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Herston Quarter Redevelopment - Northern Carpark

Herston Quarter

Noise Impact Assessment for Development Application

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Noise Impact Assessment for Development Application

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CLIENT

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Amendment Register

Rev. No	Section & Page No.	Issue/Amendment	Author	Project Engineer	Checked	Date
A	-	Original Issue[1]	SS	JC	JC	27/07/2020

[1] Refer to 17537-E-Noise Impact Assessment for the previous noise assessment for this site

EXECUTIVE SUMMARY

Floth Pty Ltd (Floth) has been commissioned by Hutchinson Builders Pty Ltd to provide a noise impact assessment for the proposed multi-level Northern Carpark at the Herston Quarter Redevelopment. The proposed carpark is within the Herston Quarter Priority Development Area (PDA) established by the Minister of Economic Development Queensland (MEDQ) and is an approved land use within the PDA to support the Royal Brisbane and Women's Hospital (RBWH) and wider Herston Quarter precincts.

The following scenarios were assessed at the nearest potentially affected noise sensitive receivers:

- Normal operation of the carpark and access roads within the precinct during the daytime, evening and night periods;
- Maximum noise events from car door slams during the night period, and
- Increases in road traffic noise due to peak traffic volumes associated with the Northern Carpark.

The normal operation and maximum noise events associated with the Northern Car Park were found to satisfy the Brisbane City Plan 2014 and Acoustic Quality Objectives of the EPA Noise 2019 at the surrounding noise sensitive receivers and health precinct buildings respectively. The changes in road traffic volumes along local roads were found to have minimal noise impact on the noise sensitive receivers.

It was found that operational noise from the carpark was predicted to exceed the Acoustic Quality Objectives at surrounding noise sensitive receivers by up to 2 and 5 dB(A) during the night period for the default and custom time histograms respectively. The Brisbane City Council's Noise Impact Assessment Planning Scheme Policy (NIAPSP) noise criteria is predicted to be satisfied at these residential receivers. The NIAPSP criteria is considered to be more appropriate as it takes the zoning of receivers into account, as opposed to the EPP(Noise) which outlines criteria that could equally be applied to a detached dwelling in a rural setting, or an apartment in the central business district or along a major transport route. As such, compliance with the NIAPSP noise criteria is considered to be a good indication that the noise impacts will be acceptable at the surrounding noise sensitive receivers. It is also noted that these noise impacts would be further mitigated with windows closed, which may be case based on existing noise levels at site.

As such, the proposed Northern Car Park is considered to meet the acoustic objectives of the Herston Quarter PDA Development Code. The design of the car park has introduced features that minimise the potential noise impact on surrounding noise sensitive receivers. This includes a 'non-squealing' finish to all trafficable areas that Hutchinson Builders has advised will be installed to minimised noise from tyre screech as far as practicable. The anti-screech finish has not be incorporated into the noise modelling but is considered to be good practice.

The mechanical plant has not been assessed directly as the equipment selection has not been finalised. However, the applicable noise limits are presented in Section 5.

In conclusion, the noise impact assessment has shown that compliance with the relevant noise criteria can be achieved, and that the design of the Herston Quarter Northern Car Park meets the acoustic objectives of the Herston Quarter PDA Development Code.

Contents

1. INTRODUCTION

Floth Pty Ltd (Floth) has been commissioned by Hutchinson Builders Pty Ltd to provide a noise impact assessment for the proposed multi-level Northern Carpark at the Herston Quarter Redevelopment. The proposed carpark is within the Herston Quarter Priority Development Area (PDA) established by the Minister of Economic Development Queensland (MEDQ) and is an approved land use within the PDA to support the Royal Brisbane and Women's Hospital (RBWH) and wider Herston Quarter precincts.

The Northern Carpark development is proposed to be located within Precinct 4 of the Herston Quarter PDA as presented in Figure A-1 and Figure A-2 of Appendix A.

One of the preferred land use intents of Precinct 4 is to deliver a multi-storey parking station. The siting, design, construction and operation of the development shall protect community safety by:

- Avoiding, to the greatest extent practicable, then managing or mitigating significant adverse impacts from noise emissions on sensitive uses, including those from transport noise corridors and RBWH helicopter operations[2].

This report is an extension of the initial noise impact assessment report (Document reference: 17357-E-Noise Impact Assessment) also conducted by Floth. In addition to the residential receptors, this report will also assess the potential noise impacts from the operation of the proposed carpark on nearby health precinct noise sensitive receivers (NSRs) in accordance with the Brisbane City Plan 'Centre or Mixed-Use Code' and Environmental Protection (Noise) Policy and shows that the objectives of the Herston Quarter PDA, as outlined above, can be achieved.

[2] Queensland Government's Herston Quarter Development Scheme

2. PROPOSED SITE AND SURROUNDING AREA

2.1 Site Details

The Northern Carpark is proposed to be located in the north-east corner of the Herston Quarter PDA, within precinct 4 as shown in Figure A-1 and Figure A-2 of Appendix A. The Herston Quarter PDA is located at 300 Herston Road, Herston (formally described as Lot 545 on SP289113). The development site is located within the Brisbane City Council local government area. The BCC City Plan 2014 Interactive Mapping classifies the site location to be within CF6 Community Facilities (Emergency Services). Property details are outlined in Table 1.

Table 1: Property Details of the Subject Site

PROPERTY DETAILS	DESCRIPTION
Property Address	300 Herston Road, Herston QLD 4006
Property Holding Details	Lot 545 on SP289113
Planning Scheme	BCC City Plan 2014
Zone Name	CF6 Community Facilities (Emergency Services)
Local Area Plan	Herston Quarter PDA

2.2 Project Description

The car park is to be nine storeys high and constructed adjacent to an existing cliff which will provide significant noise attenuation to the remaining PDA and RBWH. The car park will have a capacity of approximately 1,150 spaces.

The location of the proposed site, which is currently in the early works stage and the surrounding noise sensitive receivers (NSRS) are presented in Figure 1. A description of the noise sensitive receivers and health precinct buildings is presented in Table 2 and Table 3 respectively.

Figure 1: Location of Proposed Northern Carpark and Nearby Noise Sensitive Receivers (Ref. NearMap)

The car park has two vehicle access points, one is via Research Road which is accessed via Butterfield Street, and the other is on Back Road which is accessed via Bramston Terrace as shown in Figure 2.

Figure 2: Surrounding Road Network and Vehicular Access Arrangements (Ref. Google Maps)

2.2.1 Nearest Noise Sensitive Receivers

The nearest potentially affected receivers are the noise sensitive residential dwellings along Garrick Terrace presented in Table 2 and the health precinct buildings within the Herston Quarter are outlined in Table 3.

Table 2: Description of Nearby NSRs Surrounding the Proposed Site

ID	BUILDING / ADDRESS	DESCRIPTION	APPROXIMATE SEPERATION DISTANCE (m)
1	24 Garrick Tce	3 Storey Residential Dwelling	45
2	26 Garrick Tce	3 Storey Residential Dwelling	≥45
3	28 Garrick Tce	2 Storey Residential Dwelling	≥45
4	32 Garrick Tce	3 Storey Residential Dwelling	≥45
5	34 Garrick Tce	2 Storey Residential Dwelling	≥45
6	36 Garrick Tce	2 Storey Residential Dwelling	≥45
7	38 Garrick Tce	2 Storey Residential Dwelling	≥45
8	42 Garrick Tce	2 Storey Residential Dwelling	≥45
9	44 Garrick Tce	2 Storey Residential Dwelling	≥45

Table 3: Description of Commercial / Health Precinct Receivers Surrounding Proposed Site

ID	BUILDING	DESCRIPTION	APPROXIMATE SEPERATION DISTANCE (m)
10	Herston Alcohol Drug Service (B62)	Multi-storey facility providing inpatient and stabilisation for alcohol and drug dependency.	13
11	Ronald McDonald House (B63)	Sleeping accommodation for families.	30
12	Herston Medical Research Laboratory	Research facility containing animal houses and laboratories.	20
13	Joyce Tweddel Building (B39)	Six-storey building utilised for cancer care and oncology services.	35
14	Centre of Clinical Teaching (B34)	Three storey education building with training rooms and offices.	13
15	Sir Albert Sazewski Research Laboratory (C28)	Multi-storey building for medical virology research.	5

3. REFERENCES

The following references have been used in this document:

[1] Australian Standard AS 1055.2:1997 Acoustics – Description and measurement of environmental noise, Part 2

[2] Australian / New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors

[3] Queensland Department of Environment and Heritage Protection Environmental Protection Act 1994

[4] Brisbane City Council City Plan 2014 SC 6.21 Noise Impact Assessment Planning Scheme Policy

[5] Queensland Department of State Development, Manufacturing, Infrastructure and Planning Herston Quarter Priority Development Area Development Scheme 2017

[6] Queensland Department of Environmental and Heritage Protection Environmental Protection (Noise) Policy 2019

[7] World Health Organisation Guidelines for Community Noise 1995

[8] Bavarian State Agency for the Environment 2007, Parking Area Noise, 6th Edition, Bavarian State Ministry for the Environment, Germany

[9] Nicol, L & Johnson, P, 2011, 'Prediction of parking area noise in Australian conditions', Paper Number 39 Proceedings of Acoustics 2011, Australian Acoustical Society, Gold Coast, Qld, pp. 1-6

[10] Edwards, N & Grierson, M. Herston Quarter Northern Carpark – Traffic Impact Assessment Report. Brisbane: Cambray Consulting Pty Ltd; 2017. 35 p. Report No.: 0003_TIA_Northern Carpark

[11] Skavo, S. Conomos, J. Herston Quarter Redevelopment – Ned Hanlon Carpark Building Noise Assessment: Floth Pty Ltd; 2020. 18p. Report No.: 20338-A-TR-0001

[12] Trewin, T. Herston Quarter Northern Carpark – Façade Transmission Loss Results. SLR Consulting Australia Pty Ltd.48p. Report No: 620.12748-R03-v2.0

[13] Conomos, J. Northern Car Park Herston Quarter Redevelopment – Noise Impact Assessment. Floth Pty Ltd; 2020. 33p. Report No.: 17537-E-Noise Impact Assessment

4. EXISTING NOISE LEVELS

4.1 Ambient Noise

As part of the initial noise impact assessment (Document Reference: 17357-E-Noise Impact Assessment), the existing ambient noise levels in the local area were measured between the 18th December 2017 and 22nd December 2017 at the noise monitoring location (denoted by a yellow star) presented in Figure 1.

The noise logger was positioned away from vertical noise-reflecting surfaces as shown in Figure 3 and the top of the microphone was 1.5 metres above the natural ground level. This location was selected due to equipment security and pedestrian safety (i.e. trip hazard) concerns. It is also considered to be a conservative measure of the ambient background noise levels of the noise sensitive receivers, which are located along Garrick Terrace.

Figure 3: Noise Logging Location

The testing instrumentation consisted of:

- Logger: Norsonic Nor139 Class sound level meter, serial number: 1392740
- Calibrator: Pulsar Model 105 sound level calibrator, serial number: 57371

The instrumentation had current NATA laboratory calibrations during the monitoring period. Field calibration conducted prior-to and at the completion of logging did not find any drift in the calibration of the logger. The noise logging results are summarised in Table 4. The results include values for the L_{A01}[3], L_{A10}[4], L_{Aeq}[5], L_{Amax}[6], L_{A90}[7] and Rating Background Level (RBL[8]) averages for each of the day, evening and night periods for the weekdays. Refer to Appendix B for time traces.

Table 4: Existing (Free-Field) Ambient Noise Levels

PERIOD	WEEKDAY NOISE LEVEL IN dB(A)					
	L_{Amax}	L_{A01}	L_{A10}	L_{AEQ}	L_{90}	RBL
Day	78	68	59	58	51	49
Evening	75	65	55	54	48	46
Night	72	62	52	52	45	43

[3] L_{A01} is the A-weighted sound pressure level exceeded for 1% of the time

[4] L_{A10} is the A-weighted sound pressure level exceeded for 10% of the time

[5] L_{Aeq} is the equivalent or energetic-averaged A-weighted sound pressure level

[6] L_{Amax} is the average of the maximum A-weighted sound pressure levels occurring within the consecutive 15-minute samples

[7] L_{A90} is the A-weighted sound pressure level exceeded for 90% of the time

[8] RBL is determined from the median of the daily assessment background levels (ABLs). The ABLs are determined from the 10th percentile of the hourly L_{A90} noise level measured during the day, evening and night-time periods

4.2 Estimated Average Background Noise Levels

The average background noise levels from Appendix A of AS 1055.2 [1] are presented in Table 5 for reference purposes. It can be seen that the existing ambient noise levels at site presented in Table 4 exceed the estimated average background noise levels in AS 1055 [1] by 1, 3 and 5 dB(A) during the day, evening and night periods respectively.

Table 5: Estimated Average Background A-weighted Sound Pressure Levels ($L_{A90,T}$) for Different Areas Containing Residences in Australia (Ref. AS 1055.2)

NOISE AREA CATEGORY	DESCRIPTION OF NEIGHBOURHOOD	AVERAGE BACKGROUND A-WEIGHTED SOUND PRESSURE LEVEL, $LA_{90,T}$					
		MONDAY TO SATURDAY			SUNDAYS AND PUBLIC HOLIDAYS		
		0700 – 1800	1800 – 2200	2200 – 0700	0700 – 1800	1800 – 2200	2200 - 0700
R3	Areas with medium density transportation or some commerce or industry	50	45	40	50	45	40

4.3 Ned Hanlon Building Carpark Noise

Measurement and assessment of noise generated by the existing Ned Hanlon Building Carpark was conducted between the 6th and 8th of July 2020 to assist in defining source noise levels and estimating the potential impacts associated with proposed Northern Carpark. The proposed Northern Carpark will have slightly less capacity than the existing Ned Hanlon Building Carpark (1150 vs 1400). The Ned Hanlon Building Carpark is located at 20 Butterfield Street, Herston, approximately 50 metres northeast of the proposed site.

Refer to the 'Ned Hanlon Carpark Building Noise' [11] (ref. 20338-A-MS-001) for details of the assessment findings.

5. NOISE CRITERIA

The noise impact assessment will be undertaken in accordance with the BCC City Plan 2014 NIAPSP 'Centre or Mixed-Use Code' [4], EHP Environmental Protection Act 1994 [3] and Environmental Protection (Noise) Policy 2008 (EPP Noise 2009) as required by the Herston Quarter PDA Development Scheme [5]. We note that the EPP Noise 2009 has been superseded by the 2019 version [6], however the Acoustic Quality Objectives are consistent. Other applicable noise assessment criteria include the World Health Organisation Community Noise Guidelines [7] which can be used to assess the potential for sleep disturbance associated noise.

5.1 Carpark Operational Noise Emissions

5.1.1 Brisbane City Council (BCC) – NIAPSP

The noise emissions from the proposed development must satisfy the noise limits at the nearby NSRs, which are derived based on their zoning classification. The noise emissions from the proposed Northern Carpark development must satisfy the performance outcomes of the Centre or Mixed-Use code at the surrounding NSRs. The noise emissions are subject to the noise (planning) criteria as shown in Table 6 (referenced from Table 9.3.3.3.F of the NIAPSP).

Table 6: Noise (Planning) Criteria for Mixed Use (Ref. Table 9.3.3.3.F of the BCC City Plan 2014 NIAPSP)

CRITERIA LOCATION	INTRUSIVE NOISE CRITERIA ($L_{Aeq,adj,T}$) - RBL + 5 dB(A)			ACOUSTIC AMENITY CRITERIA ($L_{Aeq,adj,T}$)		
At a sensitive use in the Principal Centre Zone	Day – 11h (0700 – 1800)	Evening – 4h (1800 – 2200)	Night – 9h (2200-0700)	Day – 11h (0700-1800)	Evening – 4h (1800-2200)	Night – 9h (2200-0700)
	54 dB(A)	**51 dB(A)**	**48 dB(A)**	60 dB(A)	55 dB(A)	50 dB(A)

The low frequency noise limits for the proposed development are presented in Table 7 (referenced from Table 9.3.3.3.G of the NIAPSP) and apply to mechanical plant such as large exhaust fans. The car park is intended to be naturally ventilated and there are no significant low frequency noise sources within the development.

