

Environmental Noise Assessment - Gravel Extraction Quarry

Lot 3938/406 Catterick Road, Catterick

Reference: 24048870-01A

Prepared for:
Cross Verwijmeren Ltd

Reference: 24048870-01A

Lloyd George Acoustics Pty Ltd

ABN: 79 125 812 544

PO Box 717

Hillarys WA 6923

www.lgacoustics.com.au

Contacts	General	Terry George	Matt Moyle	Matt Nolan
E:	info@lgacoustics.com.au	terry@lgacoustics.com.au	matt@lgacoustics.com.au	matt.nolan@lgacoustics.com.au
P:	9401 7770	0400 414 197	0412 611 330	0448 912 604
Contacts	Accounts	Rob Connolly	Hao Tran	Dave Perry
E:	accounts@lgacoustics.com.au	rob@lgacoustics.com.au	hao@lgacoustics.com.au	dave@lgacoustics.com.au
P:	9401 7770	0410 107 440	0438 481 207	0410 468 203

This report has been prepared in accordance with the scope of services described in the contract or agreement between Lloyd George Acoustics Pty Ltd and the Client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client, and Lloyd George Acoustics Pty Ltd accepts no responsibility for its use by other parties.

Date	Rev	Description	Author	Verified
27/09/24	-	Issued to Client	Daniel Lloyd	-
25-Oct-25	A	Revised Plant List	Rob Connolly	Terry George

CONTENTS

EXECUTIVE SUMMARY.....	i
1. INTRODUCTION.....	1
2. CRITERIA.....	3
2.1. Construction Works.....	3
2.2. Extraction, Crushing and Haulage Works	3
2.2.1. Regulations 7, 8 & 9.....	3
2.2.2. Regulation 3.....	5
2.3. Airblast.....	6
2.4. Airblast Vibration.....	7
3. METHODOLOGY	8
3.1. Site Measurements.....	8
3.2. Noise Modelling.....	8
3.2.1. Meteorological Conditions	8
3.2.2. Topographical Data.....	9
3.2.3. Ground Absorption	9
3.2.4. Source Sound Levels	9
3.3. Airblast Calculations	11
3.4. Blasting Ground Vibrations.....	12
4. RESULTS	13
4.1. Ambient Noise Measurements.....	13
4.2. Noise Modelling.....	14
4.2.1. Construction Phase.....	14
4.2.2. Extraction Phase	14
4.2.3. Crushing & Loading Phase	16

4.3.	Drill and Blast.....	17
4.3.1.	Drilling.....	17
4.3.2.	Airblast Overpressure	17
4.3.3.	Blast Ground Vibration	18
5.	ASSESSMENT & RECOMMENDATIONS	19
5.1.	Construction Phase.....	19
5.2.	Extraction Phase	19
5.3.	Crushing and Loading Phase.....	21
5.4.	Blast hole Drilling.....	23
5.5.	Blasting	23
6.	CONCLUSION.....	24

List of Tables

Table 2-1	Adjustments Where Characteristics Cannot Be Removed	4
Table 2-2	Baseline Assigned Levels.....	4
Table 2-3	Assigned Levels	5
Table 3-1:	Modelling Meteorological Conditions	9
Table 3-2:	Source Sound Power Levels, dB.....	9
Table 4-1:	Predicted Levels during Construction Phase, dB(A)	14
Table 4-2:	Predicted Levels during Extraction Phase without Noise Mitigation, dB(A)	14
Table 4-3:	Predicted Levels during Crushing & Loading Phase without Noise Mitigation, dB(A)	16
Table 4-4:	Predicted Levels during Blast Hole Drilling, dB(A)	17
Table 4-5:	Calculated Airblast Noise Levels (Confined blast)	17
Table 5-1:	Predicted Levels during Excavation Phase using Alternative Plant, dB(A)	20
Table 5-2:	Predicted Levels during Crushing & Loading Phase with Noise Mitigation, dB(A)	21

List of Figures

Figure 1-1: Subject Site Location (Source: Google Earth).....	1
Figure 1-2: Proposed Extraction Stages.....	2
Figure 4-1 Results of Ambient Noise Measurements.....	13
Figure 4-2: Noise Contour Plot for Stage 1 without Noise Mitigation.....	15
Figure 5-1: Mobile Plant Exclusion Zones.....	20
Figure 5-2: Proposed Noise Bund Locations.....	22

Appendices

Appendix A - Extraction Phase Noise Contours

Appendix B - Crushing Phase Noise Contours

Appendix C – Drilling Noise Contours

Appendix D - Terminology

EXECUTIVE SUMMARY

The noise emissions resulting from a proposed extraction and crushing operations at Lot 3938/406 Catterick Road, Catterick, Western Australia, have been assessed by means of predictive noise modelling and the results compared against the assigned levels within the *Environmental Protection (Noise) Regulations 1997*.

The proposed hours of operation are 7.00 am to 7.00 pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays. The site will be closed on Sundays and Public Holidays.

The proposed plant required for the construction, extraction and crushing works includes:

- Metso LT120 Jaw Crusher;
- Metso LT350HP with TK Prescreen Cone Crusher;
- Metso LT1213S Impact Crusher;
- Metso ST4.10 Triple Deck Screener;
- Metso S4.11 Reclaimer HD Screen;
- Telestack 424x Radial Stacker;
- Telestack 624R Radial Material Stacker;
- Caterpillar 982M Wheeled Loader;
- Caterpillar 352 Excavator;
- Caterpillar 336 Excavator;
- Caterpillar 306 Excavator;
- Semi Water Cart;
- Caterpillar 140M Grader;
- Bell B40D Articulated Dump Truck;
- Service Truck;
- Light Vehicles.

Intermittent use of the following plant is envisaged for construction/regeneration phases:

- Caterpillar D9T Dozer;
- Caterpillar D8T Dozer;
- Caterpillar CP76 Pad Foot Roller
- CAT 982 Front End Loader;
- Caterpillar CS76 Smooth Drum Roller.

Intermittent use of the following plant is envisaged for Drill and Blast Operations:

- Tamrock Drill Rig (or similar)

Based on the assumptions made, the noise predictions show that the operations can achieve compliance with the applicable regulatory criteria, between 7.00 a.m. and 7.00 p.m. Monday to Saturday at all noise sensitive receivers, providing the D8T dozer is restricted to certain areas and a series of earth bunds are constructed around the crushing and screening plant as recommended in this assessment.

1. INTRODUCTION

Lloyd George Acoustics was engaged by Cross Verwijmeren Ltd to undertake an environmental noise assessment for a gravel extraction pit to be located at Lot 3938/406 Catterick Road, Catterick - refer *Figure 1-1*.



Figure 1-1: Subject Site Location (Source: Google Earth)

The extraction will be undertaken in 14 stages. Six (6) stages will be used for gravel extraction and eight (8) stages for drill and blast. The stage layout is shown in *Figure 1-2*.

With regard to noise emissions, consideration is given to the noise from extraction and crushing plant on the site as well as trucks entering the site to cart the material away. It is expected that approximately 4 truck movements per hour would occur, depending on demand.

Noise and airblast is assessed at neighbouring properties and compared to the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*.

Typical operating hours of the quarry will be from 7.00 am to 7.00 pm Monday to Friday and 7.00 am to 1.00 pm on Saturdays. The site will be closed on Sundays and Public Holidays.

Appendix D contains a description of some of the terminology used throughout this report.



Figure 1-2: Proposed Extraction Stages

2. CRITERIA

2.1. Construction Works

Construction activities are covered under Regulation 13 of the *Environmental Protection (Noise) Regulations 1997, (the Regulations)* and provide the noise requirements that are to be satisfied. Regulation 13 is considered appropriate for the removal of topsoil and the construction of noise bunds, which means that the normally prescribed assigned noise levels under regulation 7 of the *Regulations* are not applicable to this phase of the operations as described below.

Regulation 7 does not apply to noise emitted from a construction site as a result of construction work carried out between 0700 hours and 1900 hours on any day which is not a Sunday or public holiday if the occupier of the premises ... shows that –

- a) The construction work was carried out in accordance with control of environmental noise practices set out in section 4 of AS 2436-2010 Guide to noise and vibration control on construction, maintenance and demolition sites; and*
- b) The equipment used on the premises was the quietest reasonably available; and*
- c) If the occupier was required to prepare a noise management plan ... in respect of the construction site-*
 - i. The noise management plan was prepared and given in accordance with the requirement, and approved by the Chief Executive Officer; and*
 - ii. The construction work was carried out in accordance with the noise management plan, excluding any ancillary measure.*

2.2. Extraction, Crushing and Haulage Works

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997 (the Regulations)*.

2.2.1. Regulations 7, 8 & 9

This group of regulations provide the prescribed standard for noise as follows:

“7. Prescribed standard for noise emissions

- (1) Noise emitted from any premises or public place when received at other premises –*
 - (a) must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and*
 - (b) must be free of –*
 - (i) tonality; and*
 - (ii) impulsiveness; and*
 - (iii) modulation,**when assessed under regulation 9.*
- (2) For the purposes of subregulation (1)(a), a noise emission is taken to significantly contribute to a level of noise if the noise emission ... exceeds a value which is 5 dB below the assigned level at the point of reception.”*

Tonality, impulsiveness and modulation are defined in regulation 9 (refer *Appendix A*). Under regulation 9(3), “Noise is taken to be free of the characteristics of tonality, impulsiveness and modulation if -

- (a) the characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and
- (b) the noise emission complies with the standard prescribed under regulation 7(1)(a) after the adjustments in the table [Table 2-1] ... are made to the noise emission as measured at the point of reception.”

Table 2-1 Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music*			Where Noise Emission is Music	
Tonality	Modulation	Impulsiveness	No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

* These adjustments are cumulative to a maximum of 15 dB.

The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in *Table 2-2*. The L_{A10} assigned level is applicable to noise present for more than 10% of a representative assessment period, generally applicable to “steady-state” noise sources. The L_{A1} is for short-term noise sources present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time.

Table 2-2 Baseline Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

1. *highly sensitive area* means that area (if any) of noise sensitive premises comprising —

- (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
- (b) any other part of the premises within 15 metres of that building or that part of the building.

As there are no commercial or industrial premises within 450m of the affected receivers, the influencing factor (IF), in relation to noise received at noise sensitive premises, has been calculated as 0 dB. Therefore it is the baseline assigned levels provided in *Table 2-2* that are relevant to this assessment. The relevant assigned levels are provided in *Table 2-3*.

Table 2-3 Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	45	55	65
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

It must be noted the assigned levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces.

The assigned levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as “a period of time of not less than 15 minutes, and not exceeding 4 hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission”. An inspector or authorised person is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Water Environmental Regulation. Acoustic consultants or other environmental consultants are not appointed as an inspector or authorised person. Therefore, whilst this assessment is based on a 4-hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

2.2.2. Regulation 3

“3. Regulations do not apply to certain noise emissions

(1) *Nothing in these regulations applies to the following noise emissions –*

(a) *Noise emissions from the propulsion and braking systems of motor vehicles operating on a road;”*

noise emissions from –

(b) *a reversing alarm fitted to a motor vehicle, mobile plant, or mining or earthmoving equipment;*

If -

*it is a requirement under another written law that such an alarm be fitted; and
it is not practicable to fit an alarm that complies with the written law under which it is required to be fitted and emits noise that complies with these regulations;*

It is considered that any reversing alarms fitted to the mobile plant and transport trucks are not necessarily exempt under the Regulations, since they are not specifically required under another written law.

The commonly used fixed noise output tonal reversing alarms also known as 'reversing beeper' emit, by their very nature, tonal and modulating noise at high levels. As such, this type of reversing alarm generally cannot comply with the Regulations even at distant receivers. Alternative alarms such as broadband alarms are commonly used to minimise the impact.

