mixed use\Model\4969B children first.PEN
Thursday 05 Mar, 2020 at 15:10:50

Environmental Calculations

All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.
Noise level results are the logarithmic addition of all the noise sources Noise level results incorporate the incoherent ground reflection algorithm
Meteorology :Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m) Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)
Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1	506651.0	6964938.0	10.8	3.4	40.3
R2	506687.0	6964893.0	10.8	3.0	32.4
R3	506750.0	6964802.0	10.8	3.0	26.0
R4	506787.0	6964787.0	10.8	3.0	41.3
R5	506847.0	6964845.0	10.8	3.0	42.9

Table B5: Receiver point calculations, deliveries/rubbish collection. Levels are in dB(A) $L_{eq,1hr}$

POINT CALCULATIONS

Pen3D2000 V 1.9.32
Project Code: 4969B
Project Description: Noise assessment of 15 Hercules Street, Hamilton
File:D:\IZ Drive\4969 15 Hercules Street, Hamilton - residential mixed use\Model\4969B deliveries.PEN
Thursday 05 Mar, 2020 at 13:10:12

Environmental Calculations

All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.
Noise level results are the logarithmic addition of all the noise sources Noise level results incorporate the incoherent ground reflection algorithm
Meteorology :Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m) Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)
Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1	506651.0	6964938.0	10.8	3.4	6.8
R2	506687.0	6964893.0	10.8	3.0	10.5
R3	506750.0	6964802.0	10.8	3.0	33.0
R4	506787.0	6964787.0	10.8	3.0	31.8
R5	506847.0	6964845.0	10.8	3.0	33.1

Plate B1: Noise contours at 7.2m, vehicle movements. Levels are in dB(A) $L_{eq,1hr}$