Table 7: Low Frequency Noise Criteria for Mixed-Use (Ref. Table 9.3.3.3.G of the BCC City Plan 2014 NIAPSP)

CRITERIA LOCATION	LOW FREQUENCY NOISE CRITERIA		
	DAY	EVENING	NIGHT
At a sensitive use in the Principal Centre Zone	$L_{Ceq,adj,\ 11h\ (0700-1800)}$	$L_{Ceq,adj,\ 11h\ (1800-2200)}$	$L_{Ceq,adj,\ 11h\ (2200-0700)}$
	75 dB(C)	75 dB(C)	70 dB(C)

The L_{Amax} noise assessment applies during the night time period and only to specified noise sources including:

- Impact noises;
- Hammering;
- Loading / unloading;
- Dropping items;
- Beepers, alarms, belts, phones, sirens;
- Power tools;
- Valve releases;
- Air brakes;
- Door slamming

The limits for the L_{Amax} noise assessment for car door slams etc. are presented in Table 8.

Table 8: Night Time Noise Criteria for Mixed-Use (Ref. Table 9.3.3.3.H of the BCC City Plan 2014 NIAPSP)

CRITERIA LOCATION	AVERAGE OF THE HIGHEST 15 SINGLE L_{Amax} events	ABSOLUTE HIGHEST SINGLE L_{Amax} event
	NIGHT	NIGHT
External to a sensitive use in the Mixed-Use Zone	$L_{Amax, adj,9h}$ (2200 – 0700)	$L_{Amax, adj,9h}$ (2200 – 0700)
	65 dB(A)	70 dB(A)

5.1.2 Environmental Protection Act 1994

Section 440U of the Environmental Protection Act 1994 [3] applies to premises for which there is air conditioning equipment. The noise limits applicable to surrounding noise sensitive uses are as follows:

An occupier of premises must not use, or permit the use of, the equipment on any day –

- Before 7a.m., if it makes a noise of more than 3 dB(A) above the background level; or
- From 7a.m. to 10p.m., if it makes a noise of more than 5 dB(A) above the background level; or
- After 10p.m., if it makes a noise of more than 3 dB(A) above the background level.

The noise limits based on the above criteria are 56 dB(A), 53 dB(A) and 48 dB(A) for the daytime, evening and night periods respectively. As such, compliance with the BCC City Plan Intrusive Noise Criteria for mechanical plant will result in compliance with the Environmental Protection Act noise limits.

5.1.3 Environmental Protection (Noise) Policy 2019

Schedule 1 of the EPP Noise 2019 provides 'Acoustic Quality Objectives' that are directed in protecting environmental values and sensitive receptors. Schedule 1 of the EPP Noise 2019 for residential and hospital sensitive receptors is reproduced in Table 9 for the relevant noise sensitive receivers.

Table 9: Schedule 1 of EPP Noise 2019

SENSITIVE RECEPTOR	TIME OF DAY	ACOUSTIC QUALITY OBJECTIVES (MEASURED AT THE RECEPTOR) dB(A) $L_{Aeq, adj,1hr}$	ENVIRONMENTAL VALUE
Dwelling (for outdoors)	daytime and evening	50	health and wellbeing
Dwelling (for indoors)	daytime and evening	35	health and wellbeing
	night-time	30	health and wellbeing, in relation to the ability to sleep
Hospital, surgery or other medical institution (for indoors)	visiting hours[9]	35	health and wellbeing
	anytime, other than visiting hours	30	health and wellbeing, in relation to the ability to sleep

In order to assess the indoor noise levels, the transmission loss values for building facades (Ref. [12]) have been used.

[9] General visiting hours for Royal Brisbane and Women's Hospital are 10am to 8pm, as provided on the Hospital's website.

5.1.4 Sleep Disturbance Criteria

In the World Health Organisation (WHO) Guidelines for Community Noise [7], Section 4 "Guideline Values" recommends noise criteria to mitigate sleep disturbance due to noise impacts.

- For residential dwellings:

The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30 dB LAeq for continuous noise and 45 dB LAmax for single sound events.

- For hospital spaces:

For most spaces in hospitals, the critical effects are sleep disturbance, annoyance, communication interference, including warning signals. The LAmax of sound events during the night should not exceed 40 dB(A) indoors.

5.1.5 Summary of Carpark Noise Criteria

The most stringent criteria in relation to proposed carpark site environment is derived from a combination of the EPP Noise 2019 and WHO Guidelines for Community Noise. Where the EPP Noise 2019 formulates appropriate $L_{Aeq,1hr}$ criteria to control continuous noise events and the WHO guideline provides a sleep disturbance criterion for intermittent single noise events through L_{Amax} limits.

The controlling noise criteria for the Health Precinct and Residential Receivers are presented in Table 10 and Table 11 respectively. Achieving compliance with these criteria will also ensure compliance with BCC NIAPSP and the EPA 1994.

Table 10: Summarised Carpark Noise Criteria at Health Precinct Receivers

NSR CRITERIA LOCATION	OPERATIONAL NOISE CRITERIA		SLEEP DISTURBANCE CRITERIA
	$L_{Aeq, adj,1hr}$ dB(A)		L_{Amax} dB(A)
	Visiting Hours (Day and Evening)	Non-visiting hours (Night)	Night (2200-0700)
Hospital, wards (indoors)	35, Note 1	30, Note 1	40, Note 2

Note 1: Derived from EPP Noise 2019 Schedule 1 -Acoustic Quality Objectives

Note 2: Derived from WHO Guidelines for Community Noise

Table 11: Summarised Carpark Noise Criteria at Residential Receivers

NSR CRITERIA LOCATION		NOISE CRITERIA			SLEEP DISTURBANCE CRITERIA
		Average $L_{Aeq, 1hr}$ dB(A)			L_{Amax} dB(A)
		Day (0700-1800)	Evening (1800-2200)	Night (2200-0700)	Night (2200-0700)
Residential	Outdoors / Facade	50	50	40, Note 1	55, Note 1
	Indoors	35	35	30	45

Note 1: Assumes a 10dB correction from external-to-internal to account for partially opened windows

5.2 Construction Noise

Section 440R of the Environmental Protection Act 1994 [3] sets limits on when building work may be conducted, as follows:

(1) A person must not carry out building work in a way that makes an audible noise –

a. On a business day or Saturday, before 6:30a.m. or after 6:30p.m.; or

b. On any other day, at any time.

It is generally accepted in Queensland that noise emissions from construction activities that occur within the approved hours and in accordance with a suitable Construction Management Plan can be managed to acceptable levels. Construction noise has not been assessed further in this report.

6. NOISE MODEL

6.1 Operational Noise

A SoundPLAN noise model was created using topographical data and plans provided. Three-dimensional views of the SoundPLAN model are presented in Appendix C. It is noted that the Carpark will be constructed adjacent to an existing cliff which provides significant attenuation to the existing hospital and Herston Quarter PDA.

The noise emission of the carpark during normal operation has been predicted using the algorithms developed by Bavarian State Agency for Environment (Ref.[8]) and verified for Australian conditions (Ref.[9]). The Standard is included in the SoundPLAN noise modelling software. The maximum carparking allocation of 1,150 has been modelled using the both the default time histograms in the algorithm for a 'Visitor and Staff' car park, as well as a custom histogram developed from data provided by the Ned Hanlon car park operators.

A description of the histograms used is as follows:

- 'Default' Histogram for a 'Visitor and Staff' car park: Assumes a maximum 50% vehicle turnover per hour during the day and evening period. For the night period, a maximum 1% vehicle turnover per hour is assumed. This can be interpreted as a worst-case scenario for the daytime and evening period. Refer to Appendix D.
- 'Custom' Histogram: Derived from the Ned Hanlon Noise Measurement Summary Report by Floth [11]. Maximum vehicle turnovers of 30%, 6% and 3% per hour are anticipated for the day, evening and night periods, respectively. This scenario is expected to be representation of the typical carpark traffic movements and yields the highest results for the critical night period. Refer to Appendix D.

These histograms have been used to predict the operational noise from the car park and access roads within the site with results from each scenario provided in Section 7.2.

6.2 Road Traffic Noise Increase

6.2.1 Traffic Engineering Report

Peak demand traffic volumes for the local roads that feed Research Road and Back Road that provide access to the Northern Carpark have been assessed in a report by the Project's Traffic Consultant [10]. The peak traffic volumes are reproduced in Table 12 and Table 13 for Butterfield Street / Garrick Terrace and Herston Road / Bramston Terrace, respectively.

The maximum predicted increase in road traffic noise levels due to any increased traffic volumes are presented in the Tables, compared with the base case without the proposed Northern Carpark. It can be seen from the tables that any increase in noise levels on local roads due to the introduction of the car park are predicted to be less than 1dB which is not significant and would not be audibly perceptible at the noise sensitive receivers along these local roads.

Table 12: Expected Vehicular Traffic at Peak Times – Intersection at Butterfield Street / Garrick Terrace

SCENARIO	DEMAND (VEHICLES/hr)		MAXIMUM PREDICTED TRAFFIC NOISE LEVEL DIFFERENCE DUE TO INCREASED TRAFFIC VOLUMES ON LOCAL ROADS (dB)
	AM PEAK (7:30 TO 8:30 a.m.)	PM PEAK (5:00 TO 6:00 p.m.)	
2016 Survey	808	786	
2020 BG	839	816	+ 0.5 dB
2020 BG + DEV	944	889	
2030 BG	928	904	+ 0.5 dB
2030 BG + DEV	1032	977	

Table 13: Expected Vehicular Traffic at Peak Times – Intersection at Herston Road/ Bramston Terrace

SCENARIO	DEMAND (VEHICLES/hr)		MAXIMUM PREDICTED TRAFFIC NOISE LEVEL DIFFERENCE DUE TO INCREASED TRAFFIC VOLUMES ON LOCAL ROADS (dB)
	AM PEAK (7:30 TO 8:30 a.m.)	PM PEAK (5:00 TO 6:00 p.m.)	
2016 Survey	1423	1068	
2020 BG	1527	1123	+ 0.3 dB
2020 BG + DEV	1617	1153	
2030 BG	1682	1236	+ 0.2 dB
2030 BG + DEV	1771	1268	

6.2.2 B40 Ned Hanlon Carpark Building Noise Assessment

A measurement survey of the existing Ned Hanlon Carpark revealed a maximum traffic noise level of 68 dB(A) $L_{Aeq,\ 1hr}$ at 4 metres for 123 vehicle movements, as per the measurement report for the existing Ned Hanlon Carpark Building [11]. The noise emission from the proposed access routes to the proposed Northern Carpark has been derived using this source definition and adjusted using the time histograms in Appendix D.

These traffic movement histograms are incorporated into the SoundPLAN model calculations for the purposes of determining the maximum access road noise level for the peak periods.

Results from each time histogram scenario is provided in Section 7.3 and Appendix E.

6.3 Maximum Noise Events

The use of the carpark has the potential to result in intermittent, high noise events such as car door slams, engine starts and tyre screeches. The maximum sound power level from a car door slam can reach 97 dB(A) L_{Amax} and is considered as the worst-case noise event for the carpark. It is noted that although most car door closures have noise levels significantly lower (up to 20 dB(A)) than this, a conservative approach has been adopted for the noise model. This maximum sound power level of 97 dB(A) L_{Amax} is higher when compared to maximum L_{Amax} levels of intermittent single sound events assessed in the Ned Hanlon Carpark Building Noise Measurement Summary Report [11]. This also demonstrates further conservativeness.

The approach used involves a point source (representative of the worst-case intermittent L_{Amax} noise event from a car door slam) in each level of the carpark at the edge nearest to the NSRs. The noise contribution of each point source (i.e. it is not assumed that these events are occurring simultaneously) is assessed at the surrounding receivers and if this scenario is found to satisfy the noise criteria, all other reasonable scenarios are expected to comply.

An anti-tyre screech finish will be applied to all trafficable areas to minimise the potential for tyre screech to occur. In addition, the cover plates on expansion joints will be designed to mitigate noise generation (e.g. resilient materials), as opposed to the metal cover plates on the existing car park at site. Hutchinson Builders have advised that these noise control measures will be developed during the detailed design phases.

6.4 Mechanical Plant Noise

The carpark is designed to be naturally ventilated and as such, no mechanical ventilation to the carpark itself will be required. The only mechanical ventilation will be to the Substation. At this stage, the details of the mechanical plant required to service the Substation have not been finalised. However, we expect that the noise emission will be minimal.

The mechanical plant selection will be required to achieve the noise limits specified in Section 5.

7. NOISE ASSESSMENT

7.1 Façade Transmission Losses

Façade constructions and transmission losses for the nearest health precinct buildings have been addressed in the report 'Façade Transmission Loss Results' by SLR Consulting [12]. The façade construction and weighted sound level differences for each health precinct receiver in close proximity to the proposed Northern Carpark are reproduced in Table 14. These transmission losses have been used to assess predicted internal noise levels where applicable.

Table 14: Façade Properties and Transmission Loss

HEALTH PRECINCT RECEIVER	FAÇADE CONSTRUCTION	GLAZING/WINDOW TYPE	MINIMUM WEIGHTED SOUND LEVEL DIFFERENCE
Herston Alcohol Drug Service (B62)	Heavy brick masonry with single glazed windows.	Fixed	31
Ronald McDonald House (B63)	Brick masonry with large single glazed sliding doors.	Operable	30[10]
Herston Medical Research Laboratory	Double masonry with small 'punched window openings for approximately 1.2mx1.2m double glazed windows.	Operable	30[10]
Joyce Tweddel Building (B39)	Concrete blade façade with modern insulated cladding sections and fixed wide gap double glazed windows.	Fixed	28
Centre of Clinical Teaching (B34)	Heavy brick masonry with single glazed windows.	Fixed	30
Sir Albert Sazewski Research Laboratory (C28)	Appears to have a concrete blade and masonry brick façade with single glazed windows.	Fixed	Note 1

[10] Assuming closed windows

Note 1: The façade performance of the Sir Albert Sazewski building was not measured in the referenced report (Ref. [12]). However, it is noted that the Sir Albert Sazewski Research Laboratory façade composition is similar to that of the Centre of Clinical teaching building. Based on this, it can be expected that the façade transmission loss of the Sir Albert Sazewski Research Laboratory building is in the order of 30.

It is noted that for buildings that were identified with having operable windows, the weighted sound transmission loss would be limited if windows remain open.

7.2 Operational Noise – Car Park Only

7.2.1 Residential Receivers – City Plan Criteria

The noise from the typical operation of the Northern Carpark was predicted at the surrounding residential noise sensitive receivers and health precinct receivers in accordance with the carpark noise standard [8]. The $L_{Aeq,T}$ for each time period (day, evening and night) and for the default and custom time histograms at residential noise sensitive receivers are shown in Table 15 and Table 16 respectively. It can be seen from Table 15 and Table 16 that the BCC City Plan noise criteria is predicted to be satisfied at all surrounding noise sensitive receivers for the time histograms modelled.

