Noise Management Plan

Shepherd Court, Harrisdale

Reference: 10051573-03.docx

Prepared for:
Calibre Consulting
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.
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A  November 2010 Report
B  Terminology
1 INTRODUCTION

In November 2010, Lloyd George Acoustics completed an assessment of noise to an area of land referred to as Shepherd Court in Harrisdale and more specifically Lots 100 and 106 Wright Road, Lots 101 to 111 & 124 Shepherd Court, Lot 112 Hatch Court and Crown Reserve 34077 (Noise Impact Assessment, Shepherd Court Rezoning; Reference: 10051573-01a). This assessment is contained in full in Appendix A, with the focus being on dog barking noise associated with kennels located within Hatch Court.

At the time of the 2010 assessment, the Shepherd Court lots and Lots 113-123 were zoned as Urban Deferred. In accordance with the City of Armadale’s Town Planning Scheme No.4 (refer Figure 1-1), the Shepherd Court land is now zoned Urban Development with the Hatch Court land remaining as Urban Deferred and zoned as General Rural.

Figure 1-1 also shows the properties within Hatch Court that are understood to have valid kennel licenses. The expectation is that over time, the properties within Hatch Court will be sold and when this occurs, any current kennel license on that property will also be cancelled, as occurred for Lot 119, which was sold in February 2015. However, with no defined timeline on when this will occur, some form of noise management is required to the proposed residential dwellings within Shepherd Court. The focus of this report is to develop these noise management requirements, based on the Figure 1-2 Structure Plan.
Given that over time the kennels will not exist, the preferred approach is to place notifications on title (that could be removed once all kennel licenses are cancelled) and incorporate façade treatment upgrades as well as restricting locations of one outdoor living area.

Figure 1-2 Shepherd Court Structure Plan
## 2 CRITERIA

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

Regulation 7 defines the prescribed standard for noise emissions as follows:

“7. (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;
   ii. Impulsiveness; and
   iii. Modulation”.

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…”

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics 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 after the adjustments of *Table 2-1* are made to the noise emission as measured at the point of reception.

### Table 2-1 Adjustments for Intrusive Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Tonality</th>
<th>Modulation</th>
<th>Impulsiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 5dB</td>
<td>+ 5dB</td>
<td>+ 10dB</td>
<td></td>
</tr>
</tbody>
</table>

Note: The above are cumulative to a maximum of 15dB.

The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown in *Table 2-2*.
### Table 2-2 Baseline Assigned Noise Levels

<table>
<thead>
<tr>
<th>Premises Receiving Noise</th>
<th>Time Of Day</th>
<th>Assigned Level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$L_{A10}$</td>
</tr>
<tr>
<td>Noise Sensitive</td>
<td>0700 to 1900 hours Monday to Saturday (Day)</td>
<td>45 + influencing factor</td>
</tr>
<tr>
<td></td>
<td>0900 to 1900 hours Sunday and public holidays (Sunday)</td>
<td>40 + influencing factor</td>
</tr>
<tr>
<td></td>
<td>1900 to 2200 hours all days (Evening)</td>
<td>40 + influencing factor</td>
</tr>
<tr>
<td></td>
<td>2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)</td>
<td>35 + influencing factor</td>
</tr>
</tbody>
</table>

With road traffic volumes in excess of 15,000 vehicles per day on Ranford Road (28,672 MRWA October 2014), dwellings within 100 metres receive a + 6 dB influencing factor and those within 450 metres receive a + 2 dB influencing factor – refer Figure 2-1. Note that all dwellings will be within 450 metres of Ranford Road. *Tables 2-3 & 2-4* provide the assigned noise levels for the two zones. Note that the mixed-use area (considered commercial for the purposes of the influencing factor calculation) has been ignored for simplicity but could potential increase the influencing factor for those residences within 100 metres of the mixed use by 1 dB.

### Table 2-3 Assigned Noise Levels: Residences Within 100m of Ranford Road

<table>
<thead>
<tr>
<th>Premises Receiving Noise</th>
<th>Time Of Day</th>
<th>Assigned Level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$L_{A10}$</td>
</tr>
<tr>
<td>Noise Sensitive</td>
<td>0700 to 1900 hours Monday to Saturday (Day)</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>0900 to 1900 hours Sunday and public holidays (Sunday)</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>1900 to 2200 hours all days (Evening)</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)</td>
<td>41</td>
</tr>
</tbody>
</table>
## Table 2-4 Assigned Noise Levels: Residences Within 450m of Ranford Road

<table>
<thead>
<tr>
<th>Premises Receiving Noise</th>
<th>Time Of Day</th>
<th>Assigned Level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$L_{A10}$</td>
</tr>
<tr>
<td>Noise Sensitive</td>
<td>0700 to 1900 hours Monday to Saturday (Day)</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>0900 to 1900 hours Sunday and public holidays (Sunday)</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>1900 to 2200 hours all days (Evening)</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)</td>
<td>37</td>
</tr>
</tbody>
</table>

*Figure 2-1 Shepherd Court Land Proximity to Ranford Road*
3 METHODOLOGY

The methodology is based on the measurements and modelling within the 2010 report. The only updates to the methodology are to include nominal building outlines over the structure plan, noting that R30 zoned dwellings are conservatively assumed to be single storey with a height of 3.5 metres and the R40 zoned dwellings assumed to be double storey with a height of 6.0 metres.

