PKA ACOUSTIC CONSULTING

Acoustic Assessment
M4 Traffic Noise Impact
South Western Precinct
Claremont Meadows Stage 2 DA

Project 205-062

April 2008

File : *205 062 R07.3 Stage 2 DA Acoustic Report.doc*

Prepared For:
Phil Gardner
Proust and Gardner
406 Pacific Highway
LINDFIELD, NSW, 2070

Facsimile: 9416 3845

Prepared By
Simon Connolly
Peter R Knowland & Associates Pty Ltd
t/a PKA Acoustic Consulting
Suite 16, 401 Pacific Highway
ARTARMON, NSW, 2064
ABN 73 001 594 583, ACN 001 594 583
Telephone: (02) 9460 6824, Facsimile: (02) 9460 6823

Document Information

File: *205 062 R07.3 Stage 2 DA Acoustic Report.doc*

Author: Simon Connolly

Checked:

Revision: 7.0

Distribution:

Date	Copies	Version	To:	By:
2/2/2006	1	4.0	Phil Gardner	pg@png.com.au
2/2/2006	12	4.0	Phil Gardner	Courier
26/6/2006	1	5.0	Phil Gardner	pg@png.com.au
6/7/2006	1	6.0	Phil Gardner	pg@png.com.au

9/4/2008	1	7.0	Phil Gardner	pg@png.com.au

Contents

1 INTRODUCTION

This report has been prepared to accompany the DA submission for development of the South Western precinct of the Claremont Meadows Stage 2 Release Area.

The southern boundary of the precinct has an abutment to the M4 motorway and is therefore impacted by noise emissions from road traffic. This report presents the results of noise level measurements carried out along the affected parts of the site. We have also as requested carried out measurements along the Motorway boundary further east and west of the site in order to provide information for possible future subdivisions in these areas.

The recommendations in this report address the impact of the traffic on the existing lots zoned for residential development, Lot 1000 in plan No. 22012/SUB2 (PT Lots 10 & 11 DP 27107 & Lot 19 DP239091).

This report is a modified version of overall masterplan acoustic report prepared in 2006. The scope has however been reduced to address the acoustic requirements for the lots identified above.

2 SUMMARY

Recent acoustic modelling using SoundPlan software to include the proposed Kent Road upgrade (Werrington Arterial) and the proposed exit ramps at the M4 has indicated an additional noise impact is likely to occur in the future compared with that established by measurements of existing levels.

The standard noise criteria is the Department of Environment and Conservations (DEC) Environmental Criteria for Road Traffic Noise (ECRTN).

Modelling of future noise impacts has indicated that compliance with the EPA / DEC criteria will require typical noise wall heights ranging from 3.1 metres to 8.4 metres above the ground level.

It has however been agreed in principle with the RTA that, for aesthetic reasons, a day / night criteria of 60/55 dB(A) is a reasonable noise criteria for the site, providing reduced noise wall heights of around 2.0 to 3.9 metres above the ground level .

More specific recommendations for compliance with these criteria are set out in section 7 of this report. Section 8 provides a reduced noise barrier scheme that allows general stage 2 compliance with some minor exceptions. These would be resolved with the barriers are fully completed for the remaining stages as required by the Masterplan.

The proposed layouts and barrier heights are however shown on the following pages for RTA noise goals.

We expect that the existing and future traffic noise impacts on the site can be reduced to within acceptable levels using appropriate acoustic screening and walls.

It is also possible to provide acoustic treatment to the building façades in order to improve internal acoustic amenity while moderating noise wall heights. Clearly however, façade treatment will have no effect on external acoustic amenity and requires some or all windows to be closed. Typical acoustic treatments are outlined in section 8. These will require confirmation for construction certificate stages.

Diagram 2.1 Summary of proposed noise wall layout for stage 2 development

3 SITE DESCRIPTION

The existing site layout and extent has been documented by Proust and Gardner, Surveyors and Planners, as per the site layout shown in diagram 3.1.

Lots 4,5,6,8,9,10, 11,12,13 and 101 are not located immediately adjacent the Motorway but up to 150 metres back from the boundary.

Lot 17, 103 and Part Lot 1, 18,19 abut the Motorway boundary. Lot 101 abuts the Kent Road boundary.

There are existing isolated dwellings toward the south eastern corner of the site near Kent Road and the south western corner near Castle Road.

The southern area of Lot 18 and 19 is set below the level of the motorway pavement by approximately 1.5 metres. The existing boundary is approximately 25 - 30m from the motorway kerb side, separated by an RTA maintenance track. An embankment then rises toward the motorway pavement.

The site rises toward the eastern end of lot 103, becoming level with the motorway pavement. It then forms a cutting with the motorway providing a significant rise (around 10-15 metres). The motorway is not visible from the site at the eastern site boundary.

The scope of this assessment is however limited to Lot 1000 in plan No. 22012/SUB2 (PT Lots 10 & 11 DP 27107 & Lot 19 DP239091). The extent of parcel of land is shown plan 22012/SUB 2A prepared by Proust and Gardner Surveyors.

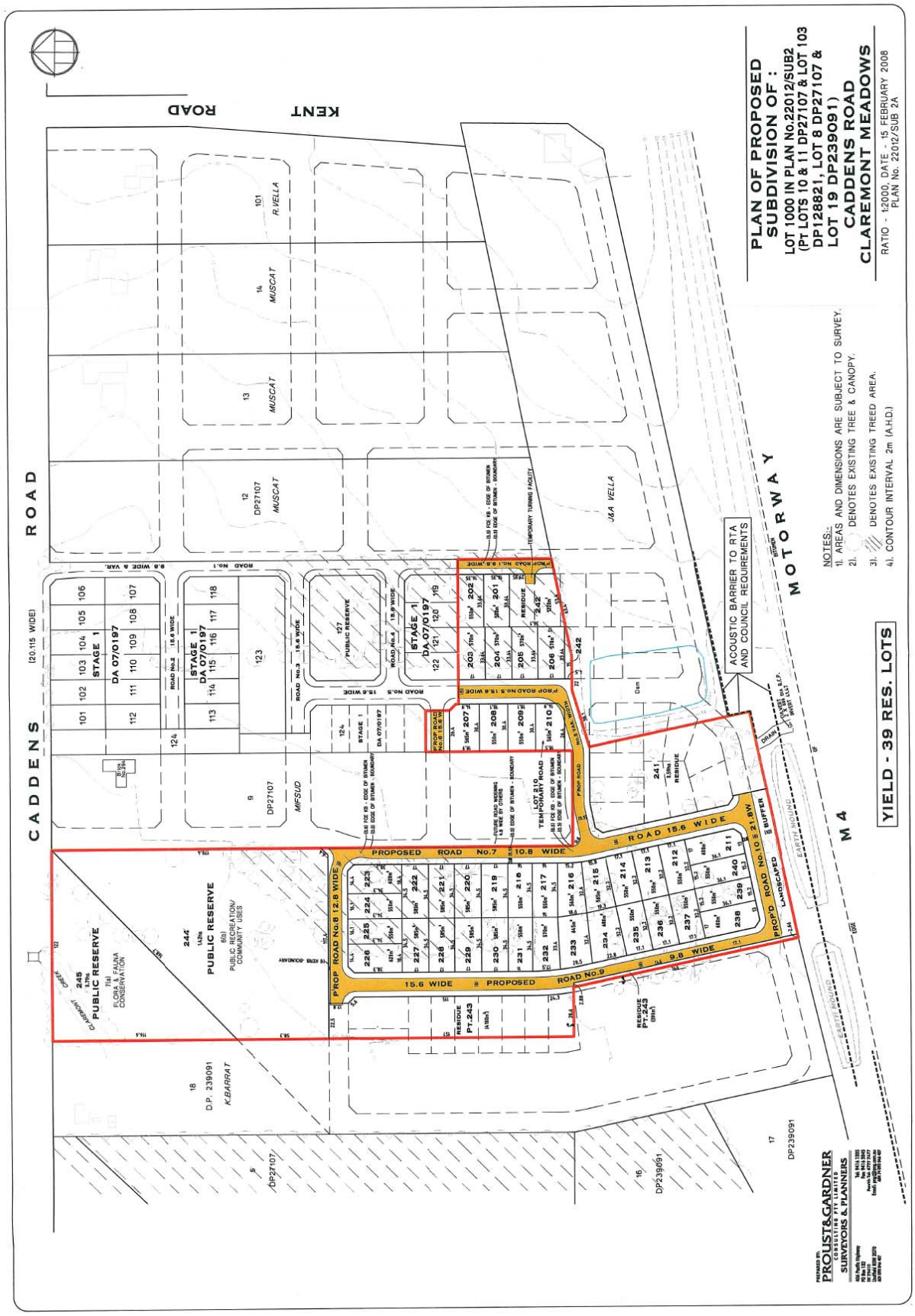


Diagram 3.1: Existing Site layout

4 NOISE CRITERIA

4.1 External Noise Criteria

The Department of Environment (DEC) *Environmental Criteria for Road Traffic Noise* (ECRTN) has standard assessment goals for road traffic noise intrusion, as set out in the excerpt of table 1 below:

Table 1. Road traffic noise criteria for proposed road or residential land use developments

For an explanation of the terms used here, see the sections 'Guide to terms used in the tables' and 'Tech cal notes to the tables' immediately following the tables.

TYPE OF DEVELOPMENT	CRITERIA		
	DAY (7 am–10 pm) dB(A)	NIGHT (10 pm–7 am) dB(A)	WHERE CRITERIA ARE ALREADY EXCEEDED
1. New freeway or arterial road corridor	$L_{Aeq(15hr)}$ 55	$L_{Aeq(9hr)}$ 50	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.
2. New residential land use developments affected by freeway/arterial traffic noise	$L_{Aeq(15hr)}$ 55	$L_{Aeq(9hr)}$ 50	Where feasible and reasonable, existing noise levels should be reduced to meet the noise criteria via judicious design and construction of the development. Locations, internal layouts, building materials and construction should be chosen so as to minimise noise impacts.

The recommended noise levels in the above in are to be measured at 1 m from the façade. As such it is taken to include a 2.5 dB(A) façade correction component.

The RTA have however advised that practical considerations mean that a day / night goal of 60/55 dB(A) is a more feasible approach for subdivision along the M4 order to limit noise barrier heights to a more reasonable level.

We will, in this report, assess the noise wall requirements for the RTA recommended goal for the stage 2 DA application.

4.2 Internal Noise Criteria

For aesthetic reasons there are limits to acceptable noise wall heights. It may be necessary to compromise on the wall height requirements and provide noise reduction utilising building façade treatment in addition to the external screening. A guide to alternative internal noise criteria can be found within the ECRTN (page 14) as follows:

Internal noise levels

It is preferable for internal noise level criteria to be set by the relevant planning or building authority. The internal levels that are set may vary depending on the type of development the planning authority wants to encourage for an area. The Hornsby Shire and Sydney City councils have codes for internal noise level criteria in place. Sleeping areas are usually the most sensitive to noise impact, so in the absence of any local codes internal levels of 35–40 dBA at night are recommended. As a guide for other living areas, internal noise levels 10 dB below external levels are recommended on the basis of openable windows being opened sufficiently to provide adequate ventilation (refer to Building Code of Australia for additional information). For most residences this equates to a minimum of 20% of the window area left open.

From the above a suitable and economical internal noise criteria could be derived as follows:

Sleeping Areas	40 dB(A) Laeq 1hr
Other habitable rooms	45 dB(A) Laeq 1 hr.

4.3 Internal Noise Levels - Sleep Arousal

In addition to continuous noise, the ECRTN discusses sleep arousal issues arising from high level short term noise levels. A criteria based on maximum noise levels is normally applied in these instances. The ECRTN discusses various literature and concludes as follows.

> Considering all of the foregoing information the following conclusions can be drawn:
>
> - Maximum internal noise levels below 50–55 dBA are unlikely to cause awakening reactions.
> - One or two noise events per night, with maximum internal noise levels of 65–70 dBA, are not likely to affect health and wellbeing significantly.

It is difficult to control maximum noise levels with noise walls alone as the variation in noise levels means that the height of the wall can be out of proportion with that required for the control of continuous noise. Further the criteria would be applied to bedrooms only. The additional barrier height would therefore not be required for other habitable spaces, leading to inefficient use of construction materials. Local treatment of bedroom windows may be preferable.

Where feasible we propose to address the recommendations for a typical maximum ($L_{A1(15min)}$) internal noise level of 50 - 55 dB(A). While not an absolute maximum it would require that the noise levels exceeded over 1% of the measurement time (ie 9 seconds for each 15 minute period) do not exceed 55 dB(A).

This will require at the least the relevant bedroom windows be closed with the associated implications for ventilation provided by mechanical means.

5 EXISTING TRAFFIC NOISE IMPACT ON SITE

Existing noise levels across the site were measured via the installation of noise data loggers over a number of days together with spot surveys as required . The measurements were performed in accordance with the DEC *Environmental Criteria for Road Traffic Noise*.

5.1 Noise Data Logger Measurements

Noise data loggers were situated as follows:

Location Number	Location Description	Start Date	Finish Date
1	Lot 19, mid boundary to M4	Wednesday 27th April 2005	Wednesday 4th May 2005
2	Lot 17, Western end near Calverts Road	Tuesday 3rd May 2005	Wednesday 4th May 2005
3	Toward Eastern end of lot 103	Wednesday 4th May 2005	Tuesday 10th May 2005
4	Lot 17, Western end	3rd June 2005	7th June 2005
5	Lot 103, in front of existing dam	3rd June 2005	7th June 2005
6	Lot 103, SE corner at existing property line	3rd June 2005	7th June 2005
7*	Lot 10/11 Behind existing dam	8th July 2005	11th July 2005
*Not shown on following measurement diagram			

- The logger at location 1 was positioned at the existing post and wire fence at 1.2 m above ground level but below the pavement level of the motorway. This position was selected in order to estimate the noise levels at the closest likely façades of any future dwelling at lot 18 and 19. As such noise levels at this location will be reduced by the partial screening to motorway traffic offered by the existing embankment. The ground between the logger and the motorway was essentially grass and scrub. This will also have provided some additional reduction by ground absorption. A receptor at a higher level (eg 1st level window) will therefore be subject to higher noise levels.

- The logger at locations 2 and 4 were not part of the proposed site being just west of lot 17. These provided an assessment toward the western end of the subdivision of the noise levels expected without the screening effect of the embankment. At location 2 the receptor was similar in level to the motorway pavement. The Laeq 15hr was not shown due to the short sample time before the logger was relocated. The Laeq 9hr 62 dB(A) is however considerably higher and provides an indication of the natural screening provided by the difference in level between the receptor and the motorway pavement at the other locations. Location 4 was further east of location 4 and indicates slightly reduced noise levels as the land falls away from the motorway pavement.

- The logger at location 3 was located up the hill at the eastern end at approximately 3 m south of the post and wire fence. Screening to the motorway was provided by the relative height difference between the motorway pavement and the site at this point.

- Locations 5 and 7 set out the noise levels measured at the eastern end of lot 103, at the existing dam location. Location 5 is south of the dam facing the motorway. This point is elevated above the motorway but with little natural screening. Location 7 is behind the dam on the northern boundary with lot 103 and lot 10/11 and shows reduced noise levels due to the increased set back.

- Location 6 describes the noise levels measured at the boundary line at the SE corner of the lot 103. These was significant screening from the motorway due to the significant elevation at this point

The following results were obtained:

Location number	$L_{AEQ(15hr)}$		$L_{AEQ(9hr)}$	
	As measured	Including Façade Correction	As measured	Including Façade Correction
1	60	62.5	57	59.5
2			62	64.5
3	57	59.5	53	55.5
4	63	65.5	60	62.5
5	60	62.5	58	60.5
6	54	56.5	51	53.5
7	59	61.5	52	54.5

5.2 Individual Noise Level Measurements

Included from December 2005 report

The purpose of the noise loggers was to determine the longer term noise levels over a daily period. In addition to these measurements it was necessary to conduct individual measurements in order to help establish the reduction in noise level with distance from the thoroughfare. These noise level measurements were carried out on Wednesday 27th April 2005, between 1300 and 1400 hours.

An adjustment was made to each reading to provide a reading equivalent to the time averaged measurements of the corresponding logger position. Note that as the readings at all locations were not carried out simultaneously, the comparison is an approximation only. The corrections and calculated Leq's are set out in the following table (and shown on the attached diagrams):

Location	Distance from traffic source (m)	Measured Leq*	Estimated Leq (15hour)* dB(A)	Estimated Leq (9hour)* dB(A)
Lot 19 Post and wire fence	30	59	60	57
Lot 19 mid	60	56	57	54
Lot 19 boundary with Lot 8 and 9	110	49	50	47

* results do not include façade reflection
Spot noise level measurements were also carried out at the eastern end of the site approaching Kent Road, between the hours of 1400 and 1515 10th May 2005. The microphone was located approximately 3m back from the ridge to the M4 cutting in each instance.

The following results were obtained:

Location		Measured Leq*	Estimated Leq (15hour)* dB(A)	Estimated Leq (9hour)* dB(A)
1	20 m west of logger	51.1	57	53
2	40 m west of logger	52.0	58	54
3	60 m west of logger	53.7	60	56
4	80 m west of logger	53.7	60	56

The surveys indicate that compliance with both the day and night noise criteria is currently being achieved at the southern boundary over lots of lots 8, 9,10 11 ,12,13, 14 and part of lots 18 and 19 located north of a line between the south western corner of lot 8 and the south eastern corner of lot 5.

The results agree with the noise logger measurements and confirm that reduction of current noise levels is required for compliance with the noise criteria for lots 18, 19, 101 and 103.

The Allam homes subdivision in the north western corner of the precinct should comply with the EPA traffic noise criteria due to large set back from the motorway alignment.

Diagram 5.1 Site photo showing existing measured noise levels

5.3 Comment on Existing Measured Noise Levels

It is the night time requirements that dictate the overall noise reduction required. This is due to the night noise M4 traffic not reducing sufficiently to offset the more stringent noise criteria from 10pm to 7am.

The measurement results indicate that the site is subject to varying noise impacts along its length. The highest noise impact indicated is that measured off site at lot 17 near the Castle Road alignment. In this situation the site is almost level with the road pavement, offering no screening or shielding to the motorway.

5.3.1 Comparison with DEC ECRTN noise goals

The following table indicates the noise levels measured and the over all reductions required, based on the ECRTN 55 / 50 Laeq day/night criteria:

Location / Lot	Measured L_{aeq9hr} (including façade)	Design criteria L_{aeq9hr}	Typical Level reduction required
Lot 19 south bdy with M4	59.5	50	9.5
Lot 103 along existing dam	60.5	50	10.5
Lot 103, in line with lot 14	55.5	50	5.5
Lot 103 SE corner	53.5	50	3.5

5.3.2 Comparison with RTA recommended goals

The following table indicates the noise levels measured and the over all reductions required, based on the proposed 60/55 L_{AEQ} day/night criteria:

Location / Lot	Measured L_{aeq9hr} (including façade)	Design criteria L_{aeq9hr}	Typical Level reduction required
Lot 19 south bdy with M4	59.5	55	4.5
Lot 103 along existing dam	60.5	55	5.5
Lot 103, in line with lot 14	55.5	55	0.5
Lot 103 SE corner	53.5	55	-

6 FUTURE NOISE IMPACTS

It is proposed to widen Kent Road providing a 4 lane arterial Road, referred to as the Werrington Arterial. Data has been provided by Penrith City Council, suggesting approximately 25000 vehicles AADT as a 10 year prediction. This is a very significant increase as currently, Kent Road provides a negligible noise impact on the site particularly compared with M4 generated levels. Further we understand that an exit ramp will be provided along the southern boundary of the site, from the eastbound carriageway of the M4 to the expanded Kent Road . Projections provided by Council indicate around 5000 vehicles AADT from the M4 off ramp.

Both of these future proposals are expected to generate additional noise impact to the eastern portion of the site.

In order to model this effect we have created a SoundPlan model for the noise impact generated by the M4 together with the proposed ramp and Kent Road (Werrington Arterial). SoundPlan is a proprietary sound modelling software program that essentially models the expected noise impact across the site based on estimated traffic flow together with topographical information for the site.