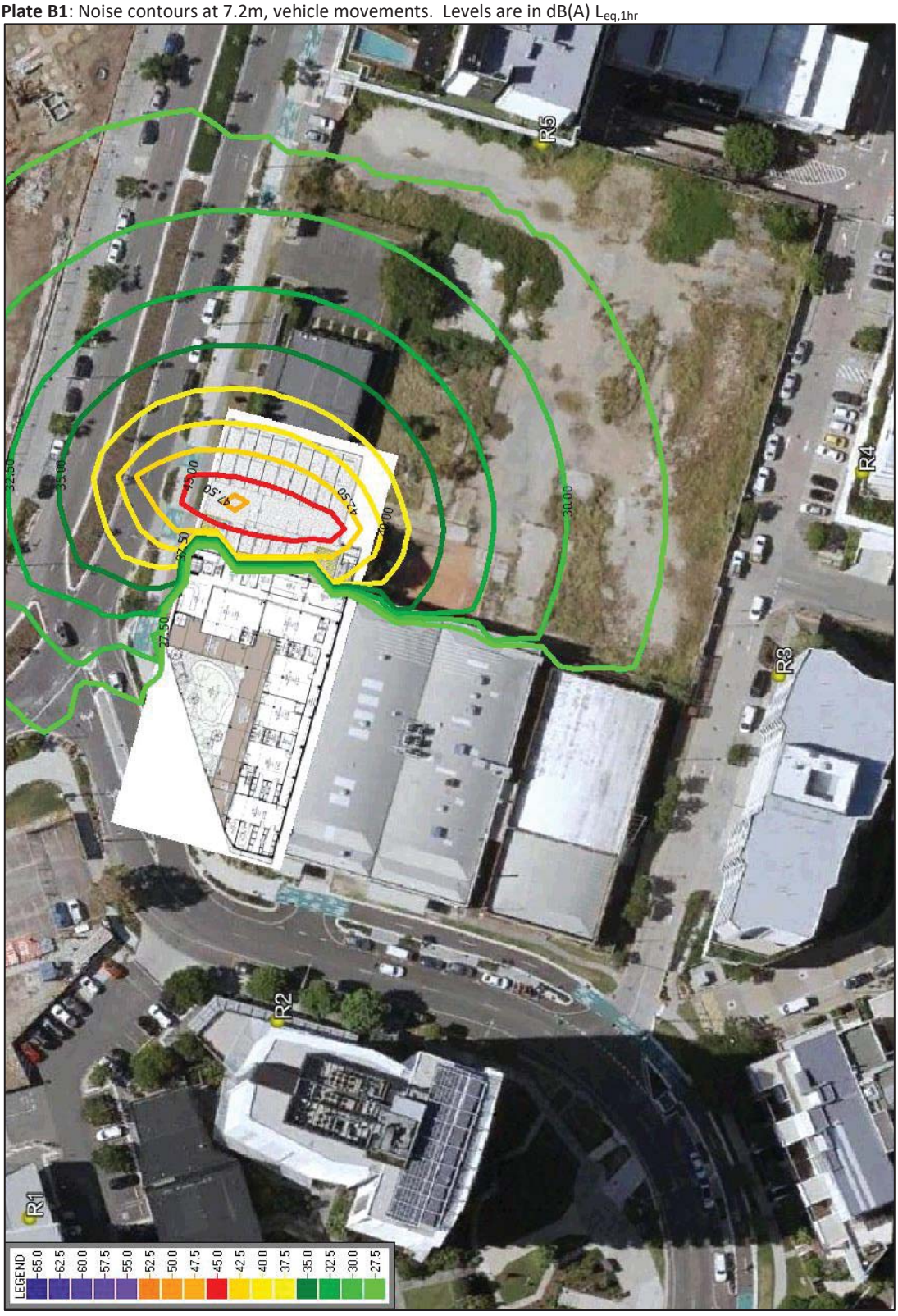


Plate B2: Noise contours at 7.2m, outdoor play, Ground Floor. Levels are in dB(A) $L_{eq,1hr}$

