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PROPOSED CHANGE OF USE TO 'TRANSPORT DEPOT' ON LOT 2 (508) KING ROAD, OLDBURY NOISE ASSESSMENT

Report 10.00140R-01

prepared for HI Plant Services
c/- Planning Horizons – Development Solutions
on 23/12/2020

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REPORT PREPARED BY

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BASIS OF REPORT

This report has been prepared by **Acoustics Consultants Australia (ACA)** with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with the Client. Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

REFERENCE	DATE	PREPARED	REVIEWED	AUTHORISED
10.00140R-01 – DRAFT	24/11/2020	SF	MdlM	MdlM
10.00140R-01 – FINAL	23/12/2020	SF	MdlM	MdlM

CONTENTS

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Report 10.00140R-01

1. INTRODUCTION

This report presents the findings of a noise assessment conducted by Acoustics Consultants Australia (ACA) for the proposed Change of Use of the site located at Lot 2 (508) King Road, Oldbury.

A Change of Use from residential to 'Transport Depot' is proposed.

The aims of this assessment are:

- To identify the main sources of noise from the proposal and the potential noise exposure of the nearest noise sensitive receivers;
- To conduct an objective noise assessment based on noise modelling of typical operations proposed for the site; and
- If necessary, to identify any practicable and effective noise mitigation measures recommended to control noise from the premises to satisfactory levels.

This report has been prepared in response to the Shire of Serpentine Jarrahdale's requirement for acoustic assessment, due to the proximity of existing residential properties to the site.

The assessment summarised in the following sections of this report has been conducted following the stipulations of the WA Environmental Protection (Noise) Regulations 1997 (EPNR) considering typical operational conditions.

The methodology and standards used to conduct the assessment, as well as the numeric assessment results are presented in the following sections.

Acoustic terms used in this report are defined in the Glossary in **Appendix A**.

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2. BACKGROUND INFORMATION

The subject site at Lot 2 (508) King Road, Oldbury is currently used primarily for residential purposes. However, as detailed in the Development Application (DA), the site also currently facilitates some commercial on-site parking.

Due to the growth of the landowner's plant hire business it is proposed to change the use of the site for the purposes of operating as a 'Transport Depot'.

Key aspects of the required change of use of the subject site are:

- The storage of three or more commercial vehicles on the site;
- Ancillary maintenance, minor repairs and refuelling of the vehicles on site;
- The potential need for the ancillary storage of goods brought to the premises by the stored commercial vehicles if and when required; and
- The transfer of goods or persons from one vehicle to another.

To accommodate the increased intensity of the parking of commercial vehicles, a hardstand pad of aggregate has been laid on-site. The hardstand area is not proposed to be increased and no construction works are proposed as a part of the change of use application.

2.1. Location

The site is located approximately 360m to the west of the King Road within a rural zoning, as identified by the Shire of Serpentine Jarrahdale's current local planning scheme (LPS3). **Figure 1** identifies the site and surrounding area, including the closest existing dwellings to the east and south-east of the site.

The proposed depot is identified by red outline in the figure. The full property boundary of 508 King Road is identified by **Figure 3**.

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Figure 1 Site Location and Nearest Noise Sensitive Receivers

Note: Depot Site identified by red outline – the full property boundary of 508 King Road is identified by Figure 3.

2.2. Sensitive Receivers

The nearest noise sensitive receivers, as shown in **Figure 1** are as follows:

- R2 – 494 King Road - Existing dwelling located approximately 250m to the east; and
- R3 – 510 King Road - Existing dwelling located approximately 190m to the south-east.

R1 is owned and occupied by the Applicant and therefore not considered noise sensitive for the purposes of assessment. This assessment considers the potential noise impacts on R2 an R3 only.

2.3. Proposed Use

The vehicles and machinery proposed to be stored on site are:

- 3 x Scania six-wheel tippers;
- 2 x JCB Dinosaur watercarts; and
- 1 x Telehandler.

It is understood that when the machinery and vehicles are hired out, they remain off site for the duration of the hire period, which is typically several weeks or months at a time. Therefore, there are no regular daily trips to and from site for the commercial vehicles.

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When the commercial vehicles are returned to the subject site, they remain dormant until they are required on another worksite.