4 RESULTS & ASSESSMENT

Worst-case noise levels from the closest kennels are predicted as noise level contours and shown on Figure 4-1.

The most critical assigned noise level is the night-time $L_{A1}$, so for those residences within 100 metres of Ranford Road, the allowable level is 51 dB $L_{A1}$ and for the remainder of the development, the allowable noise level is 47 dB $L_{A1}$. For those dwellings that are within 100 metres of Ranford Road, these are also significantly further from the dog kennels compared to other dwellings with a lower assigned noise level.

The worst-case noise level is at the south-eastern most point of the development, where noise levels are calculated to be up to 57 dB $L_{A1}$, or 62 dB $L_{A1}$ including the + 5 dB tonality adjustment also included in the contour plots. This represents an exceedance of the night-time assigned noise level of 15 dB, 10 dB exceedance during the evening/Sundays and 5 dB exceedance during other days.

For the residences within 100 metres of Ranford Road where the night-time assigned noise level is 47 dB $L_{A1}$, the predicted noise level is around 48 dB $L_{A1}$ and hence represents only a minor exceedance.

Because of the range of exceedances, 6 packages have been developed for the purposes of noise management as discussed in Section 5. Alternatives to these packages can be accepted if supported by a report provided by a suitably qualified acoustical consultant (member firm of the Association of Australian Acoustical Consultants (AAAC)).
Figure 4-1

Shepherd Court, Harisdale
LA1 Noise Level Contours (Includes + 5 dB Tonal Penalty) from Dogs Barking

13 April 2016

Length Scale 1:3000

Noise level in dB(A)

- 47
- 49
- 51
- 53
- 55
- 57
- 59
- 61
- 63

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5 NOISE MANAGEMENT

To manage the noise emissions whilst any Hatch Court property has a kennel license, six acoustic packages have been developed and are described in Tables 5-1 to 5-6. Figure 5-1 shows where each package is applicable.

Table 5-1 Package 1 Acoustic Treatment

<table>
<thead>
<tr>
<th>Area type</th>
<th>Orientation</th>
<th>Package 1 Measures</th>
</tr>
</thead>
</table>
| **H habitable Room (Includes bedrooms, living areas, kitchens and the like)** | Northeast, Southeast & Southwest | • 6mm (minimum) glazing.  
• High quality, residential grade frames. |
| | Northeastwest | • Standard glazing permissible. |
| **Non-Habitable Room (Includes laundry, bathroom, WC and the like)** | Northeast, Southeast & Southwest | • Standard glazing permissible. |
| | Northwest | • Standard glazing permissible. |
| **All Parts of Dwelling** | Any | • Ground floor slab on ground.  
• Closed eaves.  
• Double brick cavity construction.  
• Pitched roof, minimum 24-degree slope and masonry tiles or metal sheet with sarking (impervious membrane) over rafters.  
• Horizontal ceiling so that roof and ceiling trusses are both required, minimum 10mm thick plasterboard.  
• Fibrous thermal insulation R2.5 or greater between ceiling joists. |
| **Other** | | • Notification on title such as:  
This lot is in the vicinity of dog kennels, and is currently affected by dog barking noise. Further information is available on request from the City of Armadale.  
• To gain the benefits of the improved façade construction, consideration should be given to incorporating mechanical ventilation/air-conditioning in order to allow windows to be closed. |
## Table 5-2 Package 2 Acoustic Treatment

