

# Traffic Noise Assessment

## Chianti Private Estate Stages 2 & 3, Woodvale

Prepared For

Cardno

August 2010

Reference: 10041539-04




Acoustics

## Report: 10041539-04

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## 1 INTRODUCTION

Chianti Private Estate is a proposed residential subdivision at Lots 27, 28 & 801 Wanneroo Road in Woodvale, as shown on the following page. On the eastern side of the subdivision is Wanneroo Road, which currently carries around 40,000 vehicles per day.

Stages 2 and 3 of the subdivision are the subject of this report, which are in the central part of the land, containing 82 residential lots, including 1 future group housing sites. A previous report was completed in June 2010<sup>1</sup> examining the noise impact to Stage 1. Subsequent reports are produced as the finished lot levels become available.

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

## 2 CRITERIA

The criteria relevant to this assessment is the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (hereafter referred to as the Policy) produced by the Western Australian Planning Commission (WAPC). The objectives in the Policy are to:

- Protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of proposals;
- Protect major transport corridors and freight operations from incompatible urban encroachment;
- Encourage best practice design and construction standards for new development proposals and new or redevelopment transport infrastructure proposals;
- Facilitate the development and operation of an efficient freight network; and
- Facilitate the strategic co-location of freight handling facilities.

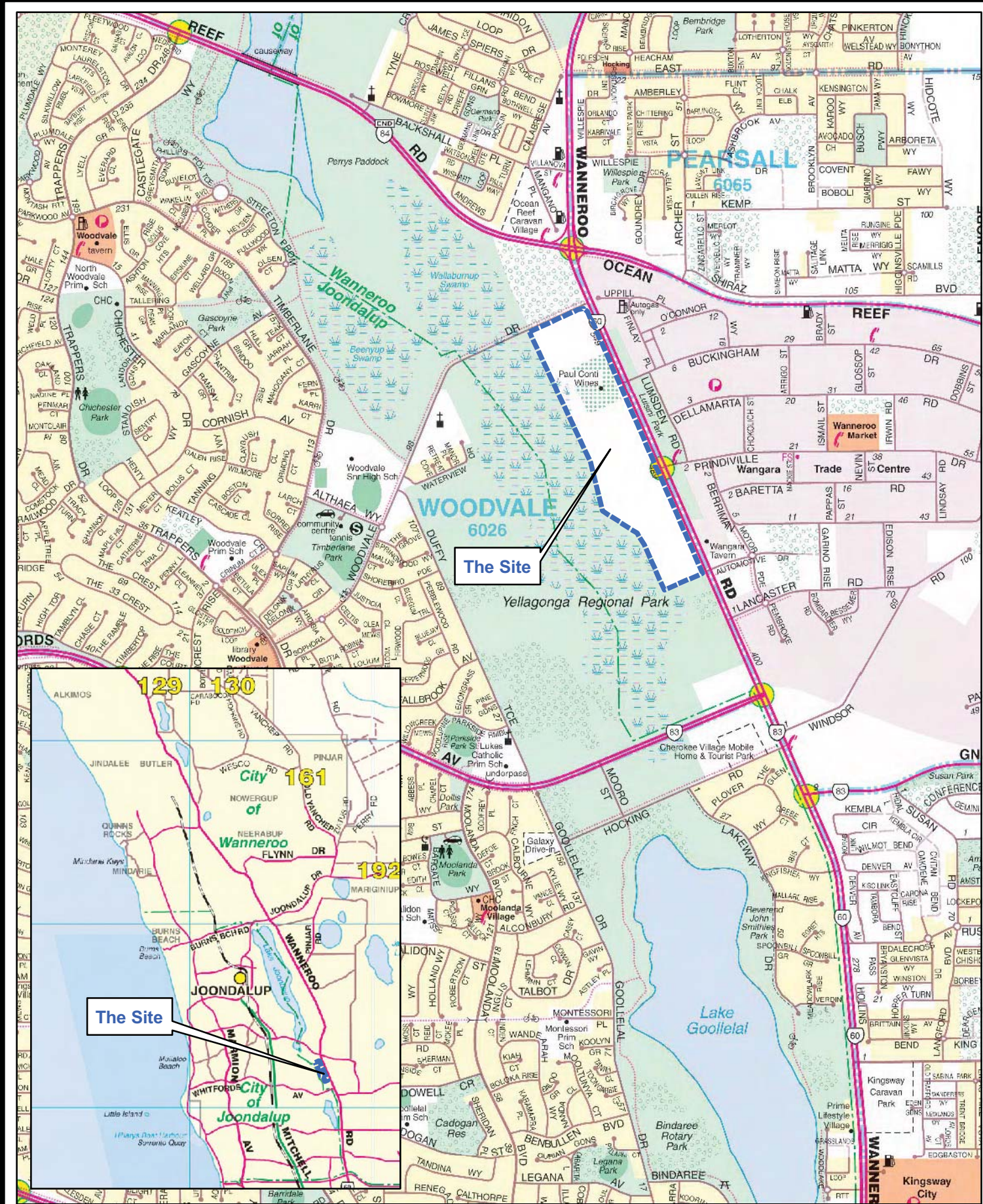
The Policy's outdoor noise criteria are shown below in *Table 2.1*. These criteria applying at any point 1-metre from a habitable façade of a noise sensitive premises and in one outdoor living area.

**Table 2.1 – Outdoor Noise Criteria**

Period	Target	Limit
Day (6am to 10pm)	55 dB L <sub>Aeq</sub> (Day)	60 dB L <sub>Aeq</sub> (Day)
Night (10pm to 6am)	50 dB L <sub>Aeq</sub> (Night)	55 dB L <sub>Aeq</sub> (Night)

The 5 dB difference between the *target* and *limit* is referred to as the *margin*.

<sup>1</sup> *Traffic Noise Assessment, Chianti Private Estate Stage 1, Woodvale*; Reference 10041539-03



DATE	No.	ACTIVITY - REVISION DESCRIPTION	DES	DRN	CHKD	APPD	DATE	No.	ACTIVITY - REVISION DESCRIPTION	DES	DRN	CHKD	APPD

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Scale: **1:20,000**

PROJECT: **Woodvale - Wetlands Revegetation Management Plan**

DRAWING TITLE: **FIGURE 1 : Locality Plan**

PRINCIPAL: **Watson Property Group Northern Aspect Ltd**



Project Number: **V7016** Original: **A4**

Drawing Number: **SK01** Revision:

Designed MF Checked

Drawn MGW Approved

Local Authority: **City of Joondalup**

Sheet 1 of 1 Date: **26/02/09**

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In the application of these outdoor noise criteria to new noise sensitive developments, the objectives of this policy is to achieve -

- acceptable indoor noise levels in noise-sensitive areas (eg bedrooms and living rooms of houses); and
- a 'reasonable' degree of acoustic amenity in at least one outdoor living area on each residential lot.

If a noise sensitive development takes place in an area where outdoor noise levels will meet the *target*, no further measures are required under this policy.

In areas where the *target* is exceeded, but noise levels are likely to be within the 5 dB margin (i.e. less than the *limit*), mitigation measures should be implemented by the developer with a view to achieving the *target* levels in at least one outdoor living area on each residential lot. Where indoor spaces are planned to be facing any outdoor area in the *margin*, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces.

In areas where the *limit* is exceeded (i.e. above  $L_{Aeq(Day)}$  of 60dB(A) or  $L_{Aeq(Night)}$  of 55dB(A)), a detailed noise assessment is to be undertaken. Customised noise mitigation measures should be implemented with a view to achieving the *target* in at least one outdoor living area on each residential lot, or if this is not practicable, within the *margin*. Where indoor spaces are planned to be facing outdoor areas that are above the *target*, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces.

### 3 METHODOLOGY

Noise measurements and modelling have been undertaken in accordance with the requirements of the Policy as described below in *Sections 3.1 and 3.2*.