2.3. Airblast

With regard to airblast level, regulation 11 of the Regulations prescribes that:

- (4) *Subject to subregulation (5), no airblast level resulting from blasting on any premises or public place, when received at any other premises between 0700 hours and 1800 hours on any day, may exceed -*
 - (a) *for an airblast level received at noise sensitive premises —*
 - (i) *when received at a sensitive site — 120 dB $L_{Z\ peak}$; or*
 - (ii) *when received at a location other than a sensitive site — 125 dB $L_{Z\ peak}$;*
 - or*
 - (b) *for an airblast level received at any other premises — 125 dB $L_{Z\ peak}$.*
- (5) *The levels specified in subregulation (4) do not apply in respect of an airblast level when received at premises, or a part of premises, on which the blaster believes on reasonable grounds no person is present at the time of the blast.*
- (6) *Despite subregulation (4), airblast levels for 9 in any 10 consecutive blasts (regardless of the interval between each blast), when received at any other single premises between 0700 hours and 1800 hours on any day, must not exceed —*
 - (a) *for airblast levels received at noise sensitive premises —*
 - (i) *when received at a sensitive site — 115 dB $L_{Z\ peak}$; or*
 - (ii) *when received at a location other than a sensitive site — 120 dB $L_{Z\ peak}$;*
 - or*
 - (b) *for airblast levels received at any other premises — 120 dB $L_{Z\ peak}$.*
- (8) *Subject to subregulation (9), no airblast level resulting from blasting on any premises or public place, when received at other premises outside the periods between 0700 hours and 1800 hours on any day, may exceed 90 dB $L_{Z\ peak}$ except where that blasting is carried out in accordance with the Mines Safety and Inspection Regulations 1995 regulation 8.28(4).*

2.4. Airblast Vibration

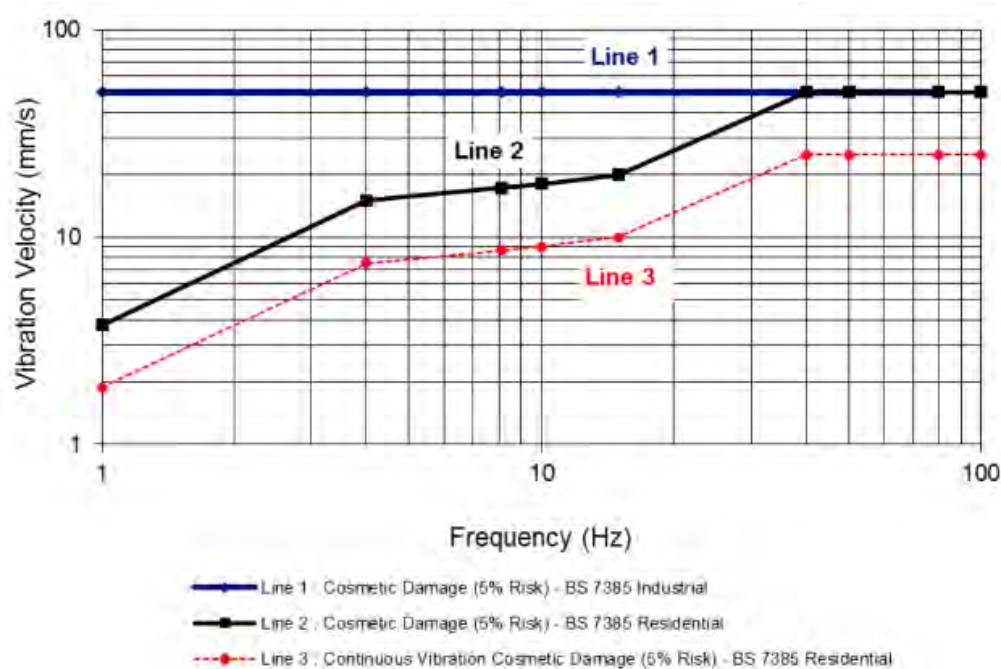
While there are no legislated criteria regarding ground vibration levels at biological sensitive receivers, Appendix J of *AS 2187.2-2006 Explosives - Storage and use - Use of explosives* provides guidance on the possibility of cosmetic damage to buildings from transient vibration sources. This guidance is reproduced below:

TABLE J4.4.2.1
TRANSIENT VIBRATION GUIDE VALUES FOR COSMETIC DAMAGE
(BS 7385-2)

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structure. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

NOTES:

- 1 Values referred to are at the base of the building.
- 2 For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.



3. METHODOLOGY

3.1. Site Measurements

Under the Regulations, there are certain requirements that must be satisfied when undertaking measurements and are defined in Regulations 19, 20, 22 and 23 and Schedule 4. In undertaking the measurements, these have been satisfied, specifically noting the following:

- The noise data logger used was an ARL Type Ngara (S/N: 8780F6).
- All equipment holds current laboratory certificates of calibration that are available upon request. The equipment was also field calibrated before and after and found to be within +/- 0.5 dB.
- The microphone was fitted with a standard wind screen.
- The microphone was at least 1.2 metres above ground level and at least 3.0 metres from reflecting facades (other than the ground plane).

Measurements were recorded from the 7th to 18th March 2024. The sample period was set to 15-minutes and various percentile data recorded.

3.2. Noise Modelling

Computer modelling has been used to predict the noise emissions from the development to all nearby receivers. The software used was *SoundPLAN 9.0* with the CONCAWE algorithms (ISO 171534-3 improved method) selected, as they include the influence of meteorological conditions. Input data required in the model are listed below and discussed in *Section 3.2.1* to *Section 3.2.4*:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.2.1. Meteorological Conditions

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1: Modelling Meteorological Conditions

Parameter	Day (7.00am to 7.00pm) ²
Temperature (°C)	20
Humidity (%)	50
Wind Speed (m/s)	4
Wind Direction ¹	All
Pasquil Stability Factor	E

Notes:

1. The modelling package allows for all wind directions to be modelled simultaneously.
2. The conditions above are as defined in *Guideline: Assessment of Environmental Noise Emissions*; May 2021.

Alternatives to the above default conditions can be used where one year of weather data is available and the analysis considers the worst 2% of the day and night for the month of the year in which the worst-case weather conditions prevail (source: *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016). In most cases, the default conditions occur for more than 2% of the time and therefore must be satisfied.

3.2.2. Topographical Data

Topographical data was sourced from *Google Earth* in the form of spot heights. For the purpose of modelling all equipment is located on natural ground level with no adjustments made for any lowering of ground levels in order to be conservative.

3.2.3. Ground Absorption

The ground absorption has been assumed to be an average of 0.8 (80%) across the survey area, noting that 0.0 represents hard reflective surfaces such as concrete and 1.0 represents absorptive surfaces such as grass.

3.2.4. Source Sound Levels

The source sound power levels used in the modelling are provided in *Table 3-2*.

Table 3-2: Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	31.5	63	125	250	500	1k	2k	4k	
Metso LT120 Jaw Crusher	121	123	117	119	114	114	109	101	121
Metso Screens	119	119	113	111	109	107	103	96	115
Metso S4.11 Reclaimer	121	119	119	113	111	109	107	103	115
Telestack 424x/624R	108	106	107	101	106	103	91	88	110
Caterpillar 928M FEL	105	105	104	105	105	104	105	105	112
Caterpillar 352 Excavator	99	102	113	112	97	95	94	90	106

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	31.5	63	125	250	500	1k	2k	4k	
Caterpillar 336 Excavator	98	101	112	111	96	94	93	89	105
Caterpillar 306 Excavator	92	95	106	105	90	87	87	84	99
Semi Water Cart, moving source	-	116	113	106	97	92	92	89	103
Dump/Haulage Trucks, moving source	116	116	112	103	101	103	100	96	107
Caterpillar 140M Grader	135	124	113	103	105	98	94	87	114
Service Truck/Light Vehicles Idling	71	74	56	81	80	78	72	61	84
Truck Being Loaded	104	98	93	92	86	82	76	74	
Truck Idling	101	98	91	82	77	77	74	64	88
Caterpillar D9T Dozer	110	114	119	117	108	109	105	100	114
Caterpillar D8T Dozer	109	113	118	116	107	109	104	99	113
Caterpillar Cs/CP76 Roller	93	97	97	107	102	98	95	90	107
Tamrock Drill Rig (or similar)	97	114	103	104	106	110	113	111	118

The following is noted in relation to *Table 3-2*:

- Crusher/screening plant sound power is derived from on-site sound pressure level measurements at a different quarry site or from manufacturers data;
- Crusher/Screening plant is modelled in same location for both current and expansion operations;
- All noise sources are assumed to be L_{A10} unless noted otherwise;
- All sources are modelled to be operating concurrently for each scenario with the exception being that only one excavator or dozer is operational at any one time;
- All sources are modelled as omni-directional point sources;
- All plant is modelled at 2 metres above existing ground height;
- Truck Haulage noise is only considered where the trucks are off 'Public Roads' as whilst on public roads.
- Trucks/Water Carts are modelled as line sources travelling at a maximum of 30 km/hr whilst on the site area;
- It is assumed that the excavation and crushing operations do not occur simultaneously;
- Location of noise sources represent worse-case scenario and are indicated within the noise contour plots.

3.3. Airblast Calculations

Airblast is calculated using equations provided in Australian Standard *AS 2187.2-2006 Explosives - Storage and use*.

The accurate estimation of airblast levels is a complex task. The blasting process is highly non-linear and the variability of most rock types also contributes to the difficulty in accurate predictions of the environmental outcomes. In the absence of either field data or the opportunity to conduct blasting trials in the region of interest, it is possible to estimate likely airblast levels using simple charge weight scaling laws. Such laws incorporate the charge weight per delay and the distance from the blast to the monitoring location.

The prediction formula is detailed below:

Confined Charge

$$P = K_a \left(\frac{R}{Q^{1/3}} \right)^a$$

where

P = pressure, in kilopascals
 Q = explosives charge mass, in kilograms
 R = distance from charge, in metres
 K_a = site constant
 a = site exponent

It is noted that Q is also referred to as the Maximum Instantaneous Charge (MIC), which is the mass of explosives detonating within a defined time period, usually approximately 8 milliseconds. Therefore, when delay blasting occurs, the MIC (or Q) may be relatively small compared to the overall amount of explosive used for each blast.

For confined blast hole charges, assumed to be the primary type used on this project, a site exponent a of -1.45 is used, and the site constant K_a is commonly in the range 10 to 100.

The following are assumed as inputs to these calculations:

- Maximum charge mass per delay;
- Average/Free Face Rock;
- Confined blasts only.

3.4. Blasting Ground Vibrations

For ground vibration, it is assumed that the blasting conditions are for 'free-face average rock' formation. In the absence of specific blast vibration measurements at the site, the following scaled distance site law has been used:

$$PPV = 1140 \left(\frac{\sqrt{m}}{D} \right)^{1.6}$$

Where:

PPV = Peak particle velocity (mm/s)

m = Charge mass per hole or per delay (kg)

D = Distance from blast (m)

4. RESULTS

4.1. Ambient Noise Measurements

The purpose of undertaking ambient noise measurements is to determine whether the subject noise, particularly annoying characteristics such as tonality, is likely to be audible above background levels. To achieve this, the noise level that is exceeded for 90% of the time (lowest 10%) over a 15-minute period (L_{A90} level) is calculated and then the 90th percentile of that level is used as the background level over the corresponding time period.

While the subject noise may not be audible at all times, due to short-term noise events such as traffic or farm machinery (L_{A10} level), the overall background level can be used to determine if the subject noise is likely to be audible during times when no other noise events are occurring.

The noise level in each 15-minute interval is shown *Figure 4-1*. The overall background noise level for the day period (when extraction works are proposed to be carried out) is calculated as 31.5 dB L_{A90} .

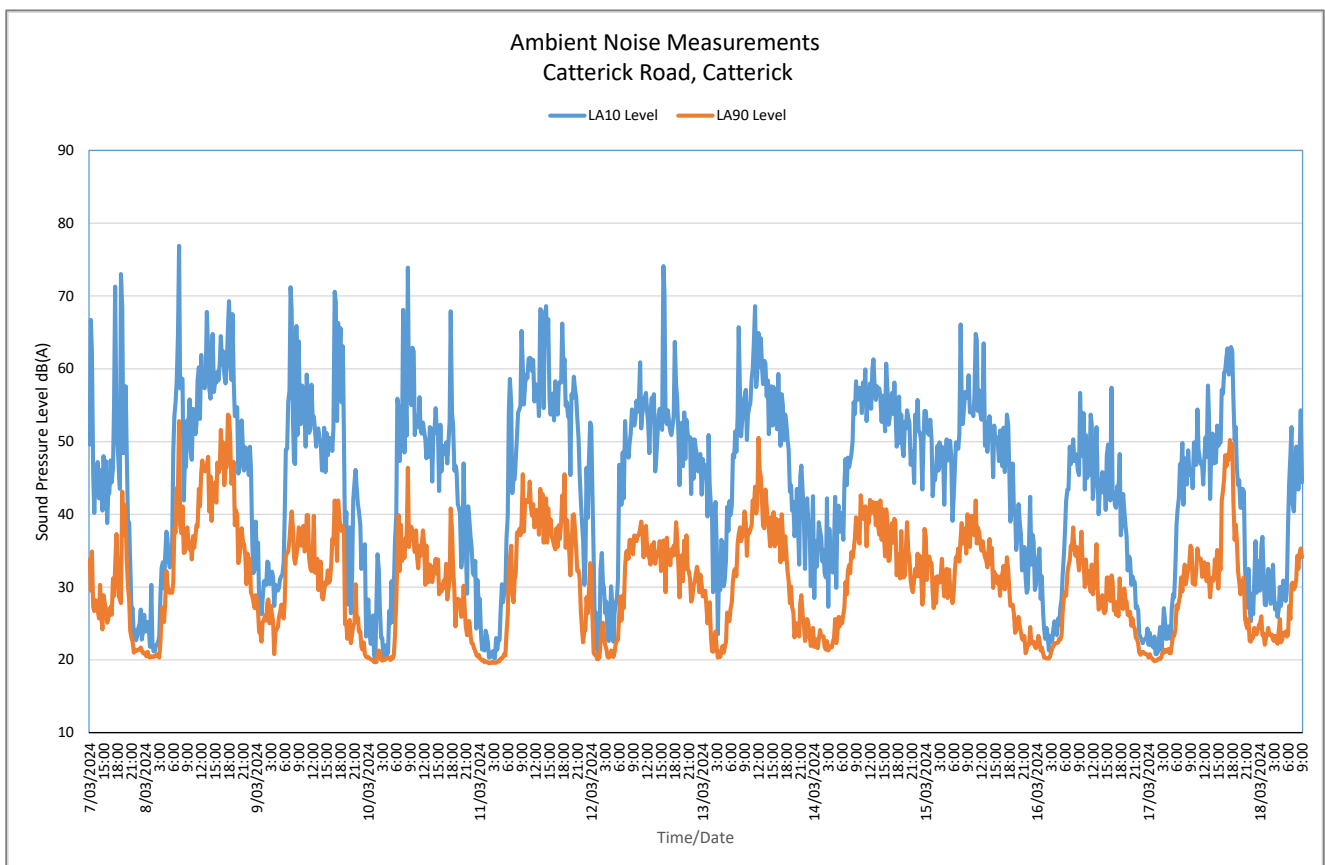


Figure 4-1 Results of Ambient Noise Measurements

From the measurement results, the proposed works may be audible in this area.