Under rare circumstances, vehicles may be returned to the subject site during a contract/project for maintenance or repairs, but this would only occur if the maintenance and repairs cannot be successfully completed at the worksite.

Light vehicles associated with scheduled work shifts would access the site on a daily basis, with the maximum number of light vehicle movements to and from the site not exceeding eight on a busy day. Of these, no more than four movements would occur prior to 0700 hours with the other four trips occurring later in the day at the end of the work shift (within 0700 to 1900 hours daytime period).

A maximum of two heavy vehicle movements to and from the site would occur each day. These would only occur within 0700 to 1900 hours daytime period.

Periodic servicing and light repair work would be undertaken on site on an ad hoc basis.

2.4. Operations and Noise Sources

The principal sources of noise associated with the proposed use would be expected to be:

- Light vehicles manoeuvring on the site access road and within the site;
- Heavy vehicles manoeuvring on the site access road and within the site; and
- Servicing and light repair work within the site.

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3. ACOUSTIC CRITERIA

Criteria have been determined from a review of the following documents:

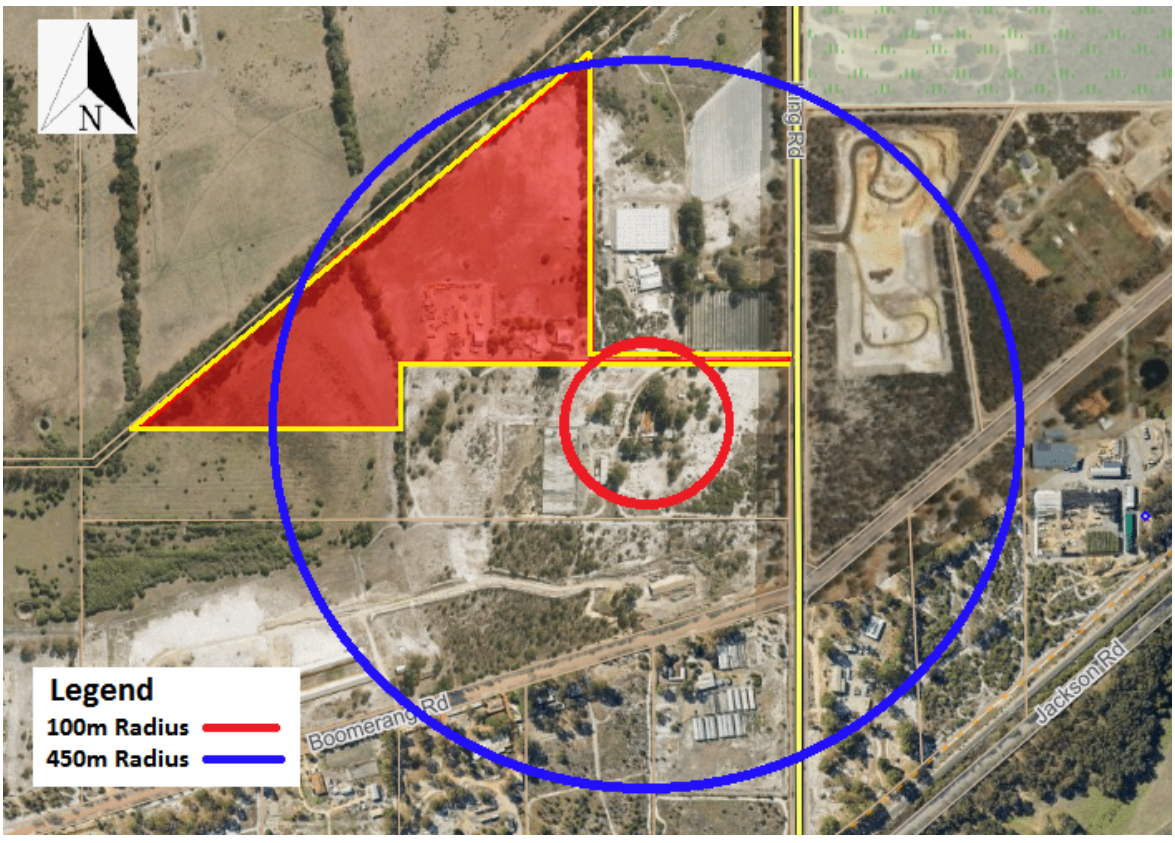
- State requirements: Western Australia *Environmental Protection (Noise) Regulations 1997* (EPNR1997); and
- Australian Standard AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS 2107).

3.1. WA Environmental Protection (Noise) Regulations 1997

Noise emissions from commercial premises are regulated by state noise policy in the form of the Western Australia Environmental Protection (Noise) Regulations of 1997 (EPNR). To achieve compliance with this policy, noise levels at nearby residential areas are not to exceed defined limits. These limits are determined from consideration of prevailing background noise levels and 'influencing factors' that consider the level of commercial and industrial zoning in the locality.

The influencing factor considers zoning and road traffic volumes around the sensitive receiver of interest, within a 100 and 450 m radius. **Figure 2** identifies these radii from the closest receiver, R3.

Figure 2 Influencing Factor Calculation Map



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Considering the land uses within the Rural 'Special Use' zone surrounding the site an influencing factor of 1 dB has been applied for this assessment. Given the notable setback distance from any major roads, an adjustment has not been applied for road traffic volumes.

It should be noted that the proposed 'Transport Depot' land use of the subject site has not been considered in the influencing factor calculation. Any subsequent applications should take account of the changed land use in the recalculation of the influencing factor.

A summary of the applicable outdoor noise criteria is provided in the following table.

Table 1 WA EPNR Assigned Noise Levels

Type of premises receiving noise	Time of day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area	0700 to 1900 hours Monday to Saturday	46 (45+1)	56 (55+1)	66 (65+1)
	0900 to 1900 hours Sunday and public holidays	41 (40+1)	51 (50+1)	66 (65+1)
	1900 to 2200 hours All days	41 (40+1)	51 (50+1)	56 (55+1)
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays	36 (35+1)	46 (45+1)	56 (55+1)
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial premises	All hours	65	80	90

A series of adjustments must be added to the noise source levels if noise received at the sensitive premises cannot reasonably be free of audible characteristics of tonality, modulation and impulsiveness, and the adjusted level must comply with the assigned level. Definition of these terms (tonality, modulation and impulsiveness) are provided by Regulation 9(1) of the EPNR. **Table 2** summarises the adjustments, as defined by the Regulations.

Table 2 Noise Character Adjustments

Where tonality is present	Where modulation is present	Where impulsiveness is present
+5 dB	+5 dB	+10 dB

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3.2. Australian Standard 2107:2016

For internal spaces, Australian Standard 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* (AS/NZS 2107) and the World Health Organisation Guidelines for Community Noise 1999 (The WHO Guidelines) documents provide recommended noise limits for specific room usages.

Indoor targets are considered more appropriate to noise sensitive activities such as sleep and residential living since they generally occur indoors. Therefore, where it can be shown that the *outdoor* Assigned Noise Levels are impracticable to achieve, consideration is usually given to appropriate application of industry guidelines such as Australian Standard 2107:2016.

The following table presents recommended internal noise levels recommended for residential houses in areas with negligible transportation and in locations near minor roads (extracted from Table 1 of AS/NZS 2107).

Table 3 AS/NZS 2107 Recommended Design Sound Levels

Type of occupancy	Design sound levels ($L_{Aeq,t}$ range) – dB
Houses in areas with negligible transportation	
Sleeping areas (night-time)	25-30
Houses near minor roads	
Living areas	30-40
Sleeping areas (night-time)	30-35
Work areas	35-40

From this table an internal noise target of L_{Aeq} 30 dB is considered reasonable for sleeping areas facing the site. The recommended sound levels given are not necessarily appropriate in all circumstances and may not reflect each occupant's expectations of quality; this is particularly the case when the noise content has considerable low frequency energy or when the levels do not correspond to a quasi-steady noise source (i.e. sound fluctuates by a significant range in a short period of time).

The WHO Guidelines provide internal noise limits recommended to avoid negative health impacts based on sleep disturbance scenarios, as shown in **Table 4**.