#### 3.1 Site Measurements

Noise monitoring was undertaken at an existing residence; being 533 Wanneroo Road in order to:

- Quantify the existing noise levels;
- Determine the differences between different acoustic parameters ( $L_{A10,18hour}$ ,  $L_{Aeq(Day)}$  and  $L_{Aeq(Night)}$ ); and
- Calibrate the noise model for existing conditions.

The instrument used was an ARL Type 316 noise data logger (pictured below in *Figure 3.1*). The logger was programmed to record hourly  $L_{A1}$ ,  $L_{A10}$ ,  $L_{A90}$ , and  $L_{Aeq}$  levels. This instrument complies with the instrumentation requirements of *Australian Standard 2702-1984 Acoustics – Methods for the Measurement of Road Traffic Noise*. The logger was field calibrated before and after the measurement session and found to be accurate to within +/- 1 dB. Lloyd George Acoustics also holds current laboratory calibration certificate for the loggers.



**Figure 3.1 – Automatic Noise Data Logger**

The measurement location is shown in *Figure 3.2*.

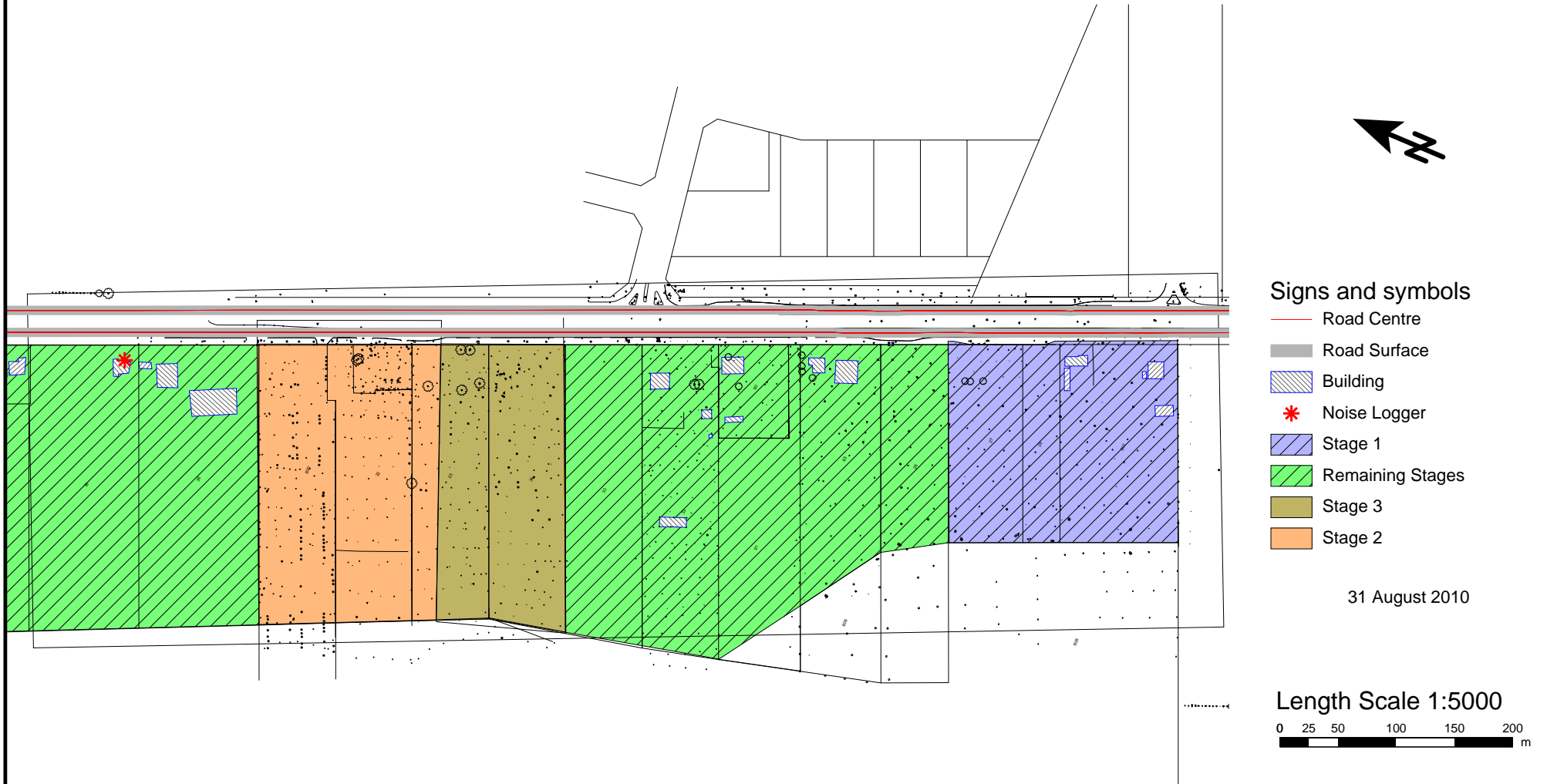
The noise logger was set-up to obtain at least 3 full weekdays, between 11 May to 18 May 2010.

Sound pressure levels were measured in accordance with Australian Standard 2702-1984: *Acoustics - Method For Measurement of Road Traffic Noise*, with the logger positioned at one metre from the façade of interest. The logger was placed at least one metre from any corner of the building and the microphone height was 1.4 metres above ground floor level.

From the hourly measurements, the  $L_{A10,18 \text{ hour}}$ ,  $L_{Aeq,24 \text{ hour}}$ ,  $L_{Aeq \text{ (Day)}}$  and  $L_{Aeq \text{ (Night)}}$  values were determined for each complete measurement day. These results were averaged and the mean level reported.

Woodvale Subdivision (Chianti Private Estate) - Watson Property Group Northern Aspects Ltd  
Logger Location and Known Stages

**Figure 3.2**





### 3.2 Noise Modelling

The computer programme *SoundPLAN 7.0* was utilised incorporating the *Calculation of Road Traffic Noise (CoRTN)* algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Classes 1 & 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two sources, at heights of 1.5 metres and 3.6 metres above road level, to represent the engine and exhaust respectively. By splitting the noise source into three, allows for less barrier attenuation for high level sources where barriers are to be considered. Note that corrections are applied to the exhaust of  $-8.0$  dB (based on *Transportation Noise Reference Book, Paul Nelson, 1987*) and to the engine source of  $-0.8$  dB, so as to provide consistent results with the CoRTN algorithms for the no barrier scenario.
- An adjustment of  $-1.7$  dB has been applied to the predicted levels based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group 1982.

Predictions are made at a height of 1.4 metres above ground floor level and at 1.0 metre from an assumed building façade (resulting in a  $+2.5$  dB correction due to reflected noise).

Various input data are included in the modelling such as ground topography, road design, traffic volumes etc. These model inputs are discussed below.

#### 3.2.1 Ground Topography, Road Design & Cadastral Data

The existing topographical data was provided by Cardno and are in 0.25 metre intervals, covering the area of concern. The design drawings were also provided which show the proposed finished lot levels for Stage 1 – refer *Appendix A*.

Buildings have also been included as these can provide barrier attenuation when located between a source and receiver, in much the same way as a hill or wall provides noise shielding. All buildings are assumed to have a height of 3.5 metres, representing a single storey residence.

#### 3.2.2 Traffic Data

Traffic data includes:

- Road Surface – The noise relationship between different road surface types is shown below in *Table 3.1*.

**Table 3.1 – Noise Relationship Between Different Road Surfaces**

Road Surfaces						
Chip Seal			Asphalt			
14mm	10mm	5mm	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	0.0 dB	-0.2 dB	-1.0 dB	-2.5 dB

The existing road surface is dense graded asphalt and it is assumed this will remain so in the future.

- Vehicle Speed – The existing posted speed is 70km/hr and is assumed to remain unchanged into the future.
- Traffic Volumes – Existing traffic counts were obtained from MRWA and are shown below in *Table 3.2*, being December 2008 counts. The forecast 2031 volume was also obtained as ranging between 34,000 to 42,000. To remain conservative and allow for some future growth, the upper limit has been used in the model.

