Landcom and Campbelltown City Council

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Menangle Park Land Release Area

Acoustic Assessment Report

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Prepared for

Landcom and Campbelltown City Council

Prepared by

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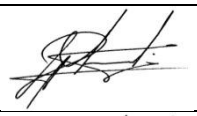
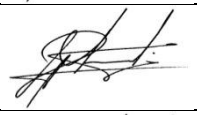
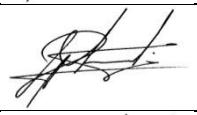
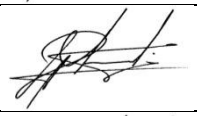
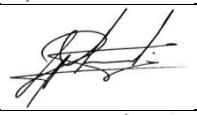
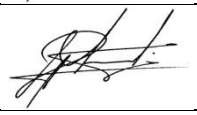
00	09-Jan-2008	Preliminary draft	Patrick Martinez Senior Acoustic Engineer	
01	11-Feb-2010	Draft issue for client review	Patrick Martinez Associate Director - Acoustics	
02	18-Mar-2010	Revised draft report	Patrick Martinez Associate Director - Acoustics	
03	22-Mar-2010	Final issue	Patrick Martinez Associate Director - Acoustics	
04	19-Apr-2010	Revised report. New SFP alignment	Patrick Martinez Associate Director - Acoustics	
05	28-May-2010	Revised report. Appendix D updated	Patrick Martinez Associate Director - Acoustics	

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1.0 Introduction

AECOM (formerly Bassett Acoustics) has been commissioned by APP Corporation Pty Ltd (APP) on behalf of Landcom and Campbelltown City Council (Council) to carry out an acoustic impact assessment report for the Menangle Park Land Release Project.

It is intended that this acoustic assessment report will form one of the supporting documents for the Local Environmental Study (LES) for Campbelltown City Council which will assist in the development of a Development Control Plan (DCP) for the Menangle Park land release area.

This report will:

- Establish appropriate noise criteria based upon the requirements of the NSW Department of Environment, Climate Change and Water (DECCW) and other relevant standards and guidelines;
- Establish the existing ambient noise climate;
- Assess the impact of road-traffic noise on the proposed development including:
  - Modelling the noise from existing (2007) road traffic volumes;
  - Calibration of the noise model with site noise measurements;
  - Establish appropriate road-traffic noise criteria based upon measured noise data, Council requirements and the requirements of the NSW Department of Environment, Climate Change and Water (DECCW), SEPP 2007;
  - Establish appropriate internal noise criteria for residential receivers based on site specific standards and guidelines;
  - Model predicted future road traffic noise levels across the site, based on projected traffic volumes (year 2017 – commencement of land release); and
  - Provide general acoustic recommendations where the established noise criteria are exceeded;
- Assess the impact of rail noise on the proposed development including:
  - Modelling the noise of existing (2007) rail-traffic volumes;
  - Calibration of the noise model with site noise measurements;
  - Establish appropriate railway noise criteria based upon, Council requirements, and RailCorp, DECCW, SEPP 2007 and DoP;
  - Establish appropriate internal noise criteria for residential receivers based on site specific standards and guidelines;
  - Model predicted future rail noise levels across the site, based on projected rail volumes (year 2017 – commencement of land release); and
  - Provide general acoustic recommendations where the established noise criteria are exceeded

The acoustic terminology used in this report is explained in Appendix A.

1.1 Project background

The Menangle Park Land Release Area has been earmarked for urban development since 1968. Originally it was envisaged that development of the area would occur in the late 1980s and early 1990s however in 1990 planning for the area stalled following concerns over air and water quality in South Western Sydney.

At the end of 2001 in light of concerns over Sydney's housing market and housing affordability, the State government announced further investigations of release areas in Western Sydney, including Menangle Park. The area was placed on the 'fast track' to urban release following research indicating that the previous concerns regarding air and water quality could be overcome in a sustainable and viable manner. At the same time the government established the Metropolitan Development Programme (MDP) which coordinates the planning, funding, servicing and development of all new major new residential projects in the Sydney region. Menangle Park was included within the MDP and in November 2008 the Department of Planning agreed in principle for a notional yield of 3,600 lots.

In light of its inclusion within the MDP, Campbelltown City Council in conjunction with Landcom and the Department of Planning commenced the preparation of a Local Environmental Study (LES). The LES was to identify the capability of the study area to accommodate urban development and recommend appropriate land use zones for incorporation into a subsequent draft local environmental plan (LEP) for the area.

In September 2004 a preliminary LES was prepared for the study area by MG Planning. The LES was supported by technical studies addressing geology and soils, air quality, local drainage, riverine flooding, flora and fauna, indigenous heritage, non indigenous heritage, transport and access, visual and landscape character, socio-economic issues, extractive resources, infrastructure and services, bushfire and noise. In addition preliminary Master Planning work was undertaken to test various development scenarios for the site and ultimately to conclude a preferred development option.

The preliminary LES concluded that the site is suitable and capable of urban development with a likely yield in the order of 4,200 lots (in November 2008 the Department of Planning agreed in principle to lowering the yield from 4,200 to 3,600) having regard to the "moderate" development option. It was identified that this yield would contribute to land supply within the Sydney Metropolitan Region consistent with the objectives for the site under the MDP.

However, it was also identified that the site is underlain by a high quality coal resource which is of State significance. Consideration of the potential impacts of coal mining on the site determined that mining of the site would be likely to result in unacceptable impacts on urban development, primarily in the form of mine subsidence, should urban development occur prior to mining. The report therefore concluded that the decision regarding what development should ultimately occur on the site is a matter for the State government in balancing the competing demands of coal mining and urban land supply.

Following preparation of the preliminary LES in September 2004 work on the Menangle Park release area stalled pending a decision from the State Government regarding whether mining or urban development would be pursued on the site. The State government decided against supporting mining and in May 2006 advised that planning for the urban development of Menangle Park should be recommenced as a matter of priority.

Accordingly Landcom in conjunction with Campbelltown City Council, is now seeking to progress work on the release area with a view to having relevant documents and draft planning controls (LEP, DCP, Section 94 Contribution Plan/ Planning Agreement etc) ready for public exhibition in early 2010.

1.2 Study area and site description

Menangle Park land release area is located in south-western Sydney approximately 5 km south west of Campbelltown, between Menangle Road and the Nepean River. As shown in Figure 1, the study area is bounded to the west and south by The Hawkesbury-Nepean River, by Menangle Road to the east and by the approximate alignment of the Mount Annan Coal Railway spur to the north. The Main Southern Railway line bisects the site in a north-south direction. The study area includes a variety of current land uses, including the Menangle Park residential subdivision, semi-rural residential dwellings, Glenlee House, the National Equestrian Sports Centre and the Menangle Park Harness Paceway Park.

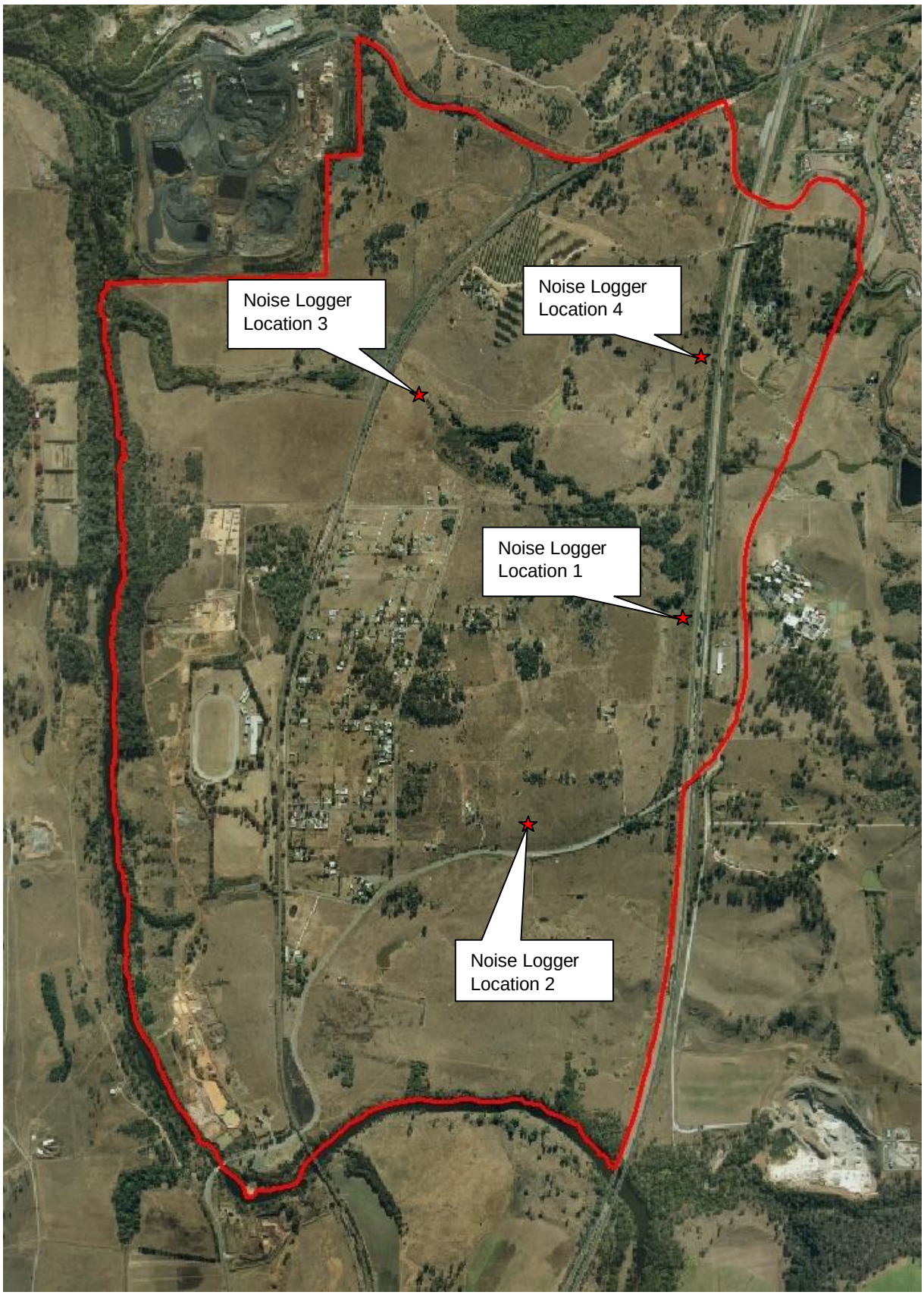


Figure 1 - Site location plan (land release area bounded by red)

2.0 Ambient Noise Monitoring

2.1 Noise monitoring locations

In order to establish the existing noise environment adjacent to the project area, ambient noise monitoring was conducted at four representative locations (refer to Figure 1). Four noise loggers, one ARL 215 noise logger and three Sonometre 01dB noise loggers were used to continuously measure noise levels in four locations within the proposed development.

The noise monitoring was conducted in accordance with the NSW Department of Environment, Climate Change and Water (DECCW) Environmental Criteria for Road Traffic Noise (ECRTN) and the Industrial Noise Policy (INP) requirements. These locations were selected after a detailed inspection of the project area taking into consideration sensitive locations and other noise sources which may influence the measurements.

Table 1 presents the selected monitoring locations, whilst Figure 1 shows these noise monitoring locations.

Table 1 - Ambient noise monitoring locations

Location Noise monitoring survey duration	Description/ address	Instrumentation	Comments
R1 Start: 18 Mar 07 Finish: 27 Mar 07	Noise logger was located approximately 15 m west of the F5 Freeway (middle of the site).	Sonometre 01dB Sound Level Metre.	Location chosen to determine appropriate operational road-traffic noise criteria. Information used to calibrate noise model. Noise logger located approximately 1.5 m above ground level and approximately 15 m west of the F5 Freeway.
R2 Start: 14 Mar 07 Finish: 27 Mar 07	Noise logger was located approximately 10 m north of Menangle Road (south of the site).	Sonometre 01dB Sound Level Metre.	Location chosen to determine appropriate operational road-traffic noise criteria. Information used to calibrate noise model. Noise logger located approximately 1.5 m above ground level and approximately 10 m north of Menangle Road.
R3 Start: 18 Mar 07 Finish: 27 Mar 07	Noise logger was located approximately 45 m east of the Main Southern Railway line (north of the site).	Sonometre 01dB Sound Level Metre.	Location chosen to determine appropriate operational rail-traffic noise criteria. Information used to calibrate noise model. Noise logger located approximately 1.5 m above ground level and approximately 45 m east of the Main Southern Railway line.
R4 Start: 18 Mar 07 Finish: 23 Mar 07	Noise logger was located approximately 15 m west of the F5 Freeway (south of the site).	ARL 215 Noise Logger.	Location chosen to determine appropriate operational road-traffic noise criteria. Information used to calibrate noise model. Noise logger located approximately 1.5 m above ground level and approximately 15 m west of the F5 Freeway.

2.2 Continuous noise monitoring

Four noise loggers were used to continuously measure background noise levels between Wednesday 14 March 2007 through until Tuesday 27 March, 2007. The selected locations are considered to be representative of the future noise sensitive receivers in the area.

A noise logger measures the noise level over the sample period and then determines L_{A1}, L_{A10}, L_{A90}, L_{Amax} and L_{Aeq} levels of the noise environment. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample period respectively. The L_{Amax} is indicative of maximum noise levels due to individual noise events such as the pass by of a heavy vehicle. The L_{A90} is taken as the background noise level. The L_{Aeq} level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The results of the noise monitoring have been processed in accordance with the procedures contained in the DECCW's INP and the DECCW's ECRTN guidelines.

Graphical representation of the logging results are shown in Appendix B.

2.3 Traffic noise

Locations R1, R2 and R4 noise survey results have been used to determine existing traffic noise levels impacting on the Menangle Park land release area. Measured traffic noise levels are presented in Table 2.

Table 2 – Measured traffic noise levels

Measurement location	Noise level, dB(A)	
	Day, $L_{Aeq\ (15hr)}$	Night, $L_{Aeq\ (9hr)}$
R1	65	64
R2	69	62
R4	64	64

Notes:

1. Day is defined as 7:00am to 10:00pm.
2. Night is defined as 10:00pm to 7am.
3. The noise measurements were conducted in a "free field" environment without the influence of any noise reflected from a facade.

2.4 Railway noise measurements

Railway noise was monitored at Location 3. While some road traffic noise was evident at the logger location the 1 hour, 24 hour L_{Aeq} noise levels and maximum noise levels appear to be dominated by rail noise. The measured 24 hour L_{eq} level of 56 dB(A) was used to calibrate the SoundPLAN noise model and to establish an empirical relationship between the 24 hour L_{Aeq} and the 1 hour noise levels. The derived empirical relationship is +3.6 dBA and +4.4 dBA for the daytime and night time 1 hour L_{Aeq} noise levels respectively.

Table 3 – Measured rail traffic noise levels, dB(A)

Measurement location	Noise level, dB(A)			
	Daytime noise level $L_{Aeq,1hr}$	Night-time noise level $L_{Aeq,1hr}$	24hr noise level $L_{Aeq,24hr}$	Maximum noise level L_{Amax}
R3	60	60	56	86

2.5 Instrumentation

The long-term unattended noise loggers; ARL 215 noise logger and Sonometre 01dB noise logger equipment comply with Australian Standard 1259.2-1990 “Acoustics - Sound Level Meters – Part 2: Integrating - averaging” and are designated as a Type 2 instrument having an accuracy suitable for field use.

The long-term noise loggers were calibrated before and after the measurements with no significant drift in calibration.

3.0 Noise Criteria

This section will establish the appropriate noise emission criteria in order to assess environmental noise from the roads surrounding the development and the Main Southern Railway line.

3.1 Road traffic noise criteria

The DECCW's document *Environmental Criteria for Road Traffic Noise (ECRTN)* will be used for the assessment and control of road traffic noise.

3.1.1 External L_{Aeq} level criteria

The F5 Freeway (Hume Highway) and Menangle Road are classified as arterial roads according to the DECCW guidelines. Table 4 below presents the DECCW's road traffic noise criteria for new residential land use developments affected by noise from arterial and collector roads. The external noise criteria are applied at 1 metre from the facade that is most exposed to traffic noise and at a height of 1.5 m from the floor level. The DECCW's road traffic noise criteria for new arterial road corridor, applicable to the new Spring Farm Parkway, are presented in Table 5 . The residential noise level criteria include an allowance for noise reflected from the facade.

Table 4 – Road traffic noise criteria for new residential land use

Period	Parameter	Criterion dB(A)
Arterial and Sub-Arterial Roads		
Day (7.00 am – 10.00 pm)	$L_{Aeq, 15hr}$	55
Night (10.00 pm – 7.00 am)	$L_{Aeq, 9hr}$	50
Collector Roads		
Day (7.00 am – 10.00 pm)	$L_{Aeq, 1hr}$	60
Night (10.00 pm – 7.00 am)	$L_{Aeq, 1hr}$	55

Notes:

1. In cases where noise from an existing road already exceeds the above criteria, the DECCW document recommends that "*Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria for occupants by judicious design and construction of the development.*
   Locations, internal layouts, building materials and construction should be chosen so as to minimise noise impacts."

Table 5 – Road traffic noise criteria for new roads

Period	Parameter	Criterion dB(A)
New Arterial Road Corridor		
Day (7.00 am – 10.00 pm)	$L_{Aeq, 15hr}$	55
Night (10.00 pm – 7.00 am)	$L_{Aeq, 9hr}$	50

Notes

1. In cases where noise from an existing road already exceeds the above criteria, the DECCW document recommends that "*The new road should be designed so as not to increase existing noise levels by more than 0.5 dB.*
   Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In some instances this may be achievable only through long-term strategies such as improved planning, design and construction of adjoining land use developments; reduced vehicle emission levels through new vehicle standards and regulation of in-service vehicles; greater use of public transport; and alternative methods of freight haulage."

3.1.2 Internal noise levels

3.1.2.1 State Environmental Planning Policy (Infrastructure) 2007 (SEPP 2007)

Internal noise levels due to road and rail traffic noise must comply with the State Environmental Planning Policy (Infrastructure) 2007 (SEPP 2007) for the following situations:

*"**Clause 102**: development for any of the following purposes that is on land in or adjacent to a road corridor for a freeway, a tollway or a transit way or any other road with an annual average daily traffic volume of more than*

40,000 vehicles (based on the traffic volume data available on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

- *building for residential use*
- *a place of public worship*
- *a hospital*
- *an educational establishment or childcare*
- *centre"*

The applicable SEPP 2007 Clause (internal noise criteria) is as follows:

"If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

- *in any bedroom in the building : 35dB(A) at any time 10pm–7am*
- *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time.*

In summary, the SEPP 2007 criteria for road and rail traffic noise intrusion is **40 dB(A)** for living areas and **35 dB(A)** for sleeping areas.

3.1.2.2 Australian/New Zealand Standard 2107:2000

Where external facade levels cannot be achieved, internal noise levels should satisfy Australian/New Zealand Standard 2107 '*Acoustics – Recommended design sound levels and reverberation times for building interiors*'. A summary of the noise levels in typical residential areas is given below.

Table 6 – AS/NZS 2107:2000 Internal noise criteria

Type of occupancy/activity	Recommended design sound level, L_{Aeq}, dB(A)		Recommended reverberation times (s)
	Satisfactory	Maximum	
House and apartments near major roads			
Living areas	35	45	-
Sleeping areas	30	40	-
Work areas	35	45	-
Apartment Common Areas eg Foyer, Lift Lobby (See Note)	45	55	Note
Office buildings			
General office areas/call centres/design/draughting offices	40	45	0.4- 0.6
Private offices	35	40	0.6-0.8
Conference rooms	30	40	0.6-0.8
Public spaces	40	50	0.5-1.0
Reception areas	40	45	Note

Notes:

1. AS/NZS 2107:2000 recommends that reverberation times in these spaces should be minimised as far as possible for noise control.

The DECCW states that in the absence of other internal criteria set by the relevant planning or building authority, internal noise levels should be 35-40 dB(A) in sleeping areas and 10 dB below external levels for other living areas. If closed windows are required to achieve the internal noise levels, alternative ventilation systems should be provided.

3.1.3 Sleep arousal

The DECCW's ECRTN recommends that an assessment of sleep arousal due to the heavy vehicle passbys during the night period be conducted.

A detailed discussion of the issues involved in sleep arousal is available in the ECRTN.

The following summary of sleep arousal issues gives recommendations for noise criteria to control maximum internal noise levels. The intent of a sleep arousal criterion is to ensure that the amenity of sleeping areas is protected and sleep arousal is avoided.

The following characteristics of a noise signal are identified as being strongly related to sleep disturbance.

- The peak level of the noise events, described by L_{Amax};
- The emergence of noise events above the general ambient noise level, described by measures such as ($L_{Amax} – L_{Aeq}$) or ($L_{Amax} – L_{A90}$)
- The number of such noise events occurring during the sleeping period;

A comparison of the existing research on sleep arousal results in the following conclusions:

- Maximum internal noise levels below 55 dB(A) are unlikely to cause awakening reactions; and
- One or two noise events per night, with maximum internal noise levels of 70 dB(A), are not likely to affect health and well being significantly.

Based on the above discussion, it is recommend that maximum internal noise levels in a sleeping area are assessed against the following sleep arousal criteria.

- One or two noise events per night are permitted to exceed 55 dB(A) internally by up to 15 dB(A).
- The remaining vehicle pass-bys in the night period (10pm to 7am) should not exceed 55 dB(A) LAmax internally.

3.1.4 Summary of road traffic noise criteria

3.1.4.1 Facade noise levels

A summary of the facade noise criteria from the DECCW's ECRTN is presented in Table 7 below.

Table 7 – Road traffic noise criteria (residential) – External L_{Aeq} dB(A)

Land Use	Criteria	
	Daytime	Night-time
New residential land use developments affected by freeway/arterial traffic noise	55	50

3.1.4.2 Internal noise levels

A summary of the internal noise criteria from the SEPP 2007, DECCW and AS/NZ2107:2000 is presented in Table 8 below.

Table 8 – Road traffic noise criteria (residential) – Internal L_{Aeq} dB(A)

Occupancy	Period	Parameter	Criteria[1] dB(A)
Living Areas	Day (7.00 am – 10.00pm)	$L_{Aeq,15hr}$	40
	Night (10.00 pm – 7.00am)	$L_{Aeq,9hr}$	40
Bedrooms	Night (10.00 pm – 7.00am)	$L_{Aeq,9hr}$	35
	Night (10.00 pm – 7.00am) Maximum Noise Level	L_{Amax}	55

Notes:

1. It is recommended that the SEPP 2007 acoustic requirements are applied to all future residential developments, including areas impacted by Menangle Road and the Spring Farm Parkway.

3.2 Railway noise criteria

3.2.1 Internal noise levels

3.2.1.1 Department of Planning - *Development Near Rail Corridors and Busy Roads – Interim Guideline*

The Department of Planning document '*Development Near Rail Corridors and Busy Roads – Interim Guideline*' refers to the acoustic requirements in SEPP 2007 for residential developments near rail corridors and busy roads.