Specific road layout design is not available for the Kent Road Expansion or the access Ramps. As such we have assumed the following for incorporation into the Sound Plan Model:

- Kent Road to comprise a 4 lane arterial, with similar pavement levels as that existing. Traffic flow taken to be 25000 AADT with 10% heavy vehicles.

- Access ramp to rise gradually from M4 pavement to Kent Road Pavement. Traffic flow taken to be 5000 AADT with 10% heavy vehicles.

The results of the projected noise impact model is set out on the following contour diagrams shown as Charts 6.1 and 6.2. We have shown the night time Laeq (9hour) as it is this parameter that governs the noise impact across the site.

The noise contour following includes screening from natural topographical features. It does not include screening from any purpose built walls or mounds. Chart 6.1 does not include screening from any existing or future dwellings. Chart 6.2 however shows the screening effect of 2 storey dwellings constructed along the closest boundaries to the M4 and Kent Road.

As such it provides an indication of the extent of the site unlikely to be impacted by noise from future traffic flow. It is possible to locate dwellings on these parts of the site without providing additional noise control features. Two possible zones can be considered, depending on the required design criteria:

<50 $L_{AEQ(9\ hour)}$

This is the EPA/DEC night time noise criteria zone. Compliance with this criteria would be achieved in this zone without additional noise control features.

<55 $L_{AEQ(9\ hour)}$

This is the proposed RTA night time noise criteria zone. Compliance with this criteria would be achieved in this zone without additional noise control features. It is clear that adopting this design goal significantly increases the proportion of the site considered to be “unaffected” by traffic noise impacts.

Chart 6.2 shows the considerable screening effect expected from the initial “row” of possible dwellings closest to the M4 and Kent Road. While the dwelling location and footprint are only approximate indications, the model demonstrates the possible screening effect of the initial dwelling row. There is therefore scope to use these dwellings as a noise screen, provided there is sufficient acoustic treatment incorporated into the dwelling facades. There would also be little or no acoustic amenity in the outdoor areas associated with each of these dwellings. This noise impact would however be generally limited to those outdoor areas directly facing the M4 or Kent Road.

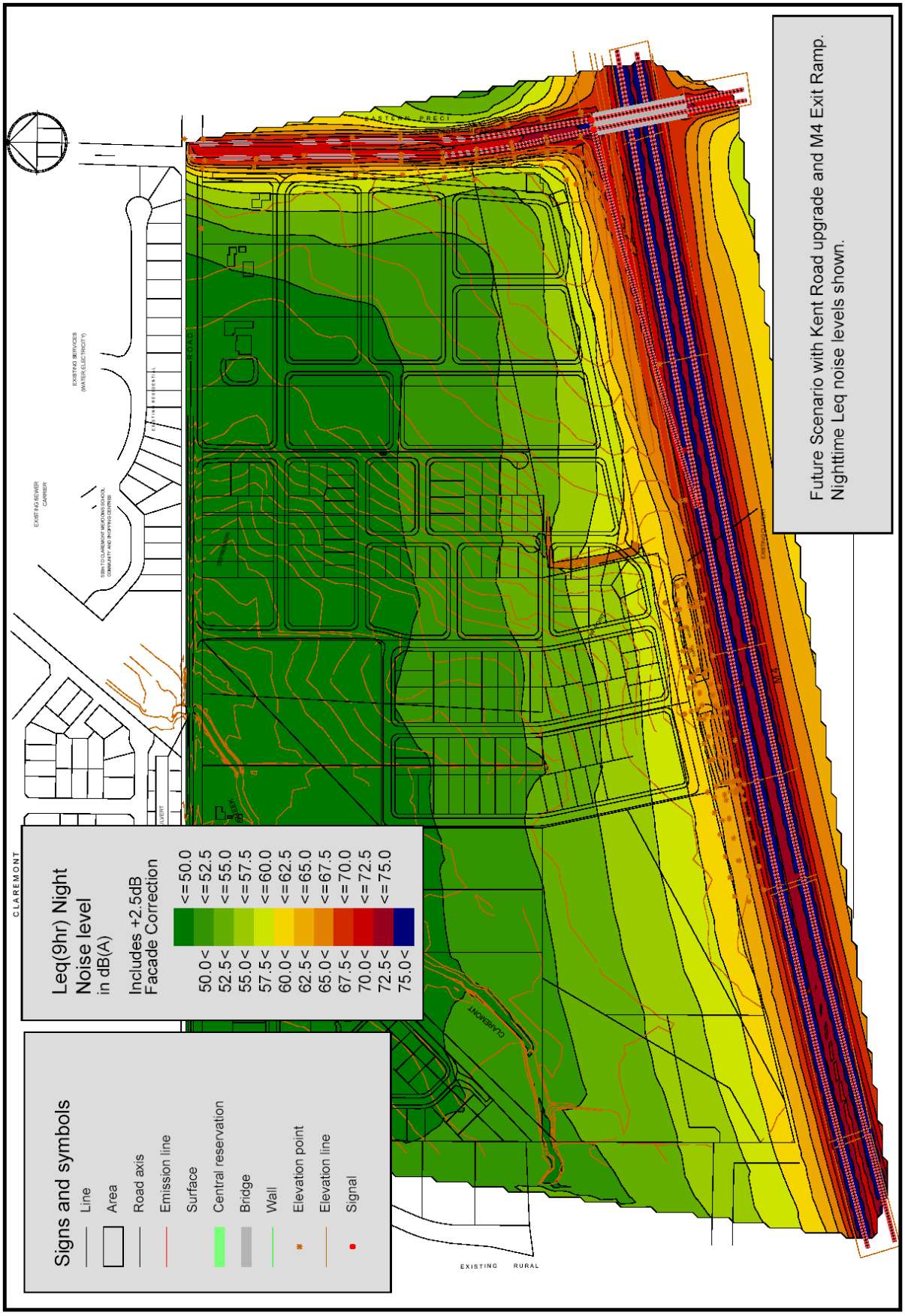


Chart 6.1 Noise Contour Chart showing future noise impact across site without screening features. Noise impact from M4 Motorway and Werrington Arterial

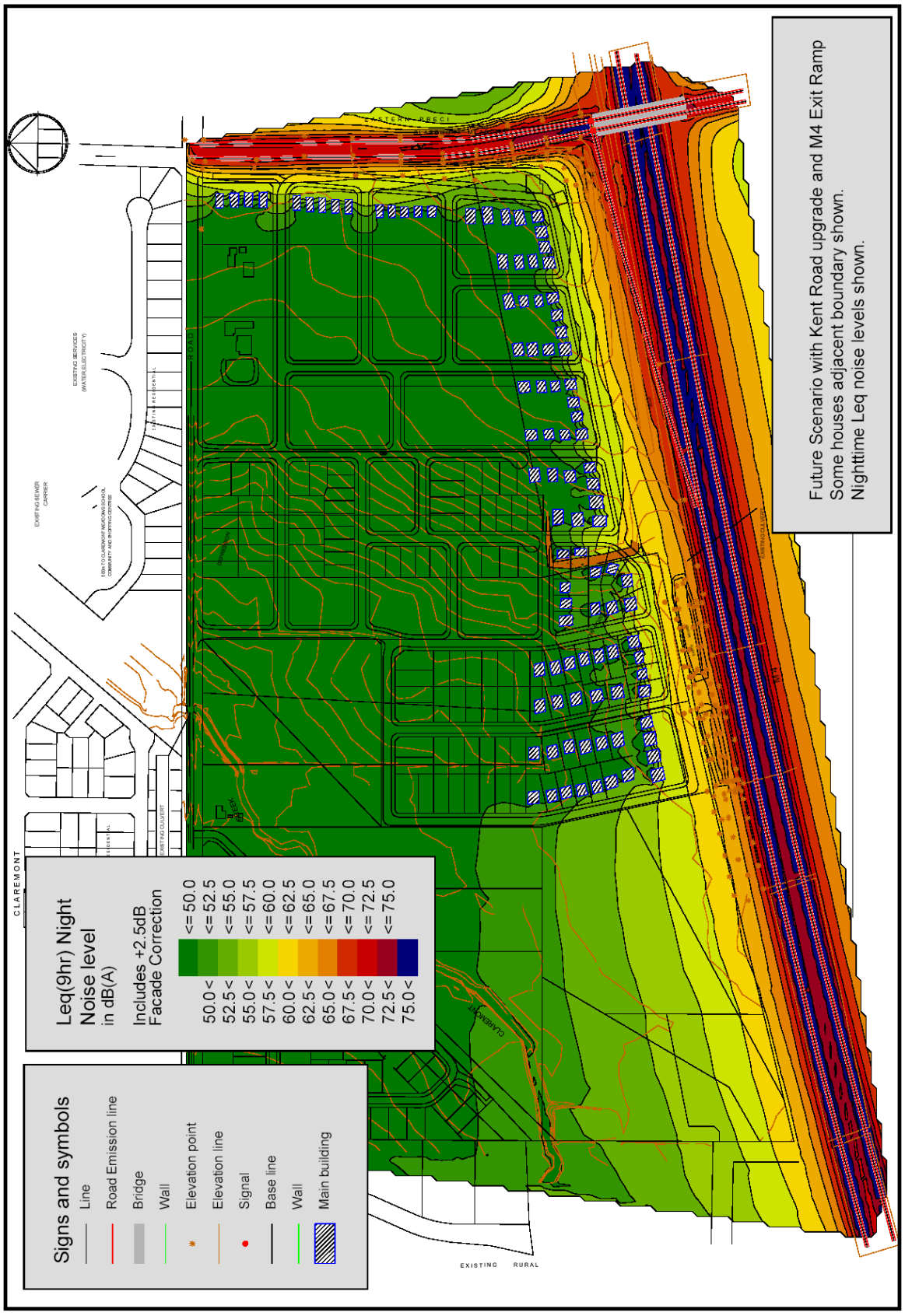


Chart 6.2 Noise Contour Chart showing possible screening effect from dwellings

7 MASTERPLAN RECOMMENDATIONS

The Noise Contour Charts set out in section 6 indicate that while some of the site can be developed without specific noise control features, full development will require substantial screening measures. The extent of the screening measures will depend on the design noise goals required for the Masterplan. Clearly the extent and height of the screening walls or other features would be significantly increased by adopting the EPA/DEC noise criteria compared with the RTA criteria.

7.1 Expected Noise Wall Heights

We have based the calculation on the proposed noise wall extent shown on the attached layouts for both the EPA and the RTA noise criterion. Generally it is proposed that that the wall commence at the western end of the site, along lot 17. It will be necessary to extend the wall beyond the western boundary of lot 18 across lot 17. This is to provide continuing noise reduction to future residential lots to be developed along the western portion of lot 18. It does not address the requirements for lot 17 as this land is proposed to be zoned for conservation purposes.

7.1.1 Compliance with EPA / DEC Noise Criteria

- Western Wall section (part lot 17): The proposal is to locate the western wall section close to the motorway pavement, minimising height. We have assumed a nominal set back from the edge of bitumen of 5 to 6 metres. The recommended height for this 160 metre section would be 5.9 metres above the ground level at any point.

- Midsite Wall Section fronting lot 18 and 19: At the western boundary of lot 18 the barrier would relocated closer to the subdivision and extend across the tops of the existing earth mounds. The recommended height for this section ranges from 7.0 to 8.4 metres above the ground level pavement, for the length of this proposed wall section.

- Eastern Wall section along lot 103: A second barrier would be set further back, along the boundary of lot 103 with the M4 easement. Apart from western end of lot 103, the existing land level progressively rises above the level of the M4 pavement. We propose that the height of this wall section be 6.5 metres above the existing ground level of the proposed barrier location. This height would be maintained until approximately CH 110, where the height would reduce to 6 metres above the ground level. The 6 metre wall would then continue until approximately CH 00. The height would then be gradually reduced to 3.1 metres above the ground level.

- Kent Road along lot 101: The noise barrier would now (compared with that required for existing noise impacts) be required to extend along the Kent Road boundary for a height of 3.1 metres above ground level. This height would be maintained for a distance of 160m North of the South Eastern corner. The height would then increase to 4 metres for the remainder of the eastern boundary with Kent Road.

  It will also be necessary to specify maximum finished floor levels for the lots closest to the motorway. This is to ensure that sites are not filled such that the floor is not extended in height above existing ground levels.

The night time noise contours with the proposed noise barriers are shown in chart 7.1 following. This shows that compliance with the EPA/DEC criteria can generally be achieved, allowing for a 1-2 dB(A) tolerance around the western and north eastern portion of the site. This is due to the need to terminate the noise wall near the site extremities.

There is an apparent zone showing some exceedance nearby the existing dam in mid southern boundary. This an anomaly due to the current elevation of the dam retaining walls. As the dam will be filled and the surrounding land reprofiled we expect that this apparent exceedance will not appear in the final development.

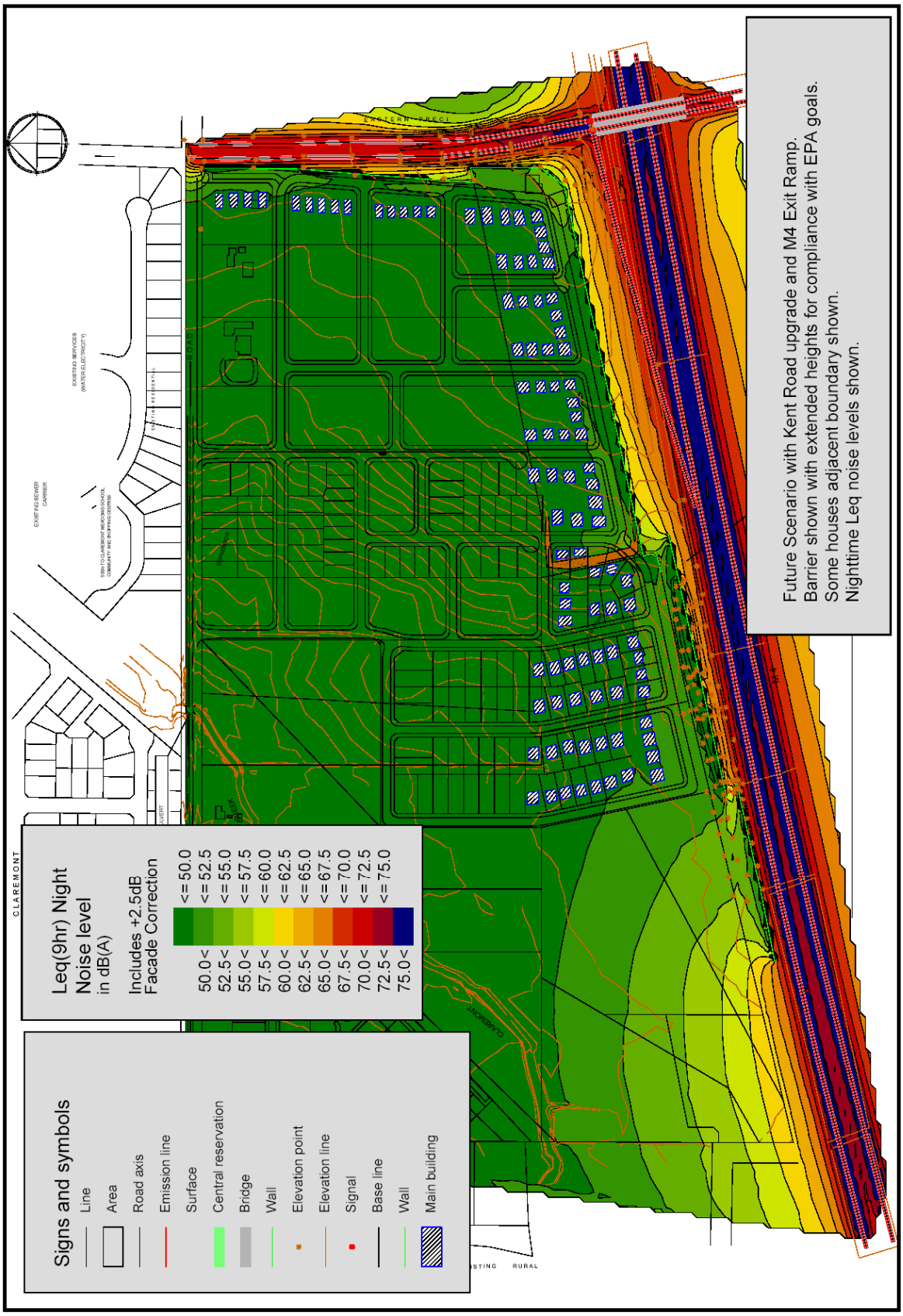


Chart 7.1 Noise Contour Chart showing EPA/DEC criteria compliance zone with proposed walls

7.1.2 Compliance with RTA recommendations

- Western Wall section (part lot 17): The proposal is to locate the western wall section close to the motorway pavement, minimising height. We have assumed a nominal set back from the edge of bitumen of 5 to 6 metres. The recommended height for this 100 metre section would be 3.25 metres above the ground level at any point.

- Midsite Wall Section fronting lot 18 and 19: At the western boundary of lot 18 the barrier would relocated closer to the subdivision and extend across the tops of the existing earth mounds. The recommended height for this section varies from 3.4 – 4.8 metres above the ground level, for the length of this proposed wall section.

- Eastern Wall section along lot 103: A second barrier would be set further back, along the boundary of lot 103 with the M4 easement. Apart from western end of lot 103, the existing land level progressively rises above the level of the M4 pavement. We propose that the height of this wall section be 3 metres above the existing ground level of the proposed barrier location until CH 110. This height would be maintained until approximately CH 110, where the height would reduce to 2.0 metres above the ground level.

- Kent Road section along lot 101: The noise barrier would now (compared with that required for existing noise impacts) be required to extend along the Kent Road Boundary for a height of 2.0 metres above ground level.

  It will also be necessary to specify maximum finished floor levels for the lots closest to the motorway. This is to ensure that sites are not filled such that the floor is not extended in height above existing ground levels.

