NORTHROP

ACOUSTICS REPORT

Muswellbrook Shire Council Depot

252 Coal Road Muswellbrook NSW 2333

Ref: SY241473-00-AU-RP01
Rev: 1
Date: 28 Sep 24

PREPARED FOR
CCG Architects Pty Ltd
accounts@caldiscook.com
Newtown NSW 2042

Acoustics Report

Revision Information

Project:	Muswellbrook Shire Council Depot
Document Title:	Acoustics Report
Client:	CCG Architects Pty Ltd
Revision:	1
Status:	Issue for Information
Revision Date:	28 September 2024
Author:	Ryan Hughes
Verifier:	Neil Macabenta

Northrop Consulting Engineers Pty Ltd

ACN 064 775 088 | ABN 81 094 433 100

Level 11, 345 George Street, Sydney NSW 2000

02 9241 4188 | sydney@northrop.com.au | www.northrop.com.au

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1. Introduction

Northrop Consulting Engineers (Northrop) has been engaged by CCG Architects to provide a Development Application (DA) Acoustic Report for the proposed council depot located at 252 Coal Road, Muswellbrook NSW 2333 (the Project). This acoustic report will form part of the DA documents to be submitted to Council.

The report has assessed the noise associated with the Project as outlined in Section 1.1. Provided our recommendations are implemented, the Project is predicted to comply with the acoustic requirements of Muswellbrook Shire Council, NSW EPA Noise Policy for Industry and other relevant Australian standards and guidelines.

1.1 Acoustic Considerations

Table 1 outlines the acoustic considerations that were taken into account for the assessment of the Project.

Table 1: Acoustic considerations

Acoustic Consideration	Comments
Waste facility operation impact (noise intrusion)	Addressed in Section 4
Impact on neighbours (noise emission)	Addressed in Section 5
Waste facility operation removal of bund wall	The bund wall only provides acoustic shielding to the residential receivers to the south. Given that the nearest residential receiver to the south is over 2.5 kilometres from the site. It is anticipated that the noise emission from the waste facility would be minimal at this large distance. Furthermore, the southern receivers would be impacted by road traffic noise as they are located within close proximity to a major road (New England Highway). Therefore, the removal of the bund wall is not expected to change the acoustic environment to the residential receivers to the south.

1.2 Referenced Documents

This assessment has been prepared with reference to the following documents.

1.2.1 Project Documents

- Pre-DA architectural drawings provided by CCG Architects (see Appendix A)

1.2.2 Relevant Standards and Guidelines

The following standards and guidelines have been used to assess the noise and vibration impacts associated with the Project.

- Muswellbrook Shire Council Development Control Plan, 2009 (DCP)

- NSW Environmental Protection Authority (EPA) *Noise Policy for Industry*, 2017 (NPfI)
- Australian/ New Zealand Standard 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS/NZS 2107)

2. Project Description

2.1 Proposed Development

The Project will consist of the following:

- On-grade car parking
- Wash bays
- Material storage bays
- Split level depot building with an upper and lower ground floor that includes:
  - Store rooms
  - Workshop
  - Small offices
  - Open plan office space
  - Meeting room
  - Meals room
  - Reception

2.2 Hours of Operation

The proposed hours of operation are as follows:

- Monday to Sunday: 6am to 4:30pm

2.3 Site Description

The site is located on Coal Rd, immediately surrounded by vegetation in all directions. It is zoned as SP2 Waste Management Facility and has R1 – General Residential receivers at Queen St to the west and New England Highway to the south, E4 – General Industrial receivers on Thiess Cr to the southwest, an RE1 - Public Recreation field to the west, an open pit mine on Coal Rd to the east and a church to the north.

The nearby residential receivers on Queen Street, industrial receivers on Coal Rd and Theiss Cres and the recreational receiver at Weeraman Fields are considered the nearest affected receivers. These receivers are much closer than the other identified receivers and therefore it is anticipated that compliance at the assessed receivers would result in compliance at the further receivers.