4.2. Noise Modelling

4.2.1. Construction Phase

The predicted noise levels during the construction phase of stripping the topsoil and constructing noise bunds using a DT8 or DT9 dozer, front end loaders, trucks & extractors are provided below in *Table 4-1*. An adjustment of + 5 dB is included for tonality, since this may be present for such noise sources.

Table 4-1: Predicted Levels during Construction Phase, dB(A)

Receiver #	Details	Adjusted Noise Level L_{A10} dB ¹
R1	385 Catterick Road	58
R2	195 Eastcott Road	53
R3	147 Eastcott Road	46
R4	195 Catterick Road	40
R5	378 Connell Road	32

¹ Adjusted by + 5 dB for tonality

4.2.2. Extraction Phase

Noise levels during the gravel extraction phase are predicted to the closest noise sensitive premises for a typical scenarios using the proposed D8T or D9T dozer and haulage trucks. The predicted noise levels are presented in *Table 4-2*. The results for Stage 1, being the closest to noise sensitive receivers, are shown as noise level contours in *Figure 4-2*. An adjustment of + 5 dB is included for tonality, since this may be present for such noise sources. Results that exceed the assigned noise levels are highlighted in grey below.

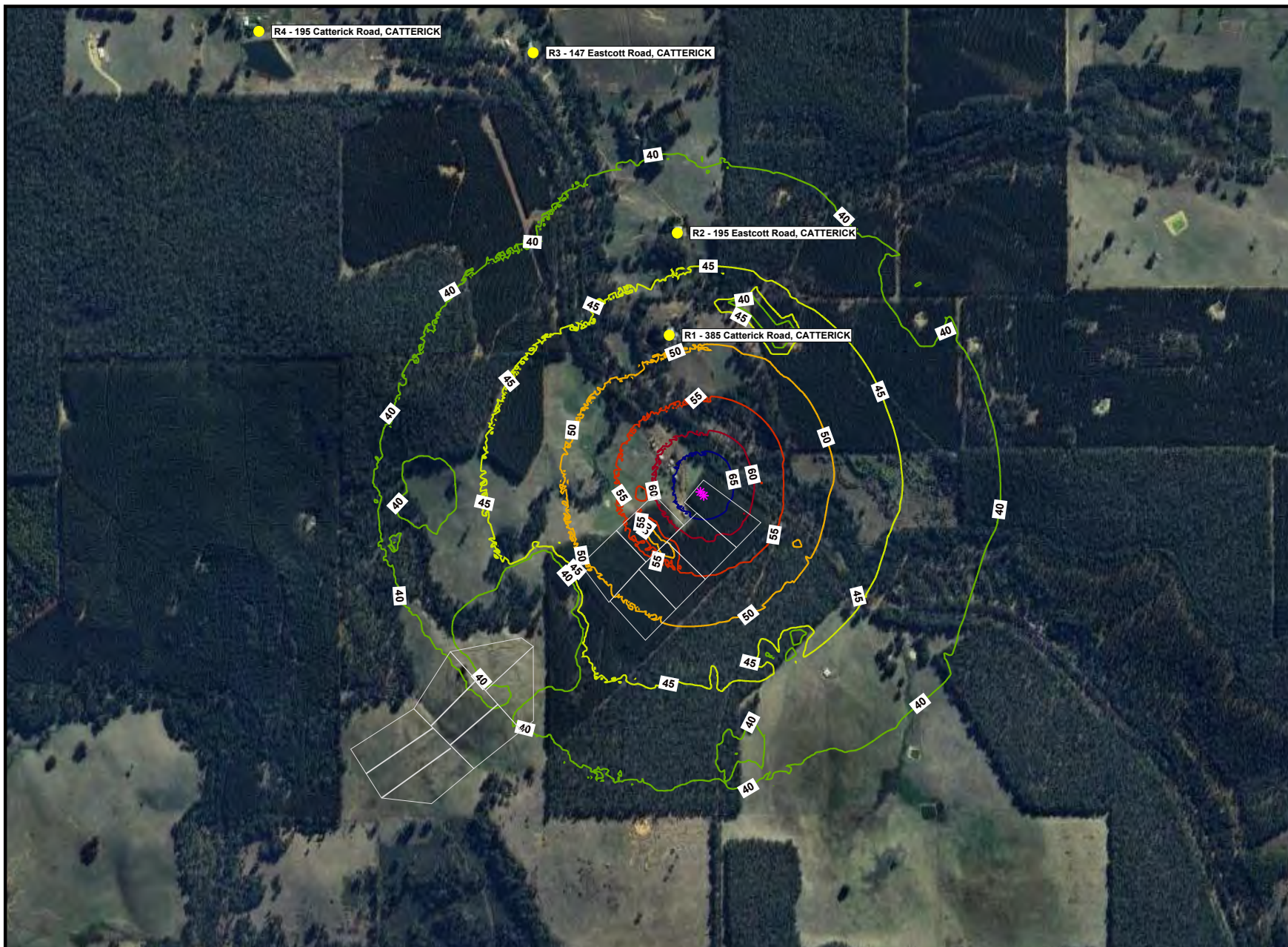
Table 4-2: Predicted Levels during Extraction Phase without Noise Mitigation, dB(A)

Receiver #	Details	Adjusted Noise Level L_{A10} dB ¹					
		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
R1	385 Catterick Road	54	52	53	50	50	47
R2	195 Eastcott Road	48	47	48	45	46	43
R3	147 Eastcott Road	40	40	40	39	39	37
R4	195 Catterick Road	35	35	22	27	22	34
R5	378 Connell Road	27	25	14	16	13	29

¹ Adjusted by + 5 dB for tonality

The results, presented in *Table 4-2*, show that noise management is required in order to achieve compliance with the assigned levels for all stages.

Figure 4-2



Signs and symbols

- * Point source
- Receiver

Length Scale

0 50 100 200 300 400 500 m

Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick
 Predicted L_{A10} Noise Levels during Stage 1 of Extraction Operations - No Mitigation
 Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
 (08) 9401 7770

4.2.3. Crushing & Loading Phase

During the crushing and loading phase, gravel will be loaded into the crusher using an excavator. The crushed gravel will then be stockpiled and trucks will enter the site where they will be loaded with gravel using a front-end loader.

The predicted noise levels during crushing and loading for each stage is provided in *Table 4-3*. An adjustment of + 5 dB is included for tonality, since this may be present for such noise sources. Results that exceed the assigned noise levels are highlighted in grey below.

Table 4-3: Predicted Levels during Crushing & Loading Phase without Noise Mitigation, dB(A)

Receiver #	Details	Adjusted Noise Level L_{A10} dB ¹					
		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
R1	385 Catterick Road	59	59	60	58	58	57
R2	195 Eastcott Road	54	54	54	53	53	53
R3	147 Eastcott Road	47	47	47	46	47	46
R4	195 Catterick Road	39	39	29	32	28	33
R5	378 Connell Road	34	14	22	21	19	19

¹ Adjusted by + 5 dB for tonality

The results, presented in *Table 4-3*, show that noise management is required in order to achieve compliance with the assigned levels for all stages.

4.3. Drill and Blast

Noise from drilling, airblast overpressure and vibration levels have been predicted to nearby sensitive receptors and are detailed below.

4.3.1. Drilling

It is assumed that one drill rig will be operating to drill holes for explosives to be packed into. The predicted noise levels to each noise sensitive premises resulting from blast-hole drilling at Stage 13, being the closest to noise sensitive receivers, is provided below in *Table 4-4*. Noise from drilling is generally not tonal, therefore, a penalty would not be applied to these predicted levels.

Table 4-4: Predicted Levels during Blast Hole Drilling, dB(A)

Receiver #	Details	Predicted Noise Level L_{A10} dB
R1	385 Catterick Road	40
R2	195 Eastcott Road	36
R3	147 Eastcott Road	31
R4	195 Catterick Road	10
R5	378 Connell Road	2

4.3.2. Airblast Overpressure

Airblast calculations assume a certain charge mass-per-hole (Kg) of explosive as well as a site constant, which would need to be determined on-site by the blast engineer. The site constant generally ranges from 10 to 100.

Table 4-5 presents the airblast predicted from Stage 13, for a given charge mass-per-hole (kg) and site constant. This can be used as a guideline when planning the blasting. The table highlights complying with a 115 dB_{Lin Peak} limit level in green.

Table 4-5: Calculated Airblast Noise Levels (Confined blast)

Charge Mass per Hole (kg)	Airblast Level (dB $L_{Linear peak}$) for either 10/100 Site Constant									
	R1 - 385 Catterick Rd		R2 - 195 Eastcott Rd		R3 - 147 Eastcott Rd		R4 - 195 Catterick Road		R5 - 378 Connell Rd	
5	94	114	91	111	87	107	85	105	81	101
10	97	117	94	114	90	110	88	108	84	104
20	100	120	97	117	93	113	91	101	87	107
50	104	124	101	121	97	117	95	115	91	111
100	106	126	104	124	100	120	98	118	94	114

Based on the above calculation results, compliance with the Regulations for a specific charge mass-per-hole of explosive is highly dependent on the site constant and is constrained by the closest receptor, being R1 -385 Catterick Road. Airblast levels are not expected to exceed at this location when keeping the mass of charge no greater than 5 kg for a Site Constant of 100 or over 100 kg for a Site Constant of 10. Once the site constant has been established, then the charge mass should be tailored such that 9 out of 10 blasts be no more than 115 dB_{Linear, Peak}, but should never exceed 120 dB_{Linear, Peak}.

4.3.3. Blast Ground Vibration

As with airblast, ground vibration levels resulting from blasting are dependent on the charge mass-per-hole of explosive and the distance from the source to the receiver. This will be constrained by the closest receiver to Stage 13, being R1 - 385 Catterick Road.

Assuming a maximum charge mass-per-hole of 100 kg, the predicted ground vibration level at R1- 385 Catterick Road, as a result of blasting within Stage 13, is expected to be between 0.29 and 2.88 mm/s.

5. ASSESSMENT & RECOMMENDATIONS

5.1. Construction Phase

From the background noise measurements presented in *Section 4.1*, it can be seen that the lowest background level is around 32 dB L_{A90} , so the highest predicted noise level of 55 dB (without tonal penalty factored in) L_{A10} , will be audible. Noise from mobile plant such as dozers and excavators, generally exhibit tonal noise characteristics and therefore a penalty of +5 dB, as detailed in *Table 2-1*, would apply to the predicted noise levels where mobile plant is being operated.

Noise from the construction activity is not required to meet the assigned levels. However, under regulation 13, it must be demonstrated that the noise is being managed such that the emissions are as low as reasonably practicable. In this instance, this would be achieved by:

- using well-maintained equipment at all times;
- where practicable, orientating equipment such that the noise side faces away from the residences;
- where practicable and safe, any reversing alarms fitted to the mobile plant should be of the broadband noise type rather than tonal, beeping type. It was noted on the site visit that this was predominately the case already for the existing mobile plant.

From the results of the operational phases (*Table 4-2 & Table 4-3*), it can be seen that with the addition of a +5 dB penalty, noise levels resulting from the extraction, crushing and loading phases, are predicted to exceed the assigned level of 45 dB L_{A10} during the hours 7.00 a.m. to 7.00 p.m. Monday to Saturday. As such noise mitigation is required to achieve compliance.

5.2. Extraction Phase

During the extraction phase, the noise from both the DT8 & DT9 dozer are predicted to exceed the assigned levels at noise sensitive premises. Due to the site topography, the use of noise bunds along the stage boundaries is not considered a practicable noise mitigation option. Therefore, it is recommended that alternative plant be used to extract the gravel as detailed in *Figure 5-1*.