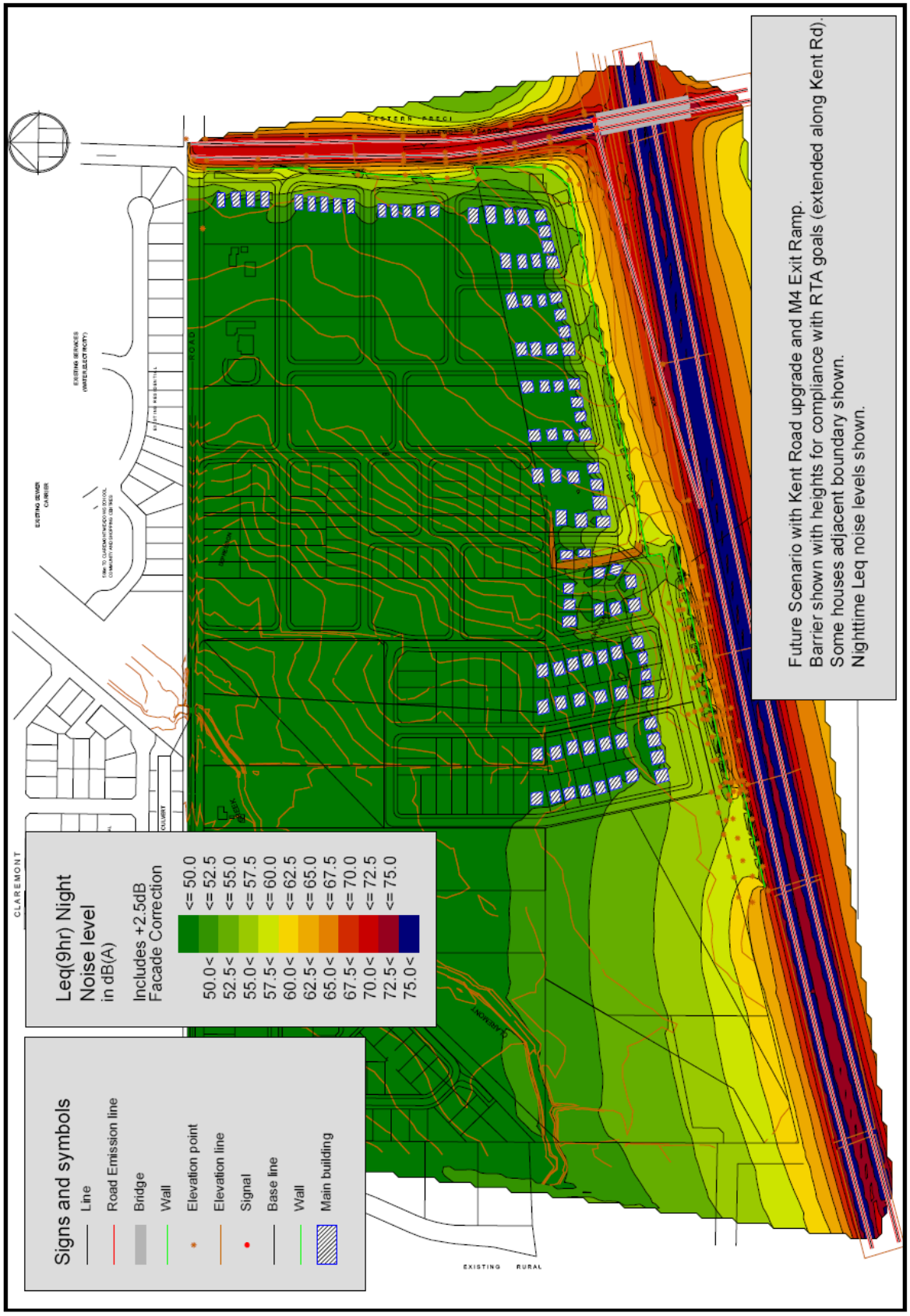


Chart 7.2 Noise Contour Chart showing RTA criteria compliance zone with proposed walls

8 DA STAGE 2 RECOMMENDATIONS

8.1 Noise Barrier Extent

Modelling has been carried out to determine the extent of the noise impact across the Stage 2 development assuming the extent of the barrier as shown below. The barrier heights are the same as that required for the development masterplan as outlined in section 7. The extent however is reduced to provide sufficient screening to allow general compliance with RTA 60/55 dB(A) day/night criteria for the Stage 2 development only.

The extent of the proposed barrier screening is shown by the green lines on the site plan below.

Diagram 8.1 Proposed Stage 2 Noise Barrier Extent

The resulting noise contours have been plotted for the ground floor level on the following SoundPlan plot:

<55 $L_{AEQ(9\ hour)}$

This is the proposed RTA night time noise criteria zone. Compliance with this criteria would be achieved in this zone without additional noise control features.

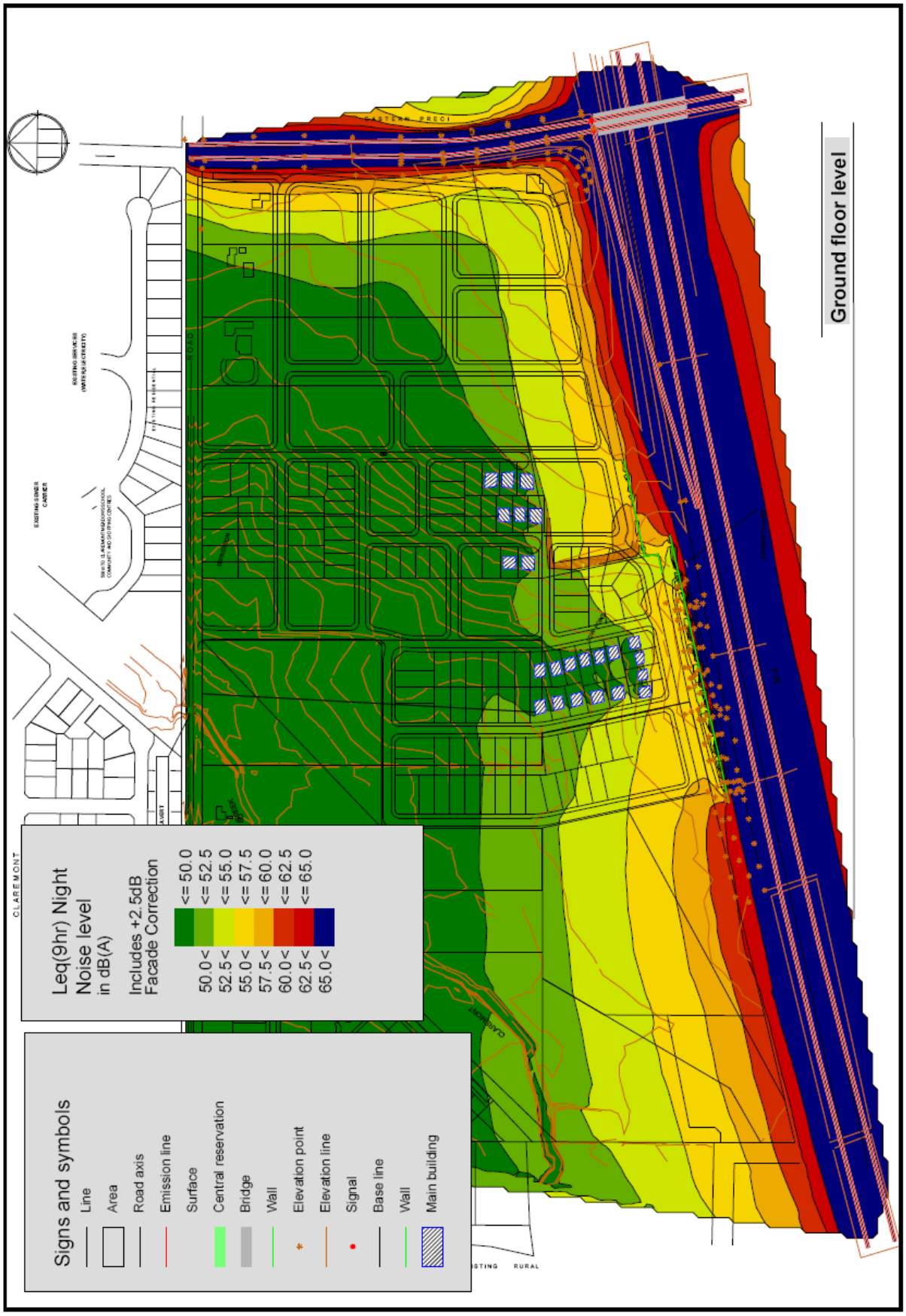


Diagram 8.2 Ground Floor Noise Contours.

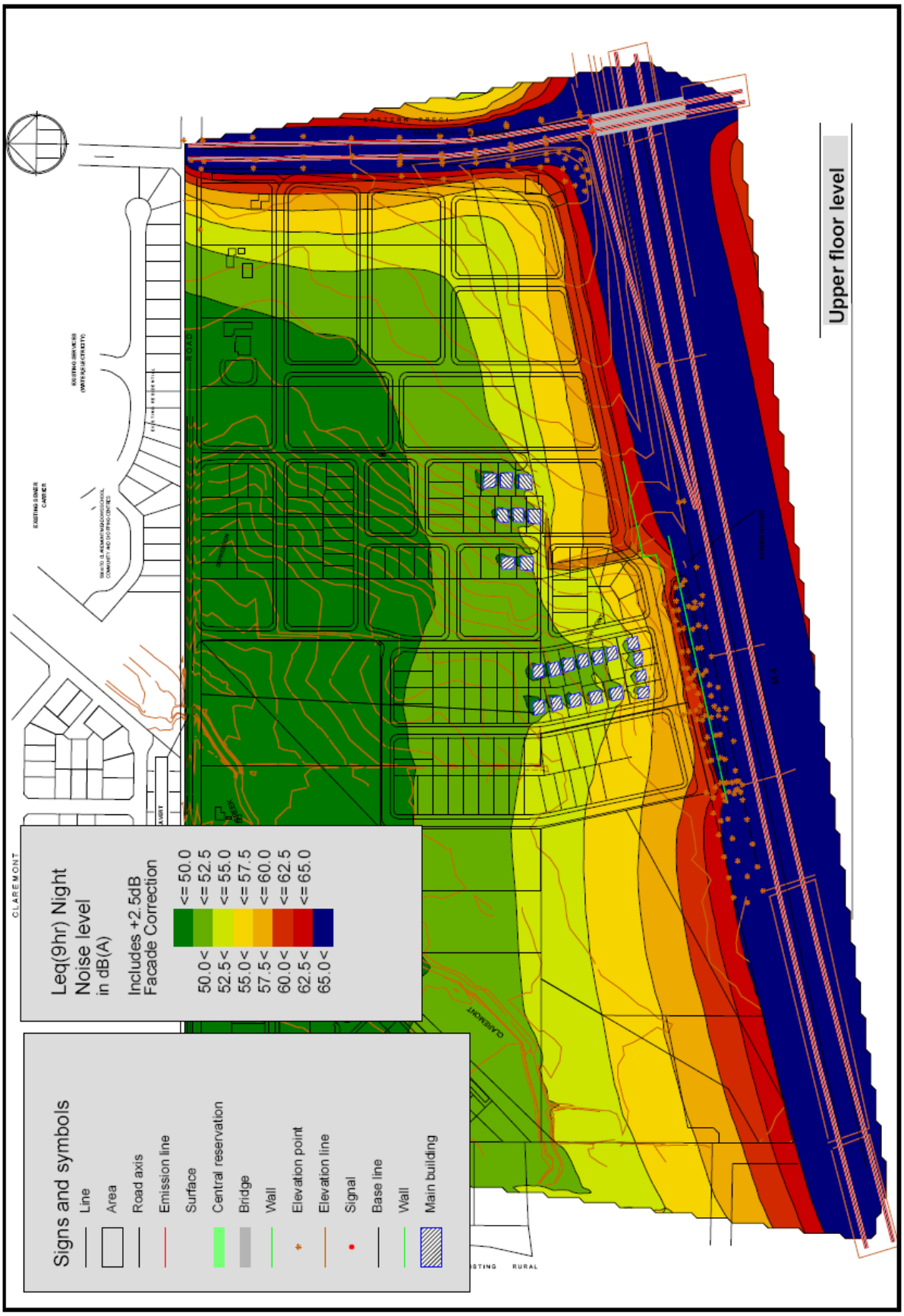


Diagram 8.3 Upper Floor Noise Contours

Diagram 8.2 shows that when considering the proposed extent of noise barrier, compliance with the RTA 55 dB(A) overnight criteria can be generally expected at the ground level facades. The exception is lot 238 where a 2 – 3 dB(A) exceedance is possible.

This exceedance would be eliminated however, when the noise barrier is extended westwards as the remaining precinct is fully developed.

It the meantime, it is possible to upgrade the ground level façade to provide equivalent internal noise levels. In any event it would be necessary to upgrade some upper level facades as it is not feasible to obtain full screening to these levels using a noise barrier of reasonable height.

8.2 Façade Construction

Depending on the final acoustic design noise goals and the associated wall layout some supplementary façade upgrading treatment is likely to be required to the dwellings closest to the M4. The façade upgrading is likely to be required when the upper levels of 2 storey dwellings are not fully screened by any proposed noise barrier.

It would also be desirable to incorporate a lesser degree of treatment to the ground floor in order to allow for the adoption of the compromise RTA criteria over the standard DEC criteria.

In these circumstances it is likely to be necessary to incorporate some form of acoustic treatment to the building façade for sleep disturbance purposes in order to moderate noise wall height requirements.

Note that the recommendations below will need to be coordinated with any Thermal insulation requirements of Council or the BCA. The acoustic construction recommendations will also require confirmation based on specific dwelling designs. The recommendations are currently outline only and can be considered as typical only. Confirmation of the acoustic treatment requirements will be required for construction certificate stages of each individual dwelling.

8.2.1 Upper Floors lots 238, 239,240,211

- Glazing comprising acoustic rated frames and glass to approximately Rw 30 (typically 6.38mm laminated in acoustic rated frames)
- Tiled Roof with sarking
- Roof space ventilation openings to face away from noise source
- 16mm plasterboard ceiling and R3 insulation between joists. Penetrations in ceiling to be acoustically treated.
- Brick veneer wall including R1.5 insulation
- Any lightweight walls (eg upper level) to comprise 2 layers 13 mm plasterboard internally and R2.5 insulation in cavity.
- Suitable air conditioning or ventilation system to enable window to be closed when required.

8.2.2 Lower Floors lots 238, 239,240,211

- Glazing comprising acoustic rated frames and glass to approximately Rw 30 for lot 238. (typically 6.38mm laminated in acoustic rated frames). Glazing comprising acoustic rated frames and glass to approximately Rw 25 for lots 239,240 and 211 (typically 5mm plain glass in acoustic rated frames).
- Tiled Roof with sarking (single level dwellings)
- Roof space ventilation openings to face away from noise source (single level dwellings)
- 13mm plasterboard ceiling and R3 insulation between joists. Penetrations in ceiling to be acoustically treated. (single level dwellings)
- Brick veneer wall including R1.5 insulation
- Any lightweight walls (eg upper level) to comprise 2 layers 13 mm plasterboard internally and R2.5 insulation in cavity.
- Suitable air conditioning or ventilation system to enable window to be closed when required.

8.2.3 Upper Floors lots 212-214, 234-237,210,206,242

- Glazing comprising acoustic rated frames and glass to approximately Rw 25 (typically 5mm plain glass in acoustic rated frames)
- Tiled Roof with sarking
- Roof space ventilation openings to face away from noise source
- R3 insulation between joists. Penetrations in ceiling to be acoustically treated.
- Brick veneer wall including R1.5 insulation
- Any lightweight walls (eg upper level) to comprise 2 layers 13 mm plasterboard internally and R2.5 insulation in cavity.
- Suitable air conditioning or ventilation system to enable window to be closed when required.

8.2.4 Lower Floors lots 212-214, 234-237,210,206,242

- Suitable air conditioning or ventilation system to enable windows to be closed when required to exclude motorway noise levels.

9 NOISE LOGGER RECORDS

9.1 Western End, South Boundary of lot 17

205 062 Caddens Rd **Western End South Bdy lot 17**

EPA TRAFFIC NOISE POLICY NOISE LEVELS						
Date	**Leq 15hr**	**Leq 9hr**	**Leq 24hr**	**L10 18hr**	**Leq 1hr**	
	0700-2200	**2200-0700**	**0000-2400**	**0600-2400**	**0700-2200**	**2200-0700**
03/06/2005	x	58.6	x	x	63.4	60.8
04/06/2005	61.7	57.1	60.7	64.0	62.8	59.3
05/06/2005	60.6	59.4	59.6	62.7	62.6	62.6
06/06/2005	63.0	59.6	62.0	65.4	65.0	62.0
07/06/2005	63.0	59.9	62.0	65.4	64.6	61.9
08/06/2005	x	x	x	x	64.3	x
09/06/2005	x	x	x	x	x	x
10/06/2005	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
Average	**62**	**59**	**61**	**64**	**64**	**61**

Leq 15hr, 9hr, 24hr - Assessment of logarithmic averages determined in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

L1 - Assessment of highest tenth percentile hourly Leq in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

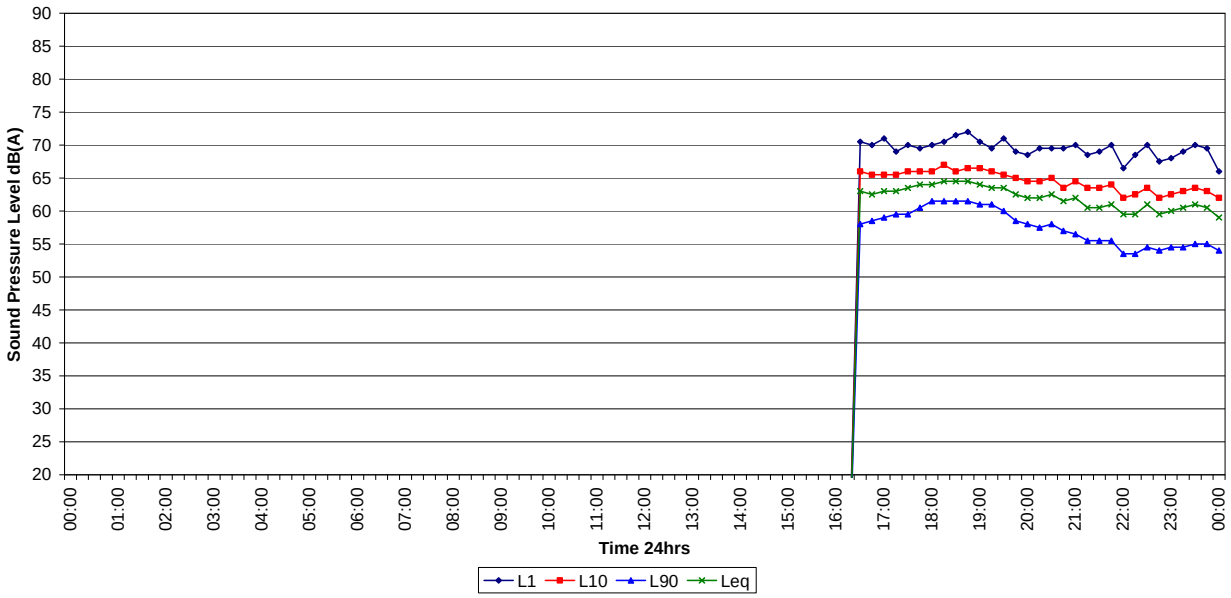
L10 18hr - Assessment of arithmetic averages determined in accordance with EPA Environmental Noise Control Manual (Ch 157-2 1987)

EPA Environmental Criteria for Road Traffic Noise criteria:	
Type of development:	New residential affected by freeway/arterial traffic noise
Daytime Criteria:	55
Nighttime Criteria:	50
Measurement Descriptor:	Leq(15hr)/Leq(9hr)

205 062 Caddens Rd

Western End South Bdy lot 17

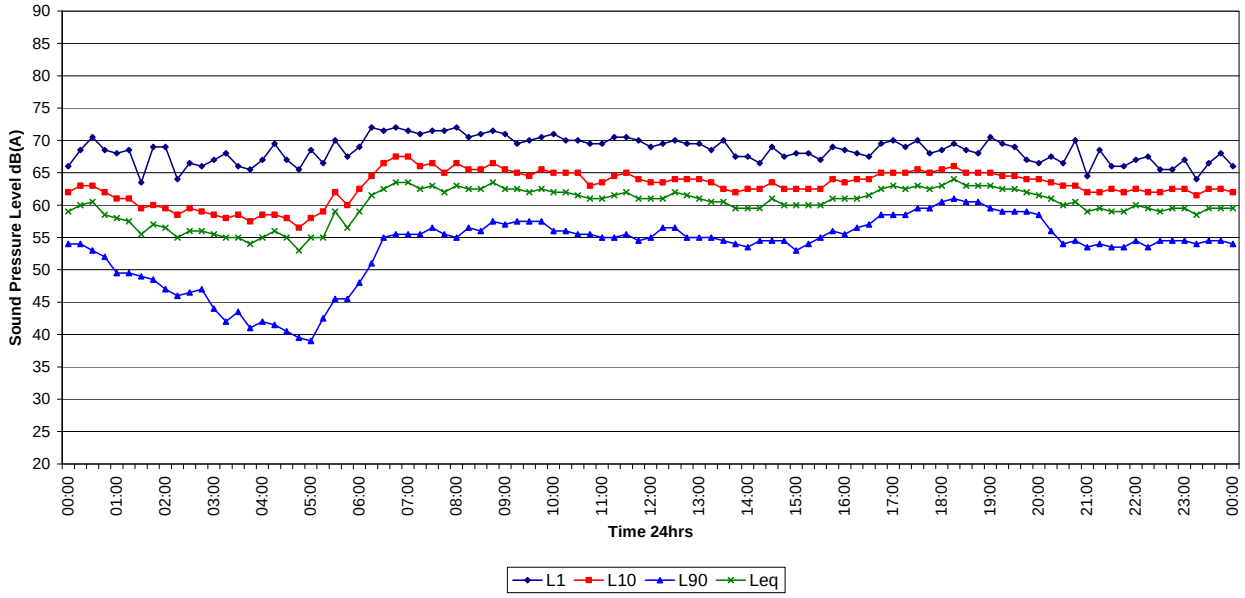
Friday 03/06/2005

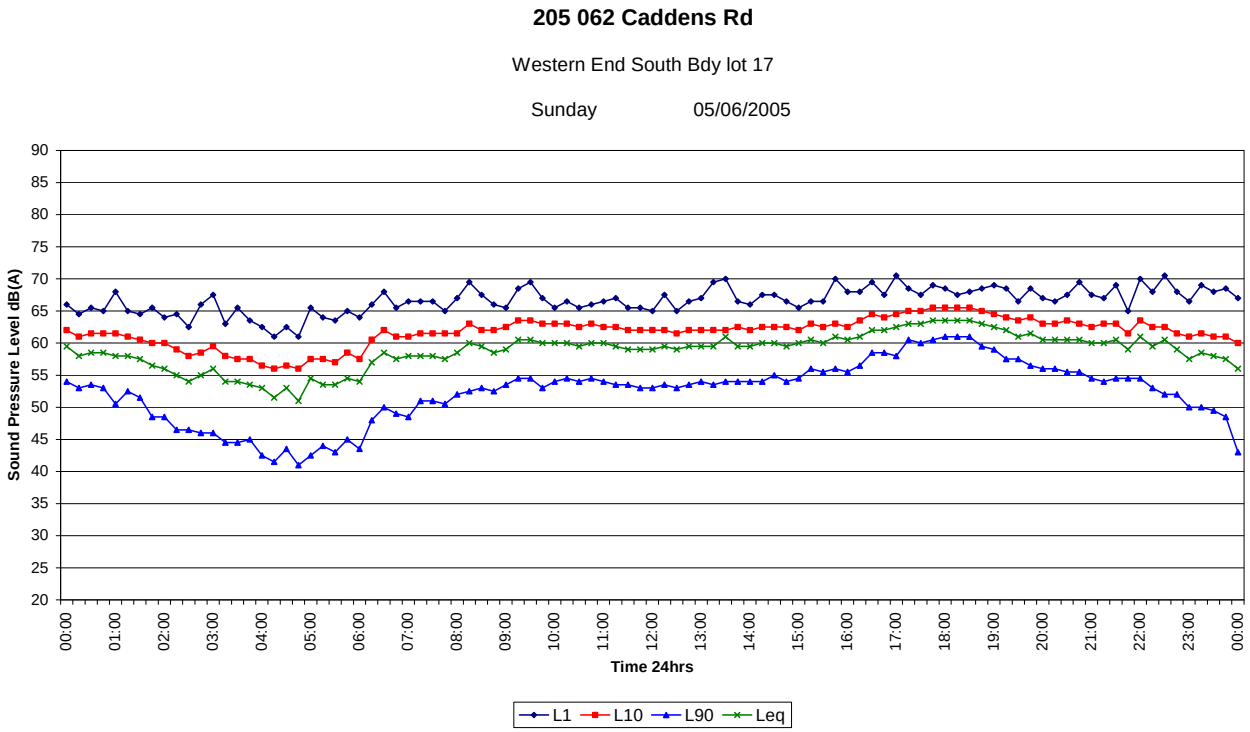


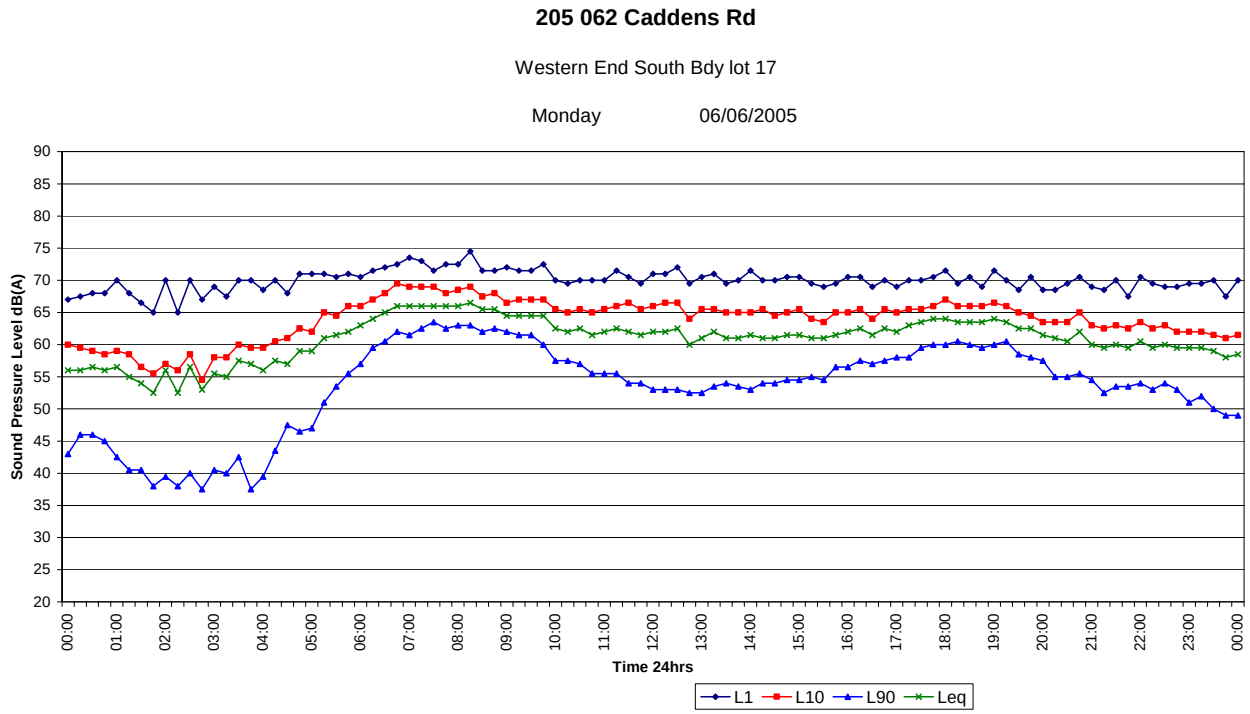
205 062 Caddens Rd

Western End South Bdy lot 17

Saturday 04/06/2005



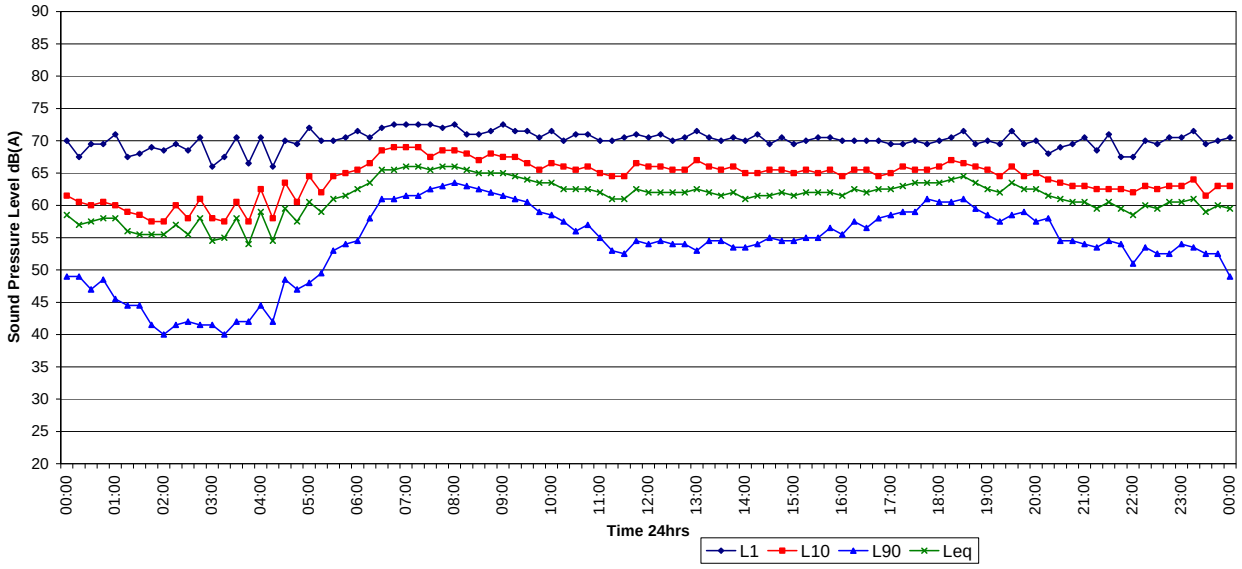

205 062 Caddens Rd
Western End South Bdy lot 17
Sunday 05/06/2005
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


205 062 Caddens Rd
Western End South Bdy lot 17
Monday 06/06/2005
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq

205 062 Caddens Rd

Western End South Bdy lot 17

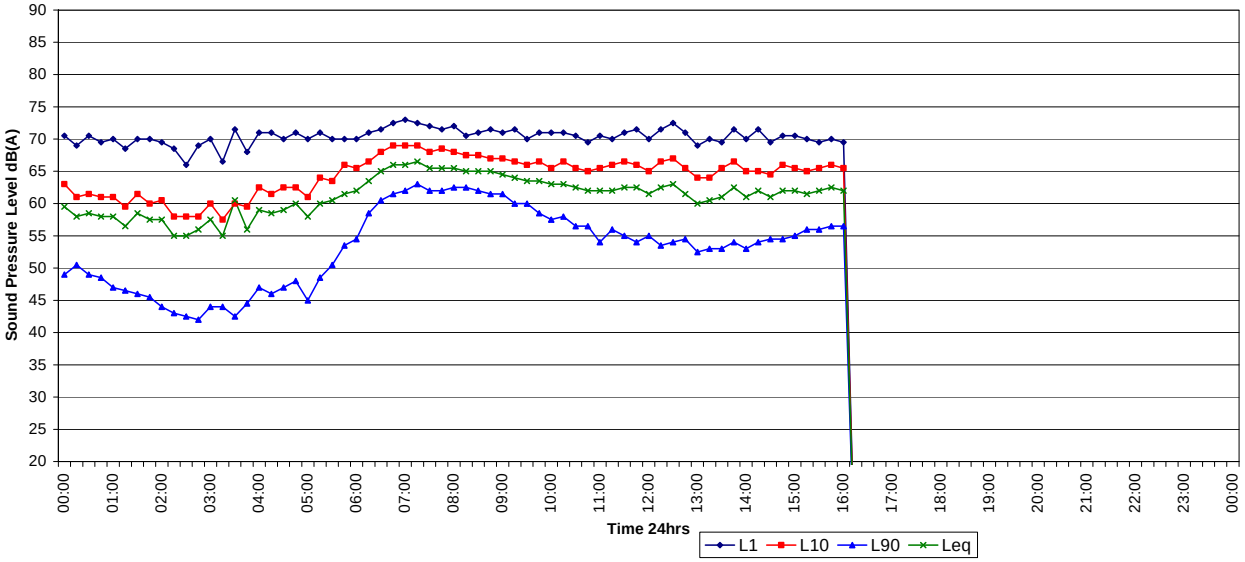
Tuesday 07/06/2005



205 062 Caddens Rd

Western End South Bdy lot 17

Wednesday 08/06/2005



9.2 Mid Site, South Boundary Conservation Zone

205 062 Caddens Rd **Mid Location 27m from M4 Motorway**

EPA TRAFFIC NOISE POLICY NOISE LEVELS						
Date	**Leq 15hr**	**Leq 9hr**	**Leq 24hr**	**L10 18hr**	**Leq 1hr**	
	0700-2200	**2200-0700**	**0000-2400**	**0600-2400**	**0700-2200**	**2200-0700**
27/04/2005	x	57.9	x	x	59.8	60.2
28/04/2005	60.1	58.6	59.5	62.8	61.5	60.6
29/04/2005	61.1	56.4	60.2	63.2	62.5	58.2
30/04/2005	59.8	56.6	58.9	62.2	61.4	58.6
1/05/2005	59.2	57.2	58.3	61.3	60.5	60.0
2/05/2005	61.2	57.3	60.1	63.5	62.8	59.8
3/05/2005	60.4	58.1	59.8	62.8	62.2	60.5
4/05/2005	x	x	x	x	62.8	x
0/01/1900	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
Average	**60**	**57**	**59**	**63**	**62**	**60**

Leq 15hr, 9hr, 24hr - Assessment of logarithmic averages determined in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

L1 - Assessment of highest tenth percentile hourly Leq in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

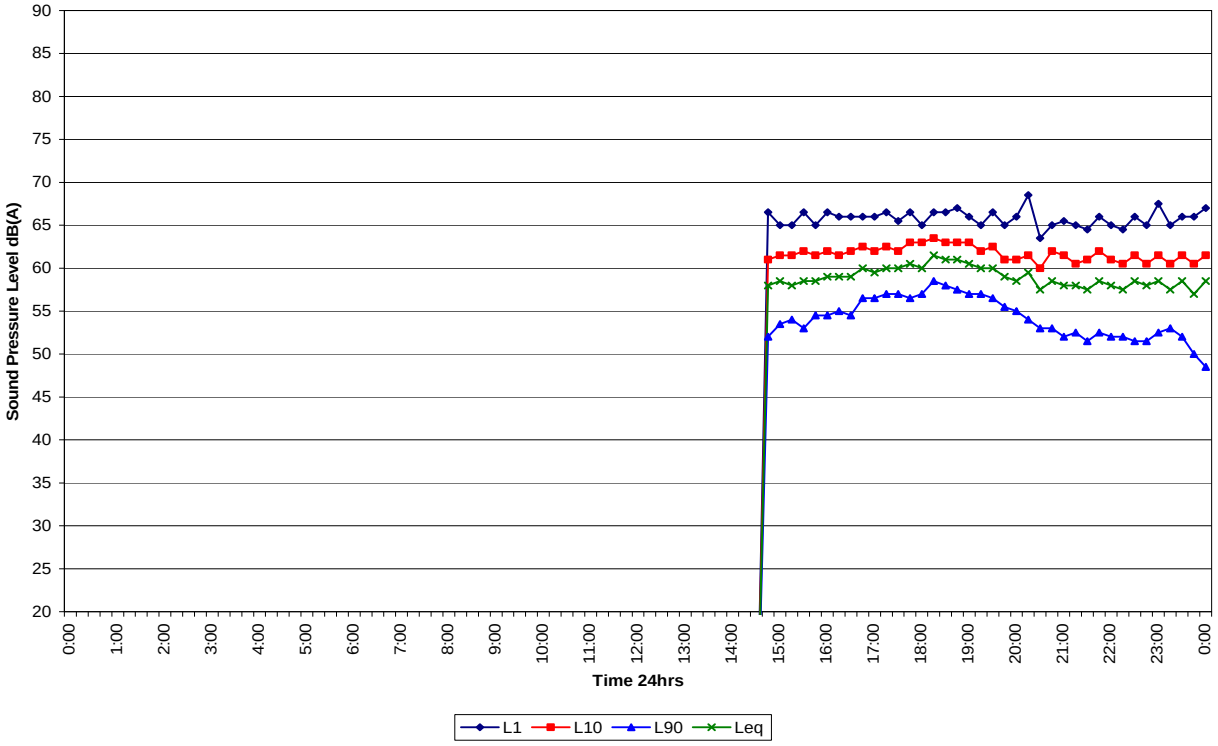
L10 18hr - Assessment of arithmetic averages determined in accordance with EPA Environmental Noise Control Manual (Ch 157-2 1987)

EPA Environmental Criteria for Road Traffic Noise criteria:	
Type of development:	New residential affected by freeway/arterial traffic noise
Daytime Criteria:	55
Nighttime Criteria:	50
Measurement Descriptor:	Leq(15hr)/Leq(9hr)