The applicable SEPP 2007 Clause (internal noise criteria) is as follows:

"If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

- *in any bedroom in the building : 35dB(A) at any time 10pm–7am*
- *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time.*

In summary, the SEPP 2007 criteria for rail traffic noise intrusion is **40 dB(A)** for living areas and **35 dB(A)** for sleeping areas.

3.2.2 Sleep disturbance

Consideration may also be given to DECCW criteria for sleep disturbance due to train pass by noise. Following a review of available literature and the ECRTN, the current position of the DECCW is to assess sleep disturbance by considering the emergence of intermittent noise events above the RBL for screening purposes and the emergence of the noise events above the background noise level at the time of the disturbance for assessments. The likely hood of sleep disturbance is significant when the L_{Amax} or $L_{A1,1min}$ is greater than 15 dB(A) above the background noise levels.

The screening criterion is therefore:

$$L_{Amax} \text{ or } L_{A1,1min} < L_{A90} + 15 \text{ dB(A)}$$

The DECCW recognises that this is not ideal but concludes that there is insufficient evidence as to what should replace it.

When the criterion is likely to be exceeded, more detailed analysis is required. The additional analysis should consider the extent by which the criterion is exceeded and how many noise events are likely to occur during the night time period.

The ECRTN concludes as a result of the review of research that:

> *Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions; and*
>
> *One or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and wellbeing significantly.*

4.0 Noise Modelling Methodology

The assessment of environmental noise emission from the surrounding roads and railway line is carried out in this section of the report with regard to the established criteria detailed in Section 3.0. This includes assessment of:

- Existing and Future Road Traffic Noise
- Existing and Future Railway Noise

The industry standard noise mapping software 'SoundPLAN' was used in the prediction of environmental noise propagation. This software is capable of accurately predicting environmental noise levels and mapping the results. It takes into account source directivity, the terrain, shielding, location of buildings, meteorological effects, air absorption and distance attenuation.

4.1 Railway noise

4.1.1 Noise model

Rail noise emission levels were predicted using the Nordic Rail Prediction Method (Kilde Report 130) as implemented in SoundPLAN noise modelling software.

The inputs to the Nordic Model are:

- number of each type of train per day;
- train pass-by energy (L_{AE}) and the maximum sound pressure (L_{Amax}) for each train using the line;
- train speed (km/h);
- typical train length (m); and
- track, buildings, and terrain geometry;

The inputs used in the modelling of trains using the Main Southern Railway for the existing (2007) and future (2017) situations are given in Table 9 and Table 10 below.

Table 9 – Railway noise model input parameters

Train type	Daily frequency	Length (m)	Average speed (km/h)
Existing data 2007			
Endeavour	34	75	80
XPT	4	204	80
XPT Engine	4	20	
Explorer	7	75	80
Freight Train Wheels	28	50	80
Freight Train Engine	28	50	80
Freight Train Wagon	28	1800	80
Wagon Max	28	1800	80
Existing data 2017			
Endeavour	66	75	80
XPT	4	204	80
XPT Engine	4	20	
Explorer	7	75	80
Freight Train Wheels	61	50	80
Freight Train Engine	61	50	80
Freight Train Wagon	61	1800	80
Wagon Max	61	1800	80

Notes:

1. AECOM has been informed that CountryLink services (Explorer) are unlikely to change (RailCorp).
2. Based on peak hour increase from 4 to 8 services (AECOM).
3. Freight numbers based on forecasts in Australian Rail Track Corporation publication: "Background to ARTC" 1 June, 2005.

Table 10 – Railway noise model input noise levels, dB(A)

Train type	Noise source	L_{Amax}	L_{AE}	Source height (m)
XPT	Wheel-Rail	90	89	0.5
	Diesel Engine – Medium	84	83	4
Endeavour/Explorer	Wheel-rail/Engine	90	90	0.5
Diesel Locomotive	Wheel-rail	81	81	0.4
	Diesel Engine – Medium	91	90	4
Freight Wagon	Wheel-rail	87	96	0.5
All Coal	Wheel-rail	85	94	0.5

Notes:

1. Based on previous noise measurements conducted by AECOM.

4.1.2 Model validation

The model was validated by comparing predicted noise emissions from the existing Main Southern Railway with measured noise emissions at a test location near the railway line as described in Section 2.0 above. At the measurement location the measured L_{Aeq} (24 hour) noise level is 56 dB(A). This compares well with the predicted L_{Aeq} (24 hour) noise level of 58 dBA and is well within the accuracy of the model.

4.2 Road-traffic noise

4.2.1 Road-traffic numbers

The SoundPLAN model used the Calculation of Road Traffic Noise (CoRTN) method for calculating road noise emission. This method is acceptable to the DECCW. Research by Australian Road Research Board (ARRB) has shown that the CoRTN model has a standard deviation of 1.8 dB(A) for free-field prediction locations (*An Evaluation of the U.K DoE Traffic Noise Prediction Method* -1983).

Existing and predicted road traffic numbers, provided by AECOM, are listed in Table 11 below. Road traffic levels are given in terms of the equivalent daytime (15-hour) and night-time (9 hour) levels, as required by the DECCW, and has been for some time the preferred model for calculating road traffic noise in NSW.

4.2.2 Spring Farm Parkway

Traffic data has been supplied by SMEC in the form of AM and PM Peak Flows and Annual Average Daily Traffic (AADT) Numbers. As hourly data was not available the AADTs have been converted to daytime (15hour) and night-time (9hour) traffic flows by applying a similar proportion daytime/night-time traffic flows to Spring Farm Parkway as has been predicted on Menangle Road. The daytime to night-time ratio used is approximately 88% daytime traffic, 12% night-time traffic. The traffic flows used are provided in Table 12.

.

Table 11 – Road traffic numbers

Modelled traffic data													
	HUME HWY							Menangle Road – S of Geary Road					
	ADT	15hr Traffic	1hr	%Heavy	Cars	Trucks		ADT	15hr Traffic	1hr	%Heavy	Cars	Trucks
Northbound	17747	15617	1041	20	833	208	Eastbound	7650	6732	449	10	404	45
Southbound	17747	15617	1041	20	833	208	Westbound	7650	6732	449	10	404	45
Night-time							Night-time						
	HUME HWY							Menangle Road – S of Geary Road					
	Avg 9 hr	9hr Traffic	1hr	%Heavy	Cars	Trucks		Avg 9 hr	9hr Traffic	1hr	%Heavy	Cars	Trucks
Northbound	26067	3128	348	50	174	174	Eastbound	7492	899	100	5	95	5
Southbound	26067	3128	348	50	174	174	Westbound	7492	899	100	5	95	5
Future Data 2017													
Daytime							Daytime						
	HUME HWY							Menangle Road – West of F5				Menangle Road – East of F5			
	ADT	15hr Traffic	1hr	%Heavy	Cars	Trucks		1hr	%Heavy	Cars	Trucks	1hr	%Heavy	Cars	Trucks
Northbound	25590	22519	1501	20	1201	300	Eastbound	867	10	780	87	1473	10	1326	147
Southbound	25590	22519	1501	20	1201	300	Westbound	242	10	218	24	433	10	390	43
Night-time							Night-time						
	HUME HWY							Menangle Road – S of Geary Road					
	Avg 9 hr	9hr Traffic	1hr	%Heavy	Cars	Trucks		Avg 9 hr	9hr Traffic	1hr	%Heavy	Cars	Trucks
Northbound	37592	4511	501	50	251	251	Eastbound	13583	1630	181	5	172	9
Southbound	37592	4511	501	50	251	251	Westbound	13583	1630	181	5	172	9

Notes:

1. Numbers obtained from AECOM and adjusted for Daytime (15hr) and Night-time (9hr) periods.

Table 12 – Spring Farm Parkway traffic figures

Year	AADT	Daytime (15hour)			Night-time (9hour)		
		% Heavy	Cars	Trucks	%Heavy	Cars	Trucks
2016	7811	10	6891	689	5	920	46
2026	15566	10	13732	1373	5	1834	92

4.2.3 Model validation

The model was validated by comparing predicting noise emissions from the existing roads surrounding the development with measured noise emissions at logger locations 1, 2 and 4 as described in Section 2.0 above.

5.0 Noise Modelling Results

5.1 Road traffic noise

The results of the existing (2007) and future (2017) noise modelling are presented as noise contour plots in Appendix C.

5.1.1 Existing (2007)

Figure 1, Appendix C shows the contour plot of existing noise on the site due to road traffic on all surrounding roads during the *day-time* period.

Figure 2, Appendix C shows the contour plot of existing noise on the site due to road traffic on all surrounding roads during the *night-time* period.

Both figures indicate that the established noise criteria are currently exceeded at the bounds of the development footprint.

5.1.2 Future (2017)

5.1.2.1 Without noise barriers

Figure 3, Appendix C shows the contour plot of future noise on the site due to road traffic on all surrounding roads during the day-time period.

Figure 4, Appendix C shows the contour plot of future noise on the site due to road traffic on all surrounding roads during the night-time period.

Both figures indicate that noise control will be required to achieve the noise criteria within the development footprint.

5.1.2.2 With noise barriers

Figure 7, Appendix C shows a noise difference map which presents the noise reduction offered by the 6 metre noise barrier along the F5 Freeway site boundary.

The RTAs Environmental Noise Management Manual (ENMM) provides guidance on what is deemed to be a reasonable and feasible noise barrier. A noise barrier that either does not achieve an insertion loss of at least 5 dB(A) or that requires a height of greater than 6 metres in order to provide a significant effect, is not generally considered feasible for construction. Modelling by AECOM indicates that barriers of 6 metres height or less are of limited benefit along the F5 Freeway for both ground floor and two storey residences (refer to Figures 7, Appendix C). This is mainly due to the surrounding topography, elevated ridge lines and the fact that any proposed noise barrier is to be located at the development's boundary. A noise barrier is most effective when is located close to the noise source, however in this instance the development boundary is located approximately 15 – 20 m away from the F5 Freeway.

5.2 Railway noise

The results of the existing (2007) and future (2017) noise modelling are presented as noise contour plots in Appendix C, Figure 5 and Figure 6 respectively.

5.2.1 Existing (2007)

Contour plots of noise due to railway traffic using *existing* rail traffic numbers are presented in Figure 5.

5.2.2 Future (2017)

Contour plots of noise due to railway traffic using *future* rail traffic numbers are presented in Figure 6.

5.3 Governing criterion

Review of existing (2007) and future (2017) noise indicates that the night-time criterion is the more stringent. Therefore, the night-time criterion has been taken as the governing criterion, compliance with the night-time noise criterion requirements will ensure compliance with the daytime noise requirements.

At this stage of the development the proposed housing designs have not been considered (e.g. separate dwelling, villas, townhouses, single storey or double storey, orientation of living and sleeping areas, etc), therefore, the predicted noise levels presented in Appendix C have only been calculated for the ground floor only. Noise levels for upper floors are expected to be equal or higher than those presented in Appendix C.

6.0 Discussion and Recommendations

The following section describes the acoustic recommendations required to limit environmental noise levels within the development envelope due to road traffic and railway noise to the design criteria.

Review of the Menangle Park Draft Structure Plan (refer to Appendix D) indicates that the potentially affected residential lots are the 'bigger' residential and rural lots (i.e. 540-700 sqm lots and 1,000-1,500 sqm lots) facing the F5 Freeway.

6.1 Noise barrier / berms

The RTAs Environmental Noise Management Manual (ENMM) provides guidance on what is deemed to be a reasonable and feasible noise barrier. A noise barrier that either does not achieve an insertion loss of at least 5 dB(A) or that requires a height of greater than 6 m in order to provide a significant effect, is not generally considered feasible for construction. Modelling by AECOM indicates that barriers of 6 m height or less are of limited benefit along the F5 Freeway for both ground floor and two storey residences (calculations indicate approximately 3 dB(A) reduction of the night-time noise levels from the F5 Freeway for a 6 m barrier) . This is mainly due to the surrounding topography, elevated ridge lines and the fact that any proposed noise barrier is to be located at the developments boundary. A noise barrier is most effective when is located close to the noise source, however in this instance the development boundary is located approximately 15 – 20 away from the F5 Freeway.

6.2 Development footprint set-backs

Without acoustic treatment (in the form of noise barriers/berms, building insulation, building orientation, etc.) setbacks will be required to ensure that the noise levels at the facades of buildings and also internal noise levels within the development satisfy the established criteria.

The noise contours for the day and night-time periods for the Future scenarios (2017), shown in Appendix C, Figures 3 and 4, indicate that, some residential and some of the bigger rural lots will need treatment.

In order to be able to subdivide the land release area and maintain the development footprint as proposed in the Draft Structure Plan, Appendix D, one or more of the acoustic recommendations described below should be adopted.

6.3 Rail noise

6.3.1 Main Southern Railway

Noise modelling shows that the established noise criterion is likely to be exceeded within the 60 m assessment area as shown in Appendix C, Figure 6.

AECOM has been advised that the development footprint will not extend to within 60 m of the railway line. However the assessment area may be extended beyond 60 m to address development proposals that are:

- In the vicinity of steel bridges;
- Near sections of high speed track; and
- In locations where there is no acoustic shielding by topography or buildings between the track and the potential noise receiver.

AECOM has been advised that the provision of acoustic barriers along the railway corridor are unlikely due to topographical, visual, waterflow and wildlife reasons. Thus, acoustic recommendations contained in Section 6.6 may be required. This will be confirmed during further detailed modelling at the Development Application stage of the project.

6.4 Buffer zones

A reduction in noise levels can be achieved by maintaining a noise buffer zone between the noise source (rail and road traffic) and the proposed residential development. Buffer zones in the order of 400 metres along the F5 Freeway boundary and up to 200 metres along the rail corridor may be considered.

6.5 Carriage house studio option

An alternative option to noise barriers may consist of buildings forming part of the noise barrier. Further to this concept “carriage house” studios in combination with lower walls is presented in Figure 2 below (Reference: http://www.holroyd.nsw.gov.au/html/eps/dev/pemulwuy/chapter3c.pdf).

Figure 2 shows the concept where by “carriage house” in the order of 5.5 metres in combination with a lower wall are proposed for noise control. As with the barrier option upper levels of any multi level buildings will need to be acoustically treated. It is also anticipated that the first row of housing adjacent to the roads and the rail line will provide noise shielding to other dwellings behind.

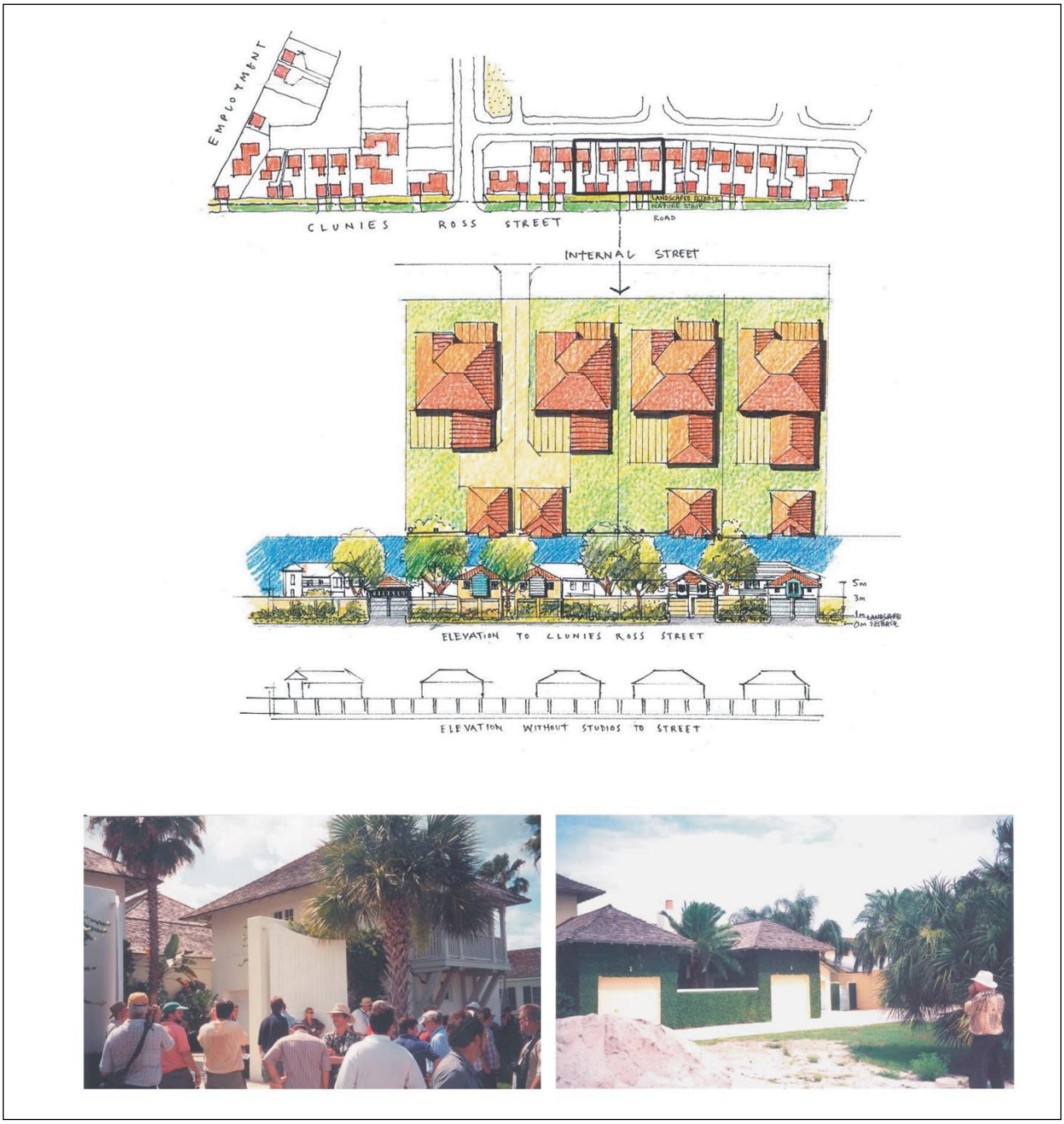


Figure 2 – Carriage housing details

6.6 Architectural recommendations

Preliminary road traffic noise modelling during this assessment indicates that architectural treatments may be required at distances up to 400 m from the site boundary adjacent to the F5 Freeway (see 60 dBA and 55 dBA noise contours in Appendix C, Figure3 and Figure 4) and that noise walls may only provide limited benefit at a small number of residences. This should be confirmed by more detailed modelling that includes the orientation and height of all proposed residences during the Development Application stage.

Preliminary rail noise modelling indicates that architectural treatments may be required at distances up to180 m from the site boundary (see 60 dBA and 55 dBA noise contours in Appendix C, Figure 6).

Where it is not possible or feasible to construct acoustic barriers or berms that meet the road traffic and rail noise criteria the following general architectural design recommendations should be considered. These recommendations are general and specific design requirements depend upon the specific architectural design of the building such as building usage, facade construction, extent of glazing, layout, location and orientation of dwellings, etc.

The following general recommendations are provided below for areas where acoustic treatment is required to achieve the established criteria.

6.6.1 Building layout and design

Orientation of residences

Residences may be situated within lots along the site boundary so that they provide acoustic shielding for residences at greater distances from the highway. This may reduce the number of residences that require noise treatment within the development.

Orientation of rooms

The layout of the rooms within the building is important in determining individual noise exposure. The less noise sensitive rooms such as garages, bathrooms, and laundries should preferably be located closer to the noise source to shield noise sensitive areas such as bedrooms and frequently used living areas. Kitchens may be regarded as either less sensitive or more sensitive, depending on whether they form part of frequently used living areas.

Where a development includes various buildings or a range of occupancies, the orientation of these may be used to provide shielding to the more sensitive receivers.

Windows

Windows and doors present acoustic weaknesses which control the overall sound transmission loss of the composite wall.

Buildings should be constructed so that facades most exposed to the noise source have a minimum number of windows and doors to reduce the internal noise levels. Where windows that open onto habitable areas exposed to the noise source are unavoidable, the following glazing principles should be employed:

- Habitable rooms exposed to the southern railway should be provided with glazing constructions sufficient to limit internal noise levels to the relevant criteria;
- Such glazing constructions could consist of thicker than normal glass, laminated glass or double glazing to attenuate sufficiently the noise;
- For double glazing the panes should be of different thicknesses to prevent sympathetic resonance that will detract from the acoustic performance;
- Air gaps for double glazing may vary from 25 mm to 100 mm depending upon other design factors such as room size, internal sound absorption, treatment and the required noise attenuation;
- It will be acceptable to use thicker acoustic glazing than the glazing normally used for structural or safety reasons;
- Hinged or casement windows are preferred over sliding windows as the former two have more effective sealing mechanisms. The overall intent is to form an air-tight construction;
- Any gaps between the window frames and the house frame/masonry must be sealed with flexible mastic;
- Glass windows and doors that are specified for acoustic reasons will require acoustic seals and must remain closed to meet the internal noise criteria;

- For rooms where the external windows and doors are to remain closed to achieve the internal noise criteria, air conditioning or alternative ventilation systems must be provided.

Enclosed balconies

Enclosed balconies can be used to reduce internal noise levels by providing a second glazed wall, which will act like double glazing with a large air-gap between glass panes. As mentioned previously, where windows are required to remain closed to achieve the internal noise criteria, air conditioning or alternative ventilation systems should be provided.

External walls

All facades should be masonry or concrete as these provide greater transmission losses than weatherboard or other light-weight structures. It should also be noted that double brick walls are acoustically superior to brick veneer walls. Light-weight cavity constructions can be used provided that they have been adequately assessed acoustically.

Doors

Where external doors open into habitable areas they should be heavy solid-core doors with effective acoustic seals . These may involve all or a combination of perimeter, meeting stile and foot seals.

Insulation

Acoustic insulation such as polyester or rockwool / glasswool batts paced between the wall studs of brick veneer and timber framed buildings will reduce the noise entering the building by an additional 5 dB(A).

Insulation provided in the ceilings will reduce noise levels entering through the roof by an additional 5–8 dB(A). Metal roofs are acoustically superior to tiled roofs due to the fact that there are often unsealed air gaps between the tiles of the tiled roof. Ventilated eaves should be avoided as they will compromise the acoustic integrity of a treated roof and façade. Sealing strips at the edges of metal roofs are also beneficial. Care should be taken when considering the use of skylights as they have the potential to degrade the acoustic integrity of the roof-ceiling construction significantly. These constructions should be carefully evaluated at the detailed design stage.

6.6.2 Architectural treatment

Architectural treatment measures (typically involving acoustic treatment windows and facades) are designed to achieve internal noise levels that would have normally prevailed if the external noise criteria were achieved. Therefore, architectural treatment should generally be considered only when the external rail and road traffic noise cannot be achieved at the premises and other measures are impractical or not cost-effective.

The typical outdoor to indoor noise reductions provided by most standard dwellings (ie without special acoustical treatment) is generally accepted as being 10 dB(A) with windows open (20% of the window area left open, sufficiently to provide adequate ventilation as per the requirements of the Building Code of Australia) and 20 dB(A) with windows closed.

Provision of air-conditioning and/or mechanical ventilation aa a minimum, would enable windows and doors to be shut, resulting in internal noise levels approximately 20 dBA lower than those predicted outside the dwellings.

