AECOM Imagine it. Delivered.

SSD Noise and Vibration Impact Assessment
University of Newcastle
20-Feb-2019
Doc No. 60579316-RPNV-01_A

# University of Newcastle - HCCD Stage 1A

## SSD Noise and Vibration Impact Assessment

# University of Newcastle - HCCD Stage 1A

## SSD Noise and Vibration Impact Assessment

Client: University of Newcastle

ABN: 15 736 576 735

Prepared by

**AECOM Australia Pty Ltd**
Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com
ABN 20 093 846 925

20-Feb-2019

Job No.: 60579316

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

# Quality Information

Document University of Newcastle - HCCD Stage 1A

Ref 60579316

Date 20-Feb-2019

Prepared by Laura Keen

Reviewed by Gayle Greer

Revision History

| Rev | Revision Date | Details | Authorised | |
|---|---|---|---|---|
| | | | Name/Position | Signature |
| A | 20-Feb-2019 | Revision A | Joe Mescall | |
| | | | | |
| | | | | |
| | | | | |

# Table of Contents

# 1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been engaged by the University of Newcastle (UoN) to provide a State Significant Design (SSD) Noise and Vibration Impact Assessment Report to support their application for the Honeysuckle City Campus Development (HCCD) Stage 1 Building 1A (Stage 1A) located at 16B Honeysuckle Drive, Newcastle, NSW.

The Honeysuckle City Campus at 16 Honeysuckle Drive comprises three parcels of land with a total area of 20,412 $m^2$. The land identified for HCCD Stage 1A has an area of 8,546 $m^2$ and is described as art Lot 1 DP 1163346.

This Noise and Vibration Impact Assessment has been prepared on behalf of UoN and includes an operational and indicative construction noise and vibration impact assessment. The assessment has been prepared in support of an Environmental Impact Statement (EIS), which has been prepared to assess the environmental impacts associated with the project.

The Secretary's Environmental Assessment Requirements (SEARs) issued on 27 August 2018 states that the EIS must include the following:

> *"…a noise and vibration assessment prepared in accordance with the relevant EPA guidelines. This assessment must detail construction and operation noise impacts on nearby noise sensitive receivers and outline proposed noise mitigation and monitoring procedures"*

Operational noise management levels and vibration criteria have been established using:

- *Noise Policy for Industry* (NPfI), Environment Protection Authority (EPA), 2017
- *State Environment Protection Policy (SEPP) (Infrastructure*), 2007
- *Development Near Rail Corridors and Busy Roads – interim guideline*, Department of Planning, 2008
- *Assessing Vibration: A Technical Guideline* (AVATG), Department of Environment and Conservation (DEC), 2006
- *NSW Road Noise Policy* (RNP), Department of Environment, Climate Change and Water (DECCW), 2011
- *Newcastle Development Control Plan (DCP)*, City of Newcastle, 2012

Construction noise management levels and vibration criteria have been established using:

- *Interim Construction Noise Guideline* (ICNG), Department of Environment and Climate Change (DECC), 2009
- *Assessing Vibration: A Technical Guideline* (AVATG), Department of Environment and Conservation (DEC), 2006
- *NSW Road Noise Policy* (RNP), Department of Environment, Climate Change and Water (DECCW), 2011.

The operational and construction noise and vibration impact assessment is presented in this report along with noise and vibration mitigation treatments and strategies. The scope of the assessment includes:

- Operational noise and vibration
  - Major noise emitting plant
  - Traffic noise generation
  - Design of building envelope to attenuate traffic noise intrusion
  - Patron noise emission from event spaces
  - Recommendations for noise control measure to be incorporated into the architectural and services design strategies

- Construction noise and vibration
  - Noise predictions for construction scenarios
  - Noise impact assessment
  - Recommendations for construction noise control measures to be incorporated into a construction noise management strategy.

## 1.1 Site description

The site is bounded to the north, west and south by Honeysuckle Drive, Worth Place and Wright Lane respectively. It is bounded to the east by 16A Honeysuckle Drive which comprises part of the Honeysuckle City Campus Development.

Land use to the north of the site is predominantly residential with some commercial and tourism. The Honeysuckle Hotel is located beyond this, on the edge of the Hunter River. East of the site is the HCCD with residential, commercial, tourism and Newcastle Museum beyond. South of the site is also the HCCD with low to medium commercial and the NeW Space development on the other side of this. West of the site is predominantly residential and commercial developments.

The site location is shown in Figure 1.

**Figure 1 Site location and noise monitoring locations**


## 1.2 Proposed development

HCCD Stage 1A comprises a new building on the Honeysuckle City Campus to accommodate the UoN School of Creative Industries (SOCI) and an Innovation Hub. These facilities will provide learning studios and flexible spaces for co-working, meetings and informal collaboration. HCCD Stage 1A includes:

- Design and construction of a single standing, multi-storey building on the corner of Worth Place and Honeysuckle Drive

- Space for the use of the Innovation Hub, SOCI and building fit out to make these spaces suitable for their uses
- Associated landscaping and infrastructure works.

## 1.3 Document purpose

This Noise and Vibration Impact Assessment is intended to provide a reference for the policies, guidelines and standards that apply to the treatment and management of operational and construction noise and vibration associated with a large building project.

The Noise and Vibration Impact Assessment also sets out the applicable criteria, standard noise and vibration mitigation measures and monitoring, reporting and complaint management requirements.

# 2.0 Noise Monitoring

Long-term unattended measurements at two locations were undertaken to establish the existing ambient and background noise environment at potentially affected receivers in the vicinity of the proposed HCCD site. AECOM has conducted noise monitoring from Tuesday 8 May 2018 to Thursday 17 May 2018 to establishing existing background noise levels. One noise logger was located within the development boundary at 16 Honeysuckle Drive the other was located at 558 Hunter Street.

## 2.1 Instrumentation

The equipment used for site measurements is detailed below in Table 1.

**Table 1 Environmental noise monitoring equipment**

| Location | Equipment | Serial Number |
|---|---|---|
| 16 Honeysuckle Drive, Newcastle | Rion NL21 | 265112 |
| 558 Hunter Street, Newcastle West | Rion NL21 | 765701 |

Calibration of the meters was checked on site with a Rion NC74 Sound Calibrator (serial number 34283659) at the beginning and end of the measurement periods. No significant drifts in calibration were observed. All the acoustic instrumentation employed during the noise measurements comply with the requirements of AS IEC 61672.1-2004 Electroacoustics - Sound level meters - Specifications and were within their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period (i.e. calibration in the last two years). The noise measurements have been conducted in accordance with AS1055.1 – 1997 “Acoustics – Description and measurement of environmental noise – Part 1: General procedures”.

In accordance with the EPA’s Noise Policy for Industry (NPfI), noise monitoring affected by adverse weather conditions or extraneous noise events was excluded from the monitoring data. The NPfI advises that data may be affected where adverse weather, such as wind speeds higher than five metres per second or rain, occurs. Weather data were acquired from the Bureau of Meteorology’s Williamtown weather station (station ID 061078).

## 2.2 Noise monitoring locations

The first noise logger was located close to the southern end of the development boundary at 16 Honeysuckle Drive, close to Wright Lane and the second was located in the front garden of 558 Hunter Street adjacent to the front fence. The microphones of both loggers were 1.5 m above ground level.

The loggers were set for sample periods of 15 minutes. The loggers measured the noise levels over the sample period and then determined $L_{A10}$, $L_{A90}$, $L_{Amax}$, and $L_{Aeq}$ levels of the noise environment. The $L_{A10}$ and $L_{A90}$ levels are the levels exceeded for 10% and 90% of the sample period respectively. The $L_{Amax}$ is indicative of the maximum noise levels due to individual noise events such as the pass-by of a heavy vehicle. The $L_{A90}$ is taken as the background noise level. The $L_{Aeq}$ level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The background noise level is defined by the EPA as ‘the underlying level of noise present in ambient noise when all unusual extraneous noise is removed’. It can include sounds that are normal features of a location and may include birds, traffic, insects etc. The background noise level is considered to be represented by the $L_{A90}$ descriptor. The noise levels measured at the proposed development site were analysed to determine a single assessment background level (ABL) for each day, evening and night period in accordance with the EPA’s NPfI, for each monitoring location. The ABL is established by determining the lowest ten percentile level of the $L_{A90}$ noise data acquired over each period of interest.

A summary of the measurement data is presented in Table 2. Noise levels are also graphically presented in Appendix B.

**Table 2 Existing background ($L_{A90}$) and ambient ($L_{Aeq}$) noise levels**

| Measurement Date | $L_{A90}$ Background Noise Levels, dB(A) | | | $L_{Aeq}$ Ambient Noise Levels, dB(A) | | |
|---|---|---|---|---|---|---|
| | Day[1] | Evening[1] | Night[1] | Day[1] | Evening[1] | Night[1] |
| **16 Honeysuckle Drive, Newcastle** | | | | | | |
| Tuesday 08 May 2018 | | 45 | 42 | | 54 | 55 |
| Wednesday 09 May 2018 | 50 | 46 | 44 | 66 | 57 | 56 |
| Thursday 10 May 2018 | 50 | 46 | - | 62 | 56 | 0 |
| Friday 11 May 2018 | - | - | - | - | - | - |
| Saturday 12 May 2018 | - | - | - | - | - | - |
| Sunday 13 May 2018 | - | - | - | - | - | - |
| Monday 14 May 2018 | - | 46 | 44 | 0 | 56 | 57 |
| Tuesday 15 May 2018 | 51 | 46 | 43 | 64 | 57 | 56 |
| Wednesday 16 May 2018 | 52 | 46 | 44 | 62 | 58 | 56 |
| Thursday 17 May 2018 | - | | | - | | |
| **RBL/Log Average** | **50** | **46** | **44** | **64** | **56** | **56** |
| **558 Hunter Street, Newcastle West** | | | | | | |
| Tuesday 08 May 2018 | | 45 | 43 | | 58 | 56 |
| Wednesday 09 May 2018 | 50 | 46 | 43 | 63 | 58 | 56 |
| Thursday 10 May 2018 | 49 | 45 | - | 62 | 58 | - |
| Friday 11 May 2018 | - | - | - | - | - | - |
| Saturday 12 May 2018 | - | - | - | - | - | - |
| Sunday 13 May 2018 | - | - | - | - | - | - |
| Monday 14 May 2018 | - | 44 | 42 | 0 | 58 | 56 |
| Tuesday 15 May 2018 | 50 | 43 | 41 | 63 | 57 | 55 |
| Wednesday 16 May 2018 | 51 | 48 | 43 | 62 | 58 | 55 |
| Thursday 17 May 2018 | - | | | - | | |
| **RBL/Log Average** | **50** | **45** | **43** | **63** | **58** | **56** |

*Notes:*

1. *Day is defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays.*
2. *Evening is defined as 6pm to 10pm Monday to Sunday and Public Holidays.*
3. *Night is defined as 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.*

## 2.3 Traffic noise monitoring

Attended measurements of traffic noise were conducted at the proposed HCCD Stage 1A façade on Honeysuckle Drive on 13 February 2019 at 5:15 pm to determine external traffic noise levels for the purposes of façade design. The results of these measurements are presented in Table 3.

**Table 3 Traffic noise levels at HCCD Stage 1A facade**

| | Sound Pressure Level at HCCD Stage 1A Façade, dB | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Octave Band Centre Frequency, Hz | | | | | | | | |
| | 31.5 | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Road Traffic | 40 | 46 | 51 | 52 | 55 | 57 | 55 | 49 | 44 |

# 3.0 Operational Noise Criteria

## 3.1 Environmental noise emission – Noise Policy for Industry

Under the NSW Protection of the Environment (Operations) Act 1997, the Environment Protection Authority (EPA) document Noise Policy for Industry (NPfI) provides guidance in relation to acceptable noise trigger levels for industrial noise emission.

The Department of Planning and Environment has advised that the EPA's NPfI should be used to assess noise emission from developments.

The NPfI provides noise levels for assessing the potential impact of noise from industry and includes a framework for considering feasible and reasonable noise mitigation measures. The NPfI applies to all noise emission from permanent operations fixed facilities for the project. The assessment procedure for industrial noise sources has two components that must be considered:

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

The NPfI provides noise levels for assessing the potential impact of noise from industry and includes a framework for considering feasible and reasonable noise mitigation measures. The NPfI applies to all noise emission from permanent operations fixed facilities for the project. The assessment procedure for industrial noise sources has two components that must be considered:

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

### 3.1.1 Intrusiveness noise impacts

The NPfI states that the intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source ($L_{Aeq}$ level), measured over a 15 minute period, does not exceed the background noise level measured by more than 5 dB. The Rating Background Levels (RBLs) and resultant project intrusiveness noise levels are presented in Table 4.

**Table 4 NPfI recommended $L_{Aeq,15\ minute}$ intrusiveness noise levels from industrial noise sources**

| Location | | Period | RBL ($L_{A90}$), dB(A) | Intrusive Noise Level (RBL+5), dB(A) |
|---|---|---|---|---|
| Residential Receivers | Honeysuckle Drive, Wright Lane and Workshop Way[1] | Day | 50 | 55 |
| | | Evening | 46 | 51 |
| | | Night | 44 | 49 |
| | Hunter Street and King Street[2] | Day | 50 | 55 |
| | | Evening | 45 | 50 |
| | | Night | 43 | 48 |

*Notes:*

1. *Based upon measured noise levels at 16 Honeysuckle Drive, Newcastle*
2. *Based upon measured noise levels at 558 Hunter Street, Newcastle West*
3. *Day is defined as 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays.*
4. *Evening is defined as 6pm to 10pm Monday to Sunday and Public Holidays.*
5. *Night is defined as 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.*

As per the NPfI, intrusiveness noise levels are only applied to residential receivers. For other receivers, only the amenity levels apply.