**Table 3.2 – Traffic Volumes Used in the Modelling**

Parameter	Scenario	
	Existing	Future
24 Hour Volume	35,728	42,000
% Heavy	5.1	5.1

### 3.2.3 Ground Attenuation

The ground attenuation has been assumed to be 0.25 (25%) within the road reserve, 0.5 (50%) throughout the subdivision, except for the public open space, which was set to 1.00 (100%). Note 0.0 represents hard reflective surfaces such as water and 1.00 represents absorptive surfaces such as grass.

### 3.2.4 Parameter Conversion

The CoRTN algorithms used in the *SoundPlan* modelling package were originally developed to calculate the  $L_{A10,18\text{hour}}$  noise level. The WAPC draft policy however uses  $L_{Aeq (Day)}$  and  $L_{Aeq (Night)}$ . The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles).

In this instance, the relationship between parameters that has been measured by the noise logger has been assumed to remain the same in the future.

## 4 RESULTS

### 4.1 Noise Monitoring

The results of the noise monitoring are summarised below in *Table 4.1* and shown graphically in *Figure 4.1*.

**Table 4.1 – Measured Average Noise Levels – 533 Wanneroo Road**

Date	Average Weekday Noise Level, dB			
	L <sub>A10,18hour</sub>	L <sub>Aeq,24hour</sub>	L <sub>Aeq (Day)</sub>	L <sub>Aeq (Night)</sub>
12 May 2010	62.9	59.8	61.2	53.5
13 May 2010	65.3	62.1	63.6	55.1
14 May 2010	64.4	61.0	62.4	54.5
17 May 2010	63.2	60.2	61.6	54.0
<b>Weekday Average</b>	<b>63.9</b>	<b>60.8</b>	<b>62.2</b>	<b>54.2</b>

The average differences between the L<sub>A10,18hour</sub> & L<sub>Aeq(Day)</sub> is 1.7 dB and between the L<sub>Aeq(Day)</sub> and L<sub>Aeq(Night)</sub> is 8.0 dB. As such, it is the daytime parameter that will dictate compliance since satisfying the L<sub>Aeq(Day)</sub> criteria will automatically result in satisfying the L<sub>Aeq(Night)</sub>.

### 4.2 Noise Modelling

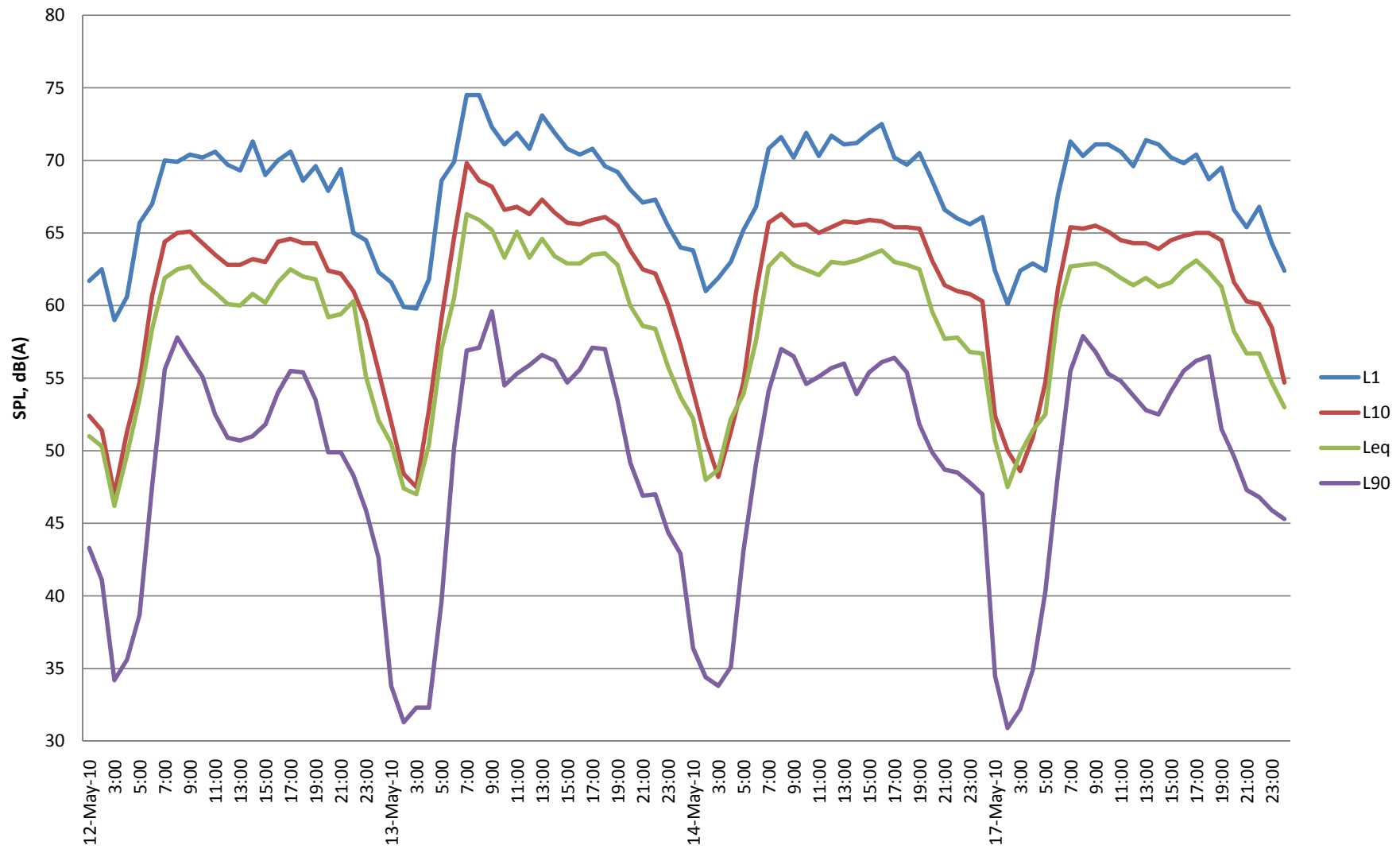
Three scenarios were initially considered being:

1. No noise walls;
2. With walls that satisfy a noise level of no more than 60 dB L<sub>Aeq(Day)</sub> (the *limit*) at all proposed residences; and
3. With walls that satisfy a noise level of no more than 55 dB L<sub>Aeq(Day)</sub> at all proposed residences.

It should be noted that in this area, Western Power provide a restriction that wall heights cannot be more than 2.0 metres above road level so this may impact the noise levels that can be achieved.