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Table 4 WHO Guidelines, Sleep Disturbance Recommended Noise Limits

Noise metric	Recommended indoor levels – dB
Sleep disturbance, inside bedrooms	
$L_{Aeq,8hour}$	35
L_{Amax}	50

Note: The WHO Guidelines set out outdoor limits based on assumptions of 10dB indoor-outdoor difference. For windows closed, indoor to outdoor level difference may be 5-15 dB higher than with windows open. We summarise the indoor goals, as the façade transmission would vary from resident to resident.

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4. ASSESSMENT

4.1. Approach

The assessment has been undertaken based on the following steps:

- Review of drawings and information provided by the proponent with respect to the proposed Change of Use;
- Review of the proposed activities and identification of the key potential noise emissions;
- Noise modelling to predict noise levels at surrounding noise sensitive receivers;
- Assessment of predictions against the applicable noise criteria; and
- Consideration of practicable and effective noise mitigation measures.

4.2. Noise Levels and Assumptions

With consideration to the relatively low number of vehicle movements that would occur on the site access road, it is anticipated that the L_{A10} and L_{A1} noise levels would not be materially influenced by the access road noise. Accordingly, for the purpose of assessment the L_{Amax} criterion is considered for the evaluation of noise emissions from the access road.

In the case of the assessment of noise from the proposed depot site, the L_{A10} and L_{Amax} noise levels have been considered for the purpose of providing a robust assessment. A 10 dB character adjustment has been applied to the predicted L_{A10} noise levels to account for the potential for impulsive noise emissions from the repair work that may be undertaken on the site.

Previous measurements conducted by ACA at other similar sites have been used to estimate noise emissions from the proposal. These are summarised in **Table 5**.

Table 5 Noise Source Sound Power Levels

	1/1 Octave Band Sound Level – dB								
Frequency	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	dBA
Light Vehicle Movement on Access Road (L_{max})	69	72	78	85	92	91	84	74	**96**
Heavy Vehicle Movement on Access Road (L_{max})	78	84	92	98	101	97	92	84	**104**
Servicing/repair Work on Depot Site (L_{10})	80	86	91	95	83	90	84	74	**98**
Servicing/repair Work on Depot Site (L_{max})	100	106	111	115	103	110	104	100	**118**

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4.3. Noise Modelling

Operational noise emissions from the site have been predicted using a model created with the iNoise environmental noise prediction software (Version 2020), implementing the ISO 9613:1996 (*Acoustics – Attenuation of sound during propagation outdoors*) calculation algorithm. This program is used and recognised internationally as a preferred computer noise model.

Factors that are addressed in the noise modelling are:

- Equipment noise level emissions and locations (as discussed in **Section 2**)
- Shielding/reflection effects from structures
- Receiver locations
- Ground topography
- Noise attenuation due to geometric spreading
- Ground absorption
- Atmospheric absorption and
- Influence of meteorology, per ISO 9613 methodologies.

The noise predictions undertaken are considered reasonably representative of 'typical worst case' scenarios and it is expected that actual noise levels would typically be less than predicted for the majority time.

4.4. Predicted Noise Levels

Noise contour maps at an elevation of 1.5 m above ground level have been generated using the iNoise software. These are presented in **Appendix B**.

The numerical results from the noise model at outdoor locations are presented in **Table 6**.

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Table 6 Predicted Outdoor Noise Levels

Receiver	Predicted Noise Levels – dBA			
	Light Vehicles on Access Road	Heavy Vehicles on Access Road	Servicing/Repair Work within Depot Site	
	L_{Amax}	L_{Amax}	L_{A10}	L_{Amax}
R2 – 494 King Road - Existing dwelling located approximately 250m to the east	48	55	44	54
R3 – 510 King Road - Existing dwelling located approximately 190m to the south-east	45	59	45	55

4.5. Assessment and Discussion

The results presented in the previous section have been assessed against the noise criteria (per **Section 3**). A summary is presented in **Table 7**.

Table 7 Assessment of Results

Receiver	Type of Receiver	Noise Prediction (dB)	Assigned Noise Level (dB)	Difference (dB)	Comments
Light Vehicles (Prior to 0700 Hours)					
R2	Existing Residential	L_{Amax} 48	L_{Amax} 56	-8	Complies
R3	Existing Residential	L_{Amax} 45	L_{Amax} 56	-11	Complies
Heavy Vehicles (0700 to 1900 Hours)					
R2	Existing Residential	L_{Amax} 55	L_{Amax} 66	-11	Complies
R3	Existing Residential	L_{Amax} 59	L_{Amax} 66	-7	Complies
Servicing/Repair Work (0700 to 1900 Hours)					
R2	Existing Residential	L_{A10} 44	L_{A10} 46	-2	Complies
R3	Existing Residential	L_{A10} 45	L_{A10} 46	-1	Complies
Servicing/Repair Work (0700 to 1900 Hours)					
R2	Existing Residential	L_{Amax} 54	L_{Amax} 66	-12	Complies
R3	Existing Residential	L_{Amax} 55	L_{Amax} 66	-11	Complies

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As shown in **Table 7,** EPNR compliance would be expected at the closest existing sensitive residential locations (R2 and R3). Additionally, internal noise levels would be expected to be within the recommended levels recognised by AS 2107 and the WHO Guidelines.

The requirement for specific noise mitigation measures is not considered necessary.

Nevertheless **Section 5** of this report recommends a number of measures that can be applied to manage noise emissions from the site as much as reasonably possible and maintain noise within acceptable levels.

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5. RECOMMENDATIONS

Table 8 outlines the considerations of various noise mitigation options to reduce impact on residents from operations at the site. The table is divided in 3 sections:

- Treating the source: This refers to ways of reducing emissions directly at the source of sound generation (i.e. vehicles).
- Treating the path: This refers to treatment to the medium that is physically in between the source and the receivers (i.e. air paths, buildings, reflective surfaces, supporting structures).
- Management: This refers to measures that will be required by the site management to minimise noise from operations.

Table 8 Noise Mitigation Options

Item #	Recommendation
Treating the Source	
1	Maintain good driving behaviour and practices on the access road and within the depot site.
2	Ensure vehicles accessing the site are generally well maintained and serviced to minimise their noise emissions.
3	Ensure the access road is generally well maintained to avoid noise arising from potholes.
Treating the Path	
4	Where there is potential to, the acoustic screening provided by structures should be exploited to reduce noise from repair works at sensitive receiver locations.
5	Maximise the offset distance between noisy plant items and the receivers where practicable.
Management	
6	Maintain good management practices on site at all times and review procedures periodically.

It is expected that with the thorough implementation of the identified noise control measures, noise levels at sensitive receivers would remain in compliance with the EPNR noise criteria.

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APPENDIX A: Glossary of Acoustic Terms

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1 Sound Level or Noise Level

The terms "sound" and "noise" are almost interchangeable, except that in common usage "noise" is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2 "A" Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dB(A), which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dB(A) is a good measure of the loudness of that sound. Different sources having the same dB(A) level generally sound about equally loud.

A change of 1 dB(A) or 2 dB(A) in the level of a sound is difficult for most people to detect, whilst a 3 dB(A) to 5 dB(A) change corresponds to a small but noticeable change in loudness. A 10 dB(A) change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

Sound Pressure Level (dB(A))	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as "linear", and the units are expressed as dB(lin) or dB.

3 Sound Power Level

The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dB(A)), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W. The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

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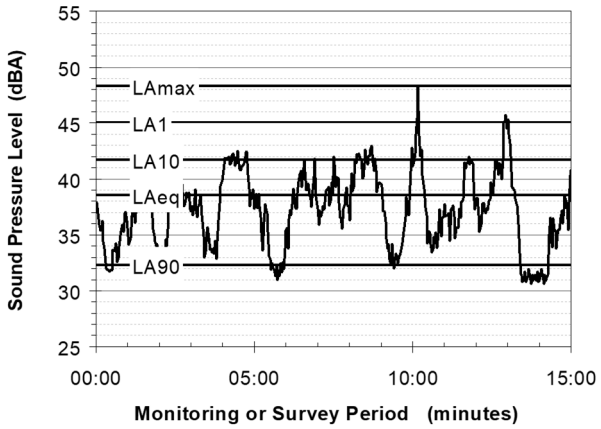
4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the "repeatable minimum" LA90 noise level over the daytime and night-time measurement periods, as required by the EPA. In addition, the method produces mean or "average" levels representative of the other descriptors (LAeq, LA10, etc)