### 3.1.2 Protecting noise amenity

To limit continuing increases in noise levels, the maximum ambient noise level resulting from all industrial noise sources in an area should not normally exceed the recommended amenity noise levels specified in Table 2.2 of the NPfI. As per the definitions of receiver types within the NPfI, residences are classified as being in urban and suburban areas.

**Table 5 NPfI recommended $L_{Aeq}$ amenity noise levels from industrial sources**

| Type of Receiver | Noise Amenity Area | Time of Day | Recommended Noise Level ($L_{Aeq}$), dB(A) |
|---|---|---|---|
| Residential | Urban | Day | 60 |
| | | Evening | 50 |
| | | Night | 45 |
| Hotel/motel | Urban | Day | 65[1] |
| | | Evening | 55[1] |
| | | Night | 50[1] |
| Commercial Premises | All | When in Use | 65 |

*Notes:*

1. *Recommended amenity noise level is 5 dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day*

The amenity level applicable to the project is equal to the recommended level minus 5 dB(A). The approach of deriving the project amenity noise level resulting from a new development on the basis of the recommended amenity noise level minus 5 dB is based on a receiver not being impacted by more than three to four individual industrial noise sources.

As per the NPfI, the project amenity level is converted to a 15 minute period by adding 3 dB(A).

### 3.1.3 Project noise trigger levels

Table 6 presents the applicable project noise trigger levels.

**Table 6 NPfI project noise trigger levels**

| Type of Receiver | | Time of Day | Intrusive Noise Level (RBL+5) ($L_{Aeq, 15\ minutes}$), dB(A) | Project Amenity Level ($L_{Aeq, 15\ minutes}$), dB(A) | Project Noise Trigger Level ($L_{Aeq\ 15\ minutes}$), dB(A) |
|---|---|---|---|---|---|
| Residential Receivers | Honeysuckle Drive, Wright Lane and Workshop Way | Day | 55 | 58 | 55 |
| | | Evening | 51 | 48 | 48 |
| | | Night | 49 | 43 | 43 |
| | Hunter Street and King Street | Day | 55 | 58 | 55 |
| | | Evening | 50 | 48 | 48 |
| | | Night | 48 | 43 | 43 |
| Hotel/Motel | | Day | - | 63 | 63 |
| | | Evening | - | 53 | 53 |
| | | Night | - | 48 | 48 |
| Commercial Premises | | When in Use | - | 63 | 63 |

Adjustments to the level of noise predicted at the assessment location may be applied in accordance with Fact Sheet C of the NPfI to account for the subjective effects of specific noise characteristics including tonality, low frequency content, intermittency, impulsiveness and duration.

### 3.1.4 Sleep disturbance trigger levels

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

Where night-time noise levels from the proposed development at a residential location exceed the following screening levels, a detailed maximum noise level event assessment should be undertaken:

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

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL and the number of times this happens during the night-time period.

Based on the measured background noise levels during the night, the sleep disturbance trigger levels for the noise sensitive residential receivers are presented in Table 7.

**Table 7 Night-time sleep disturbance trigger levels**

| Type of Receiver | Measured Night Period RBL ($L_{Aeq,\ 15\ minute}$), dB(A) | Sleep Disturbance Screening Trigger Levels | |
|---|---|---|---|
| | | $L_{Aeq,\ 15\ minutes,\ dB(A)}$ | $L_{AFmax,\ dB(A)}$ |
| Residential | 44 | 49 | 59 |

## 3.2 Noise from road traffic generation – Road Noise Policy

Land use developments with the potential to create additional traffic on surrounding roads should be assessed using the EPA's Road Noise Policy (RNP). The external noise criteria are applied at 1 metre from the affected external building façade.

**Table 8 Road traffic noise assessment criteria for existing residences affected by additional traffic**

| Period | Parameter | Criterion |
|---|---|---|
| **Hunter Street (Arterial) and King Street (Sub-Arterial)** | | |
| Day (7am – 10pm) | $L_{Aeq\ (15hr)}$ | 60 dB(A) |
| Night (10pm – 7am) | $L_{Aeq\ (9hr)}$ | 55 dB(A) |
| **Surrounding Local Roads** | | |
| Day (7am – 10pm) | $L_{Aeq\ (1hr)}$ | 55 dB(A) |
| Night (10pm – 7am) | $L_{Aeq\ (1hr)}$ | 50 dB(A) |

In cases where existing traffic noise levels are above the noise assessment criteria, the primary objective is to reduce these through feasible and reasonable measures to meet the assessment criteria. In assessing feasible and reasonable mitigation measures, an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person.

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

## 3.3 Traffic noise intrusion

### 3.3.1 Development Near Rail Corridors and Busy Roads – Interim Guideline

The NSW Department of Planning document Development Near Rail Corridors and Busy Roads – Interim Guideline, presents noise criteria for sensitive receivers. Criteria relevant to the HCCD Stage 1 development are outlined in

**Table 9 Traffic noise intrusion – Development Near Rail Corridors and Busy Roads – Interim Guideline**

| Type of Occupancy | Noise Criteria, dB(A) |
|---|---|
| Educational Institutions | 40 |

### 3.3.2 Australian and New Zealand Standard AS/NZS 2107:2016

Australian and New Zealand Standard AS/NZS 2107:2016 *Acoustics – Recommended design levels and reverberation times for building interiors* recommends internal noise levels for building interiors based on room designation and location of the development with respect to external noise sources. Internal noise levels should not exceed the levels recommended in this standard. Internal noise levels will consist of both traffic noise intrusion and noise from air conditioning and mechanical ventilation plant. To allow equal contribution from both sources, traffic noise intrusion levels should be 3 dB below the levels presented in AS 2107:2016.

**Table 10 Traffic noise intrusion – AS/NZS 2107:2016**

| Type of Occupancy / Activity | Design Sound Level ($L_{Aeq}$), dB(A) | Traffic Noise Intrusion Criteria ($L_{Aeq}$), dB(A) |
|---|---|---|
| Meeting Rooms | 40 to 45 | 37 to 42 |
| Audio-Visual Areas | 35 to 45 | 32 to 42 |
| Film or Television Studios | 25 to 30 | 22 to 27 |
| Teaching Spaces | 35 to 45 | 32 to 42 |
| Office Areas` | 40 to 45 | 37 to 42 |

# 4.0 Construction Noise

Construction of the proposed development has the potential to temporarily contribute to the existing external noise environment. Noise is expected to be generated by construction works as well as construction traffic movements. This section will establish management levels in order to address the following acoustical issues:

- Construction noise and vibration impacts
- Construction road traffic impacts.

## 4.1 Construction noise management levels

The risk of adverse impact of construction noise on a community is determined by the extent of its emergence above the existing background noise level, the duration of the event and the characteristics of the noise.

The Interim Construction Noise Guideline (ICNG) is a NSW Government document that sets out ways to deal with the impacts of construction noise on residences and other sensitive land uses. It presents assessment approaches tailored to the scale of the construction project and identifies practices to minimise noise impacts. The ICNG recommends that a quantitative assessment is carried out for all major construction proposals that are typically subject to the environmental impact assessment processes. A quantitative assessment, based on the likely construction scenarios, has been carried out for the project.

Predicted noise levels at nearby noise sensitive receivers (eg residences, schools, hospitals, places of worship, passive and active recreation areas) are compared to the levels provided in the ICNG. Where an exceedance of the management levels is predicted the ICNG advises that receivers can be considered 'noise affected' and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially impacted residents of the nature of the works to be carried out, the expected noise level and duration, as well as contact details.

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

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

*Feasible*

> *A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements.*

*Reasonable*

> *Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.*

The construction noise management levels (NMLs) for the residential and other sensitive land uses in proximity to the site are detailed below.

### 4.1.1 Residential receivers

Guidance for setting construction noise management levels for residential receivers are summarised in Table 11.

**Table 11 Construction noise management levels – residential receivers**

| Time of Day | NML, $L_{Aeq,15min}$, dB(A)[1] | How to Apply |
|---|---|---|
| **Recommended standard hours[2]:**<br>Monday to Friday 7 am to 6 pm<br>Saturday 8 am to 1 pm<br><br>No work on Sundays or public holidays | Noise affected RBL + 10 dB | The noise affected level represents the point above which there may be some community reaction to noise.<br>• Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>• The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly noise affected<br>75 dB(A) | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br>• Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:<br>1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences<br>2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |
| **Outside recommended standard hours** | Noise affected RBL + 5 dB | • A strong justification would typically be required for works outside the recommended standard hours.<br>• The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>• Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.<br>• For guidance on negotiating agreements see section 7.2.2 (ICNG). |

*Notes:*

1. *Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.*
2. *As noted Standard construction hours are Monday to Friday 7 am to 6 pm and Saturday 8 am to 1 pm*

The above guidance has been utilised to define NMLs applicable to residences adjacent to the development. The project specific NML's are summarised in Table 12.

**Table 12 Construction noise management levels – Residential receivers**

| Residential receivers location | Recommended Standard Hours RBL | Recommended Standard Hours Noise Management Levels $L_{Aeq}$ dB(A) | Highly Noise Affected Level $L_{Aeq}$ dB(A) |
|---|---|---|---|
| Honeysuckle development precinct | 50 | 60 | 75 |

### 4.1.2 Other sensitive land uses and commercial receiver noise management levels

Noise management levels for non-residential receivers located adjacent to the site have been determined using the recommended levels in the ICNG for other sensitive land uses and commercial buildings. The NMLs are presented in Table 13.

**Table 13 Noise at sensitive land uses (other than residences) and commercial buildings**

| Land Use | External noise levels, $L_{Aeq,15min}$ (applies when properties are in use) |
|---|---|
| Educational institutions | 65 dB(A)[1] |
| Theatre | 60 dB(A)[1] |
| Museum | 65 dB(A)[1] |
| Commercial Premises (including cafes, bars, restaurants and retail stores) | 70 dB(A) |

*Notes:*

1. *Assumes an external to internal noise level reduction through a close window of 20 dB(A)*

## 4.2 Construction traffic noise

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

To assess noise impacts from construction traffic, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A). Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. However, where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criterion then noise mitigation should be considered for those receivers affected. An increase of up to 2 dB(A) represents a minor impact that is considered barely perceptible to the average person.

The RNP does not require assessment of noise impact to commercial or industrial receivers.

# 5.0 Vibration Criteria

Vibration, at levels high enough, has the potential to cause damage to structures and disrupt human comfort. Vibration and its associated effects are usually classified as continuous, impulsive or intermittent as follows:

- continuous vibration continues uninterrupted for a defined period and includes sources such as machinery and continuous construction activities
- impulsive vibration is a rapid build up to a peak followed by a damped decay. It may consist of several cycles at around the same amplitude, with durations of typically less than two seconds and no more than three occurrences in an assessment period. This may include occasional dropping of heavy equipment or loading activities
- intermittent vibration occurs where there are interrupted periods of continuous vibration, repeated periods of impulsive vibration or continuous vibration that varies significantly in magnitude. This may include intermittent construction activity, impact pile driving, jack hammers.

The relevant standards and guidelines for the assessment of construction vibration are summarised in Table 14.

**Table 14 Standards/guidelines used for assessing construction vibration**

| Item | Standard/guideline |
|---|---|
| Structural damage | German Standard DIN 4150 – Part 3 – Structural Vibration in Buildings – Effects on Structures (DIN 4150) |
| Human comfort (tactile vibration) | Assessing Vibration: A Technical Guideline (AVATG)[1] |

*Notes:*

1. *This document is based upon the guidelines contained in British Standard 6472:1992, "Evaluation of human exposure to vibration in buildings (1-80 Hz)". This British Standard was superseded in 2008 with BS 6472-1:2008 "Guide to evaluation of human exposure to vibration in buildings – Part 1: Vibration sources other than blasting" and the 1992 version of the Standard was withdrawn. However the Environment Protection Authority still requires vibration to be assessed in accordance with the 1992 version of the Standard at this point in time.*

### 5.1.1 Structural damage

At present, no Australian Standards exist for the assessment of building damage caused by vibration. The German Standard (DIN 4150) provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are presented in Table 15. DIN 4150 states that buildings exposed to higher levels of vibration than recommended limits would not necessarily result in damage. In this assessment of DIN 4150 structural damage safe limits have been adopted for residential, non-residential and heritage structures.

**Table 15 Structural damage safe limits (DIN 4150) for building vibration (Vibration peak particle velocity)**

| Group | Type of structure | At foundation – Less than 10 Hz | At foundation – 10 Hz to 50 Hz | At foundation – 50 Hz to 100 Hz[1] | Vibration at the horizontal plane of the highest floor for all frequencies |
|---|---|---|---|---|---|
| 1 | Buildings used for commercial purposes, industrial buildings and buildings of similar design | 20 mm/s | 20 to 40 mm/s | 40 to 50 mm/s | 40 mm/s |
| 2 | Dwellings and buildings of similar design and/or use | 5 mm/s | 5 to 15 mm/s | 15 to 20 mm/s | 15 mm/s |
| 3 | Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order/heritage listed) | 3 mm/s | 3 to 8 mm/s | 8 to 10 mm/s | 8 mm/s |

*Notes:*

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

### 5.1.2 Human comfort

The assessment of intermittent vibration outlined in the NSW EPA guideline A*ssessing Vibration: A Technical Guideline* (AVTG) is based on Vibration Dose Values (VDVs). The VDV accumulates the vibration energy received over the daytime and night-time periods.

Maximum and preferred VDVs for intermittent vibration arising from construction activities are listed in Table 16. The VDV criteria are based on the likelihood that a person would comment adversely on the level of vibration over the entire assessment period.