The site and its surroundings are shown in Figure 1.

Figure 1: Site aerial view and nearest affected receivers

2.4 Sensitive Receivers

The nearest representative receivers which have potential of being impacted by noise associated with the Project are summarised in Table 2.

Table 2: Noise and vibration sensitive receivers

Receiver ID	Address	Land use
R01	8 Thiess Crescent, Muswellbrook NSW 2333	Active recreational
R02	6 Thiess Crescent, Muswellbrook NSW 2333	Industrial
R03	17 Industrial Close, Muswellbrook NSW 2333	Industrial
R04	39 Queen Street, Muswellbrook NSW 2333	Residential

3. Existing Environment

For the purpose of this report, the minimum Rating Background Levels (RBL) specified in the NSW NPfI has been adopted for a conservative assessment.

The minimum RBLs adopted for this Project are detailed below.

- Day time: 35 dBA
- Evening and night: 30 dBA

Noise monitoring can be undertaken in the future to measure the actual background noise levels at the nearest affected receivers. The measured background noise levels can be adopted to determine site specific noise emission criteria at the nearest affected receivers.

4. Noise Intrusion Assessment

The noise intrusion assessment identifies the required noise mitigation required to reduce the external noise to acceptable internal noise levels.

4.1 Noise Intrusion Criteria

4.1.1 Musswellbrook Development Control Plan 2009

Given that the DCP does not provide quantitative noise intrusion criteria relevant to this development, the internal design sound levels detailed in AS/NZS 2107 have been adopted herein.

4.1.2 Australian New Zealand Standard AS/NZS 2107:2016

AS/NZS 2107 provides recommended design sound level and reverberation times for different areas of occupancy in buildings. The recommended noise levels are given in terms of an equivalent continuous A-weighted noise level (L_{Aeq}). The AS/NZS recommended values for the internal background sound levels and reverberation times are shown in Table 3.

Table 3: Internal design sound levels

Type of occupancy	Recommended design sound level range – L_{eq} dBA
Meeting room (small)	40 – 45
Open plan office	40 – 45
Quiet rooms	40 – 45
Reception areas	40 – 45
Rest rooms and break-out spaces	40 – 45

4.2 Calculated Façade Noise Levels

The noise from the existing waste facility operation impacting the future depot was calculated using a 3D noise modelling program (Cadna-A version 2023).

Based on advice from Muswellbrook Shire Council, the typical activity at the waste facility would involve the following plant and equipment:

- Water cart
- Waste compactor
- Hook lift truck
- Articulated dump truck
- Loader; and
- Waste crusher

For a conservative assessment it was assumed that the plant and equipment are operating concurrently and at the closest offset distance to the future depot.

The external noise levels at the façade were predicted using this model to be 76 dBA.

The dimensions of the rooms as well as façade elements were assumed for the following spaces based on measurements taken using the pre-DA architectural drawings:

- Administration

- Meals room
- Meeting room 2
- Reception
- Private office

4.3 Recommendations – Glazing

Based on the above assumptions, the glazing was designed to reduce the external noise levels (calculated in Section 4.2) to the meet the recommended internal levels in Table 3.

From this assessment, the internal noise level is predicted to comply with the criteria using the following glazing construction.

- Double glazing consisting of 8mm glass/ 16mm air gap/ 10.8mm laminated glass (**Rw 43**).

Glazing thicknesses can be increased to comply with Section J requirements or as required.

Glazing is generally the weakest component of the facade, and if not designed or installed properly would be a major transmission path.

In some instances different glass configurations have the same R_w rating, but they have different sound transmission loss characteristics at each frequency band. Our recommendation for glazing is based on glass performance across frequency spectrum. Alternative glazing selections should be approved by an Acoustic Consultant.

All windows / doors should be well sealed when closed with quality seals such as Q-LON acoustic seals (or equivalent) along the top and bottom sliders. Special attention should be given to balcony or slider doors to have quality acoustic seals all around them. Any airgap will significantly reduce the acoustic performance or the ability to reduce noise. Mohair seals are not considered to be acoustic seals.

4.4 Recommendations – Walls and Ceiling

The following wall and roof construction were considered:

- CLD:01 (Rw 47) – 9mm CFC, steel stud frame (0.55mm); cavity width 94mm, stud spacing 600mm, 60mm fibreglass insulation, 10mm plasterboard
- CLD:02 (Rw 45) – Colorbond, steel stud frame (0.55mm); cavity width 94mm, stud spacing 600mm, 60mm fibreglass insultation, 2 layers of Fyrcheck plasterboard
- Roof (Rw 44) – 0.6mm roof cladding, suspended light steel grid frame; cavity width 200mm, stud spacing 600mm, 75mm Earthwool 11kg/m^3 acoustic wall batt, 10mm plasterboard

Provided the above wall and ceiling construction are adopted, the external noise levels are expected to be reduced to acceptable levels.

5. Noise Emission Assessment

This section assesses noise emissions from the development impacting the surrounding noise receivers.

5.1 Criteria

5.1.1 Musswellbrook Council Development Control Plan (DCP) 2009

Given that the DCP does not provide quantitative noise emission criteria relevant to this development, the noise emission criteria detailed in the NPfI have been adopted herein.

5.1.2 NSW EPA Noise Policy for Industry (2017)

The NPfI sets out noise criteria to control the noise emission from industrial noise sources. Operational noise from the development will be assessed in accordance with the NPfI.

The NPfI assessment procedure has two components:

- Controlling intrusive noise into nearby residences (Intrusiveness Criteria)
- Maintaining noise level amenity for particular land uses (Amenity Criteria)

The project noise trigger level is the lower (that is, the more stringent) value of the project intrusiveness noise level and project amenity noise level determined in Section 5.1.2.1 and Section 5.1.2.2. The project noise trigger level provides a benchmark for assessing the noise emissions from a development.

5.1.2.1 Project Intrusiveness Noise Level

The intrusiveness noise level aims to limit the change in the existing environment due to the introduction of a new noise source. The intrusiveness noise level is defined as:

$$L_{Aeq,15min} = RBL + 5\ dB$$

Where RBL is determined using the assumed policy minimums stated in Section 3. The project intrusiveness noise levels are presented in Table 4 below.

Table 4: Project intrusiveness noise level (residential receivers only)

Receiver	Time period[1]	Minimum RBL – L_{90} dBA	Project intrusiveness noise level – $L_{eq,15min}$ dBA
Residential (R04)	Day	35	40
	Evening	30	35
	Night	30	35

1. Time periods defined as: Day 7am to 6pm Monday to Saturday and 8am to 6pm Sunday; Evening 6pm to 10pm Monday to Sunday; Night 10pm to 7am Monday to Saturday and 10pm to 8am Sunday

5.1.2.2 Project Amenity Noise Level

For the purpose of limiting continual increase in noise levels, recommended noise levels are defined to maintain acoustic amenity for different types of land uses. The recommended amenity noise levels are described in Table 2.2 of the NPfI.

Based on Table 2.3 of the NPfI, the residential receivers can be considered as suburban receivers. The recommended amenity noise levels applicable to the Project are detailed in Table 5.

Table 5: Amenity noise levels

Receiver	Noise amenity area	Time period[1]	Recommended amenity noise level – $L_{eq,\ period}$ dBA	Project amenity noise level – $L_{eq,\ period}$ dBA[2]	Project amenity noise level – $L_{eq,15min}$ dBA[3]
Residential	Suburban	Day	55	50	53
		Evening	45	40	43
		Night	40	35	38
Active recreational	All	When in use	55	50	53
Industrial premises	All	When in use	70	65	68

1. Time periods defined as: Day 7am to 6pm Monday to Saturday and 8am to 6pm Sunday; Evening 6pm to 10pm Monday to Sunday; Night 10pm to 7am Monday to Saturday and 10pm to 8am Sunday
2. Recommended amenity noise level minus 5 dB
3. In accordance with the NPfI, a 3dBA correction has been applied to convert from a period level to a 15 minute level

5.1.2.3 Project Trigger Levels

The project noise trigger level is the more stringent of the project intrusiveness noise level and project amenity noise level. The site specific project trigger levels have been determined for the nearby sensitive receivers and have been detailed in Table 6.

Table 6: Project noise trigger levels

Receiver ID	Land use	Time period[1]	Project intrusiveness noise level – $L_{eq,15min}$ dBA	Project amenity noise level – $L_{eq,15min}$ dBA	Project trigger levels – $L_{eq,15min}$ dBA
R04	Residential	Day	40	53	40
		Evening	35	43	35
		Night	35	38	35
R01	Active recreational	When in use	-	53	53
R02 and R03	Industrial premises	When in use	-	68	68

1. Time periods defined as: Day 7am to 6pm Monday to Saturday and 8am to 6pm Sunday; Evening 6pm to 10pm Monday to Sunday; Night 10pm to 7am Monday to Saturday and 10pm to 8am Sunday

5.1.2.4 Maximum Noise Level Event Screening Criteria

The potential for sleep disturbance from maximum noise level events from truck reverse alarms during the night should be considered.

In accordance with the NPfI, where the subject development/premises night time noise levels at a residential location exceed the following, a detailed maximum noise level event assessment should be undertaken.

- $L_{eq,15min}$ 40 dBA or the prevailing RBL plus 5 dB, whichever is the greater, and/or
- L_{Fmax} 52 dBA or the prevailing RBL plus 15 dB, whichever is the greater.

The maximum noise trigger levels are detailed in Table 7.

Table 7: Maximum noise level criteria

Receiver type	Assessment level – $L_{eq,15min}$	Assessment level – L_{Fmax}
Residential	40dBA	52dBA

5.2 Noise Emission Assessment

The noise emission from the Project should comply with the external noise emission criteria (Project Trigger Noise Levels) detailed in Table 6.

It is anticipated that the noise from the Project will emanate from the following noise sources.

- Car park activity
- Mechanical plant and equipment
- Warehouse activity
- Emulsion and wash bays

The cumulative noise from the above noise sources should comply with the Project Trigger Noise Level criteria presented in Table 6.

5.2.1 Noise Sources

5.2.1.1 External Activities

The following noise sources shown in Table 8 have been used in the assessment of noise produced in the car park. The noise levels are based on Northrop's database.

Table 8: External noise source levels

Noise source	Sound Power Level, dBA
Heavy vehicles	101
Light vehicles	68
Truck reverse alarm	109[1]
2 x High pressure hoses	106 per unit
Bitumen pump	102

1. Includes a +5dB penalty for annoyance

As advised by Muswellbrook Shire Council, the following traffic movements were assumed to occur within a 15 minute period.

- Heavy vehicles: Up to 10 movements during the day or night time
- Light vehicles: Up to 26 movements during the day or night time
- 10 heavy vehicles using reverse beeping for 20 seconds

Additionally, it is assumed that the use of the high pressure hoses are limited to the day time only (ie. between 7am and 6pm).

5.2.1.2 *Mechanical Plant*

The mechanical plant has yet to be selected at this stage and therefore a noise assessment of the mechanical plant servicing the Project cannot be undertaken. It is recommended that an assessment of mechanical plant is undertaken at the detailed design stage (CC stage).

It is anticipated that in principle noise engineering measures can be utilised to meet the environmental noise criteria. This can include the following:

- Selection of quieter equipment
- Locate equipment away from sensitive receivers
- Incorporate acoustic louvres or attenuators
- Incorporate duct lining
- Design acoustic barriers/ enclosures

5.2.1.3 *Internal Activities*

The noise breakout from the warehouse is modelled as a continuous vertical area source at the location corresponding to the shutters in the architectural elevations with an assumed internal Sound Pressure Level of 75 $L_{eq,15min}$ dBA. It is assumed that the shutters are open for a worst case scenario.

5.2.2 Methodology

This section has assessed the noise generated from the proposed development. The noise emissions were modelled using a 3D noise modelling program (Cadna-A version 2023). For a worst-case scenario, the noise was modelled under noise enhancing weather conditions.

The noise model takes the following into account:

- Noise attenuation from the buildings and barriers
- Ground type between the source and the receiver

Table 9 details the modelling inputs.

Table 9: Noise modelling inputs

Modelling Inputs	Description
Calculation method	CONCAWE
Meteorological conditions	Day: Stability Class D with 3m/s winds in the worst case wind direction Night: Stability class F with 2m/s winds in the worst case wind direction
Source height	• Light vehicles: 0.5m • Heavy vehicles: 2m • Truck reverse alarms: 0.5m • Pump and pressure hoses: 1.5m
Receiver height	All receivers: 1.5m above ground level
Receiver location	As shown in Figure 1
Ground contours	2m ground contours obtained from ELVIS

Ground absorption	0.5

5.2.3 Predicted Noise Levels

Noise emissions were predicted at the nearest affected receivers shown in Table 10 below.

Table 10: Predicted noise emissions levels at each identified affected receivers

Receiver ID	Land use	Criteria[1]			Predicted noise level $L_{eq,15\ min}$ dBA	
		Day	Evening	Night	Day	Evening/ Night
R01	Active recreational	53[2]	53[2]	53[2]	48	43
R02	Industrial	68[2]	68[2]	68[2]	40	36
R03	Industrial	68[2]	68[2]	68[2]	34	29
R04	Residential	40	35	35	40	35

1. Time periods defined as: Day 7am to 6pm Monday to Saturday and 8am to 6pm Sunday; Evening 6pm to 10pm Monday to Sunday; Night 10pm to 7am Monday to Saturday and 10pm to 8am Sunday
2. When in use

Based on the results shown in Table 10, the noise levels are predicted to comply with the noise emission criteria for all time periods. Nevertheless, the following recommendations should be considered to help minimise noise emissions.

- Heavy vehicles should utilise broadband reverse beepers (where feasible); and
- Locate trucks in car spaces that allow forward movement to avoid reverse beeping.

5.3 Maximum Noise Level Assessment

The potential for sleep disturbance is assessed using the NPfI maximum noise level event assessment for residential receivers. It is anticipated that the maximum noise level event from the development would likely occur from truck reversing alarms while trucks are entering/ exiting the development.

Based on data from our internal database, a truck reversing alarm is anticipated to have a sound power level of 115 L_{max} dBA.

Table 11: Maximum noise level assessment results at affected residential receivers

Receiver ID	Noise Criteria		Predicted Noise Levels	
	$L_{eq,15min}$ dBA	L_{Fmax} dBA	$L_{eq,15min}$ dBA	L_{Fmax} dBA
R04	40	52	35	40

The results show that the night time noise levels from the Project is predicted to comply with the maximum noise level criteria and therefore sleep disturbance is not anticipated. Therefore, no further noise mitigation measures are required.

6. Conclusion

This report forms part of the DA submission for the new council depot located at 252 Coal Road, Muswellbrook.

Noise from the existing waste facility was predicted to the future depot. Recommendations were provided to reduce external noise to acceptable levels.

For a conservative assessment, the minimum noise emission criteria were adopted for this assessment. Noise emissions where predicted at the nearest affected receivers and where exceedances occurred, recommendations were provided to achieve compliance.

Provided our recommendations are implemented, noise emissions from the subject development will comply with the acoustic requirements of Muswellbrook Shire Council, NSW EPA Noise Policy for Industry and relevant Australian standards and guidelines.

6.1 Summary of Recommendations

- **External façade** – to minimise noise break in from the existing waste facility the façade should be designed in accordance with the recommendations provided in Section 4.3 and 4.4
- **Mechanical plant** – an assessment of noise emissions from the mechanical and building services equipment should be undertaken at the detailed design stage to ensure cumulative noise does not exceed the project specific criteria at the nearest affected receivers. Indicative recommendations that can be incorporated in the design is detailed in Section 5.2.1.2
- **High pressure hoses and bitumen pumps** – Sound power level of the high pressure and bitumen pumps should not exceed the sound power levels provided in Table 8. The use of the high pressure hoses should be limited to the day time (between 7am and 6pm)
- **Heavy vehicles** – Utilise broadband reverse beepers where possible. Locate heavy vehicles in parking spaces that allow for forward movement to minimise reverse beeping

Appendix B: Glossary of Acoustic Terminology

Decibel – dB – Unit of Acoustic measurements for power, pressure and intensity. Expressed in dB relative to standard levels.

A-weighted decibel – dB(A) – Unit of acoustic measurement weighted approximately to human hearing to sound.

SPL – Sound Pressure Level – 20 times the logarithm to the base 10 of the ratio of r.m.s. sound pressure to the reference pressure of 20 micro Pascals, sound pressure level is measured using a microphone and a sound level meter and varies with distance from the source.

SWL – Sound Power Level – 10 times the logarithm to base 10 of the ratio of the sound power of the source to the reference sound power of 1 Pico Watt. Sound power level cannot be directly measured using a microphone and a sound level meter, and it does not change with distance. The sound power of a machine will vary depending on the operation conditions or load.

R_w – Weighted Sound Reduction Index – Measured sound reduction of a building element in a laboratory, corrected for room volume and reverberation time, the higher values correspond to better sound insulation. It describes the sound-proofing effectiveness of a partition or glazing depending on its material and construction. Each increasing increment in R_w is equivalent to 1 dB of noise reduction. R_w however, is a rating determined in a laboratory - a highly controlled environment - and should only be used as an indicative value for design purposes. Spectrum adaptation terms C and C_{tr} are often added to the measured R_w result to account for low frequency noise.

L_{nw} – Weighted Normalised Impact Sound Pressure Level – the design value of the achievable impact noise attenuation of a building element. L_{nw} measures the perceived impact noise in the receiver room, so maximum values are usually quoted, with lower values corresponding to lower levels of theoretical perceived impact noise. Each increasing increment in L_{nw} is equivalent to 1 dB of impact noise increase. Spectrum adaptation term CI is often added to the L_{nw} result to account for low frequency noise.

L_{Amax} – The Maximum Noise Level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A10} – The noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{Aeq} – The Equivalent Continuous Sound Level is the energy average of the varying noise over the sample period (often given in the subscript) and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise. L_{Aeq} is measured in dB(A).

L_{A90} – The noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level or RBL.

L_{Amin} – The Minimum Noise Level over a sample period is the minimum level, measured on fast response, during the sample period.

Contact Us

BRISBANE
07 3365 0400
brisbane@northrop.com.au
Level 25, 12 Creek Street
Brisbane QLD 4000

CANBERRA
02 6285 1822
canberra@northrop.com.au
Level 6, 224 Bunda Street
Canberra ACT 2608

CENTRAL COAST
02 4365 1668
centralcoast@northrop.com.au
Level 1, Suite 4 257-259 Central Coast Highway
Erina NSW 2250

COFFS HARBOUR
02 5603 3053
coffsharbour@northrop.com.au
Suite 6, 27 Orlando Street
Coffs Harbour NSW 2450

MELBOURNE
03 9600 2645
melbourne@northrop.com.au
Level 3, 520 Collins Street
Melbourne VIC 3000

NEWCASTLE
02 4943 1777
newcastle@northrop.com.au
Level 1, 215 Pacific Highway
Charlestown NSW 2290

PARRAMATTA
02 9241 4188
sydney@northrop.com.au
Level 15, 6 Hassall Street
Parramatta NSW 2150

SYDNEY
02 9241 4188
sydney@northrop.com.au
Level 11, 345 George Street
Sydney NSW 2000

WOLLONGONG
02 4226 3333
southcoast@northrop.com.au
Level 1, 57 Kembla Street
Wollongong NSW 2500

NORTHROP