Table 15: Predicted Carpark Noise Levels at Nearby NSRs – Default Time Histogram

NOISE SENSITIVE RECEIVER	PREDICTED NOISE LEVEL, $L_{Aeq,T}$ IN dB(A) – DEFAULT TIME HISTOGRAM		
	DAYTIME (CRITERIA = 54 dB(A))	EVENING (CRITERIA = 51 dB(A))	NIGHT (CRITERIA = 48 dB(A))
1 – 24 Garrick Tce	44	43	27
2 – 26 Garrick Tce	45	43	28
3 – 28 Garrick Tce	44	42	27
4 – 32 Garrick Tce	44	43	27
5 – 34 Garrick Tce	43	41	26
6 – 36 Garrick Tce	42	41	25
7 – 38 Garrick Tce	42	40	25
8 – 42 Garrick Tce	41	39	24
9 – 44 Garrick Tce	40	38	23

Table 16: Predicted Carpark Noise Levels at Nearby NSRs – Custom Time Histogram

NOISE SENSITIVE RECEIVER	PREDICTED NOISE LEVEL, $L_{Aeq,T}$ IN dB(A) – CUSTOM TIME HISTOGRAM		
	DAYTIME (CRITERIA = 54 dB(A) $L_{Aeq,1hr}$)	EVENING (CRITERIA = 51 dB(A) $L_{Aeq,1hr}$)	NIGHT (CRITERIA = 48 dB(A) $L_{Aeq,1hr}$)
1 – 24 Garrick Tce	38	37	31
2 – 26 Garrick Tce	39	37	32
3 – 28 Garrick Tce	38	37	31
4 – 32 Garrick Tce	38	37	31
5 – 34 Garrick Tce	36	35	30
6 – 36 Garrick Tce	36	35	29
7 – 38 Garrick Tce	36	34	29
8 – 42 Garrick Tce	34	33	28
9 – 44 Garrick Tce	34	33	27

7.2.2 Residential Receivers – EPP(Noise) Criteria

The noise from the typical operation of the Northern Carpark was predicted at the surrounding residential noise sensitive receivers and health precinct receivers in accordance with the carpark noise standard [8]. The maximum $L_{Aeq,1hr}$ for each time period (day, evening and night) and for the default and custom time histograms at residential noise sensitive receivers are shown in Table 17 and Table 18 respectively. It can be seen from Table 17 that the maximum $L_{Aeq,1hr}$ is consistent for the day, evening and night periods because the default time histogram has the same vehicle movements per hour from 6am to 10pm. For this reason, the custom time histogram based on actual movements at the existing car park is expected to be a more accurate representation. Table 18 shows that the night time noise criteria is expected to be marginally exceeded by up to 2 dB(A) during the night period (6am to 7am).

Table 17: Predicted Carpark Noise Levels at Nearby NSRs – Default Time Histogram

NOISE SENSITIVE RECEIVER	PREDICTED MAXIMUM NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) – DEFAULT TIME HISTOGRAM		
	DAYTIME (CRITERIA = 50 dB(A) $L_{Aeq,1hr}$)	EVENING (CRITERIA = 50 dB(A) $L_{Aeq,1hr}$)	NIGHT (CRITERIA = 40 dB(A) $L_{Aeq,1hr}$)
1 – 24 Garrick Tce	44	44	44, Exceeds by 4 dB(A)
2 – 26 Garrick Tce	45	45	45, Exceeds by 5 dB(A)
3 – 28 Garrick Tce	44	44	44, Exceeds by 4 dB(A)
4 – 32 Garrick Tce	44	44	44, Exceeds by 4 dB(A)
5 – 34 Garrick Tce	43	43	43, Exceeds by 3 dB(A)
6 – 36 Garrick Tce	42	42	42, Exceeds by 2 dB(A)
7 – 38 Garrick Tce	42	42	42, Exceeds by 2 dB(A)
8 – 42 Garrick Tce	41	41	41, Exceeds by 1 dB(A)
9 – 44 Garrick Tce	40	40	40

Table 18: Predicted Carpark Noise Levels at Nearby NSRs – Custom Time Histogram

NOISE SENSITIVE RECEIVER	PREDICTED MAXIMUM NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) – CUSTOM TIME HISTOGRAM		
	DAYTIME (CRITERIA = 50 dB(A) $L_{Aeq,1hr}$)	EVENING (CRITERIA = 50 dB(A) $L_{Aeq,1hr}$)	NIGHT (CRITERIA = 40 dB(A) $L_{Aeq,1hr}$)
1 – 24 Garrick Tce	42	35	42, Exceeds by 2 dB(A)
2 – 26 Garrick Tce	43	36	42, Exceeds by 2 dB(A)
3 – 28 Garrick Tce	42	35	42, Exceeds by 2 dB(A)
4 – 32 Garrick Tce	42	35	42, Exceeds by 2 dB(A)
5 – 34 Garrick Tce	40	34	41, Exceeds by 1 dB(A)
6 – 36 Garrick Tce	40	33	40
7 – 38 Garrick Tce	40	33	39
8 – 42 Garrick Tce	39	32	39
9 – 44 Garrick Tce	38	31	38

7.2.3 Health Precinct Buildings – EPP(Noise) Criteria

The impacts onto the health precinct NSRs (hospitals buildings etc.) are shown in Table 19 and Table 20. Table 19 provides façade noise levels, whilst Table 20 presents the predicted indoor noise levels based on the façade corrections in Section 7.1.

Table 19: Predicted Carpark Noise Levels at Façade of Health Precinct Receivers

NOISE SENSITIVE RECEIVER	MAXIMUM PREDICTED NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) AT FACADE					
	DAY		EVENING		NIGHT	
	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM
10	46	44	46	37	46	44
11	48	46	48	38	48	46
12	46	44	46	37	46	44
13	41	39	41	32	41	39
14	46	44	46	37	46	44
15	48	46	48	39	48	46

[1]Refer to Figure 1 and Table 3 for health precinct receiver descriptions.

Table 20: Predicted Carpark Noise Levels Health Precinct Receivers (Indoors)

NOISE SENSITIVE RECEIVER[1]	MAXIMUM PREDICTED NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) INDOOR					
	DAY (CRITERIA 35 dB(A))		EVENING (CRITERIA 35 dB(A))		NIGHT (CRITERIA 30 dB(A))	
	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM
10	16	14	16	7	16	14
11	17	15	17	7	17	15
12	16	14	16	7	16	14
13	13	11	13	4	13	11
14	16	14	16	7	16	14
15	18	16	18	19	18	16

[1]Refer to Figure 1 and Table 3 for health precinct receiver descriptions.

It can be seen from Table 20 that carpark noise levels are predicted to comply with the EPP Noise 2019 noise criteria at the health precinct receivers. As such, the normal operation of the carpark is considered to meet noise criteria derived in Section 5 and subsequently the acoustic objectives of the Herston Quarter PDA Development Scheme.

7.3 Operational Noise - Access Road

7.3.1 Residential Receivers – EPP(Noise) Criteria

Noise generated within the site boundaries along the access routes to the proposed car park has been predicted for the peak traffic period at the facades of the surrounding residential receivers as presented in Table 21. It is noted that the default time histogram has the same movements from 6am to 10pm, and that the custom histogram results presented in Table 22 are expected to be a better approximation of site conditions.

Table 21: Predicted Access Road Noise Levels at Nearby NSRs – Default Time Histogram

NOISE SENSITIVE RECEIVER	PREDICTED MAXIMUM NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) – DEFAULT TIME HISTOGRAM		
	DAYTIME (CRITERIA = 50 dB(A) $L_{Aeq,1hr}$)	EVENING (CRITERIA = 50 dB(A) $L_{Aeq,1hr}$)	NIGHT (CRITERIA = 40 dB(A) $L_{Aeq,1hr}$)
1 – 24 Garrick Tce	58, exceeds by 8 dB(A)	58, exceeds by 8 dB(A)	58, exceeds by 18 dB(A)
2 – 26 Garrick Tce	59, exceeds by 9 dB(A)	59, exceeds by 9 dB(A)	59, exceeds by 19 dB(A)
3 – 28 Garrick Tce	55, exceeds by 5 dB(A)	55, exceeds by 5 dB(A)	55, exceeds by 15 dB(A)
4 – 32 Garrick Tce	56, exceeds by 6 dB(A)	56, exceeds by 6 dB(A)	56, exceeds by 16 dB(A)
5 – 34 Garrick Tce	53, exceeds by 3 dB(A)	53, exceeds by 3 dB(A)	53, exceeds by 13 dB(A)
6 – 36 Garrick Tce	53, exceeds by 3 dB(A)	53, exceeds by 3 dB(A)	53, exceeds by 13 dB(A)
7 – 38 Garrick Tce	54, exceeds by 4 dB(A)	54, exceeds by 4 dB(A)	54, exceeds by 14 dB(A)
8 – 42 Garrick Tce	52, exceeds by 2 dB(A)	52, exceeds by 2 dB(A)	52, exceeds by 12 dB(A)
9 – 44 Garrick Tce	51, exceeds by 1 dB(A)	51, exceeds by 1 dB(A)	51, exceeds by 11 dB(A)

Table 22: Predicted Access Road Noise Levels at Nearby NSRs – Custom Time Histogram

NOISE SENSITIVE RECEIVER	PREDICTED MAXIMUM NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) – CUSTOM TIME HISTOGRAM		
	DAYTIME (CRITERIA = 50 dB(A) $L_{Aeq,1hr}$)	EVENING (CRITERIA = 50 dB(A) $L_{Aeq,1hr}$)	NIGHT (CRITERIA = 40 dB(A) $L_{Aeq,1hr}$)
1 – 24 Garrick Tce	57, exceeds by 7 dB(A)	54, exceeds by 4 dB(A)	52, exceeds by 12 dB(A)
2 – 26 Garrick Tce	58, exceeds by 8 dB(A)	55, exceeds by 5 dB(A)	53, exceeds by 13 dB(A)
3 – 28 Garrick Tce	54, exceeds by 4 dB(A)	51, exceeds by 1 dB(A)	49, exceeds by 9 dB(A)
4 – 32 Garrick Tce	55, exceeds by 5 dB(A)	52, exceeds by 2 dB(A)	50, exceeds by 10 dB(A)
5 – 34 Garrick Tce	52, exceeds by 2 dB(A)	49	47, exceeds by 7 dB(A)
6 – 36 Garrick Tce	52, exceeds by 2 dB(A)	49	47, exceeds by 7 dB(A)
7 – 38 Garrick Tce	52, exceeds by 2 dB(A)	49	47, exceeds by 7 dB(A)
8 – 42 Garrick Tce	51, exceeds by 1 dB(A)	48	46, exceeds by 6 dB(A)
9 – 44 Garrick Tce	49	46	44, exceeds by 4 dB(A)

It can be seen from Table 22 that the peak traffic periods are expected to result in exceedances of the noise criteria at surrounding noise sensitive receivers, however the traffic flows are expected to be significantly lower during non-peak times as shown in Appendix D.

7.3.2 Health Precinct Buildings – EPP(Noise) Criteria

Noise generated within the site boundaries along the access routes to the proposed car park has been predicted at the facades (Table 23) and for indoors (Table 24) of the health precinct NSRs.

Table 23: Predicted Access Road Noise Levels at Façade of Health Precinct Receivers

NOISE SENSITIVE RECEIVER[1]	MAXIMUM PREDICTED NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) AT FACADE					
	DAY		EVENING		NIGHT	
	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM
10	64	63	64	60	56	58
11	57	56	57	53	49	51
12	62	61	62	58	54	56
13	48	47	48	44	40	42
14	48	47	48	44	40	42
15	56	56	56	53	49	51

[1]Refer to Figure 1 and Table 3 for health precinct receiver descriptions.

Table 24: Predicted Access Road Noise Levels at Health Precinct Receivers (Indoors)

NOISE SENSITIVE RECEIVER[1]	MAXIMUM PREDICTED NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) INDOOR (CRITERIA 35 dB(A))					
	DAY (CRITERIA 35 dB(A))		EVENING (CRITERIA 35 dB(A))		NIGHT (CRITERIA 30 dB(A))	
	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM
10	34	33	34	30	26	28
11	26	25	26	22	18	20
12	32	31	22	28	24	26
13	20	19	20	16	12	14
14	18	17	18	14	10	12
15	26	26	26	23	29	21

[1] Refer to Figure 1 and Table 3 for health precinct receiver descriptions.

It can be seen from Table 24 that the access road traffic noise impact for both time histogram scenarios is predicted to comply with the indoor EPP Noise 2019 noise criteria at the health precinct receivers. As such, the access road traffic noise impact of the Northern Carpark is considered to meet noise criteria derived in Section 5 and subsequently the acoustic objectives of the Herston Quarter PDA Development Scheme.

7.4 Combined Carpark Operational and Access Road Noise

Predictions of overall noise impacts from carpark operation and carpark access road traffic noise at the surrounding residential receivers is presented in Table 25. It can be seen that for the maximum $L_{Aeq,1hr}$ periods, the noise levels are predicted to exceed the EPP(Noise) criteria. However, the maximum predicted noise levels are fairly consistent with the existing ambient average noise levels at the site as shown in Table 4, which indicates that the noise impacts are not expected to be as significant and further confirms the use of the BCC NIAPSP noise policy for residential receivers rather than the EPP(noise), which does not consider land-use zoning.

7.4.1 Residential Receivers

Table 25: Combined Noise Level Summary at Residential Receivers (Façade)

NOISE SENSITIVE RECEIVER[1]	MAXIMUM PREDICTED NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) AT FAÇADE					
	DAY (CRITERIA 50 dB(A))		EVENING (CRITERIA 50 dB(A))		NIGHT (CRITERIA 40 dB(A))	
	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM
1 – 24 Garrick Tce	58, exceeds by 8 dB(A)	57, exceeds by 7 dB(A)	58, exceeds by 8 dB(A)	54, exceeds by 4 dB(A)	51, exceeds by 11 dB(A)	52, exceeds by 12 dB(A)
2 – 26 Garrick Tce	59, exceeds by 9 dB(A)	58, exceeds by 8 dB(A)	59, exceeds by 9 dB(A)	55, exceeds by 5 dB(A)	52, exceeds by 12 dB(A)	53, exceeds by 13 dB(A)
3 – 28 Garrick Tce	55, exceeds by 5 dB(A)	54, exceeds by 4 dB(A)	55, exceeds by 5 dB(A)	51, exceeds by 1 dB(A)	49, exceeds by 9 dB(A)	50, exceeds by 10 dB(A)
4 – 32 Garrick Tce	56, exceeds by 6 dB(A)	55, exceeds by 5 dB(A)	56, exceeds by 6 dB(A)	52, exceeds by 2 dB(A)	49, exceeds by 9 dB(A)	51, exceeds by 11 dB(A)
5 – 34 Garrick Tce	53, exceeds by 3 dB(A)	52, exceeds by 2 dB(A)	53, exceeds by 3 dB(A)	49	47, exceeds by 7 dB(A)	48, exceeds by 8 dB(A)
6 – 36 Garrick Tce	53, exceeds by 3 dB(A)	52, exceeds by 2 dB(A)	53, exceeds by 3 dB(A)	49	47, exceeds by 7 dB(A)	47, exceeds by 7 dB(A)
7 – 38 Garrick Tce	54, exceeds by 5 dB(A)	52, exceed by 2 dB(A)	54, exceeds by 5 dB(A)	49	47, exceeds by 7 dB(A)	48, exceeds by 8 dB(A)

NOISE SENSITIVE RECEIVER[1]	MAXIMUM PREDICTED NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) AT FAÇADE					
	DAY (CRITERIA 50 dB(A))		EVENING (CRITERIA 50 dB(A))		NIGHT (CRITERIA 40 dB(A))	
	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM
8 – 42 Garrick Tce	52	51	52	48	46	47
9 – 44 Garrick Tce	51	49	51	46	44	45

7.4.2 Health Precinct Buildings

Predictions of overall noise impacts from carpark operation and carpark access road traffic noise at the surrounding health precinct receivers is presented in Table 26. It can be seen that for the maximum $L_{Aeq,1hr}$ periods, the noise levels are predicted to comply with the EPP(Noise) criteria.