**Table 16 Preferred and maximum vibration dose values for intermittent vibration (m/s$^{1.75}$)**

| Location | Daytime (7am – 10pm) | | Night-time (10pm – 7am) | |
|---|---|---|---|---|
| | Preferred | Maximum | Preferred | Maximum |
| Critical areas[1] | 0.1 | 0.2 | 0.1 | 0.2 |
| Residences | 0.2 | 0.4 | 0.13 | 0.26 |
| Offices, schools, educational institutions and places of worship | 0.4 | 0.8 | 0.4 | 0.8 |
| Workshops[2] | 0.8 | 1.6 | 0.8 | 1.6 |

*Notes:*

1. *Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. Places where sensitive equipment is stored or delicate tasks are undertaken require more stringent criteria than the residential criteria specified above*

*2. Examples include automotive repair shops, manufacturing or recycling facilities. This includes places where manufacturing, recycling or repair activities are undertaken but do not require sensitive or delicate tasks.*

# 6.0 Operational Noise Impact Assessment

The operational noise assessment, including assessment of noise emission and noise intrusion, is detailed in this section of the report with regard to the established criteria presented in Section 3.0. The acoustic assessment is based on the architectural drawings issued by EJE Architecture detailed below:

11749-SD-A-000 Rev B 18/01/2019
11749-SD-A-011 Rev B 18/01/2019
11749-SD-A-100 Rev M 18/01/2019
11749-SD-A-100A Rev F 18/01/2019
11749-SD-A-101 Rev L 18/01/2019
11749-SD-A-102 Rev L 18/01/2019
11749-SD-A-102 Rev L 18/01/2019
11749-SD-A-103 Rev L 18/01/2019
11749-SD-A-104 Rev E 18/01/2019
11749-SD-A-107 Rev B 18/01/2019
11749-SD-A-200 Rev F 18/01/2019
11749-SD-A-201 Rev F 18/01/2019
11749-SD-A-202 Rev F 18/01/2019
11749-SD-A-203 Rev F 18/01/2019
11749-SD-A-330 Rev A 12/12/2018

## 6.1 Building services noise emission assessment

### 6.1.1 Equipment selections and noise levels

Proposed major plant items and indicative associated sound power levels are provided in Table 17.

**Table 17 Major plant items and associated sound power levels**

| Location | Plant Item | Sound Power Level (per unit), dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Octave Band Centre Frequency, Hz | | | | | | | |
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Mezzanine Plant Room | AHU (4 units) | 79 | 79 | 79 | 75 | 74 | 71 | 68 | - |
| Level 1 Plant Room | AHU (4 units) | 79 | 79 | 79 | 75 | 74 | 71 | 68 | - |
| Level 2 Plant Room | AHU (4 units) | 79 | 79 | 79 | 75 | 74 | 71 | 68 | - |
| Plant Level (External) | Cooling Tower – 100% (2 units)[1] | 102 | 98 | 93 | 89 | 87 | 82 | 79 | 74 |
| | Cooling Tower – 75% (2 units)[1] | 94 | 90 | 85 | 82 | 79 | 74 | 72 | 67 |
| | Cooling Tower – 48% (2 units)[1] | 84 | 80 | 75 | 71 | 69 | 64 | 62 | 59 |
| Plant Level (Plant Room) | Chiller | 69 | 84 | 80 | 78 | 82 | 76 | 77 | 76 |
| | Chilled Water Pump[2,3] | 78 dB(A) | | | | | | | |
| | Condenser Water Pump[2,3] | 78 dB(A) | | | | | | | |
| | Heating Water Pumps (2 units)[3] | 65dB(A) | | | | | | | |
| | AHU (4 units) | 79 | 79 | 79 | 75 | 74 | 71 | 68 | - |
| | Fans (3 units) | 80 | 74 | 80 | 73 | 77 | 74 | 74 | - |

*Notes:*

1. *The cooling towers will operate at a reduced capacity of 75% and 48% for the evening (6pm - 10pm) and night (10pm to 7am) respectively*
2. *Additional stand-by pumps will be provided, however only one chilled water and one condenser pump will operate at any one time*

*3. Either chilled water and condenser water pumps or the heating water pumps will operate. Not all pumps will operate simultaneously*

### 6.1.2 Acoustic treatments

In order for plant noise emission to meet the applicable project noise trigger levels presented in Section 3.1, the following acoustic treatments will be incorporated into the HCCD Stage 1 design:

- Acoustic louvres to the following plant rooms:
  - Mezzanine plant room (maximum 12 $m^2$ louvred area)
  - Level 1 plant room (maximum 12 $m^2$ louvred area)
  - Level 2 plant room (maximum 12 $m^2$ louvred area)
  - Rooftop chiller plant room (maximum 6 $m^2$ louvred area)
  - Rooftop AHU plant room (maximum 12 $m^2$ louvred area)

  Acoustic louvres are meet the minimum transmission loss presented in Table 18
- External walls (with exception of louvred area) to be of masonry construction for the following plant rooms:
  - Mezzanine plant room
  - Level 1 plant room
  - Level 2 plant room
- External walls (with exception of louvred area) to be of minimum $R_w$ 35 construction for the following plant rooms:
  - Rooftop chiller plant room
  - Rooftop AHU plant room
- Chiller and AHU plant room roofs to be of minimum 0.55 mm metal deck roof construction (minimum surface density 5.5 kg/$m^2$).

**Table 18 Minim acoustic louvre transmission loss**

| Louvre location | Indicative Length, mm | Transmission Loss, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Octave Band Centre Frequency, Hz | | | | | | | |
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Plant room | 300 | 4 | 7 | 9 | 13 | 14 | 12 | 12 | 8 |

### 6.1.3 Plant noise emission

Noise emission from the proposed plant has been calculated at the most affected receivers as follows:

- 10 Worth Place (mixed use including residential)
- 19A Honeysuckle Drive (mixed use including residential).

It is considered that compliance with the project noise trigger levels at these residential receivers will result in compliance at both residential receivers and receivers of different usages (with less stringent trigger levels) and further from HCCD Stage 1A.

**Table 19 Predicted plant noise emission**

| Receiver | Time of Day | Project Noise Trigger Level ($L_{Aeq}$), dB(A) | Predicted HCCD Stage 1A Plant Noise Level at Receiver, dB(A) |
|---|---|---|---|

| Receiver | Time of Day | Project Noise Trigger Level ($L_{Aeq}$), dB(A) | Predicted HCCD Stage 1A Plant Noise Level at Receiver, dB(A) |
|---|---|---|---|
| 10 Worth Place | Day | 55 | 53 |
| | Evening | 51 | 46 |
| | Night | 48 | 41 |
| 19A Honeysuckle Drive | Day | 55 | 53 |
| | Evening | 51 | 47 |
| | Night | 48 | 42 |

The predicted plant noise emission levels meet the project noise trigger levels for all periods.

## 6.2 Event space noise emission assessment

Generally the flexible event space and entry foyer will comprise the main thoroughfare and circulation space on the ground floor. These areas are expected to be heavily trafficked with people entering the building and accessing the other floors of the building. However, on occasion it will be utilised to host events for a larger number of attendees.

There are operable doors located on the northern façade allowing the flexible event space to become a seamless indoor-outdoor venue.

The following scenario is considered to be representative of the most noise intensive use of the space:

- Total 150 attendees
- One third of attendees (50 attendees) speaking in a raised voice
- Day time (7 am to 6 pm):
  - Half of the attendees (75 attendees) located in external areas
  - Operable doors open
- Evening (6 pm to 10 pm)
  - Half of the attendees (75 attendees located in external areas
  - Operable doors partially closed (up to 10 $m^2$ may remain open to allow attendee access inside to outside)
- Night time (10 pm to 7 am)
  - All attendees located in inside
  - Operable doors fully closed
- Amplified music to be limited to internal areas with the operable doors fully closed.

The above scenarios will result in compliance with the project noise trigger levels presented in Section 3.1.

## 6.3 Traffic generation noise assessment

SECA Solution Pty Ltd (SECA Solution) have prepared a Parking and Traffic Assessment Report P01069. Existing traffic flows are established in this report along with predicted traffic generation for the HCCD Stage 1A development. The report states:

> *"The proposed development will generate minimal additional vehicle traffic however will see an increase in demand for cycling facilities and public transport use…….The vehicle*

*demands associated with HCCD Stage 1A are primarily related to servicing for the site with some demands for the pick up and drop off of people as well as for those staff and students requiring accessible parking"*

Any changes in road traffic noise on surrounding streets, occurring as a result of the HCCD Stage 1A development, is predicted to be under the 2 dB allowable increase due to the minimal traffic generation.

## 6.4 Noise intrusion assessment and acoustic façade design

Both road and light rail traffic will result in noise intrusion into the HCCD Stage 1A development. The façade of HCCD Stage 1A should be designed to attenuate traffic noise intrusion to meet the criteria presented in Section 3.3.

External design noise levels used to determine the required façade acoustic performance are presented in Table 20. These nose levels have been established based upon the GHD document *Newcastle Light Rail – Technical Paper 2 – Noise and Vibration Assessment* (2016) and attended measurements conducted on site by AECOM.

**Table 20 Sound pressure levels at HCCD Stage 1A facade**

| | Sound Pressure Level at HCCD Stage 1A Façade, dB | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Octave Band Centre Frequency, Hz | | | | | | | | |
| | 31.5 | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Light Rail[1] | 40 | 43 | 49 | 44 | 50 | 42 | 38 | 32 | 27 |
| Road Traffic[2] | 40 | 46 | 51 | 52 | 55 | 57 | 55 | 49 | 44 |

*Notes:*

1. *CAF Urbos 3 LRV measured on Inner West Light Rail extracted from the TfNSW Rail Noise Database and normalised for speed, distance and train length using the NMT method and adjusted based upon overall predicted level of 49 dB(A) as presented in Appendix D – Operational Noise Contours of Newcastle Light Rail – Technical Paper 2 – Noise and Vibration Assessment (GHD 2016)*
2. *Attended road traffic noise measurement spectrum 13 February 2019, 5:15 pm.*

It is expected that the façade will be constructed of double glazing consisting of 2 layers of 6 mm glass separated by a 12 mm air gap for thermal purposes. This is sufficient to meet the internal design sound levels presented in Section 3.3 for most areas of HCCD Stage 1A with the exception of highly noise sensitive spaces, such as studios and edit suites.

The majority of the sensitive spaces are intended to be located away from the facade with buffer zones separating these spaces from the façade. However, the Level 2 Studio is locate on the façade. The Level 2 Studio façade glazing will be required to have a minimum transmission loss as provided in Table 21.

**Table 21 Façade transmission losses**

| Location | Indicative Construction | Glazing Transmission Loss, dB | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Octave Band Centre Frequency, Hz | | | | | | |
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k |
| General | 6 mm glass/12 mm air gap/6 mm glass | 18 | 21 | 21 | 33 | 37 | 36 | 41 |
| Level 2 Studio | 6 mm glass / 12 mm air gap / 10.38 mm laminated glass | 23 | 23 | 29 | 37 | 41 | 40 | 47 |

## 6.5 Newcastle light rail vibration impacts

The proposed HCCD Stage 1A development is located more than 50 metres from the Newcastle Light Rail line. The Newcastle Light Rail Environmental Impact Statement has provided predictions on

vibration generated by the project. This document identifies that at distances greater than 25 metres vibration levels would be below 0.05 mm/s (RMS), a criteria used for critical working spaces. This vibration level would not generally be discernible and would be compliant for general use of the space.

It is understood that HCCD Stage 1A may include studios which may have more stringent vibration transmission and associated ground-borne noise requirements. This should be investigated further when more is understood about the proposed building structure and room layout during the detailed design phase of the project.

# 7.0 Construction Noise Impact Assessment

An indicative construction noise and vibration impact assessment has been completed for the HCCD. Whilst the HCCD Stage 1A is likely to be completed in multiple stages the assessment has considered a worst case scenario for the three most noise and vibration intensive stages.

## 7.1 Construction noise

This construction noise and vibration assessment is based on typical construction scenario for this type of development.

### 7.1.1 Construction phases and sources

The construction scenarios that have been assessed are detailed below:

1) Site establishment and enabling works
2) Foundations
3) Frame and facade.

The equipment and associated sound powers for the scenarios are shown in Table 22.

**Table 22 Construction phases and equipment**

| Phase | Equipment / Activity | Percentage time on | 'A' Weighted SWL dB(A) |
|---|---|---|---|
| Site establishment and enabling works | Large excavator | 100 | 98 |
| | Vibratory roller | 100 | 103 |
| | Backhoe | 100 | 102 |
| | Grader | 100 | 109 |
| | Water Cart | 100 | 100 |
| | Dump Truck | 100 | 95 |
| | **Overall** | **-** | **111** |
| Foundations | Crane | 100 | 106 |
| | Piling Rig | 100 | 103 |
| | Large excavator | 100 | 98 |
| | Pneumatic jackhammer | 33 | 111 |
| | Concrete truck | 100 | 106 |
| | Concrete pump | 100 | 106 |
| | Large truck | 100 | 108 |
| | **Overall** | **-** | **114** |
| Frame & facade | Concrete truck | 100 | 106 |
| | Concrete pump | 100 | 106 |
| | Crane | 100 | 106 |
| | General hand tools | 100 | 94 |
| | Large truck | 100 | 108 |
| | **Overall** | **-** | **113** |

Construction is scheduled to be undertaken during recommended standard hours only. As such the impacts of construction activities on sleep disturbance do not need to be assessed. Sound power

levels were obtained from published datasets in AS2436:2010 “Guide to noise and vibration control on construction, demolition and maintenance sites”, the UK Department for Environmental, Food and Rural Affairs (DEFRA) and AECOM’s database.

### 7.1.2 Modelling and conditions

Modelling of the proposed construction scenarios has been performed using SoundPLAN 8.0. Neutral weather conditions were applied.