The RTA's Environmental Noise Management Manual (ENMM) provides the following guidelines to acoustic treatment:

Table 13 – Indicative building noise reduction (adapted from FHWA 1995)

Building Type	Windows	Internal noise reduction
All	Open	10 dB(A)
Light frame	Single glazed (closed)	20 dB(A)
Masonry	Single glazed (closed)	25 dB(A)
	Double glazed (closed)	35 dB(A)

6.7 Other options

In addition to noise barrier and architectural treatment, further options for reducing noise intrusion may include land use planning by locating less noise sensitive developments (e.g. commercial) closer to the noise source and/or orienting noise sensitive areas (i.e. bedrooms and living areas) away from the Hume Highway, railway line and Menangle Road.

The extent of the acoustic treatment should be further developed during the subdivision DA stage and detail designed stage of the project once the proposed housing design is finalised (eg separate dwelling, villas, townhouses, single storey or double storey, orientation of living and sleeping areas, etc).

It is recommended that during the preparation of the Development Control Plan (DCP) for the Menangle Park land release area conditions be imposed on residential lots that are affected by road and rail noise. Conditions in the DCP may propose that further acoustic assessment be completed at the Development Application stage for the individual lots which exceed the established noise criteria presented in the DA subdivision acoustic assessment report. This assessment should demonstrate compliance with the SEPP 2007 acoustic requirements and the ECRTN's noise criteria.

7.0 Industrial Noise Sources

Industrial noise sources with the potential to adversely impact noise sensitive receivers within the proposed Menangle Park land release area have been investigated.

7.1 Glenlee industrial area

AECOM (formerly Bassett Acoustics) was commissioned to provide an acoustic assessment report of the likely noise and vibration impacts associated with the rezoning of Glenlee study area for employment and related purposes (reference: Glenlee Precinct Rezoning_Acoustics_Rev2_191208, issued 19 December 2008).

The Glenlee industrial area is located adjacent to the north west corner of the Menangle Park development boundary. The existing Glenlee industrial area land use includes the Macarthur Resource Recovery Park (MRRP), a former coal washery and current reject emplacement area, soil mixing and several truck depots. The proposed re-zoning of this area will include the WSN residual lands (residential/commercial), retail and commercial facilities, offices, warehouses and logistics and an intermodal facility. The study area will be ultimately accessed by the proposed Spring Farm Link Road.

AECOM conducted an acoustic assessment of the study area in accordance with the NSW Department of Environment, Climate Change and Water's (DECCW) Environmental Criteria for Road Traffic Noise (ECRTN), the Industrial Noise Policy (INP), relevant Australian Standards and the local environmental plans. Ambient noise measurements were undertaken and used to determine the relevant noise criteria for assessment.

The proposed development was assessed for road traffic noise, industrial noise and vibration impacts. The industrial noise assessment considers variable weather conditions that are a characteristic of the Glenlee area. The assessment considers the proposed Spring Farm Link Road to the northern Glenlee site entrance in 2016 and the extension to the South Western Freeway in 2026.

The results of the industrial noise assessment indicated compliance with the established criteria for the day evening and night-time periods at nearby noise sensitive receivers with no mitigation measures required. A review of the predicted operational noise emissions contours, for the day and night-time periods, indicates that the operation of the Glenlee Industrial Area will comply at nearby residential receivers within the Menangle Park land release area.

It is unlikely that any vibration arising from the Glenlee Industrial development would have any detrimental effects on the nearest residential receivers within the Menangle Park land release area, given the likely activities to be undertaken with the industrial development and the distances involved.

7.2 AGL gas wells

The Department of Planning has provided Project Approval to AGL Gas Production (Camden) Pty Ltd which permits the drilling of wells in Spring Farm and Menangle Park area (reference: Project Approval, File No. S02/02299, issued 4 September 2008).

The Project Approval permits the drilling of wells MP04, MP05, MP06, MP11, MP19, MP19, MP21, MP22, MP23, MP24,and MP33 in the Menangle Park land release area. The design and surface locations of wells MP04, MP19 and MP21 are subject to special conditions prior to construction, including consultation with Landcom and Campbelltown City Council.

Schedules 2 to 5 of the Project Approval provide a number of conditions which aim to:

- *"prevent, minimise, and/or offset adverse environmental impacts;*
- *set standards and performance measures for acceptable environmental performance;*
- *require regular monitoring and reporting; and*
- *provide for the on-going environmental management of the project."*

It is understood that the Environmental Assessment (EA titled "*Environmental Assessment – Expansion of Stage 2 of the Camden Gas Project Stage 2 Concept Area Spring Farm Project Area Menangle Park Project Area*", Volume 1 and 2 prepared by ENSR Australia Pty Ltd, dated September 2007) submitted to the Department of

Planning for approval considered the impact of construction as well as the operation of the gas wells upon future residential receivers within the Menangle Park land release area.

The Project Approval document provides noise conditions to minimise adverse impacts upon residential receivers during the construction and operation of the gas wells. The Project Approval provides specific noise conditions for:

- Construction and maintenance hours;
- Construction noise goals;
- Construction noise management plan;
- Operational noise criteria;
- Continuous improvements; and
- Noise monitoring program.

The above conditions are designed to maintain the acoustic amenity of nearby sensitive receivers.

Appendix A

Glossary of Acoustic Terminology

Glossary of Acoustical Terminology

The following is a brief description of acoustic terminology used in this report.

Sound power level	The total sound emitted by a source
Sound pressure level	The amount of sound at a specified point
Decibel [dB]	The measurement unit of sound
A Weighted decibels [dB(A])	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows:

0dB(A)	Threshold of human hearing
30dB(A)	A quiet country park
40dB(A)	Whisper in a library
50dB(A)	Open office space
70dB(A)	Inside a car on a freeway
80dB(A)	Outboard motor
90dB(A)	Heavy truck pass-by
100dB(A)	Jackhammer/Subway train
110 dB(A)	Rock Concert
115dB(A)	Limit of sound permitted in industry
120dB(A)	747 take off at 250 metres

Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high pitched sound and a low frequency to a low pitched sound.
Equivalent continuous sound level [L_{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.
L_{max}	The maximum sound pressure level measured over the measurement period
L_{min}	The minimum sound pressure level measured over the measurement period
L_{10}	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L_{10}.
L_{90}	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L_{90}.
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.

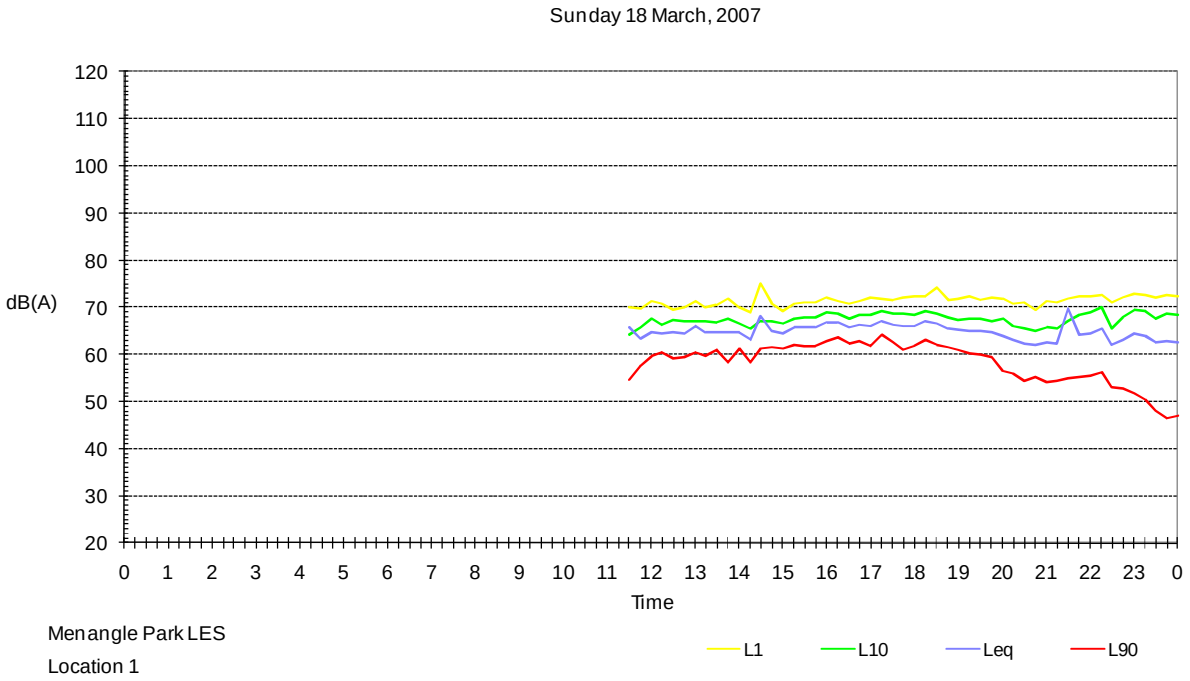
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Day	The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays.
Evening	The period from 1800 to 2200 h Monday to Sunday and Public Holidays.
Night	The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays.
Assessment background level [ABL]	The overall background level for each day, evening and night period for **each day** of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the **entire length** of noise monitoring.

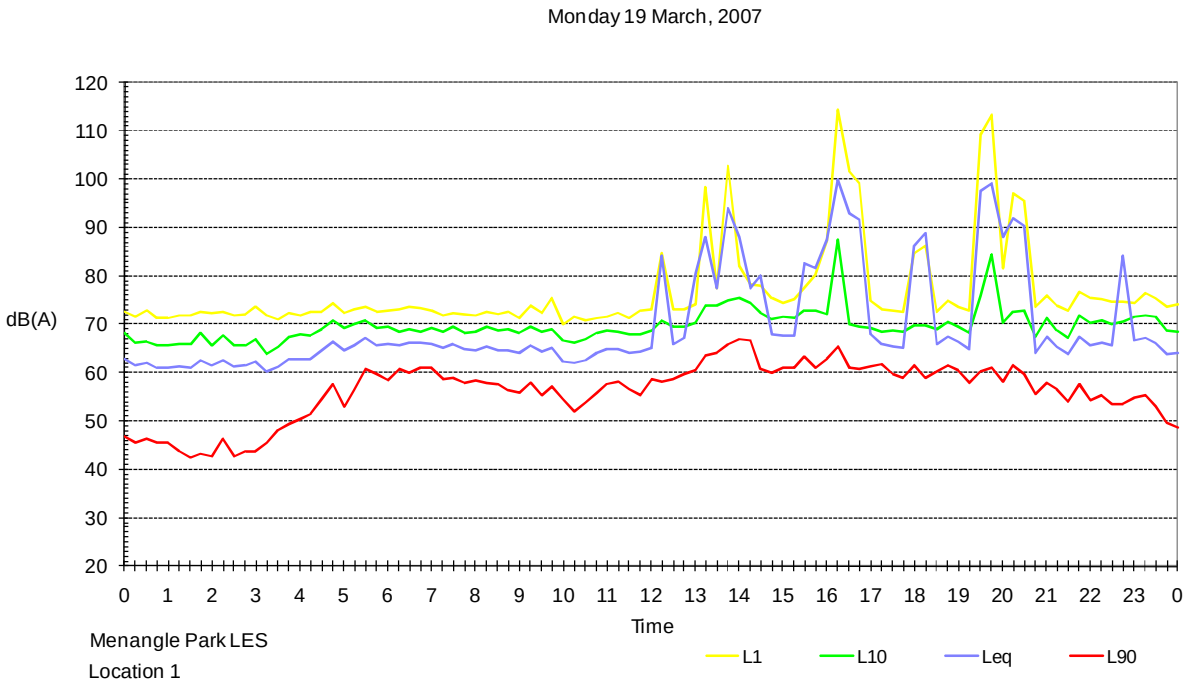
*Definitions of a number of terms have been adapted from Australian Standard AS1633:1985 *"Acoustics – Glossary of terms and related symbols"*, the DECCW's NSW Industrial Noise Policy and the DECCW's Environmental Criteria for Road Traffic Noise.