Table 26: Combined Noise Level Summary at Health Precinct Receivers (Indoors)

NOISE SENSITIVE RECEIVER[1]	MAXIMUM PREDICTED NOISE LEVEL, $L_{Aeq,1hr}$ IN dB(A) INDOOR					
	DAY (CRITERIA 35 dB(A))		EVENING (CRITERIA 35 dB(A))		NIGHT (CRITERIA 30 dB(A))	
	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM	DEFAULT HISTOGRAM	CUSTOM HISTOGRAM
10	34	33	34	30	26	28
11	27	25	27	22	21	21
12	32	31	23	28	25	26
13	21	20	21	16	16	16
14	20	19	20	15	17	16
15	27	26	27	24	29	22

[1]Refer to Figure 1 and Table 3 for health precinct receiver descriptions.

7.5 Maximum Noise Events

7.5.1 Residential Receivers

The maximum noise levels at nearby residential NSRs from car door slams on each level of the carpark are presented in Table 27.

Table 27: Residential Receivers, L_{Amax} noise event from car door slams on each level of the carpark

NOISE SENSITIVE RECEIVER[1]	FLOOR LEVEL	MAXIMUM PREDICTED NOISE LEVEL FROM CAR DOOR SLAMS, L_{Amax} IN dB(A) (NIGHT TIME CRITERIA = 70 dB(A))
1	G	52
	1	53
	2	54
2	G	54
	1	54
	2	56
3	G	39
	1	52
	2	54
4	G	53
	1	53
	2	54
5	G	51
	1	52
6	G	51

NOISE SENSITIVE RECEIVER[1]	FLOOR LEVEL	MAXIMUM PREDICTED NOISE LEVEL FROM CAR DOOR SLAMS, L_{Amax} IN dB(A) (NIGHT TIME CRITERIA = 70 dB(A))
	1	52
7	G	50
	1	52
8	G	50
	1	51
9	G	50
	1	52
10	1	57
	2	59
	3	61

[11]Refer to Figure 1 and Table 2 for NSR descriptions.

7.5.2 Health Precinct Buildings

Similarly, Table 28 addresses car door slam impact at health precinct receivers.

Table 28: Health Precinct Receivers, L_{Amax} Noise Event from Car Door Slams in the Carpark

NOISE SENSITIVE RECEIVER[1]	MAXIMUM PREDICTED NOISE LEVEL FROM CAR DOOR SLAMS, L_{Amax} IN dB(A) AT FAÇADE	MAXIMUM PREDICTED INDOOR NOISE LEVEL FROM CAR DOOR SLAMS, L_{Amax} IN dB(A) (CRITERIA 40 dB(A))
10	49	24
11	48	18
12	55	30
13	41	13
14	49	19
15	53	23

[1]Refer to Figure 1 and Table 3 for health precinct receiver descriptions.

8. SUMMARY

Floth has completed a noise impact assessment for the proposed Herston Quarter Redevelopment Northern Car Park. The following scenarios were assessed at the nearest potentially affected noise sensitive receivers including the health precinct receivers (hospital buildings etc.):

- Normal operation of the car park during the daytime, evening and night periods;
- Increases in road traffic noise due to peak traffic volumes associated with the Northern Car Park;
- Peak traffic noise generated within the site boundaries along the access routes to the proposed car park, and
- Maximum noise events from car door slams during the night period.

The normal operation and maximum noise events associated with the Northern Car Park were found to satisfy the Brisbane City Plan 2014 and Acoustic Quality Objectives of the EPA Noise 2019 at the surrounding noise sensitive receivers and health precinct buildings respectively. The changes in road traffic volumes along local roads were found to have minimal noise impact on the noise sensitive receivers.

It was found that operational noise from the carpark was predicted to exceed the Acoustic Quality Objectives at surrounding noise sensitive receivers by up to 2 and 5 dB(A) during the night period for the default and custom time histograms respectively. The Brisbane City Council's Noise Impact Assessment Planning Scheme Policy (NIAPSP) noise criteria is predicted to be satisfied at these residential receivers. The NIAPSP criteria is considered to be more appropriate as it takes the zoning of receivers into account, as opposed to the EPP(Noise) which outlines criteria that could equally be applied to a detached dwelling in a rural setting, or an apartment in the central business district or along a major transport route. As such, compliance with the NIAPSP noise criteria is considered to be a good indication that the noise impacts will be acceptable at the surrounding noise sensitive receivers. It is also noted that these noise impacts would be further mitigated with windows closed, which may be case based on existing noise levels at site.

As such, the proposed Northern Car Park is considered to meet the acoustic objectives of the Herston Quarter PDA Development Code. The design of the car park has introduced features that minimise the potential noise impact on surrounding noise sensitive receivers. This includes a 'non-squealing' finish to all trafficable areas that Hutchinson Builders has advised will be installed to minimised noise from tyre screech as far as practicable. The anti-screech finish has not be incorporated into the noise modelling but is considered to be good practice.

The mechanical plant has not been assessed directly as the equipment selection has not been finalised. However, the applicable noise limits are presented in Section 5.

In conclusion, the noise impact assessment has shown that compliance with the relevant noise criteria can be achieved, and that the design of the Herston Quarter Northern Car Park meets the acoustic objectives of the Herston Quarter PDA Development Code.

Appendix A – PDA Development Scheme MAPS

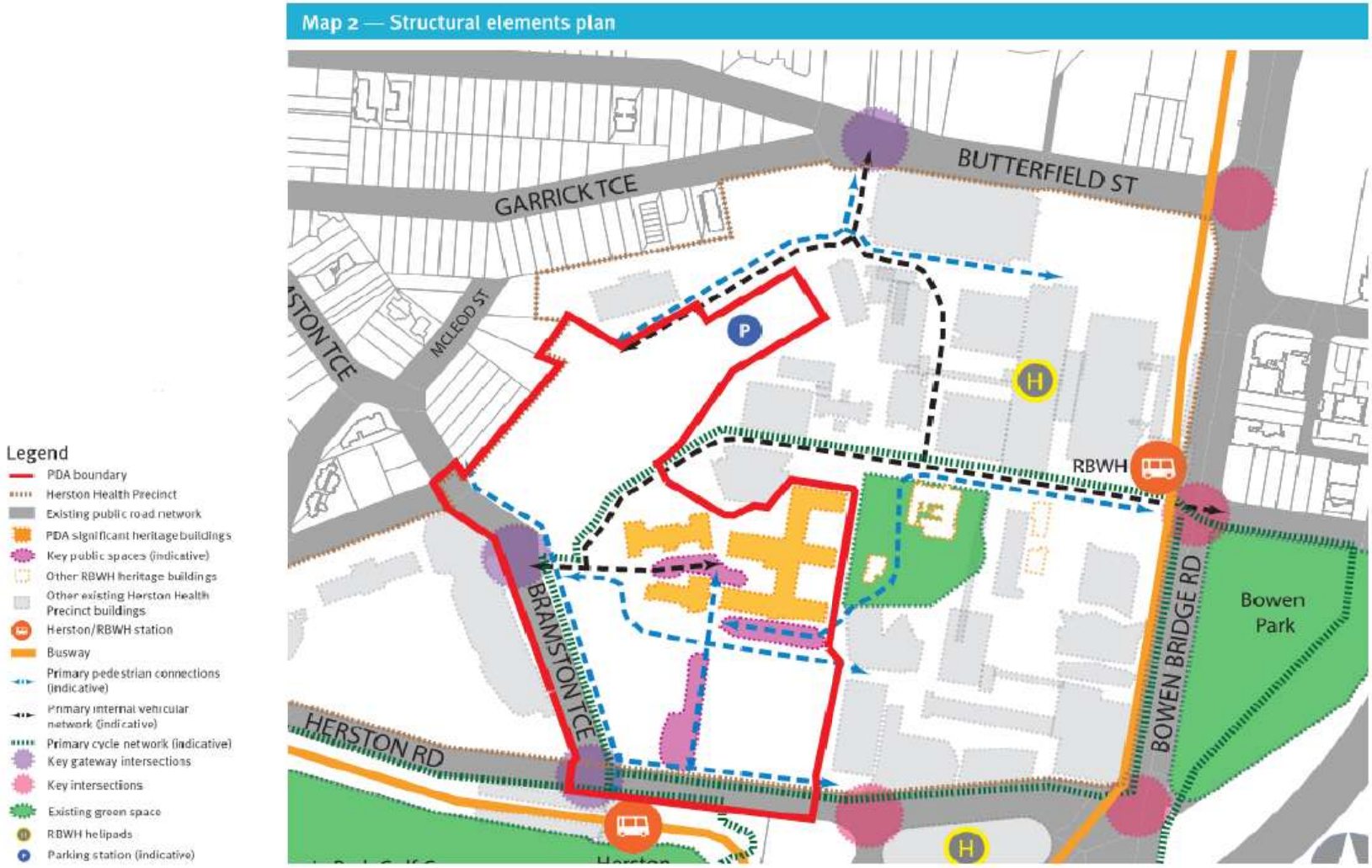


Figure A-1: Herston Quarter Priority Development Area Map (Ref. Queensland Government's Herston Quarter PDA Development Scheme)

2.5. Precinct provisions

The PDA is made up of four precincts, each having its own precinct intents, preferred land uses and precinct plan.

The four precincts are:

1. Health
2. Gateway
3. Heritage
4. Lifestyle and care

Map 3 — Herston Quarter PDA and precinct boundaries shows the location and boundaries of each of the four precincts.

Table 1 - Precinct areas identifies the precinct area of each of the four precincts. The precinct area excludes the road casements of Herston Road and Bramston Terrace.

Table 1 - Precinct areas

Precinct	Precinct area (m²)
Precinct 1	17 055
Precinct 2	1 780
Precinct 3	14 312
Precinct 4	19 769
Total	52 916

Map 3 - Herston Quarter PDA and precinct boundaries

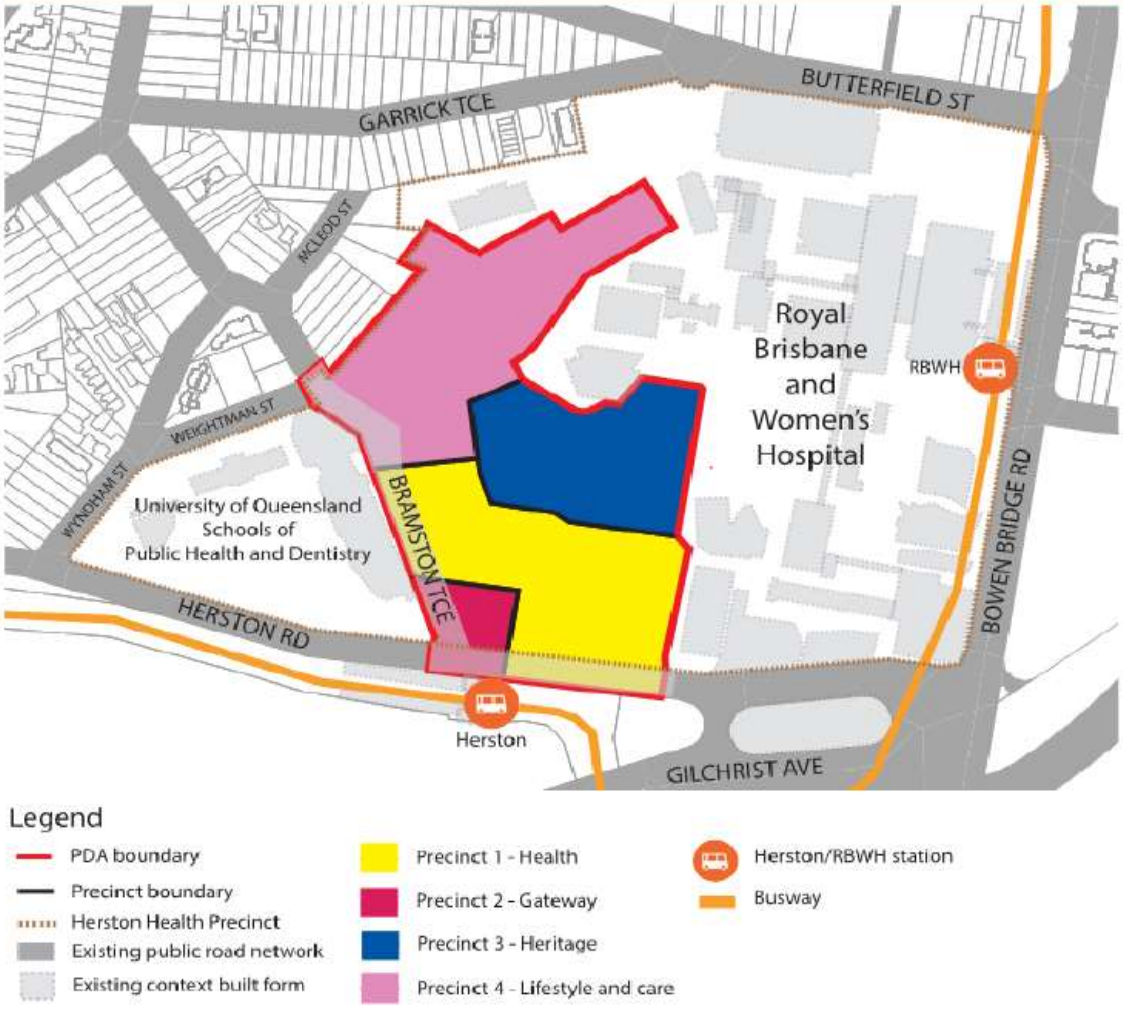
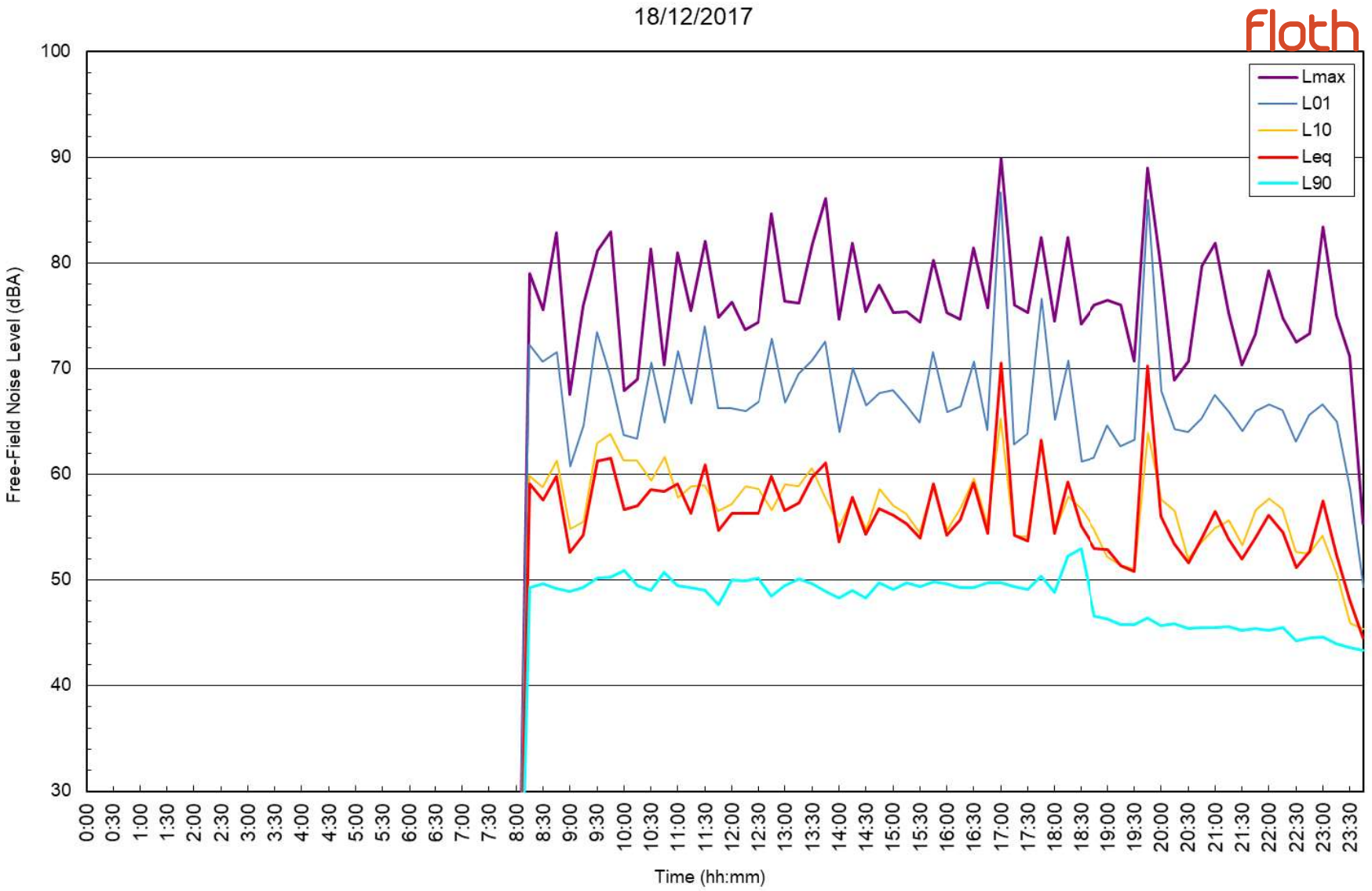