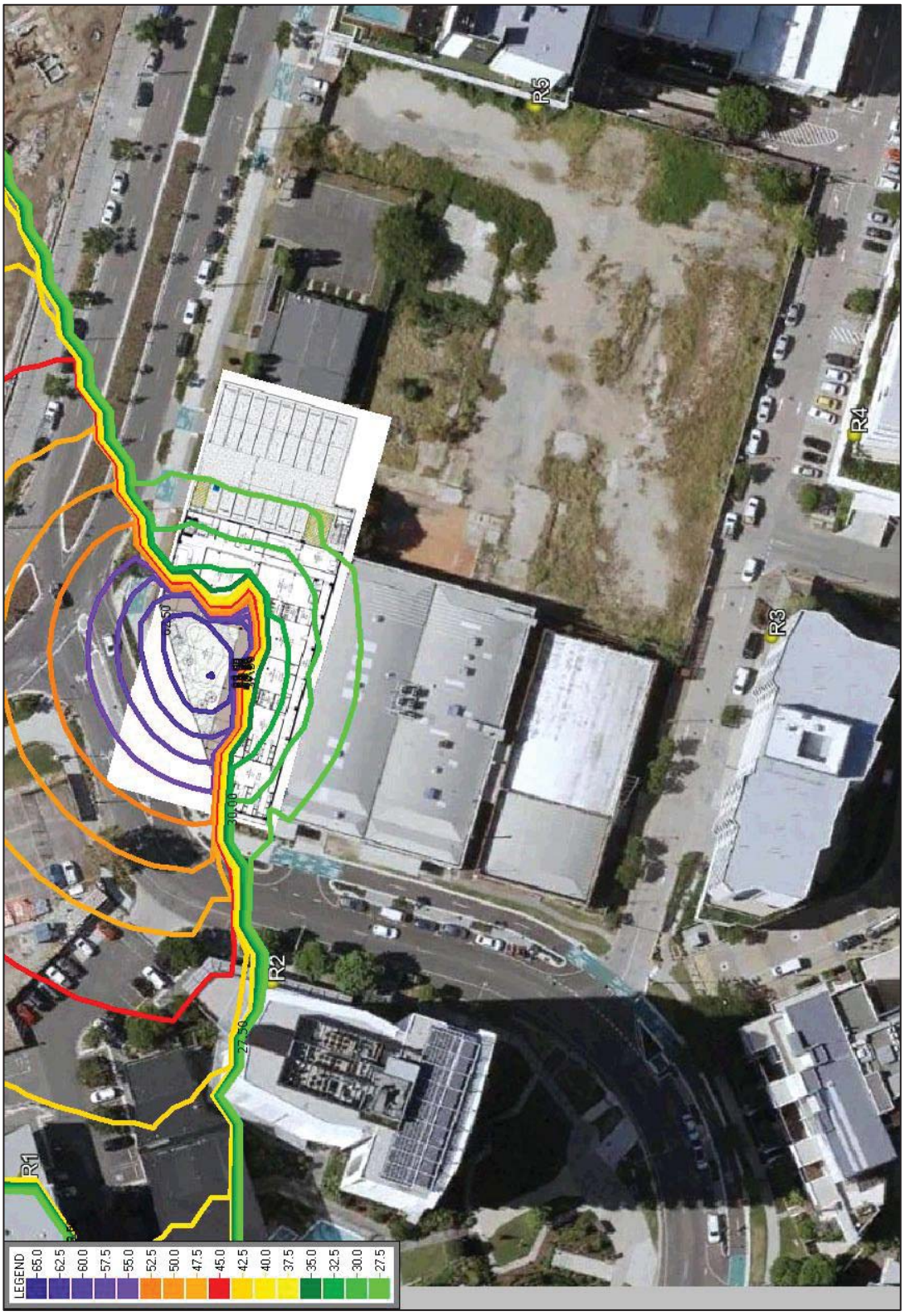


Plate B3: Noise contours at 7.2m, outdoor play, First Floor. Levels are in dB(A) $L_{eq,1hr}$