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APPENDIX B: Noise Contour Maps

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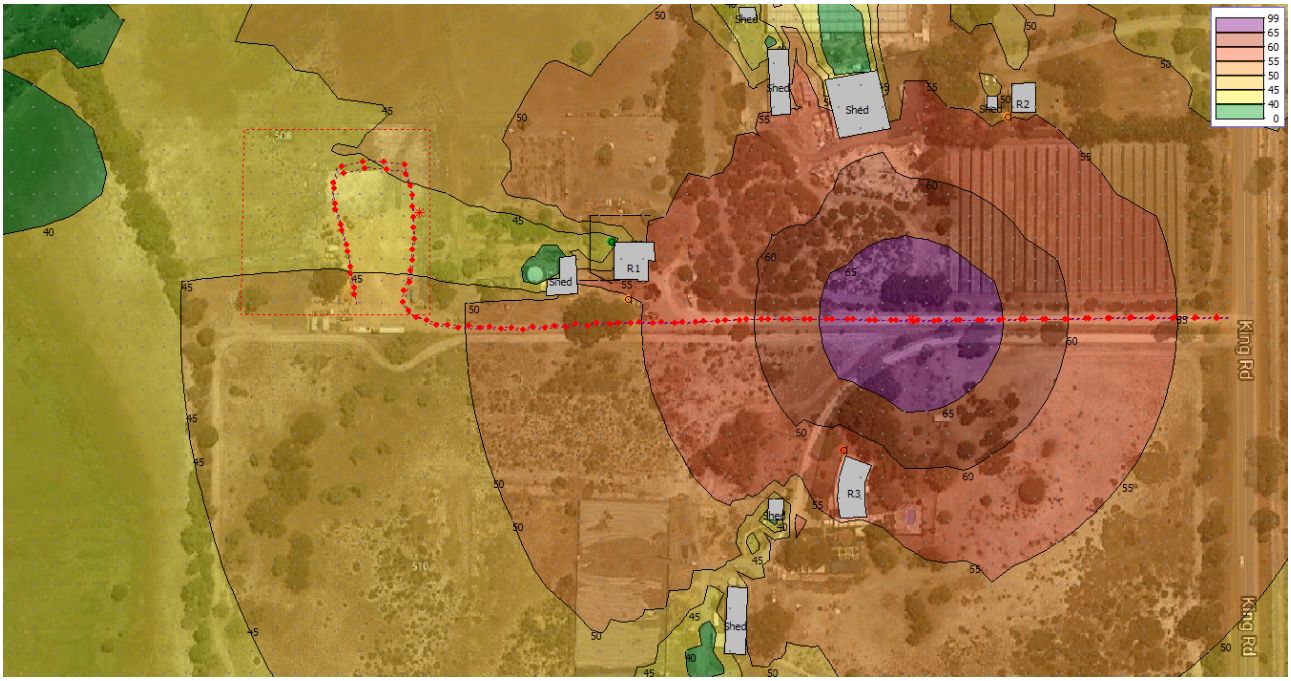
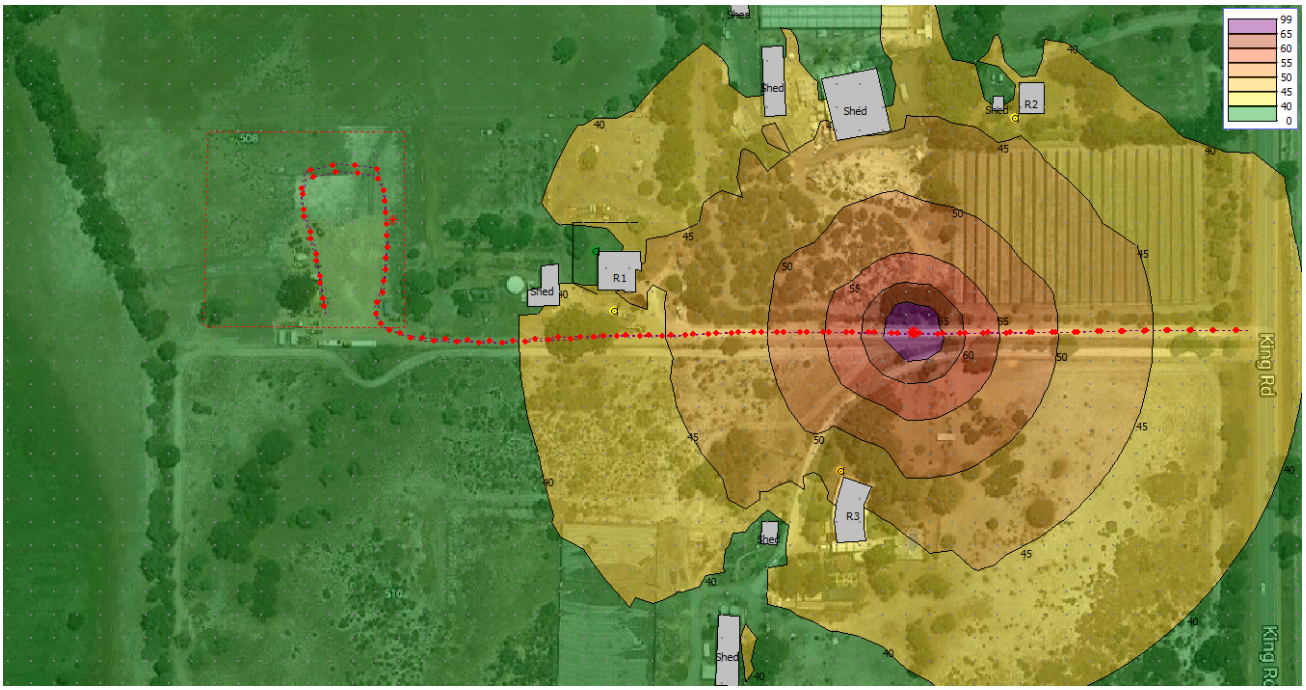
Predicted Noise Levels from Heavy Vehicle Passby on Access Road at 1.5 m above Ground Level (L_{Amax} dBA)



Predicted Noise Levels from Light Vehicle Passby on Access Road at 1.5 m above Ground Level (L_{Amax} dBA)



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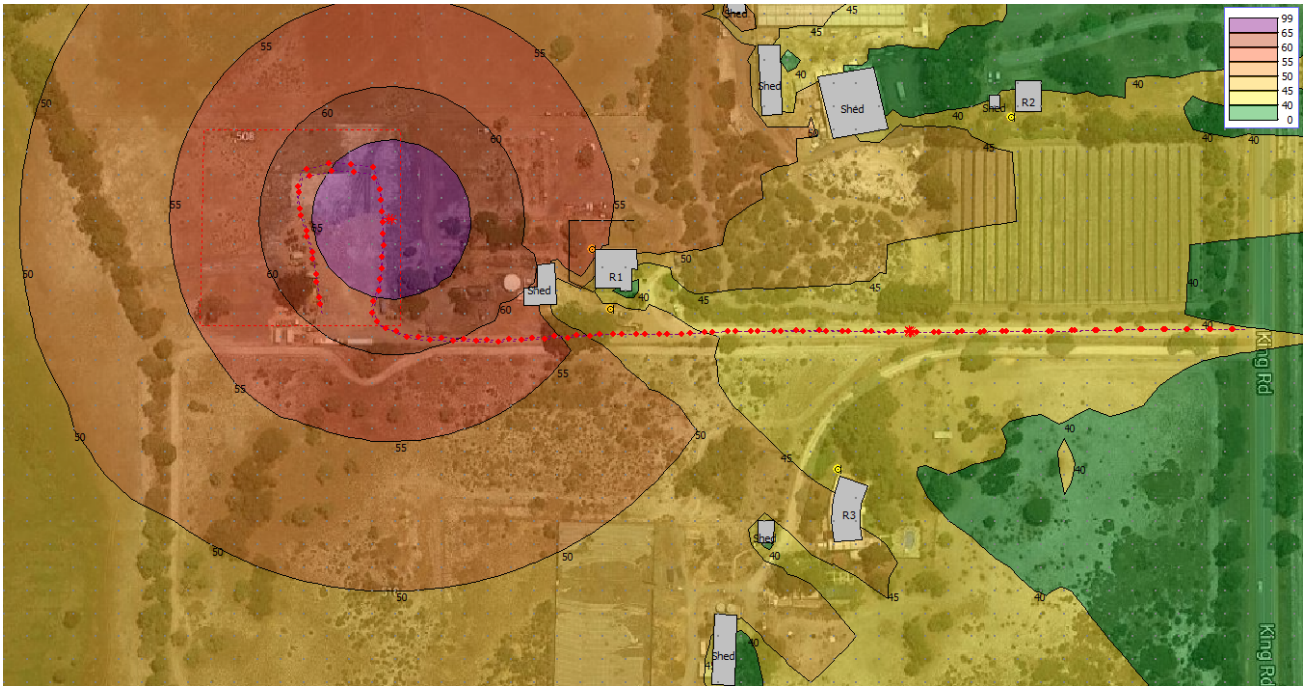
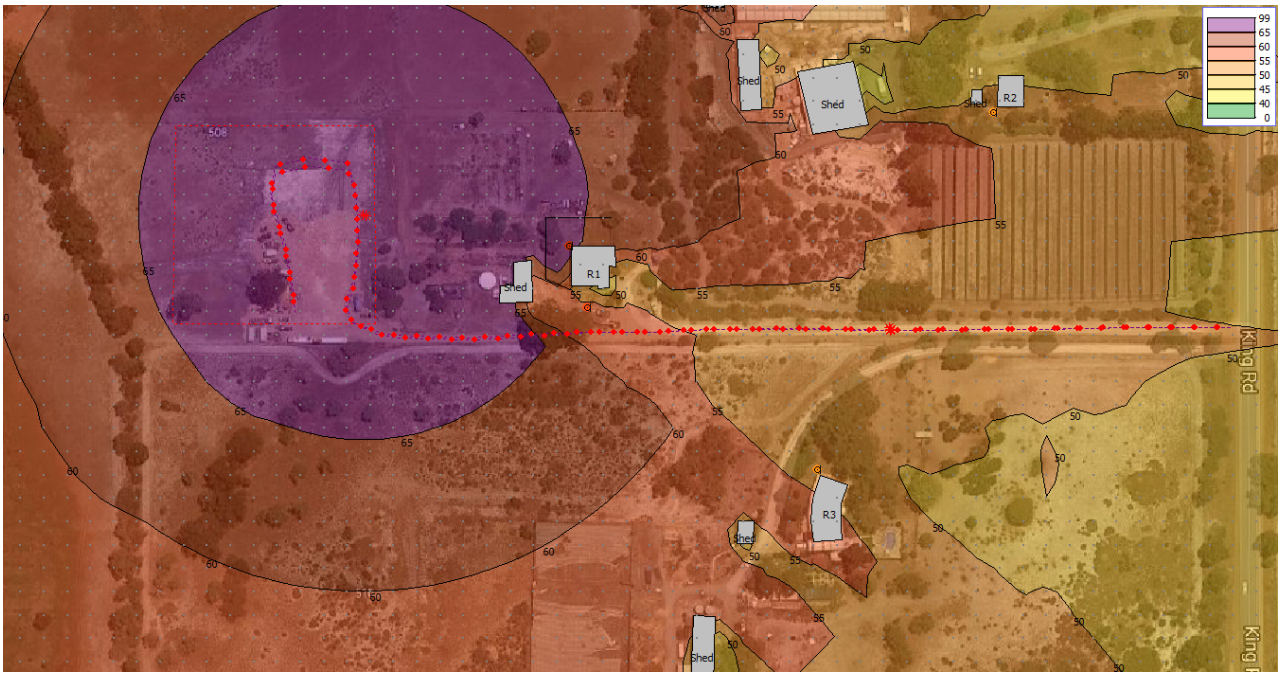
Predicted Noise Levels from Vehicle Repairs on Depot Site Road at 1.5 m above Ground Level (L_{A10} dBA), inclusive of 10 dB Impulsive Character Adjustment



Predicted Maximum Noise Levels from Vehicle Repairs on Depot Site Road at 1.5 m above Ground Level (L_{Amax} dBA)



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