Figure A-2: Herston Quarter PDA and Precinct Boundaries (Ref. Queensland Government's Herston Quarter PDA Development Scheme)

Appendix B –Noise Monitoring Data, 18.12.2017 to 22.12.2017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60
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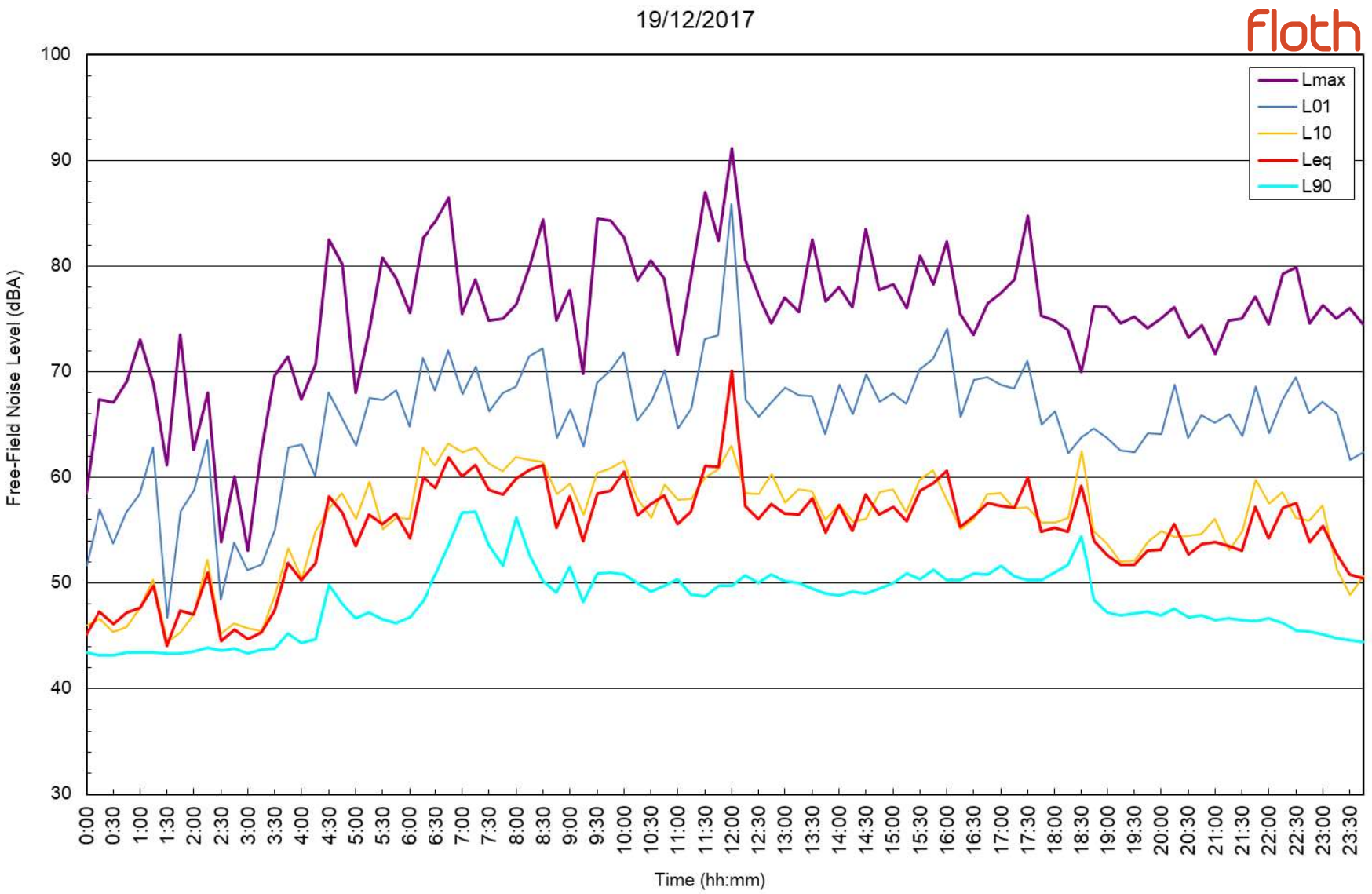
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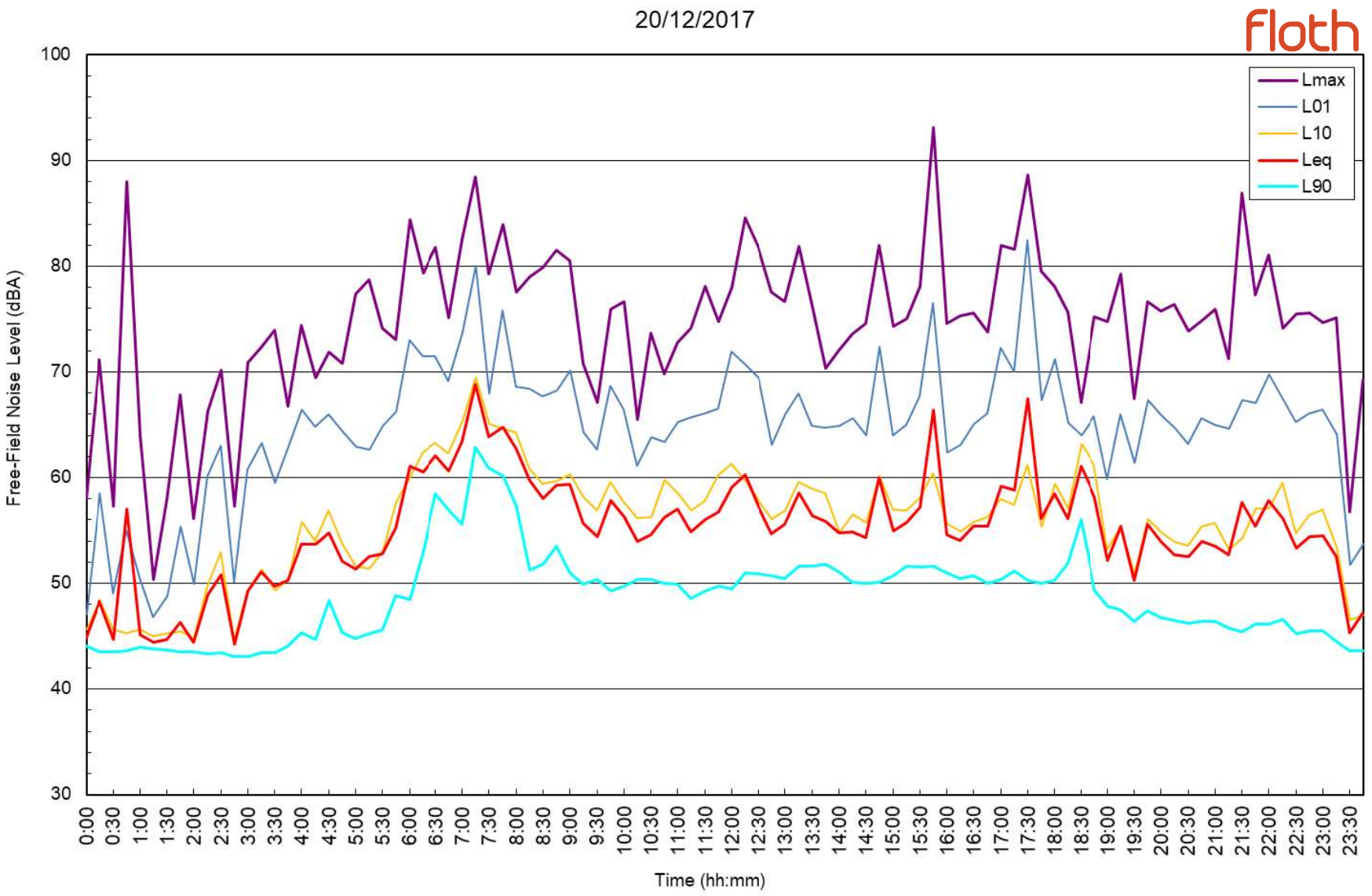
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Lmax
L01
L10
Leq
L90
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17:30
18:00
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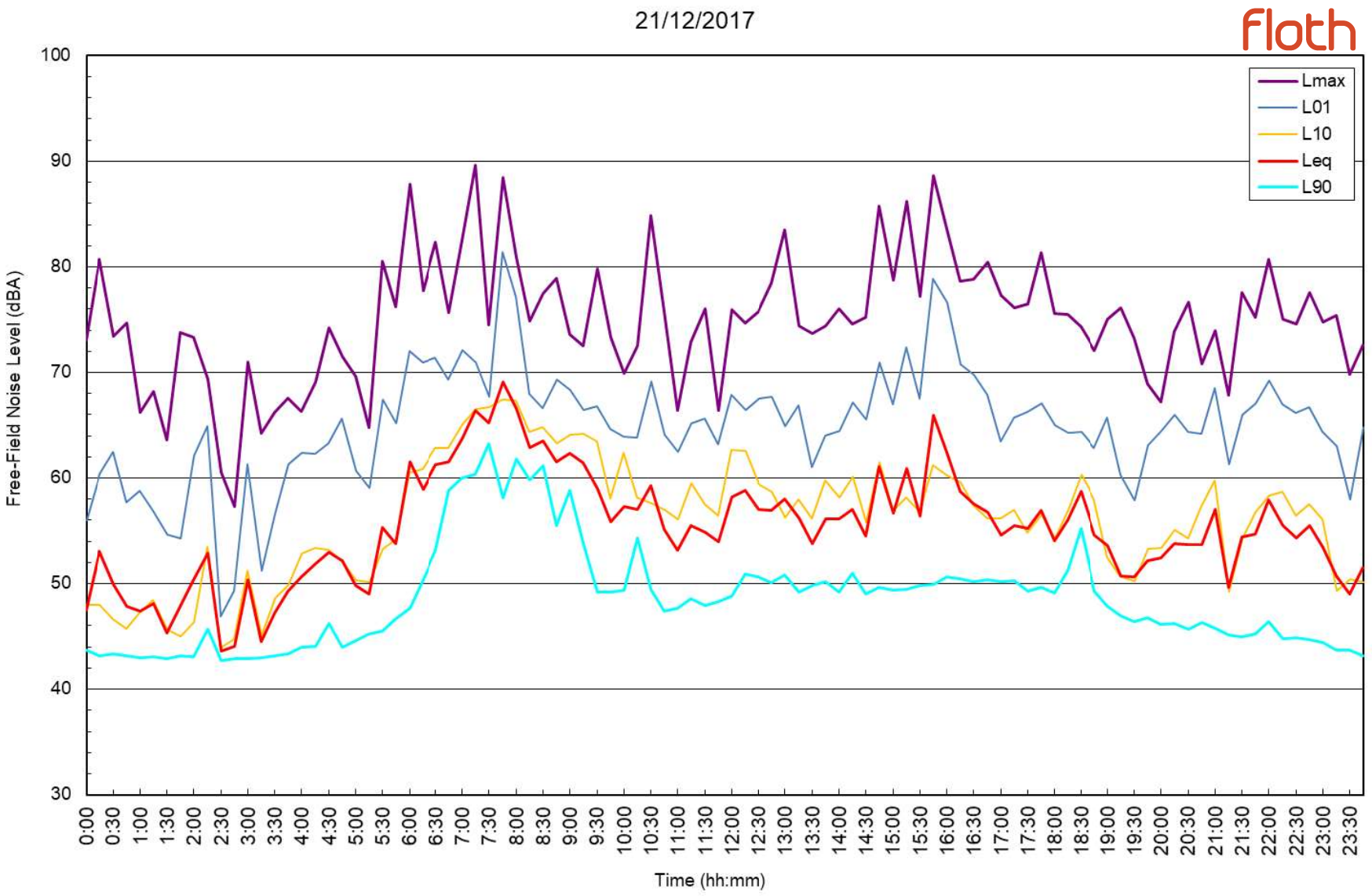
19:00
19:30
20:00
20:30
21:00
21:30
22:00
22:30
23:00
23:30
Time (hh:mm)


21/12/2017
floth
Lmax
L01
L10
Leq
L90
Free-Field Noise Level (dBA)
100
90
80
70
60
50
40
30
0:00
0:30
1:00
1:30
2:00
2:30
3:00
3:30
4:00
4:30
5:00
5:30
6:00
6:30
7:00
7:30
8:00
8:30
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10:00
10:30
11:00
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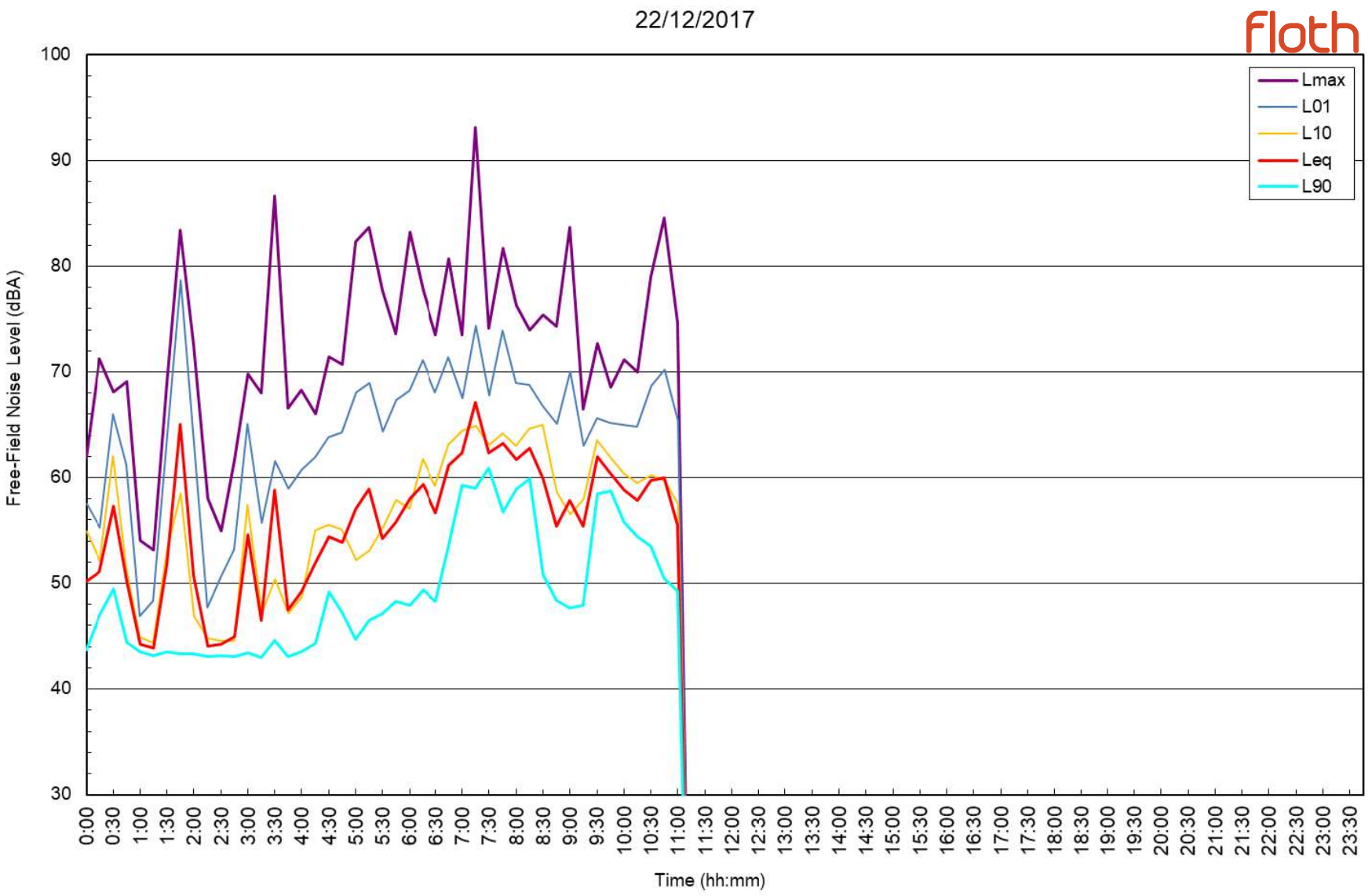
18:30
19:00
19:30
20:00
20:30
21:00
21:30
22:00
22:30
23:00
23:30
Time (hh:mm)