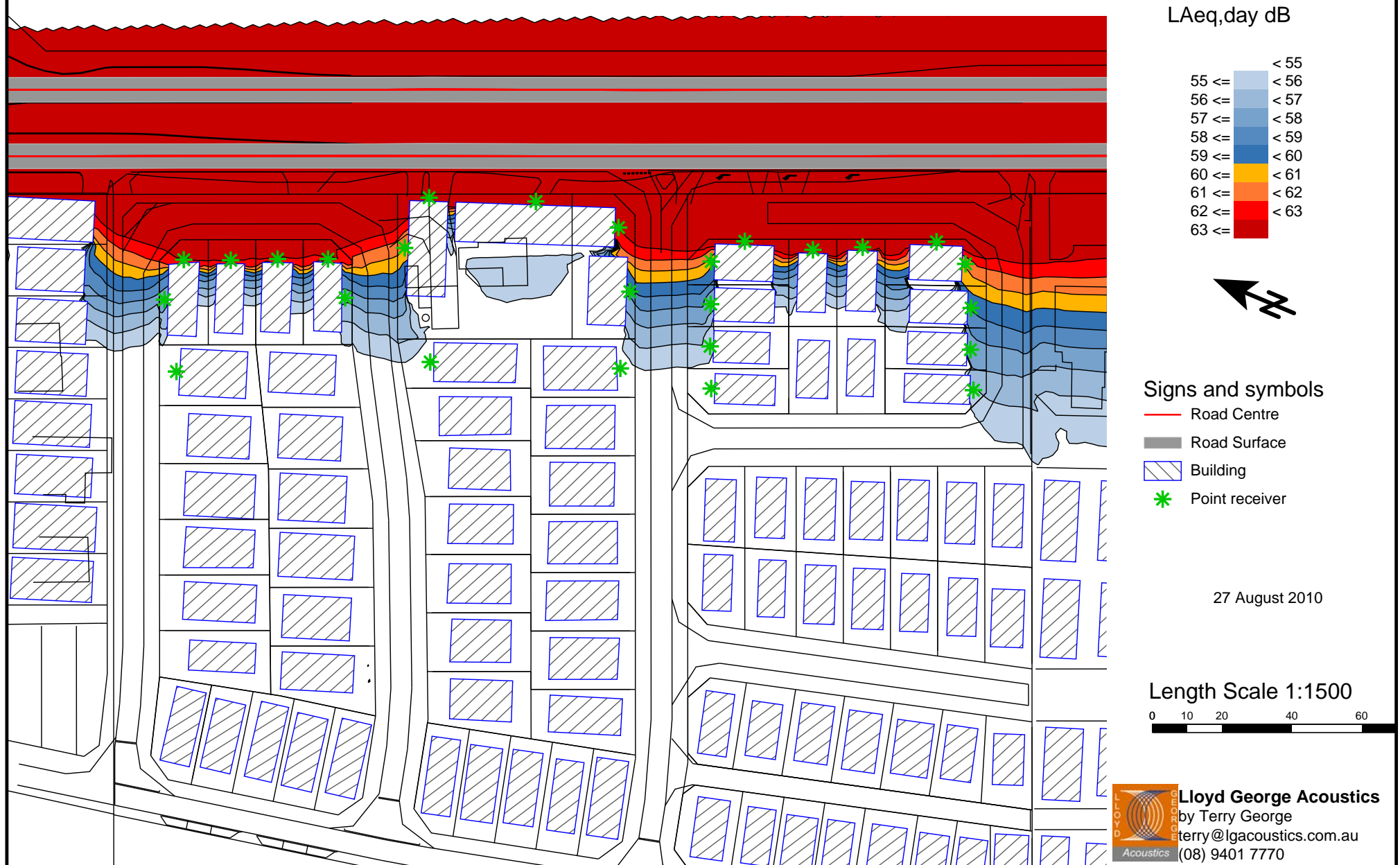
Noise contour plots for these three scenarios are shown on *Figures 4.2 to 4.4*.

**Figure 4.1 - Noise Data Logging 533 Wanneroo Road**



Woodvale Subdivision (Stages 2 & 3) - Watson Property Group Northern Aspects Ltd  
 LAeq,Day Noise Level Contours - With No Walls

**Figure 4.2**

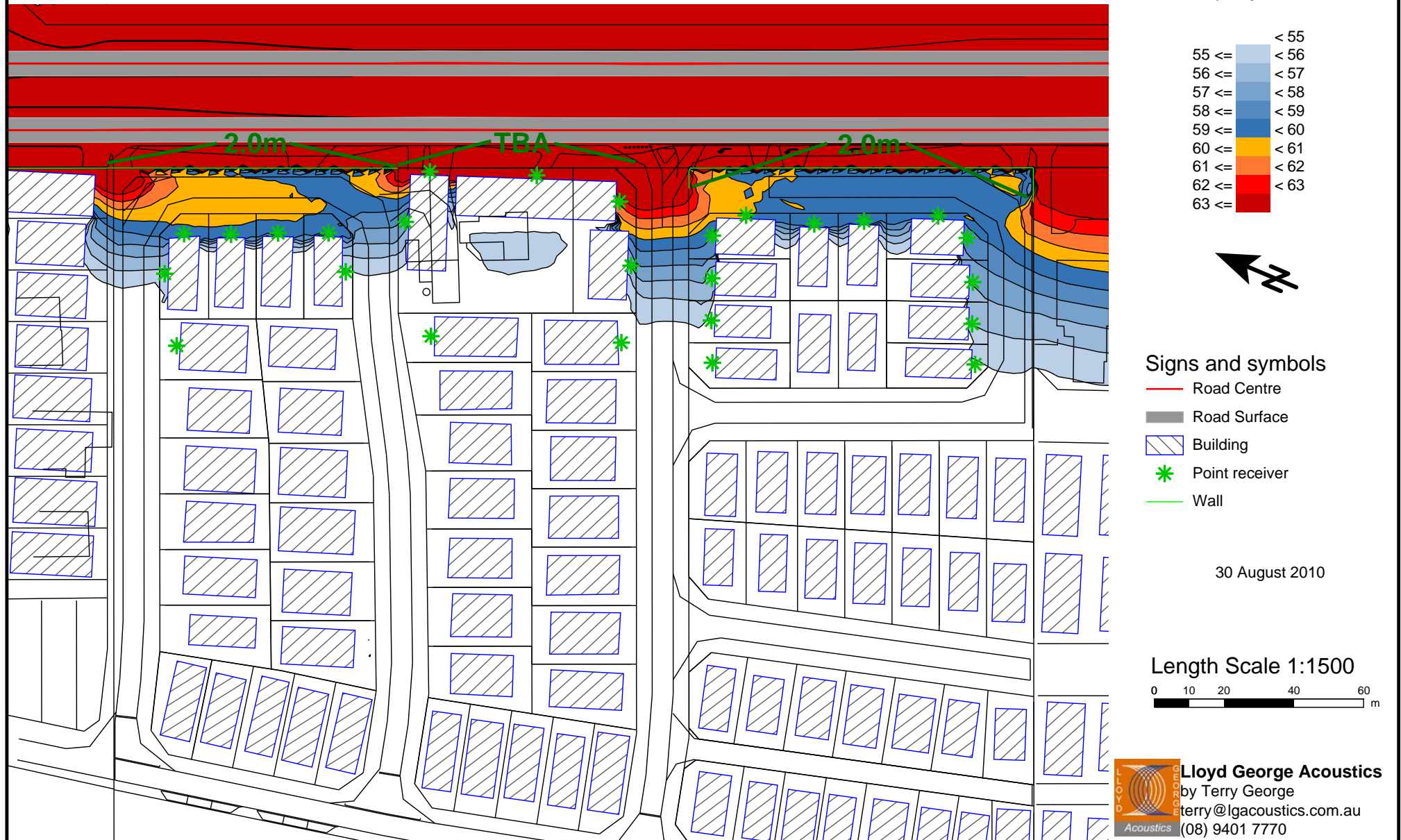


# Woodvale Subdivision (Stages 2 & 3) - Watson Property Group Northern Aspects Ltd

L<sub>Aeq,Day</sub> Noise Level Contours - With Walls to Achieve Limit of 60 dB L<sub>Aeq,Day</sub>

Note: Wall height to be advised (TBA) as existing house to remain. Once future grouped housing layout and finished lot level known, wall height can be determined.