It can be expected that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant in operation during the measurement and also the location of the plant equipment. The acoustic shielding calculated in the model due to localised fixed building structures will also vary as the construction equipment moves around the site.

### 7.1.3 Results

Table 23 presents properties where the NMLs are exceeded. Construction noise contours are presented in Appendix C.

**Table 23 NML Exceedances**

| Receiver | | Noise Management Level, dB(A) | NML Exceedance |
|---|---|---|---|
| **Site establishment and enabling works** | | | |
| 2-4 Honeysuckle Drive | Mixed Use[1] | 60 | 1-5 dB(A) |
| 14 Honeysuckle Drive | Mixed Use[1] | 60 | 1-5 dB(A) |
| 17 Honeysuckle Drive | Mixed Use[1] | 60 | >75 dB(A) Highly Affected |
| 19A Honeysuckle Drive | Residential | 60 | 6-15 dB(A) |
| 10 Worth Place | Mixed Use[1] | 60 | >75 dB(A) Highly Affected |
| **Foundation** | | | |
| 17 Honeysuckle Drive | Mixed Use[1] | 60 | 1-5 dB(A) |
| 19A Honeysuckle Drive | Residential | 60 | 1-5 dB(A) |
| 10 Worth Place | Mixed Use[1] | 60 | 6-15 dB(A) |
| **Frame and Facade** | | | |
| 17 Honeysuckle Drive | Mixed Use[1] | 60 | 1-5 dB(A) |
| 19A Honeysuckle Drive | Residential | 60 | 1-5 dB(A) |
| 10 Worth Place | Mixed Use[1] | 60 | 6-15 dB(A) |

*Notes:*

*1. Mixed use including residential*

In general it can be seen that the construction phases and activities are expected to exceed the noise management levels at various times during the HCCD Stage 1A construction. Noise from the site establishment and enabling works phase is the most noise intensive due to the use of large plant and nature of the activities. Noise from construction activities are less noise intensive and will affect fewer locations. There are still, however, expected exceedances of NMLs at some locations.

It is expected that careful selection of well-maintained and quiet plant will result in some noise reduction. Provision of a site-perimeter noise barrier will have minimal effect on construction noise emission due to the relative height of the affected buildings.

The site establishment, excavation, substructure and frame phases are expected to exceed the highly noise affected level of 75 dB(A) at up to two residential properties. As such it is recommended that respite periods are considered for the affected community.

## 7.2 Construction vibration

Vibration-intensive works may include the use of the following items of equipment:

- Vibratory rollers
- Piling rigs
- Jackhammers.

The minimum working distances of these items of equipment to nearby receivers are shown in Table 24 which is based on recommendations of the TfNSW *Construction Noise Strategy* (CNS) and AECOM's previous project experience. If these minimum working distances are complied with no adverse impacts from vibration intensive works are likely in terms of human response or cosmetic damage. Based on the indicative construction activities assessed for the proposed development, works are unlikely to occur within the minimum working distances.

**Table 24 Recommended minimum working distances for vibration intensive plant**

| Plant | Rating/Description | Minimum Working Distance | |
|---|---|---|---|
| | | Cosmetic Damage | Human Response |
| Vibratory Roller | <300 kN (Typically 7-13 tonnes) | 15 m | 100 m |
| Piling Rig | ≤800 mm | 2 m nominal | 4 m |
| Jackhammer | Handheld | 1 m nominal | Avoid contact with structure |

## 7.3 Construction traffic

The construction work would be undertaken in stages and would require a number of trucks, to deliver materials including concrete to the site. During early stages of construction workers may be able to park on site, during later stages they would park away from the site and either walk or use public transport to get to the site.

From the Newcastle Light Rail – Noise and vibration assessment technical paper dated 1 April 2016 the estimated daytime road traffic volume on Hunter Street is 11,664 vehicles in 2018. Given the high volumes of existing traffic on this road construction traffic would have a negligible impact, increasing road traffic noise levels by significantly less <1 dB(A). This complies with RNP requirements.

# 8.0 Construction Noise and Vibration Mitigation

Given that NMLs are likely to be exceeded, reasonable and feasible noise mitigation measures and work practices will need to be considered. Where receivers are predicted to be 'noise affected' the ICNG states that all feasible and reasonable works practices should be applied to meet the NMLs. It is recommended that a construction noise and vibration management plan (CNVMP) be prepared for each stage of HCCD Stage 1A.

Details of noise and vibration mitigation measures and management practices which should be considered for each CNVMP are detailed below.

The CNVMPs would include the following:

- Identification of nearby residences and other sensitive land uses.
- Description of approved hours of work.
- Description and identification of all construction activities, including work areas, equipment and duration.
- Description of what work practices (generic and specific) would be applied to minimise noise and vibration.
- A complaints handling process.
- Noise and vibration monitoring procedures.
- Overview of community consultation required for identified high impact works.

Noise and vibration mitigation measures which should be considered in the CNVMP are detailed below in Table 25. Details of an indicative monitoring program and complaints handling procedure are provided in Section 8.1 and 8.2.

**Table 25 Recommended noise mitigation measures**

| Action required | Safeguard details |
|---|---|
| **Management measures** | |
| Implement community consultation measures | Periodic notification (monthly letterbox drop or equivalent), website, Project Infoline, Construction Response Line, email distribution list and community and stakeholder meetings. |
| Site inductions | All employees, contractors and subcontractors are to receive an environmental induction. |
| Behavioural practices | No swearing or unnecessary shouting or loud stereos/radios on site.<br>No dropping of materials from height, throwing of metal items and slamming of doors. |
| Monitoring | A noise monitoring program should be considered in accordance with the CNVMP. Further details are provided in Section 8.1. |
| Attended vibration measurements | Attended vibration measurements are recommended at the commencement of vibration generating activities to determine site specific minimum working distances.<br>Vibration intensive work should not proceed within the minimum working distances unless a permanent vibration monitoring system is installed approximately a metre from the building footprint, to warn operators (via flashing light, audible alarm, SMS etc.) when vibration levels are approaching the peak particle velocity objective. |
| Building condition surveys | It is advisable to carry out building condition surveys of any sensitive historical structures before vibration intensive work begins close to minimum working distances. |
| **Source controls** | |
| Construction hours and scheduling | Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels should be scheduled during less sensitive time periods. Consideration should be given to avoiding examination periods. |
| Construction respite period | High noise and vibration generating activities (eg rock breaking) may only be carried out in continuous blocks, not exceeding three hours each, with a minimum respite period of one hour between each block. |
| Equipment selection and maintenance | Use quieter and less vibration emitting construction methods where feasible and reasonable. Equipment would be regularly inspected and maintained to ensure it is in good working order. |
| Maximum noise levels | The noise levels of plant and equipment must have operating sound power or sound pressure levels that would meet the predicted noise levels. |
| Rental plant and equipment | Noise emissions should be considered as part of the selection process. |

| Action required | Safeguard details |
|---|---|
| Use and siting of plant | Avoid simultaneous operation of noisy plant within discernible range of a sensitive receiver.<br>The offset distance between noisy plant and adjacent sensitive receivers is to be maximised.<br>Plant used intermittently to be throttled down or shut down.<br>Plant and vehicles to be turned off when not in use.<br>Noise-emitting plant to be directed away from sensitive receivers. |
| Plan works site and activities to minimise noise and vibration | Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site. |
| Non-tonal reversing alarms | Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. |
| Minimise disturbance arising from delivery of goods to construction sites | Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers.<br>Select site access points and roads as far as possible away from sensitive receivers.<br>Dedicated loading/unloading areas to be shielded if close to sensitive receivers.<br>Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. |
| Construction related traffic | Schedule and route vehicle movements away from sensitive receivers and during less sensitive times.<br>Limit the speed of vehicles and avoid the use of engine compression brakes.<br>Maximise on-site storage capacity to reduce the need for truck movements during sensitive times. |
| Silencers on Mobile Plant | Where possible reduce noise from mobile plant through additional fittings including:<br>• Residential grade mufflers<br>• Damped hammers such as “City” Model Rammer Hammers<br>• Air parking brake engagement is silenced |
| Alternative methods | The use of less vibration-intensive methods of construction or equipment is preferred where practical to reduce the potential for cosmetic damage. All equipment should be maintained and operated in an efficient manner, in accordance with manufacturer’s specifications, to reduce the potential for adverse vibration impacts |
| Site specific minimum working distances | Attended vibration measurements are undertaken when work commences, to determine site-specific minimum working distances. Vibration intensive work should not proceed within the minimum working distances unless a permanent vibration monitoring system is installed around one metre from the building footprint, to warn operators (e.g. via flashing light, audible alarm, SMS) when vibration levels are approaching the peak particle velocity objective. |

| Action required | Safeguard details |
|---|---|
| **Path controls** | |
| Shield stationary noise sources such as pumps, compressors, fans etc. | Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. |
| Shield sensitive receivers from noisy activities | Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant. |

## 8.1 Construction monitoring

### 8.1.1 Monitoring and reporting

A monitoring program should be developed and include recommendations to complete attended measurements at the commencement of construction stages and in response to any complaints. The sections below outlines items to be considered for inclusion in the program.

### 8.1.2 Monitoring procedure

The measurements should be conducted in accordance with the procedures outlined in Australian Standard AS 1055 *Acoustics – Description and measurement of environmental noise* and in accordance with methods outlined in the NSW Noise Policy for Industry (NPfI). The following points should be followed when conducting noise monitoring:

- a field calibration should be conducted before and after measurements
- the sound level meters must be set to an A-weighting and Fast
- the sound level meters sample period should be set to 15 minutes
- the following descriptors should be measured as a minimum: $L_{A1,}$ $L_{Aeq}$ and $L_{A90}$
- measurements should be conducted a minimum of 3 metres from the nearest façade and/or solid fence/wall. If it is not possible to do this, corrections for façade reflection should be applied to the measurement results.

### 8.1.3 Monitoring of equipment procedure

In addition to the residential noise monitoring procedures described above, the following equipment measurements should be undertaken:

- noise emission levels of all critical items of mobile plant and equipment should be checked for compliance with noise limits appropriate to those items prior to the equipment going into regular service
- for equipment and mobile plant used for construction works, $L_{Aeq}$ measurements should be taken at an appropriate distance, normally 7m and converted to a Sound Power Level
- an Equipment Noise Certificate, presenting relevant sound levels of the equipment tested, should be issued within the first week of the equipment commencing at the construction site.

The equipment sound power levels should be compared to the levels contained in Section Table 17. If noise checks on any equipment result in a prediction of non-compliance, noise mitigation strategies to achieve compliance should be developed.

### 8.1.4 Equipment

All acoustic instrumentation employed throughout the monitoring programme should comply with the requirements of AS IEC 61672.1-2004 Electroacoustics - Sound level meters – Specifications. All sound level meters must have current calibration certificate from a NATA accredited laboratory in

accordance with NATA guidelines. Instrument calibration should be checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dB.

### 8.1.5 Monitoring & reporting schedule

#### 8.1.5.1 Construction monitoring schedule

Table 26 below provides an indicative monitoring schedule for construction.

**Table 26 Construction noise monitoring schedule**

| Schedule Day | Action |
|---|---|
| During first month of construction | Complete one round of operator-attended 15 minute noise monitoring on separate days at site boundaries and closest residences |
| | Carry out equipment noise level checks on all critical items of plant and issue Equipment Noise Certificates |
| During subsequent months of construction period | Carry out equipment noise level checks on any new (untested) items of critical plant and issue Equipment Noise Certificates |

### 8.1.6 Reporting

#### 8.1.6.1 Reporting details

The following information should be included in the quarterly reports:

- Field calibration results (before and after measurements)
- Measurement times and dates
- Qualitative description of the noise environment during the measurements
- $L_{A1}$, $L_{Aeq}$ and $L_{A90}$ levels
- Meteorological conditions during the measurements
- Estimation of or recorded noise contribution from other major noise sources.

#### 8.1.6.2 Record keeping

A system of records which provides full documentation of all noise monitoring results, complaint handling and responses to non-compliances should be established and maintained.

### 8.1.7 Roles and Responsibilities

Roles and responsibilities for the implementation of the CNVMP should be clearly stated within the CNVMP.

## 8.2 Complaints handling procedure

A complaints handling procedure should be developed and documented within each CNVMP. The following section outlines items to be considered for inclusion in the procedure.

If complaints are received, an Environmental Incident Report Form should be completed to record details of the occurrence and actions taken. Where applicable, completed forms should detail the following:

- the date and time of the complaint
- the method by which the complaint was made
- any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect
- the nature of the complaint

- description of noise source that is the subject of complaint, duration of event
- location of complainant during time of incident, and general area in which the noise source was located
- identification of project related noise activities and locations that could have or are known to have contributed to the incident
- if known, identification of non-project related noise emission activities and location at time of incident
- meteorological conditions at the time of the incident
- the action taken in relation to the complaint
- any follow-up contact with the complainant
- if no action was taken, the reason why no action was taken.

All records are to be kept in a legible form, or in a form that can readily be reduced to a legible form and kept for at least 4 years after the complaint or event to which they relate took place.

The Site Environmental Officer will make available a report on complaints received to the relevant Government Agencies upon request. A summary will be included in the annual environmental report.

A response should be provided to the complainant within 24 hours. Corrective actions may involve supplementary monitoring to identify any non-compliances, and/or may involve modification of construction or operational techniques to avoid any recurrence or minimise impacts.

# 9.0 Conclusion

This report presents the results of a Noise and Vibration Impact Assessment of the proposed HCCD Stage 1A development located at 16B Honeysuckle Drive, Newcastle.

Operational noise emission from the development has been assessed with consideration to the project noise trigger levels established in accordance with the NSW NPfI and measured noise levels at the development site. The impact of noise emission from new developments can be widespread when noise issues are not correctly considered, however, this assessment indicates that standard amelioration strategies will sufficiently treat noise emission to meet the project noise trigger levels and, as such, will minimise possible acoustic impacts on neighbouring areas.