22/12/2017
floth
Lmax
L01
L10
Leq
L90
Free-Field Noise Level (dBA)
100
90
80
70
60
50
40
30
0:00
0:30
1:00
1:30
2:00
2:30
3:00
3:30
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5:00
5:30
6:00
6:30
7:00
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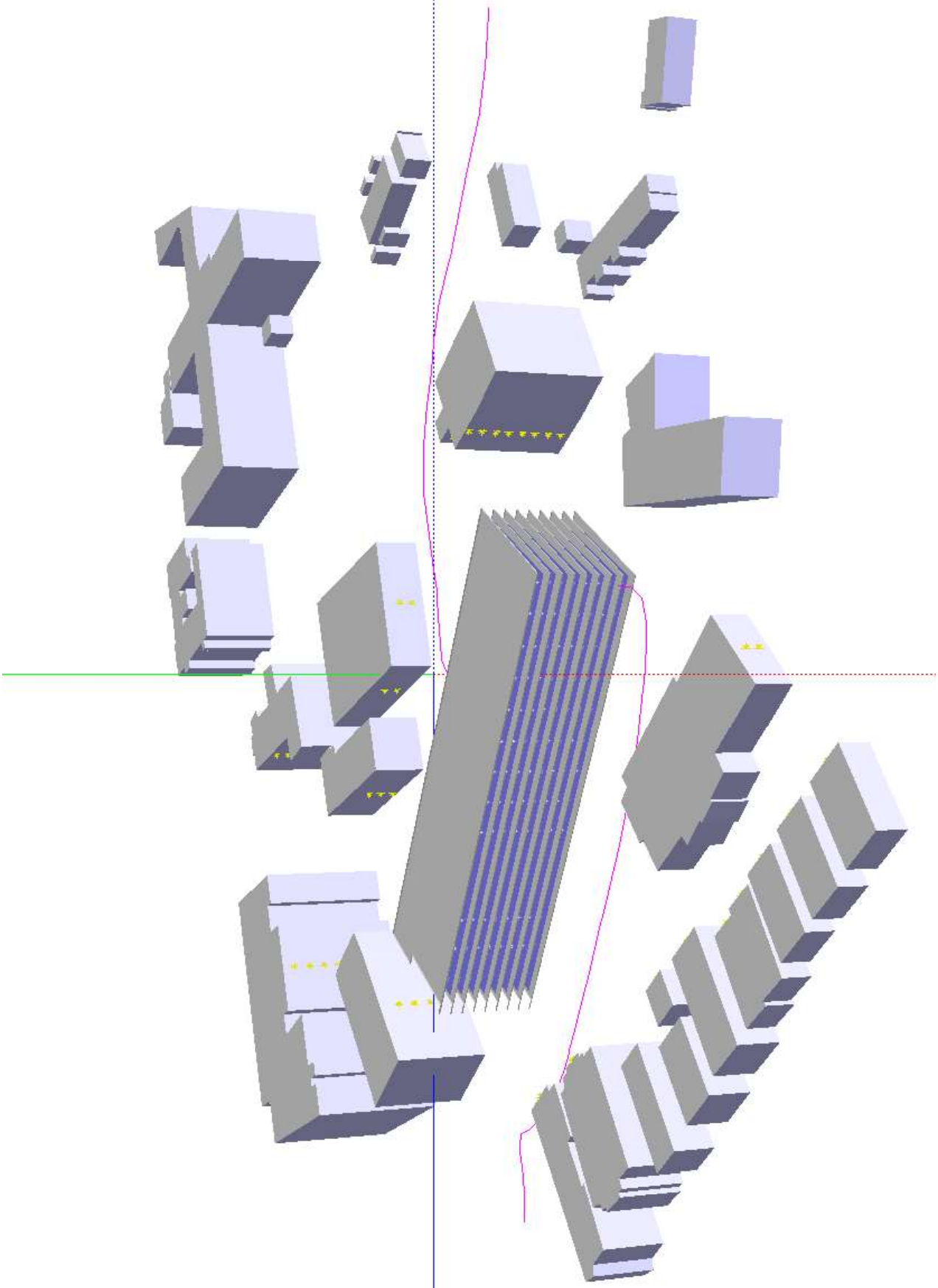
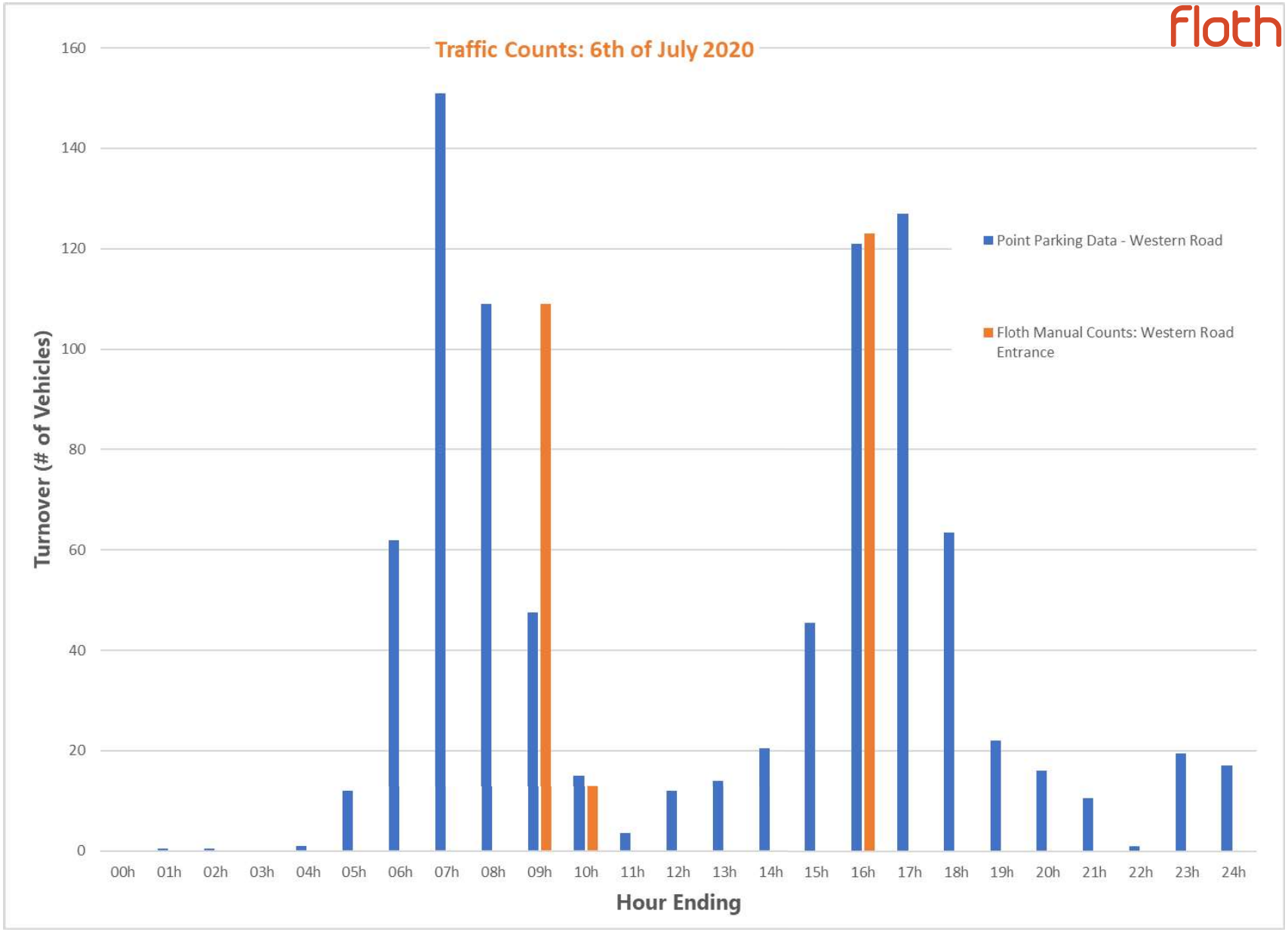
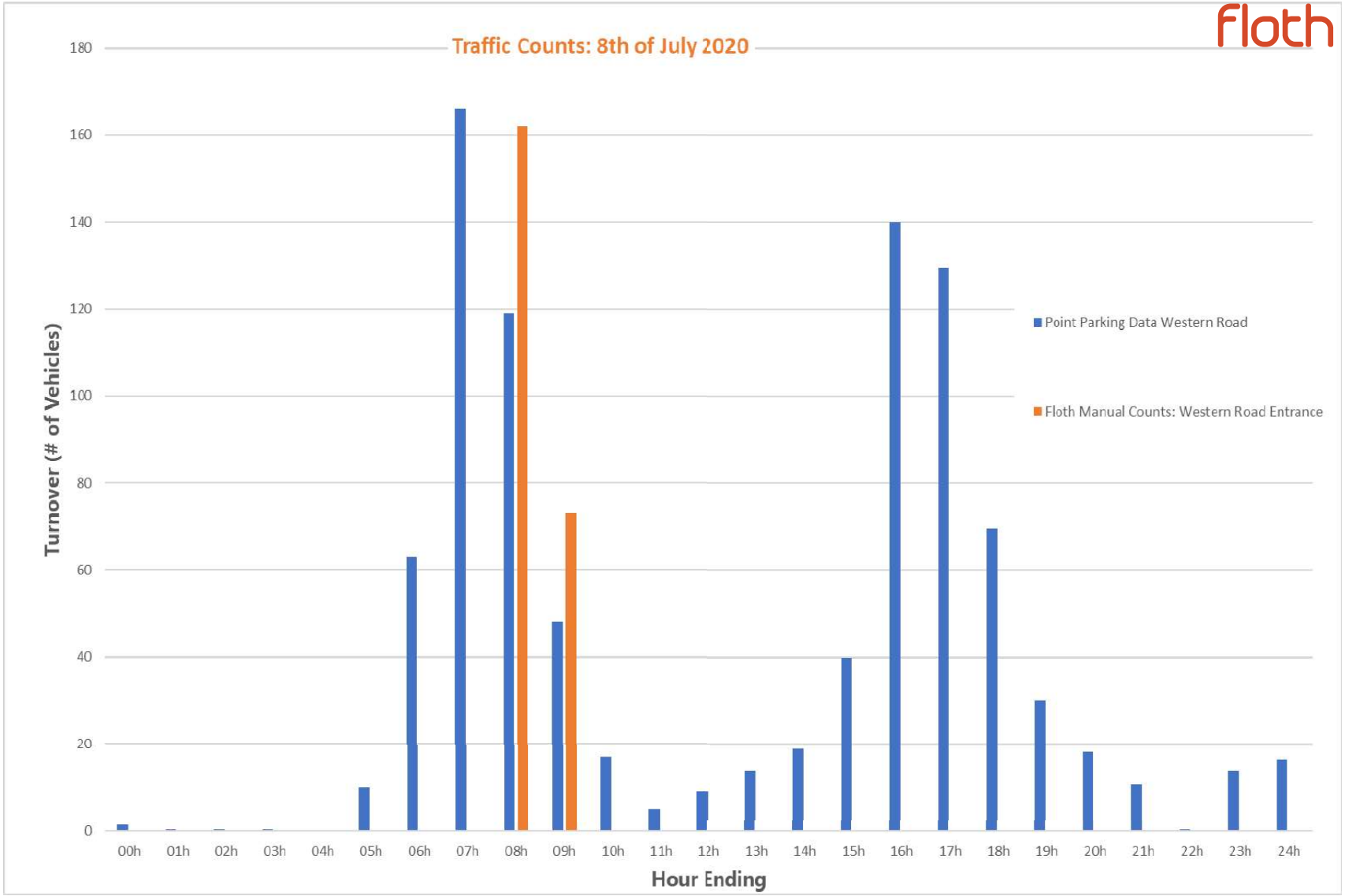
22:00
22:30
23:00
23:30
Time (hh:mm)

Appendix C – Noise Model Screenshots

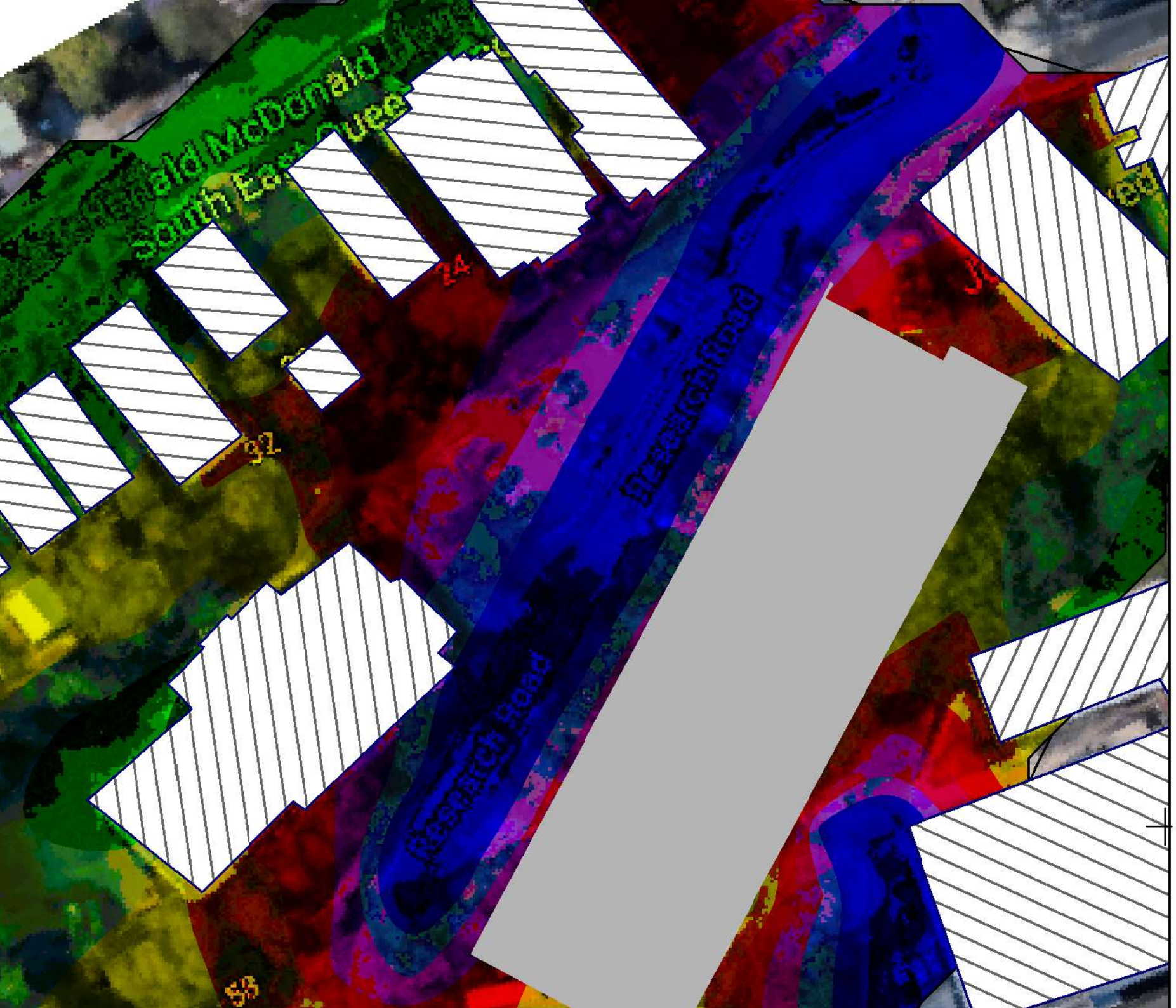


Appendix D – Carpark Movement Custom Time Histograms


Traffic Counts: 6th of July 2020
Turnover (# of Vehicles)
160
140
120
100
80
60
40
20
0
00h
01h
02h
03h
04h
05h
06h
07h
08h
09h
10h
11h
12h
13h
14h
15h
16h
17h
18h
19h
20h
21h
22h
23h
24h
Hour Ending
Point Parking Data - Western Road
Floth Manual Counts: Western Road Entrance