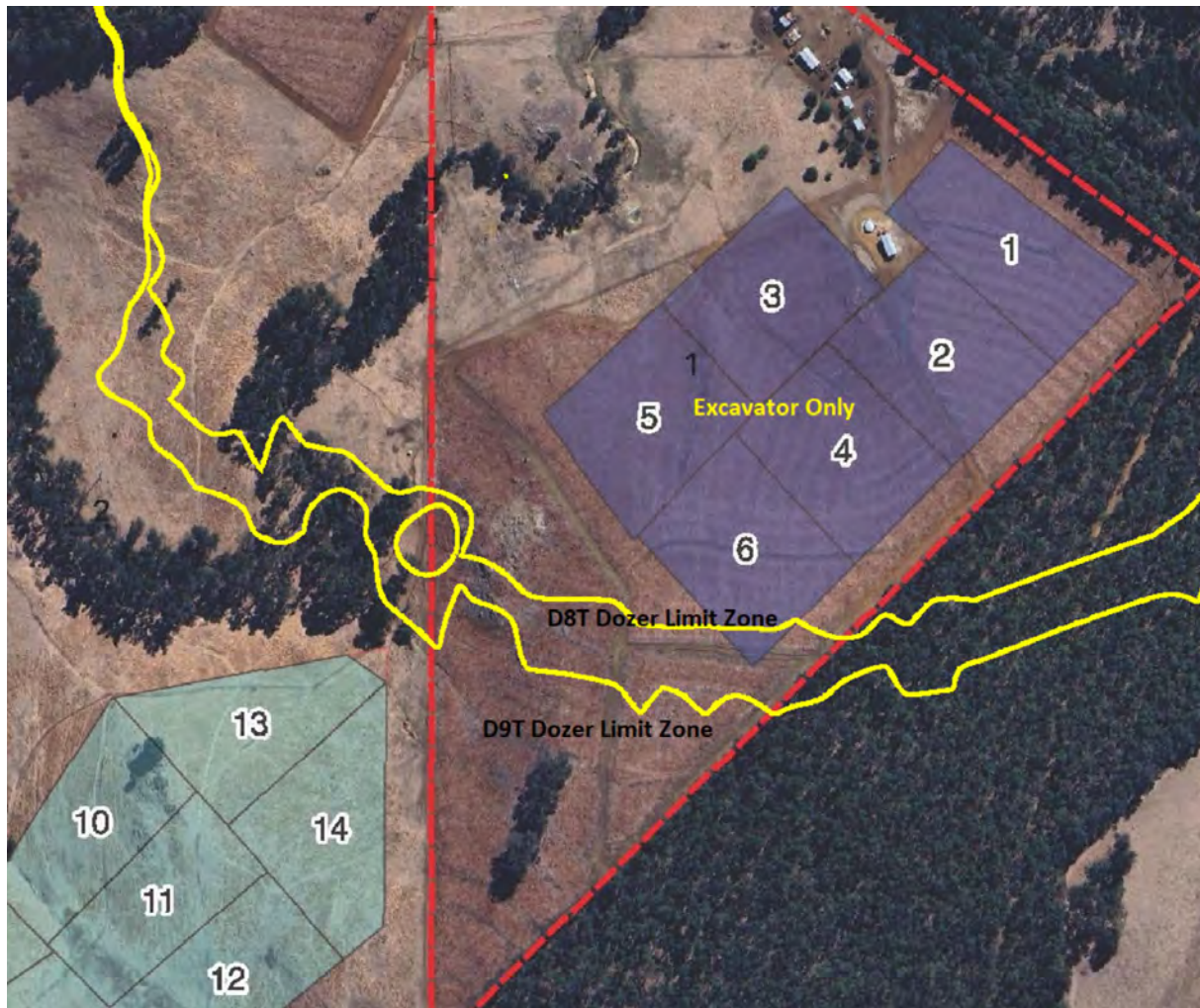


Figure 5-1: Mobile Plant Exclusion Zones

The predicted noise levels for the extraction phase, are provided in *Table 5-1*. The noise level predictions assume that an excavator will be used except for the southern part of Stages 6, where a D8T dozer could be used as detailed in *Figure 5-1*. An adjustment of + 5 dB is included for tonality, since this may be present for such noise sources. The predictions are shown as noise level contours in *Appendix A*.

Table 5-1: Predicted Levels during Excavation Phase using Alternative Plant, dB(A)

Receiver #	Details	Adjusted Noise Level L_{A10} dB ¹					
		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
R1	385 Catterick Road	44	42	44	40	41	45
R2	195 Eastcott Road	38	37	38	36	37	41
R3	147 Eastcott Road	31	30	30	29	29	35
R4	195 Catterick Road	26	25	15	19	14	33
R5	378 Connell Road	18	16	7	9	6	28

¹ Adjusted by + 5 dB for tonality

5.3. Crushing and Loading Phase

Crushing and loading is to occur in each of the extraction stages following the extraction phase. From the results presented in *Table 4-3*, it can be seen that noise mitigation is required to achieve compliance with the Regulations at all noise sensitive premises.

It is proposed to construct a 5m high noise bund behind the crushing operations for each stage. The bund would be constructed such that it blocks any line-of-sight to noise sensitive premises to the north of the quarry from the crusher and loading area. The proposed noise bund locations are provided in *Figure 5-2*.

The predicted noise level assuming the bunds are constructed is provided in *Table 5-2*. An adjustment of +5 dB is included for tonality, since this may be present for such noise sources. The predictions are shown as noise level contours in *Appendix B*.

Table 5-2: Predicted Levels during Crushing & Loading Phase with Noise Mitigation, dB(A)

Receiver #	Details	Adjusted Noise Level L_{A10} dB ¹					
		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
R1	385 Catterick Road	45	45	45	43	44	45
R2	195 Eastcott Road	40	41	40	40	40	41
R3	147 Eastcott Road	34	34	32	43	32	35
R4	195 Catterick Road	23	29	20	22	21	22
R5	378 Connell Road	37	37	22	21	20	20

¹ Adjusted by + 5 dB for tonality

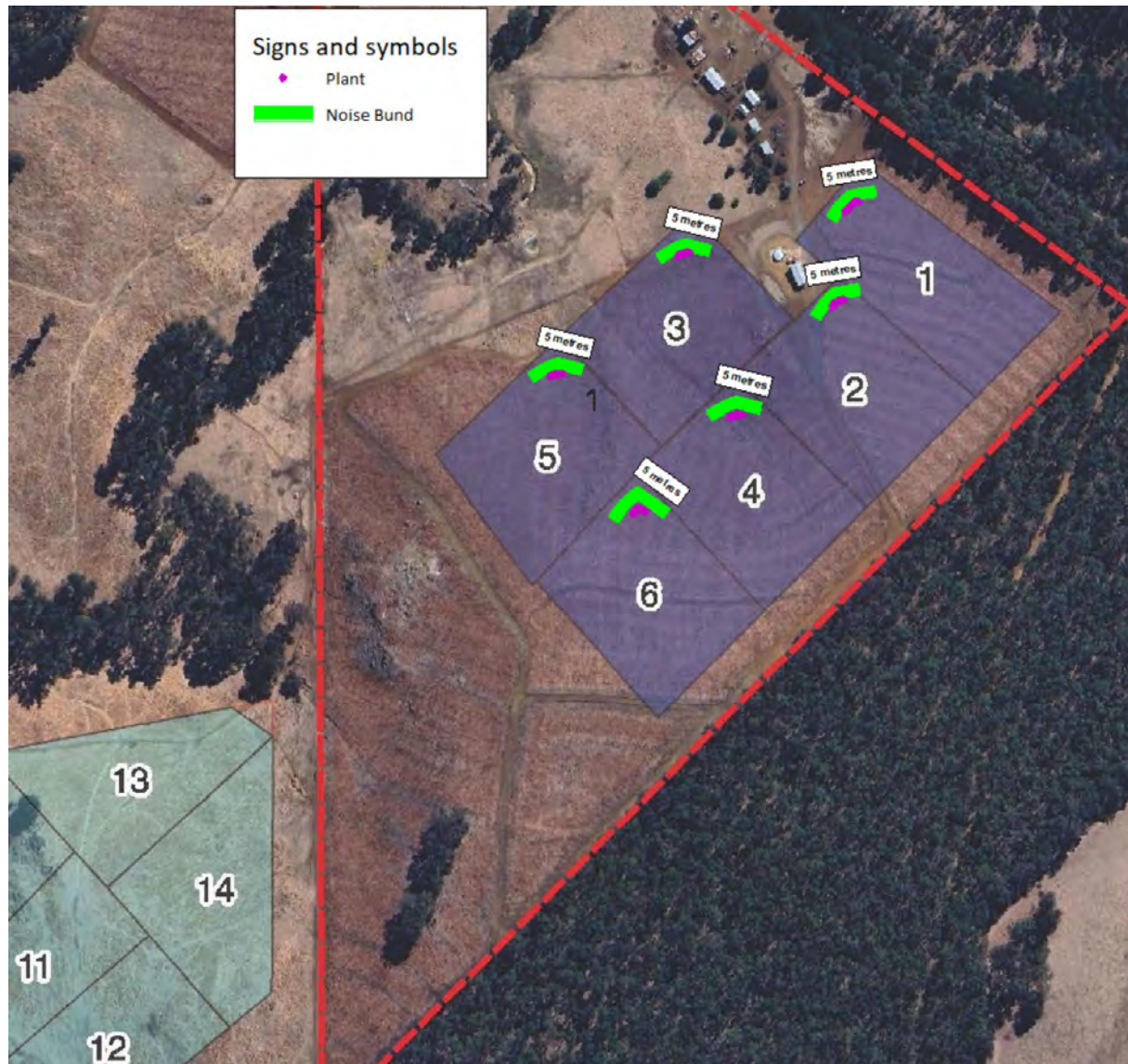


Figure 5-2: Proposed Noise Bund Locations

5.4. Blast hole Drilling

From the results provided in *Table 4-4*, the noise from blast hole drilling is predicted to comply with the Regulations at all noise sensitive premises. Care should be taken to ensure other noisy activities are not being undertaken at the same time when drilling occurs.

5.5. Blasting

The results provided in *Table 4-5*, show that airblast levels can achieve compliance with the Regulations at all sensitive receivers. The charge mass-per-hole of explosive that can be used will be dependent on the Site Constant, which will be determined by the Blast Engineer.

Ground vibration levels as a result of blasting is predicted to be well below levels where building damage might occur (from 5mm/s), and therefore, impact and damage to surrounding homes is unlikely to result from blasting activities, noting that annoyance occurs at far lower levels.

6. CONCLUSION

Noise, airblast and ground-vibration emissions resulting from the proposed extraction and crushing operations at Lot 3938/406 Catterick Road, Catterick, Western Australia, have been assessed by means of predictive modelling and the results compared against the relevant criteria within the *Environmental Protection (Noise) Regulations 1997*.

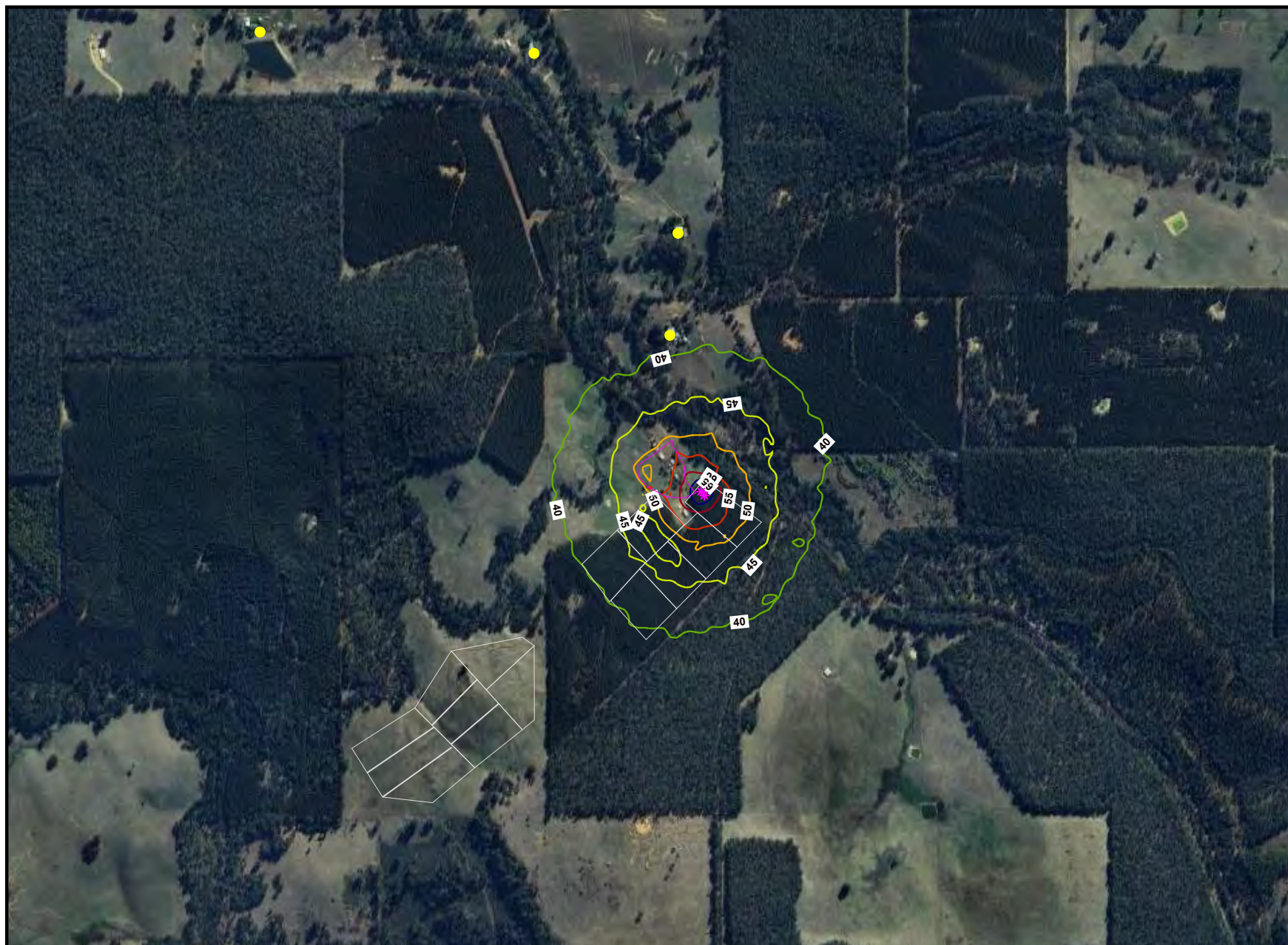
Based on the assumptions made, it is concluded that compliance with the Regulations can be achieved at all noise sensitive receivers between 7.00 a.m. and 7.00 p.m. Monday to Saturday, providing the dozer is restricted to certain areas and a series of earth bunds are constructed around the crushing and screening plant as recommended in *Section 5* of this assessment.