Noise and vibration intrusion to the development form road and light rail traffic has been assessed and complies with the criteria established in accordance with AVATG, AS/NZS 2107:2016 and *Development Near Rail Corridors and Busy Roads – Interim Guideline.*

Traffic generation as a result of the proposed development is minimal and predicted traffic noise increases will comply with the applicable criteria outlined in the NSW Road Noise Policy.

Construction noise has been assessed in accordance with the EPA's Interim Construction Noise Guideline. Worst case construction scenarios have been considered. Construction works will be undertaken during standard hours. The level and number of exceedances of the construction noise management levels are provided in Section 7.1.3. It should be noted that the exceedances presented are the highest at each receiver during the HCCD Stage 1A construction phase.

Based upon this assessment documented above, all environmental noise and vibration impacts can be appropriate managed in accordance with the relevant guidelines and standards.

# Appendix A

## Glossary of Acoustic Terminology

# Appendix A Glossary of Acoustic Terminology

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

| | |
|---|---|
| *Sound power level* | The total sound emitted by a source. |
| *Sound pressure level* | The amount of sound at a specified point. |
| *Decibel [dB]* | The measurement unit of sound. |
| *A Weighted decibels [dB(A)]* | The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A). |
| *Decibel scale* | The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows: |

| | |
|---|---|
| 0dB(A) | Threshold of human hearing |
| 30dB(A) | A quiet country park |
| 40dB(A) | Whisper in a library |
| 50dB(A) | Open office space |
| 70dB(A) | Inside a car on a freeway |
| 80dB(A) | Outboard motor |
| 90dB(A) | Heavy truck pass-by |
| 100dB(A) | Jackhammer/Subway train |
| 110 dB(A) | Rock Concert |
| 115dB(A) | Limit of sound permitted in industry |
| 120dB(A) | 747 take off at 250 metres |

| | |
|---|---|
| *Frequency [f]* | The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound. |
| *Equivalent continuous sound level [$L_{eq}$]* | The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy. |
| $L_{max}$ | The maximum sound pressure level measured over the measurement period. |
| $L_{min}$ | The minimum sound pressure level measured over the measurement period. |
| $L_{10}$ | The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the $L_{10}$. |

| | |
|---|---|
| *$L_{90}$* | The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the $L_{90}$. |
| *Ambient noise* | The all-encompassing noise at a point composed of sound from all sources near and far. |
| *Background noise* | The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The $L_{90}$ sound pressure level is used to quantify background noise. |
| *Traffic noise* | The total noise resulting from road traffic. The $L_{eq}$ sound pressure level is used to quantify traffic noise. |
| *Day* | The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays. |
| *Evening* | The period from 1800 to 2200 h Monday to Sunday and Public Holidays. |
| *Night* | The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays. |
| *Assessment background level [ABL]* | The overall background level for each day, evening and night period for **each day** of the noise monitoring. |
| *Rating background level [RBL]* | The overall background level for each day, evening and night period for the **entire length** of noise monitoring. |

*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*, the EPA's NSW Noise Policy for Industry and Road Noise Policy.

# Appendix B

## Graphical Noise Monitoring Results

## Logger 1 - 08/05/18 - 17/05/18

### Logger Setup

Logger Type: Rion NL21

Serial No : 265112

Address: 16 Honeysuckle Drive , Newcastle

Location: Site

Facade / Free Field: Free Field

Environment: Noise environment dominated by road traffic noise with construction noise from light rail also contributing. Logger is located within light rail construction compound.

### Logger Setup Photo

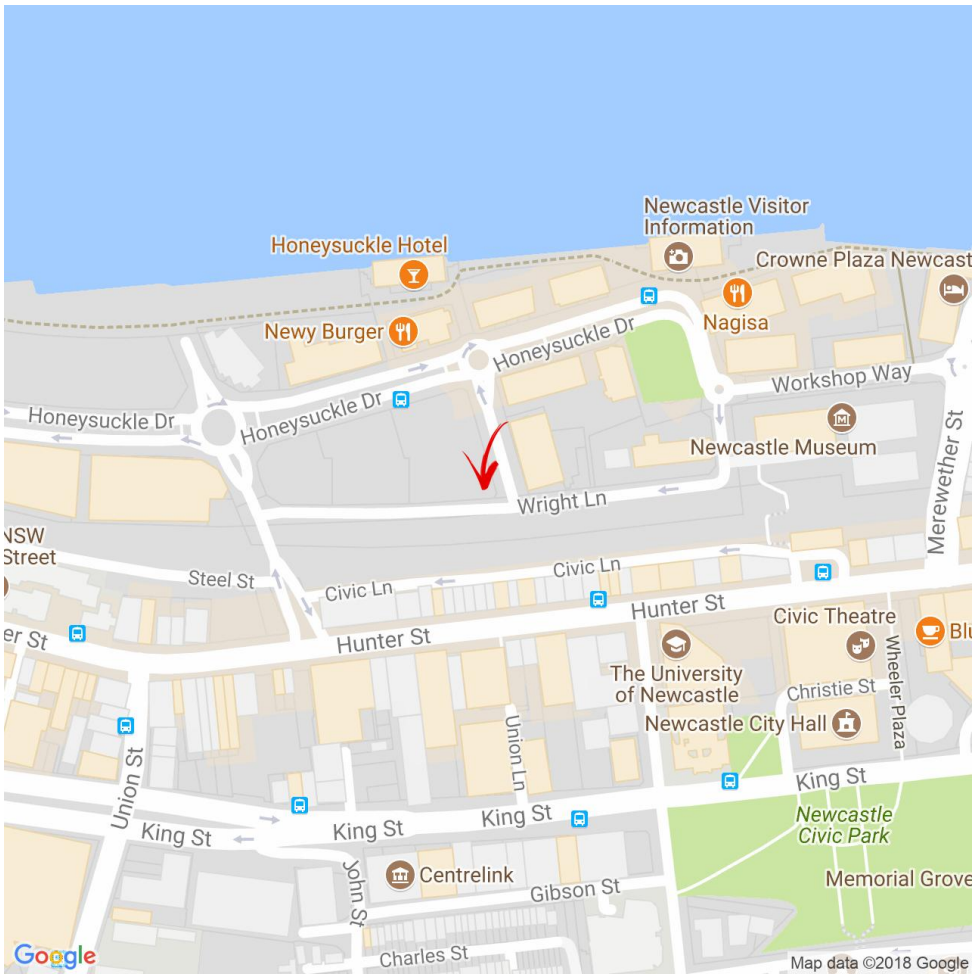
### INP Noise Level, dB(A)

| | Log Average | RBL |
|---|---|---|
| Day | 65 | 50 |
| Evening | 56 | 46 |
| Night | 56 | 44 |

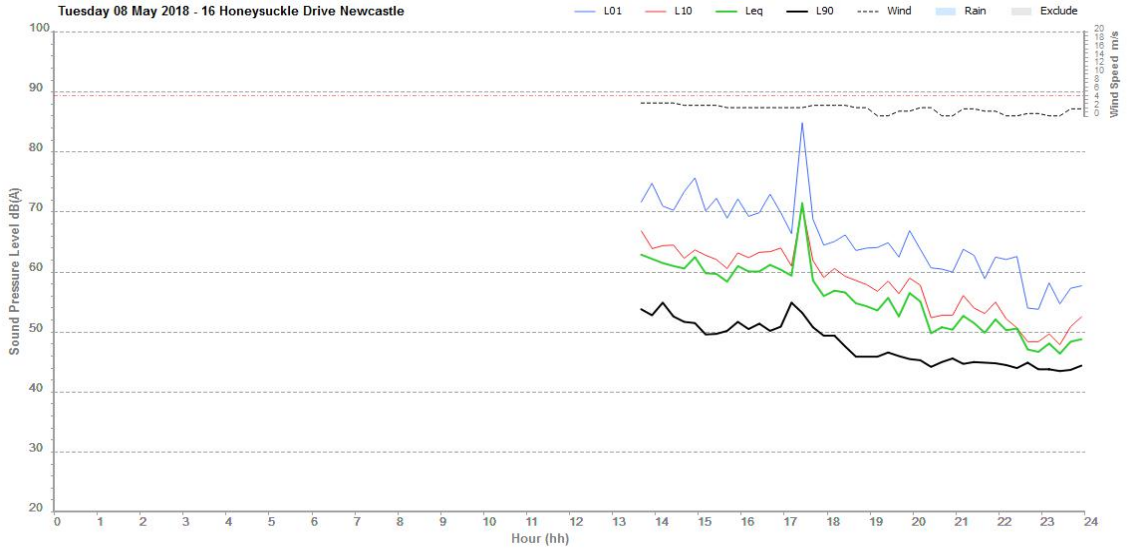
### RNP Noise Level, dB(A)

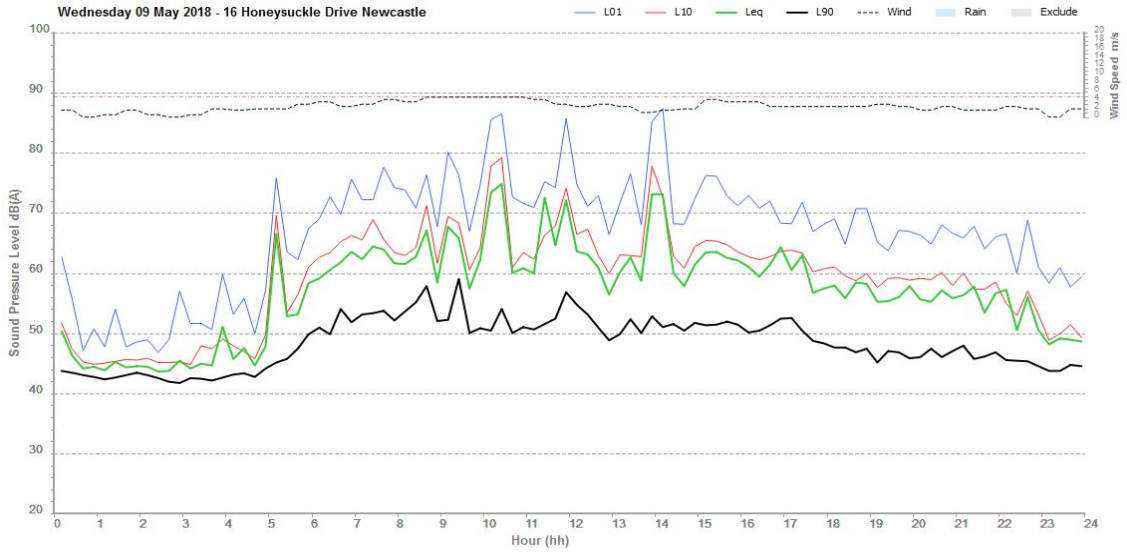
| | $L_{Aeq(1hr)}$ | $L_{Aeq(period)}$ |
|---|---|---|
| Day (7am - 10 pm) | - | - |
| Night (10pm - 7am) | - | - |