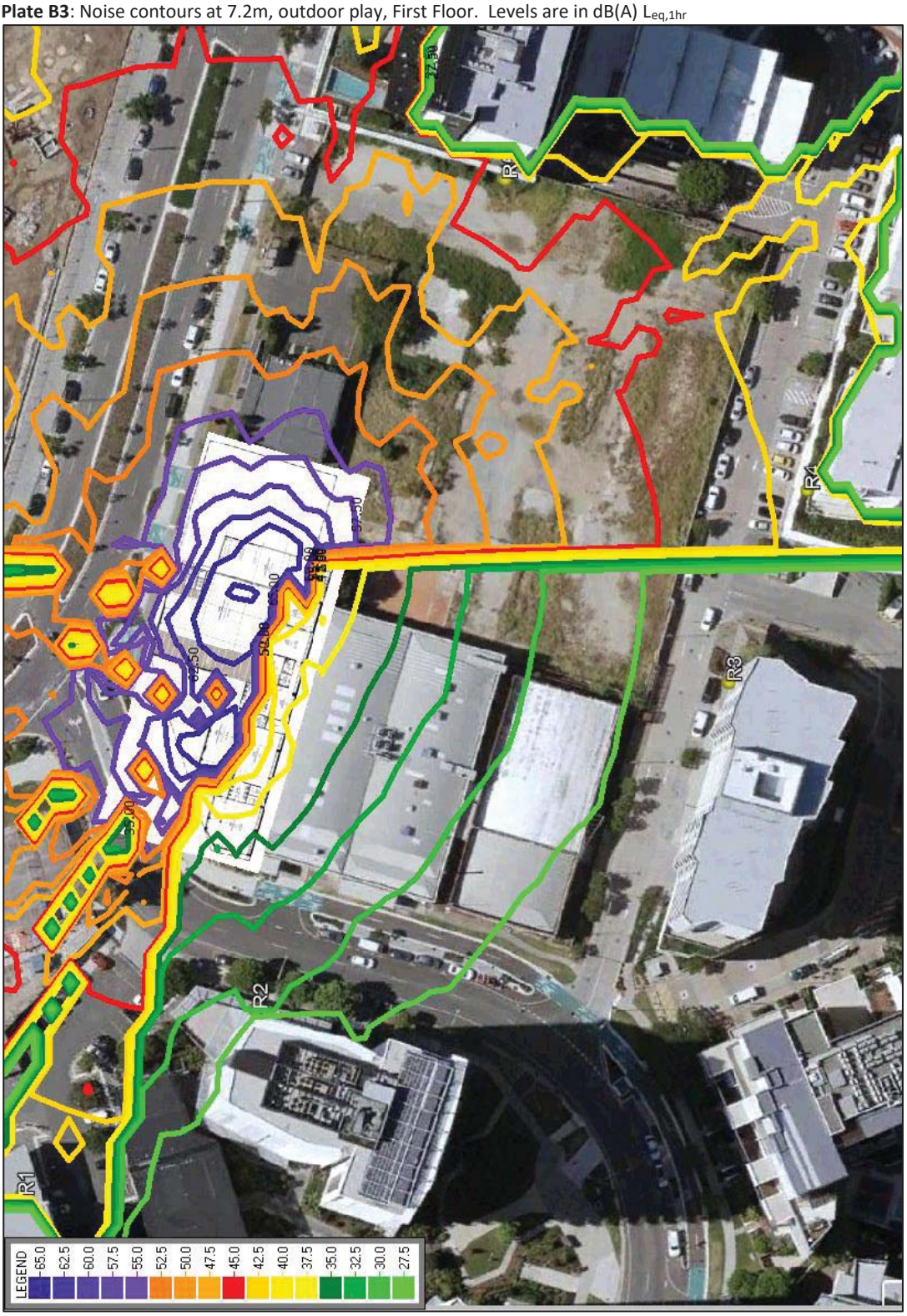
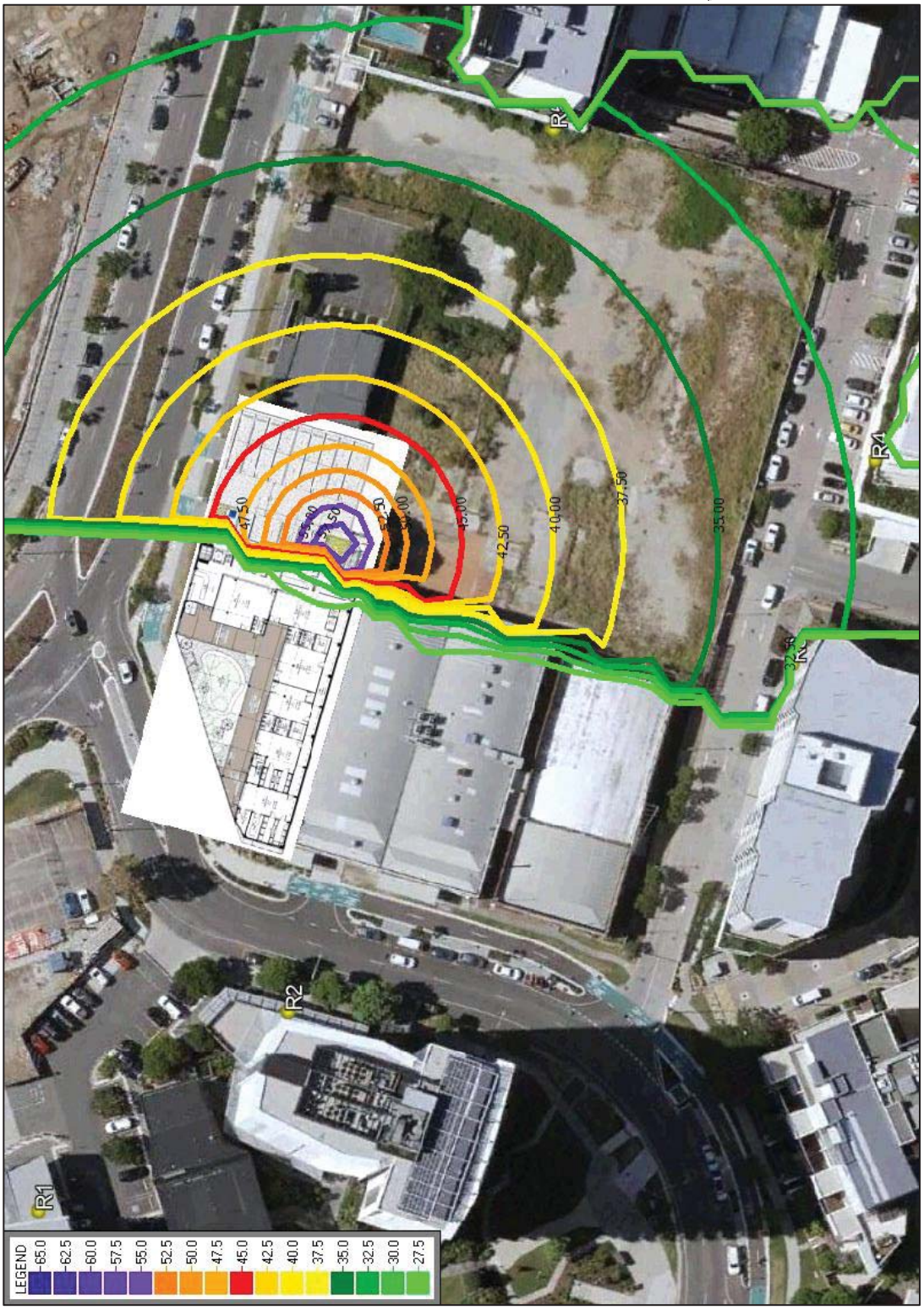


Plate B4: Noise contours at 7.2m, deliveries/rubbish collection. Levels are in dB(A) $L_{eq,1hr}$



Appendix C: Glossary

"Peak" maximum level (LAmax,T).

The peak maximum level is the absolute highest (1 second or less) sound level within the whole of the measurement time.

Event maximum sound pressure level (LA%,adj,T), L01

The L01 level is calculated as the noise level equalled and exceeded for 1% of the measurement time, for example 9 seconds in any 15 minute interval. L01 is an appropriate level to characterise single events, such as from train bypass.

In this Report, the measured L01 levels for day/evening/night are not averaged but are arranged from low to high in the relevant day/evening/night interval and the value that is found at the 90th percentile (L10 of L01 sample) in the interval is recorded as its "L01" level.

Average maximum sound pressure level (LA%,adj, T), L10

The "L10" level is an indicator of "steady-state" noise or intrusive noise conditions from traffic, music and other relatively non-impulsive noise sources. The L10 level is calculated as the noise level equalled and exceeded for 10% the measurement time, for example 90 seconds in any 15 minute interval. The measured L10 time-intervals for day/evening/night are arithmetically averaged to present the "average maximum" levels of the environment for day/evening/night. The level can be adjusted for tonality or impulsiveness.

Background sound pressure level (LA90,T), L90

Commonly called the "L90" or "background" level and is an indicator of the quietest times of day, evening or night. The L90 level is calculated as the noise level equalled and exceeded for 90% the measurement time. The measured L90 time-intervals are arithmetically averaged to present the "average background" levels of the environment for day/evening/night. The level is recorded in the absence of any noise under investigation. The level is not adjusted for tonality or impulsiveness.

Equivalent Continuous or time average sound pressure level (LAeq,T), Leq

Commonly called the "Leq" level it is the logarithmic average noise level from all sources far and near. The maximum 1-hour levels within the day/evening/night time intervals are referenced for building design. The level can be adjusted for tonality.

Façade-adjusted level

A sound level that is measured at a distance of 1.0 metre from a wall or facade. The level is nominally 2.5 dB higher than the free-field level.

Free-field level

A sound level that is measured at a distance of more than 3.5 metres from a wall or facade.