Appendix B

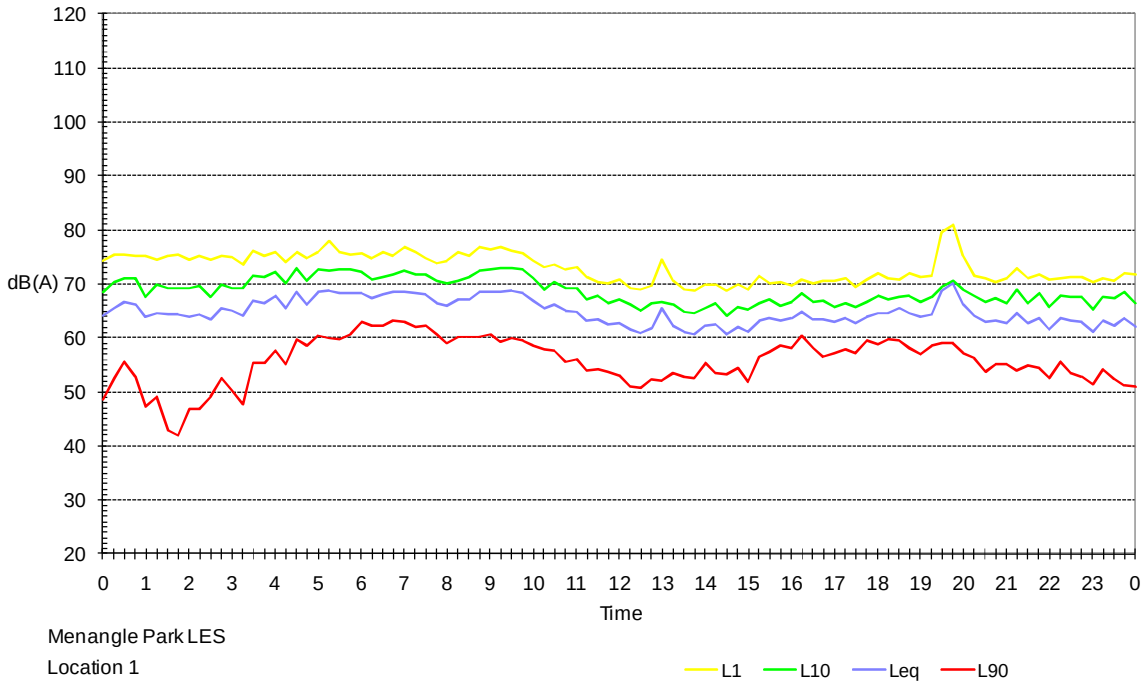
Noise Logger Graphs

B1 - Location 1



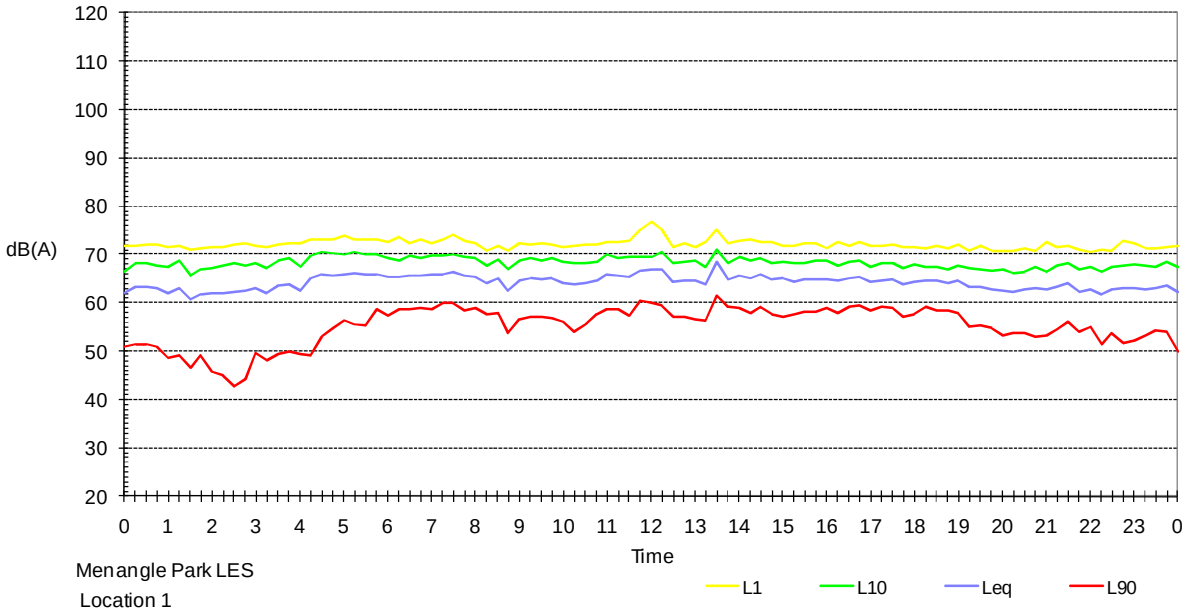


Tuesday 20 March, 2007

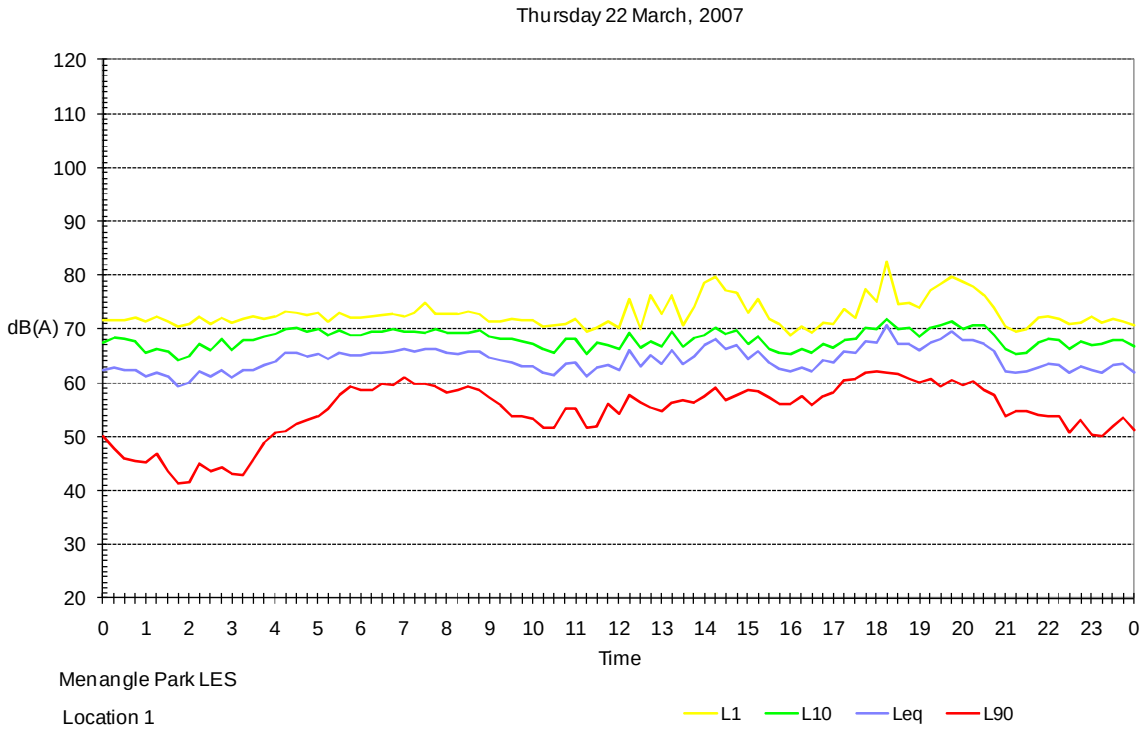


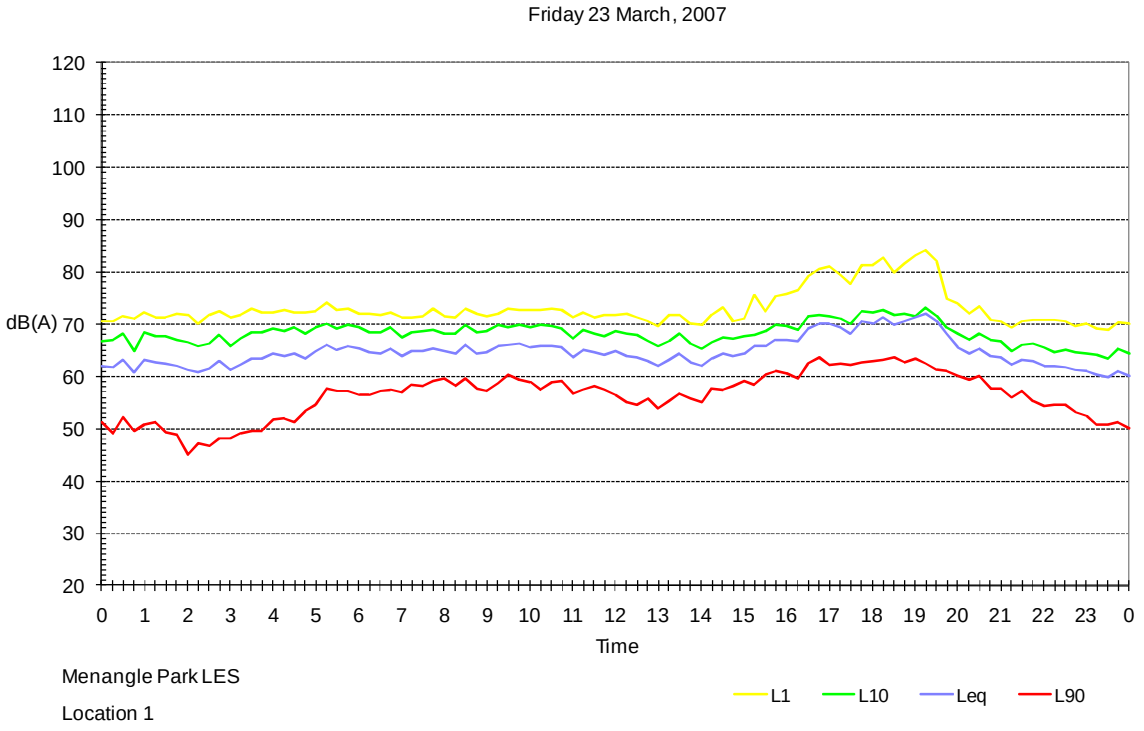
Menangle Park LES
Location 1

Wednesday 21 March, 2007



Menangle Park LES
Location 1


Thursday 22 March, 2007
120
110
100
90
80
dB(A) 70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 1
L1
L10
Leq
L90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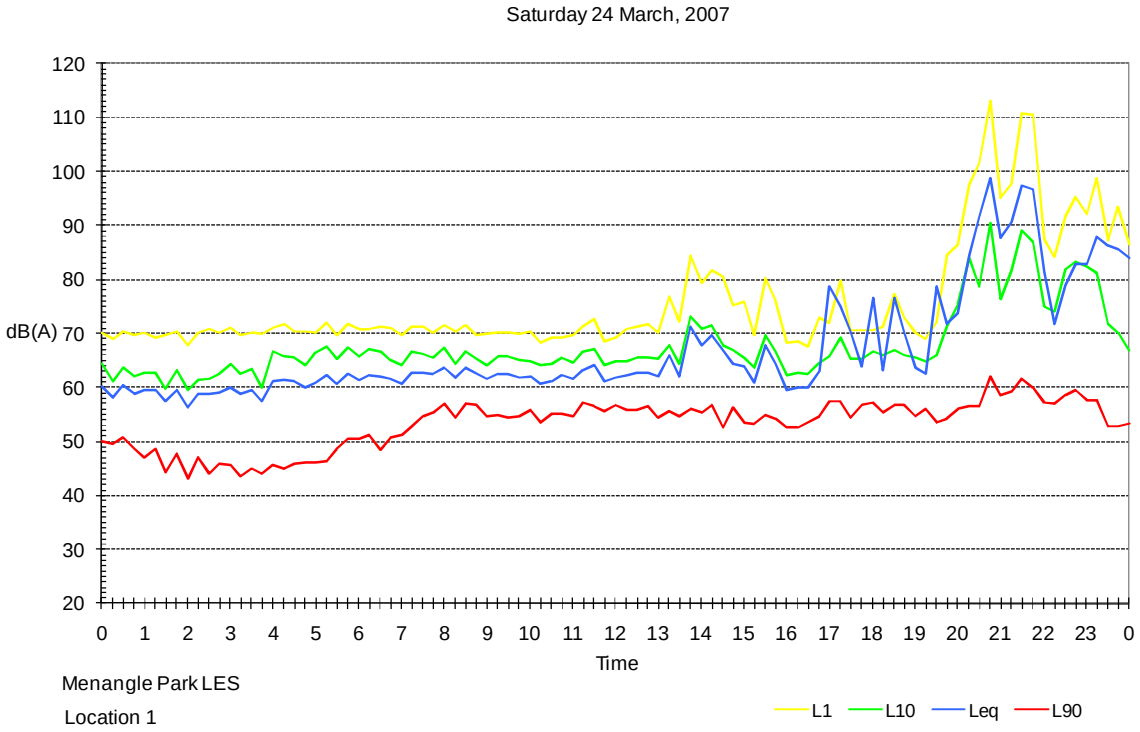
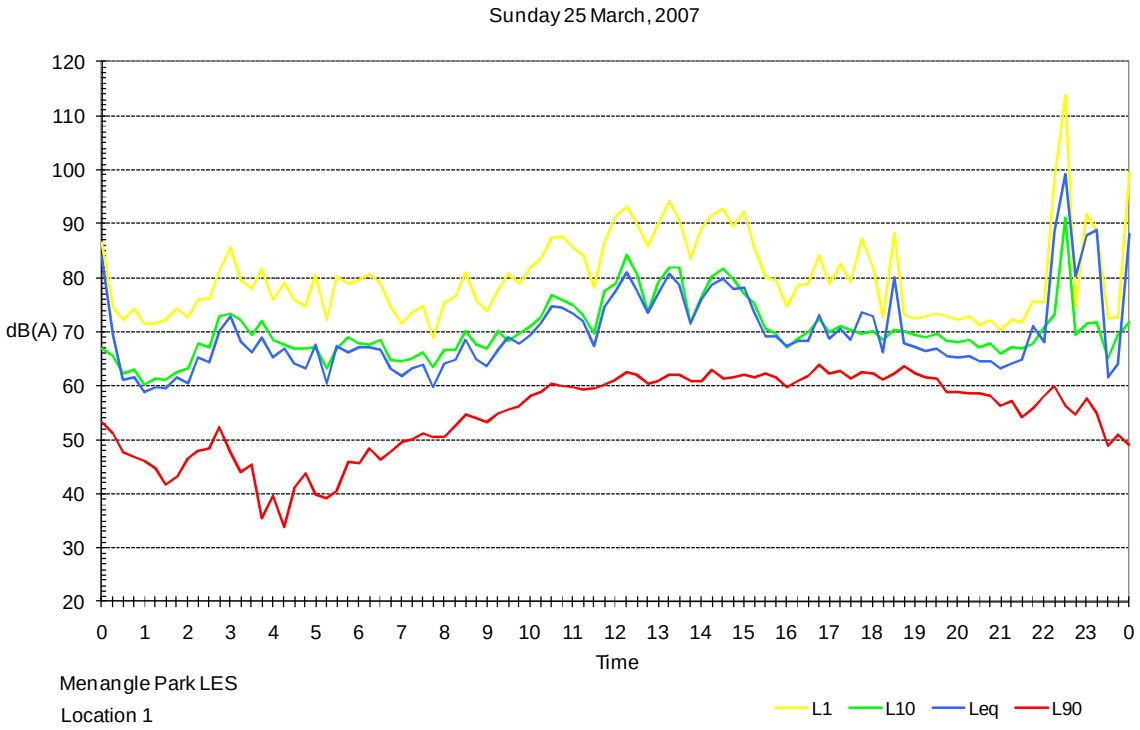
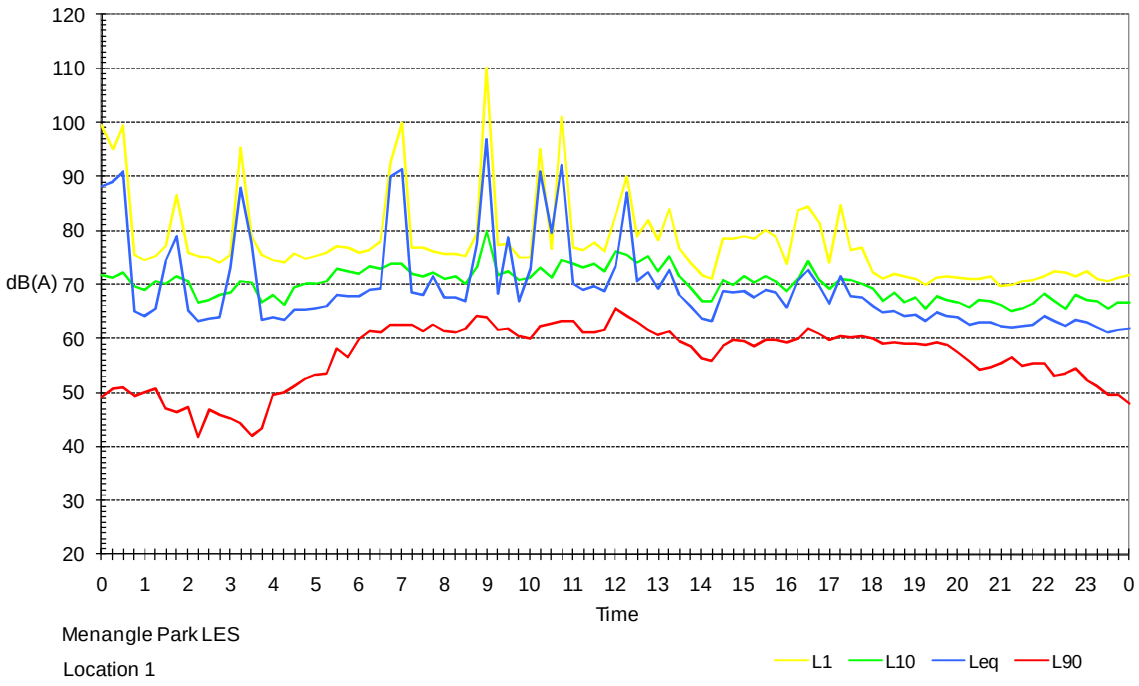
120
110
100
90
80
dB(A) 70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 1
L1
L10
Leq
L90


Saturday 24 March, 2007
120
110
100
90
80
dB(A) 70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 1
L1
L10
Leq
L90

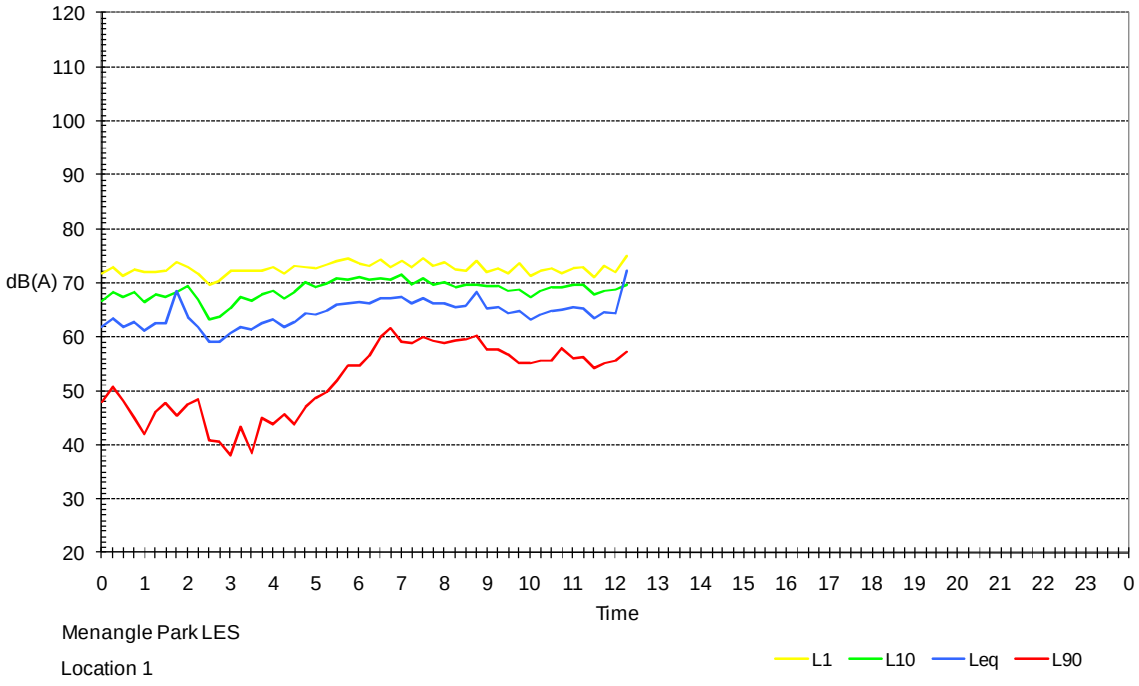

Sunday 25 March, 2007
120
110
100
90
80
dB(A) 70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 1
L1
L10
Leq
L90

Monday 26 March, 2007



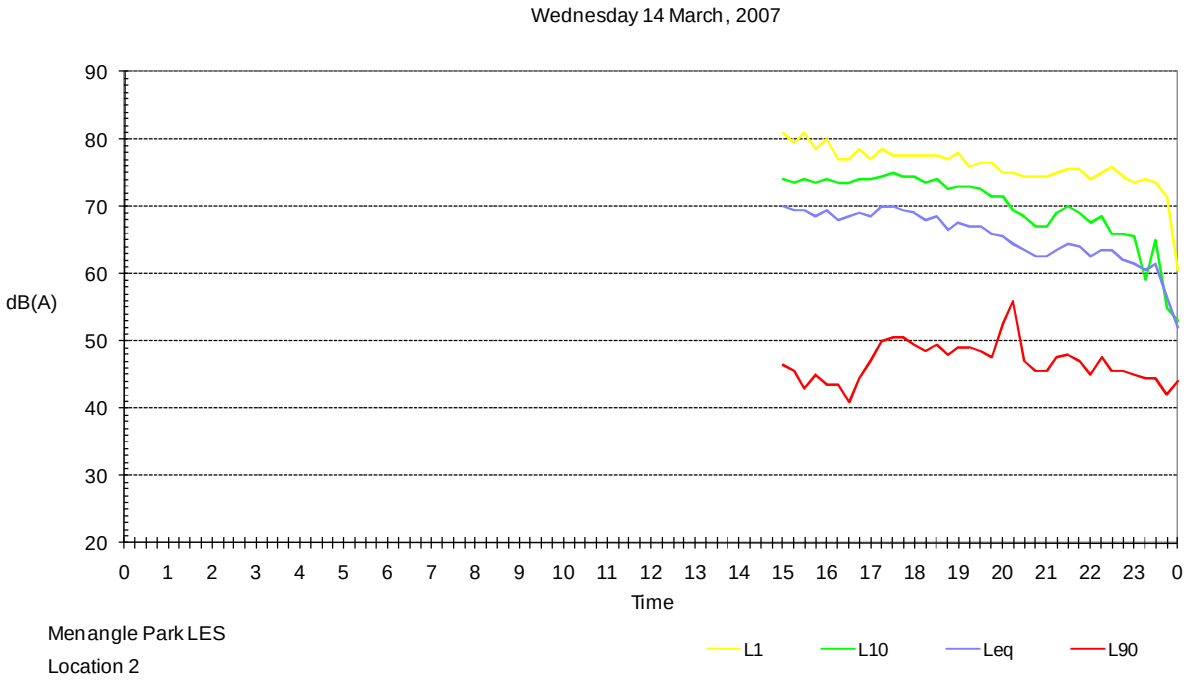
Menangle Park LES
Location 1

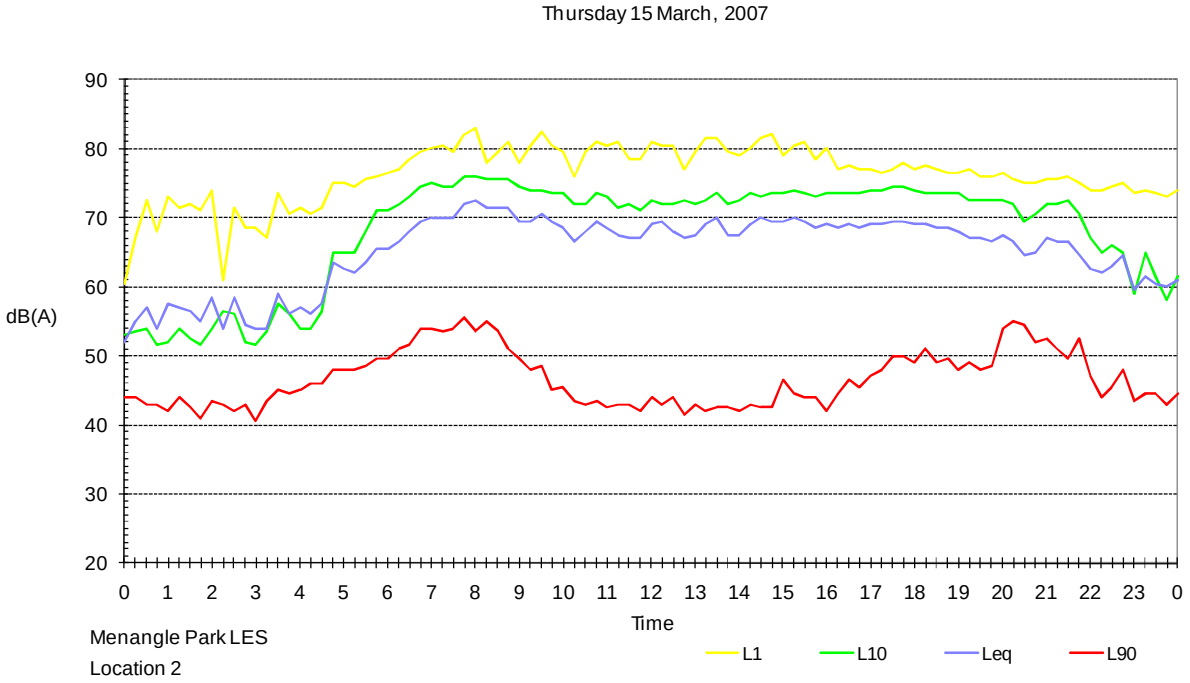
Tuesday 27 March, 2007

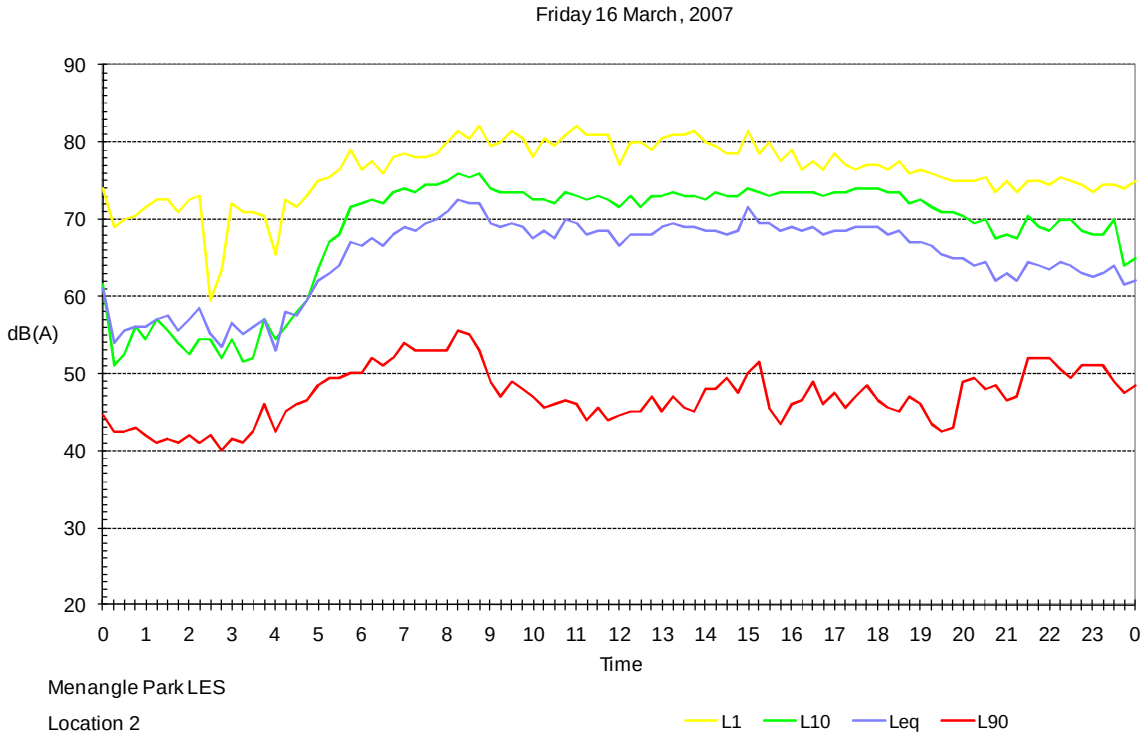


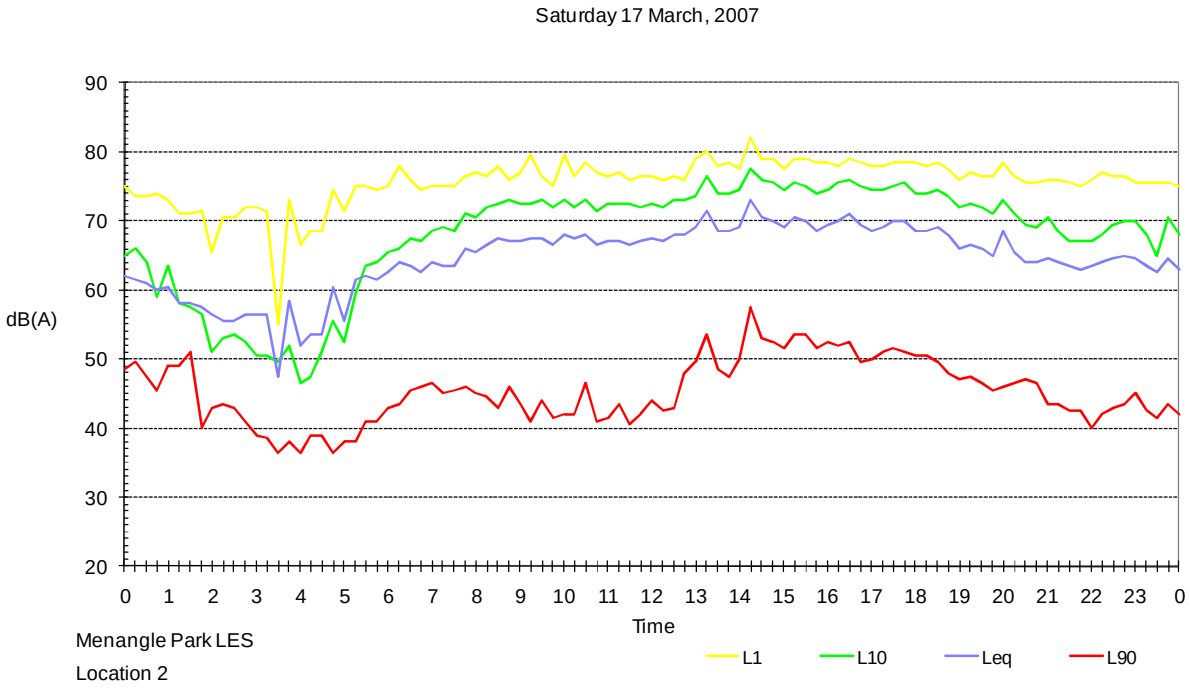
Menangle Park LES
Location 1

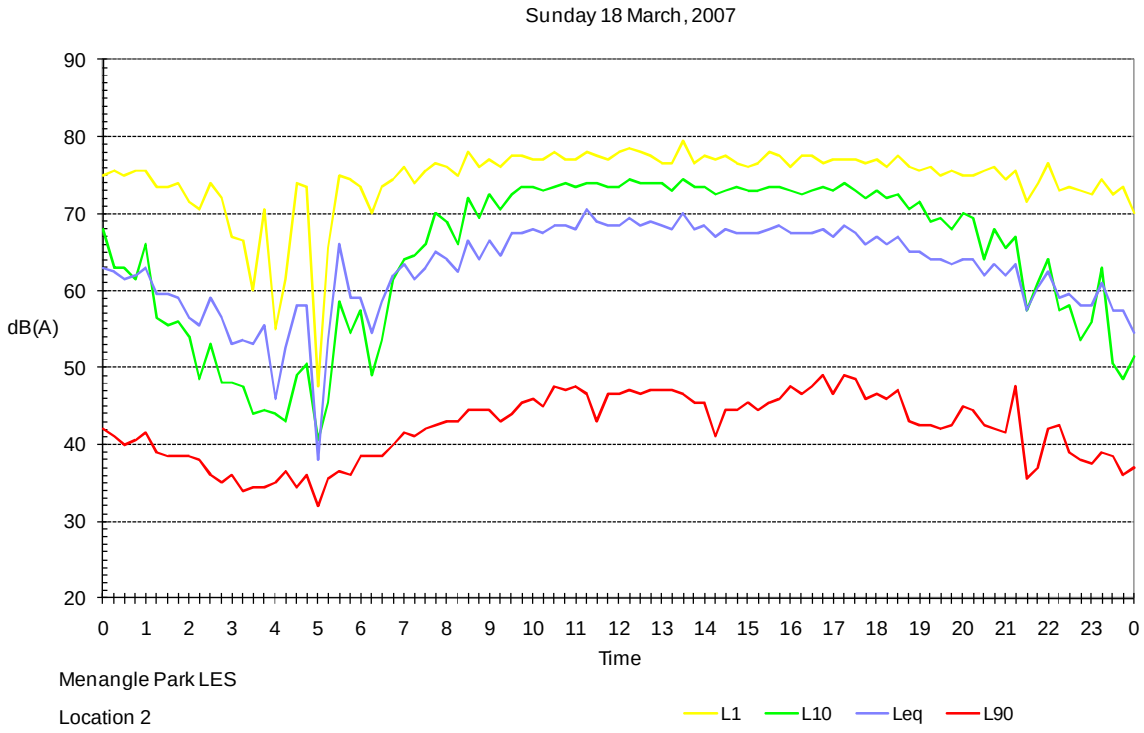
B2 - Location 2

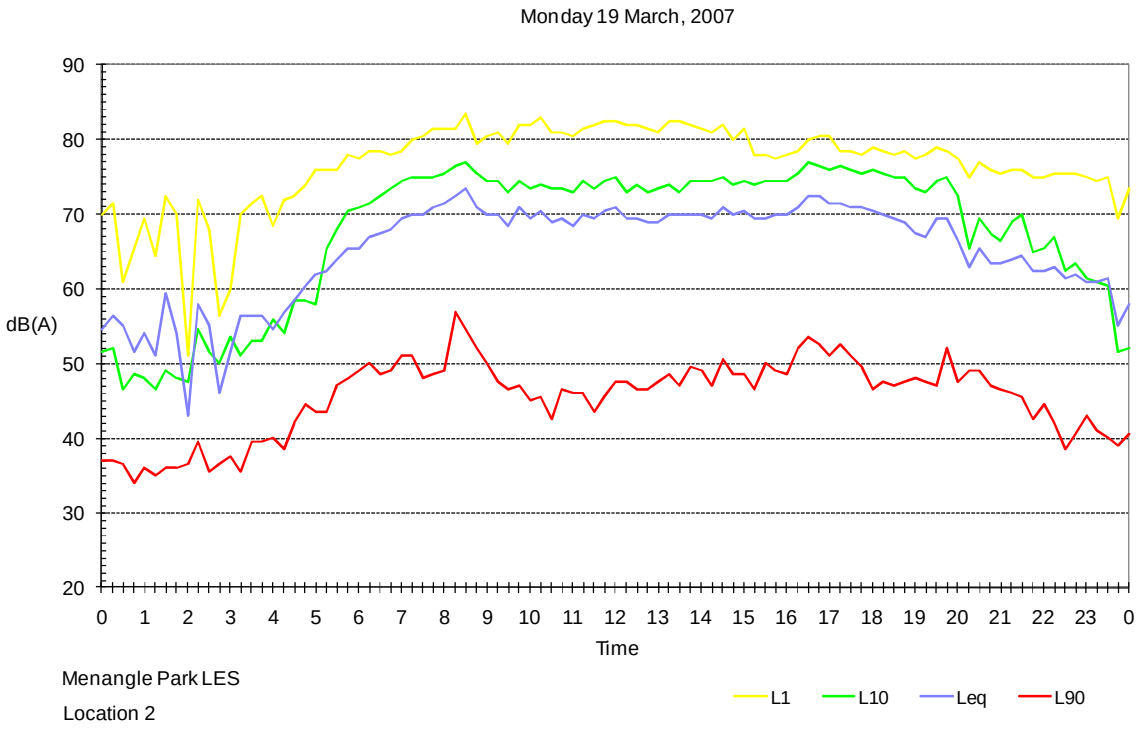


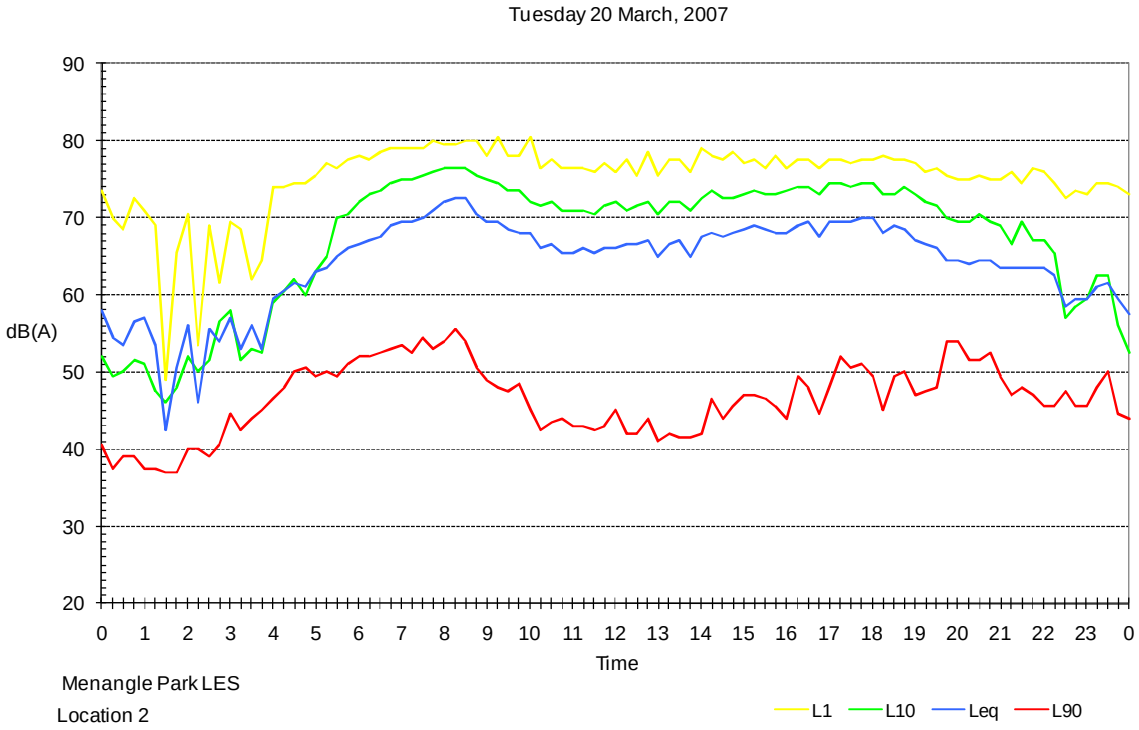



Friday 16 March, 2007
dB(A)
Time
Menangle Park LES
Location 2
L1
L10
Leq
L90


Saturday 17 March, 2007
dB(A)
Time
Menangle Park LES
Location 2
L1
L10
Leq
L90


Sunday 18 March, 2007
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 2
L1
L10
Leq
L90


Monday 19 March, 2007
90
80
70
60
50
40
30
20
dB(A)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 2
L1
L10
Leq
L90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dB(A)
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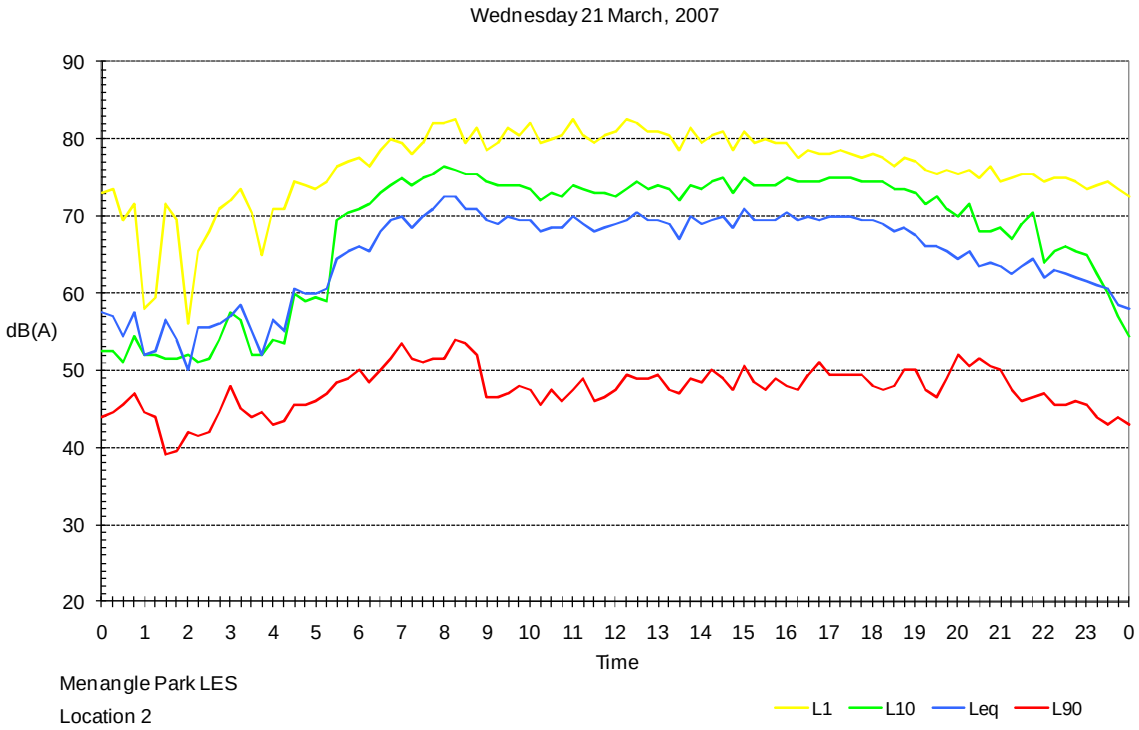
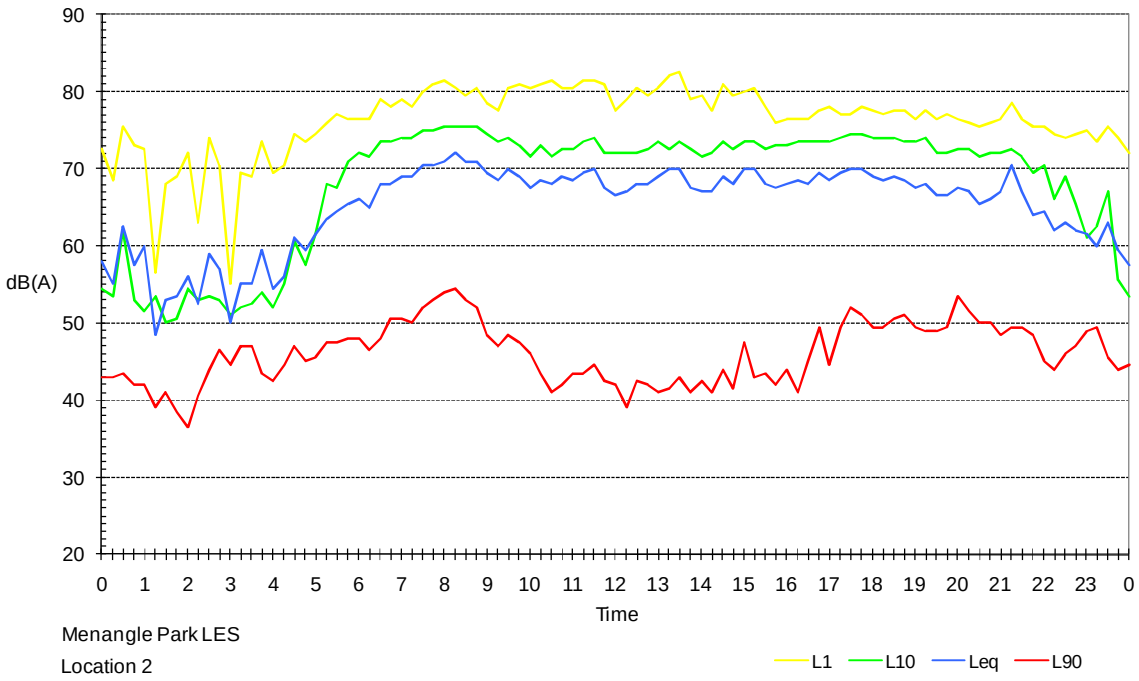
80
70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 2
L1
L10
Leq
L90

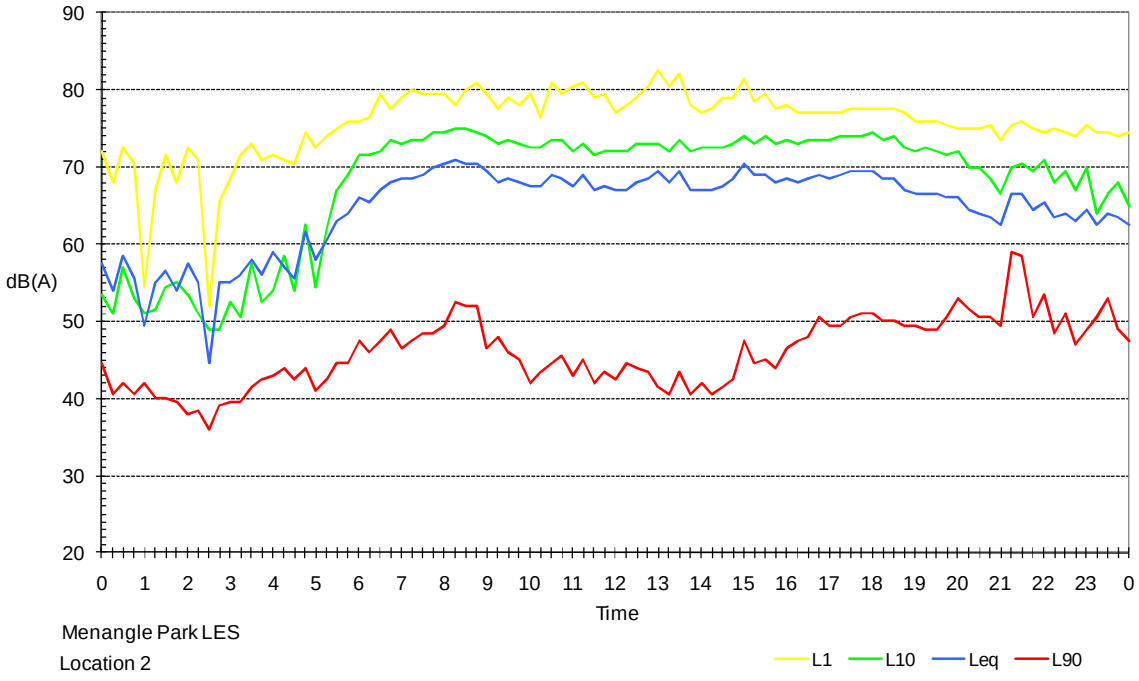

Wednesday 21 March, 2007
dB(A)
90
80
70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 2
L1
L10
Leq
L90

Thursday 22 March, 2007

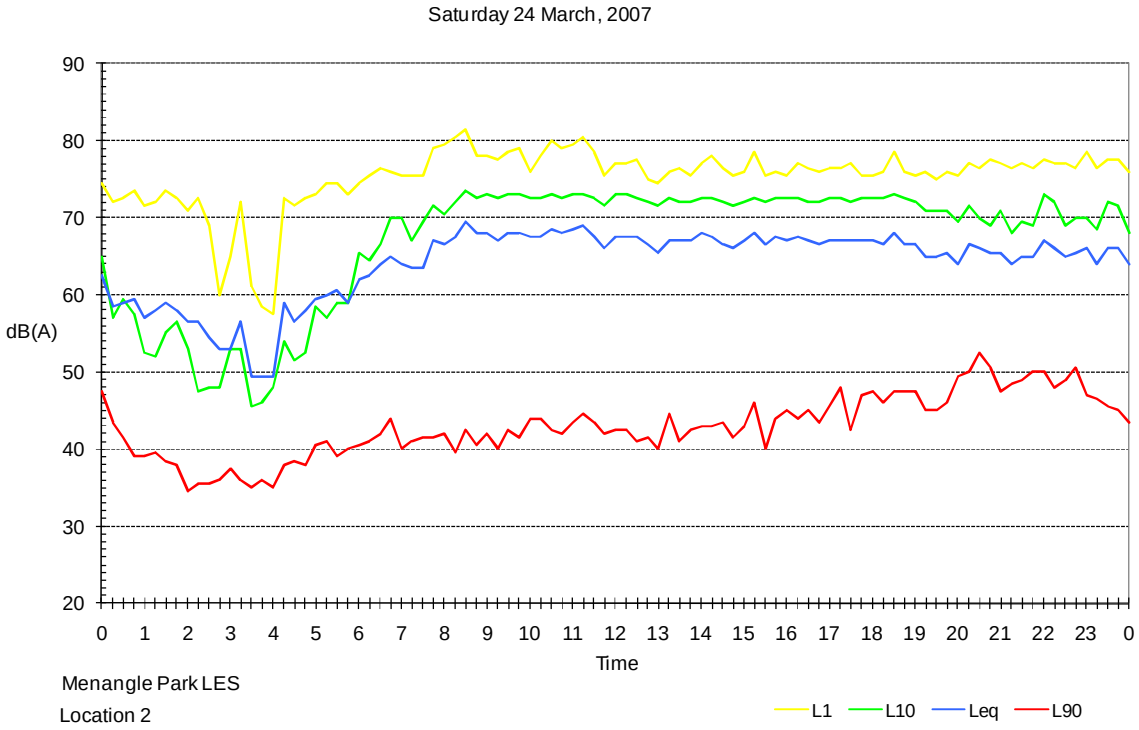


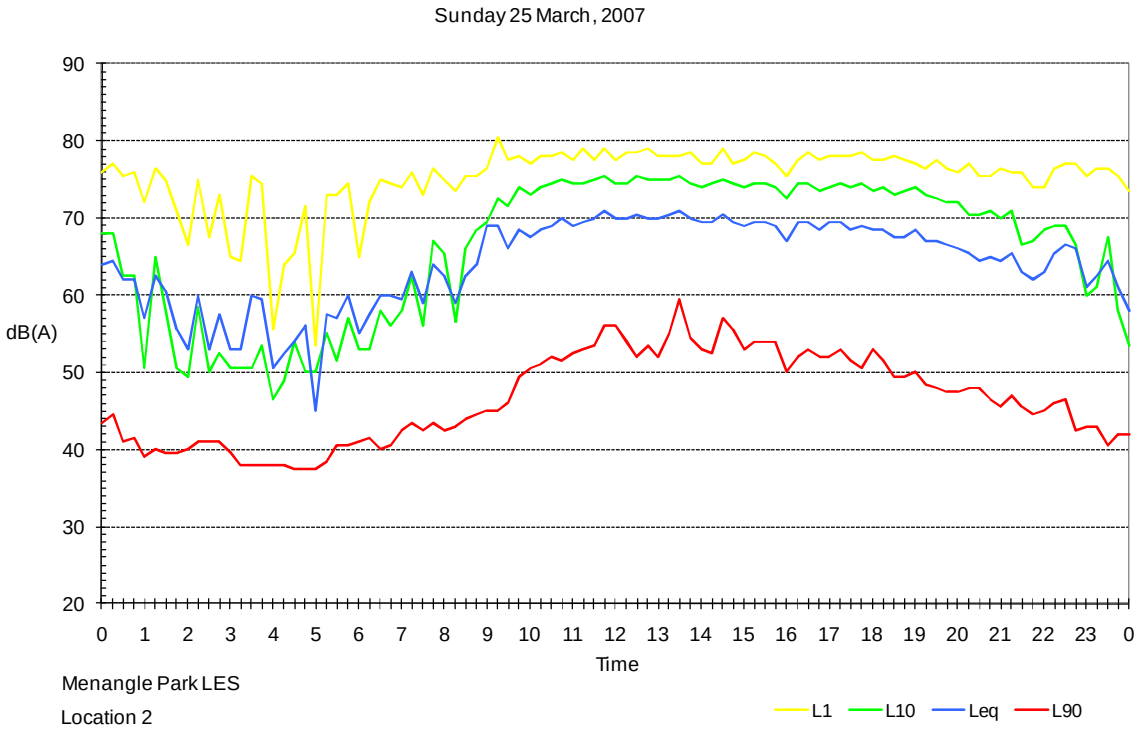
Menangle Park LES
Location 2

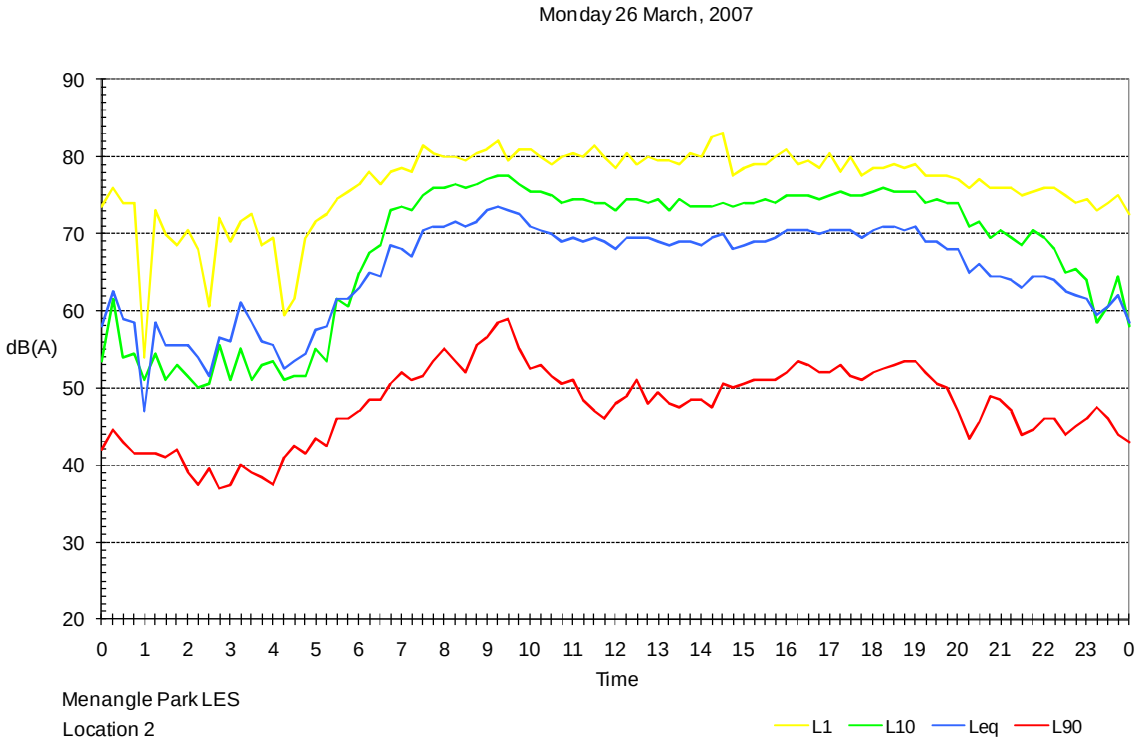
Friday 23 March, 2007

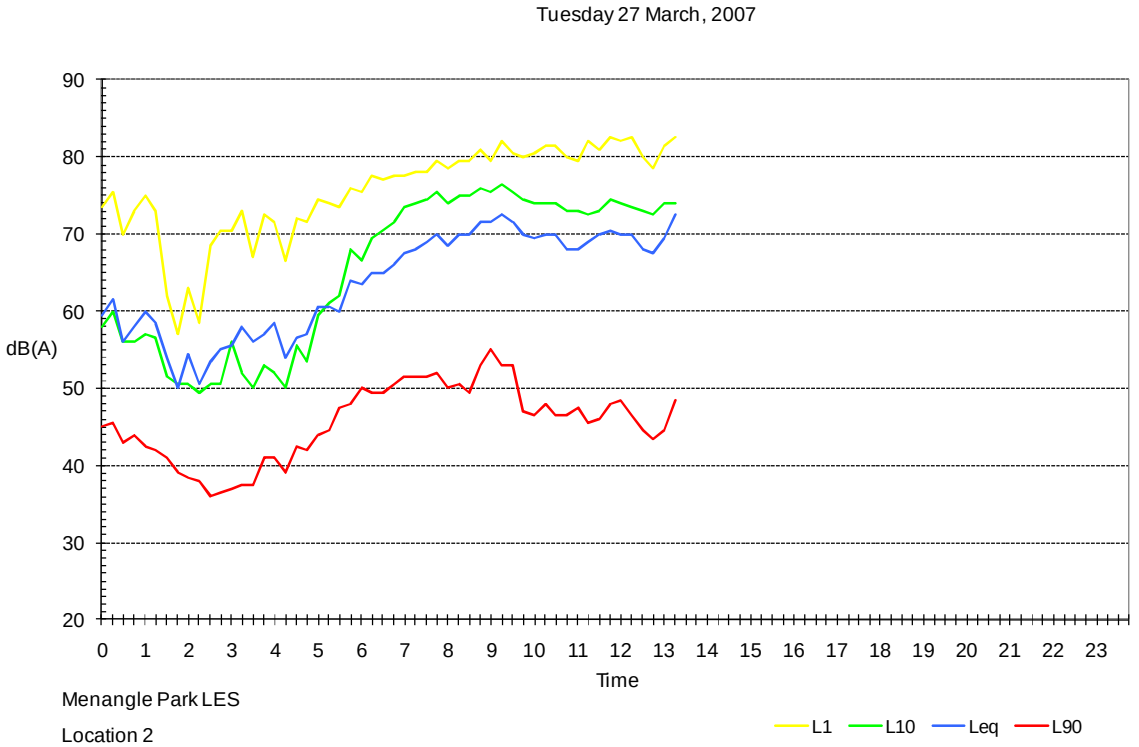


Menangle Park LES
Location 2

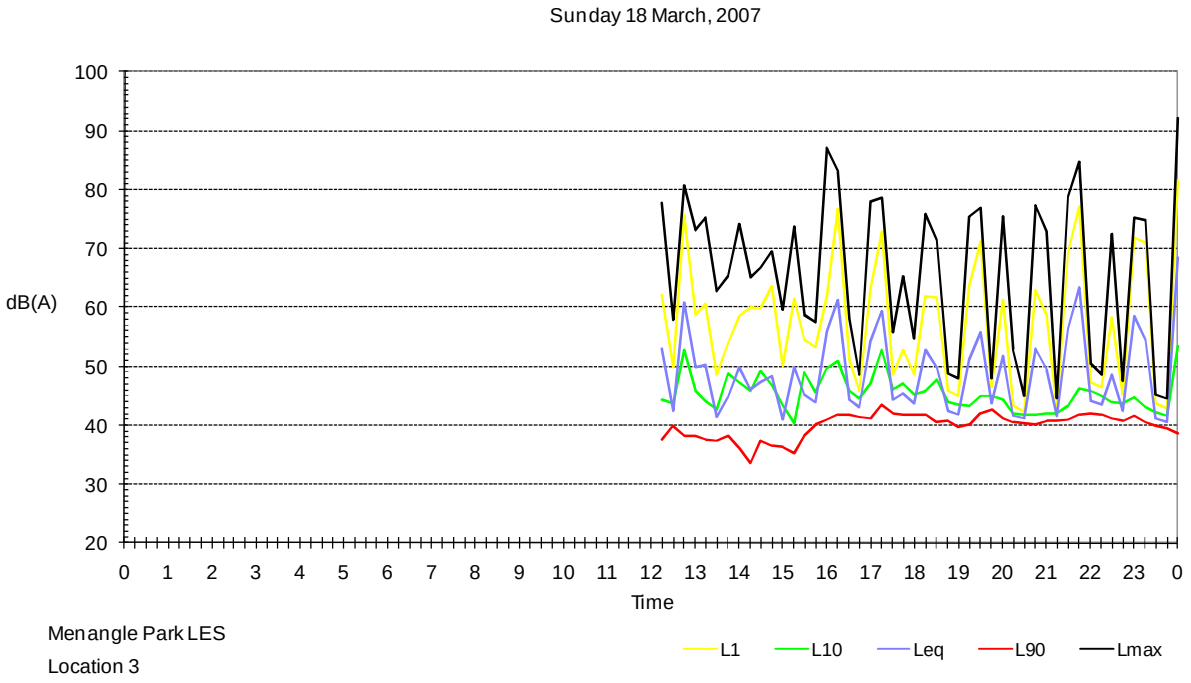

Saturday 24 March, 2007
dB(A)
90
80
70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 2
L1
L10
Leq
L90

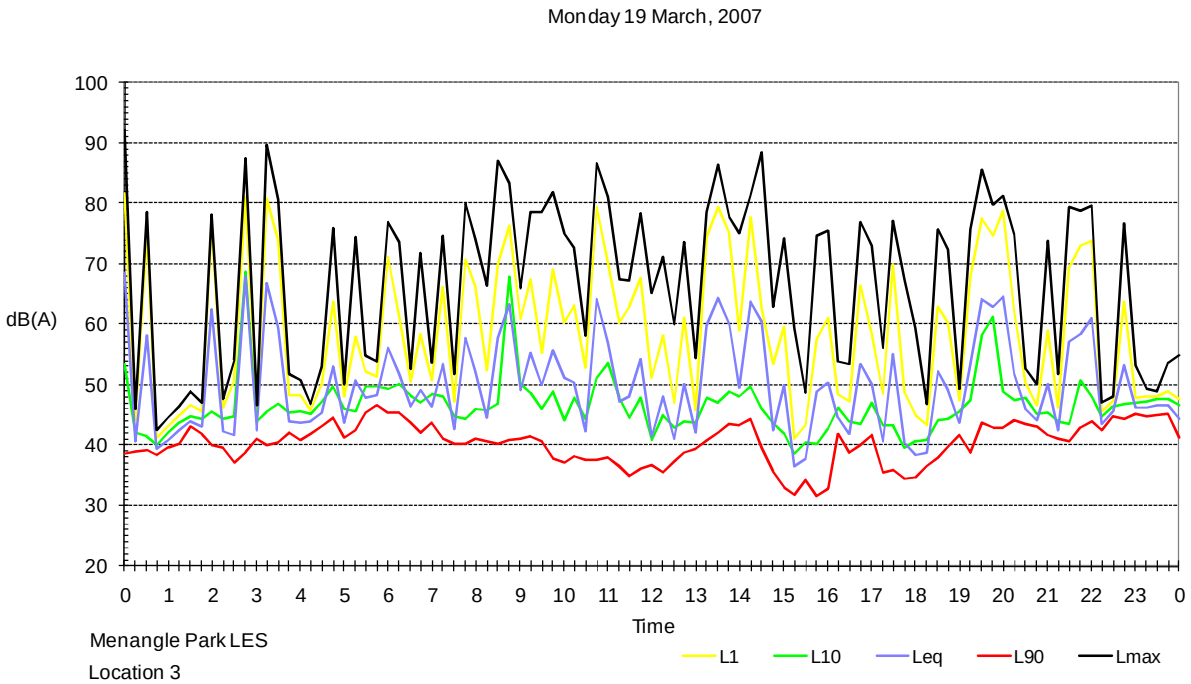

Sunday 25 March, 2007
dB(A)
90
80
70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 2
L1
L10
Leq
L90

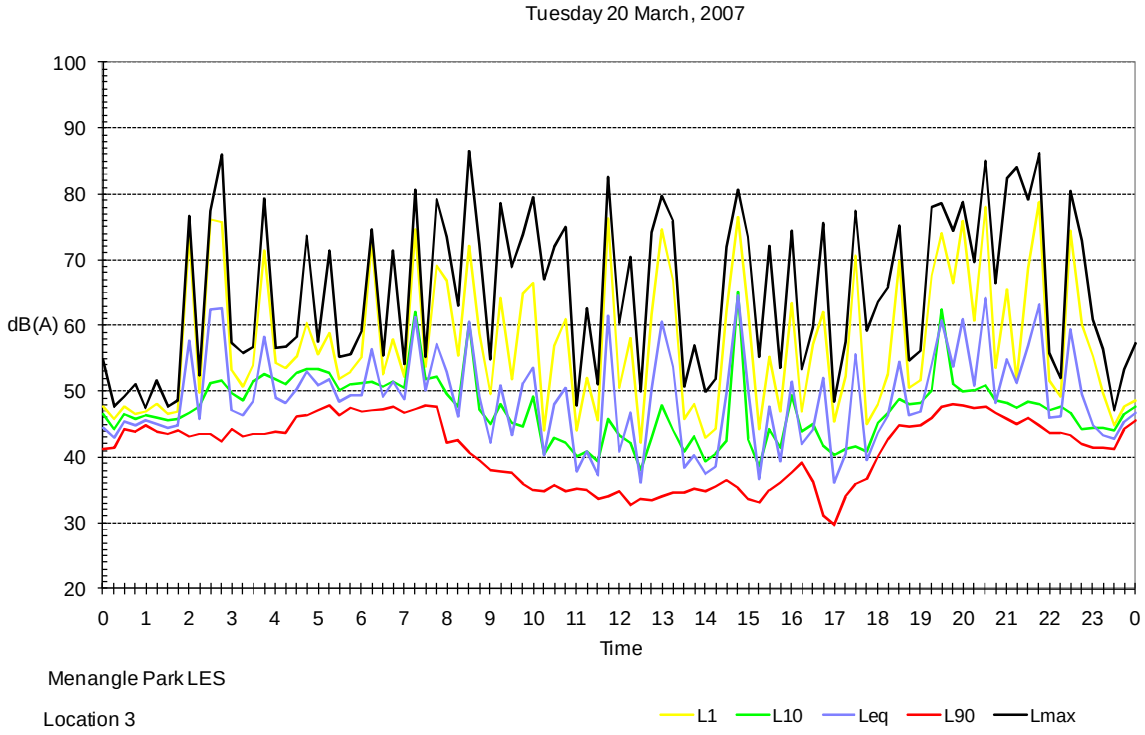

Monday 26 March, 2007
dB(A)
Time
Menangle Park LES
Location 2
L1
L10
Leq
L90

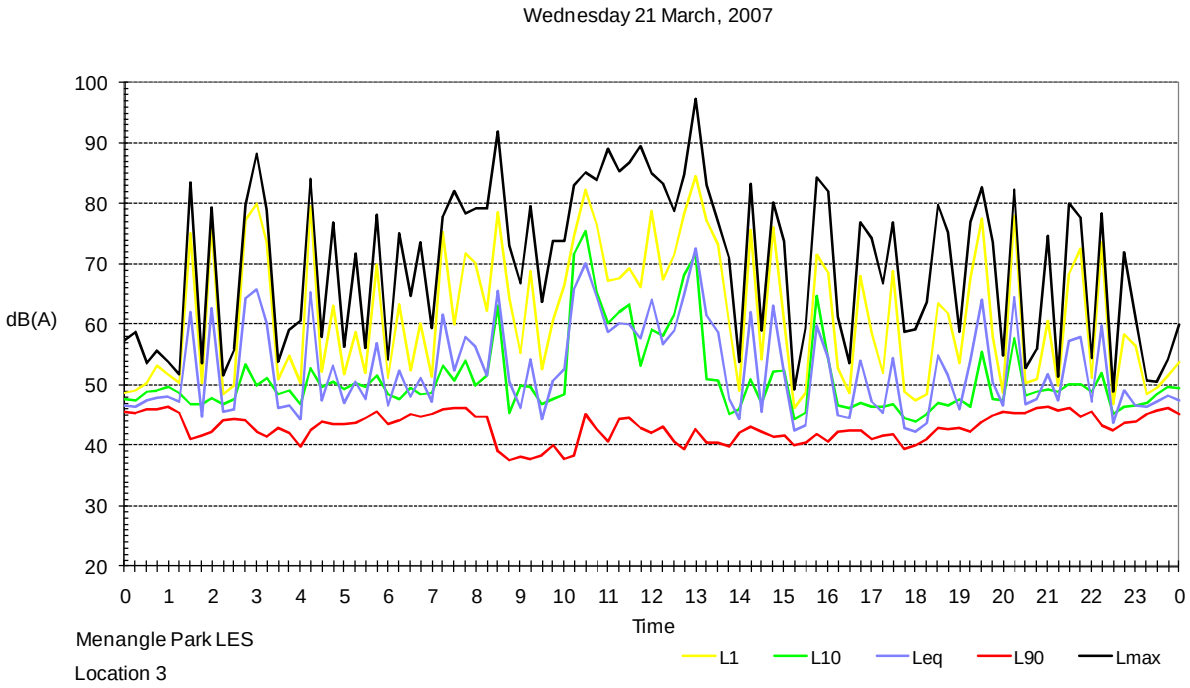

Tuesday 27 March, 2007
dB(A)
Time
Menangle Park LES
Location 2
L1
L10
Leq
L90

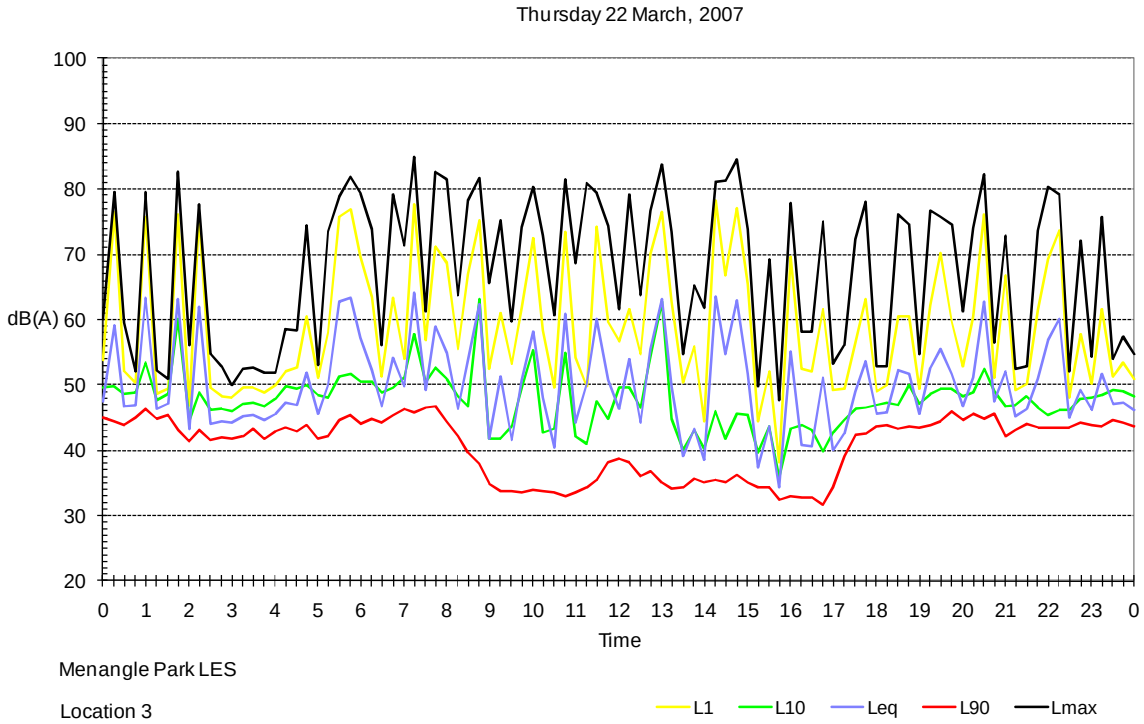
B3 - Location 3

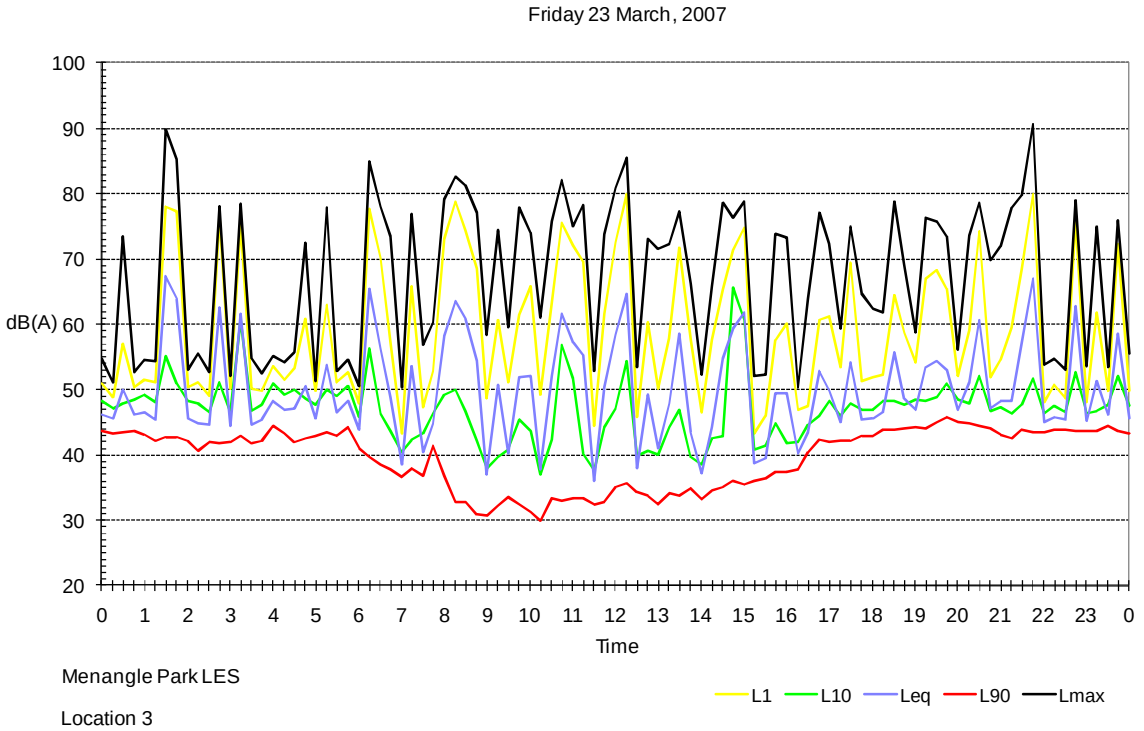


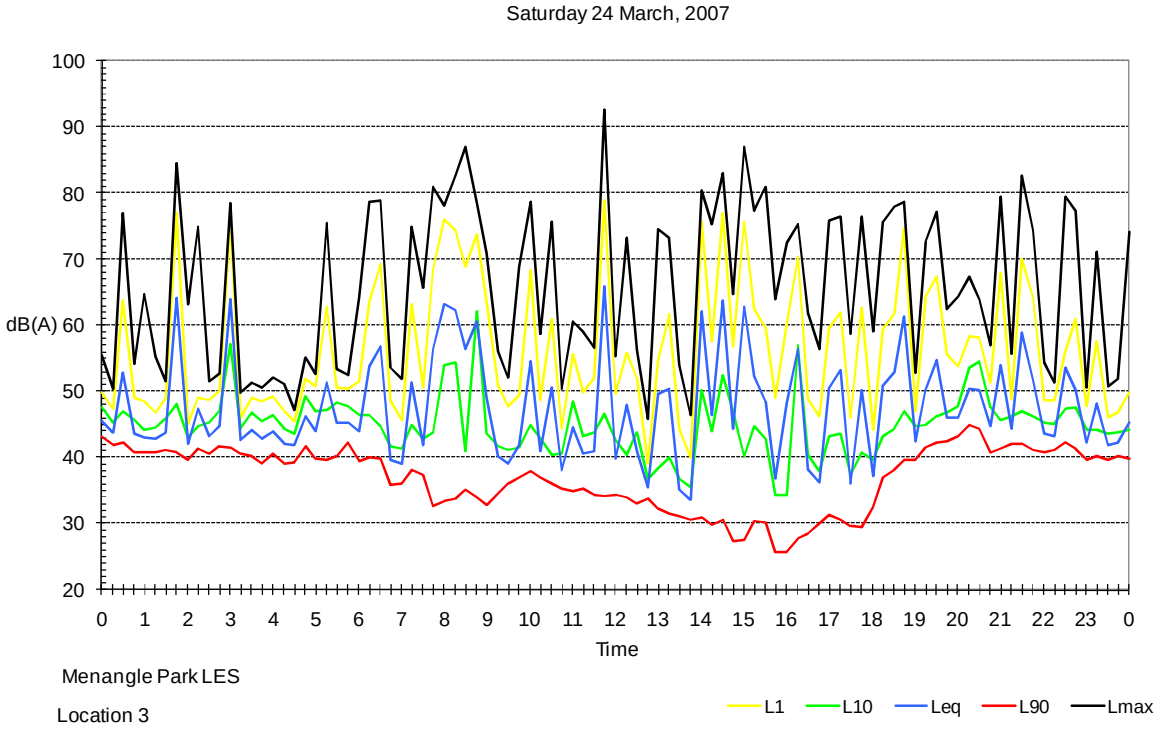


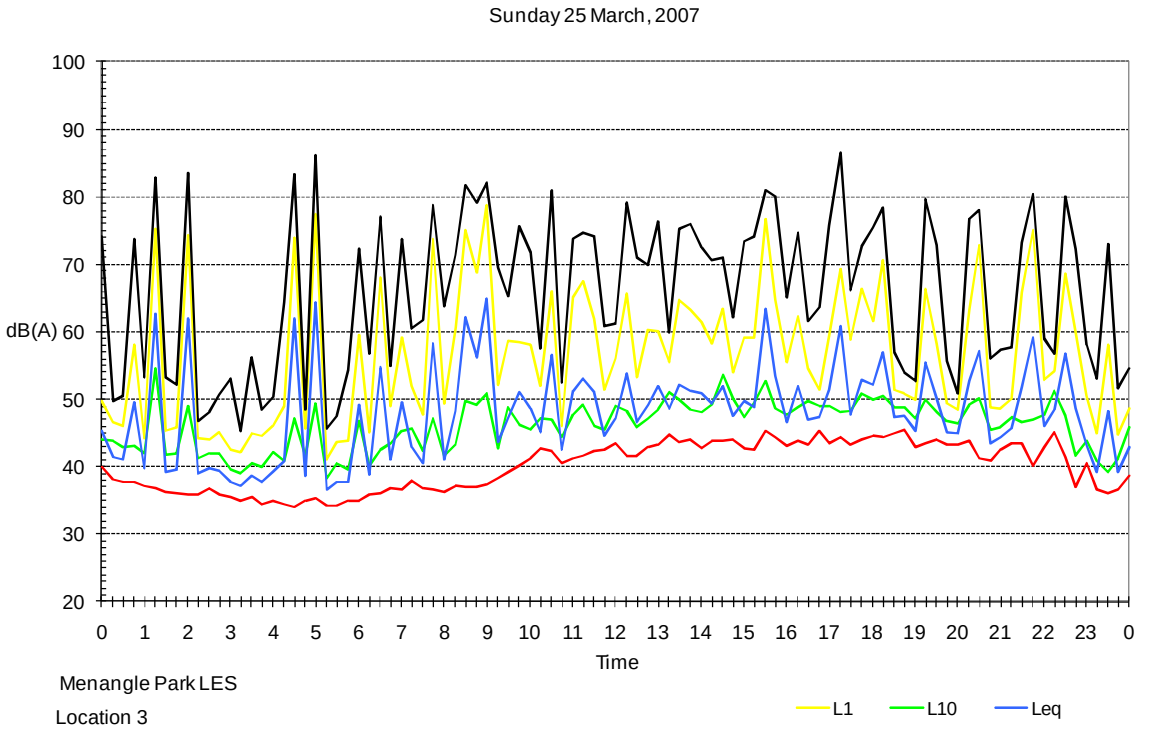

Tuesday 20 March, 2007
dB(A)
Time
Menangle Park LES
Location 3
L1
L10
Leq
L90
Lmax


Wednesday 21 March, 2007
dB(A)
Time
Menangle Park LES
Location 3
L1
L10
Leq
L90
Lmax

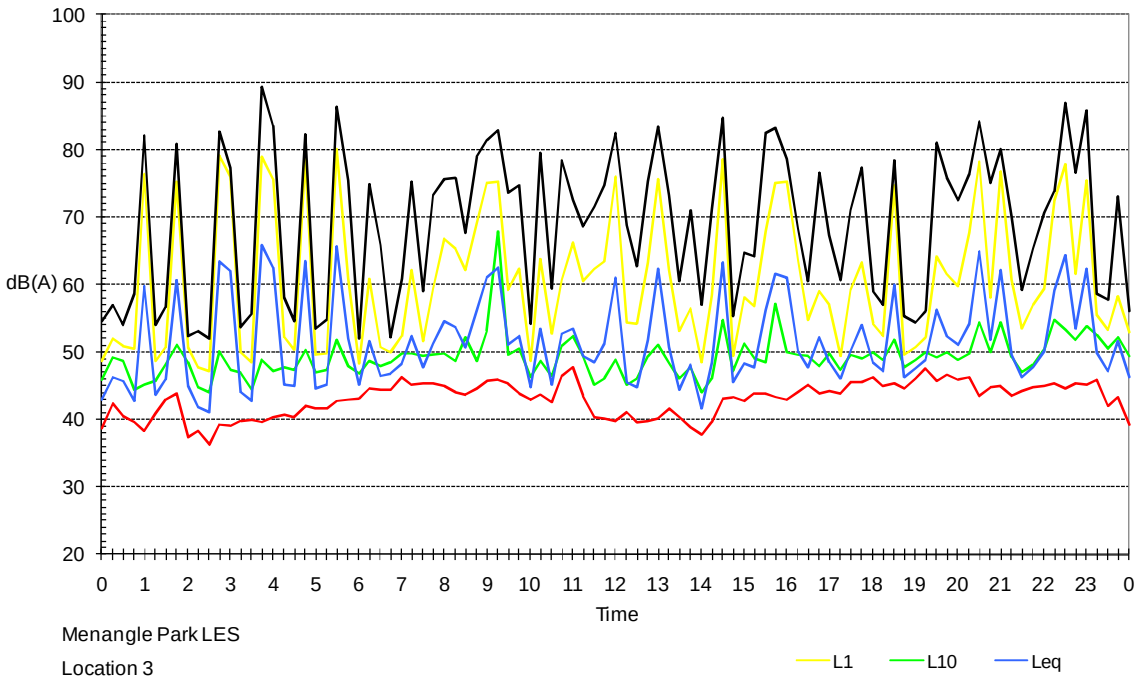

Thursday 22 March, 2007
dB(A)
Time
Menangle Park LES
Location 3
L1
L10
Leq
L90
Lmax


Friday 23 March, 2007
dB(A)
Time
Menangle Park LES
Location 3
L1
L10
Leq
L90
Lmax


Saturday 24 March, 2007
100
90
80
70
dB(A) 60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 3
L1
L10
Leq
L90
Lmax


Sunday 25 March, 2007
100
90
80
70
dB(A) 60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 3
L1
L10
Leq

Monday 26 March, 2007



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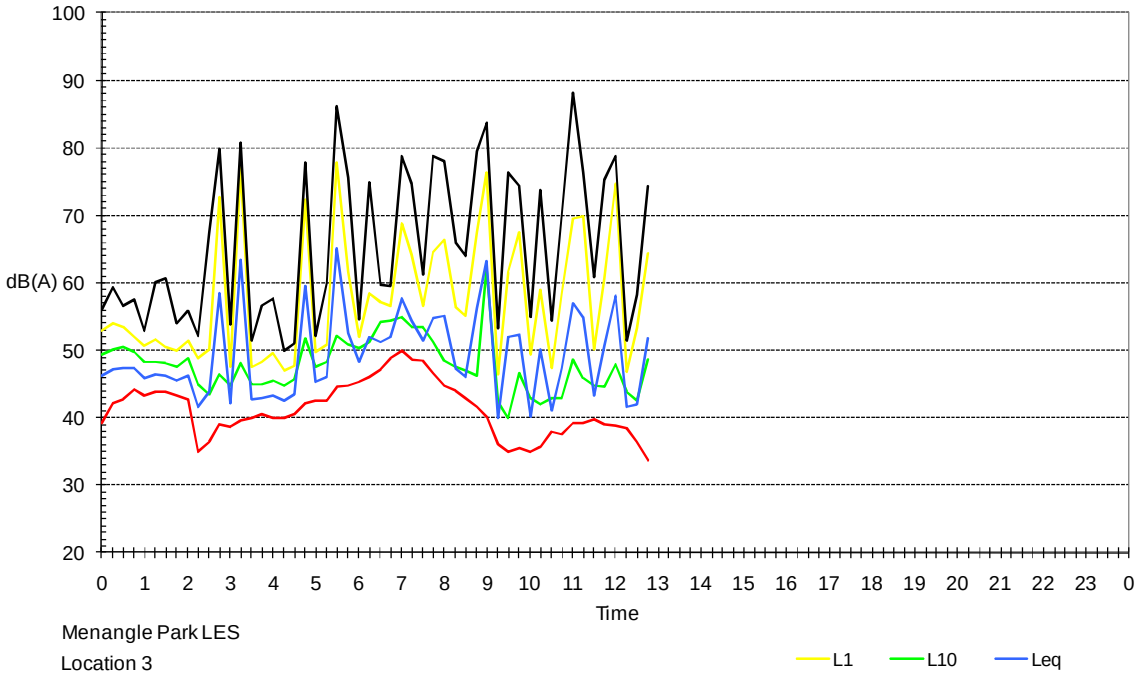
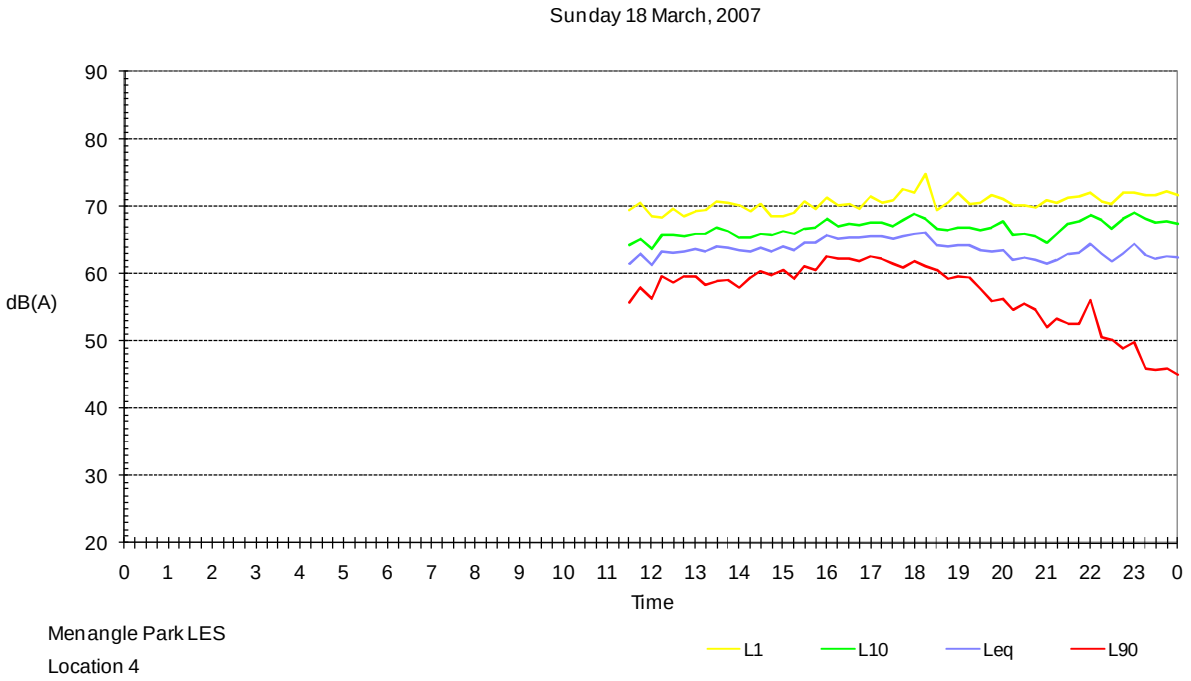
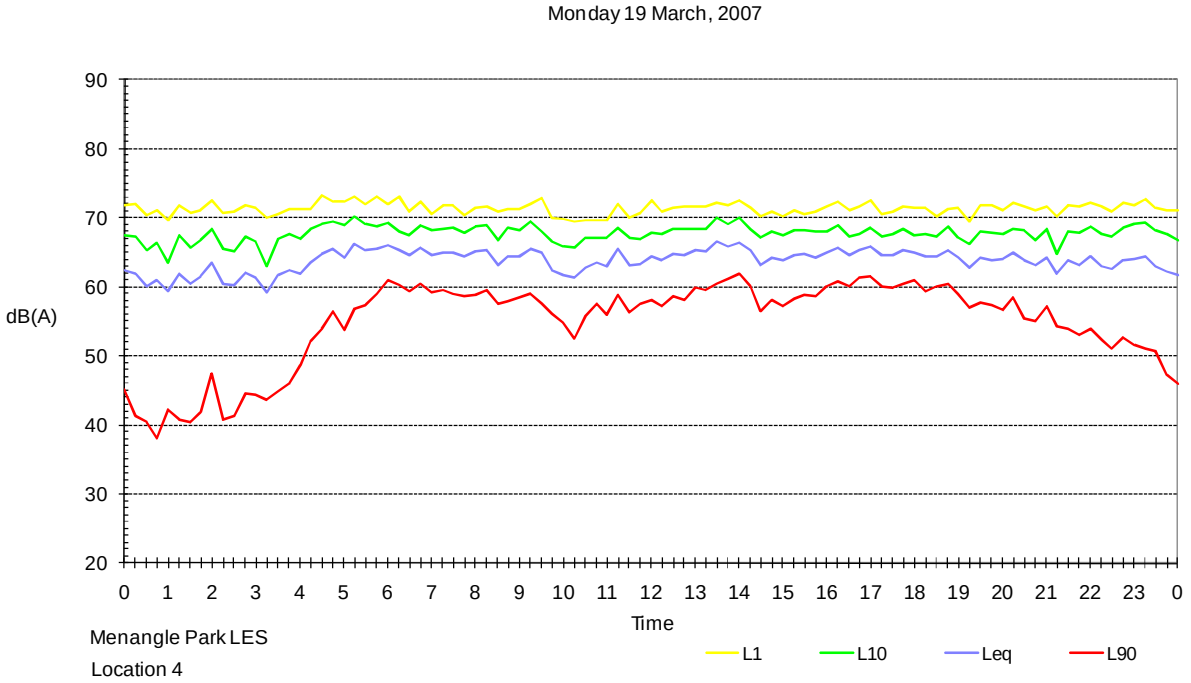
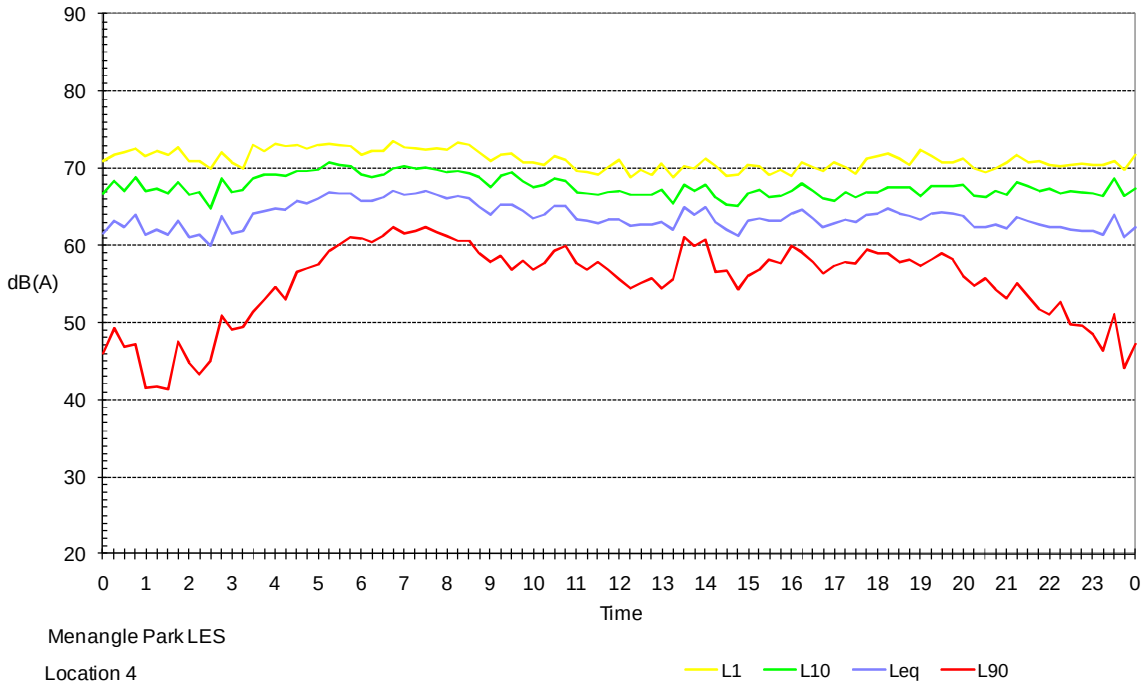


B4 - Location 4



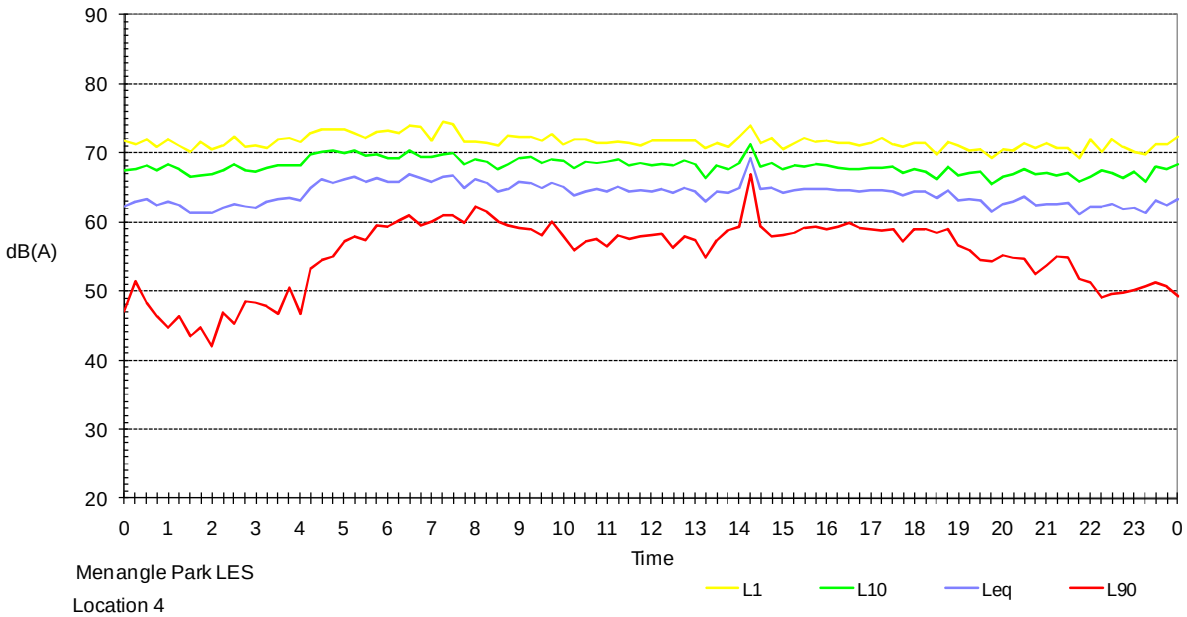


Tuesday 20 March, 2007

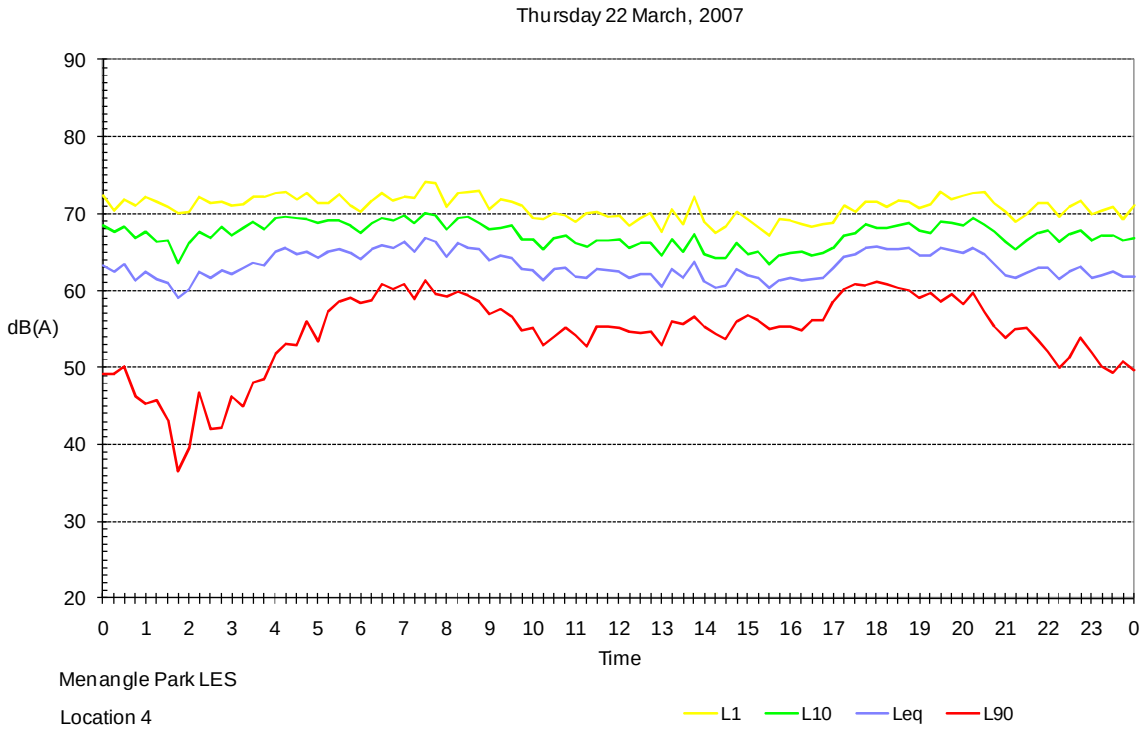


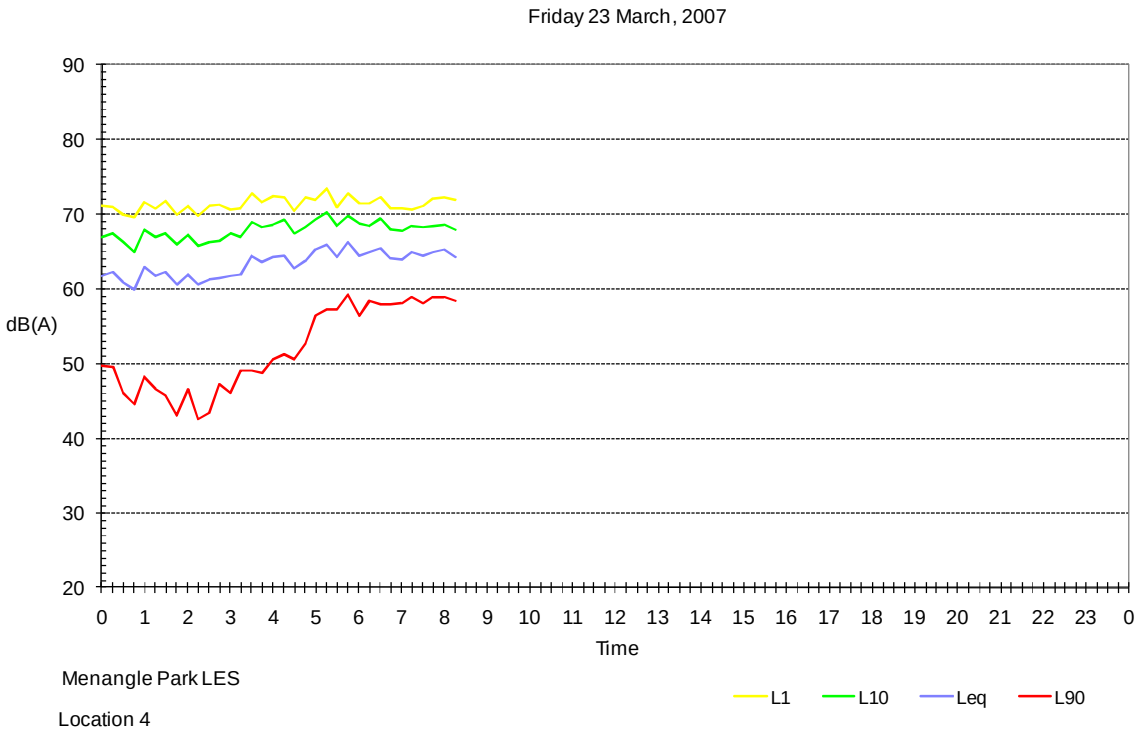
Menangle Park LES
Location 4

Wednesday 21 March, 2007



Menangle Park LES
Location 4

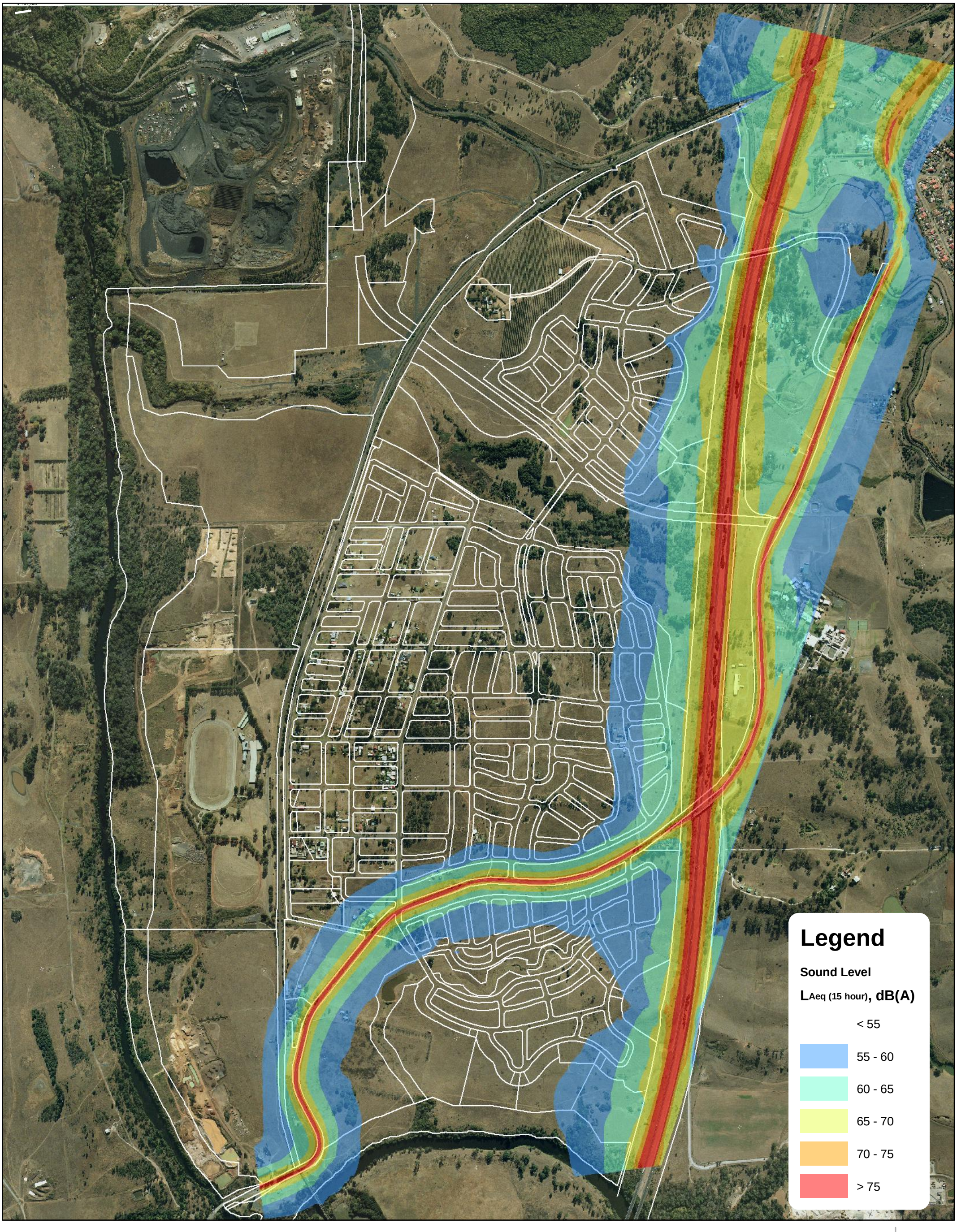

Thursday 22 March, 2007
dB(A)
90
80
70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 4
L1
L10
Leq
L90


Friday 23 March, 2007
dB(A)
90
80
70
60
50
40
30
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 0
Time
Menangle Park LES
Location 4
L1
L10
Leq
L90

Appendix C

Noise Emission Contours

AECOM



Menangle Park Land Release

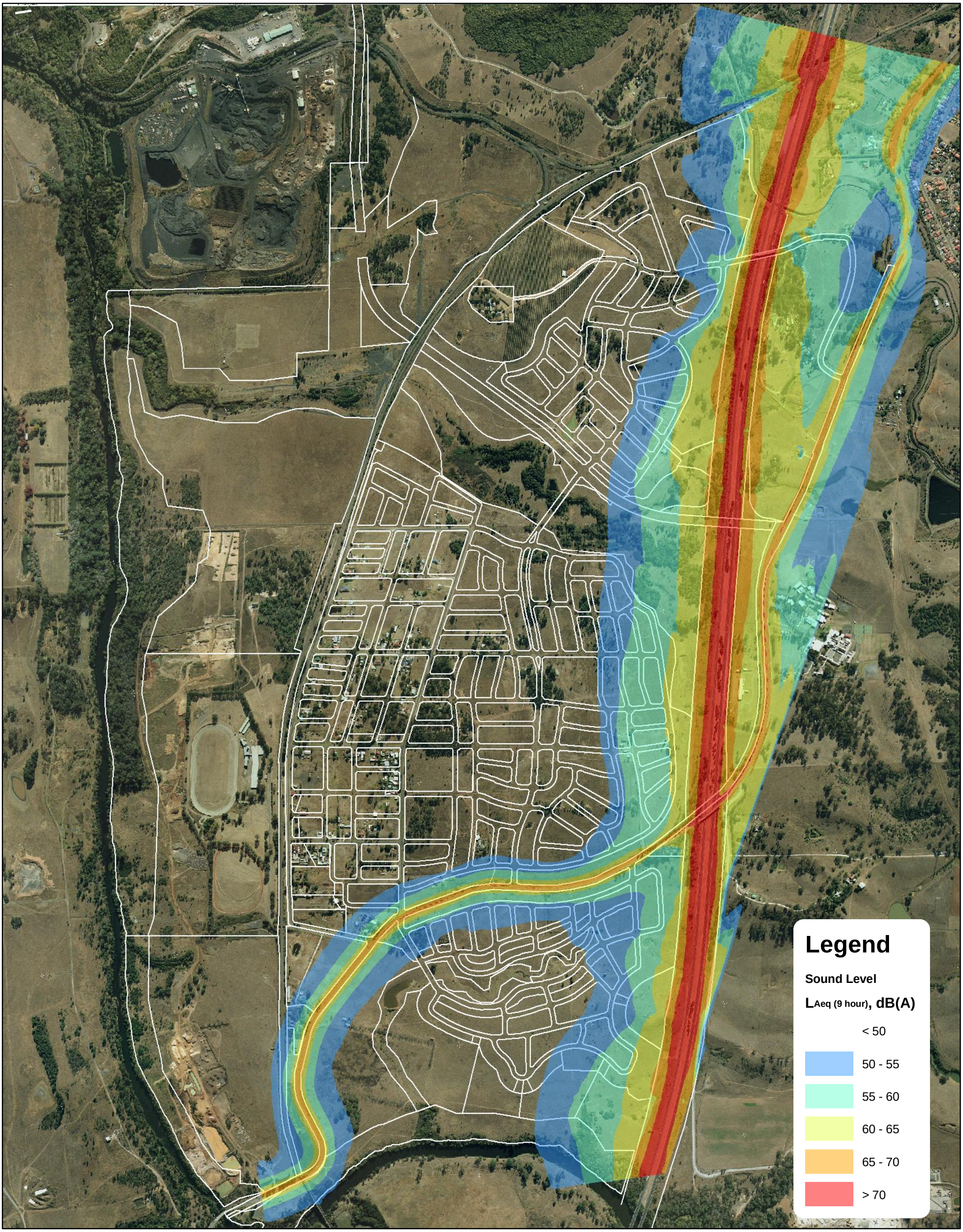
Year 2007 Existing Situation - Daytime Road Traffic Noise Levels

60023278

0 250 500 1,000 m

Fig. **1**

AECOM



Menangle Park Land Release

Year 2007 Existing Situation - Night-Time Road Traffic Noise Levels

60023278

Fig. **2**

AECOM

Legend

Sound Level

$L_{Aeq\ (15\ hour)}$, dB(A)

- < 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75
- > 75

Menangle Park Land Release

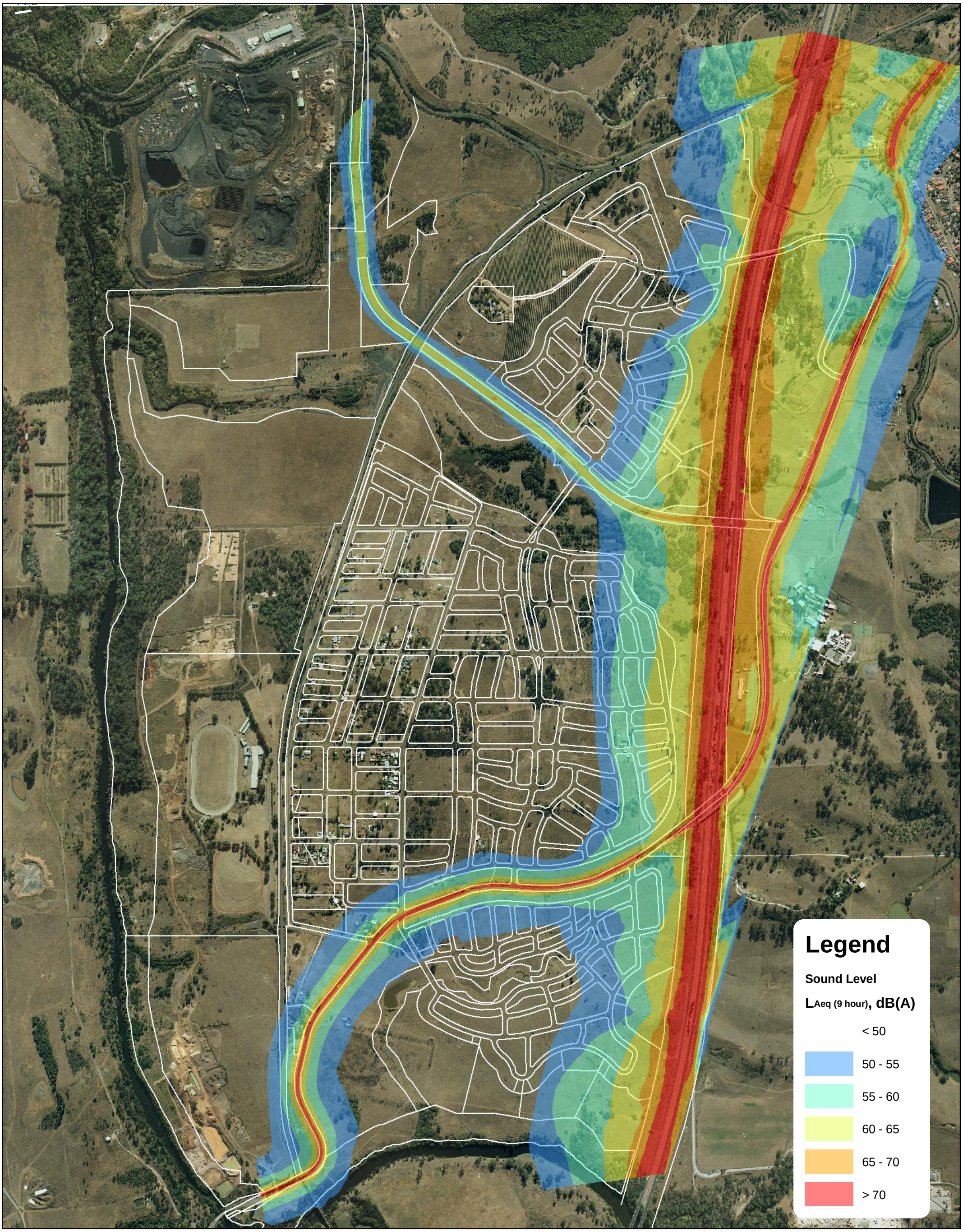
Year 2017 Future Situation - Daytime Road Traffic Noise Levels

60023278

0 250 500 1,000 m

Fig. **3**

AECOM



Menangle Park Land Release

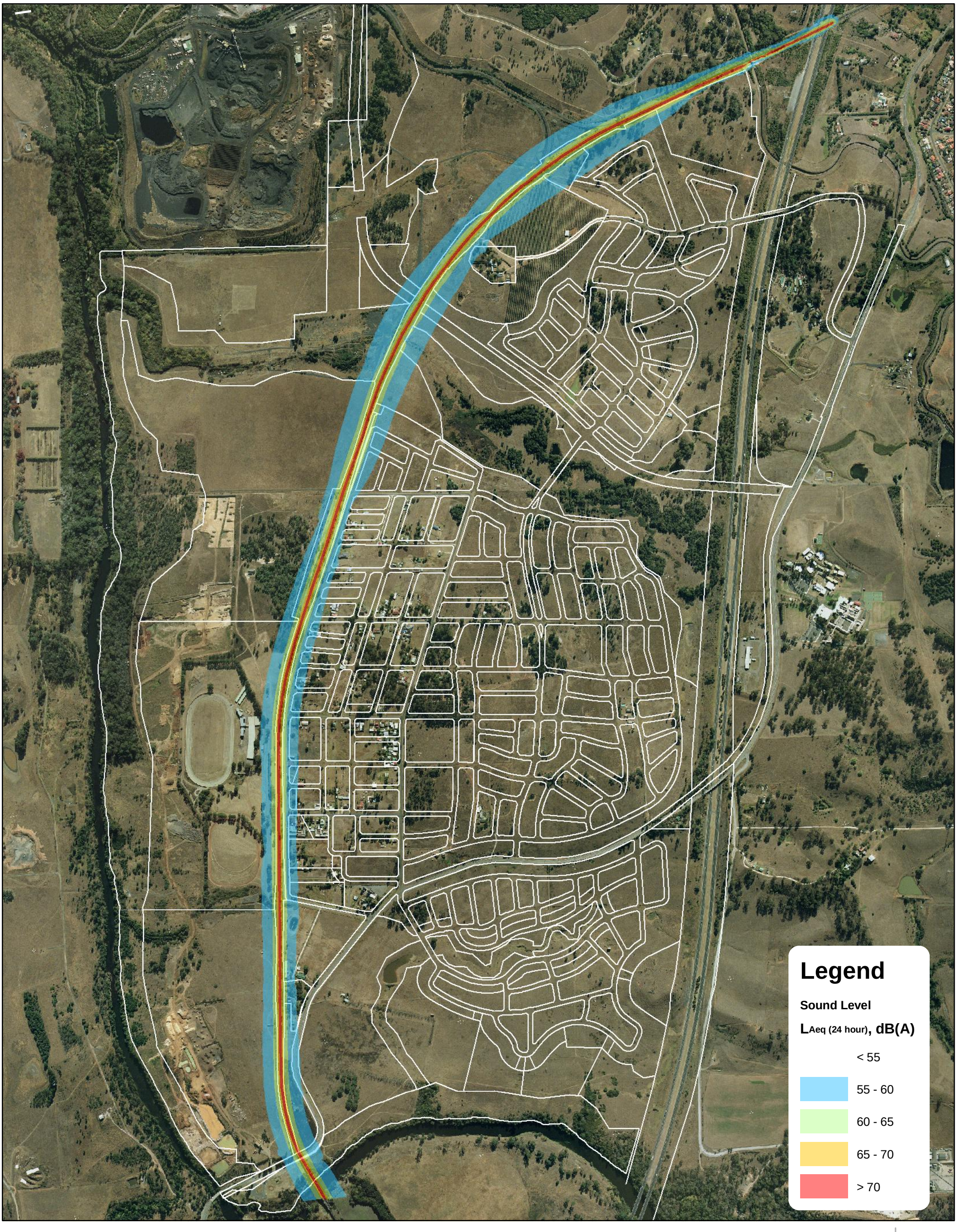
Year 2017 Future Situation - Night-Time Road Traffic Noise Levels

60023278

0 250 500 1,000 m

Fig. **4**

AECOM



Menangle Park Land Release

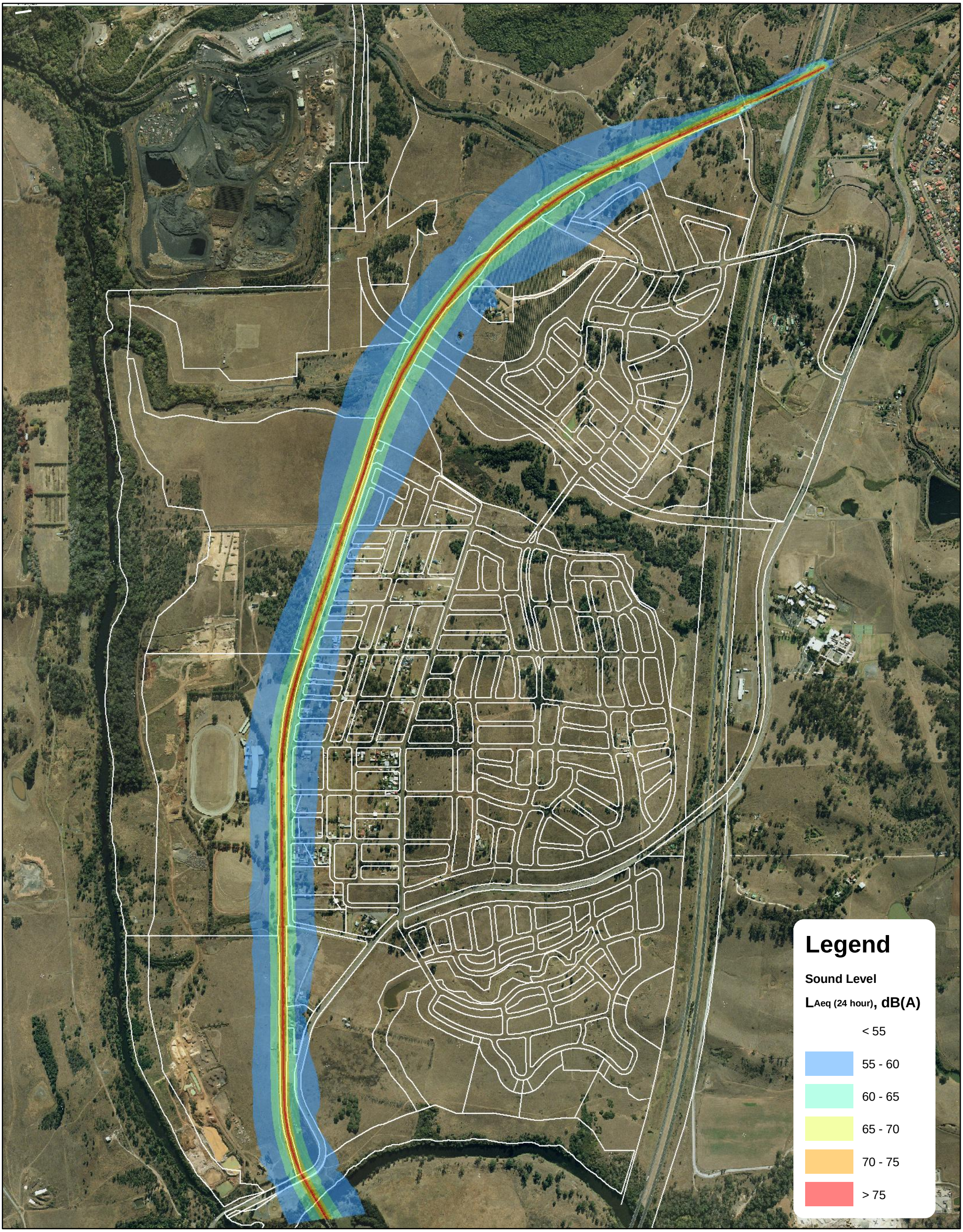
Year 2007 Existing Situation - Rail Noise Levels

60023278

0 250 500 1,000 m

Fig. **5**

AECOM



Menangle Park Land Release

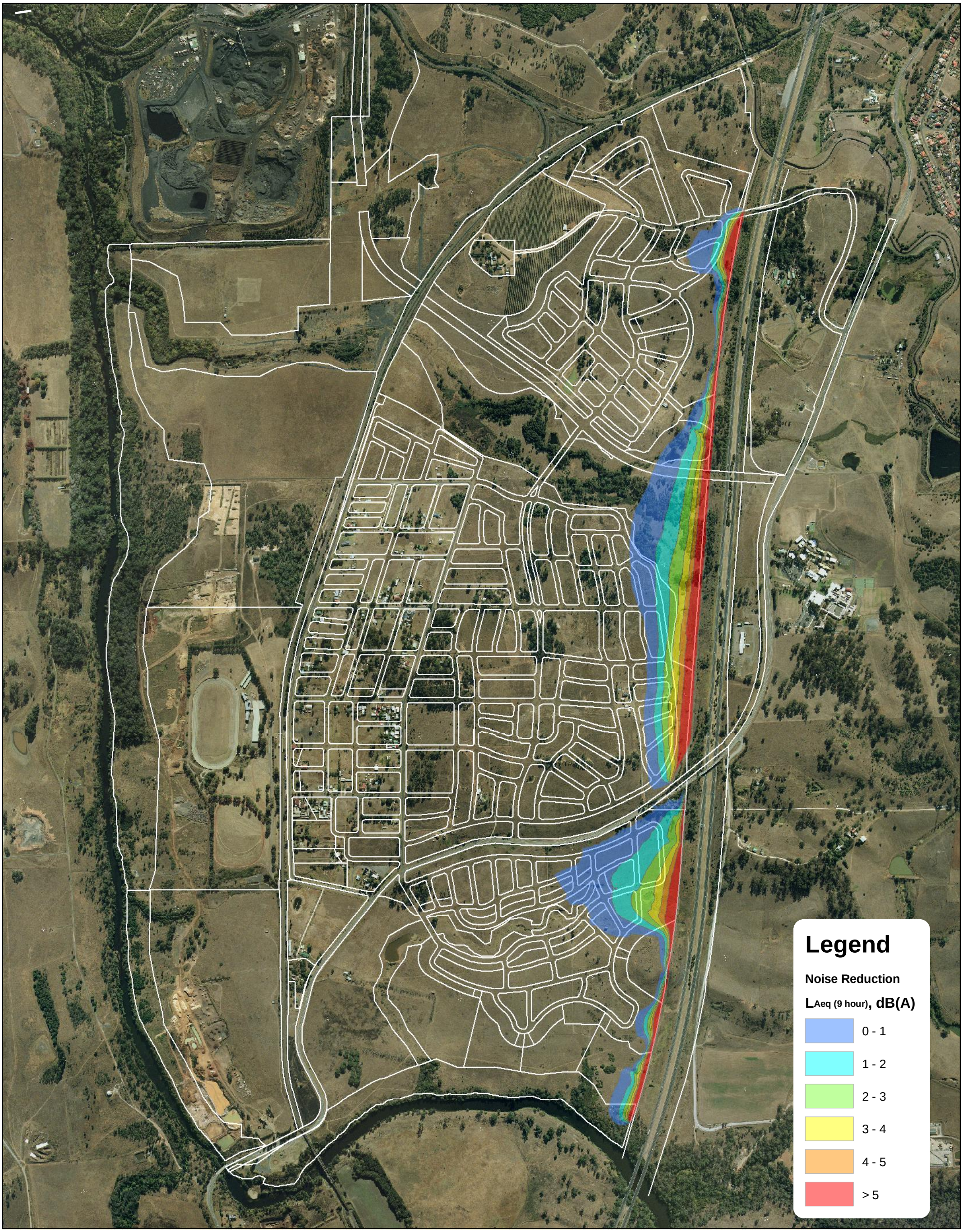
Year 2017 Future Situation - Rail Noise Levels

60023278

0 250 500 1,000 m

Fig. **6**

AECOM



Menangle Park Land Release

Year 2017 Future Nigh-time Situation - Noise Reduction Offered By A 6m Barrier

60023278

Fig. **7**

Appendix D

Menangle Park Draft Structure Plan

Spring Farm Parkway

Nepean River

Harness Racing

Town Centre

Primary School

Playing Fields

South Western Freeway

0 100 500 1000

- 350 - 390 sqm lots
- 540 - 700 sqm lots
- 1000 - 1500 sqm lots
- 2000+ sqm lots
- Private Open Space
- Town Centre
- Community Use
- Open Space
- Riparian
- Private Recreation
- Rural
- Heritage
- Employment
- Transgrid
- Collector Roads

menanglepark

See Visual Scale	Urbis	Menangle Park
10 03 04 Structure Plan.indd	24/05/2010 ISSUE 11	DRAFT Revised Structure Plan

PROJECT PARTNERS

campbelltown city council

LANDCOM

DRAFT