Traffic Counts: 8th of July 2020
floth
Turnover (# of Vehicles)
180
160
140
120
100
80
60
40
20
0
00h
01h
02h
03h
04h
05h
06h
07h
08h
09h
10h
11h
12h
13h
14h
15h
16h
17h
18h
19h
20h
21h
22h
23h
24h
Hour Ending
Point Parking Data Western Road
Floth Manual Counts: Western Road Entrance

Appendix E – Grid Noise Maps



Northern Car Park Acce
Custom Time Histogra
Max LAeq,1hr Day

Calculation at 2 m above ground

fla

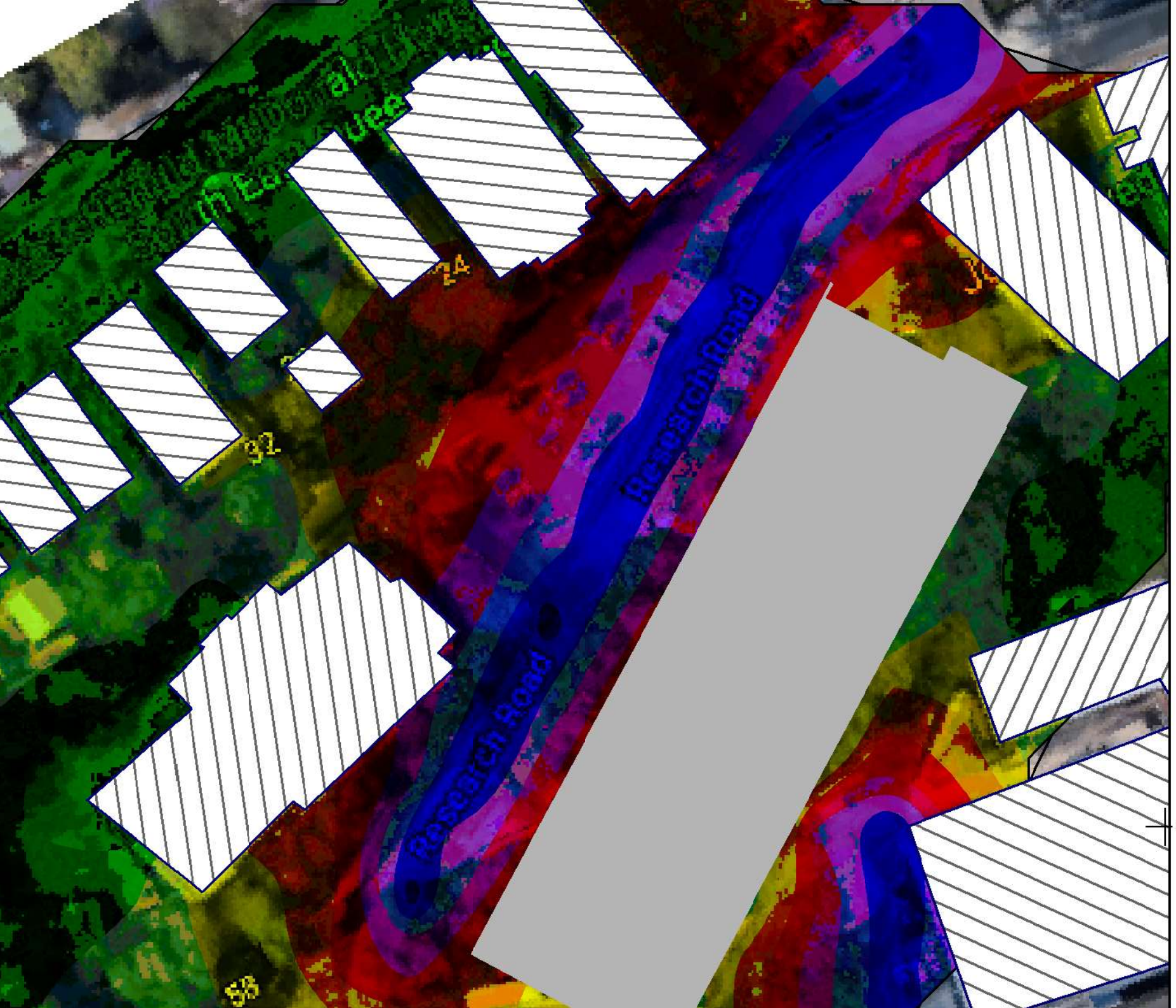
Max LAeq,1hr
in dB(A)

<	45
45 -	48
48 -	51
51 -	54
54 -	57
57 -	60
60 -	63
63 -	66
66 -	69
>=	69

N

Length sc

0 5 10



Northern Car Park Acce
Custom Time Histogra
Max LAeq,1hr Evening

Calculation at 2 m above ground

fla

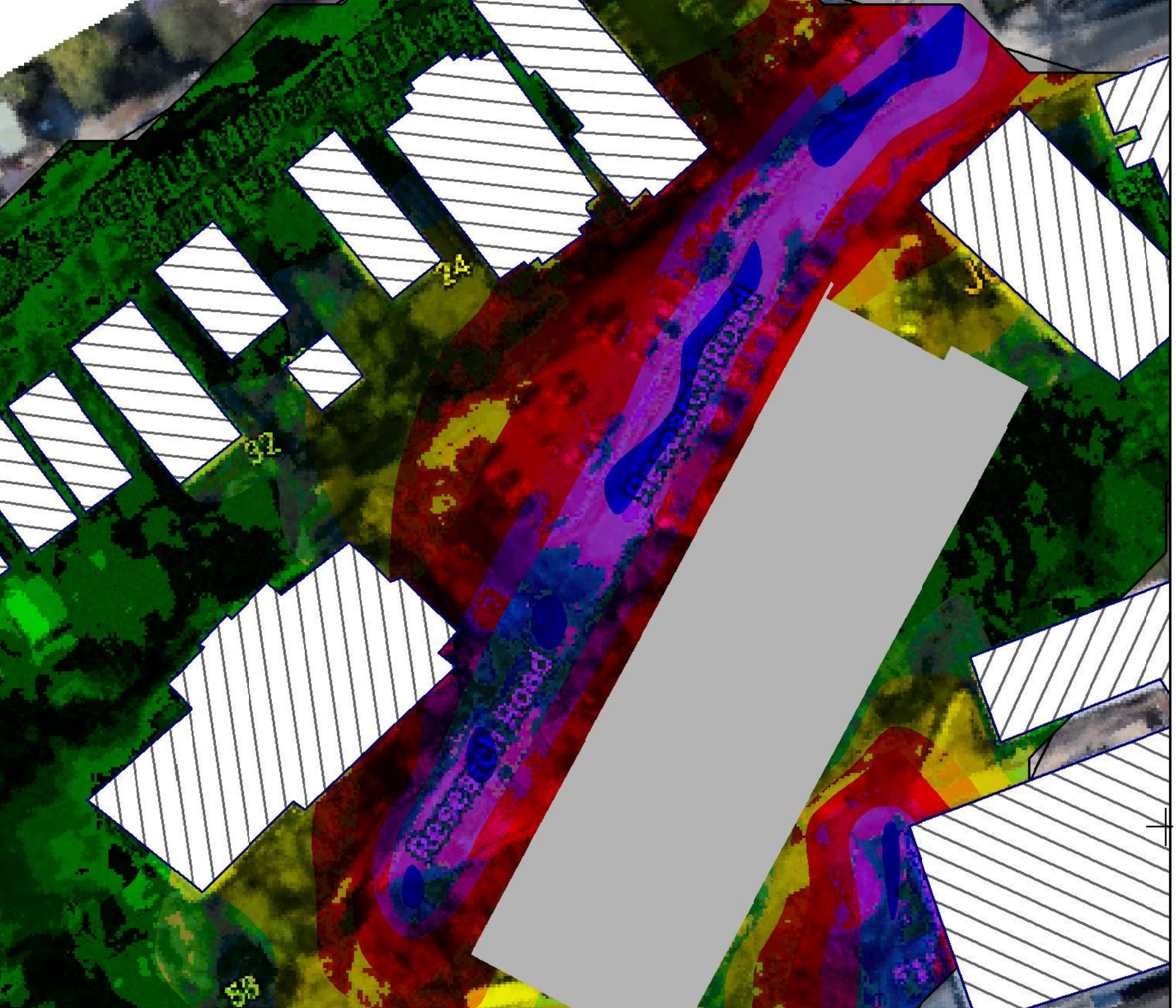
Max LAeq,1hr
in dB(A)

<	45
45 -	48
48 -	51
51 -	54
54 -	57
57 -	60
60 -	63
63 -	66
66 -	69
>=	69

N

Length sc

0 5 10



Northern Car Park Acce
Custom Time Histogra
Max LAeq,1hr Night

Calculation at 2 m above ground

fla

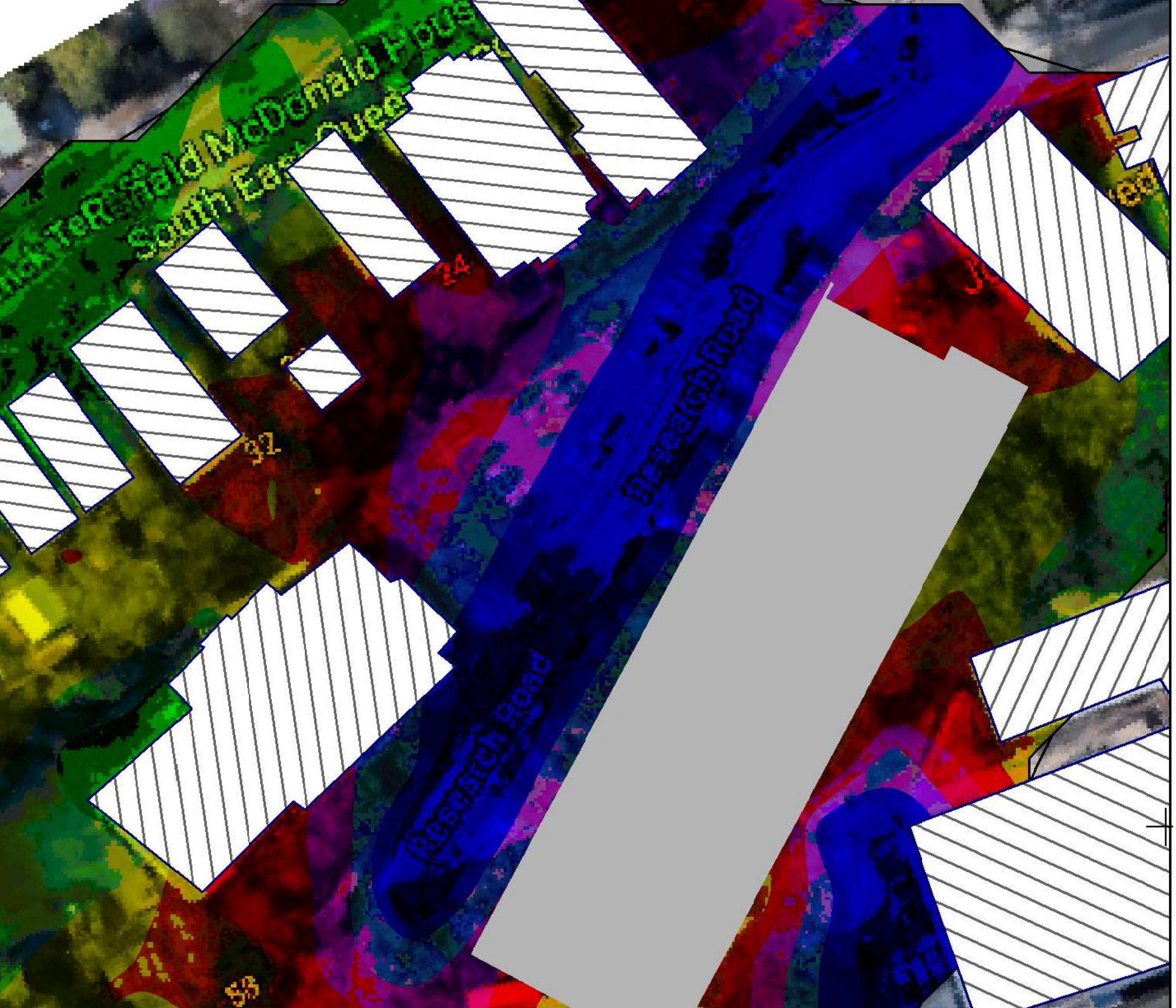
Max LAeq,1hr
in dB(A)

<	45
45 -	48
48 -	51
51 -	54
54 -	57
57 -	60
60 -	63
63 -	66
66 -	69
>=	69

N

Length sc

0 5 10



Northern Car Park Acce
Default Time Histogra
Max LAeq,1hr Daytime

Calculation at 2 m above ground

fla

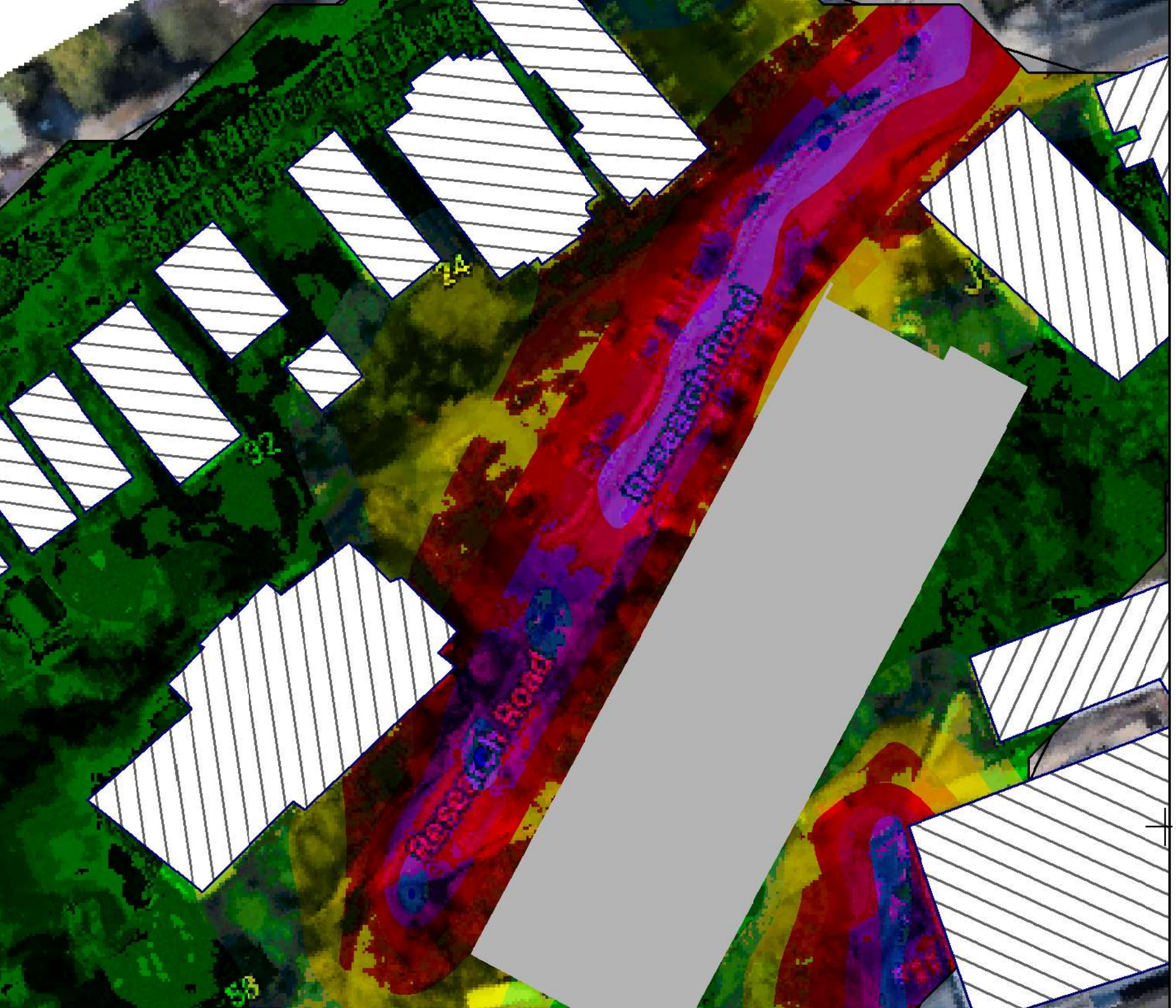
Max LAeq,1hr
in dB(A)

<	45
45 -	48
48 -	51
51 -	54
54 -	57
57 -	60
60 -	63
63 -	66
66 -	69
>=	69

N

Length sc

0 5 10



Northern Car Park Acce
Default Time Histogra
Max LAeq,1hr Night

Calculation at 2 m above ground

fla

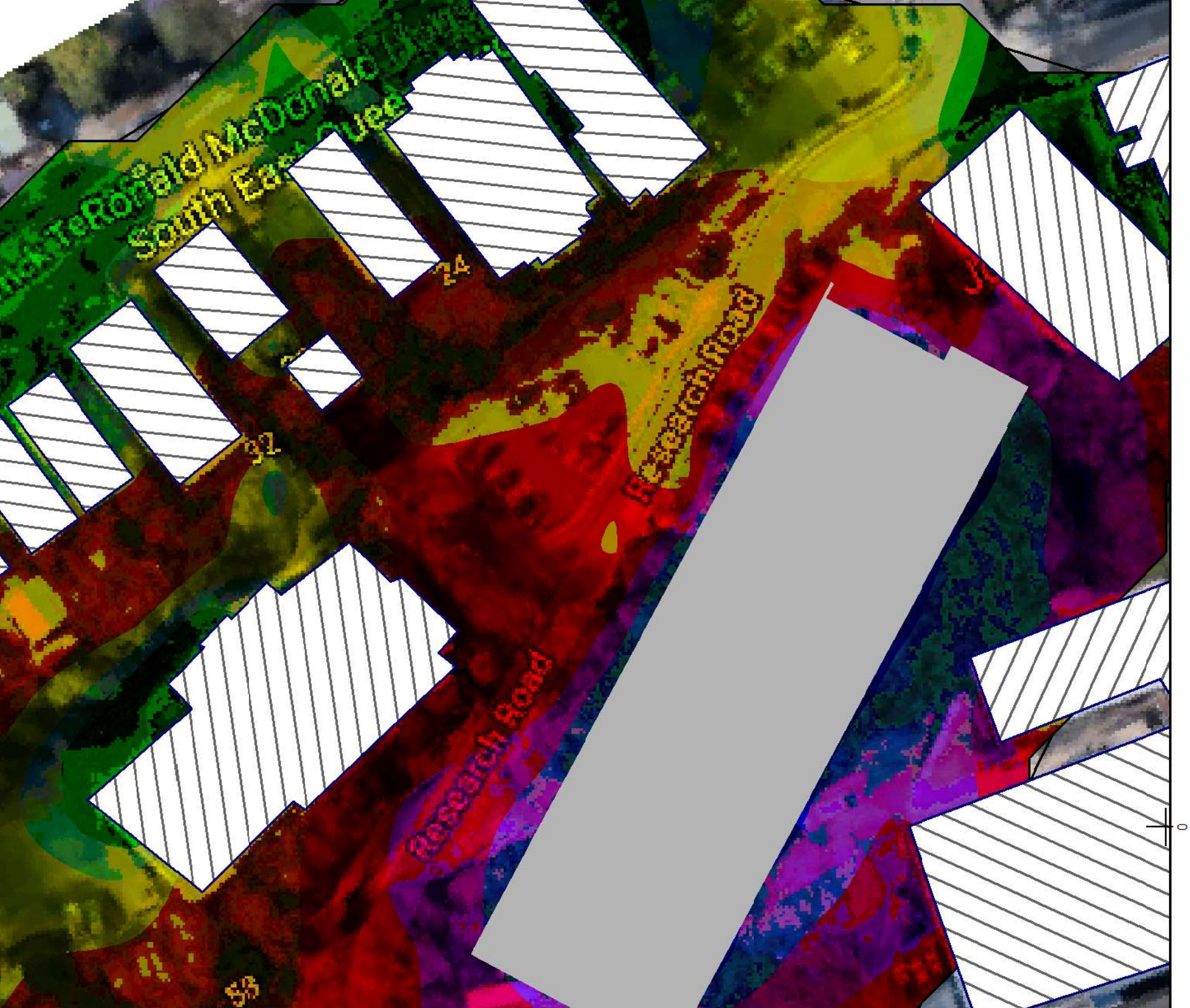
Max LAeq,1hr
in dB(A)

<	45
45	- 48
48	- 51
51	- 54
54	- 57
57	- 60
60	- 63
63	- 66
66	- 69
>=	69

N

Length sc

0 5 10



Northern Car Park
Custom Time Histogra
LAeq,Day Car Park Nois

Calculation at 2 m above ground

fla

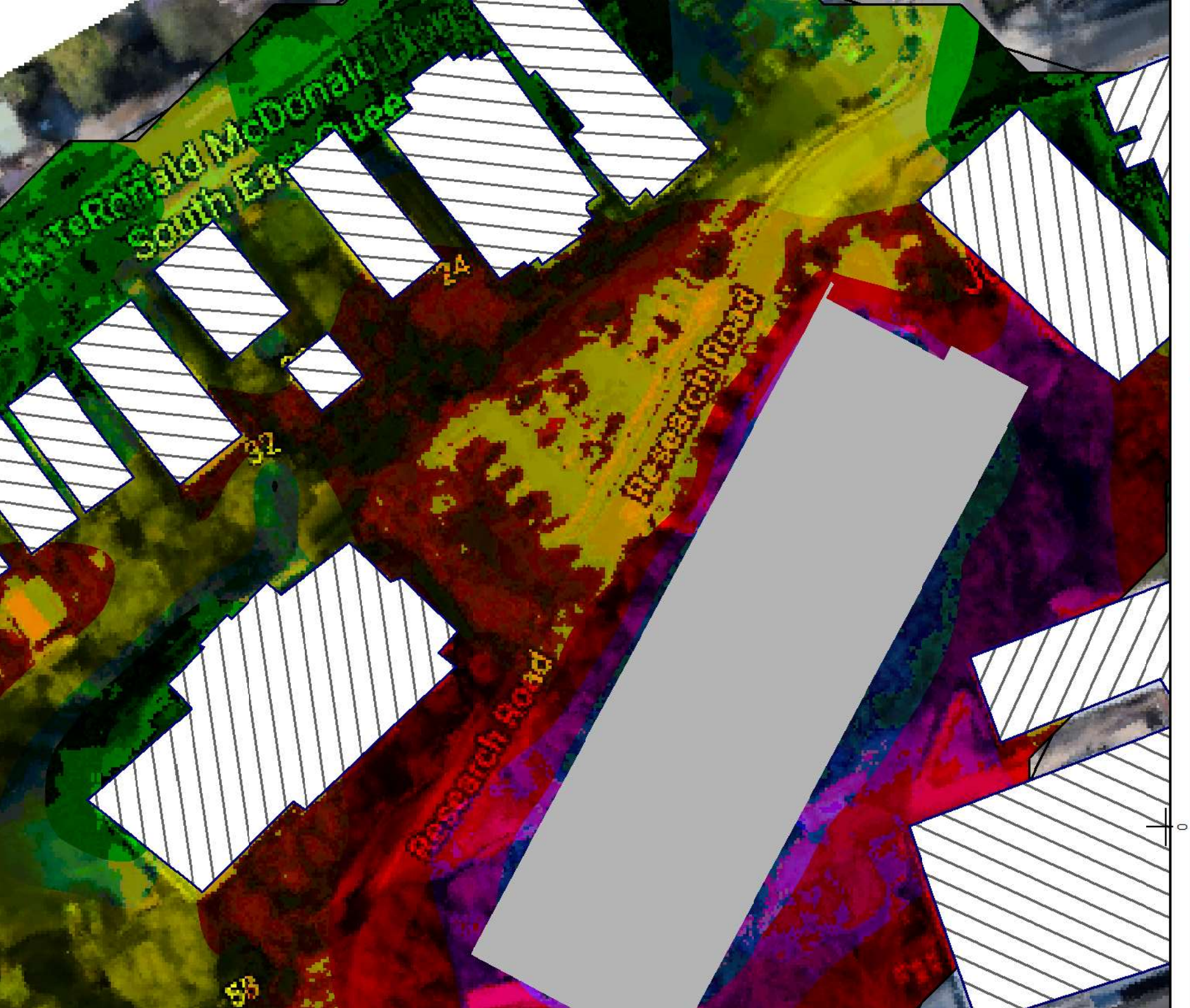
LAeq,Day
in dB(A)

<	25
25	- 28
28	- 31
31	- 34
34	- 37
37	- 40
40	- 43
43	- 46
46	- 49
>=	49

N

Length sc

0 5 10



Northern Car Park
Custom Time Histogra
LAeq,Evening Car Park

Calculation at 2 m above ground

fla

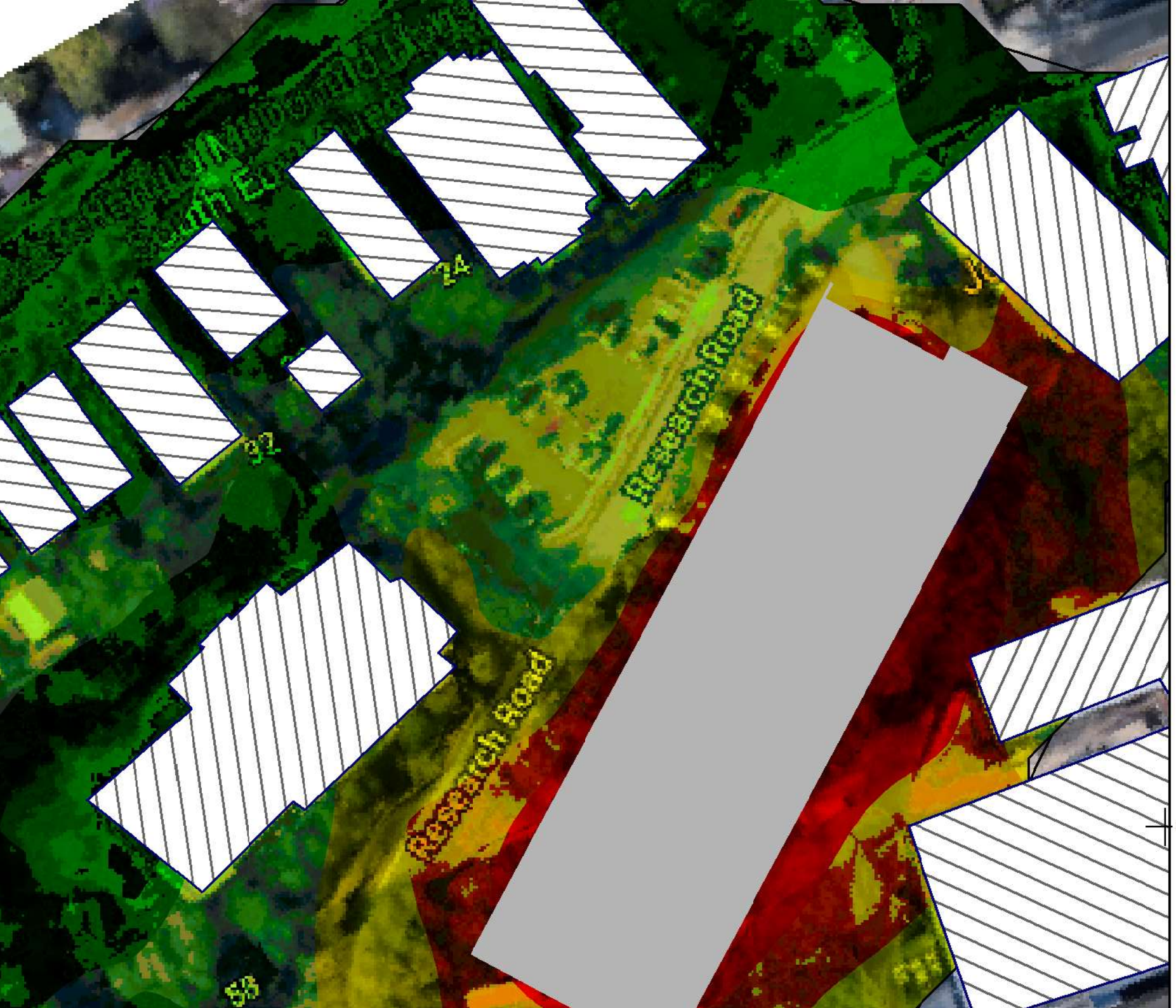
LAeq,Evening
in dB(A)

<	25
25	- 28
28	- 31
31	- 34
34	- 37
37	- 40
40	- 43
43	- 46
46	- 49
>=	49

N

Length sc

0 5 10



Northern Car Park
Custom Time Histogra
LAeq,Night Car Park No

Calculation at 2 m above ground

fla

LAeq,Night
in dB(A)

<	25
25	- 28
28	- 31
31	- 34
34	- 37
37	- 40
40	- 43
43	- 46
46	- 49
>=	49

N

Length sc

0 5 10

floth

floth.com.au

BRISBANE
Level 2
69 Robertson St
Fortitude Valley QLD 4006
+61 7 3513 8000
bne@floth.com.au

SYDNEY
Level 8, Tower A
799 Pacific Hwy
Chatswood NSW 2067
+61 2 9406 4555
syd@floth.com.au

PERTH
Level 6
66 St Georges Tce
Perth WA 6000
+61 8 6162 2396
perth@floth.com.au

MELBOURNE
Suite 13.04, Level 13
470 Collins St
Melbourne VIC 3000
+61 3 9448 8755
mel@floth.com.au

JAKARTA
Wisma Kemang Level 2
JL Kemang Selatan Raya No. 1
Jakarta Selatan 12560, Indonesia
+62 21 781 6326
floth@flothindonesia.com