205 062 Caddens Rd

Mid Location 27m from M4 Motorway

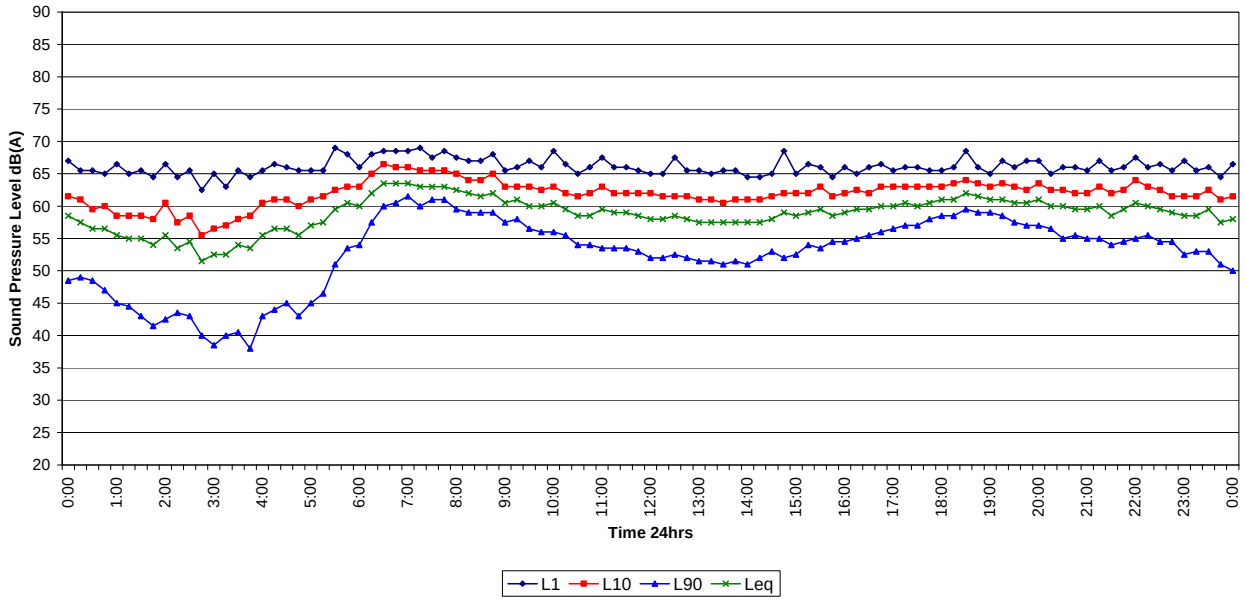
Wednesd 27/04/2005



205 062 Caddens Rd

Mid Location 27m from M4 Motorway

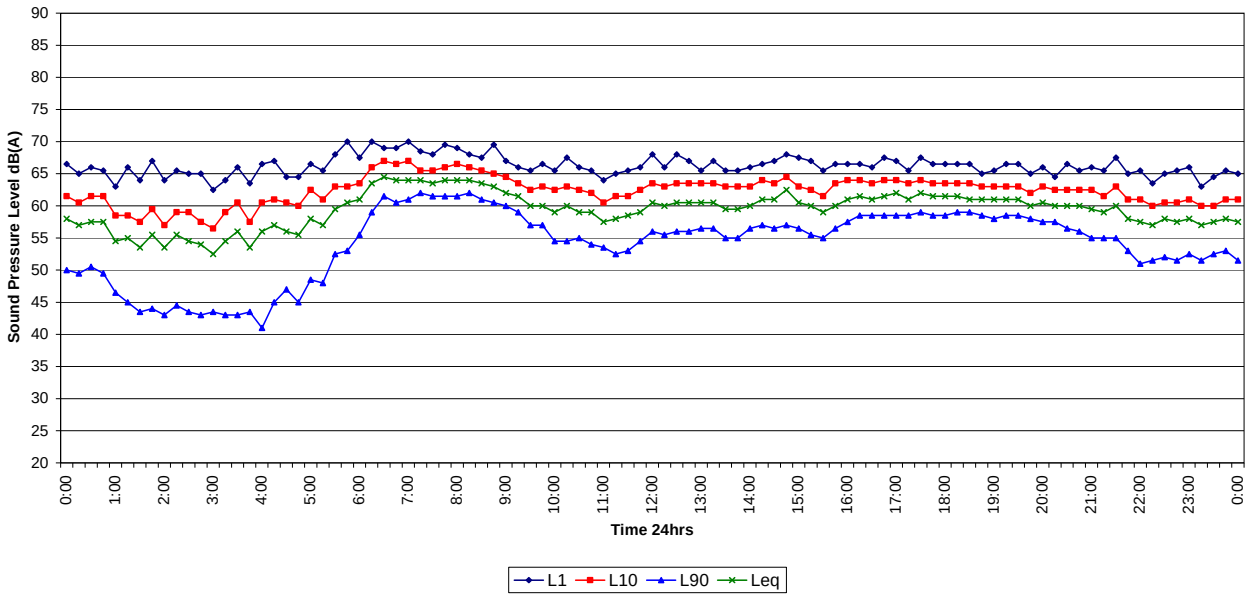
Thursday 28/04/2005



205 062 Caddens Rd

Mid Location 27m from M4 Motorway

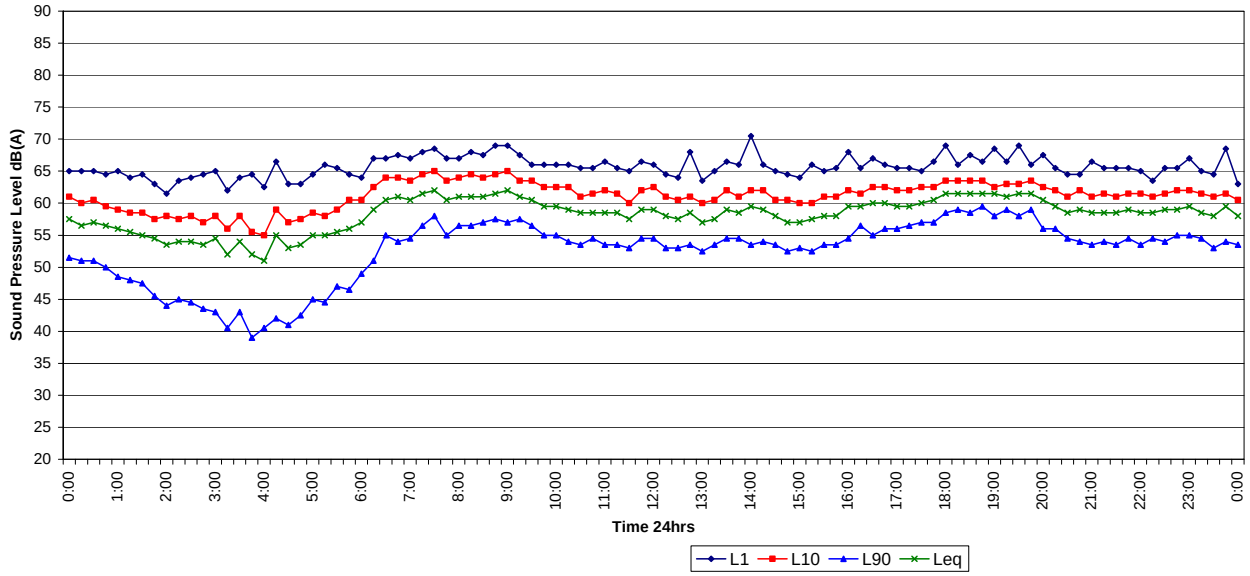
Friday 29/04/2005



205 062 Caddens Rd

Mid Location 27m from M4 Motorway

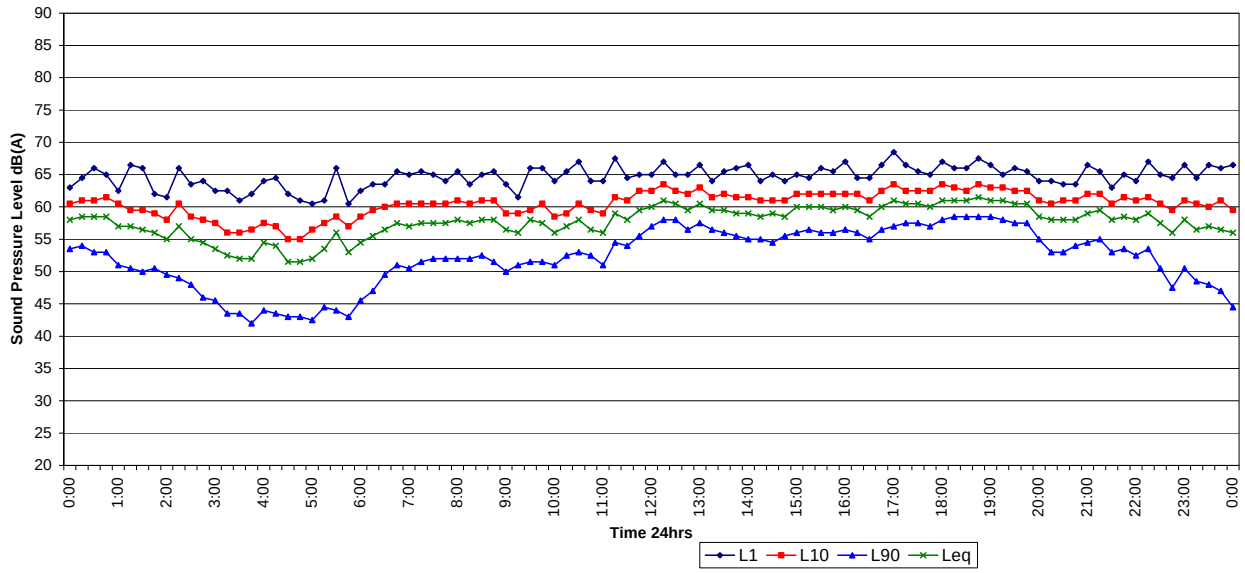
Saturday 30/04/2005



205 062 Caddens Rd

Mid Location 27m from M4 Motorway

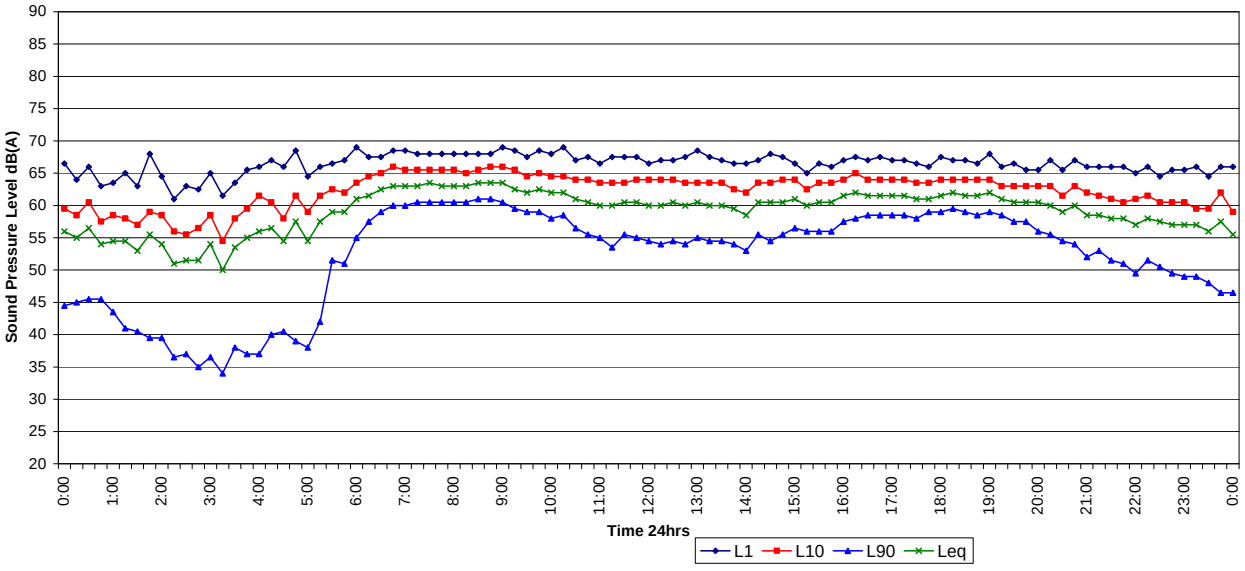
Sunday 1/05/2005



205 062 Caddens Rd

Mid Location 27m from M4 Motorway

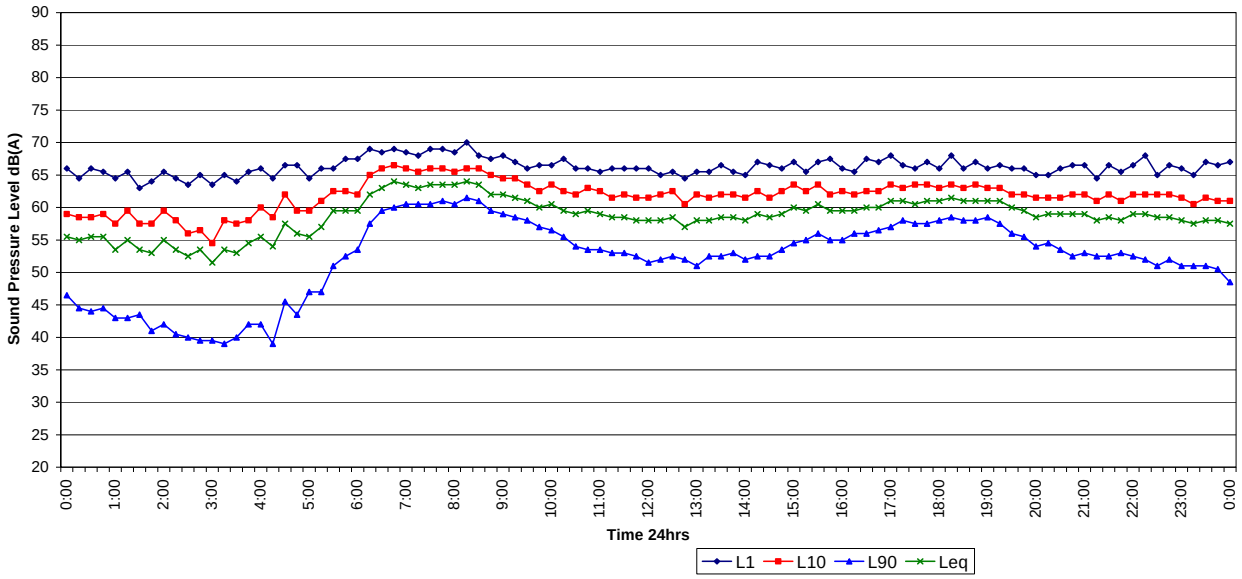
Monday 2/05/2005



205 062 Caddens Rd

Mid Location 27m from M4 Motorway

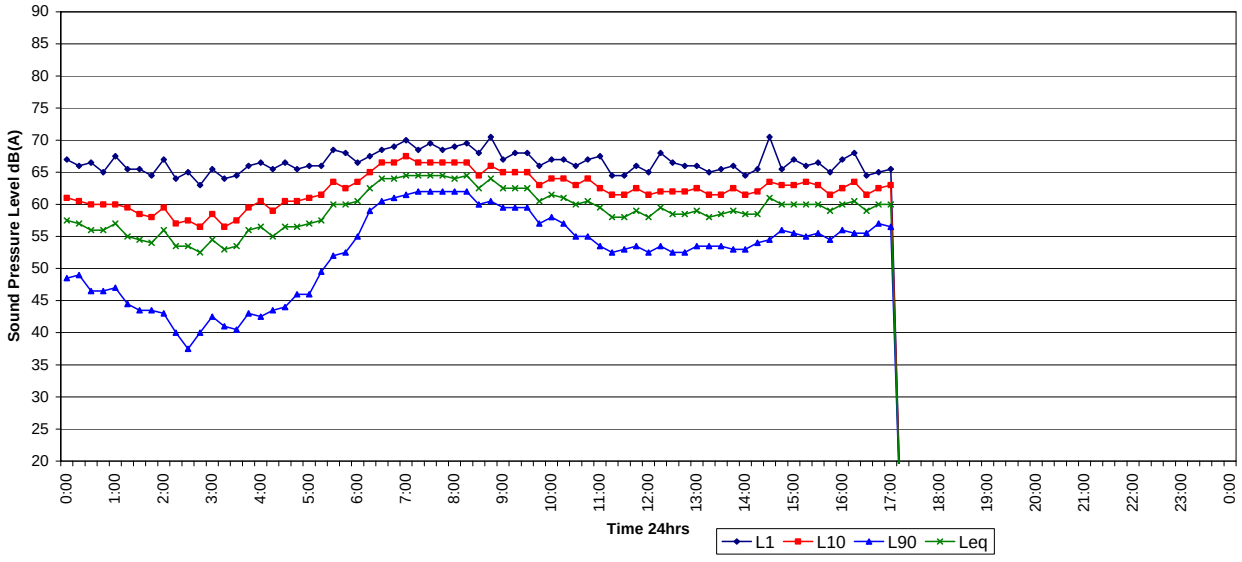
Tuesday 3/05/2005



205 062 Caddens Rd

Mid Location 27m from M4 Motorway

Wednesday 4/05/2005



9.3 South Boundary Lot 103, Western End

205 062 Caddens Rd **South Boundary Lot 103, West End**

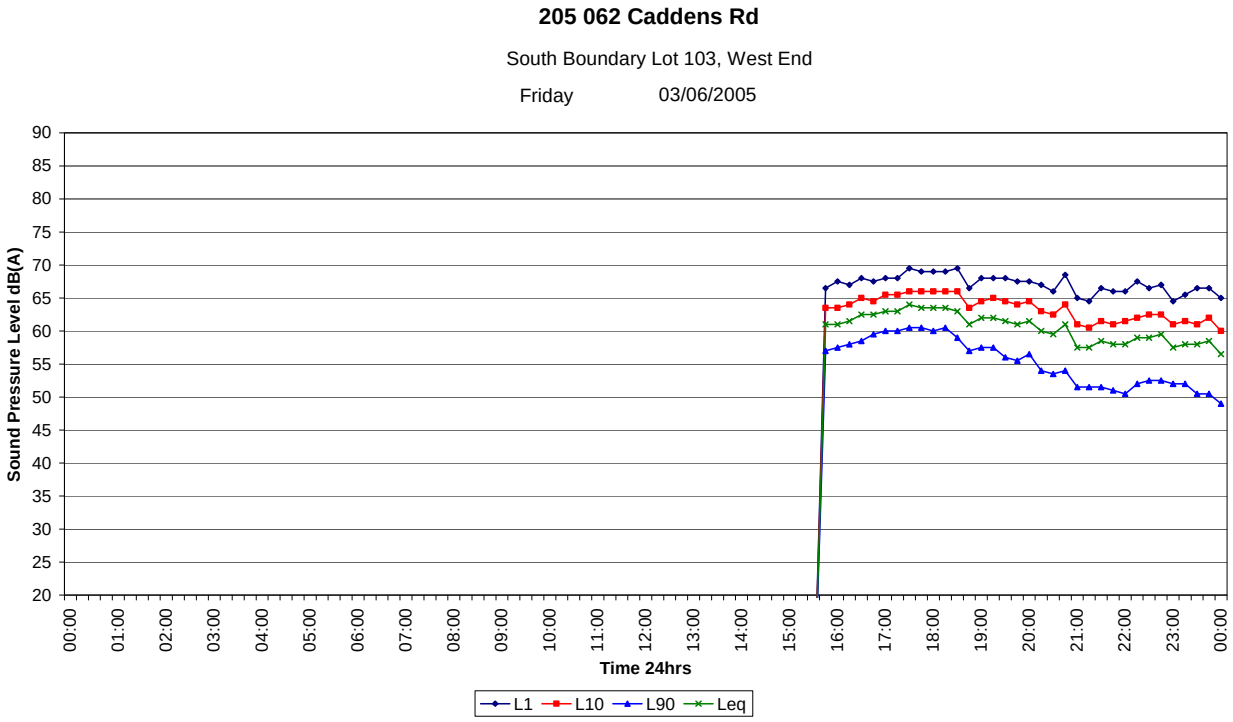
EPA TRAFFIC NOISE POLICY NOISE LEVELS						
Date	**Leq 15hr**	**Leq 9hr**	**Leq 24hr**	**L10 18hr**	**Leq 1hr**	
	0700-2200	**2200-0700**	**0000-2400**	**0600-2400**	**0700-2200**	**2200-0700**
03/06/2005	x	57.8	x	x	62.5	61.2
04/06/2005	60.0	56.0	59.3	62.6	61.8	57.7
05/06/2005	59.5	59.2	58.3	61.7	61.5	63.9
06/06/2005	60.5	59.4	60.1	63.2	61.9	64.2
07/06/2005	60.8	59.6	60.4	63.5	62.8	63.9
08/06/2005	x	x	x	x	61.4	x
09/06/2005	x	x	x	x	x	x
10/06/2005	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
Average	**60**	**58**	**60**	**63**	**62**	**62**

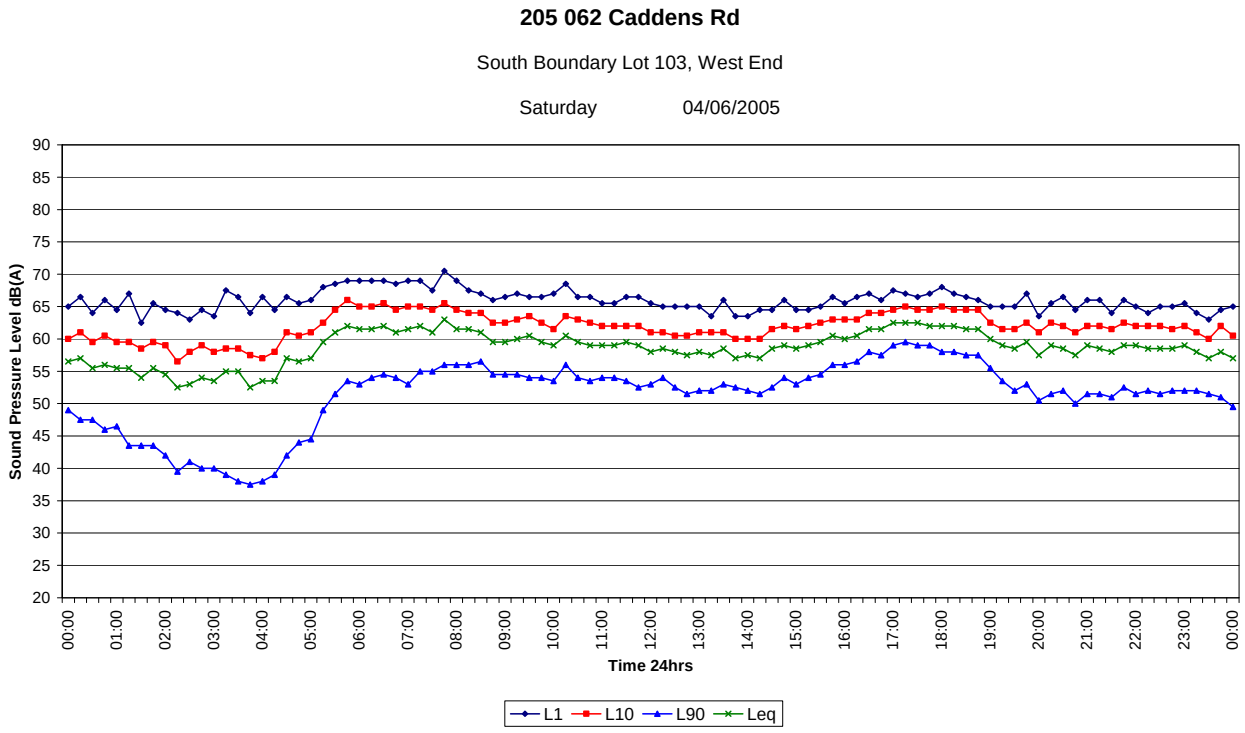
Leq 15hr, 9hr, 24hr - Assessment of logarithmic averages determined in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

L1 - Assessment of highest tenth percentile hourly Leq in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

L10 18hr - Assessment of arithmetic averages determined in accordance with EPA Environmental Noise Control Manual (Ch 157-2 1987)

EPA Environmental Criteria for Road Traffic Noise criteria:	
Type of development:	New residential affected by freeway/arterial traffic noise
Daytime Criteria:	55
Nighttime Criteria:	50
Measurement Descriptor:	Leq(15hr)/Leq(9hr)

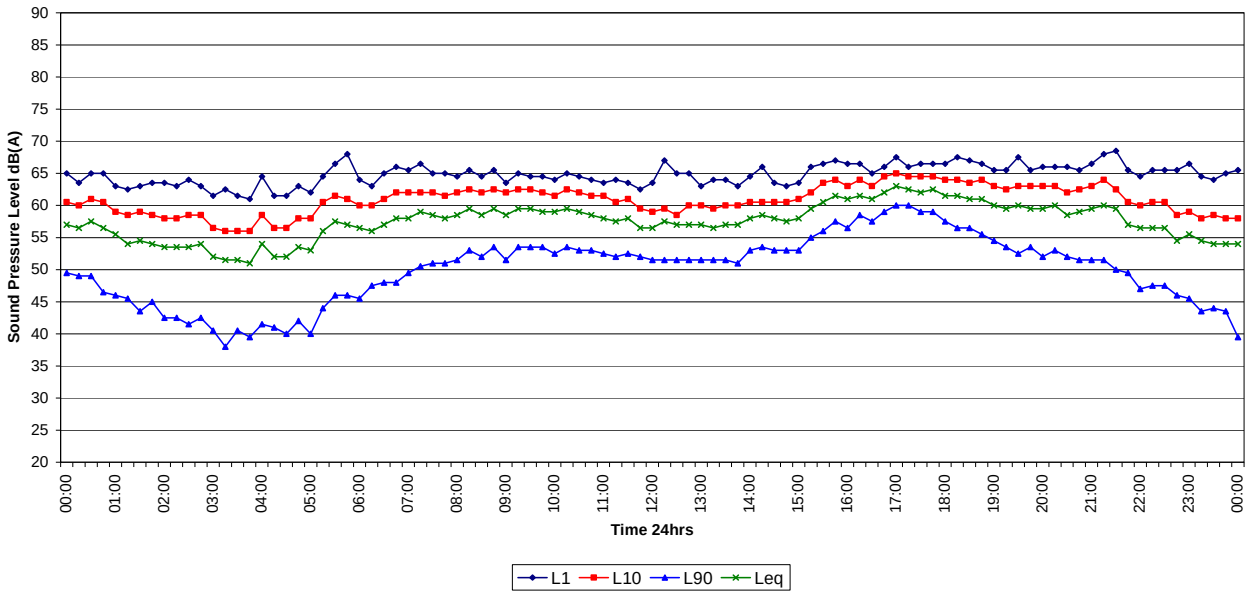

205 062 Caddens Rd
South Boundary Lot 103, West End
Friday 03/06/2005
Sound Pressure Level dB(A)
Time 24hrs
L1 L10 L90 Leq


205 062 Caddens Rd
South Boundary Lot 103, West End
Saturday 04/06/2005
Sound Pressure Level dB(A)
Time 24hrs
L1 L10 L90 Leq

205 062 Caddens Rd

South Boundary Lot 103, West End

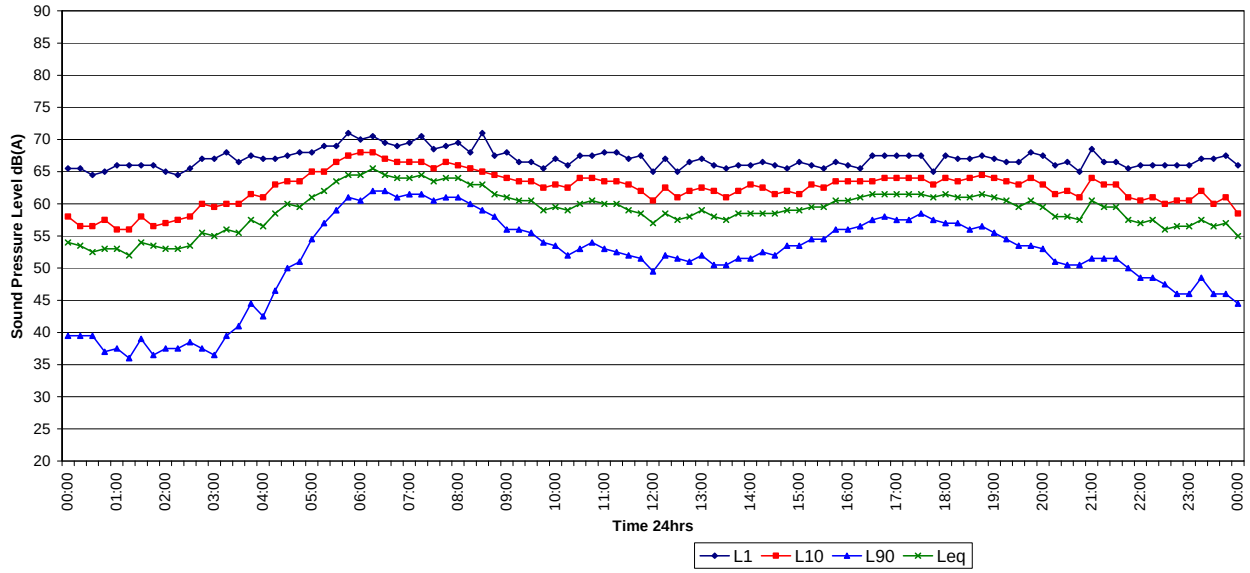
Sunday 05/06/2005



205 062 Caddens Rd

South Boundary Lot 103, West End

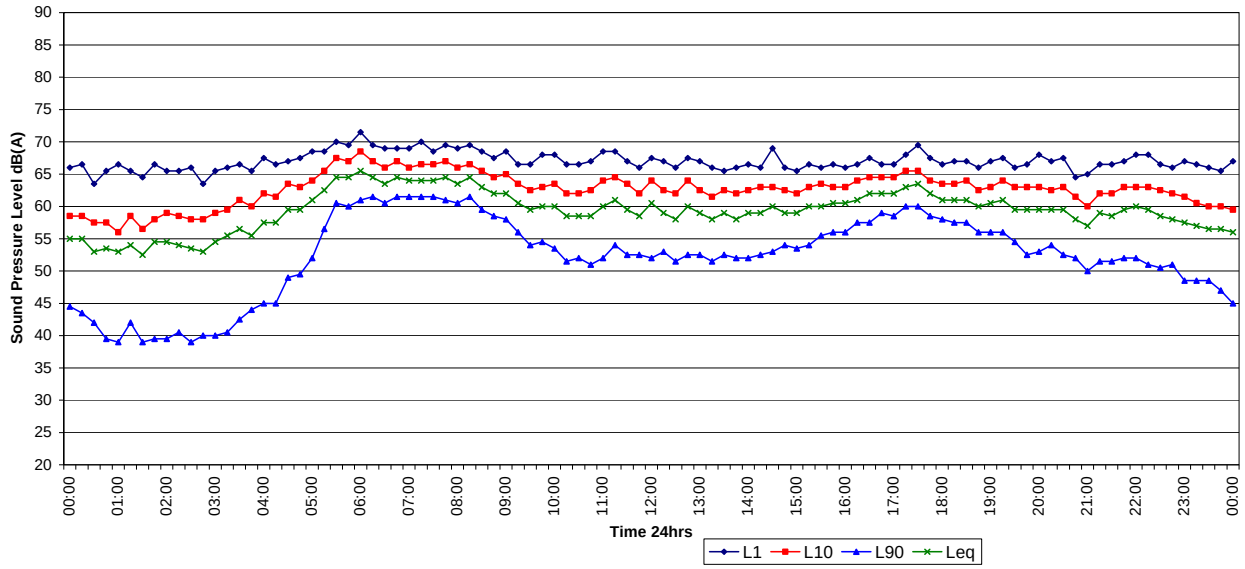
Monday 06/06/2005



205 062 Caddens Rd

South Boundary Lot 103, West End

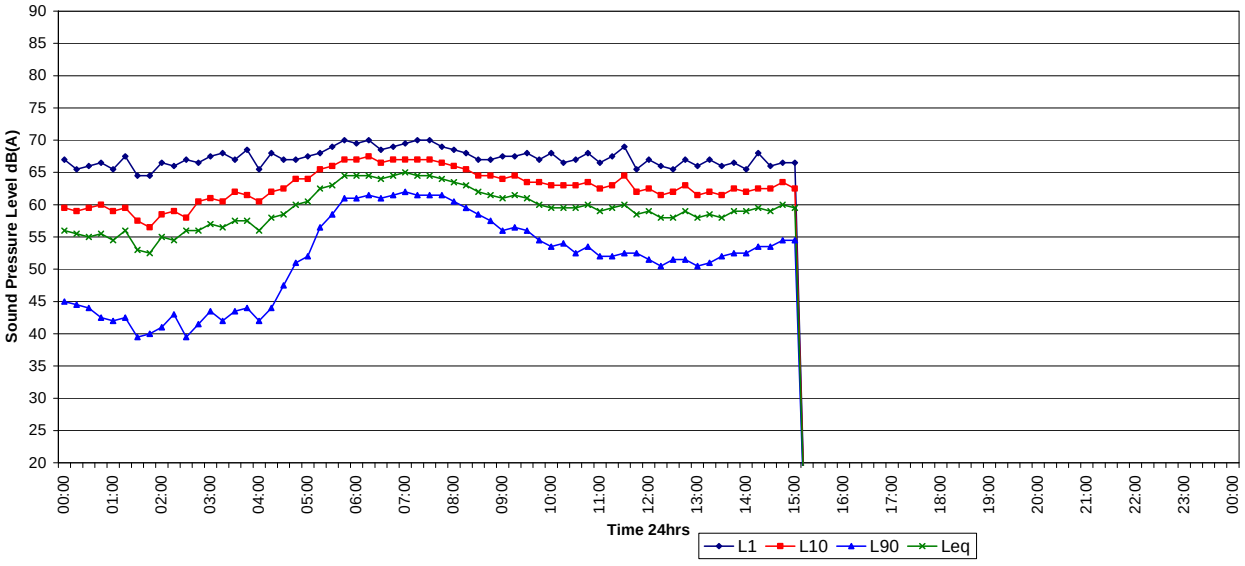
Tuesday 07/06/2005



205 062 Caddens Rd

South Boundary Lot 103, West End

Wednesday 08/06/2005



9.4 North Boundary lot 103, at lots 10 and 11

205 062 Caddens Road, Claremont Meadows **Lot 103 North Boundary at Lots 10 and 11**

EPA TRAFFIC NOISE POLICY NOISE LEVELS						
Date	**Leq 15hr**	**Leq 9hr**	**Leq 24hr**	**L10 18hr**	**Leq 1hr**	
	0700-2200	**2200-0700**	**0000-2400**	**0600-2400**	**0700-2200**	**2200-0700**
08/07/2005	x	50.1	x	x	51.3	50.8
09/07/2005	59.4	58.0	57.7	56.8	63.6	61.5
10/07/2005	65.2	52.5	63.6	62.3	68.6	57.2
11/07/2005	53.8	49.0	53.3	54.8	56.5	51.4
12/07/2005	x	x	x	x	50.6	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
Average	**59**	**52**	**58**	**58**	**58**	**55**

Leq 15hr, 9hr, 24hr - Assessment of logarithmic averages determined in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

L1 - Assessment of highest tenth percentile hourly Leq in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

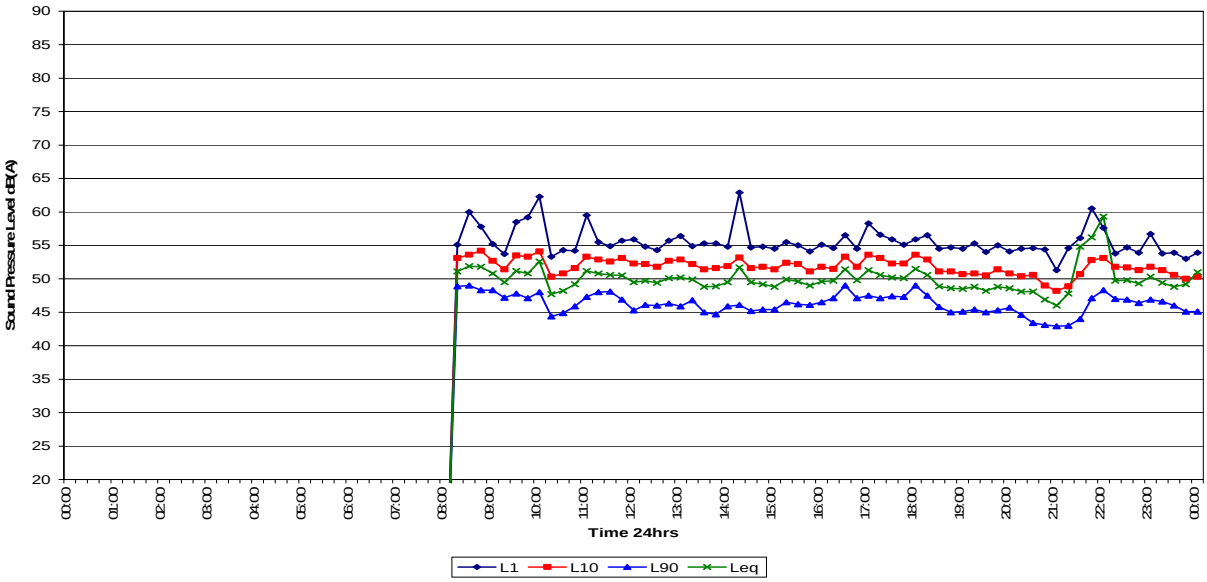
L10 18hr - Assessment of arithmetic averages determined in accordance with EPA Environmental Noise Control Manual (Ch 157-2 1987)

EPA Environmental Criteria for Road Traffic Noise criteria:	
Type of development:	New residential affected by freeway/arterial traffic noise
Daytime Criteria:	55
Nighttime Criteria:	50
Measurement Descriptor:	Leq(15hr)/Leq(9hr)

205 062 Caddens Road, Claremont Meadows

Lot 103 North Boundary at Lots 10 and 11

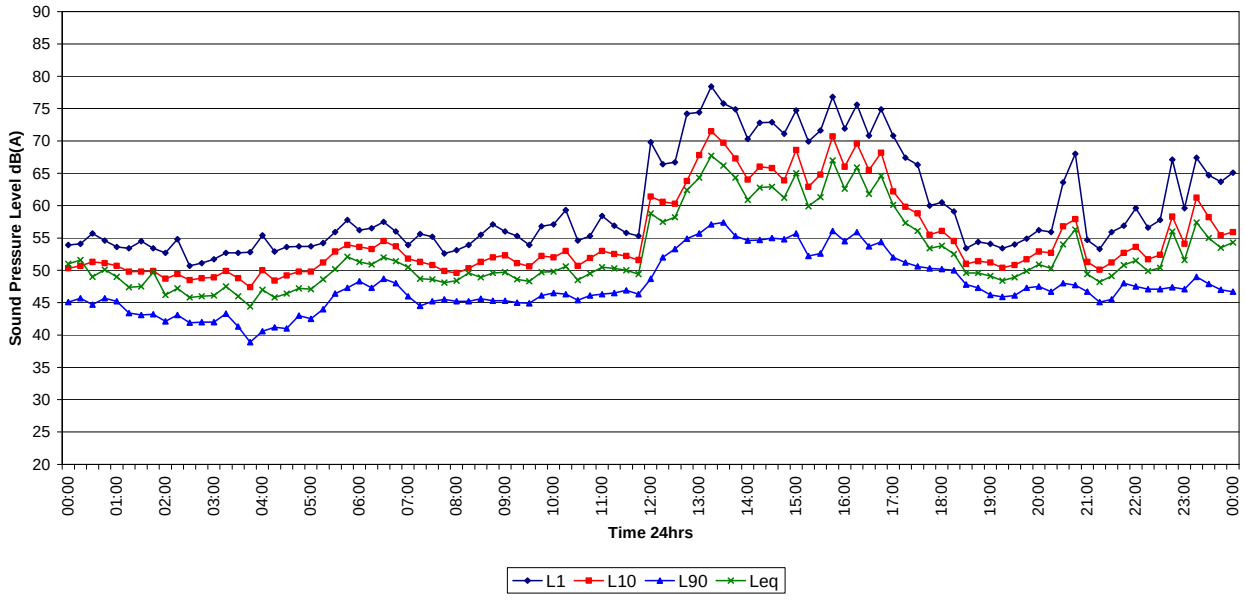
Friday 08/07/2005



205 062 Caddens Road, Claremont Meadows

Lot 103 North Boundary at Lots 10 and 11

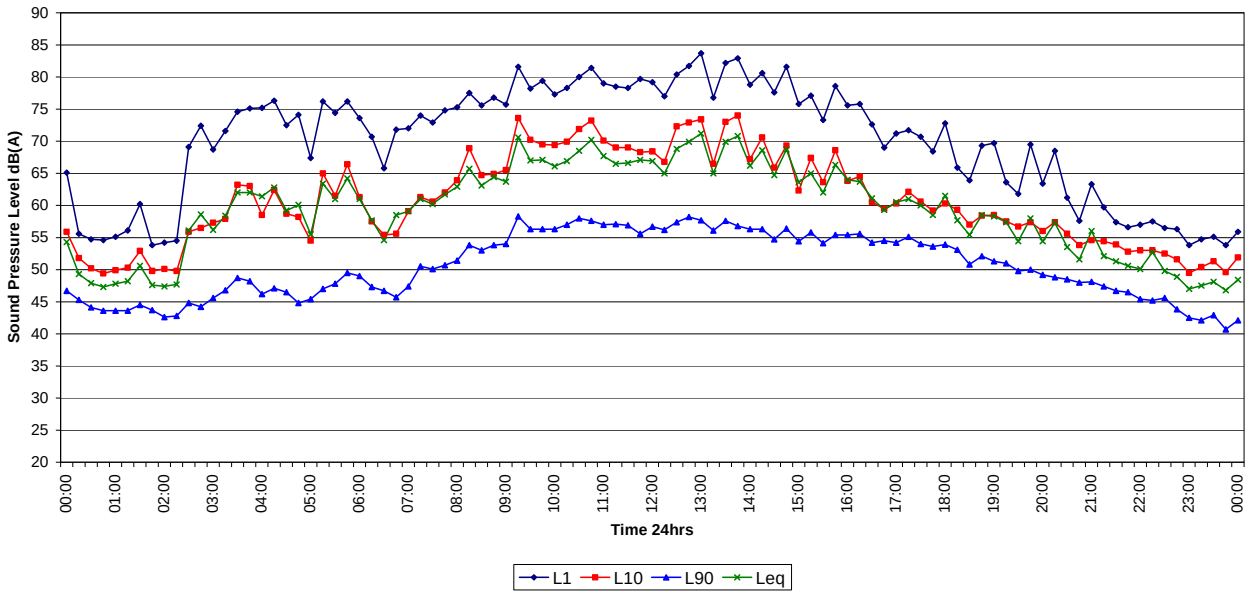
Saturday 09/07/2005



205 062 Caddens Road, Claremont Meadows

Lot 103 North Boundary at Lots 10 and 11

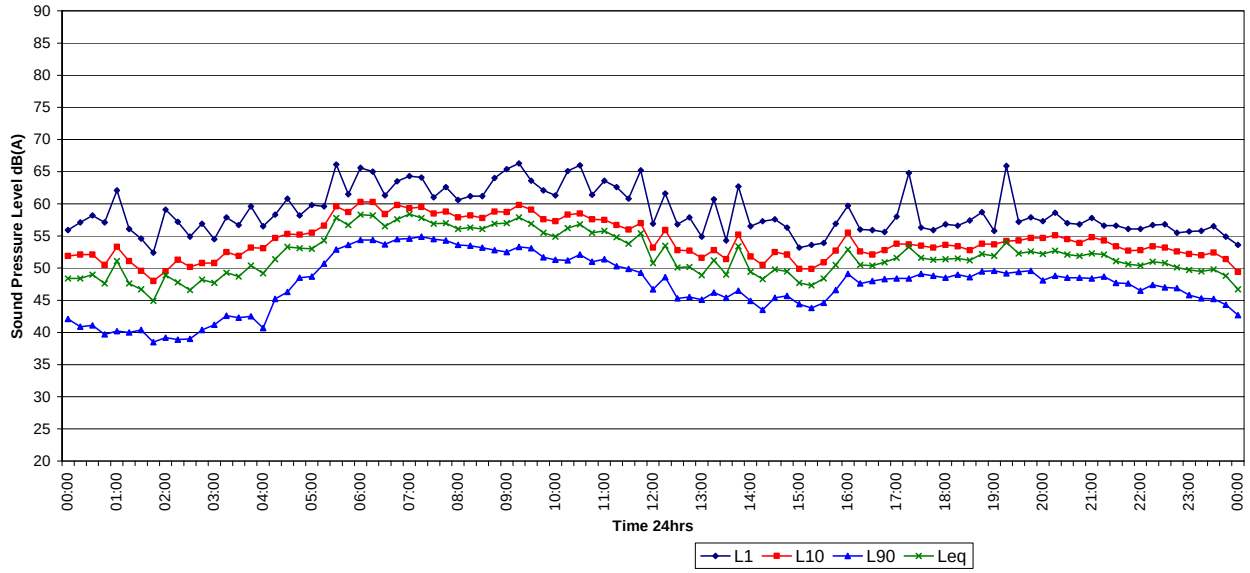
Sunday 10/07/2005



205 062 Caddens Road, Claremont Meadows

Lot 103 North Boundary at Lots 10 and 11

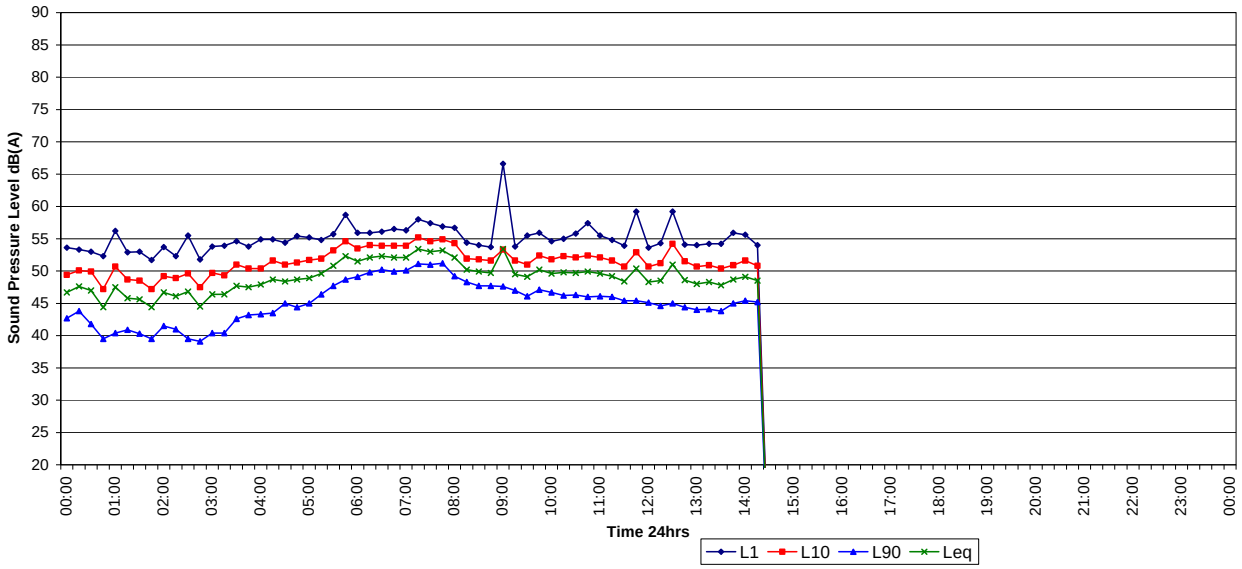
Monday 11/07/2005



205 062 Caddens Road, Claremont Meadows

Lot 103 North Boundary at Lots 10 and 11

Tuesday 12/07/2005



9.5 South Boundary Lot 103 Opposite lot 14

Caddens Road **South Boundary Lot 103 Opposite Lot 14**

EPA TRAFFIC NOISE POLICY NOISE LEVELS						
Date	**Leq 15hr**	**Leq 9hr**	**Leq 24hr**	**L10 18hr**	**Leq 1hr**	
	0700-2200	**2200-0700**	**0000-2400**	**0600-2400**	**0700-2200**	**2200-0700**
04/05/2004	x	52.5	x	x	55.8	56.2
05/05/2004	54.1	52.5	53.6	56.0	56.3	55.8
06/05/2004	65.2	54.0	63.3	57.5	58.2	55.9
07/05/2004	56.6	51.6	55.6	57.9	58.6	53.3
08/05/2004	53.9	52.1	53.0	55.2	55.8	55.6
09/05/2004	54.4	53.0	53.7	56.3	56.0	57.0
10/05/2004	x	x	x	x	54.3	x
11/05/2004	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
00/01/1900	x	x	x	x	x	x
Average	**57**	**53**	**56**	**57**	**56**	**56**

Leq 15hr, 9hr, 24hr - Assessment of logarithmic averages determined in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

L1 - Assessment of highest tenth percentile hourly Leq in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

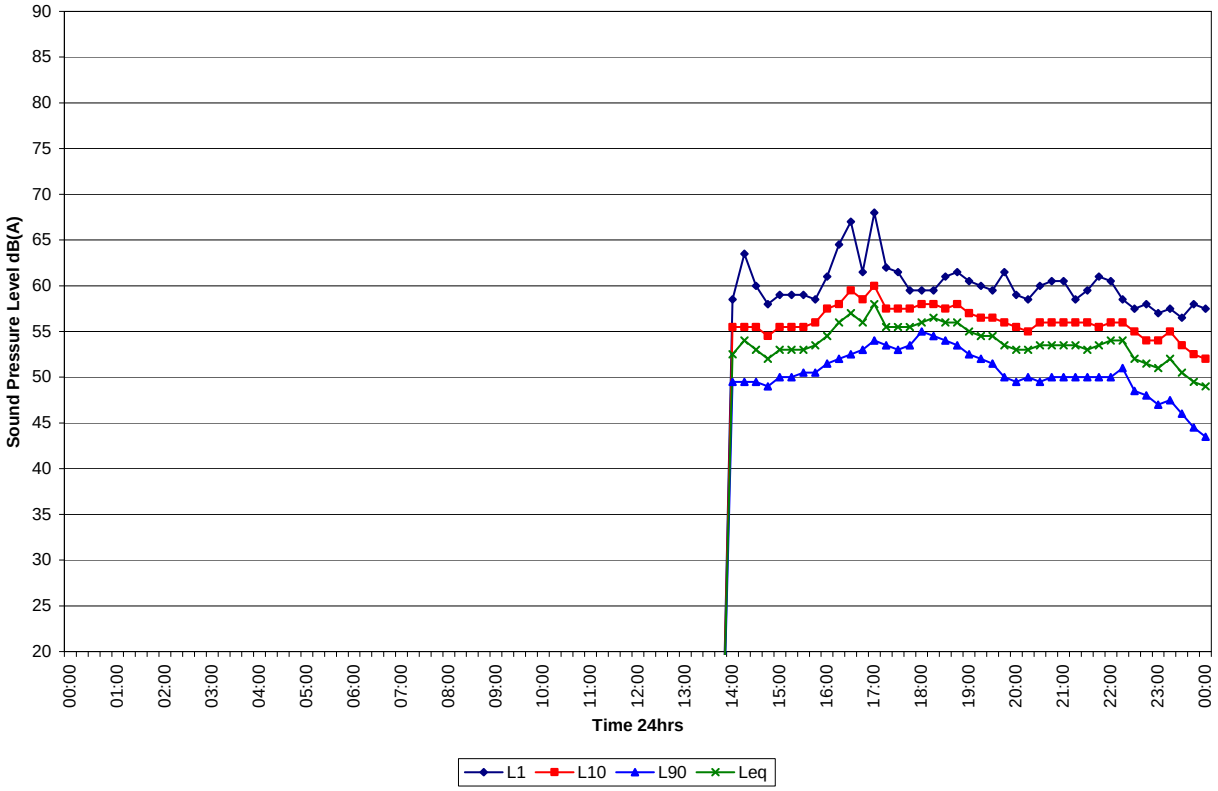
L10 18hr - Assessment of arithmetic averages determined in accordance with EPA Environmental Noise Control Manual (Ch 157-2 1987)

EPA Environmental Criteria for Road Traffic Noise criteria:	
Type of development:	New residential affected by freeway/arterial traffic noise
Daytime Criteria:	55
Nighttime Criteria:	50
Measurement Descriptor:	Leq(15hr)/Leq(9hr)