<table>
<thead>
<tr>
<th>Area type</th>
<th>Orientation</th>
<th>Package 2 Measures</th>
</tr>
</thead>
</table>
| Habitable Room (Includes bedrooms, living areas, kitchens and the like) | Northeast, Southeast & Southwest | • 6.38mm (minimum) laminated glazing.  
• High quality, residential grade fixed, awning or casement style frames. |
|                                                                          | Northwest         | • 6mm (minimum) glazing.  
• High quality, residential grade frames.                                     |
| Non-Habitable Room (Includes laundry, bathroom, WC and the like)          | Northeast, Southeast & Southwest | • 6mm (minimum) glazing.  
• High quality, residential grade frames.                                     |
|                                                                          | Northwest         | • Standard glazing permissible.                                                   |
| All Parts of Dwelling                                                    | Any               | • Ground floor slab on ground.  
• Closed eaves.  
• Double brick cavity construction.  
• Pitched roof, minimum 24-degree slope and masonry tiles or metal sheet with sarking (impervious membrane) over rafters.  
• Horizontal ceiling so that roof and ceiling trusses are both required, minimum 10mm thick plasterboard.  
• Fibrous thermal insulation R2.5 or greater between ceiling joists.         |
| Other                                                                    |                   | • Notification on title such as:  
*This lot is in the vicinity of dog kennels, and is currently affected by dog barking noise. Further information is available on request from the City of Armadale.*  
• Provide one outdoor living area that is shielded from the noise source. This can be by creating an alcove area or locating the outdoor area on the side of the house, opposite to the noise source.  
• To gain the benefits of the improved façade construction, consideration should be given to incorporating mechanical ventilation/air-conditioning in order to allow windows to be closed. |
### Table 5-3 Package 3 Acoustic Treatment

<table>
<thead>
<tr>
<th>Area type</th>
<th>Orientation</th>
<th>Package 3 Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitable Room (Includes bedrooms, living areas, kitchens and the like)</td>
<td>Northeast, Southeast &amp; Southwest</td>
<td>• 6.5mm (minimum) VLam Hush glazing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality, residential grade fixed, awning or casement style frames.</td>
</tr>
<tr>
<td></td>
<td>Northwest</td>
<td>• 6mm (minimum) glazing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality, residential grade frames.</td>
</tr>
<tr>
<td>Non-Habitable Room (Includes laundry, bathroom, WC and the like)</td>
<td>Northeast, Southeast &amp; Southwest</td>
<td>• 6mm (minimum) glazing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality, residential grade frames.</td>
</tr>
<tr>
<td></td>
<td>Northwest</td>
<td>• Standard glazing permissible.</td>
</tr>
<tr>
<td>All Parts of Dwelling</td>
<td>Any</td>
<td>• Ground floor slab on ground.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Closed eaves.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Double brick cavity construction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pitched roof, minimum 24-degree slope and masonry tiles or metal sheet with sarking (impervious membrane) over rafters.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Horizontal ceiling so that roof and ceiling trusses are both required, minimum 13mm thick plasterboard.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fibrous thermal insulation R2.5 or greater between ceiling joists.</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>• Notification on title such as: This lot is in the vicinity of dog kennels, and is currently affected by dog barking noise. Further information is available on request from the City of Armadale.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide one outdoor living area that is shielded from the noise source. This can be by creating an alcove area or locating the outdoor area on the side of the house, opposite to the noise source.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To gain the benefits of the improved façade construction, consideration should be given to incorporating mechanical ventilation/air-conditioning in order to allow windows to be closed.</td>
</tr>
</tbody>
</table>
### Table 5-4 Package 4 Acoustic Treatment

<table>
<thead>
<tr>
<th>Area type</th>
<th>Orientation</th>
<th>Package 4 Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitable Room (Includes bedrooms, living areas, kitchens and the like)</td>
<td>Northeast, Southeast &amp; Southwest</td>
<td>• 10.38mm (minimum) laminated glazing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality, commercial grade fixed, awning or casement style frames.</td>
</tr>
<tr>
<td></td>
<td>Northwest</td>
<td>• 6.5mm (minimum) glazing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality, residential grade fixed, awning or casement style frames.</td>
</tr>
<tr>
<td>Non-Habitable Room (Includes laundry, bathroom, WC and the like)</td>
<td>Northeast, Southeast &amp; Southwest</td>
<td>• 6mm (minimum) glazing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality, residential grade frames.</td>
</tr>
<tr>
<td></td>
<td>Northwest</td>
<td>• Standard glazing permissible.</td>
</tr>
<tr>
<td>All Parts of Dwelling</td>
<td>Any</td>
<td>• Ground floor slab on ground.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Closed eaves.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Double brick cavity construction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pitched roof, minimum 24-degree slope and masonry tiles or metal sheet with sarking (impervious membrane) over rafters.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Horizontal ceiling so that roof and ceiling trusses are both required, minimum 13mm thick plasterboard.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fibrous thermal insulation R2.5 or greater between ceiling joists.</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>• Notification on title such as: This lot is in the vicinity of dog kennels, and is currently affected by dog barking noise. Further information is available on request from the City of Armadale.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide one outdoor living area that is shielded from the noise source. This can be by creating an alcove area or locating the outdoor area on the side of the house, opposite to the noise source.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To gain the benefits of the improved façade construction, consideration should be given to incorporating mechanical ventilation/air-conditioning in order to allow windows to be closed.</td>
</tr>
</tbody>
</table>
### Table 5-5 Package 5 Acoustic Treatment

<table>
<thead>
<tr>
<th>Area type</th>
<th>Orientation</th>
<th>Package 5 Measures</th>
</tr>
</thead>
</table>
| Habitable Room (Includes bedrooms, living areas, kitchens and the like) | Northeast, Southeast & Southwest | - 10.5mm (minimum) VLam Hush glazing.  
- High quality, commercial grade fixed, awning or casement style frames. |
|                                               | Northwest                    | - 6.5mm (minimum) glazing.  
- High quality, residential grade fixed, awning or casement style frames. |
| Non-Habitable Room (Includes laundry, bathroom, WC and the like)              | Northeast, Southeast & Southwest | - 6.5mm (minimum) glazing.  
- High quality, residential grade fixed, awning or casement style frames. |
|                                               | Northwest                    | - 6mm (minimum) glazing.  
- High quality, residential grade frames.                                      |
| All Parts of Dwelling                       | Any                          | - Ground floor slab on ground.  
- Closed eaves.  
- Double brick cavity construction.  
- Pitched roof, minimum 24-degree slope and masonry tiles or metal sheet with sarking (impervious membrane) over rafters.  
- Horizontal ceiling so that roof and ceiling trusses are both required, minimum 13mm thick plasterboard.  
- Fibrous thermal insulation R2.5 or greater between ceiling joists.  
- Any ceiling penetrations to be acoustically treated (surface mounted lights or acoustically rated down-lights, internally insulated acoustic boots for mechanical services). |
| Other                                         |                              | - Notification on title such as:  
*This lot is in the vicinity of dog kennels, and is currently affected by dog barking noise. Further information is available on request from the City of Armadale.*  
- Provide one outdoor living area that is shielded from the noise source. This can be by creating an alcove area or locating the outdoor area on the side of the house, opposite to the noise source.  
- To gain the benefits of the improved façade construction, consideration should be given to incorporating mechanical ventilation/air-conditioning in order to allow windows to be closed. |
Table 5-6 Package 6 Acoustic Treatment

<table>
<thead>
<tr>
<th>Area type</th>
<th>Orientation</th>
<th>Package 6 Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitable Room (Includes bedrooms, living areas, kitchens and the like)</td>
<td>Northeast, Southeast &amp; Southwest</td>
<td>• 10.5mm (minimum) VLam Hush glazing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality, commercial grade fixed, awning or casement style frames.</td>
</tr>
<tr>
<td></td>
<td>Northwest</td>
<td>• 10.5mm (minimum) VLam Hush glazing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality, commercial grade fixed, awning or casement style frames.</td>
</tr>
<tr>
<td>Non-Habitable Room (includes laundry, bathroom, WC and the like)</td>
<td>Northeast, Southeast &amp; Southwest</td>
<td>• 10.5mm (minimum) VLam Hush glazing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality, commercial grade fixed, awning or casement style frames.</td>
</tr>
<tr>
<td></td>
<td>Northwest</td>
<td>• 6.5mm (minimum) glazing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• High quality, residential grade fixed, awning or casement style frames.</td>
</tr>
<tr>
<td>All Parts of Dwelling</td>
<td>Any</td>
<td>• External windows and doors to be no more than 20% of floor area for bedrooms and 50% of floor area for other habitable rooms.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ground floor slab on ground.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Closed eaves.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Double brick cavity construction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pitched roof, minimum 24-degree slope and masonry tiles or metal sheet with sarking (impervious membrane) over rafters.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Horizontal ceiling so that roof and ceiling trusses are both required, minimum 13mm thick sound-rated plasterboard.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fibrous thermal insulation R2.5 or greater between ceiling joists.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Any ceiling penetrations to be acoustically treated (surface mounted lights or acoustically rated down-lights, internally insulated acoustic boots for mechanical services).</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>• Notification on title such as:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This lot is in the vicinity of dog kennels, and is currently affected by dog barking noise. Further information is available on request from the City of Armadale.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide one outdoor living area that is shielded from the noise source. This can be by creating an alcove area or locating the outdoor area on the side of the house, opposite to the noise source.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To gain the benefits of the improved façade construction, consideration should be given to incorporating mechanical ventilation/air-conditioning in order to allow windows to be closed.</td>
</tr>
</tbody>
</table>
Figure 5-1

Shepherd Court Land
Noise Mitigation Packages

+ Existing Kennel

- Package 1
- Package 2
- Package 3
- Package 4
- Package 5
- Package 6

Length Scale 1:3000

12 April 2016

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Appendix A

November 2010 Report
Noise Impact Assessment

Shepherd Court
Rezoning

Prepared For
RPS Group

November 2010

Reference: 10051573-01a
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3 METHODOLOGY ............................................................................................................ 5
4 RESULTS ........................................................................................................................ 5
5 ASSESSMENT & RECOMMENDATIONS ...................................................................... 6

APPENDICES

A Logger Data at 15-Minute Intervals
B Logger Data at 1-Second Intervals Containing Dog Barking
C Terminology
1 INTRODUCTION

In September 2009, a minor amendment was made to the Metropolitan Region Scheme, being Amendment 1177/57 in the Ranford Road Structure Plan Precinct. The purpose of the amendment is to rezone 30 hectares of land from rural zone to urban deferred. The area in question is shown on the following page and includes 26 properties:

- Wright Road Lots 100 and 106
- Shepherd Court Lots 101 to 111, 124
- Hatch Court Lots 112-123; and
- Crown Reserve 34077

Most of the lots in this precinct contained kennels, however these have been progressively closed and purchased by developers. Approximately 10 kennels still remain in the area and as such the amendment has zoned the land urban deferred.

The subject of this report is all those lots, other than those on Hatch Court, as shown on the following page and in Figure 1.1 below. These lots have been purchased by a developer and as such this report considers the noise impact from the remaining kennels on Hatch Court to the subject side. Note that on Hatch Court, Lots 114-116, 119, 120 & 122 have active kennel licenses.

Figure 1.1 – Aerial Imagery of Subject Site
Figure 1

Ranford Precinct Structure Plan Area - proposed amendment
as advertised

14 July 2009
To assess the noise levels, an automatic noise data logger was set-up on one of the south-eastern lots. The logger used enables audio recordings so that these could be played back to identify times of dog barking as opposed to other noises that would still be recorded by the noise logger (birds, wind, road traffic, aircraft etc). Once the data is analysed, the noise levels can be assessed against the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*.

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

## 2 CRITERIA

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

Regulation 7 defines the prescribed standard for noise emissions as follows:

“7. (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;

ii. Impulsiveness; and

iii. Modulation”.

A “…noise emission is taken to *significantly contribute to* a level of noise if the noise emission exceeds a value which is 5dB below the assigned level…”

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics 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 after the adjustments of Table 2.1 are made to the noise emission as measured at the point of reception.

### Table 2.1 – Adjustments For Intrusive Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Tonality</th>
<th>Modulation</th>
<th>Impulsiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ 5dB</td>
<td>+ 5dB</td>
<td>+ 10dB</td>
</tr>
</tbody>
</table>

Note: The above are cumulative to a maximum of 15dB.

The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown in Table 2.2.
Table 2.2 – Baseline Assigned Noise Levels

<table>
<thead>
<tr>
<th>Premises Receiving Noise</th>
<th>Time Of Day</th>
<th>Assigned Level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LA10</td>
</tr>
<tr>
<td>Noise Sensitive</td>
<td>0700 to 1900 hours Monday to Saturday (Day)</td>
<td>45 + influencing factor</td>
</tr>
<tr>
<td></td>
<td>0900 to 1900 hours Sunday and public holidays (Sunday)</td>
<td>40 + influencing factor</td>
</tr>
<tr>
<td></td>
<td>1900 to 2200 hours all days (Evening)</td>
<td>40 + influencing factor</td>
</tr>
<tr>
<td></td>
<td>2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)</td>
<td>35 + influencing factor</td>
</tr>
</tbody>
</table>

For residences within 100 metres of Ranford Road, a + 2 dB influencing factor would be applicable as this is considered to be a secondary road (carrying between 6,000 and 15,000 vehicles per day) – refer Table 2.3. For the remaining land, there would be no influencing factor and the base levels of Table 2.2 applicable.

Table 2.3 – Assigned Noise Levels: Residences Within 100m of Ranford Road

<table>
<thead>
<tr>
<th>Premises Receiving Noise</th>
<th>Time Of Day</th>
<th>Assigned Level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LA10</td>
</tr>
<tr>
<td>Noise Sensitive</td>
<td>0700 to 1900 hours Monday to Saturday (Day)</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>0900 to 1900 hours Sunday and public holidays (Sunday)</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>1900 to 2200 hours all days (Evening)</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)</td>
<td>37</td>
</tr>
</tbody>
</table>
3 METHODOLOGY

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 logger used was an ARL Ngara Type (S/N: 87803e), which holds a current laboratory certificate of calibration (available upon request) and was field calibrated before and after the measurement session and found to be within +/- 0.5 dB. The microphone was fitted with a standard wind screen to minimise wind induced noise;

- 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) and as such no adjustments have been applied for reflected noise.

The noise logger was set-up at the rear of Lot 124 from 5 June to 12 June 2010, approximately 80 metres from the Hatch Court lot boundary. The weekend of 5th, 6th and 7th of June included a public holiday. This was chosen so as to represent worst-case in terms of occupancy rates at short stay dog kennels. As well as the logger recording the noise levels, it was also set to record the audio continuously. This enabled post analysis to extrapolate times when dog barking noise was present and other noises such as birds, wind, road traffic and aircraft were not present or insignificantly influencing noise levels.

The Ngara logger allows the data to be analysed for any measurement duration. Initially, the 15-minute data was downloaded, since this represents the minimum assessment period in the Regulations. However from this data, it is not possible to quantify dog barking noise alone as during any 15-minute period, other noise sources are also present. As such, the 1-second data for Sunday morning (midnight to 9am) was plotted and the audio played-back to identify and quantify times of dog barking. This time period was selected as it was considered most likely to represent a time where dogs would be barking and coincide with the worst-case night assigned noise levels of the Regulations.

4 RESULTS

Appendix A provides the results of the noise data logging at 15-minute intervals, which provides an overview of the ambient noise at this location, since it includes dog barking noise but also wind, birds, road traffic, aircraft and other residential activity noises.

As discussed in Section 3, the focus of the study was Sunday night, 6 June 2010, between midnight and 9am. The 1-second data was plotted for each half hour within this time period. The audio files were then played back to note times that dog barking noise was occurring. Up until around 4.45am, intermittent dog barking occurs but at a relatively low level and considered to be from some distance away. After this time, dog barking became more frequent with periods of higher intensity.
Times where noise was considered to be predominantly dog barking were isolated and have been graphed in Appendix B. The representative assessment period was considered to be 4-hours, between 5am and 9am, coinciding with the maximum allowable assessment period. The reasons this period has been chosen are:

- The time period coincides with the most stringent assigned noise level;
- Since the noise is irregular and of variable level over time, a longer time period is considered appropriate.

Based on this, the 4-hour $L_{A_{max}}$, $L_{A_1}$ and $L_{A_{10}}$ values at the noise logger were determined as:

- 55 dB $L_{A_{max}}$ (occurred at 8:38:11am);
- 49 dB $L_{A_1}$; and
- 34 dB $L_{A_{10}}$.

5 ASSESSMENT & RECOMMENDATIONS

Noise from dog barking is considered tonal at times and therefore a + 5 dB penalty to the measured levels is applicable. Thus, the levels for assessment purposes are 60 dB $L_{A_{max}}$, 54 dB $L_{A_1}$ and 39 dB $L_{A_{10}}$.

Where residences are within 100 metres of Ranford Road, a + 2 dB influencing factor is applicable so that at the measurement location the exceedances would be 3 dB $L_{A_{max}}$, 7 dB $L_{A_1}$ & 2 dB $L_{A_{10}}$. Where residences are further than 100 metres from Ranford Road, the exceedance based on the measured levels is 5 dB $L_{A_{max}}$, 9 dB $L_{A_1}$ & 4 dB $L_{A_{10}}$. As such, it is the $L_{A_1}$ parameter that is the most critical and will determine compliance or otherwise.

The closest kennels are around 120 metres from the logger. Based on this, the sound power level of the barking dogs is 103 dB $L_{A_1}$, which aligns reasonably well with file data. To achieve the lowest night-time assigned noise level of 40 dB $L_{A_{10}}$ (allowing for + 5 dB tonality), would require a separation of at least 360 metres from a kennel (or around 320 metres from the boundary). To achieve the 42 dB $L_{A_1}$ night-time assigned noise level for residences within 100 metres of Ranford Road (allowing for + 5 dB tonality), would require a separation of at least 280 metres from a kennel (or around 240 metres from the boundary). This is referred to as Option 1 and shown on Figure 5.1, with around 25% of the available land being acceptable for noise sensitive use.

To reduce this buffer distance, consideration has been given to constructing a wall or earth mound on the boundary. With a wall/bund height of 4-metres, the buffers reduce to 80 metres from the boundary for residences greater than 100 metres from Ranford Road and 40 metres for residences within 100 metres of Ranford Road. This is referred to as Option 2 and shown on Figure 5.2, with around 80% of the available land acceptable for noise sensitive use. Once the kennels are no longer operational, the wall/bund could be removed and the buffer area developed for noise sensitive use.
Shepherd Court Rezoning - Option 1 Showing Area That Can be Developed

Buffer Only
Total Land Area - Approx 149,000 sqm
Area Acceptable for Noise Sensitive Use - Approx 37,000 (~25%)

Figure 5.1

Signs and symbols
- Buffer / Non Residential Use
- Acceptable for Residential Use

Length Scale 1:7500

28 Sep 2010

Lloyd George Acoustics
by Terry George
terry@lgacoustics.com.au
(08) 9401 7770
Shepherd Court Rezoning - Option 2 Showing Area That Can be Developed
Buffer & Bund
Total Land Area - Approx 149,000 sqm
Area Acceptable for Noise Sensitive Use - Approx 121,000 (~80%)

**Figure 5.2**

Length Scale 1:7500

Shepherd Court Rezoning - Option 2 Showing Area That Can be Developed
Buffer & Bund
Total Land Area - Approx 149,000 sqm
Area Acceptable for Noise Sensitive Use - Approx 121,000 (~80%)
APPENDIX A

Logger Data at 15-Minute Intervals
Chart A1 - Noise Monitoring Shepherd Court - 5 June 2010

SPL, dB(A)

Lmax, L1, L10, L90

Time

Job No. 10051573
Chart A2 - Noise Monitoring Shepherd Court - 6 June 2010

Job No. 10051573
Chart A4 - Noise Monitoring Shepherd Court - 8 June 2010

Lmax, L1, L10, L90

Time: 0:00 to 23:30

SPL, dB(A): 20 to 90
Chart A6 - Noise Monitoring Shepherd Court - 10 June 2010

SPL, dB(A)

Time

Lmax, L1, L10, L90

Job No. 10051573
Chart A7 - Noise Monitoring Shepherd Court - 11 June 2010

- Lmax
- L1
- L10
- L90

SPL, dB(A)

Time
APPENDIX B

Logger Data at 1-Second Intervals Containing Dog Barking
Chart B1 - Shepherd Court Noise Monitoring - 6 June 2010 5am to 6am
Dog Barking Segments
Chart B2 - Shepherd Court Noise Monitoring - 6 June 2010 6am to 7am
Dog Barking Segments

SPL, dB(A)

Time

Job No. 10051573
Chart B3 - Shepherd Court Noise Monitoring - 6 June 2010 7am to 8am
Dog Barking Segments
Chart B4 - Shepherd Court Noise Monitoring - 6 June 2010 8am to 9am
Dog Barking Segments
APPENDIX C

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 and sound power 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 levels 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 time weighting as specified in AS1259.1-1990. 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 time weighting as specified in AS1259.1-1990. This is used when assessing the presence of modulation only.

$L_{APeak}$

This is the maximum reading in decibels using the A frequency weighting and P time weighting AS1259.1-1990.

$L_{Amax}$

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

$L_{A1}$

An $L_{A1}$ level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.
$L_{A10}$
An $L_{A10}$ level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the “intrusive” 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.

$L_{A90}$
An $L_{A90}$ level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the “background” 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 20 000 Hz inclusive.

$L_{A_{max}}$ assigned level
Means an assigned level which, measured as a $L_{A\text{ Slow}}$ value, is not to be exceeded at any time.

$L_{A1}$ assigned level
Means an assigned level which, measured as a $L_{A\text{ Slow}}$ value, is not to be exceeded for more than 1% of the representative assessment period.

$L_{A10}$ assigned level
Means an assigned level which, measured as a $L_{A\text{ Slow}}$ value, is not to be exceeded for more than 10% 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 $L_{A\text{eq,T}}$ 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 $L_{A\text{ Slow}}$ 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 tonality is:

a variation in the emission of noise that —

(a) is more than 3 dB $L_{A\text{ Fast}}$ or is more than 3 dB $L_{A\text{ Fast}}$ in any one-third octave band;

(b) is present for at least 10% of the representative

Impulsive Noise
An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of tonality is:

a variation in the emission of a noise where the difference between $L_{A\text{ peak}}$ and $L_{A\text{ Max slow}}$ 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.

Influencing factor

\[
\text{Influencing factor} = \frac{1}{10}(\% \text{ Type A}_{100} + \% \text{ Type A}_{450}) + \frac{1}{20}(\% \text{ Type B}_{100} + \% \text{ Type B}_{450})
\]

where:

\(\% \text{ Type A}_{100}\) = the percentage of industrial land within a 100m radius of the premises receiving the noise

\(\% \text{ Type A}_{450}\) = the percentage of industrial land within a 450m radius of the premises receiving the noise

\(\% \text{ Type B}_{100}\) = the percentage of commercial land within a 100m radius of the premises receiving the noise

\(\% \text{ Type B}_{450}\) = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)
  = 2 for each secondary road within 100m
  = 2 for each major road within 450m
  = 6 for each major road within 100m

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.
**Background Noise**

Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

**Ambient Noise**

Means the level of noise from all sources, including background noise from near and far and the source of interest.