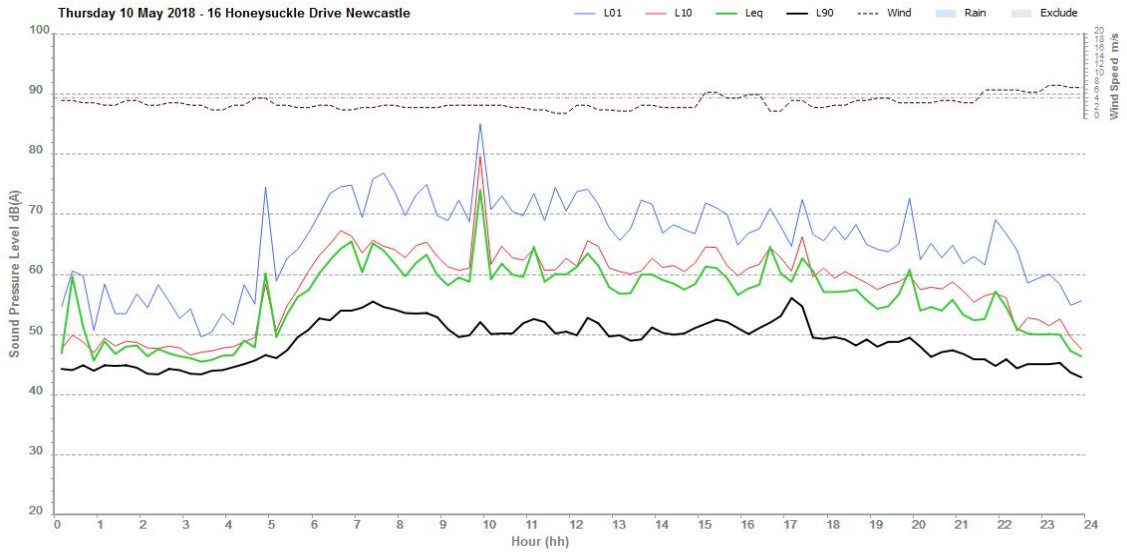
### Logger Location Map



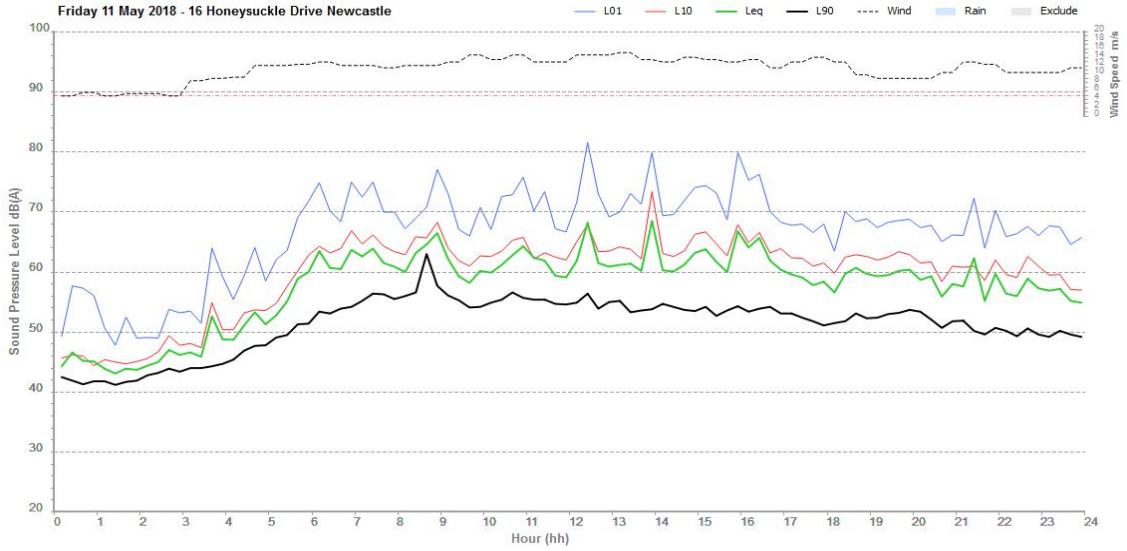
## Logger Graphs

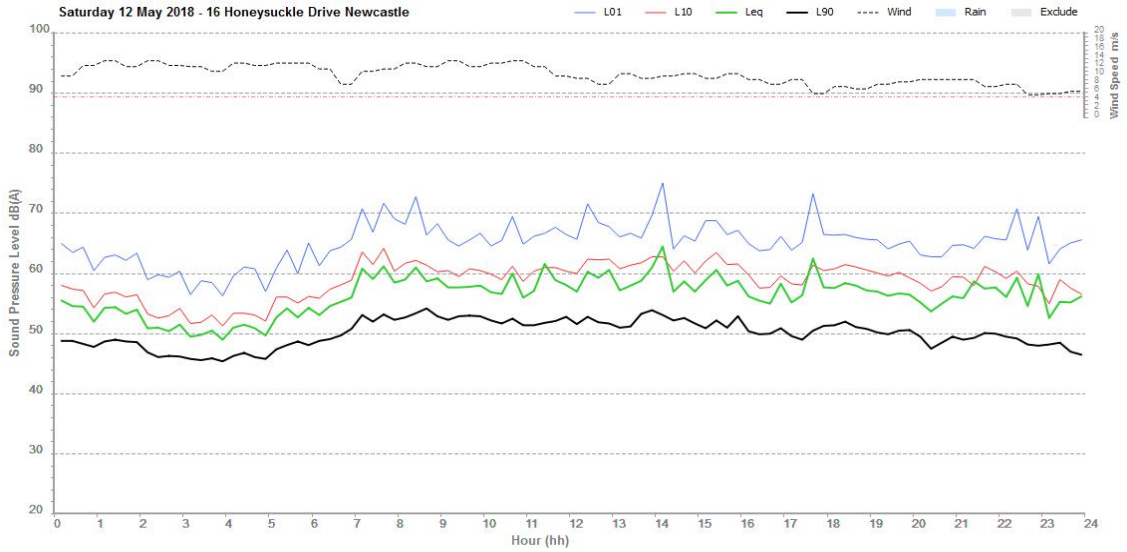


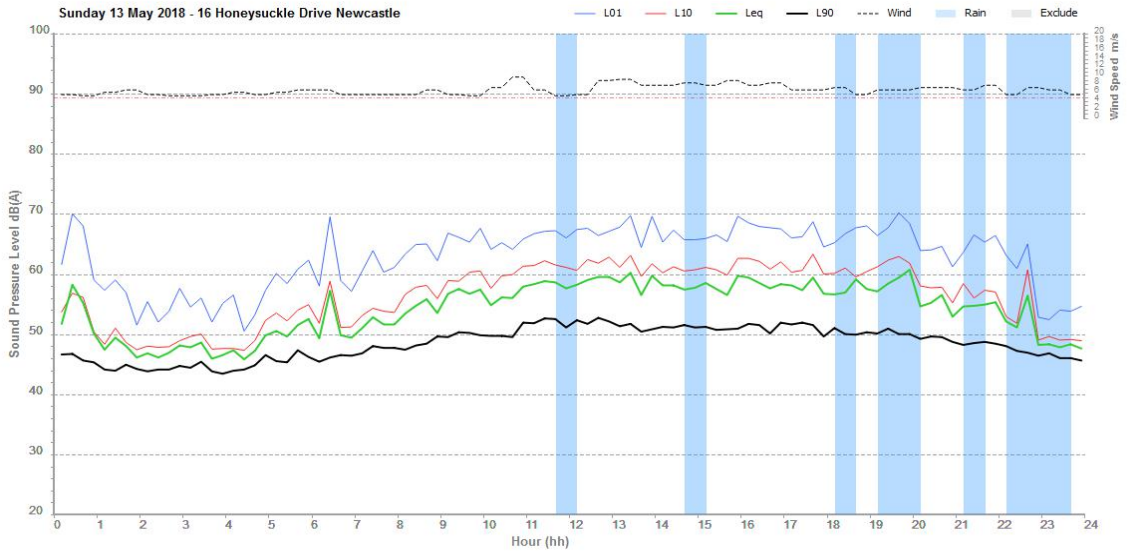



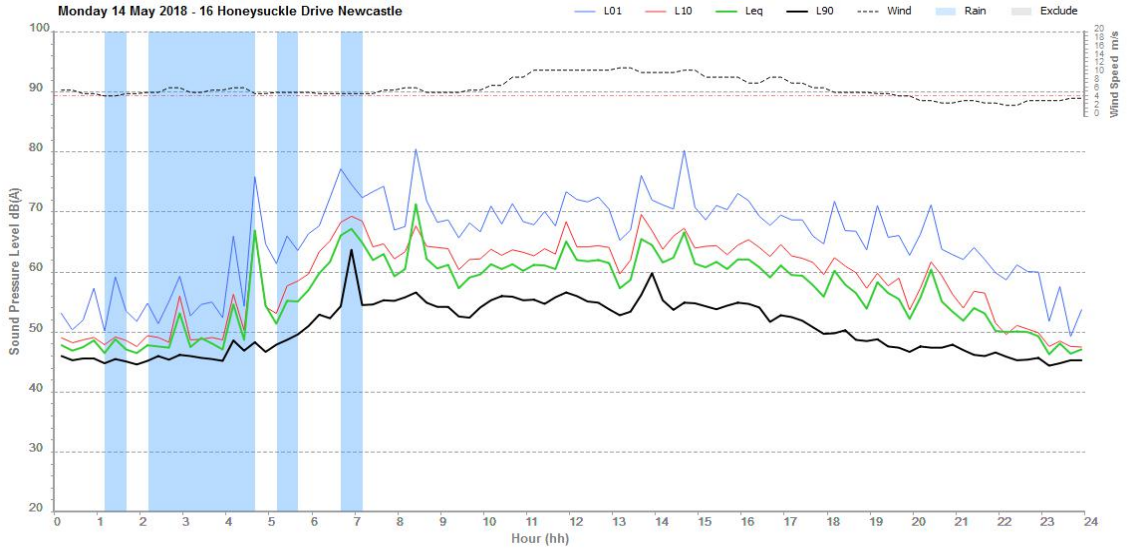
## Logger Graphs

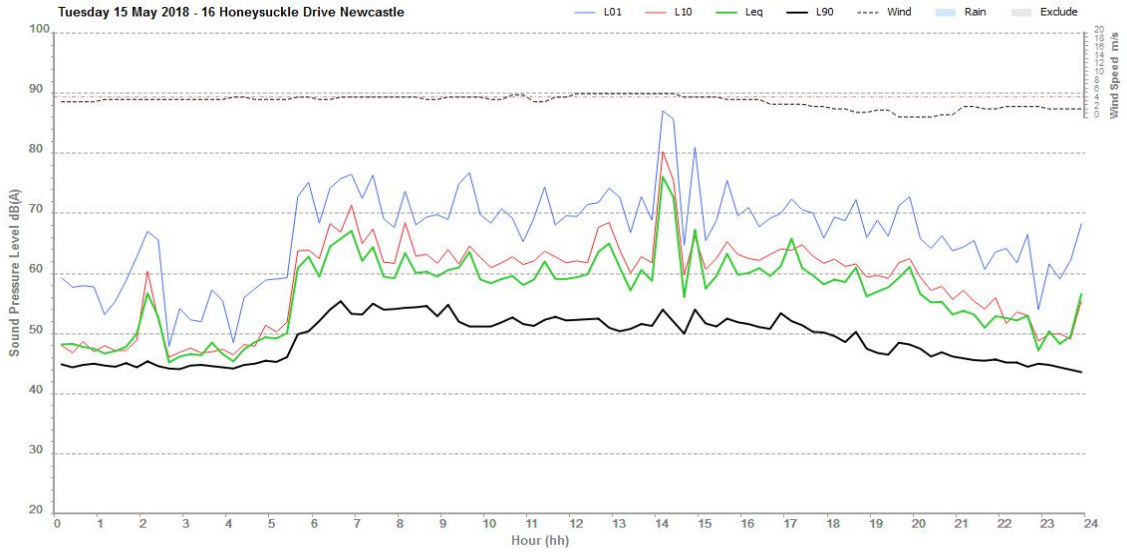


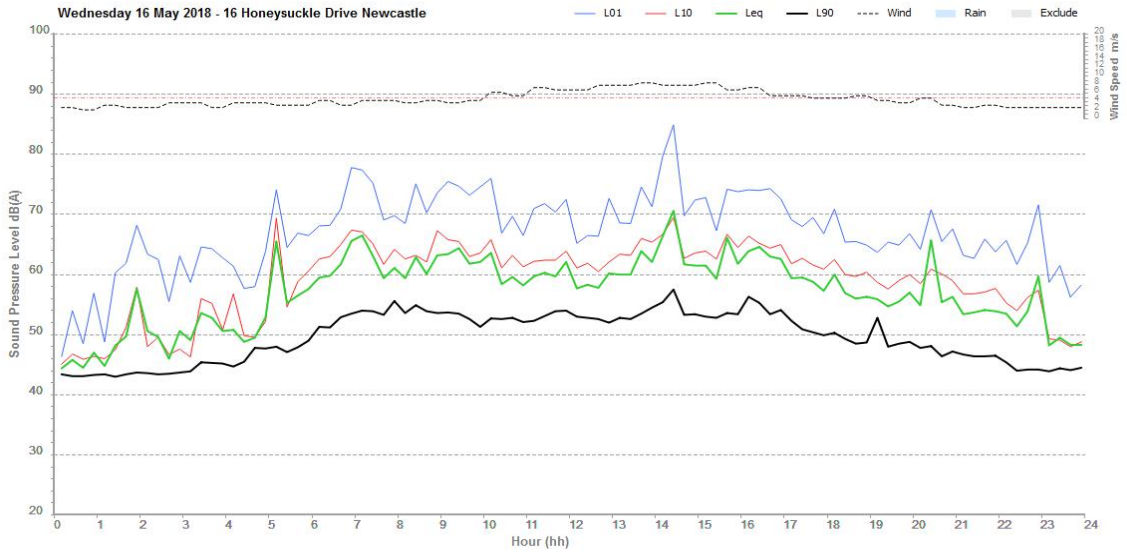



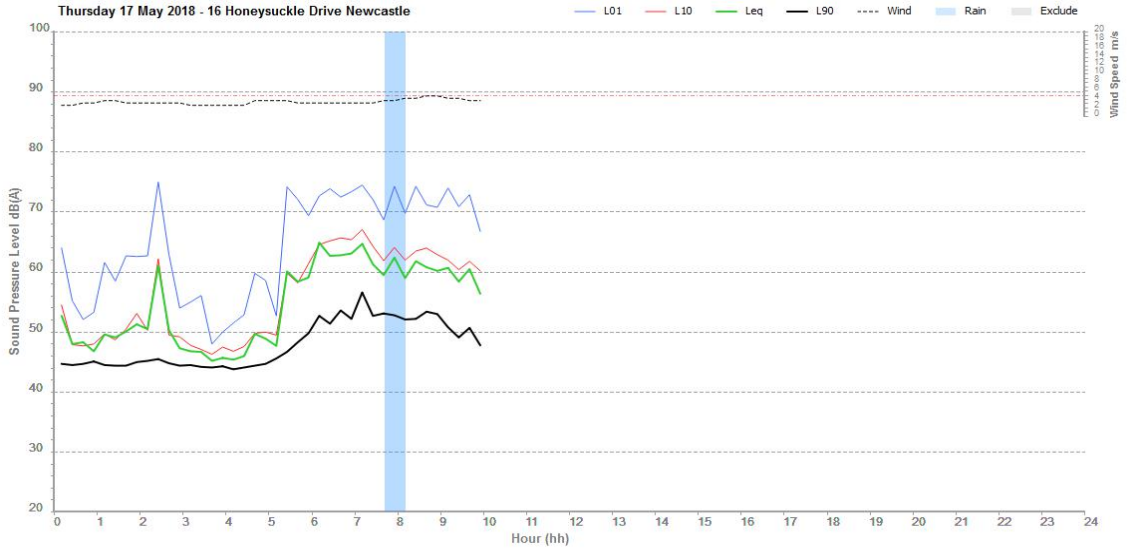
## Logger Graphs



## Logger Graphs



## Logger 2 - 08/05/18 - 17/05/18

### Logger Setup

Logger Type: Rion NL21

Serial No : 765701

Address: 558 Hunter Street , Newcastle West

Location: Front Yard

Facade / Free Field: Free Field

Environment: Noise environment dominated by road traffic noise with construction noise from light rail also contributing. Noise from construction includes sawing 58 dB(A)