## Figure 4.3

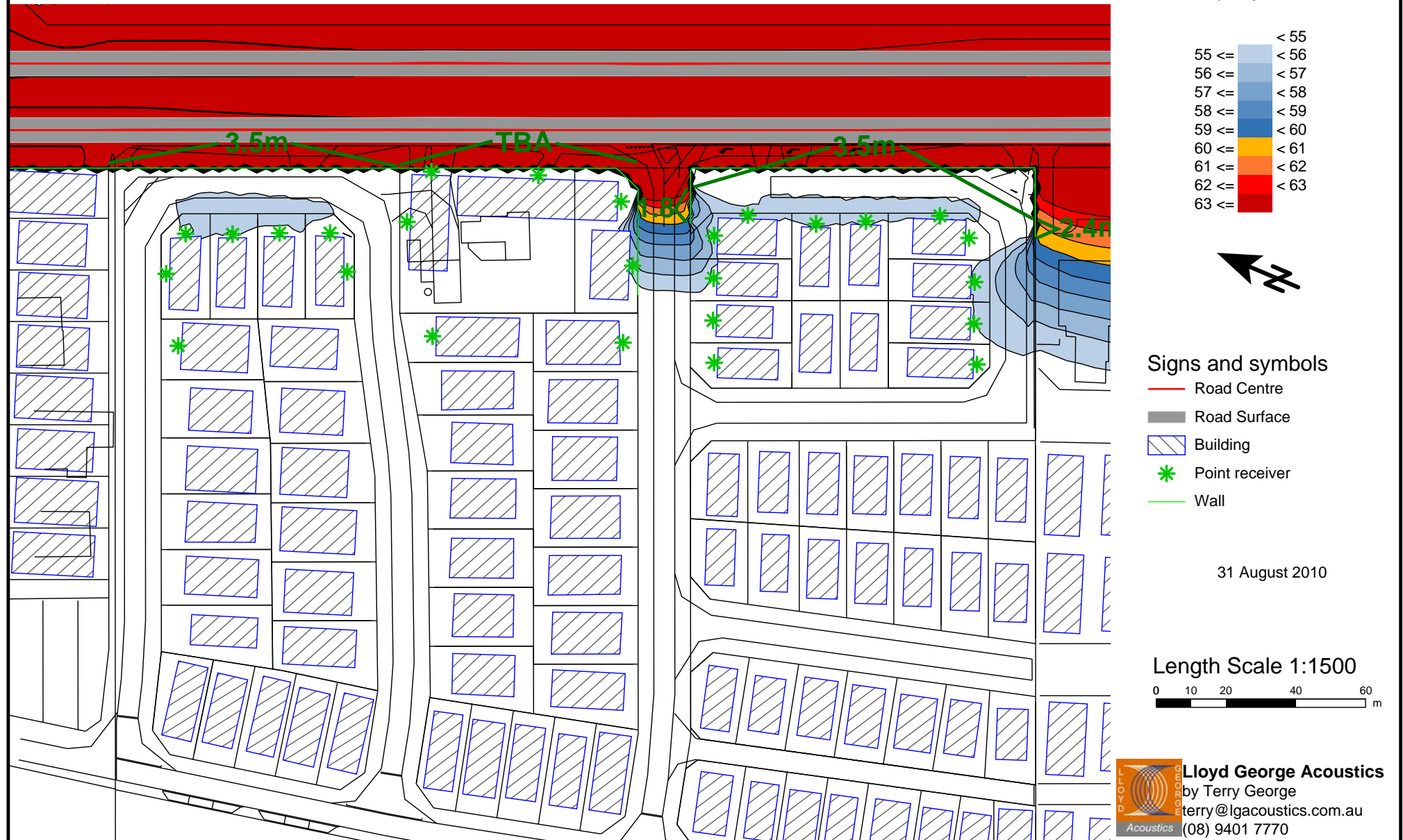


# Woodvale Subdivision (Stages 2 & 3) - Watson Property Group Northern Aspects Ltd

L<sub>Aeq,Day</sub> Noise Level Contours - With Walls to Achieve Limit of 60 dB L<sub>Aeq</sub>(Day)

Note: Wall height to be advised (TBA) as existing house to remain. Once future grouped housing layout and finished lot level known, wall height can be determined.

## Figure 4.4



## 5 ASSESSMENT

The objectives of the criteria are for noise at all houses to be no more than the *limit* and preferably no more than the *target*. Noise levels above the *limit* are generally considered unacceptable for residential use. Where the *target* is achieved, no further controls are required. Where the *limit* is achieved or noise levels are within the *margin* (between the *limit* and *target*), further controls are necessary.

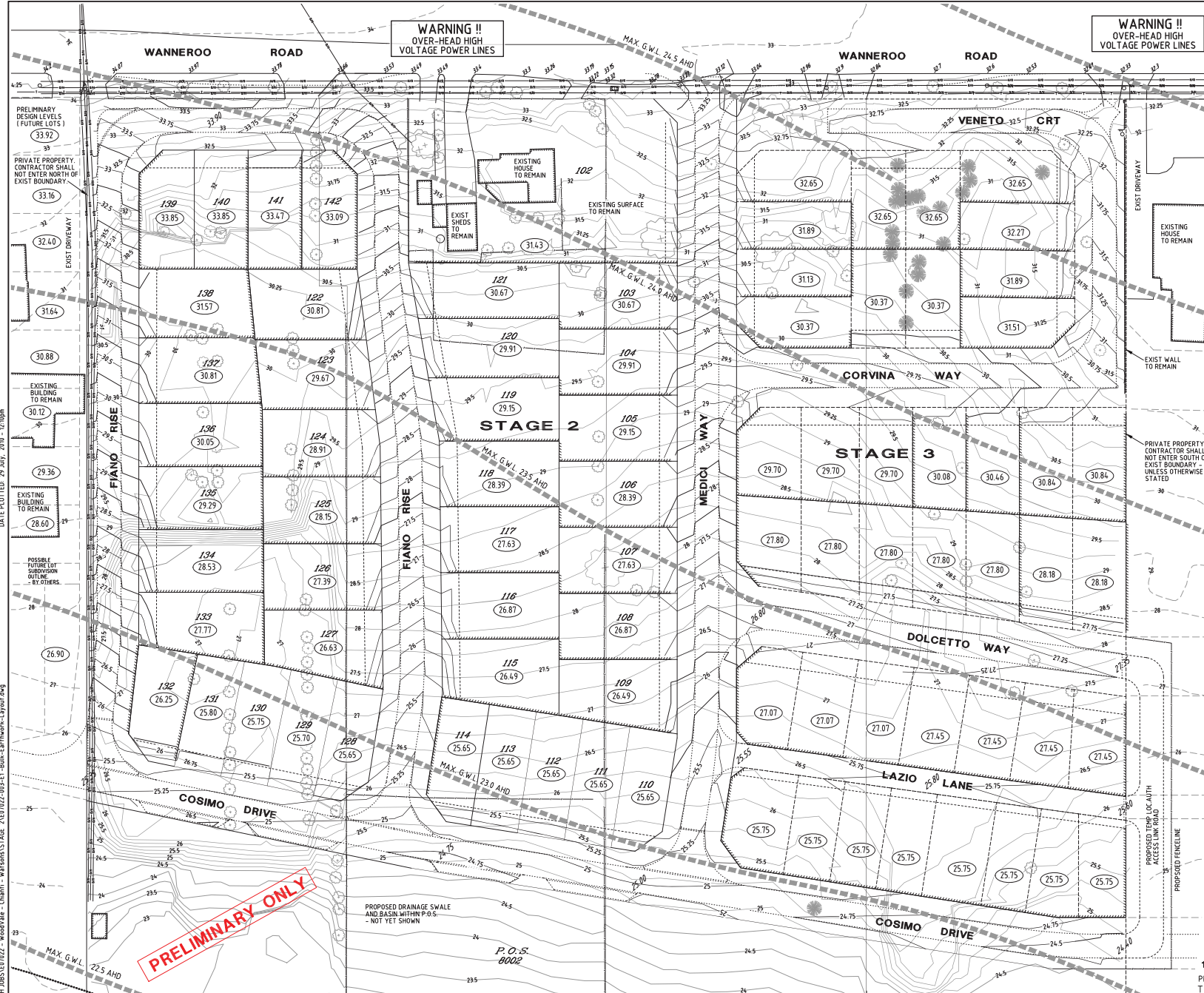
To achieve the *limit*, moderate walls are required (up to 2.0 metres high). Any dwelling that is located within the *margin* will also require the Package A treatments of the WAPC Policy – refer *Appendix B*. To achieve the *target*, walls up to 3.5 metres high would be necessary. Walls of this height are unlikely to be practicable given the Western Power height restrictions.

Note that noise walls must be solid, free of gaps and have a minimum surface mass of 12kg/m<sup>2</sup>. The base level of the walls is based on the topographical design model provided. As there may be some discrepancies, it is recommended the design team provide design strings of bottom and top of wall to confirm compliance.