**Specific Noise**

Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

**Satisfactory Design Sound Level**

The level of noise that has been found to be acceptable by most people for the environment in question and also to be not intrusive.

**Maximum Design Sound Level**

The level of noise above which most people occupying the space start to become dissatisfied with the level of noise.

**Reverberation Time**

Of an enclosure, for a sound of a given frequency or frequency band, the time that would be required for the reverberantly decaying sound pressure level in the enclosure to decrease by 60 decibels.

**RMS**

The root mean square level. This is used to represent the average level of a wave form such as vibration.

**Vibration Velocity Level**

The RMS velocity of a vibration source over a specified time period. Units are mm/s.

**Peak Velocity**

Level of vibration velocity measured as a non root mean square (r.m.s.) quantity in millimetres per second (mm/s).
Chart of Noise Level Descriptors

Typical Noise Levels

<table>
<thead>
<tr>
<th>Environment</th>
<th>Sound Pressure Levels dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock Band</td>
<td>100</td>
</tr>
<tr>
<td>Factory Floor</td>
<td>90</td>
</tr>
<tr>
<td>Busy Road</td>
<td>80</td>
</tr>
<tr>
<td>Normal Conversation</td>
<td>70</td>
</tr>
<tr>
<td>Open-Plan Office</td>
<td>60</td>
</tr>
<tr>
<td>Library</td>
<td>50</td>
</tr>
<tr>
<td>Forest Background</td>
<td>40</td>
</tr>
<tr>
<td>Threshold of Hearing</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
Appendix B

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 and sound power 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 levels 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.

$L_{A\text{Slow}}$
This is the noise level in decibels, obtained using the A frequency weighting and the S time weighting as specified in AS1259.1-1990. Unless assessing modulation, all measurements use the slow time weighting characteristic.

$L_{A\text{Fast}}$
This is the noise level in decibels, obtained using the A frequency weighting and the F time weighting as specified in AS1259.1-1990. This is used when assessing the presence of modulation only.

$L_{A\text{Peak}}$
This is the maximum reading in decibels using the A frequency weighting and P time weighting AS1259.1-1990.

$L_{A\text{max}}$
An $L_{A\text{max}}$ level is the maximum A-weighted noise level during a particular measurement.

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

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

\( L_{A90} \)
An \( L_{A90} \) level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the “background” 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 20 000 Hz inclusive.

\( L_{A\text{max}} \) **assigned level**
Means an assigned level which, measured as a \( L_{A\text{Slow}} \) value, is not to be exceeded at any time.

\( L_{A1} \) **assigned level**
Means an assigned level which, measured as a \( L_{A\text{Slow}} \) value, is not to be exceeded for more than 1% of the representative assessment period.

\( L_{A10} \) **assigned level**
Means an assigned level which, measured as a \( L_{A\text{Slow}} \) value, is not to be exceeded for more than 10% 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 \( L_{A\text{Slow}} \) 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 \( L_{A\text{Fast}} \) or is more than 3 dB \( L_{A\text{Fast}} \) in any one-third octave band;

(b) is present for at least 10% of the representative.
**Impulsive Noise**

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

A variation in the emission of a noise where the difference between $L_{A\text{ peak}}$ and $L_{A\text{ Max slow}}$ 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.

**Influencing Factor (IF)**

$$IF = \frac{1}{10} (% Type \ A_{100} + % Type \ A_{450}) + \frac{1}{20} (% Type \ B_{100} + % Type \ B_{450})$$

where:

- $% Type \ A_{100}$ = the percentage of industrial land within a 100m radius of the premises receiving the noise
- $% Type \ A_{450}$ = the percentage of industrial land within a 450m radius of the premises receiving the noise
- $% Type \ B_{100}$ = the percentage of commercial land within a 100m radius of the premises receiving the noise
- $% Type \ B_{450}$ = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)
  - 2 for each secondary road within 100m
  - 2 for each major road within 450m
  - 6 for each major road within 100m

**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.

**Background Noise**

Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

**Ambient Noise**

Means the level of noise from all sources, including background noise from near and far and the source of interest.

**Specific Noise**

Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.
**Peak Component Particle Velocity (PCPV)**
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

**Peak Particle Velocity (PPV)**
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a peak response. Peak velocity is normally used for the assessment of structural damage from vibration.

**RMS Component Particle Velocity (PCPV)**
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and in one of the three orthogonal directions (x, y or z) measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

**Peak Particle Velocity (PPV)**
The maximum instantaneous velocity in mm/s of a particle at a point during a given time interval and is the vector sum of the PCPV for the x, y and z directions measured as a root mean square (rms) response. RMS velocity is normally used for the assessment of human annoyance from vibration.

**Chart of Noise Level Descriptors**

**Typical Noise Levels**