### Logger Setup Photo

### INP Noise Level, dB(A)

| | Log Average | RBL |
|---|---|---|
| Day | 63 | 50 |
| Evening | 58 | 45 |
| Night | 56 | 43 |

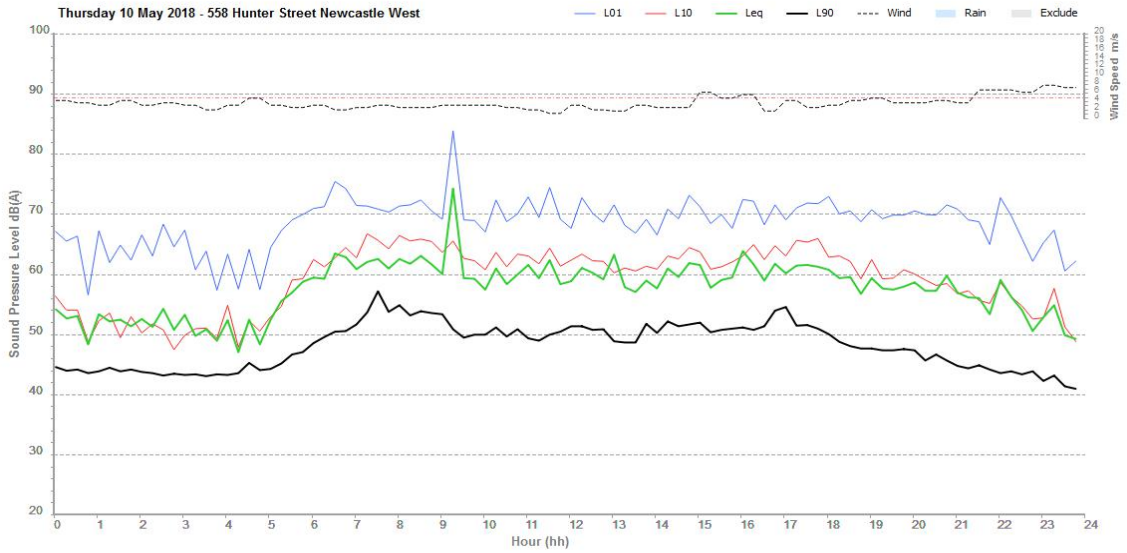
### RNP Noise Level, dB(A)

| | $L_{Aeq(1hr)}$ | $L_{Aeq(period)}$ |
|---|---|---|
| Day (7am - 10 pm) | - | - |
| Night (10pm - 7am) | - | - |