## **APPENDIX A**

### Subdivision Design Drawings

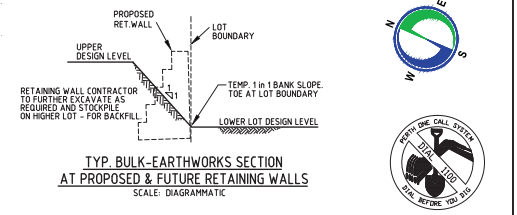


**LEGEND**

	EXISTING TREES - SURVEYED TO BE REMOVED - ONLY WITHIN THE DEVELOPMENT AREA		EXISTING SURFACE CONTOURS
	EXISTING FENCE LINE		PROPOSED FINISHED LEVEL CONTOURS
	EXISTING BUILDING / STRUCTURE		PROPOSED DESIGN SPOT LEVEL (ON ROAD CENTRELINE OR LOT CORNER)
	EXISTING DRAINAGE INLET PITS		PROPOSED FINISHED FILL LOT LEVEL (INCLUDES TOPSOIL RE-SREAD IF USED)
	EXISTING DRAINAGE PIPES & JUNCTION PITS		BUILDING SETBACK LINE
	EXISTING WATER SUPPLY		EXTENT OF NEW BATTER
	EXISTING GAS MAINS		FUTURE / PROPOSED RETAINING WALL
	EXISTING TELSTRA CONDUIT		PROPOSED LOCATION OF STAIRWAYS
	EXISTING UNDERGROUND ELECTRICAL		AREA OF CONTAMINATED TOPSOIL
	EXISTING AERIAL/OVERHEAD POWER		
	EXISTING POWER / STAY POLES LIGHT POLES		

- GENERAL NOTES**
- ALL CLEARED VEGETATION, INCLUDING ANY STOCKPILED TIMBER, CAR BODIES, ABANDONED STRUCTURES AND ANY OTHER FOREIGN MATERIAL, WITHIN THE SITE SHALL BE DISPOSED OF - OFF SITE TO THE SATISFACTION OF THE SUPERINTENDENT AND RELEVANT AUTHORITIES AT THE CONTRACTOR'S EXPENSE AND WITHOUT VARIATION COST TO THE PRINCIPAL. THE CONTRACTOR SHALL PROTECT AND MAINTAIN EXISTING TREES & VEGETATION - UNLESS SPECIFIED OTHERWISE ON PLANS. LIAISE WITH SUPERINTENDENT IF UNSURE.
  - ALL RELEVANT DEMOLITION LICENCES SHALL BE OBTAINED BEFORE WORKS COMMENCE.
  - CLEARING AND STRIPPING SHALL BE LIMITED TO THE AREAS SHOWN ON THE DRAWINGS AND/OR REQUIRED BY THE WORKS. EXCEPTION APPLIES TO DEAD TREES, WHICH SHALL BE REMOVED FROM ANY LOCATION WITHIN THE SITE.
  - TOPSOIL MATERIAL SHALL BE STRIPPED AND STOCKPILED. THE SUPERINTENDENT SHALL INSPECT STRIPPED AREAS PRIOR TO THE PLACING OF ANY FILL.
  - FILL AREAS SHALL BE PROOF COMPACTED TO A DEPTH OF 600mm PRIOR TO COMMENCING THE PLACING OF ANY FILL. CONTRACTOR SHALL ENSURE THE BASE IS COMPACTED TO 95% MDD IN ACCORDANCE WITH THE RELEVANT AUSTRALIAN STANDARD. AREAS OF CUT SHALL BE PROOF COMPACTED TO 95% MDD UNLESS OTHERWISE STATED. AREAS OF CUT SHALL BE PROOF COMPACTED TO 95% MDD UNLESS OTHERWISE STATED. FILL IN ALL ROAD RESERVES TO BE COMPACTED TO 98% MDD.
  - FILL SHALL BE CLEAN GRANULAR MATERIAL AND PLACED IN LAYERS NOT EXCEEDING 300mm COMPACTED THICKNESS TO 95% MDD. CONTRACTOR SHALL NOTIFY SUPERINTENDENT PRIOR TO COMMENCING NEXT LAYER. FILL SHALL BE GRADED EVENLY BETWEEN DESIGN LEVELS SHOWN. LOCALIZED MOUNDS AND TRENCHES SHALL BE GRADED LEVEL.
  - LOTS SHALL BE FILLED AND COMPACTED TO THE SPECIFIED DESIGN LEVELS SHOWN - WHICH INCLUDE TOP-SOIL RE-SREAD. TOPSOIL MATERIAL SHALL BE RE-SREAD OVER ALL DISTURBED AREAS (MINIMUM 100mm THICK, MAXIMUM 100mm THICK). THE MATERIAL SHALL BE FREE OF STONE AND TIMBER. TOP-SOIL RE-SREAD APPLIES TO EARTHWORKED LOTS AND ROAD VERGES. P.O.S. AREAS CAN BE FULLY FILLED WITH TOP-SOIL MATERIAL.
  - THE CONTRACTOR SHALL MAKE ALL REASONABLE ATTEMPTS, NOT NECESSARILY LIMITED TO THE ACTIONS REQUIRED IN THE SPECIFICATION, TO CONTROL WIND BLOWN SOIL. REFER TO CARBON SPECIFICATION FOR "DUST MANAGEMENT" CONDITIONS.
  - ANY DETAILS OF EXISTING SERVICES SHOWN ON THE DRAWING ARE INDICATIVE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE TO LOCATE AND PRESERVE ALL EXISTING SERVICES.
  - CONTRACTOR SHALL MAKE NECESSARY ALLOWANCES FOR REINSTATEMENT OF ALL AREAS DISTURBED BY THE WORKS.
  - THE CONTRACTOR SHALL GIVE NOTICE TO OCCUPIERS OF ANY EXISTING DWELLINGS WITHIN AND AROUND THE PERIMETER OF THE SITE - OF THE IMPENDING WORKS AT LEAST 1 WEEK PRIOR TO STARTING THE WORKS.
  - THE CONTRACTOR SHALL ALLOW FOR AND CONSTRUCT ROAD BOX-OUTS - BASED ON 250mm DEEP x 7m WIDE. RETAINING WALL DISPLACEMENT SHALL BE ALLOWED FOR - AS PER THE DETAIL ON THIS DRAWING. DESIGN CONTOURS & MODELLING, DO NOT INCLUDE THESE ITEMS. REFER TYPICAL SECTION ON DWG E07022-003-E2.

- SPECIFIC NOTES**
- ALL UN-CONTROLLED FILL MATERIAL SHALL BE REMOVED OFF SITE - UNLESS DISCUSSED PRIOR WITH THE SUPERINTENDENT TO DETERMINE A SUITABLE LOCATION.
  - THE CONTRACTOR SHALL ALLOW FOR AND CARRY OUT STABILISATION OF ALL EARTHWORKED LOTS incl. P.O.S. ROAD VERGES, DRAINAGE SUMPS AND ANY DISTURBED AREAS - USING HYDROMULCH WITH SEED, UNLESS OTHERWISE DIRECTED OR DISCUSSED WITH THE SUPERINTENDENT.
  - THIS DRAWING SHALL BE READ IN CONJUNCTION WITH SEPARATE - EXTENT OF WORKS PLAN: E07022-003-E2.
  - THE CONTRACTOR SHALL NOT EARTHWORK WITHIN WANNERERO ROAD RESERVE. PROTECT ALL EXISTING SERVICES WITHIN ROAD VERGE. CONTRACTOR SHALL LOCATE SERVICES TO EXISTING HOUSES AND PROTECT & MAINTAIN AT ALL TIMES.
  - THE CONTRACTOR SHALL ERECT SITE FENCING & DUST CONTROL FENCING - PRIOR TO ANY EARTHWORKS COMMENCING. REFER DWG: E07022-003-E2 FOR DETAILS.
  - THE CONTRACTOR SHALL STRIP TOPSOIL CONTAINING CONTAMINATED (ASBESTOS) AREAS, AS SHOWN AND DISPOSE OF - OFF SITE. CONTAMINATED TOPSOIL SHALL NOT BE RE-USED FOR TOPSOIL RE-SREAD & SHALL NOT BE USED FOR P.O.S. FILL. A REPRESENTATIVE FROM CARBON ENVIRONMENT SHALL BE CONTACTED AND BE ON SITE DURING THE WORKS AND TO CONFIRM EXENT AND FINAL DEPTH OF EXCAVATION - PRIOR TO FILLING.
  - THE CONTRACTOR SHALL MAINTAIN ADEQUATE ACCESS TO EXISTING DWELLINGS AT ALL TIMES.