In addition, the following best practices should be implemented to further minimise noise impacts:

- Orientation of the mobile plant so as the exhaust (noisiest side) is pointing to the south-west to limit noise emissions;
- Make use of radio communication between wheeled loader and road truck operators to allow for positioning and loading of trucks without the use of horn signals as far as practicable;
- Mobile plant tonal reversing alarm alternatives should be considered where deemed safe (i.e. broadband);
- Selection of the quietest plant possible;
- Ensure that trucks aren't exiting and entering the site at the same time where practicable, so as to minimise noise impact at nearby receivers;
- Purchasing staff need clear policy guidelines for procurement of new plant to ensure that noise levels do not increase over time;
- Maintenance staff may need to implement a maintenance programme to prevent noise levels increasing over time.

Appendix A – Extraction Phase Noise Contours

Figure A-1



Signs and symbols

- * Point source
- Receiver
- Moving Truck



Length Scale



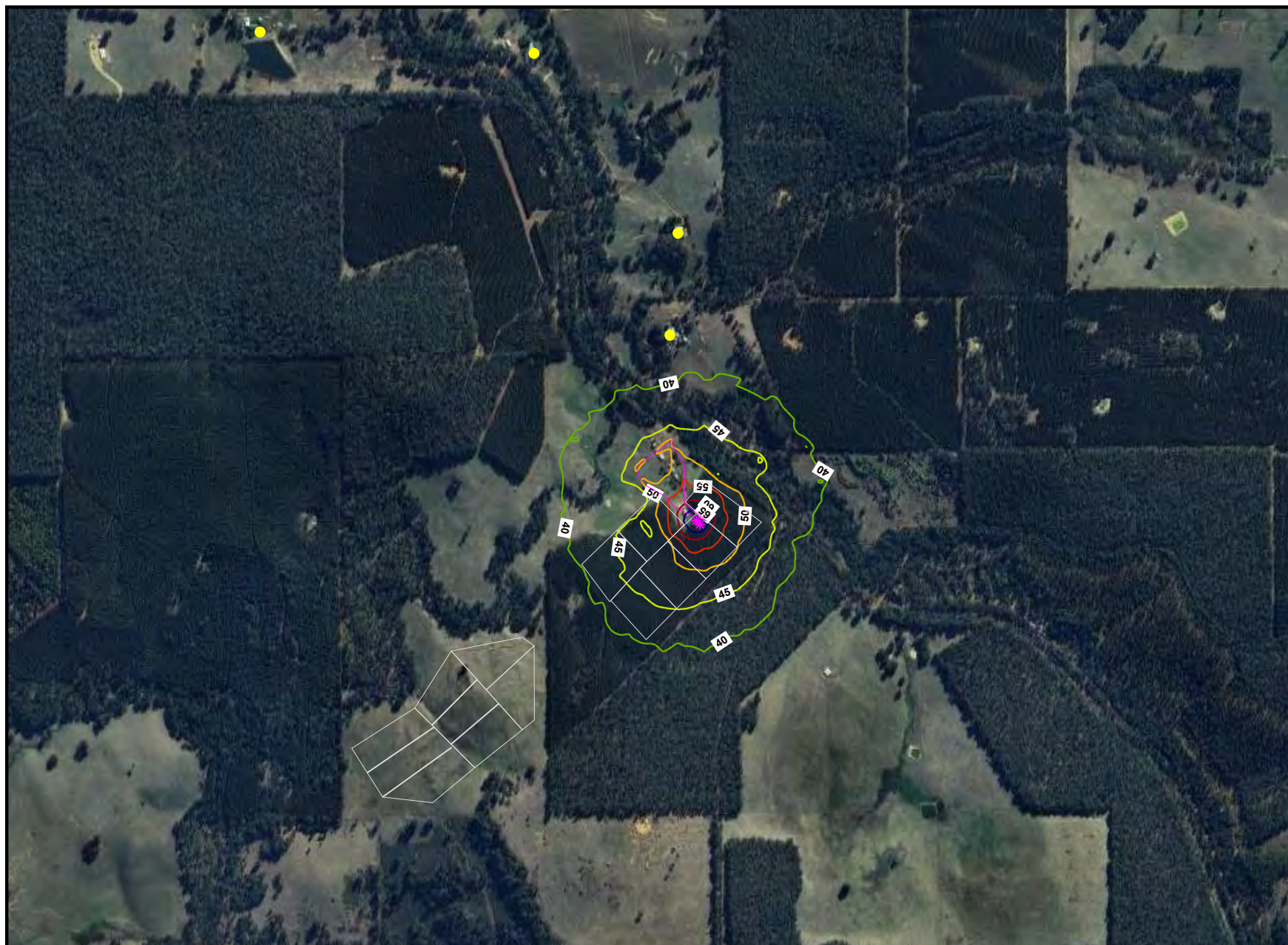
Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick - With Noise Bunds Installed
Predicted L_{A10} Noise Levels during Stage 1 of Extraction Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
(08) 9401 7770

Figure A-2



Signs and symbols

- * Point source
- Receiver
- Moving Truck



Length Scale



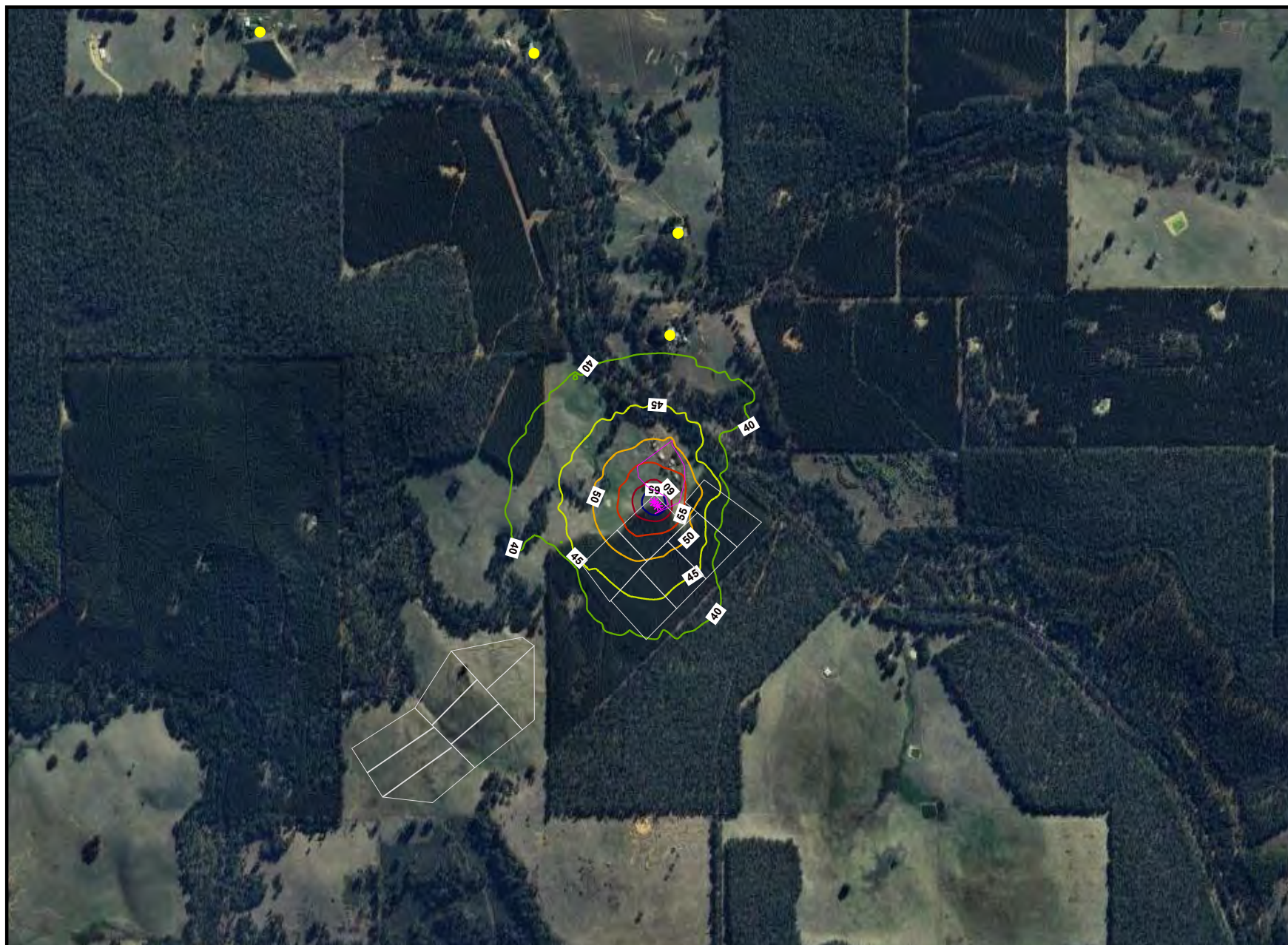
Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick - With Noise Bunds Installed
 Predicted L_{A10} Noise Levels during Stage 2 of Extraction Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
 (08) 9401 7770

Figure A-3



Signs and symbols

- * Point source
- Receiver
- Moving Truck



Length Scale



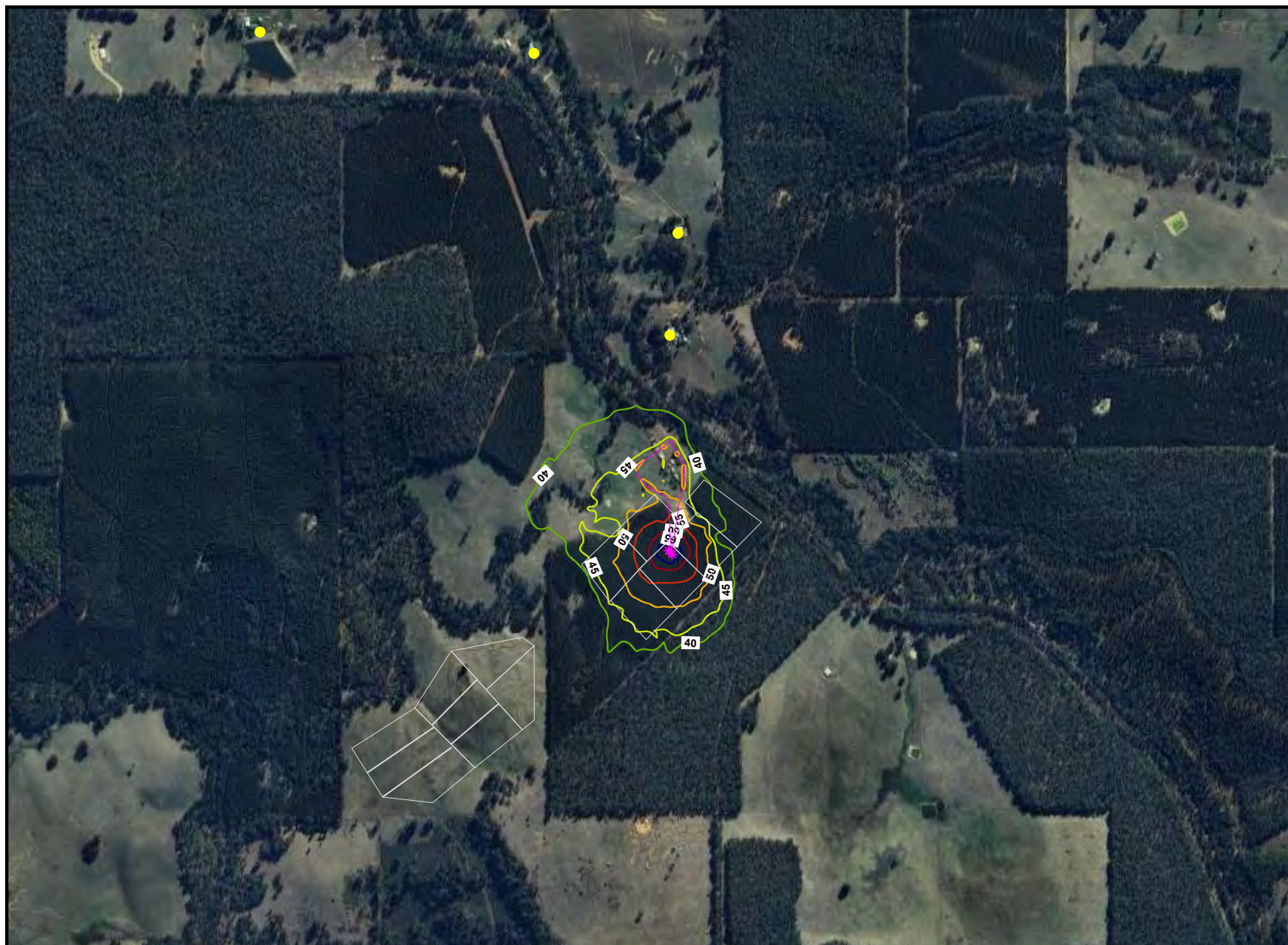
Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick - With Noise Bunds Installed
 Predicted L_{A10} Noise Levels during Stage 3 of Extraction Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
 (08) 9401 7770

Figure A-4



Signs and symbols

- * Point source
- Receiver
- Moving Truck



Length Scale



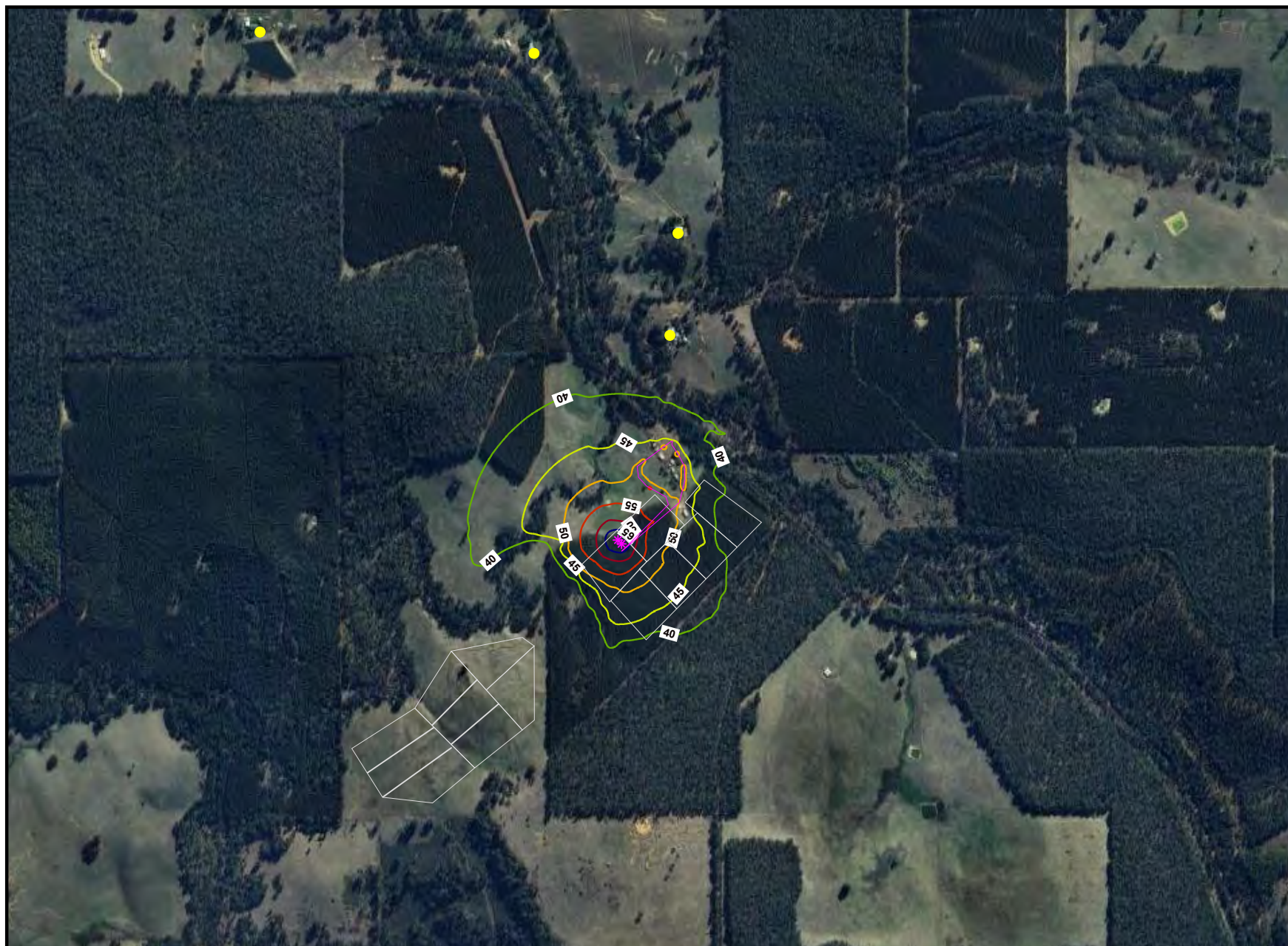
Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick - With Noise Bunds Installed
Predicted L_{A10} Noise Levels during Stage 4 of Extraction Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
(08) 9401 7770

Figure A-5



Signs and symbols

- * Point source
- Receiver
- Moving Truck



Length Scale



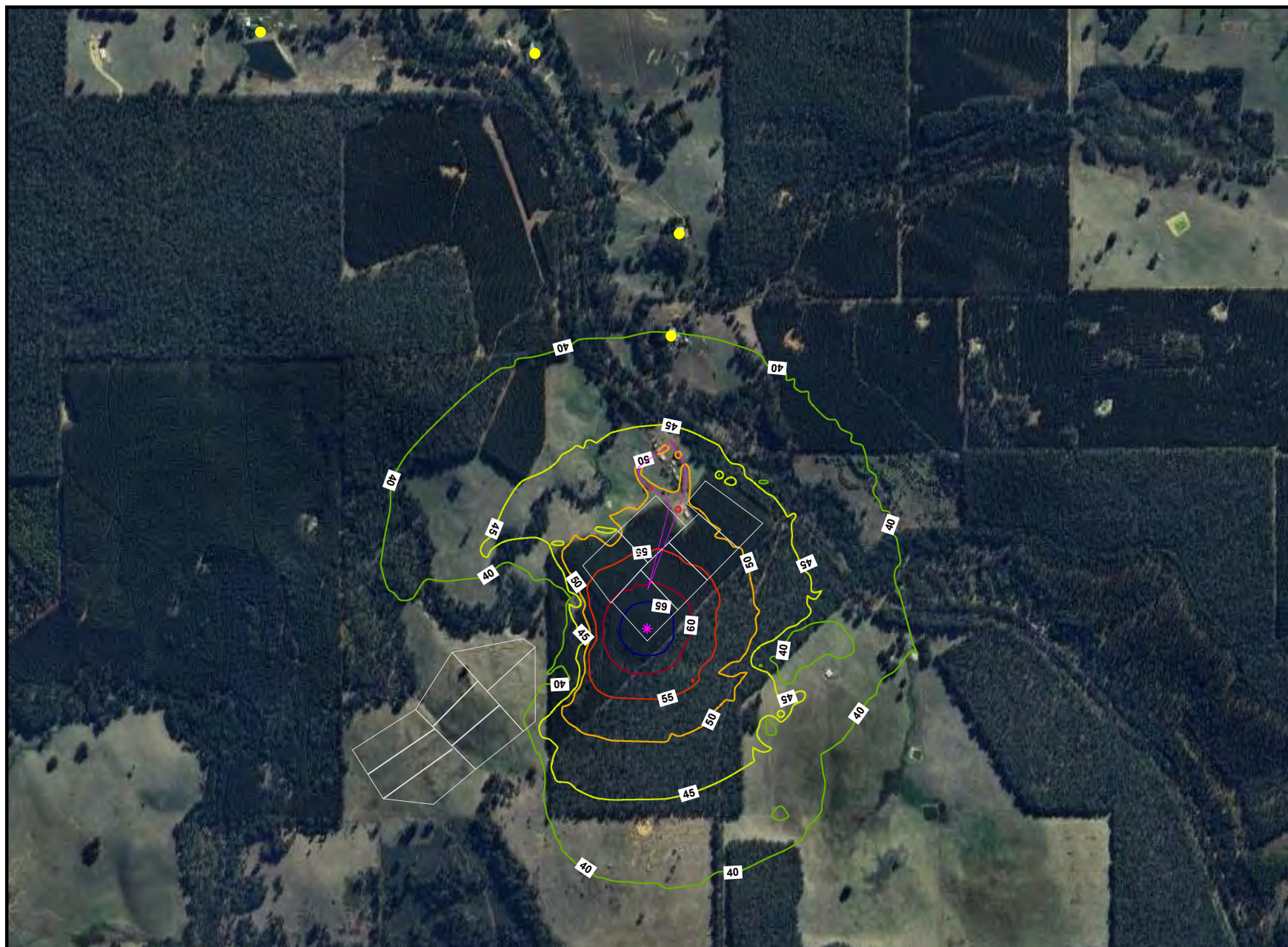
Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick - With Noise Bunds Installed
Predicted L_{A10} Noise Levels during Stage 5 of Extraction Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
(08) 9401 7770

Figure A-6



Signs and symbols

- * Point source
- Receiver
- Moving Truck



Length Scale



Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick - With Noise Bunds Installed
Predicted L_{A10} Noise Levels during Stage 6 of Extraction Operations - Wind from All Directions