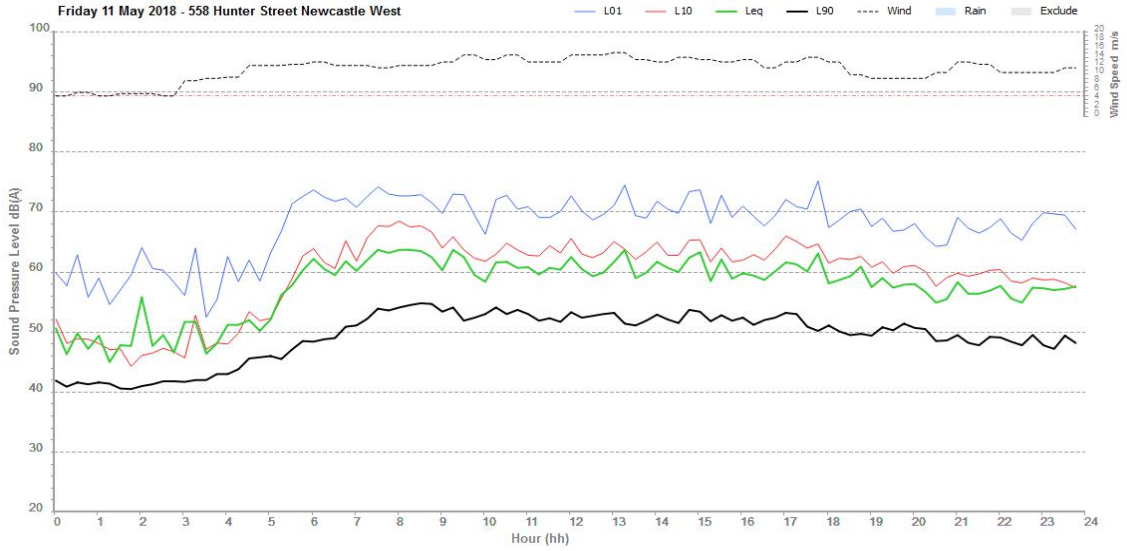
### Logger Location Map

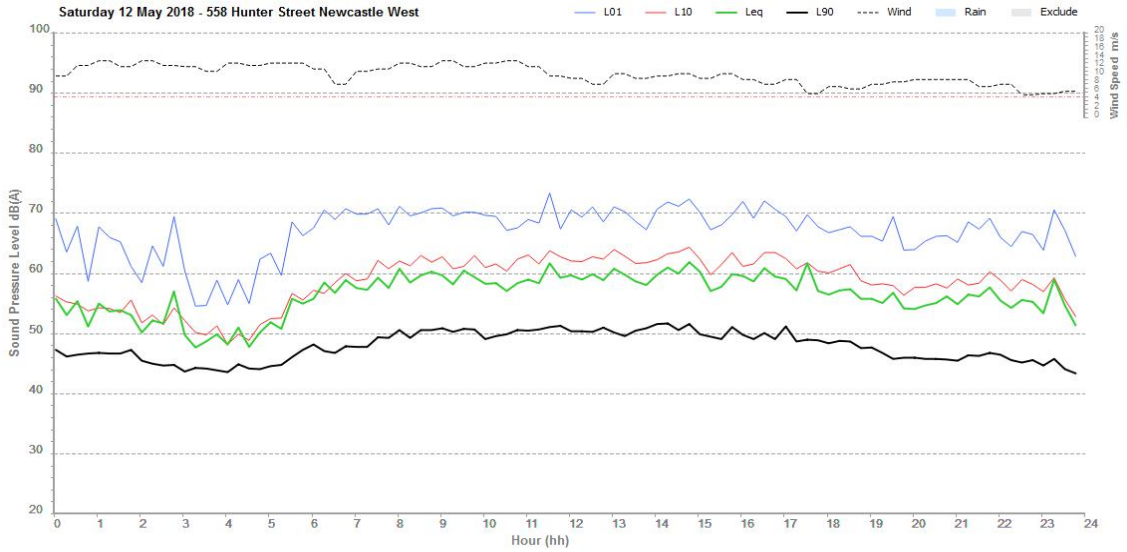
## Logger Graphs

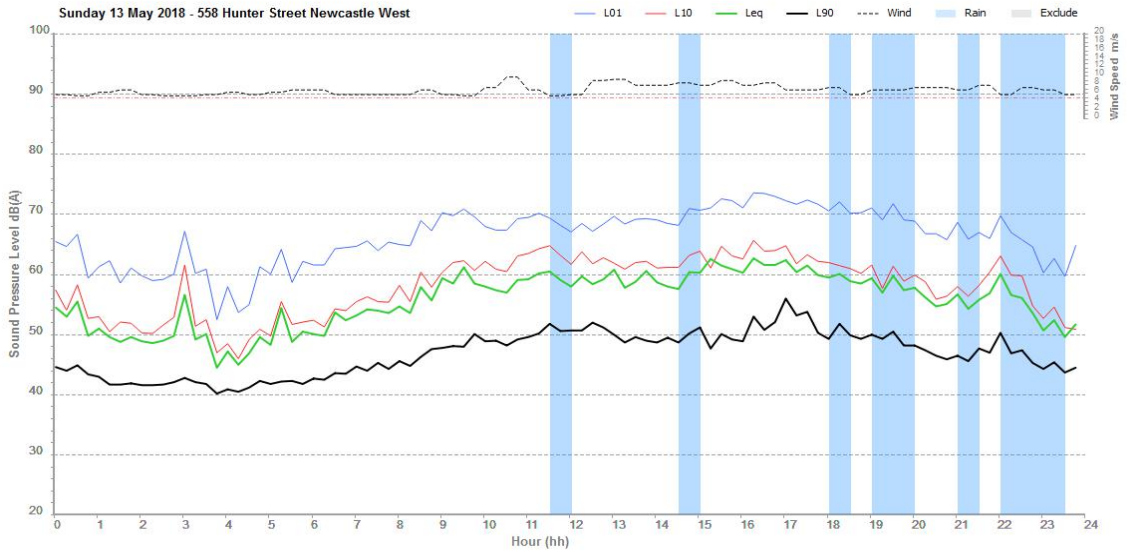




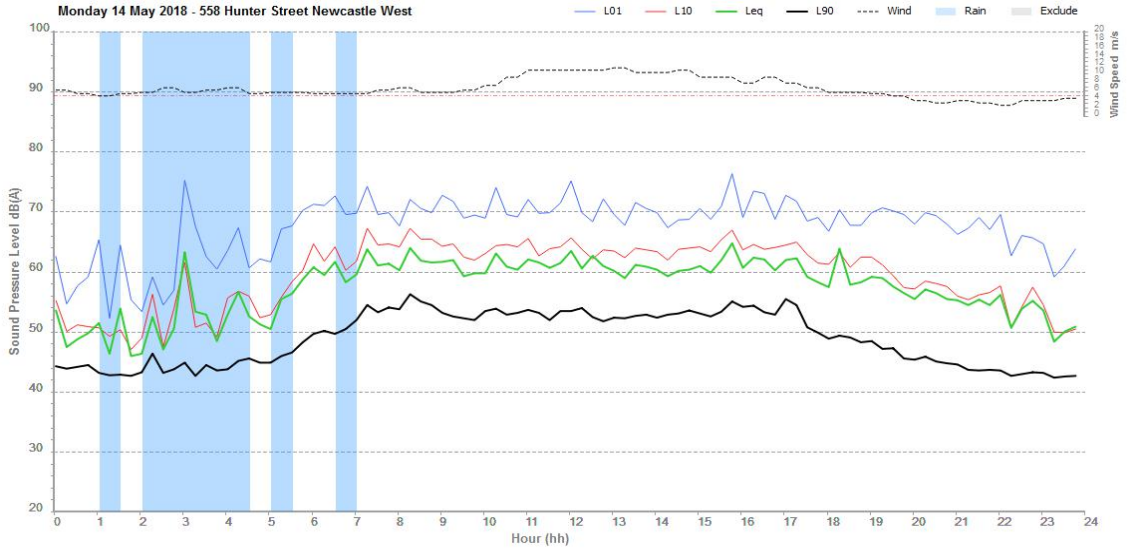
## Logger Graphs

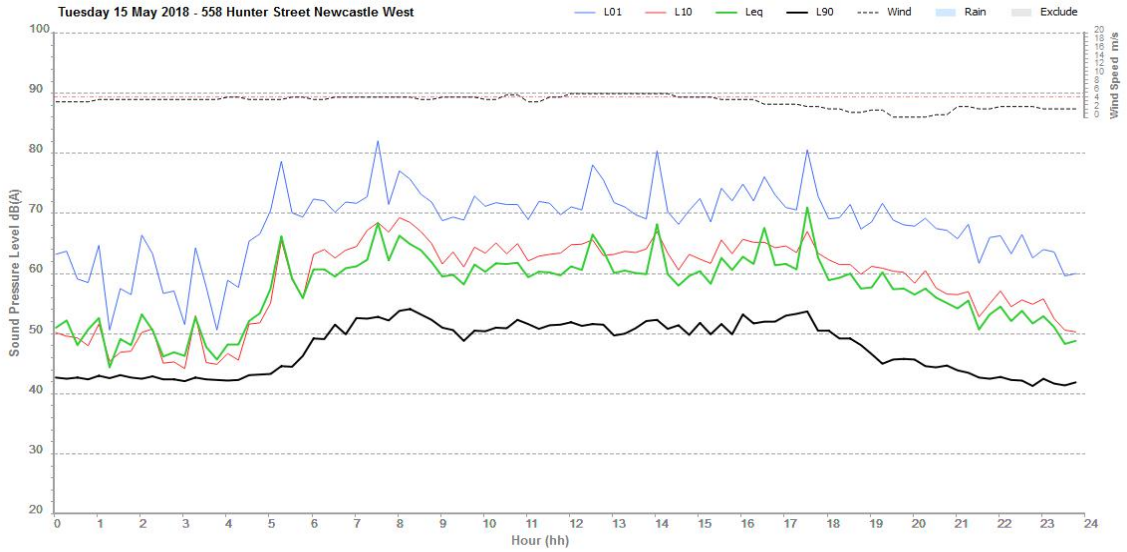


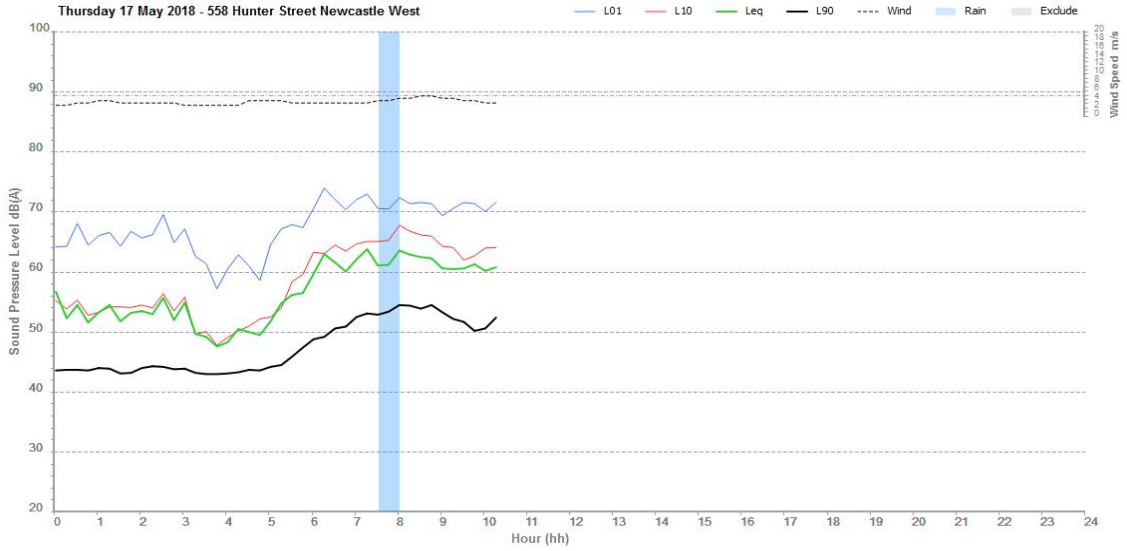



## Logger Graphs



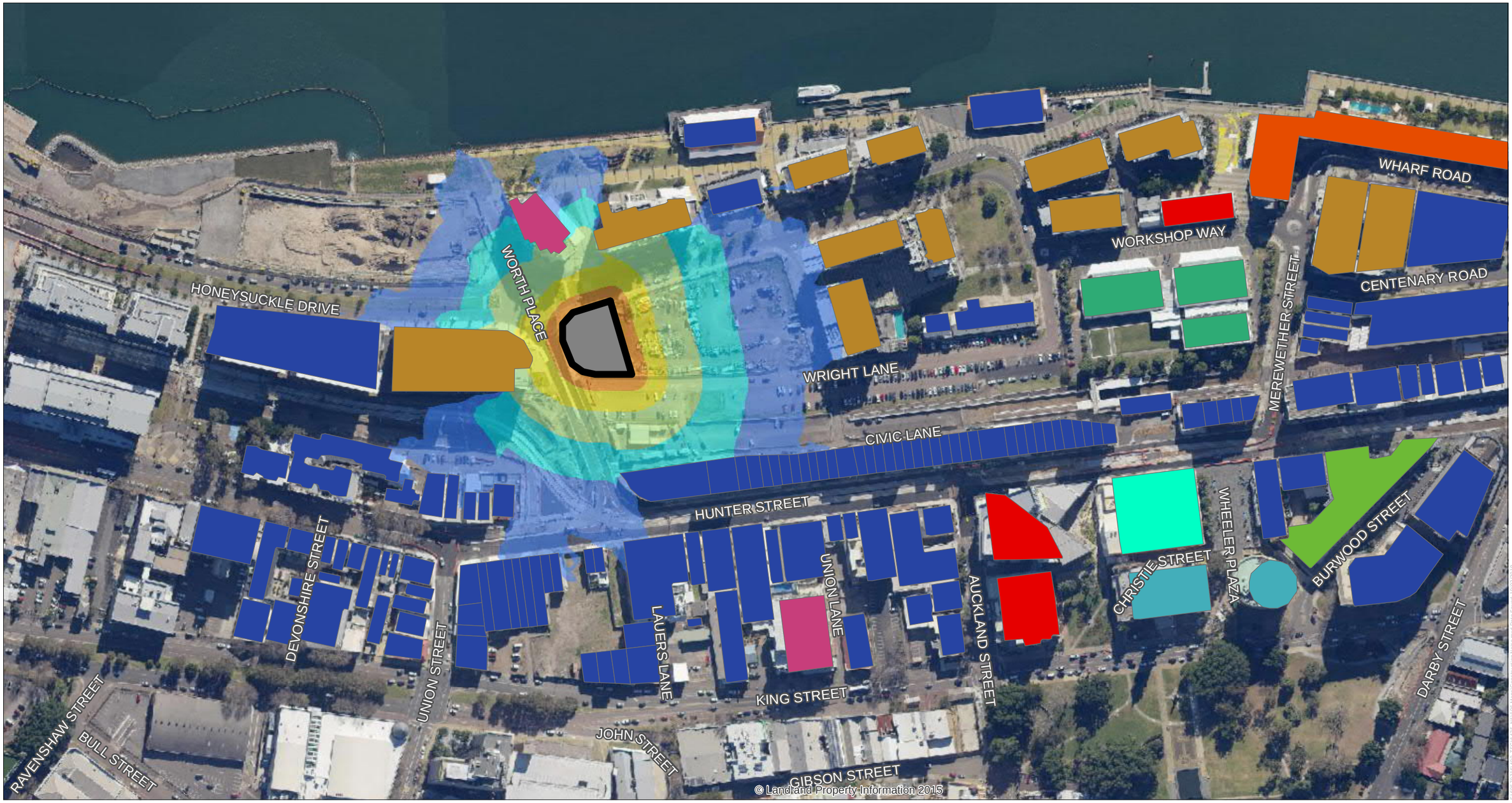




## Logger Graphs



# Appendix C

## Construction Noise Contours




Commercial
Court
Education
Government
Hotel
Mixed Use
Museum
Residential
Theatre

HCCD Stage 1A

**Sound Pressure Level, dB(A)**

< 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | 80 - 85 | > 85

Honeysuckle City Campus Development - Stage 1A

Site Establishment and Enabling Works

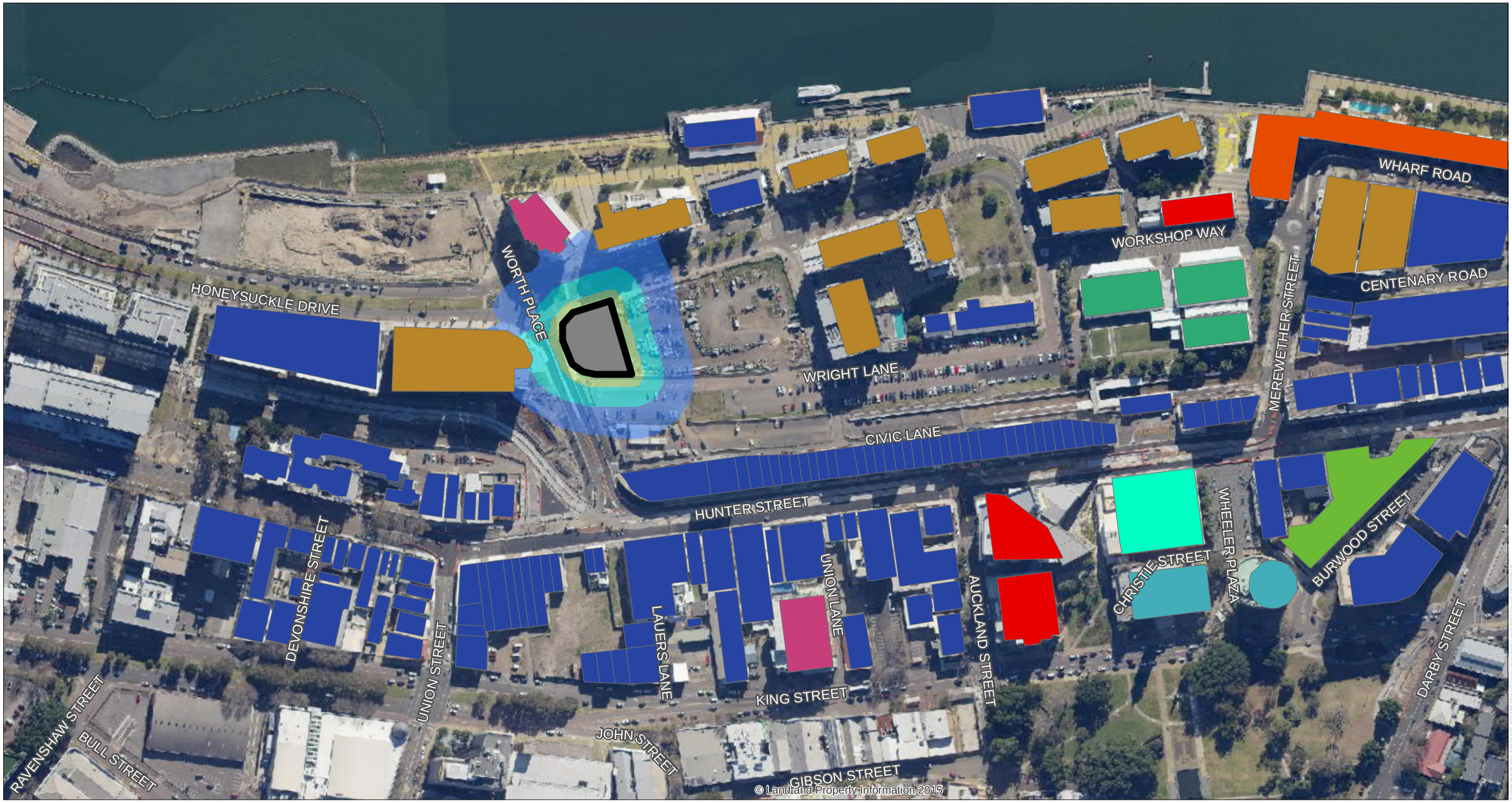
AECOM

N

0 0.04 0.08 km



Source:




Commercial
Court
Education
Government
Hotel
Mixed Use
Museum
Residential
Theatre

HCCD Stage 1A

**Sound Pressure Level, dB(A)**

< 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | 80 - 85 | > 85

Honeysuckle City Campus Development - Stage 1A

Foundations

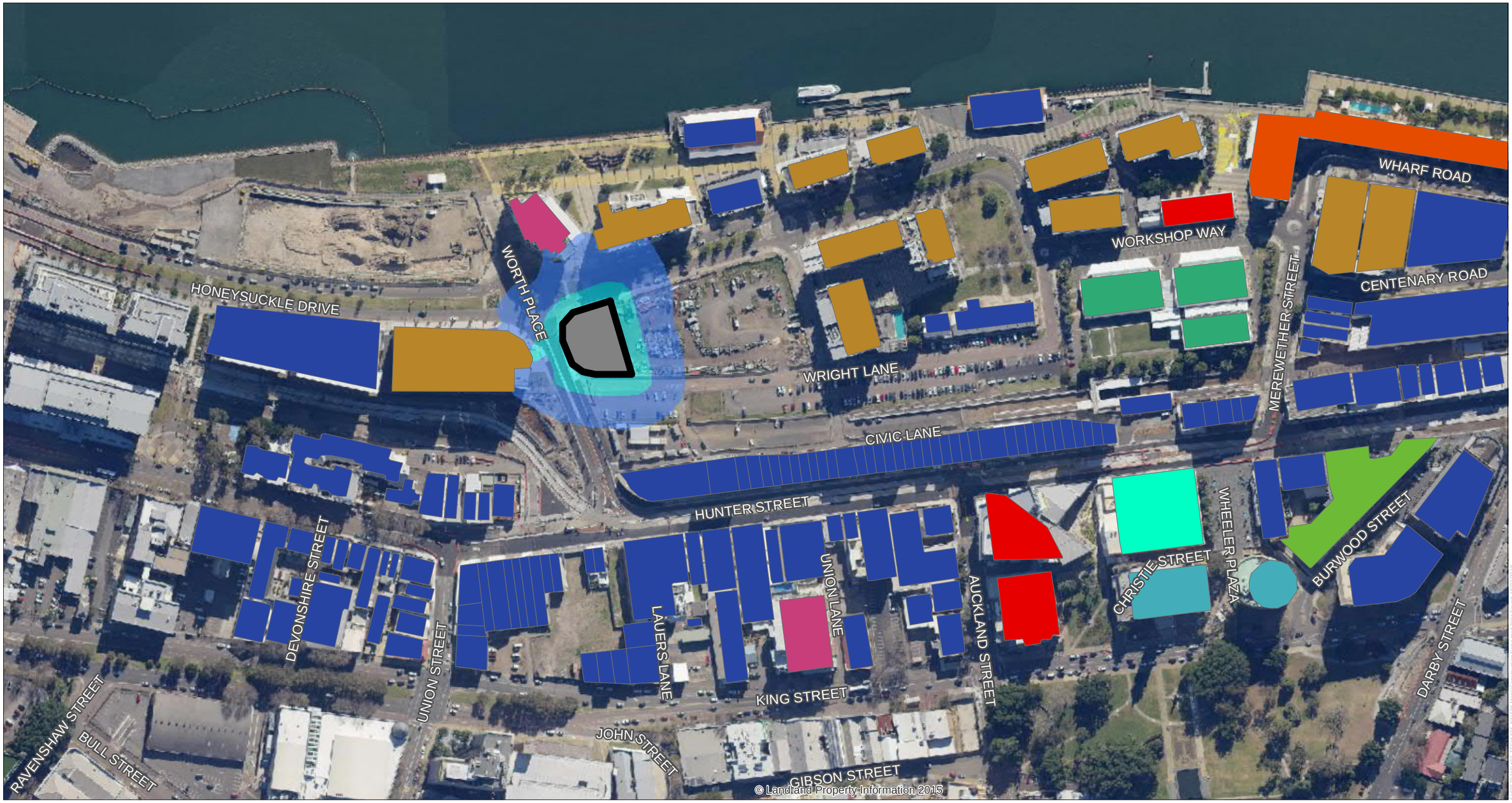
AECOM

N

0 0.04 0.08 km



Source:




- Commercial
- Court
- Education
- Government
- Hotel
- Mixed Use
- Museum
- Residential
- Theatre
- HCCD Stage 1A

**Sound Pressure Level, dB(A)**

< 60 | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | 80 - 85 | > 85

Honeysuckle City Campus Development - Stage 1A

Frame and Facade

AECOM

N

km
0 0.04 0.08



Source: