Awaba Waste Management Facility

Operational Noise Validation

Lake Macquarie City Council

9 December 2021

→ **The Power of Commitment**

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S4	0	B Elder	T Robinson		S Murphy		09/12/2021

Glossary

Term	Description
AHD	Australian Height Datum
AS	Australian Standard
Ambient Noise Level	The ambient noise level at a particular location is the overall environmental noise level caused by all noise sources in the area, both near and far, including all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. Usually assessed as an energy average over a set time period 'T' (L_{Aeq}, T).
Background Noise Level	The Background Noise Level is the minimum repeatable level of noise measured in the absence of the noise under investigation and any other short-term noises such as those caused by all forms of traffic, industry, lawnmowers, wind in foliage, insects, animals, etc. It is quantified by the noise level that is exceeded for 90% of the measurement period 'T' (L_{A90},T). Background Noise Levels are often determined for the day, evening and night time periods where relevant. This is done by statistically analysing the range of time period (typically 15 minute) measurements over multiple days (often 7 days).
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dBA	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies.
DECC	Department of Environment and Climate Change (NSW Government), later known as the Department of Environment Climate Change and Water, and now known as the Office of Environment and Heritage (OEH).
EPA	Environment Protection Authority
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A1(period)}$	The sound pressure level that is exceeded for 1 % of the measurement period.
$L_{A10(period)}$	The sound pressure level that is exceeded for 10 % of the measurement period.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90 % of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period.
Mitigation	Reduction in severity
Noise Sensitive Receptor	Noise sensitive land use that may be impacts by noise from the development
NPI	Noise Policy for Industry
PSNG	Project Specific Noise Goals
Rating Background Level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
Sound Pressure Level (SPL or L_p)	The level of sound measured on a sound level meter and expressed in decibels (dB). Where LP = 10 log10 (Pa/Po)2 dB (or 20 log10 (Pa/ Po) dB) where Pa is the rms sound pressure in Pascal and Po is a reference sound pressure conventionally chosen is 20 µPa (20 x 10-6 Pa) for airborne sound. SPL varies with distance from a noise source.
Sound Power Level, L_W	The sound power level of a noise source is the inherent noise of the device. Therefore, sound power level does not vary with distance from the noise source or with a different acoustic environment.
Tonality	Noise containing a prominent frequency or frequencies characterised by definite pitch.

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1. Introduction

1.1 Purpose of this report

GHD was engaged by Lake Macquarie City Council to conduct an operational noise validation of the Awaba Waste Management Facility (The facility) in accordance with Schedule 4 Condition 28 of the Project Approval 10_0139 for the Awaba Waste Management Facility Expansion Project.

Project Approval 10_0139 Schedule 4 Condition 28 states:

28. By 21 January 2016# or at a date approved by the Director-General, the Proponent shall undertake a Noise Validation of activities at the Site. The Validation shall be performed in accordance with the NSW Industrial Noise Policy (EPA, 2000) or the relevant policy adopted by the EPA at the time of the Validation and submitted to both the Director-General and EPA. The Validation shall include, but not be limited to, the following information:

a. *Identification of any noise sensitive locations ('sensitive receivers') likely to be affected by activities at the Site, such as residential properties, schools, hospitals and passive recreation areas. The location of any noise sensitive locations in relation to the Site shall be mapped;*
b. *Existing background (L_{A90}) and ambient (L_{Aeq}) noise levels determined for each sensitive receiver in accordance with the NSW Industrial Noise Policy (EPA, 2000) or the relevant policy adopted by the EPA at the time of the validation;*
c. *Derivation and identification of the Project specific noise levels for each sensitive receiver in accordance with the NSW Industrial Noise Policy (EPA, 2000) or the relevant policy adopted by the EPA at the time of the validation;*
d. *The expected noise level and noise character (for example tonality, impulsiveness, vibration(etc) likely to be generated from noise sources during Operation. Include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods or references used to determine noise source levels;*
e. *The noise levels likely to be received at the most sensitive receivers, including potential impacts for any identified significant adverse meteorological conditions, including:*
    i. *a plan showing the assumed location of each noise source for each prediction scenario;*
    ii. *a list of the number and type of noise sources used in each prediction or direct monitoring scenario to simulate all potential significant operating conditions on the Site;*
    iii. *any assumptions made in the predictions such as source heights, directivity effects, shielding from topography, buildings or barriers;*
    iv. *methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated;*
    v. *an assessment of appropriate weather conditions for the noise predictions, including reference to any weather data used to justify the assumed conditions;*
    vi. *the predicted noise impacts for each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate;*
    vii. *an assessment of the need to including modification factors as detailed in Section 4 of the NSW Industrial Noise Policy (EPA 2000) or the relevant policy adopted by the EPA at the time of the Validation.*
f. *Discuss the findings of the predictive modelling and direct monitoring and, where relevant noise criteria have not been met, recommend additional mitigation measures;*
g. *Include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation;*

h. After application of all feasible and reasonable mitigation measures, quantify the residual level of noise impact by identifying:

i. locations (if any) where the noise level exceeds the criteria and the extent of exceedance;

ii. numbers of people (or areas) affected;

iii. times when criteria will be exceeded;

iv. likely impact on activities (speech, sleep, relaxation, listening etc);

v. change in ambient conditions; and

vi. the result of any community consultation or negotiated agreement.

1.2 Scope of work

The scope of work involved the following tasks:

– Review of design documentation and management plans.

– Measurement of existing noise levels at the nearest potentially affected sensitive receiver locations to determine existing noise levels. The monitoring consisted of attended noise monitoring for a minimum of 15-minutes at each of the nominated monitoring locations during the day. Locations are as follows:

- Residential premises in Awaba Township.
- Toronto Adventist Primary School/ Leisure Life Caravan Village.
- Toronto residential areas.

– Conducted onsite sound power measurements of all acoustically significant existing plant and equipment during facility operations.

– Sound power levels for the existing operations (GHD measurements) were used to develop a noise model utilising the Conservation of Clean Air and Water Europe (CONCAWE) prediction methodology within SoundPlan 3D modelling software.

– Noise levels impacts for the final design at noise sensitive receiver locations surrounding the development were predicted.

– Predicted operational noise levels were assessed against the project specific noise goals.

– Provided a report presenting the findings, results and any additional mitigation measures (if required).

1.3 Limitations

This report: has been prepared by GHD for Lake Macquarie City Council and may only be used and relied on by Lake Macquarie City Council for the purpose agreed between GHD and Lake Macquarie City Council as set out in Sections 1.1 and 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Lake Macquarie City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

Specifically, this report does not take into account the effects, implications and consequences of or responses to COVID-19, which is a highly dynamic situation and rapidly changing. These effects, implications, consequences of and responses to COVID-19 may have a material effect on the opinions, conclusions, recommendations, assumptions, qualifications and limitations in this report, and the entire report must be re-examined and revisited in light of COVID-19. Where this report is relied on or used without obtaining this further advice from GHD, to the maximum extent permitted by law, GHD disclaims all liability and responsibility to any person in connection with, arising from or in respect of this report whether such liability arises in contract, tort (including negligence) or under statute.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

In conducting this assessment and preparing the report, current guidelines for noise were referred to. This work has been conducted in good faith with GHD's understanding of the client's brief and the generally accepted consulting practice.

No other warranty, expressed or implied, is made as to the information and professional advice included in this report. It is not intended for other parties or other uses.

2. Development description

2.1 Facility overview

Lake Macquarie City Council (LMCC) operates the Awaba Waste Management Facility (the facility) located off Wilton Road, Awaba. The facility has a 32.5 hectare (ha) site area and operates as a General Solid Waste (putrescible) landfill. It accepts municipal and commercial waste from the Lake Macquarie local government area.

The landfill is in a broad, deep, south-facing amphitheatre between two spurs of a north westerly trending ridgeline. Prior to filling, the base of the amphitheatre contained a gully that drained towards the south. The surrounding land acts as a buffer zone and it contains approximately 10 ha of native bushland.

The facility commenced operation in 1986 and has undergone several phases of development including upgrading and improvement since that time.

The facility is located on Wilton Road, Awaba and is formally described as Lot 372 DP 723259 as shown in Figure 2.1.

Main site access is via Wilton Road.

Paper Size ISO A4

0 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Lake Macquarie City Council
Awaba Waste Management Facility
Operational Noise Validation

Facility Site

Project No. **12565218**
Revision No. **0**
Date **08/12/2021**

FIGURE 2.1

\\ghdnet\ghd\AU\Newcastle\Projects\22\12565218\GIS\Maps\Deliverables\12565218_NoiseValidation.aprx
Print date: 08 Dec 2021 - 17:01

Data source: NSW Land Registry Services, 2017: road, hyrdoline, cadastre; public/NSW_Imagery: © Department of Customer Service 2020. Created by: mfredle

2.2 Hours of operation

The hours of operation for the facility are set out in Table 2.1.

Table 2.1 Hours of operation

Period	Start time	Finish time
Monday to Sunday	8:00 am	4:00 pm
Christmas Day	No operations	

2.3 Facility equipment

Table 2.2 lists the plant and equipment that operates on site.

Table 2.2 Quarry equipment

Type	Typical make/model	Approximate number	Location
Traxcavator	Liebherr Traxcavator LR634 Liebherr Traxcavator LR636	2	Landfilling area
Landfill Compactor	Tana E5200	1	Landfilling area
Excavator	Sumitomo 8T Excavator	1	Landfilling area
Water Cart	Hino 4x4 500 series	1	Various
Steel Drum Roller	Ammann Asc 150	1	Landfilling area
Flexi Drive Pumps	Honda GX200T	3	Various
Diesel Pumps	BBA BA 180e with perkins 11040D-44T BBA BA 80H with perkins 11040D-44T Coates Hire 4 inch Yakka with Perkins diesel	3	Various
2 Tonne Tipper	Isuzu 45 150 4x4	1	Various
Loader	Avant 750	1	Various
Light vehicles	4x4 Vehicles	2	Various

Not all the equipment listed above is operational on-site at any one time.

3. Sensitive receivers

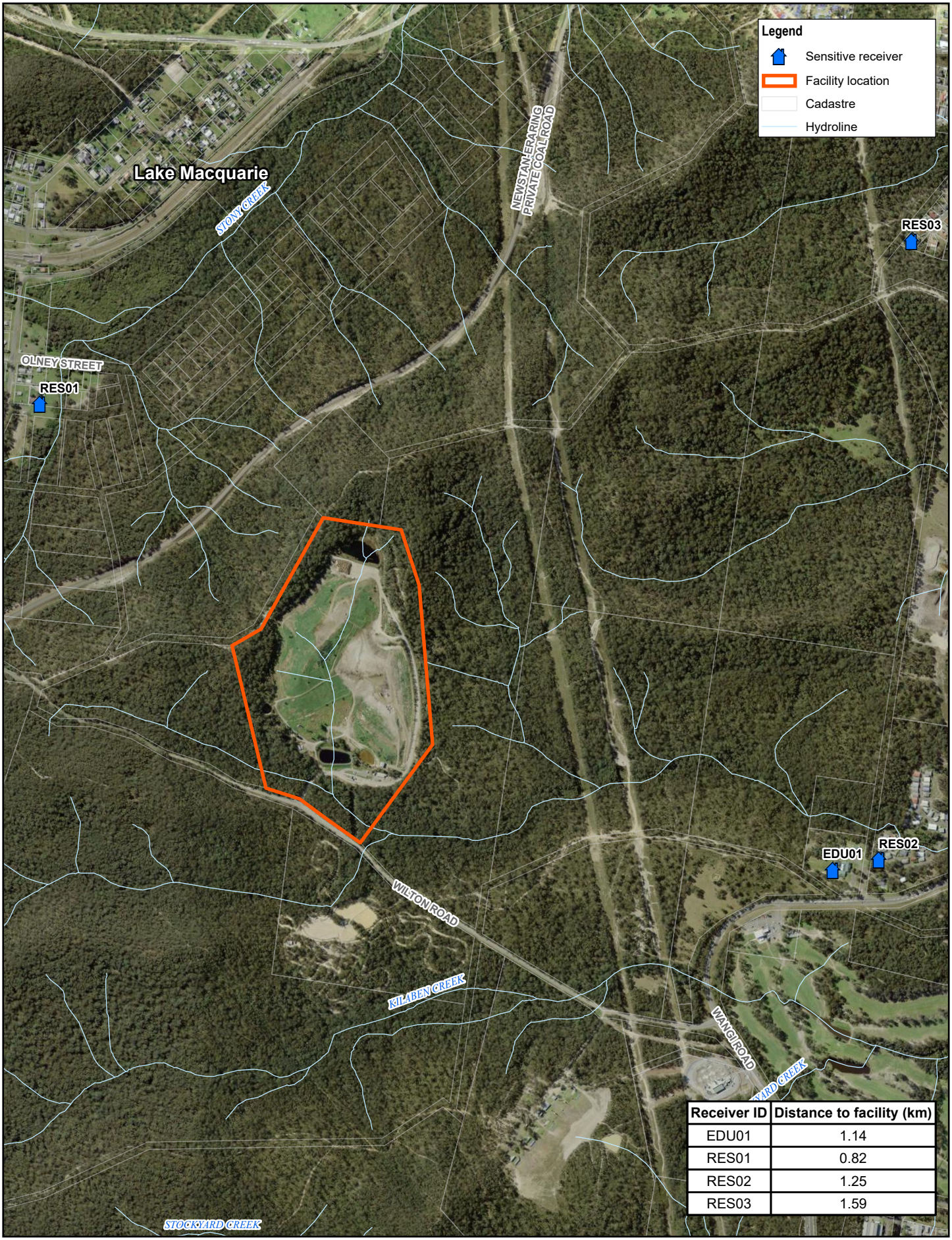
Noise sensitive receptors are defined in the Noise Policy for Industry (NPI) based on the type of occupancy and the activities performed in the surrounding land uses. Sensitive noise and vibration receptors could include:

– Residences
– Educational facilities
– Hospitals and medical facilities
– Places of worship
– Passive and active recreational areas such as parks, sporting fields, golf courses (note that these recreational areas are only considered sensitive when they are in use or occupied)
– Commercial or industrial premises

Table 3.1 provides the identified nearest potential affected sensitive receptors and land uses to the facility. Furthermore, the sensitive receptor locations are displayed in Figure 3.1.

Table 3.1 Identified noise sensitive receivers

Receiver ID	Location (m MGA56)		Approximate Distance from the facility (m)
	Easting	Northing	
RES01	363847 m E	6345933 m S	820
RES02	366122 m E	6344698 m S	1255
RES03	366211 m E	6346375 m S	1590
EDU01	365997 m E	6344670 m S	1140



Receiver ID	Distance to facility (km)
EDU01	1.14
RES01	0.82
RES02	1.25
RES03	1.59

Paper Size ISO A4

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Lake Macquarie City Council
Awaba Waste Management Facility
Operational Noise Validation

Project No. **12565218**
Revision No. **0**
Date **08/12/2021**

Noise Sensitive Receivers

FIGURE 3.1

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Print date: 08 Dec 2021 - 17:00

Data source: NSW Land Registry Services, 2017: road, hyrdoline, cadastre; public/NSW_Imagery: © Department of Customer Service 2020. Created by: mfredle

4. Effects of meteorology on noise levels

4.1 Overview

Meteorological conditions may increase noise levels by focusing soundwave propagation paths at a single point. Such refraction of sound waves will occur during temperature inversions (atmospheric conditions where temperatures increase with height above ground level), and where there is a wind gradient (that is, wind velocities increasing with height) with wind direction from the source to the receptor.

The NPI provides two options for a proponent to consider meteorological effects on noise levels:

1. Adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur – a conservative approach that considers source-to-receiver wind vectors for all receivers and F class temperature inversions with wind speeds up to 2 m/s at night.
2. Determine the significance of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30% determined in accordance with the provisions in this policy. Where noise-enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment.

This assessment has used the option 1 approach.

5. Project specific noise goals

5.1 Project Approval 10_0139

Schedule 4 Condition 27 of Project Approval 10_0139 is reproduced below.

Noise Limits

27. Noise from the premises shall not exceed:

- *a. An $L_{A10\ (15\ minute)}$ noise emission criterion of 45 dBA (7:00 am to 6:00 pm) Monday to Sunday;*
- *b. An $L_{A10\ (15\ minute)}$ noise emission criterion of 45 dBA during the evening (7:00 am to 6:00 pm) Monday to Friday;*
- *c. At all other times, an $L_{A10\ (15\ minute)}$ noise emission criterion of 35 dBA except as expressively provided by the EPL.*

5.2 Corrections for annoying noise characteristics

Where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low-frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level. The *NSW Noise Policy for Industry* (2017) outlines correction factors that are to be applied to the source noise level at the receiver before comparison with the project specific noise levels, to account for the additional annoyance caused by these modifying factors. Table 5.1 sets out the corrections to be applied.

Table 5.1 Modifying factors corrections

Factor	Assessment/ measurement	When to apply	Correction[1]	Comments
Tonal noise	*One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (ISO1996.2-2007 – Annex D)*	*Level of one-third octave band exceeds the level of the adjacent bands on both sides by:* *– 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz.* *– 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz.* *– 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.*	*5 dB[2,3]*	*Third octave measurements should be undertaken using unweighted or Z-weighted measurements.* *Note: Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.*
Low-frequency noise	*Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz*	*Measure/assess source contribution C- and A-weighted $L_{eq,T}$ levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and:* *– Where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period.* *– Where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2-dB(A) positive adjustment applies for the daytime period.*	*2 or 5 dB[2]*	*A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.*
Intermittent noise	*Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level*	*The source noise heard at the receiver varies by more than 5 dB(A) and the intermittent nature of the noise is clearly audible.*	*5 dB*	*Adjustment to be applied for night-time only.*

Factor	Assessment/ measurement	When to apply	Correction[1]	Comments
Duration	*Single-event noise duration may range from 1.5 min to 2.5 h*	*One event in any assessment period.*	*0 to 20 dB(A)*	*The project noise trigger level may be increased by an adjustment depending on duration of noise (see Table C3).*
Maximum adjustment	*Refer to individual modifying factors*	*Where two or more modifying factors are indicated.*	*Maximum correction of 10 dB(A)[2] (excluding duration correction)*	

Notes:

1. Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.

2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.

3. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.

Table 5.2 One-third octave low-frequency noise threshold

Hz/dBZ	One-third octave $L_{Zeq,15\text{-}min}$ threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dBZ	92	89	86	77	69	61	54	50	50	48	48	46	44

Notes:

- *dBZ = decibel (Z frequency weighted).*
- *For the assessment of low-frequency noise, care should be taken to select a wind screen that can protect the microphone from wind-induced noise characteristics at least 10 dB below the threshold values in Table C2 for wind speeds up to five metres per second. It is likely that high performance larger diameter wind screens (nominally 175 mm) will be required to achieve this performance (Hessler, 2008). In any case, the performance of the wind screen and wind speeds at which data will be excluded needs to be stated.*
- *Low-frequency noise corrections only apply under the standard and/or noise-enhancing meteorological conditions.*
- *Where a receiver location has had architectural acoustic treatment applied (including alternative means of mechanical ventilation satisfying the Building Code of Australia) by a proponent, as part of consent requirements or as a private negotiated agreement, alternative external low-frequency noise assessment criteria may be proposed to account for the higher transmission loss of the building façade.*
- *Measurements should be made between 1.2 and 1.5 metres above ground level unless otherwise approved through a planning instrument (consent/approval) or environment protection licence, and at locations nominated in the development consent or licence.*

Intermittent noise: noise where the level suddenly drops/increases several times during the assessment period, with a noticeable change in source noise level of at least 5 dBA; for example, equipment cycling on and off. The intermittency correction is not intended to be applied to changes in noise level due to meteorology.

Correction for duration: this is applied where a single-event noise is continuous for a period of less than two and a half hours in any assessment period. The allowable exceedance of the $L_{Aeq,15min}$ equivalent noise criterion is shown in Table C3 for the duration of the event. This adjustment is designed to account for unusual and one-off events, and does not apply to regular and/or routine high-noise level events.

Table 5.3 Adjustment for duration

Allowable duration of noise (one event in any 24-hour period)	Allowable exceedance of $L_{Aeq,15\text{-}min}$ equivalent project noise trigger level at receptor for the period of the noise event, dBA	
	Daytime and evening (7:00 am – 10:00 pm)	Night-time (10:00 pm – 7:00 am)
1 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
less than 1.5 minutes	20	10

Note: *Where the duration of the noise event is smaller than the duration of the project noise trigger level (that is, less than 15 minutes) the allowable adjusted project noise trigger level becomes:*

$$10Log_{10}\left(10^{\frac{PNTL}{10}} x \left(\frac{900 - duration}{900}\right) + \left(10^{\frac{PNTL+allowable\ exceedance\ (Table\ C3)}{10}} x\ duration\right)\right)$$

Maximum correction: the maximum correction to be applied to the predicted or the measured level where two or more modifying factors are present. The maximum adjustment is 10 dBA where the noise contains two or more modifying factors (excluding the duration correction).

6. Compliance noise monitoring

6.1 Operator attended noise monitoring

GHD undertook operator attended noise monitoring to confirm the noise contributions from the facility site at the nearest potentially affected sensitive receptors.

6.1.1 General requirements

The operational noise monitoring programme was conducted with reference to *the Lake Macquarie City Council - Awaba Waste Management Facility - Landfill Environmental Management Plan (October 2019), Project Approval 10_0139* and *AS 1055-2018 Acoustics –Description and Measurement of Environmental Noise.*

Attended noise measurements were taken using a B&K 2250 Type 1 sound level meter (serial number 2456407). This instrument is capable of measuring continuous A-weighted 1/3 octave sound pressure levels and able to record L_{Amin}, L_{A90}, L_{A10}, L_{A1}, L_{Amax} and L_{Aeq} noise descriptors.

The contribution from the site was estimated based on the observations of site equipment sound pressure level and their duration.

Field calibrations were checked by GHD immediately before and after each set of measurements using a SVAN SV36 sound level calibrator (serial number 106878). In all cases, pre and post calibration checks were within the acceptable range of 94 dB +/- 0.5 dB.

All instrumentation used during noise measurements comply with the requirements of AS IEC 61672.1-2019 Electroacoustics - Sound Level Meters – Specifications, AS IEC 61672.2-2019, AS IEC 61672.3-2019 and carry current NATA or manufacturer calibration certificates. Calibration Certificates for the sound level meters during the monitoring have been attached in Appendix A.

6.1.2 Monitoring locations

In accordance with Project Approval 10_0139 and the Awaba Waste Management Facility – Operational Noise Management Plan, operator-attended noise surveys were undertaken at each of the locations listed in Table 6.1 and shown in Figure 3.1.

Table 6.1 Monitoring locations

Monitoring Location	UTM Zone 56		Picture
	Easting (mE)	Northing (mN)	
M1 (Residential premises in Awaba township)	363800	6345898	

Monitoring Location	UTM Zone 56		Picture
	Easting (mE)	Northing (mN)	
M2 (Toronto Adventist Primary School and Leisure Life Caravan Village)	366072	6344612	No photos taken due to proximity to School.
M3 (Toronto residential areas)	366296	6346508	

6.2 Attended noise monitoring

Attended measurements were undertaken for 15 minutes during the day to determine the character and relative contribution of noise sources.

The results of the operator attended noise survey are given in Table 6.2. Ambient noise levels given in the table include all noise sources such as traffic, insects, birds. Monitoring results are also displayed graphically in Appendix B.

Table 6.2 provides the following information:

– Monitoring location
– Date and start time
– Wind velocity (m/s) and temperature (ºC) at the measurement location
– Typical maximum (L_{Amax}) and contributed noise levels

Table 6.2 Operator attended noise survey results

Location	Date/Start time/Period/Weather	Primary noise descriptor (dBA re 20 µPa)					Description of noise emission and typical maximum levels L_{Amax} (dBA)
		L_{Amax}	L_{A1}	L_{A10}	L_{A90}	L_{Aeq}	
M1	Date/Start time: 11/11/2021 10:22 Period: Day Wind: 1.9 m/s S Temperature: 19 Humidity: 89% Cloud cover: 8/8	62	57	51	39	47	Birds 39 to 55 Local road traffic 44 to 62 AWMF 37 to 40
		Awaba Waste Management Facility $L_{A10\ (15\ minutes)}$ 36 dBA					
M1	Date/Start time: 11/11/2021 10:38 Period: Day Wind: 1.9 m/s S Temperature: 20 Humidity: 85% Cloud cover: 8/8	61	54	48	37	45	Birds 34 to 51 Wind in trees 32 to 33 Local road traffic 44 to 61 AWMF 36 to 39 Haul road 45 to 48
		Awaba Waste Management Facility $L_{A10\ (15\ minutes)}$ 36 dBA					
M2	Date/Start time: 11/11/2021 11:01 Period: Day Wind: 1.9 m/s S Temperature: 19 Humidity: 89% Cloud cover: 8/8	83	79	76	61	73	Local road traffic 50 to 83
		Awaba Waste Management Facility Not discernible					
M3	Date/Start time: 11/11/2021 11:26 Period: Day Wind: 1.9 m/s S Temperature: 19 Humidity: 88% Cloud cover: 8/8	66	56	45	32	44	Birds 40 to 66 Insects 33 to 34 Dog 39 to 60 Wind in trees 35 to 37 Distant road traffic 42 to 53
		Awaba Waste Management Facility Not discernible					
M1	Date/Start time: 11/11/2021 11:26 Period: Day Wind: 1.9 m/s SSE Temperature: 19 Humidity: 88% Cloud cover: 8/8	62	57	50	36	46	Birds 36 to 62 Wind in trees 33 to 35 Local road traffic 44 to 62 AWMF 36 to 39 Haul road 43 to 51
		Awaba Waste Management Facility $L_{A10\ (15\ minutes)}$ 36 dBA					

7. Operational noise impact assessment

7.1 Operational noise modelling

7.1.1 Modelling methodology

The Conservation of Clean Air and Water Europe (CONCAWE) prediction methodology was utilised within SoundPLAN 3D modelling (Version 8.2), to predict noise emissions from the operation of the facility. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this map, together with noise source data (refer to Section 7.1.3), ground cover and atmospheric information (refer to Section 4) to predict noise levels at the nearest sensitive receptors (assumed 1.5 m above ground level).

7.1.2 Modelling input data

The noise modelling inputs and assumptions used for the validation model predictions are summarised in Table 7.1.

Table 7.1 Noise model inputs and assumptions

Inputs and assumptions	Data incorporated into the noise model
Noise model	SoundPLAN (Version 8.2)
Prediction algorithm	Conservation of Clean Air and Water Europe (CONCAWE)
Terrain data (surrounding site)	NSW Spatial Services 1m resolution point cloud
Terrain data (the facility)	Awaba Waste Management Facility – June 2021 Volumetric Survey 1m contour resolution
Buildings	All buildings modelled using the following heights: Single storey: 4.5 m Double storey: 8.0 m
Façade receiver positions	Ground floor: – 1.5 m receiver height – 1 m from building façade
Façade correction	+2.5 dBA to account for noise reflected from the façade of a dwelling.
Ground absorption	A ground absorption value of G = 0.2 was applied across the facility site. A ground absorption value of G = 0.5 was applied across the rest of the model.

7.1.3 Acoustically significant sources

Sound power levels for acoustically significant items of plant and equipment operating during site operations have been obtained from equipment manufacturer data where possible. Where this was not possible data was obtained from a GHD noise source database of similar equipment. The L_{Aeq} sound power levels of relevant plant and equipment utilised for the purpose of predicting noise emission levels are provided in Table 7.2.

Table 7.2 Equipment sound power levels

Noise source	Octave centre frequency (Hz) dBA									Lw dBA	Source of data
	31.5	63	125	250	500	1k	2k	4k	8k		
Traxcavator	79	84	100	100	105	103	101	92	84	109	B
Landfill Compactor	82	89	102	108	111	112	107	105	91	117	A
Excavator	78	83	84	87	93	94	93	89	82	99	B
Water Cart	76	81	85	90	100	100	96	88	77	104	B
Steel Drum Roller	87	92	94	92	97	98	94	88	81	103	B

Noise source	Octave centre frequency (Hz) dBA									Lw dBA	Source of data
	31.5	63	125	250	500	1k	2k	4k	8k		
Flexi Drive Pumps	67	72	87	79	83	93	95	88	89	99	B
Diesel Pumps	67	72	87	79	83	93	95	88	89	99	B
2 Tonne Tipper	85	90	94	93	99	102	102	99	94	108	B
Avant 750 Loader	76	85	91	93	96	95	92	88	79	101	B
Light vehicles	64	69	74	75	78	80	80	73	70	86	C

Notes:

a. Onsite measurement

b. BS 5228.1-2009

c. GHD database of similar plant

7.1.3.1 Modifying factor corrections

Where a noise source contains certain characteristics, such as tonality, impulsiveness, intermittency or dominant low-frequency content, it can cause greater levels of annoyance than other noise sources at the same noise level. The NPI provides correction factors which are to be applied to the predicted noise levels for when such sources exist.

A review of site noise sources has been undertaken no on-site noise sources were found to contain low frequency or tonal characteristics. Intermittency characteristics need only be assessed where the noise source occurs during the night period. Since the facility does not operate during the night time period, intermittency was not assessed.

7.1.4 Operational noise modelling scenario

As the facility progresses throughout its lifetime, the shape of the working area would change. For example, the cell floors will rise, and the location of the working area will move. Therefore, a conservative operational scenario has been modelled and assessed.

For the modelling scenario the noise impact of the facility on surrounding receivers has been assessed at with all equipment operating.

Figure 7.1 shows the location the modelled noise sources.

The following assumptions were made regarding the model configuration:

– All acoustically significant plant and equipment operates simultaneously. This is considered a conservative worst-case as this is unlikely to occur.

– Mobile noise sources, such as garbage trucks, were modelled at typical locations and assumed to operate in repetitive cycles.

7.1.5 Atmospheric conditions

Atmospheric parameters under which noise predictions were made are given in Table 7.3.

Table 7.3 Weather parameters used for noise modelling

Scenario	Atmospheric Condition	Air Temperature	Relative Humidity	Wind Velocity and direction	Atmospheric stability class
Validation	Day	19°C	89%	3.1 m/s from the south to the north	D
Worst Case	Day – prevailing winds	21°C	67%	3 m/s direct source to receiver	D

Paper Size ISO A4

0 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Lake Macquarie City Council
Awaba Waste Management Facility
Operational Noise Validation

Project No. **12565218**
Revision No. **0**
Date **08/12/2021**

Modelled Noise Source Locations

FIGURE 7.1

\\ghdnet\ghd\AU\Newcastle\Projects\22\12565218\GIS\Maps\Deliverables\12565218_NoiseValidation.aprx
Print date: 08 Dec 2021 - 17:01

Data source: NSW Land Registry Services, 2017: road, hyrdoline, cadastre; public/NSW_Imagery: © Department of Customer Service 2020. Created by: mfredle

7.2 Noise model validation

The purpose of model validation is to demonstrate that the noise model produced for the existing situation is an accurate representation of the real world within the limitations of the prediction algorithm and to identify potential errors associated with the geospatial data and modelling approach.

GHD undertook a systematic approach in the analysis and exclusion of measured data to create a robust noise model that is an accurate representation of the real world.

A comparison of the modelled and monitored results at the monitoring location where the facility was audible are shown in Table 7.4.

Table 7.4 Noise model validation results, dBA

Location	$L_{A10(15\ minute)}$ (Day)		
	(7:00 am to 6:00 pm)		
	Measured	Model	Difference
M1 / RES01	36	36	0

Notes:

1. All locations evaluated as free field.

The validation results indicate that the modelled predictions correlate well with the measured results and the model is validated for assessment purposes.

7.3 Operational noise model results

Noise levels were predicted for future operation based on the operating conditions outlined in Section 7.1. The predicted noise levels for daytime site operations are shown in Table 7.5.

Model results indicate that under worst-case atmospheric conditions, noise generated from facility operations are predicted to comply with the daytime noise criteria at all sensitive receivers.

It should be noted that this assessment is considered conservative as it is based on all equipment being operated at one time with noise enhancing meteorological conditions.

Predicted operational noise contours are presented in Appendix C.

Table 7.5 Predicted operational noise levels

Sensitive Receiver	Noise criterion $L_{A10\ (15\ minute)}$ dBA	Predicted noise level $L_{A10\ (15\ minute)}$ dBA
RES01	45	37
RES02		37
RES03		< 25
EDU01		40

As the predicted noise levels comply with the daytime noise criteria at all sensitive receivers no additional noise mitigation measures are recommended.

8. Noise mitigation and management recommendations

8.1 Operational noise mitigation and management

Although noise modelling predictions indicate compliance with the daytime noise criteria at all sensitive receivers the following noise mitigation and management strategies have been provided to encourage best practice onsite to minimise noise.

8.2 Work ethics

All site workers should be sensitised to the potential for noise impacts on residents and encouraged to take practical and reasonable measures to minimise the impact during the course of their activities. These would include:

– Where practical, operate machines at low speed or power and switched off when not being used rather than left idling for prolonged periods.
– Avoid dropping materials from height and avoid metal to metal contact on material.
– All engine covers should be kept closed while equipment is operating.

8.3 Community relations

Consultation and cooperation with the neighbours to the site would assist in minimising uncertainty, misconceptions, and adverse reactions to noise.

8.4 General noise mitigation options for industrial sources

Additional mitigation options that could be considered for noise control are:

– Control noise at the source
– Best Management Practice (BMP)
– Best Available Technology Economically Achievable (BATEA)
– Control the transmission of noise
– Use barriers and land-use controls to attenuate noise by increasing the distance between source and receiver

8.4.1 Controlling noise at the source

8.4.1.1 Best Management Practice

Best Management Practice (BMP) may be adopted for particular operational procedures that minimise noise while retaining productive efficiency.

When an appropriate mitigation strategy that incorporates expensive engineering solutions is being considered, the extent to which cheaper, non-engineering-oriented BMP can contribute to the required reduction of noise should be considered.

Application of BMP could include the following types of practice:

– Siting noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area; or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
– Keeping equipment well maintained.
– Restricting truck speed on the site to reduce noise from the transport operation.

– Employing “quiet” practices when operating equipment (e.g. positioning and unloading of trucks in appropriate areas).
– Running staff-education programmes on the effects of noise and the use of quiet work practices.

8.4.1.2 Best Available Technology Economically Achievable (BATEA)

Equipment, plant and machinery that produce noise should incorporate advanced and affordable technology to minimise noise output.

Where BMP fails to achieve the required noise reduction by itself, the BATEA approach should be considered. Uses of BATEA which could be considered are:

– Using a non-acoustic warning method to warn if a vehicle is reversing or if this method does not prove satisfactory for safety reasons, adjusting the reversing alarm volume on heavy equipment to make them “smarter”, by limiting acoustic range to immediate danger area.
– Using pieces of equipment with efficient muffler design.
– Using vehicles with quieter engines.
– Active noise control.

8.4.2 Controlling noise in transmission

8.4.2.1 Barriers

Barriers are more effective if they are near the source or the receiver. Their effectiveness is also determined by their height, the materials used (absorptive or reflective) and their density. The relationship of these design features to attenuation is well documented.

Barriers can take a number of forms - including free-standing walls, grass or earth mounds or bunds, and trenches or cuttings within which noise sources are sited. They are employed when source and receiver control is either impractical or too costly.

9. Conclusion

GHD was engaged by Lake Macquarie City Council to undertake an operational noise validation assessment of the Awaba Waste Management Facility in accordance with Project Approval 10_0139.

Operator attended noise measurements were conducted on site as well as three (3) sensitive receiver locations surrounding the site on Thursday 11 November 2021.

The operator attended operational noise monitoring showed that the noise contributions from the facility comply with the Project Approval 10_0139 noise criteria of 45 dBA $L_{A10(15\ minute)}$ at all monitoring locations.

An operational noise model of the facility was created and validated based on measurements taken on site.

Using the noise model an operational noise assessment was undertaken based on a worst-case operating scenario, with all equipment operating and noise enhancing atmospheric conditions present.

The results of the model indicated that noise levels associated with the operation of the facility are predicted comply with the Project Approval noise criterion of 45 dBA $L_{A10(15\ minute)}$ during the day at all nearby sensitive receivers.

No additional noise mitigation measures are recommended. However, noise mitigation and management recommendations have been provided in Section 8 to encourage best practice onsite to minimise potential noise impacts.

Appendices

Appendix A

Calibration Certificates

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C28815

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Svantek
Type No: SV-36 **Serial No:** 106878
Owner: GHD Pty Ltd
Level 3, 24 Honeysuckle Drive
Newcastle, NSW 2300

Tests Performed: Measured output pressure level was found to be:

Parameter	Pre-Adj	Adj Y/N	Output: (db re 20 µPa)	Frequency: (Hz)	THD&N (%)
Level 1:	NA	N	94.09	999.99	3.16
Level 2:	NA	N	114.04	999.99	0.45
Uncertainty:			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.l.) k=2					

CONDITIONS OF TEST:

Ambient Pressure: 1006 hPa ±1.5 hPa **Relative Humidity:** 53 % ±5%

Temperature: 23 °C ±2° C

Date of Calibration: 15/02/2021 **Issue Date:** 15/02/2021

Acu-Vib Test Procedure: AVP02 (Calibrators)

Test Method: AS IEC 60942 - 2017

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Jack Kielt

.Accredited for compliance with ISO/IEC 17025 – Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited Lab. 9262
Acoustic and Vibration Measurements

ACU-VIB ELECTRONICS

HEAD OFFICE
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
Web site: www.acu-vib.com.au

The Calibrator described in this report has been tested to the requirements of the standard IEC 60942-[Ed 4]:2017-11.
The tests described in Annex B of the standard (Periodic tests) were carried out under the environmental conditions listed above to the following clauses:

Clause	**Test description**
B4.6	Sound Pressure Level (By comparison with a reference calibrator).
B4.7	Frequency (By measurement with a calibrated frequency meter).
B4.8	Total distortion and noise. (By measurement with a calibrated Noise and Distortion meter).

Notes:

1. The calibrator was calibrated with the main axis vertical and facing down.
2. No corrections have been made for atmospheric pressure, temperature or humidity.

Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM 29294

EQUIPMENT TESTED: Sound Level Meter

Manufacturer:	B & K		
Type No:	2250	**Serial No:**	2456407
Mic. Type:	4189	**Serial No:**	2772005
Pre-Amp. Type:	ZC0032	**Serial No:**	15362
Filter Type:	1/3 Octave	**Test No:**	FILT 6373

Owner: GHD Pty Ltd
Level 3, 24 Honeysuckle Drive
Newcastle, NSW 2300

Tests Performed: IEC 61672-3:2013,
IEC 1260:1995, & AS/NZS 4476:1997

Comments: All Test passed for Class 1.
(See over for details)

CONDITIONS OF TEST:

Ambient Pressure	1007	hPa ±1 hPa	**Date of Receipt :**	15/04/2021
Temperature	23	°C ±1° C	**Date of Calibration :**	16/04/2021
Relative Humidity	38	% ±5%	**Date of Issue :**	19/04/2021

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: ..... **AUTHORISED SIGNATURE:** .....

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration

Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

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Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013

Tests Performed:	*Clause*	*Result*
Absolute Calibration	10	Pass
Acoustical Frequency Weighting	12	Pass
Self-Generated Noise	11.1	Observed
Electrical Noise	11.2	Observed
Long Term Stability	15	Pass
Electrical Frequency Weightings	13	Pass
Frequency and Time Weightings	14	Pass
Reference Level Linearity	16	Pass
Range Level Linearity	17	Pass N/A
Toneburst	18	Pass
Peak C Sound Level	19	Pass
Overload Indicator	20	Pass
High Level Stability	21	Pass

Statement of Compliance: The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.

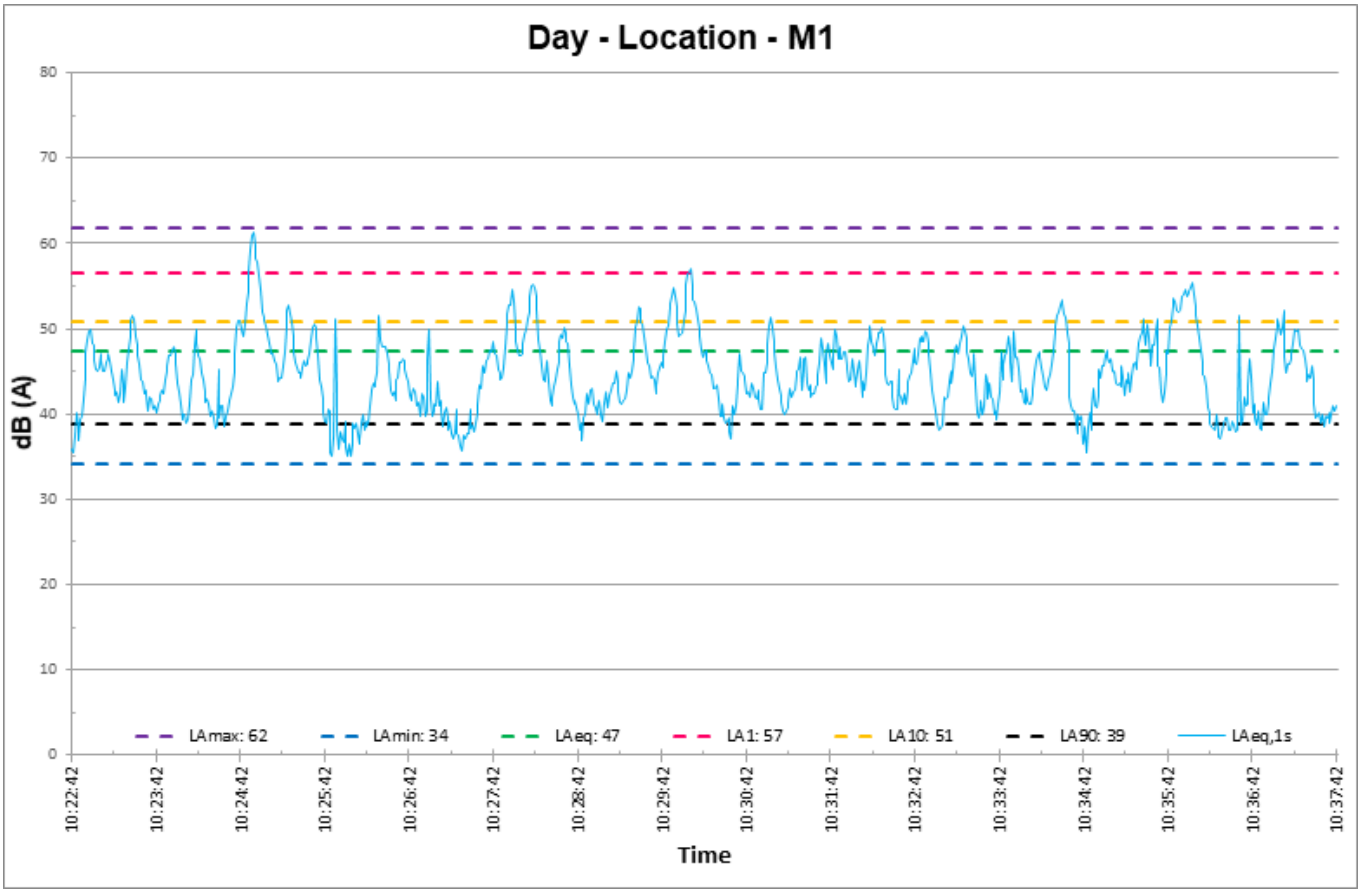
This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:

1. Relative attenuation clause 5.3

A full technical report is available on request.

Appendix B

Attended noise monitoring charts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dB (A)
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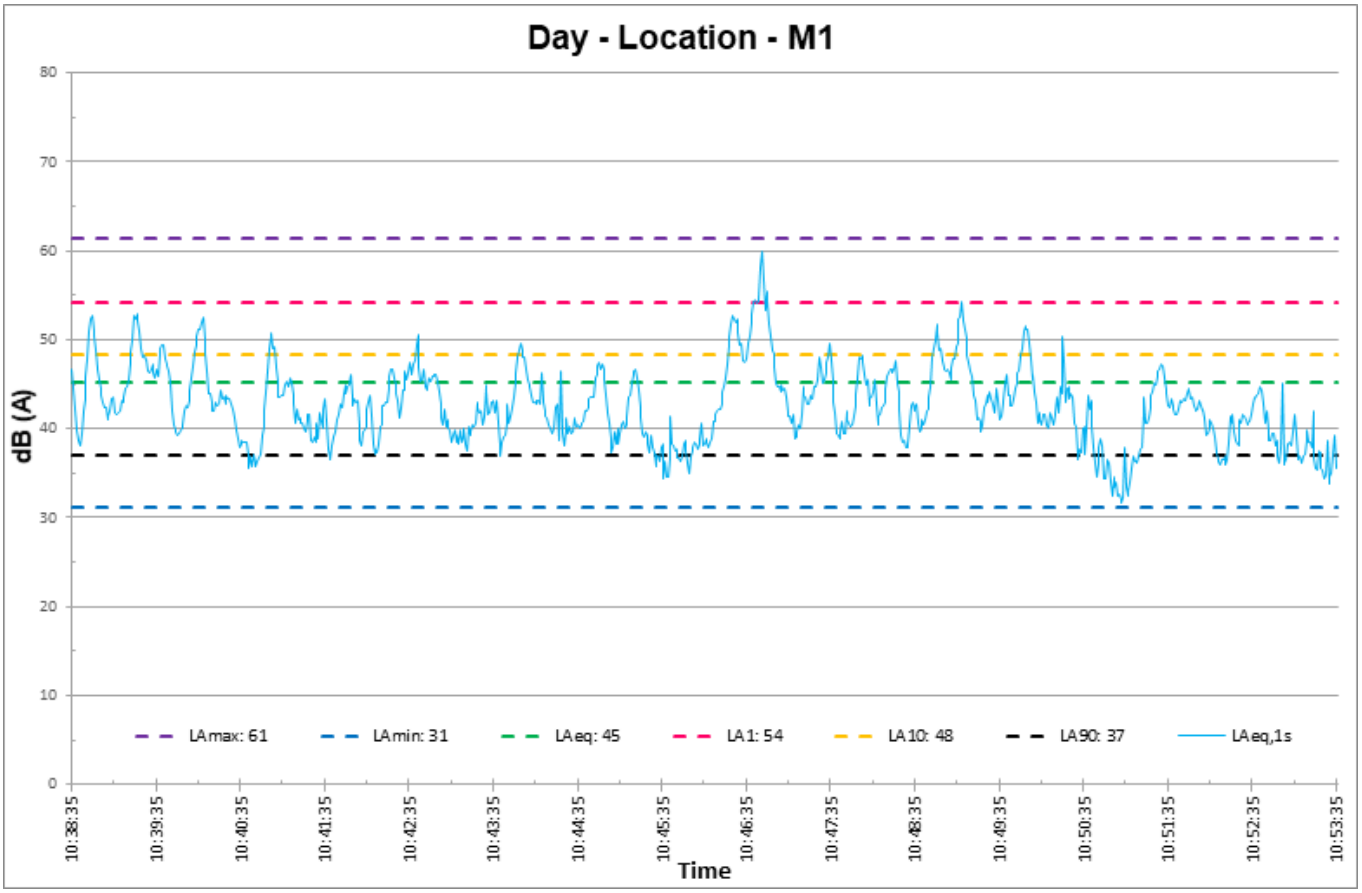
LAmax: 62
LAmin: 34
LAeq: 47
LA1: 57
LA10: 51
LA90: 39
LAeq,1s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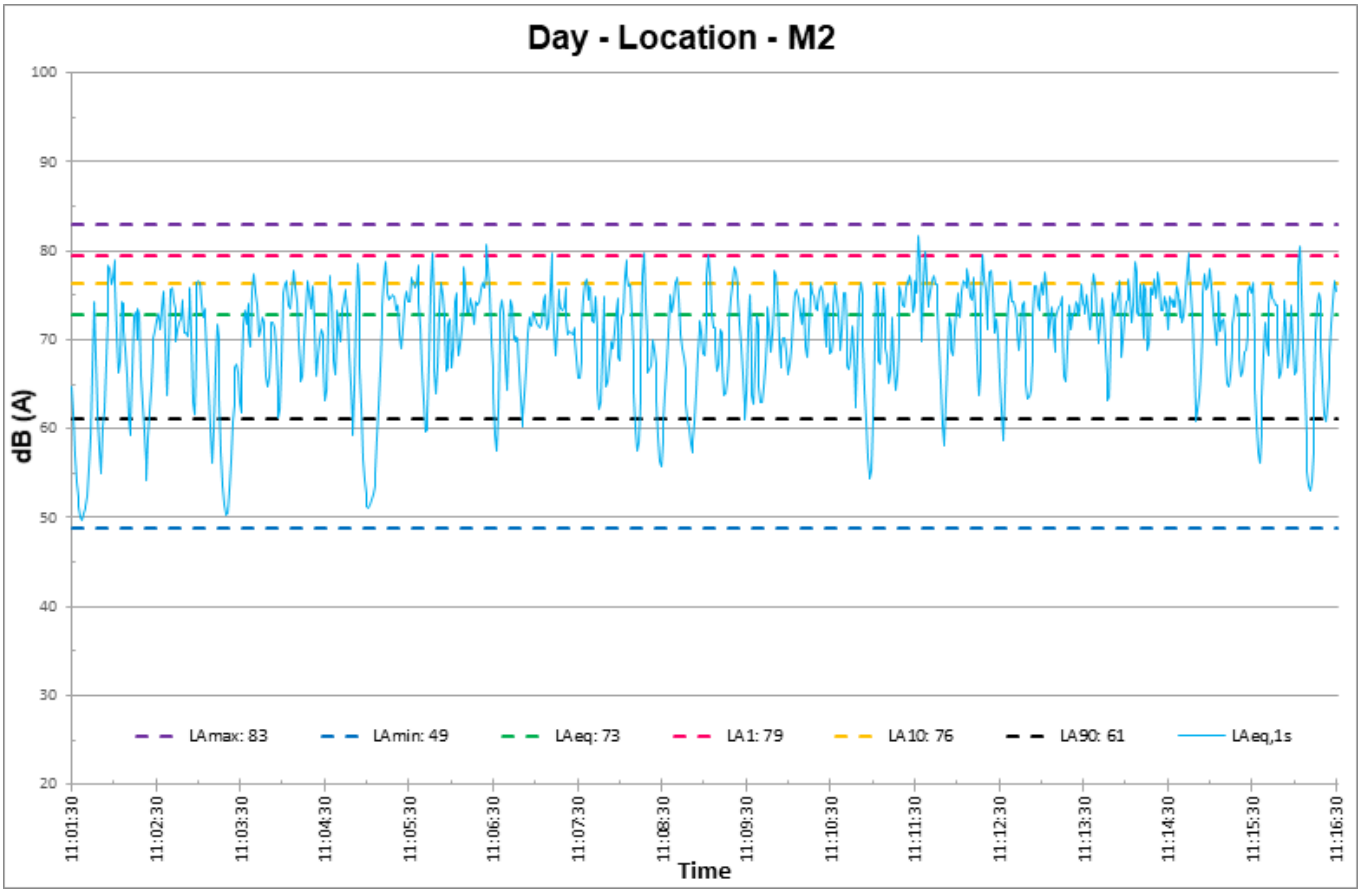
dB (A)
Time
LAmax: 61
LAmin: 31
LAeq: 45
LA1: 54
LA10: 48
LA90: 37
LAeq,1s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dB (A)
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90
80
70
60
50
40
30
20
LAmax: 83
LAmin: 49
LAeq: 73
LA1: 79
LA10: 76
LA90: 61
LAeq,1s
11:01:30
11:02:30
11:03:30
11:04:30
11:05:30
11:06:30
11:07:30
11:08:30
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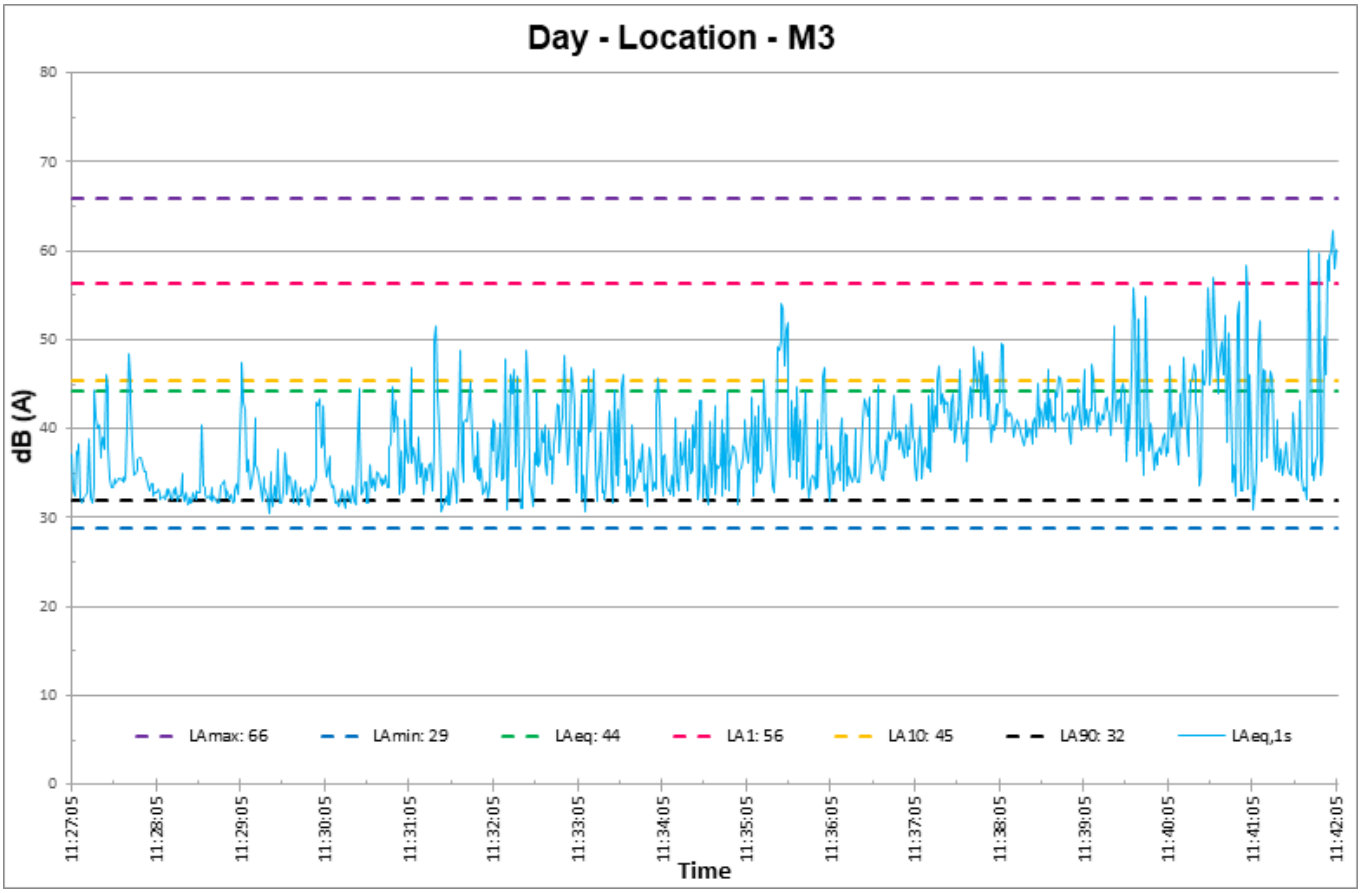
11:12:30
11:13:30
11:14:30
11:15:30
11:16:30
Time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dB (A)
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70
60
50
40
30
20
10
0
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LAmin: 29
LAeq: 44
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LA10: 45
LA90: 32
LAeq,1s
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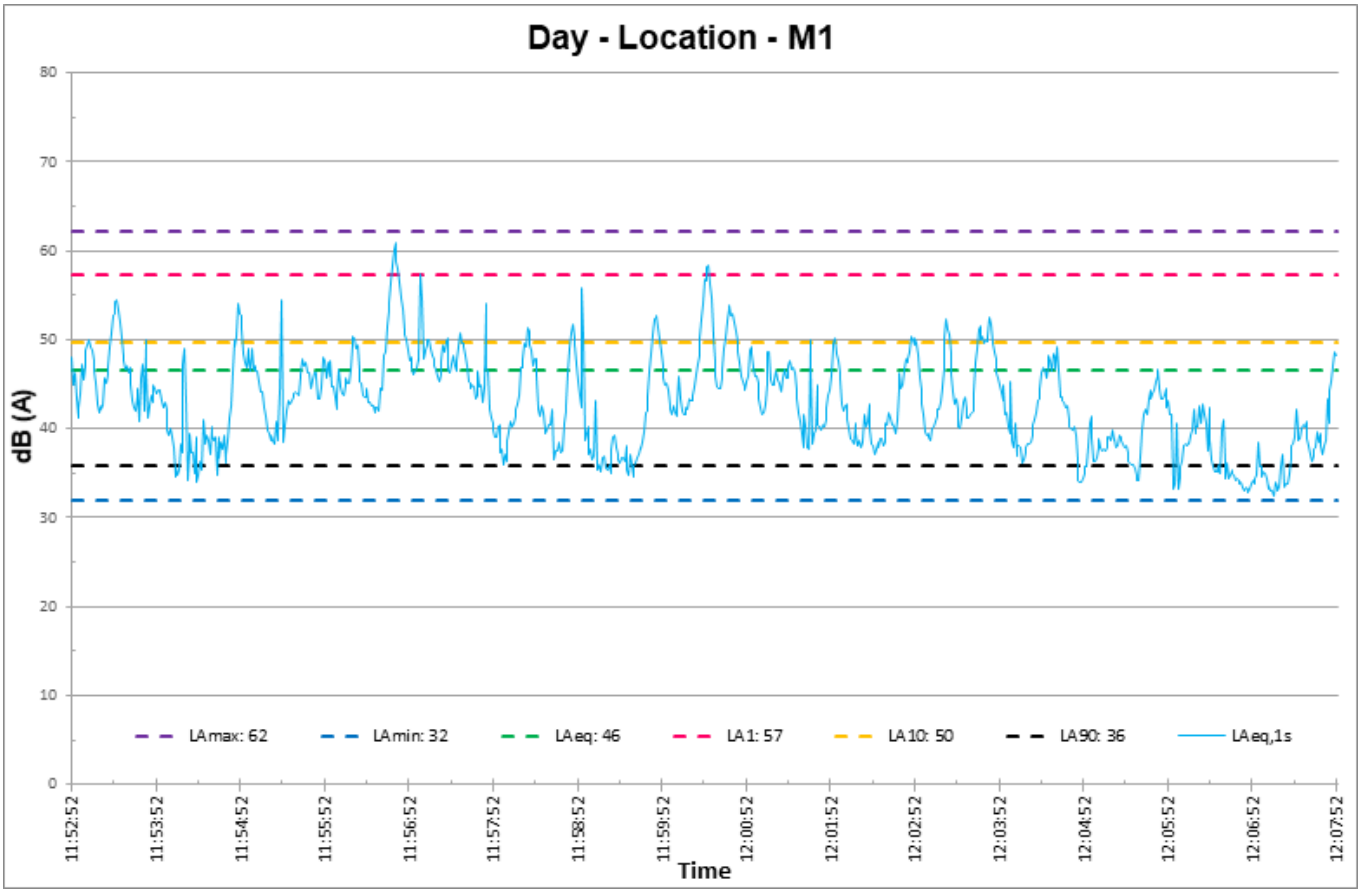
Time


Day - Location - M1
80
70
60
50
40
30
20
10
0
dB (A)
LAmax: 62
LAmin: 32
LAeq: 46
LA1: 57
LA10: 50
LA90: 36
LAeq,1s
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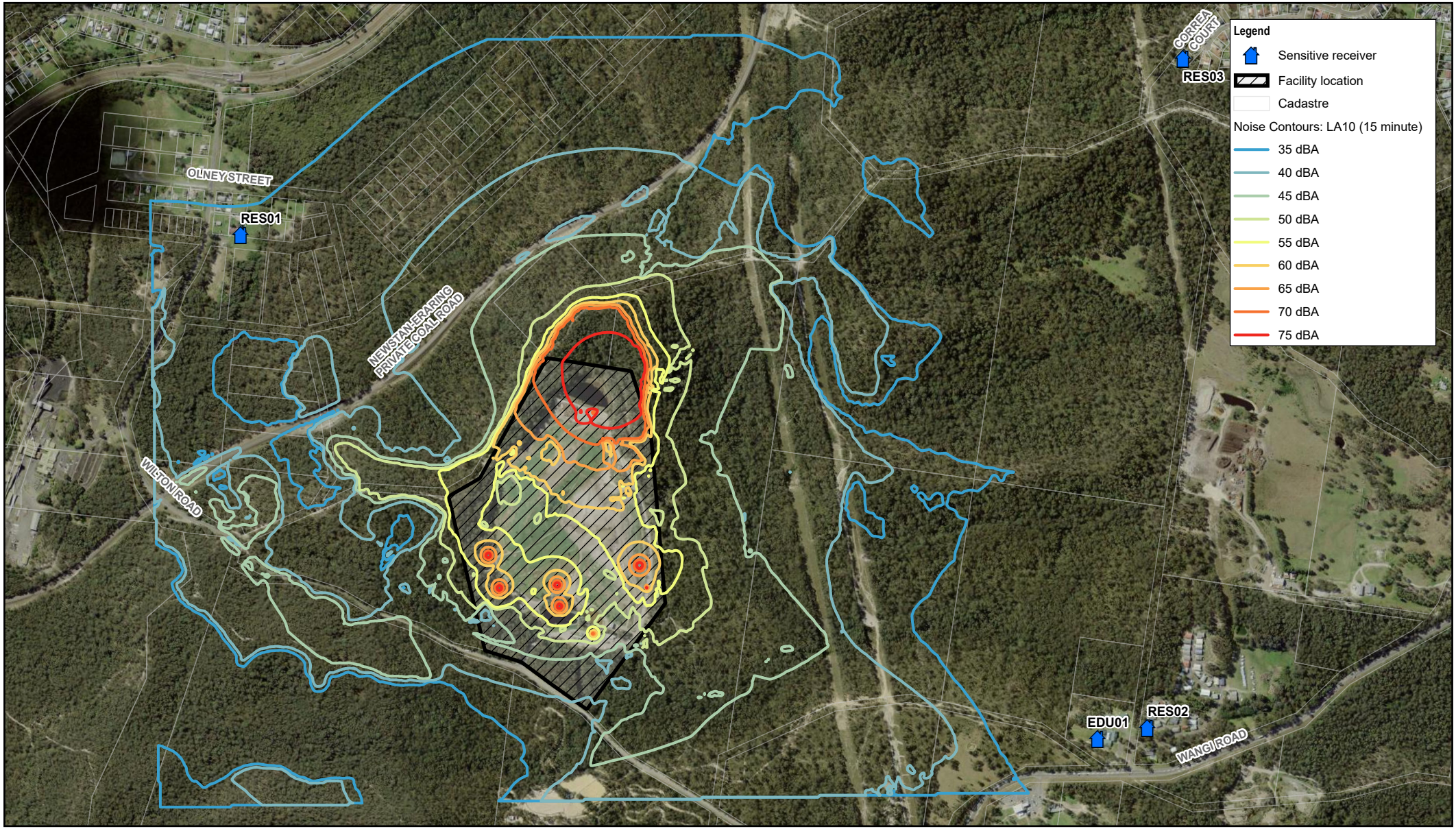
Time

Appendix C

Noise contour maps



Paper Size ISO A4

0 90 180 270 360

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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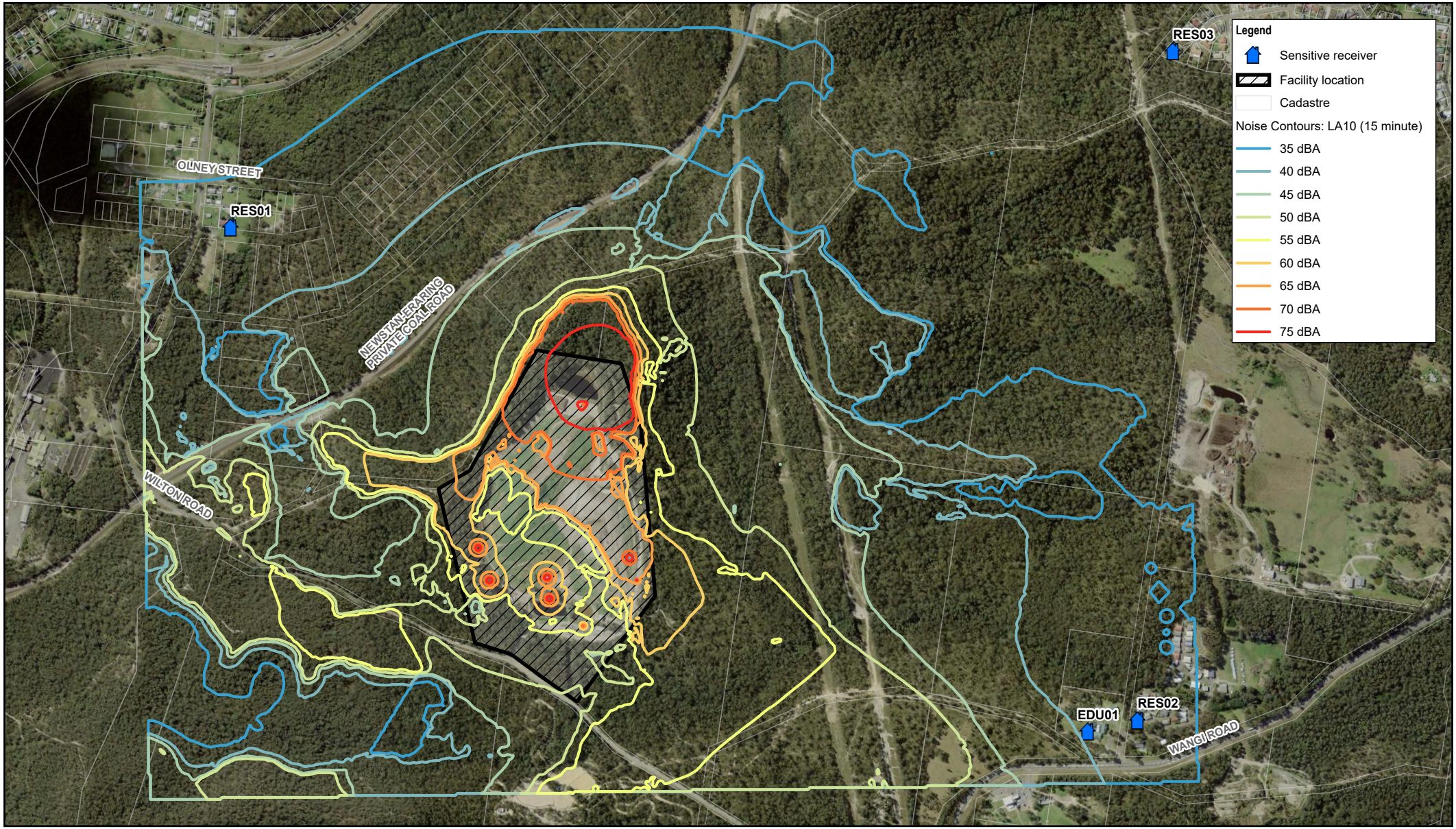
Date **08/12/2021**

Noise Validation Contours

FIGURE C.1

\\ghdnet\ghd\AU\Newcastle\Projects\22\12565218\GIS\Maps\Deliverables\12565218_NoiseValidation.aprx
Print date: 08 Dec 2021 - 17:01

Data source: NSW Land Registry Services, 2017: road, hyrdoline, cadastre; public/NSW_Imagery: © Department of Customer Service 2020. Created by: mfredle



Paper Size ISO A4

0 90 180 270 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

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Revision No. **0**
Date **08/12/2021**

Operational Noise Contours

FIGURE C.2

\\ghdnet\ghd\AU\Newcastle\Projects\22\12565218\GIS\Maps\Deliverables\12565218_NoiseValidation.aprx
Print date: 08 Dec 2021 - 17:01

Data source: NSW Land Registry Services, 2017: road, hyrdoline, cadastre; public/NSW_Imagery: © Department of Customer Service 2020. Created by: mfredle

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The Power of Commitment