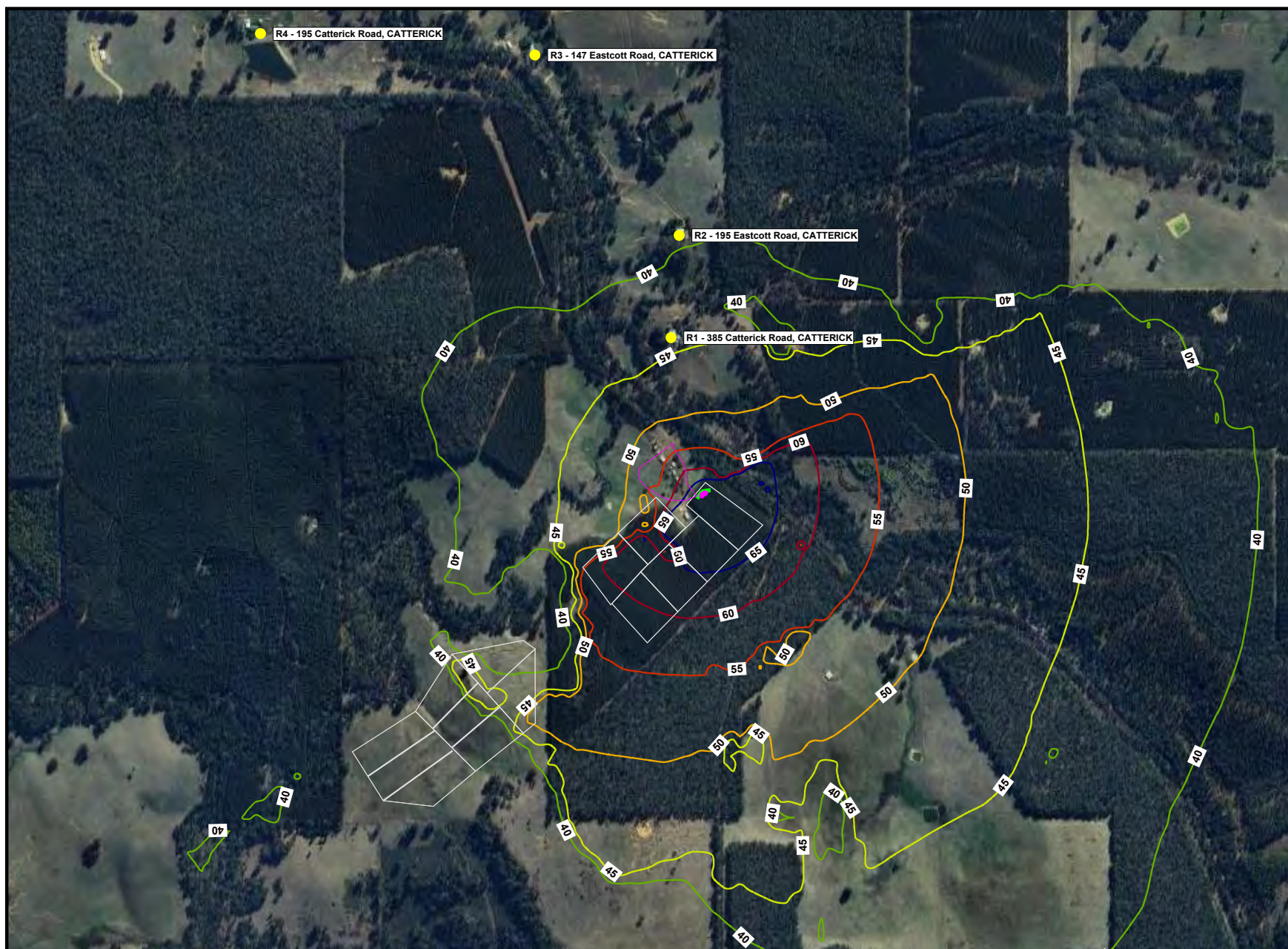


Lloyd George Acoustics

www.lgacoustics.com.au
(08) 9401 7770

Appendix B – Crushing and Loading Phase Noise Contours

Figure B-1



Signs and symbols

- Point source
- Receiver
- Bund
- Moving Truck Source



Length Scale

0 50 100 200 300 400 500 m

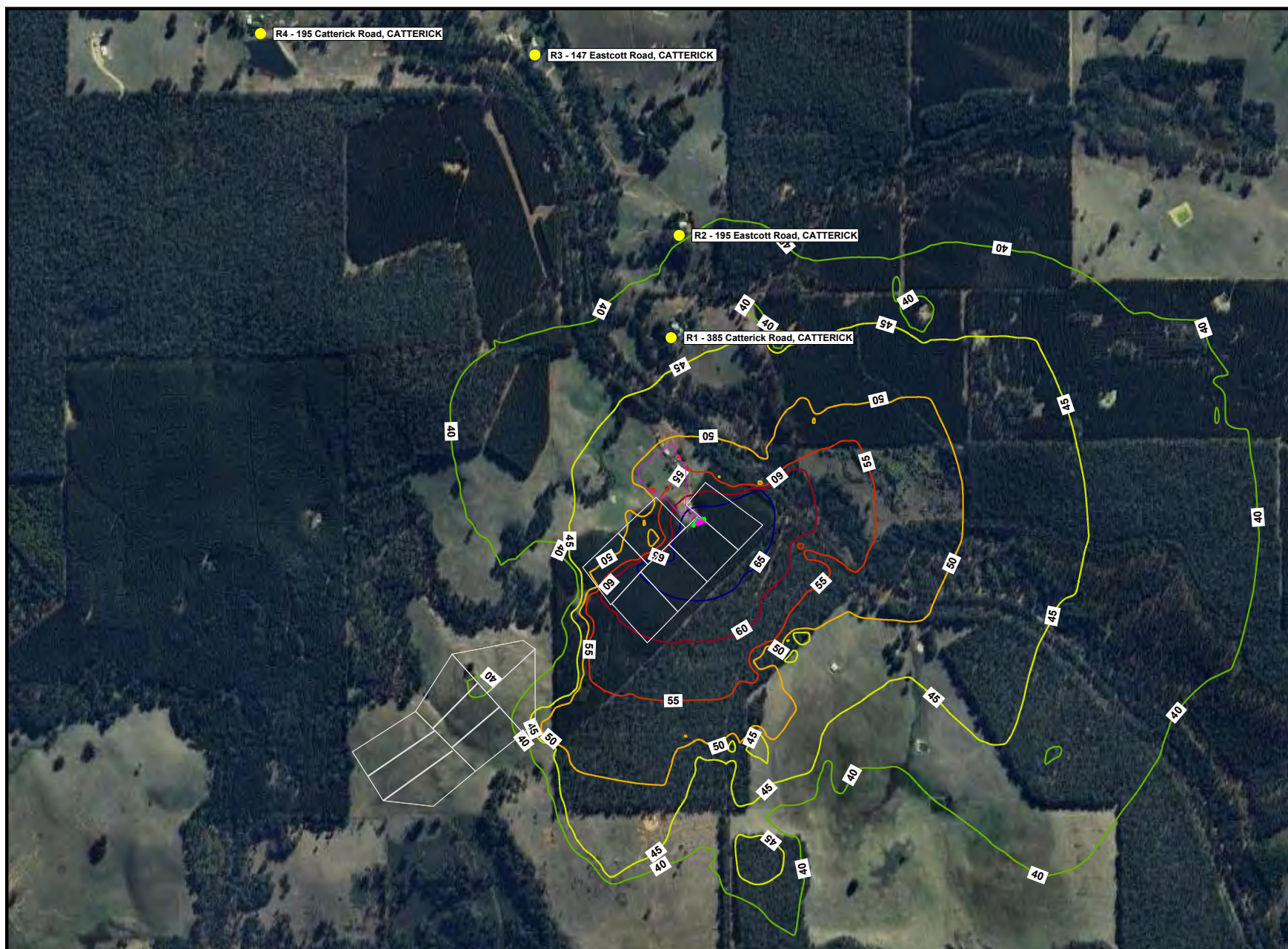
Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick
 Predicted L_{A10} Noise Levels during Stage 1 of Crushing & Loading Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
 (08) 9401 7770

Figure B-2



Signs and symbols

- Point source
- Receiver
- Bund
- Moving Truck Source



Length Scale



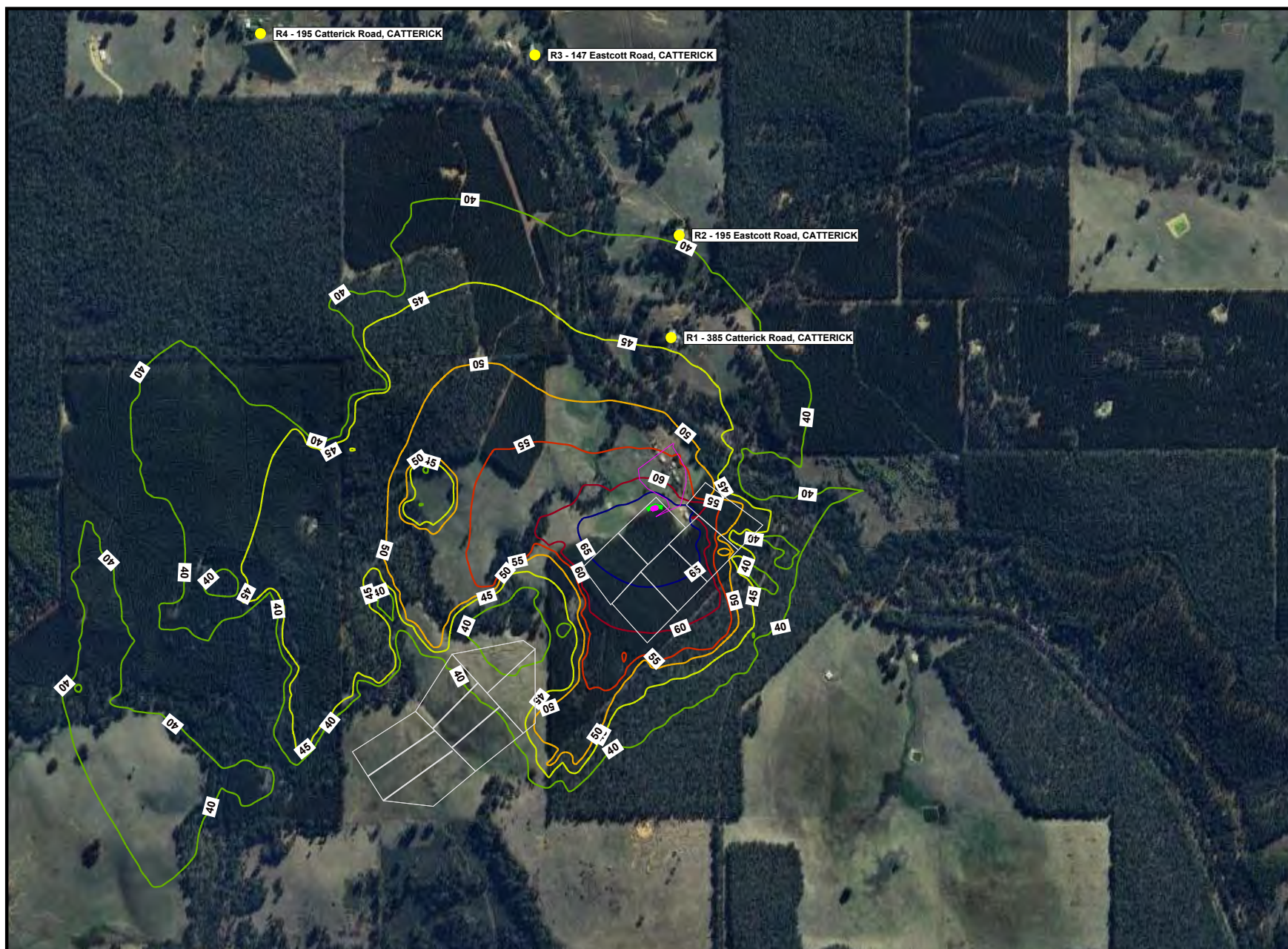
Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick
 Predicted L_{A10} Noise Levels during Stage 2 of Crushing & Loading Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
 (08) 9401 7770

Figure B-3



Signs and symbols

- Point source
- Receiver
- Bund
- Moving Truck Source



Length Scale



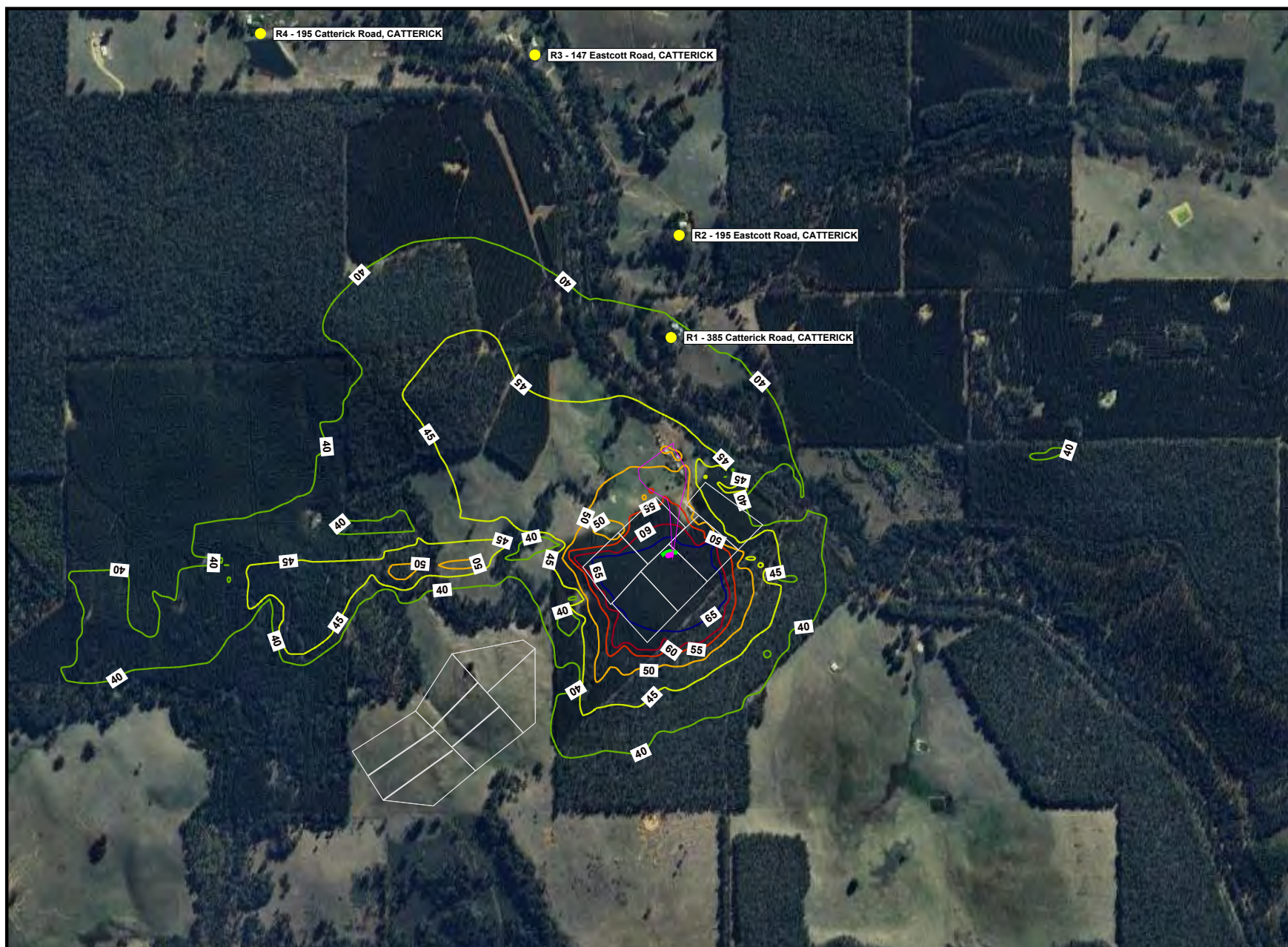
Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick
 Predicted L_{A10} Noise Levels during Stage 3 of Crushing & Loading Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
 (08) 9401 7770

Figure B-4



Signs and symbols

- Point source
- Receiver
- Bund
- Moving Truck Source



Length Scale



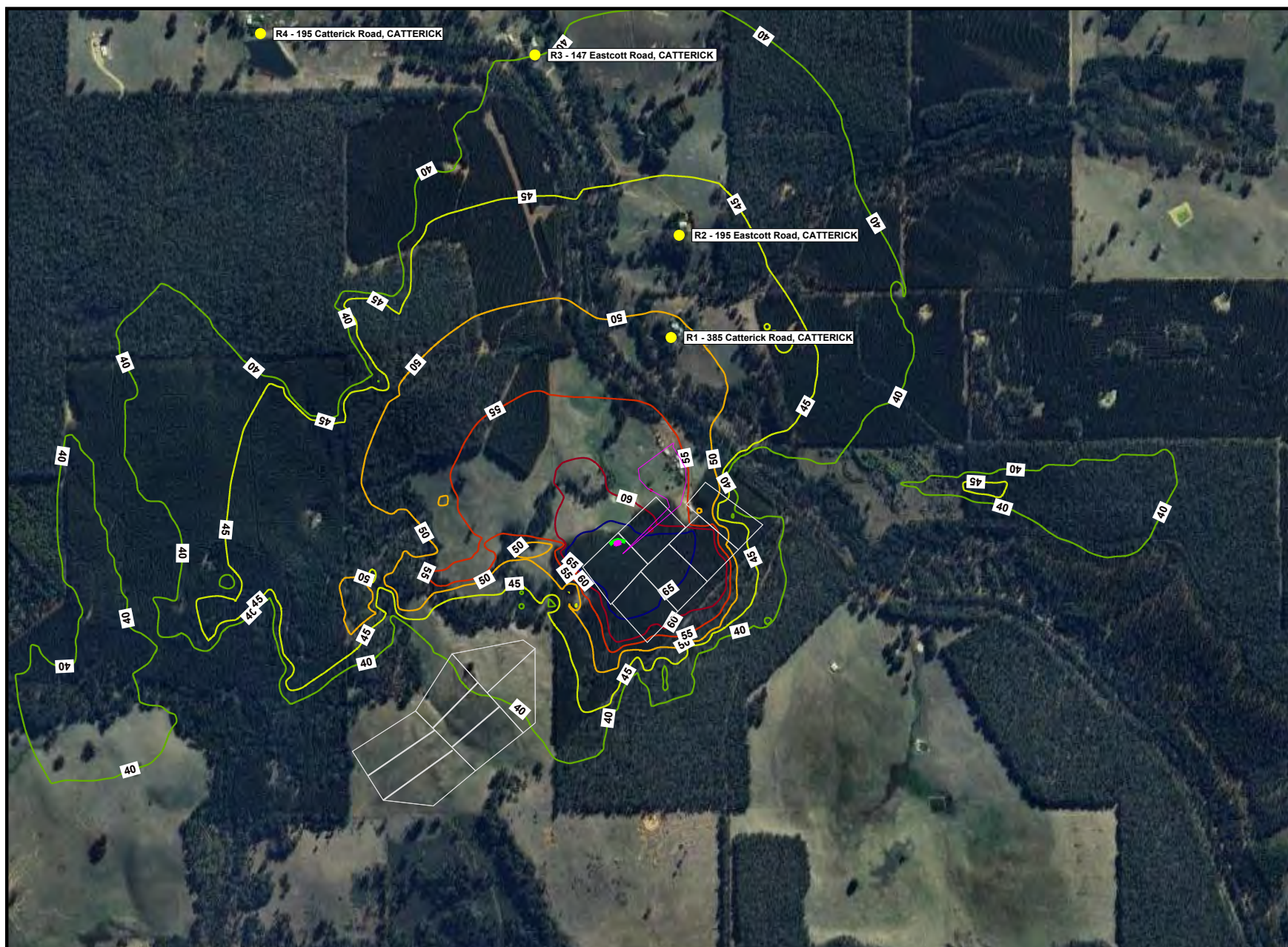
Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick
 Predicted L_{A10} Noise Levels during Stage 4 of Crushing & Loading Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
 (08) 9401 7770

Figure B-5



Signs and symbols

- Point source
- Receiver
- Bund
- Moving Truck Source



Length Scale



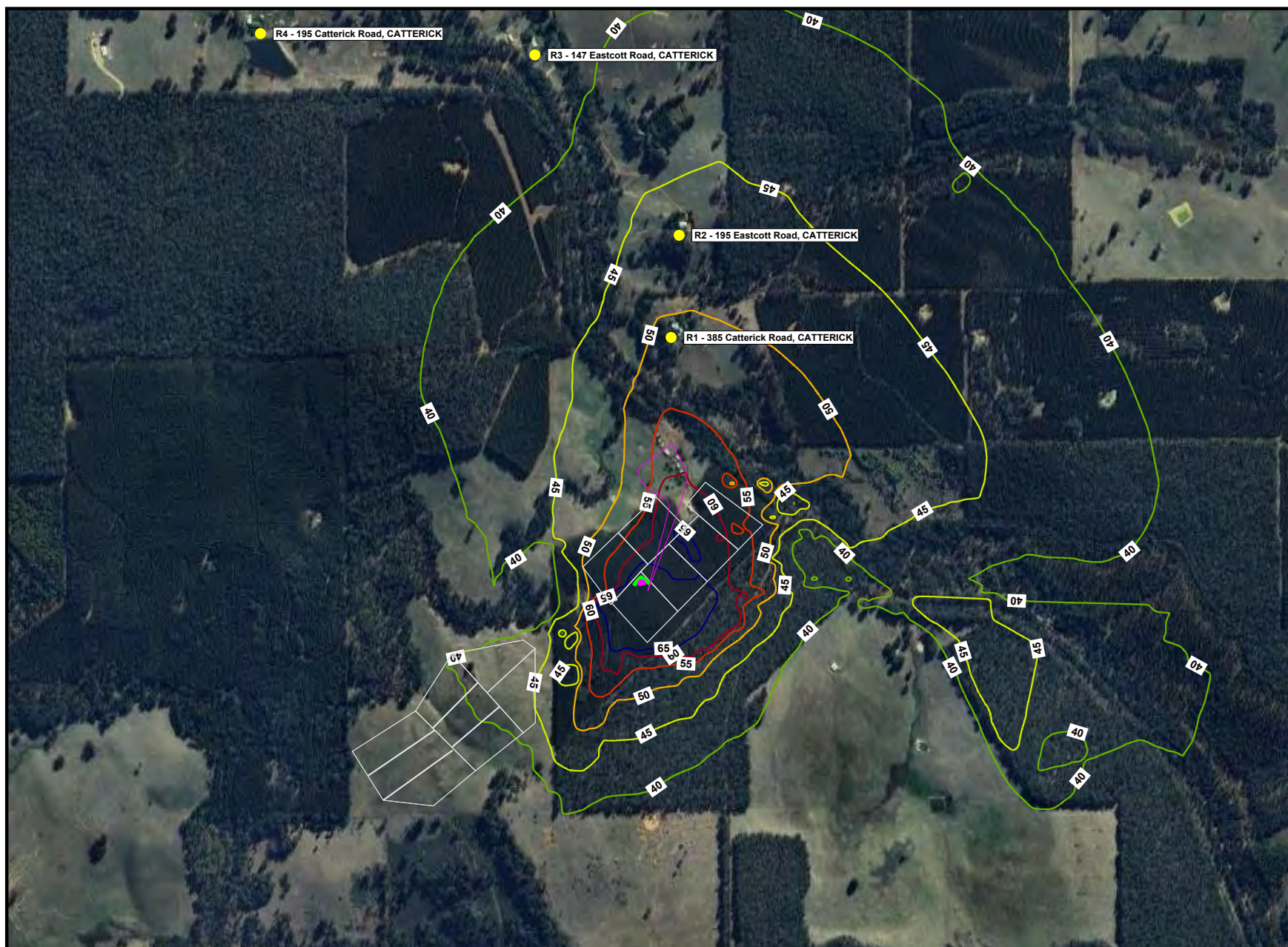
Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick
 Predicted L_{A10} Noise Levels during Stage 5 of Crushing & Loading Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
 (08) 9401 7770

Figure B-6



Signs and symbols

- Point source
- Receiver
- Bund
- Moving Truck Source



Length Scale



Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick
 Predicted L_{A10} Noise Levels during Stage 6 of Crushing & Loading Operations - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
 (08) 9401 7770

Appendix C – Drilling Noise Contours

Figure C-1



Signs and symbols

- * Point source
- Receiver



Length Scale

0 50 100 200 300 400 500 m

Gravel Extraction Quarry - Lot 3938/406 Catterick Road, Catterick
Predicted L_{A10} Noise Levels during Blast Hole Drilling - Wind from All Directions



Lloyd George Acoustics

www.lgacoustics.com.au
(08) 9401 7770

Appendix D – Terminology

The following is an explanation of the terminology used throughout this report:

- **Decibel (dB)**

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

- **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A , dB.

- **Sound Power Level (L_w)**

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure level at known distances. Noise modelling incorporates source sound power levels as part of the input data.

- **Sound Pressure Level (L_p)**

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc. and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

- **L_{ASlow}**

This is the noise level in decibels, obtained using the A-frequency weighting and the S (slow) time weighting. Unless assessing modulation, all measurements use the slow time weighting characteristic.

- **L_{AFast}**

This is the noise level in decibels, obtained using the A-frequency weighting and the F (fast) time weighting. This is used when assessing the presence of modulation.

- **L_{APeak}**

This is the greatest absolute instantaneous sound pressure level in decibels using the A-frequency weighting.

- **L_{Amax}**

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

- **L_{A1}**

The L_{A1} level is the A-weighted noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{A10}**

The L_{A10} level is the A-weighted noise level exceeded for 10 percent of the measurement period and is considered to represent the “intrusive” noise level.

- **L_{A90}**

The L_{A90} level is the A-weighted noise level exceeded for 90 percent of the measurement period and is considered to represent the “background” noise level.

- **L_{Aeq}**

The equivalent steady state A-weighted sound level (“equal energy”) in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the “average” noise level.

- **One-Third-Octave Band**

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20000 Hz inclusive.

- **Representative Assessment Period**

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

- **L_{Amax} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded at any time.

- **L_{A1} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 1 percent of the representative assessment period.

- **L_{A10} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 10 percent of the representative assessment period.

- **Tonal Noise**

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

- the presence in the noise emission of tonal characteristics where the difference between -
 - (a) the A-weighted sound pressure level in any one-third octave band; and
 - (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

- **Modulating Noise**

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

- a variation in the emission of noise that —
 - (a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band; and
 - (b) is present for at least 10% of the representative assessment period; and
 - (c) is regular, cyclic and audible.

- **Impulsive Noise**

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness means:

- a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} is more than 15 dB when determined for a single representative event.

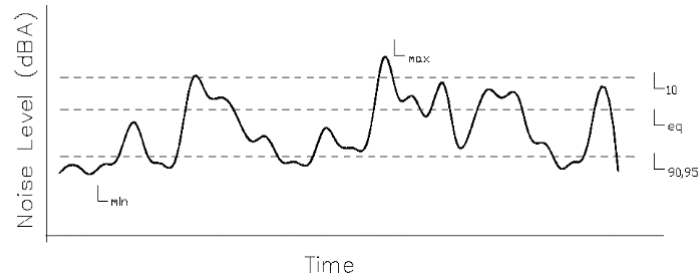
- **Major Road**

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

- **Secondary / Minor Road**

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

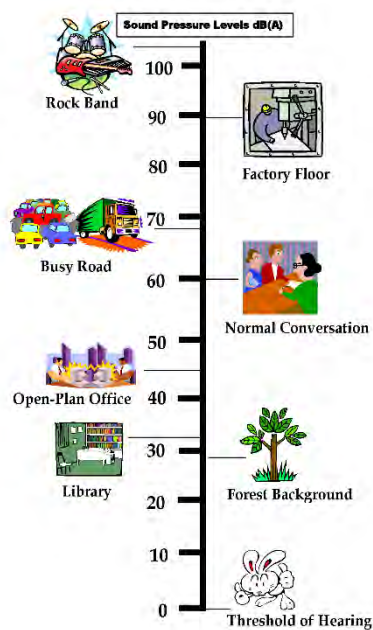
- Chart of Noise Level Descriptors



- Austroads Vehicle Class

VEHICLE CLASSIFICATION SYSTEM AUSTROADS	
CLASS	VEHICLE
1	Light Cars, vans, mopeds, utility vehicles, motorbikes
2	Light Trucks Trucks, trailers, motorhomes
3	Heavy Trucks Two axle trucks, three axle trucks
4	Heavy Trucks Three axle trucks, four axle trucks
5	Heavy Trucks Four axle trucks, five axle trucks
6	Heavy Trucks Five axle articulated trucks, six axle trucks
7	Heavy Trucks Six axle articulated trucks, seven axle trucks
8	Heavy Trucks Seven axle articulated trucks, eight axle trucks
9	Heavy Trucks Eight axle articulated trucks, nine axle trucks
10	Heavy Trucks Ten axle articulated trucks, eleven axle trucks
11	Heavy Trucks Twelve axle articulated trucks, thirteen axle trucks
12	Heavy Trucks Fourteen axle articulated trucks, fifteen axle trucks

- Typical Noise Levels



APPENDIX B - COMPLAINTS REGISTER

Complaints Register

Ref. No.	Date	Name & Address of Complainant	Time/Date of Complaint	Detail of Complaint	Summary of Actions Taken	Shire Notified	Person Responsible

APPENDIX H – DUST MANAGEMENT PLAN