1:500 0 50 100 150 200 250 300 350 400 450 500  
 PROJECT SURVEYOR: McMullen Nolan & Partners - Surveyors  
 THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG: E07022-003-E2. **W.A.P.C. 140038**

DATE PLOTTED: 29 JUL 2010 - 10:00pm

DATE: 29.07.10

Rev	Date	Description	Drawn	Appr.
A	29.07.10	ISSUED FOR INTERNAL REVIEW	WSJ	

**chianti**  
PRIVATE ESTATE - WOODVALE

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Drawn	WSJ	Date	29.07.10
Designed	WSJ	Date	29.07.10
Checked		Date	
Reviewed		Date	
Approved		Date	

**WATSON PROPERTY GROUP**

Project: CHIANTI PRIVATE ESTATE - STAGE 2 LOTS 27, 28 & 801, WANNERERO ROAD WOODVALE

The: EARTHWORKS LAYOUT FINISHED SURFACE LEVELS

**PRELIMINARY ISSUE**

Date	29.07.10	Drawn	A.H.D.	Scale	1:500	Size	A1
Drawing Number	E07022-003-E1						

## **APPENDIX B**

### Deemed-to-Satisfy Construction Standards

## Noise insulation – “Deemed to Comply” packages for residential development

The following “deemed-to-comply” Packages outline noise insulation measures that are designed to ensure that the indoor noise standards in the Policy are achieved for residential developments in areas where outdoor noise levels will exceed the *target* noise levels by up to 8 dB(A).

The deemed-to-comply specifications are intended to simplify compliance with the noise criteria, and the relevant Package should be required as a condition of development. However, this should not remove the option to pursue alternative measures or designs. Departures from the deemed-to-comply specifications need to be accompanied by acoustic certification from a competent person, to the effect that the development will achieve the requirements of the Policy.

Superior construction standards, such as those specified in the “deemed-to-comply” packages, are now becoming more prevalent in residential buildings; and do not significantly increase the cost of building. A similar standard of construction has been recommended by the Western Australian Planning Commission for new housing in areas forecast to be seriously affected by aircraft noise.<sup>2</sup> That recommendation followed a comprehensive assessment of the efficacy and costs of noise attenuation measures, taking into account the recent changes in industry building standards as well as changes to the *Building Code of Australia*.

Where transport noise levels are more than 8 dB above the noise *target*, i.e. 3 dB above the noise *limit*, or where noise-sensitive development other than residential is proposed, a Detailed Assessment should be prepared by a competent person. The report should specify the level of noise reduction required and the noise insulation measures needed to comply with the Policy. The approval may require that the construction drawings be checked for compliance with the Detailed Assessment, and that follow-up verification be carried out to certify compliance.

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<sup>2</sup> Statement of Planning Policy No 5.1, *Land Use Planning in the Vicinity of Perth Airport* and the accompanying report on *Aircraft Noise Insulation for Residential Development in the Vicinity of Perth Airport*, February 2004.

### Package A: Noise levels within the *margin*

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where noise levels exceed the noise *target* but are within the *limit*.

Area type	Orientation	Package A measures
<b>Indoors</b>		
Bedrooms	Facing road/rail corridor	<ul style="list-style-type: none"> <li>6mm (minimum) laminated glazing</li> <li>Fixed, casement or awning windows with seals</li> <li>No external doors</li> <li>Closed eaves</li> <li>No vents to outside walls/eaves</li> <li>Mechanical ventilation/airconditioning<sup>3</sup></li> </ul>
	Side-on to corridor	<ul style="list-style-type: none"> <li>6mm (minimum) laminated glazing</li> <li>Closed eaves</li> <li>Mechanical ventilation/airconditioning</li> </ul>
	Away from corridor	No requirements
Living and work areas <sup>4</sup>	Facing corridor	<ul style="list-style-type: none"> <li>6mm (minimum) laminated glazing</li> <li>Fixed, casement or awning windows with seals</li> <li>35mm (minimum) solid core external doors with acoustic seals<sup>5</sup></li> <li>Sliding doors must be fitted with acoustic seals</li> <li>Closed eaves</li> <li>No vents to outside walls/eaves</li> <li>Mechanical ventilation/airconditioning</li> </ul>
	Side-on to corridor	<ul style="list-style-type: none"> <li>6mm (minimum) laminated glazing</li> <li>Closed eaves</li> <li>Mechanical ventilation/airconditioning</li> </ul>
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
<b>Outdoors</b>		
Outdoor living area <sup>6</sup>	Facing corridor	<ul style="list-style-type: none"> <li>Minimum 2.0m high solid fence (e.g. Hardifence, pinelap, or Colorbond)</li> <li>Picket fences are not acceptable</li> </ul>
	Side-on to corridor	
	Away from corridor	No requirements

<sup>3</sup> See section on Mechanical ventilation/airconditioning for further details and requirements.

<sup>4</sup> These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".

<sup>5</sup> Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.

<sup>6</sup> The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

**Package B: Noise within 3 dB above the *limit***

The following noise insulation package is designed to meet the indoor noise standards for residential developments in areas where transport noise levels exceed the noise *limit* but by no more than 3 dB (See Table 1 in the Policy).

Area type	Orientation	Package B measures
<b>Indoors</b>		
Bedrooms	Facing road/rail corridor	<ul style="list-style-type: none"> <li>• 10mm (minimum) laminated glazing</li> <li>• Fixed, casement or awning windows with seals</li> <li>• No external doors</li> <li>• Closed eaves</li> <li>• No vents to outside walls/eaves</li> <li>• Mechanical ventilation/airconditioning<sup>7</sup></li> </ul>
	Side-on to corridor	<ul style="list-style-type: none"> <li>• 10mm (minimum) laminated glazing</li> <li>• Closed eaves</li> <li>• Mechanical ventilation/airconditioning</li> </ul>
	Away from corridor	No requirements
Living and work areas <sup>8</sup>	Facing corridor	<ul style="list-style-type: none"> <li>• 10mm (minimum) laminated glazing</li> <li>• Fixed, casement or awning windows with seals</li> <li>• 40mm (minimum) solid core external doors with acoustic seals<sup>9</sup></li> <li>• Sliding doors must be fitted with acoustic seals</li> <li>• Closed eaves</li> <li>• No vents to outside walls/eaves</li> <li>• Mechanical ventilation/airconditioning</li> </ul>
	Side-on to corridor	<ul style="list-style-type: none"> <li>• 6mm (minimum) laminated glazing</li> <li>• Closed eaves</li> <li>• Mechanical ventilation/airconditioning</li> </ul>
	Away from corridor	No requirements
Other indoor areas	Any	No requirements
<b>Outdoors</b>		
Outdoor living area <sup>10</sup>	Facing corridor	<ul style="list-style-type: none"> <li>• Minimum 2.4m solid fence (e.g. brick, limestone or Hardifence)</li> <li>• Colorbond and picket fences are not acceptable</li> </ul>
	Side-on to corridor	
	Away from corridor	No requirements

<sup>7</sup> See section on Mechanical ventilation/airconditioning for further details and requirements.

<sup>8</sup> These deemed-to-comply guidelines adopt the definitions of indoor spaces used in AS 2107-2000. A comparable description for bedrooms, living and work areas is that defined by the Building Code of Australia as a "habitable room". The Building Code of Australia may be referenced if greater clarity is needed. A living or work area can be taken to mean any "habitable room" other than a bedroom. Note that there are no noise insulation requirements for utility areas such as bathrooms. The Building Code of Australia describes these utility spaces as "non-habitable rooms".

<sup>9</sup> Glazing panels are acceptable in external doors facing the transport corridor. However these must meet the minimum glazing requirements.

<sup>10</sup> The Policy requires that at least one outdoor living area be reasonably protected from transport noise. The protected area should meet the minimum space requirements for outdoor living areas, as defined in the Residential Design Codes of Western Australia.

## **Mechanical ventilation/airconditioning**

Where outdoor noise levels are above the “target”, both Packages A and B require mechanical ventilation or airconditioning to ensure that windows can remain closed in order to achieve the indoor noise standards.

In implementing Packages A and B, the following need to be observed:

- evaporative airconditioning systems will not meet the requirements for Packages A and B because windows need to remain open;
- refrigerative airconditioning systems need to be designed to achieve fresh air ventilation requirements;
- air inlets need to be positioned facing away from the transport corridor where practicable;
- ductwork needs to be provided with adequate silencing to prevent noise intrusion.

## **Notification**

Notifications on certificates of title and/or advice to prospective purchasers advising of the potential for noise impacts from road and rail corridors can be effective in warning people of the potential impacts of transport noise. Such advice can also bring to the attention of prospective developers the need and opportunities to reduce the impact of noise through sensitive design and construction of buildings and the location and/or screening of outdoor living areas.

Notification should be provided to prospective purchasers, and required as a condition of subdivision (including strata subdivision) for the purposes of noise-sensitive development or planning approval involving noise-sensitive development, where external noise levels are forecast or estimated to exceed the “target” criteria as defined by the Policy. In the case of subdivision and development, conditions of approval should include a requirement for registration of a notice on title, which is provided for under section 12A of the Town Planning and Development Act and section 70A of the Transfer of Land Act. An example of a suitable notice is given below.

*Notice: This property is situated in the vicinity of a transport corridor, and is currently affected, or may in the future be affected, by transport noise. Further information about transport noise, including development restrictions and noise insulation requirements for noise-affected property, are available on request from the relevant local government offices.*

## **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.

**$L_1$**

An  $L_1$  level is the noise level which is exceeded for 1 per cent of the measurement period and is considered to represent the average of the maximum noise levels measured.

**$L_{10}$**

An  $L_{10}$  level is the noise level which is exceeded for 10 per cent of the measurement period and is considered to represent the “intrusive” noise level.

**$L_{90}$**

An  $L_{90}$  level is the noise level which is exceeded for 90 per cent of the measurement period and is considered to represent the “background” noise level.

**$L_{eq}$**

The  $L_{eq}$  level represents the average noise energy during a measurement period.

**$L_{A10,18hour}$**

The  $L_{A10,18hour}$  level is the arithmetic average of the hourly  $L_{A10}$  levels between 6.00 am and midnight. The CoRTN algorithms were developed to calculate this parameter.

**$L_{Aeq,24hour}$**

The  $L_{Aeq,24hour}$  level is the logarithmic average of the hourly  $L_{Aeq}$  levels for a full day (from midnight to midnight).

**$L_{Aeq,8hour} / L_{Aeq} (Night)$**

The  $L_{Aeq} (Night)$  level is the logarithmic average of the hourly  $L_{Aeq}$  levels from 10.00 pm to 6.00 am on the same day.

**$L_{Aeq,16hour} / L_{Aeq} (Day)$**

The  $L_{Aeq} (Day)$  level is the logarithmic average of the hourly  $L_{Aeq}$  levels from 6.00 am to 10.00 pm on the same day. This value is typically 1-3 dB less than the  $L_{A10,18hour}$ .

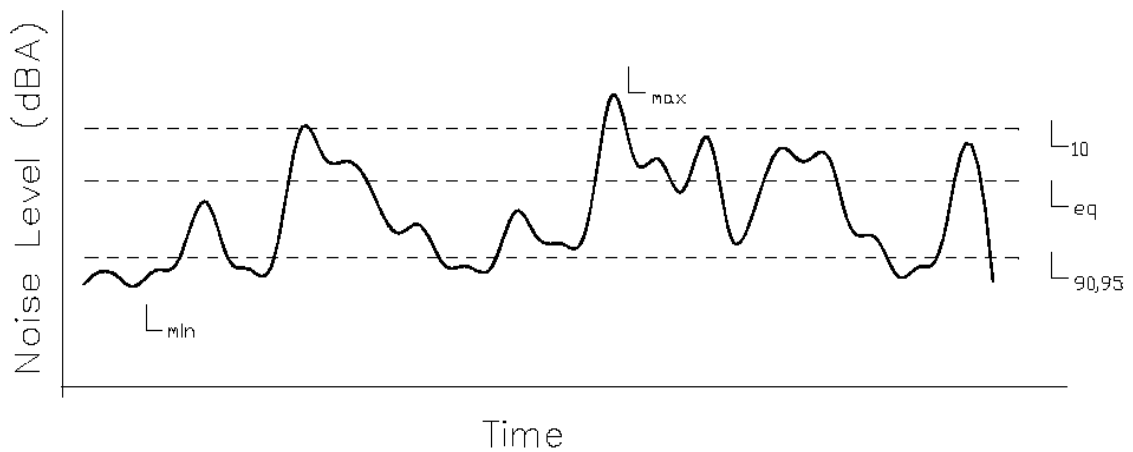
### Satisfactory Design Sound Level

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.

### Chart of Noise Level Descriptors



### Austrroads Vehicle Class

AUSTROADS Vehicle Classification System

Level 1 Length (indicative)	Level 2 Axes and Axle Groups		Level 3 Vehicle Type	AUSTROADS Classification		
Type	Axes	Groups	Typical Description	Class	Parameters	Typical Configuration
Short up to 5.5m	1 or 2	3	Short Sedan, Wagon, 4WD, Utility, Light Van, Bicycle, Motorcycle, etc	1	$d(1) \leq 3.2m$ and axles = 2	
			Short - Towing Trailer, Caravan, Boat, etc	2	groups = 3 $d(1) \geq 2.1m$ , $d(1) \leq 3.2m$ , $d(2) \geq 2.1m$ and axles = 3, 4 or 5	
Medium 5.5m to 14.5m	2	2	Two Axle Truck or Bus	3	$d(1) > 3.2m$ and axles = 2	
			Three Axle Truck or Bus	4	axles = 3 and groups = 2	
			Four Axle Truck	5	axles > 3 and groups = 2	
Long 11.5m to 19.0m	> 2	3	Three Axle Articulated Three axle articulated vehicle, or Rigid vehicle and trailer	6	$d(1) > 3.2m$ , axles = 3 and groups = 3	
			Four Axle Articulated Four axle articulated vehicle, or Rigid vehicle and trailer	7	$d(2) < 2.1m$ or $d(1) < 2.1m$ or $d(1) > 3.2m$ axles = 4 and groups > 2	
			Five Axle Articulated Five axle articulated vehicle, or Rigid vehicle and trailer	8	$d(2) < 2.1m$ or $d(1) < 2.1m$ or $d(1) > 3.2m$ axles = 5 and groups > 2	
			Six Axle Articulated Six axle articulated vehicle, or Rigid vehicle and trailer	9	axles = 6 and groups > 2 or axles > 6 and groups = 3	
Medium Combination 17.5m to 36.5m	> 6	4	B Double B Double, or Heavy truck and trailer	10	groups = 4 and axles > 6	
			Double Road Train Double road train, or Medium articulated vehicle and one dog trailer (M.A.D.)	11	groups = 5 or 6 and axles > 6	
Large Combination Over 33.0m	> 6	> 6	Triple Road Train Triple road train, or Heavy truck and three trailers	12	groups > 6 and axles > 6	

Definitions: Group: Axle group, where adjacent axles are less than 2.1m apart  
 Groups: Number of axle groups  
 Axes: Number of axles (maximum axle spacing of 10.0m)

$d(1)$ : Distance between first and second axle  
 $d(2)$ : Distance between second and third axle

### Typical Noise Levels