Caddens Road

South Boundary Lot 103 Opposite Lot 14

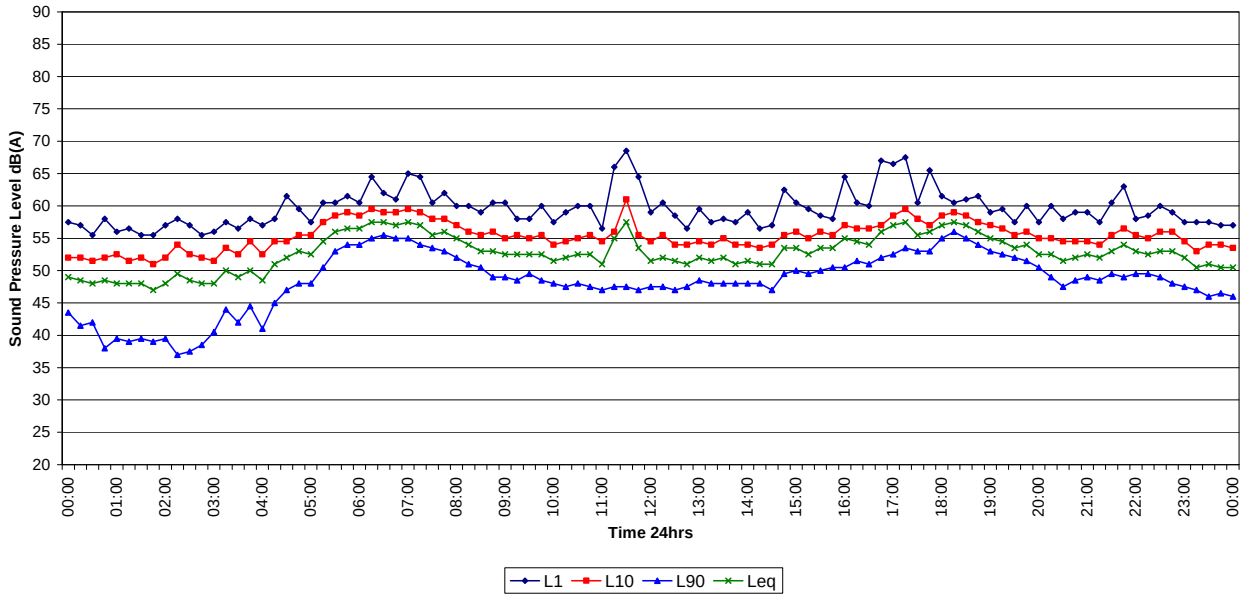
Tuesday 04/05/2004



Caddens Road

South Boundary Lot 103 Opposite Lot 14

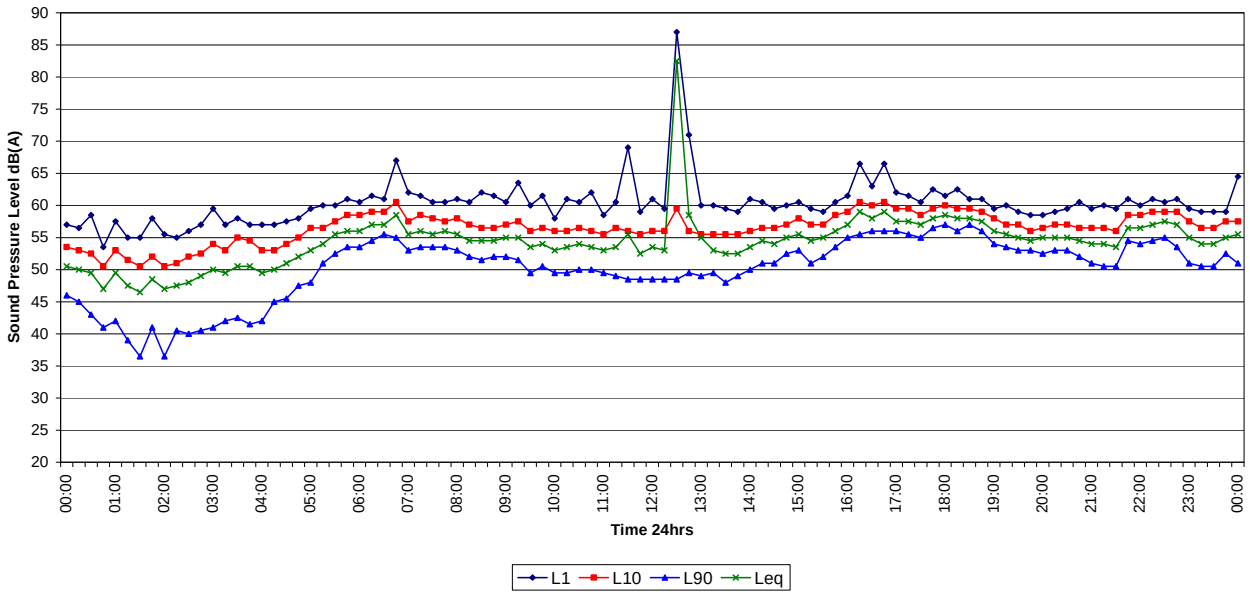
Wednesday 05/05/2004



Caddens Road

South Boundary Lot 103 Opposite Lot 14

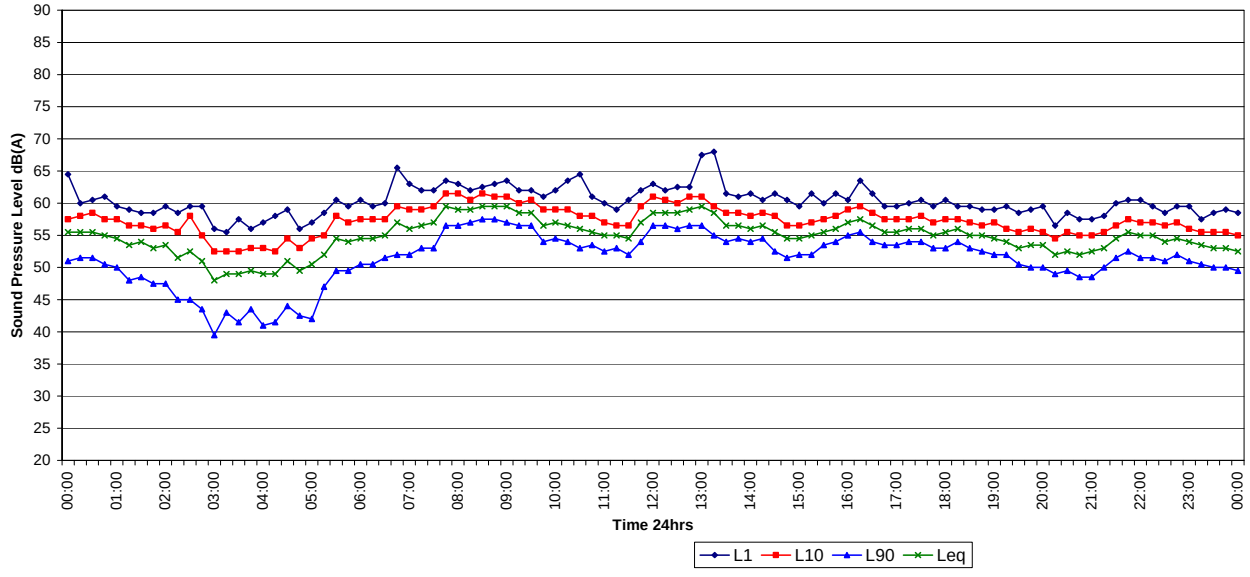
Thursday 06/05/2004



Caddens Road

South Boundary Lot 103 Opposite Lot 14

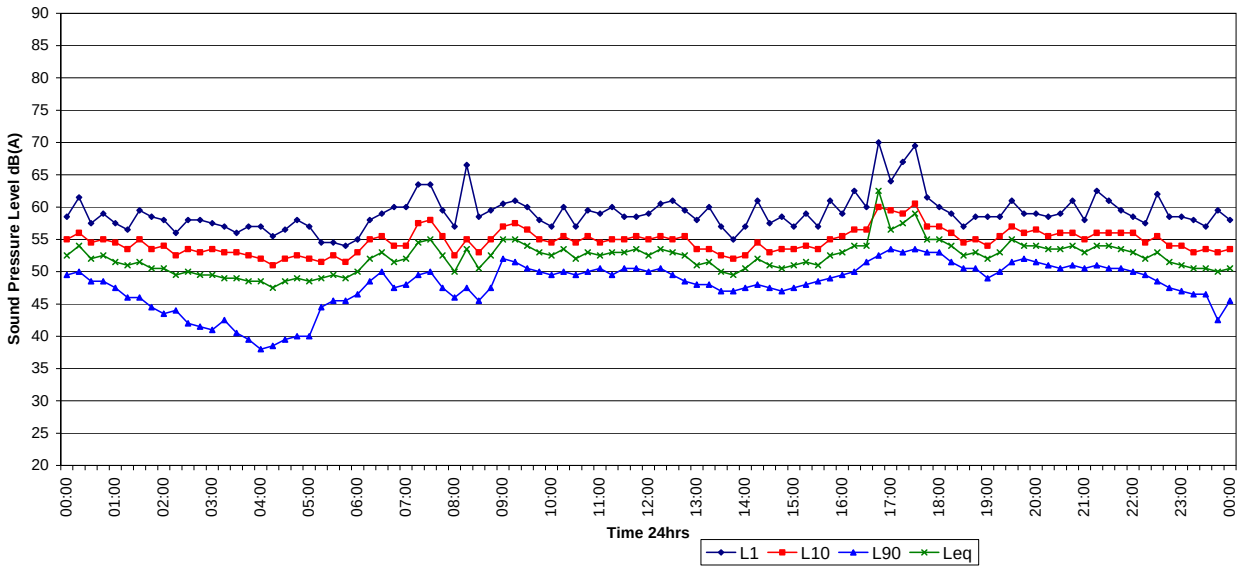
Friday 07/05/2004



Caddens Road

South Boundary Lot 103 Opposite Lot 14

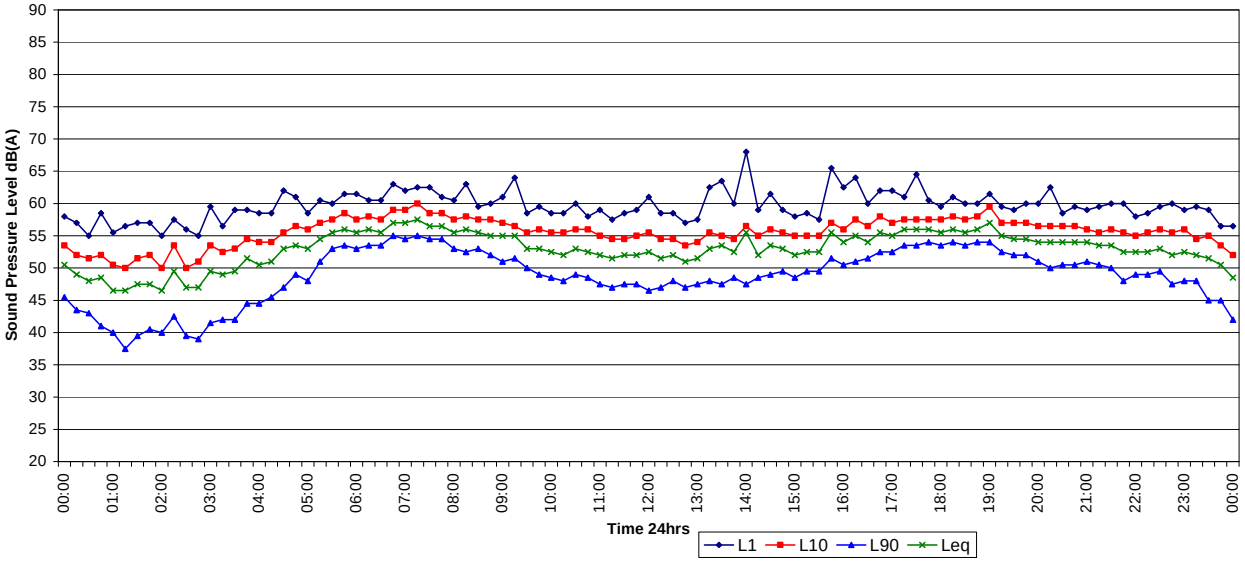
Saturday 08/05/2004

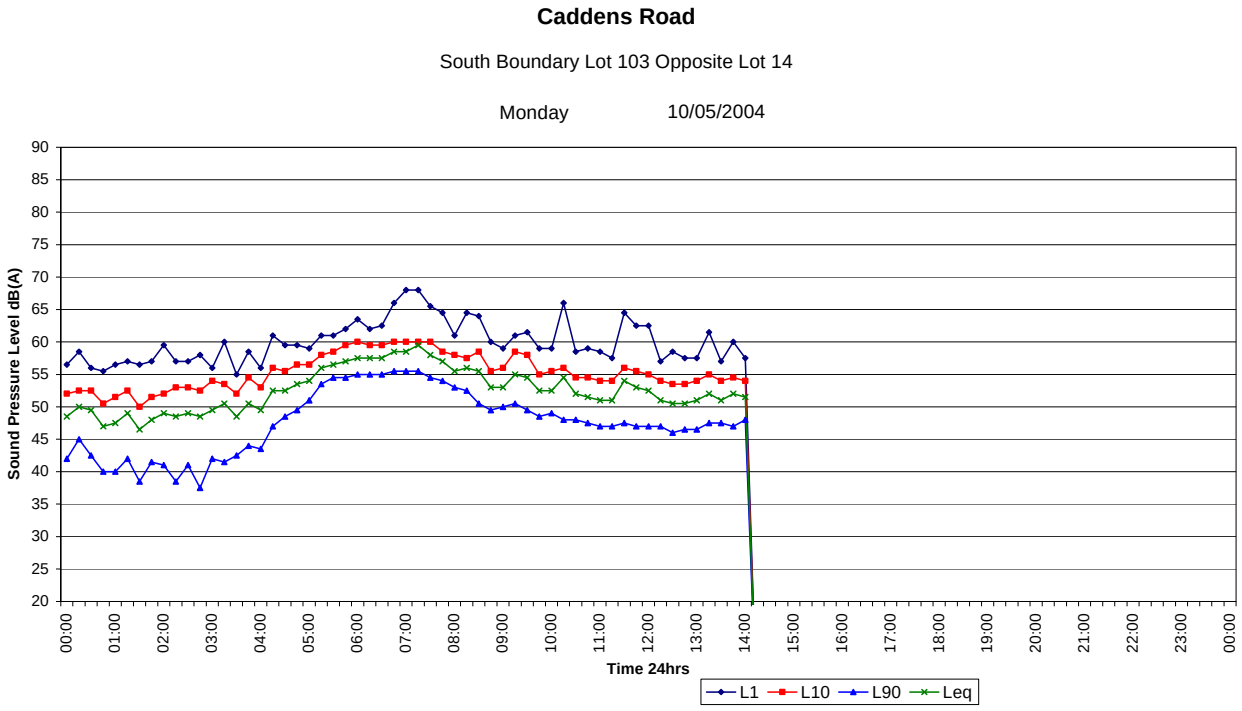


Caddens Road

South Boundary Lot 103 Opposite Lot 14

Sunday 09/05/2004




Caddens Road
South Boundary Lot 103 Opposite Lot 14
Monday 10/05/2004
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
Time 24hrs
L1
L10
L90
Leq

9.6 South East Corner Lot 103

Caddens Road **East Logger Near Kent Road**

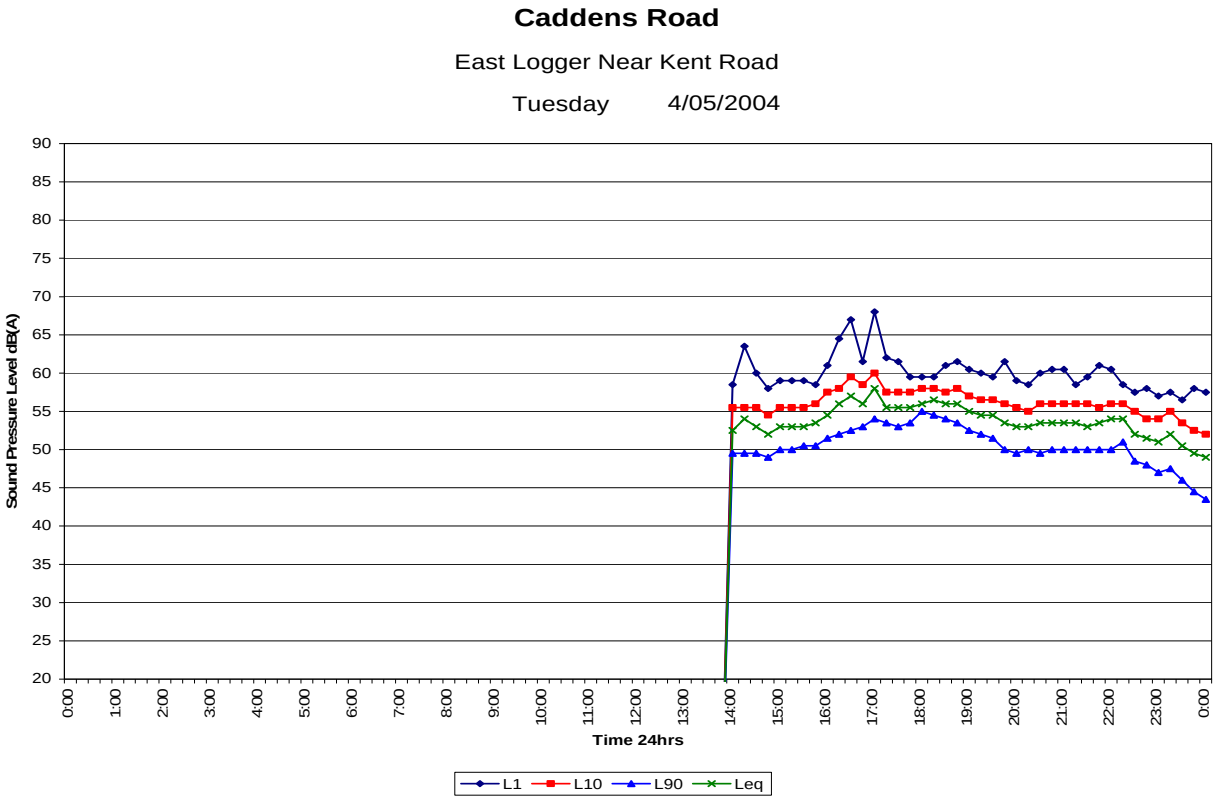
EPA TRAFFIC NOISE POLICY NOISE LEVELS						
Date	**Leq 15hr**	**Leq 9hr**	**Leq 24hr**	**L10 18hr**	**Leq 1hr**	
	0700-2200	**2200-0700**	**0000-2400**	**0600-2400**	**0700-2200**	**2200-0700**
4/05/2004	x	52.5	x	x	55.8	56.2
5/05/2004	54.1	52.5	53.6	56.0	56.3	55.8
6/05/2004	65.2	54.0	63.3	57.5	58.2	55.9
7/05/2004	56.6	51.6	55.6	57.9	58.6	53.3
8/05/2004	53.9	52.1	53.0	55.2	55.8	55.6
9/05/2004	54.4	53.0	53.7	56.3	56.0	57.0
10/05/2004	x	x	x	x	54.3	x
11/05/2004	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
0/01/1900	x	x	x	x	x	x
Average	**57**	**53**	**56**	**57**	**56**	**56**

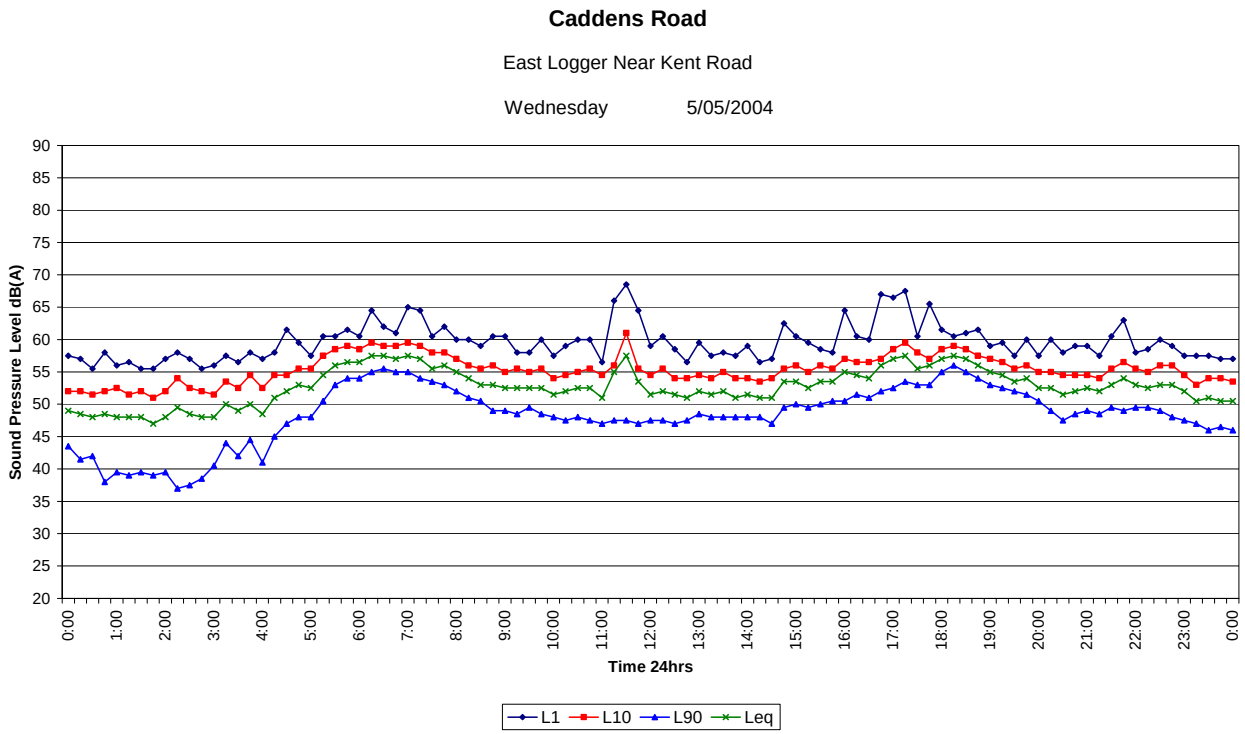
Leq 15hr, 9hr, 24hr - Assessment of logarithmic averages determined in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

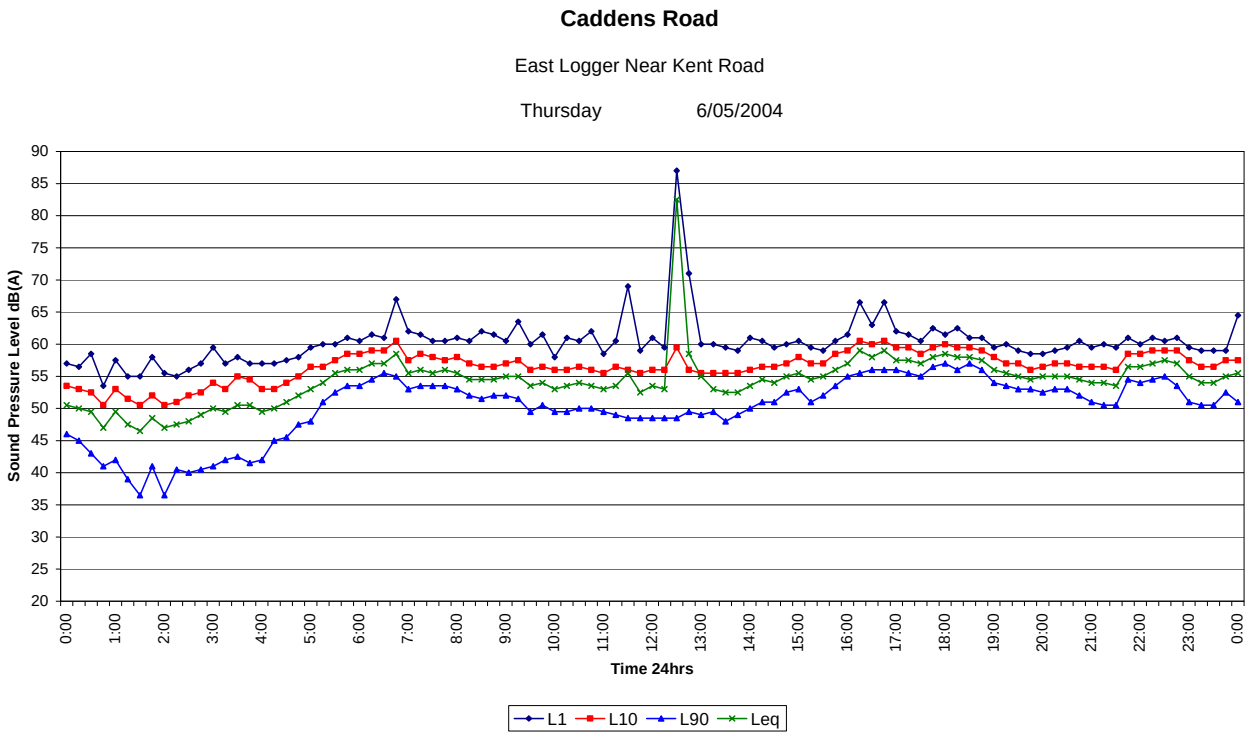
L1 - Assessment of highest tenth percentile hourly Leq in accordance with the EPA Criteria for Road Traffic Noise (May 1999)

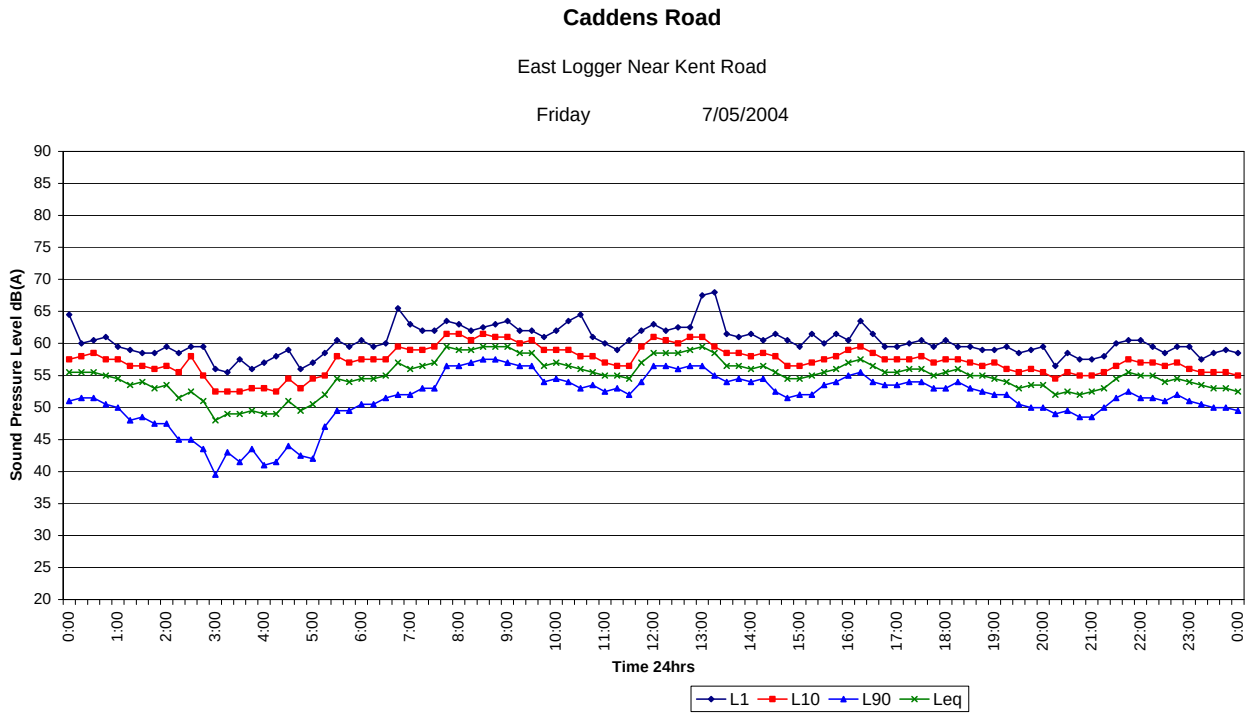
L10 18hr - Assessment of arithmetic averages determined in accordance with EPA Environmental Noise Control Manual (Ch 157-2 1987)

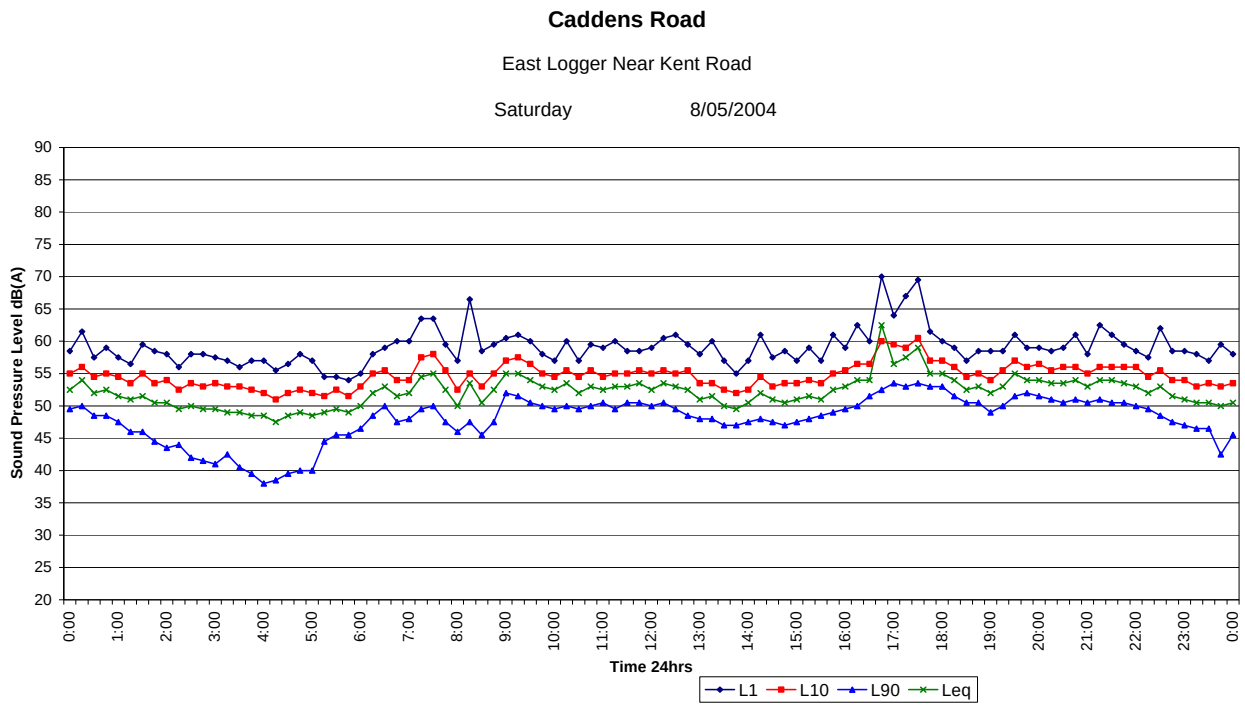
EPA Environmental Criteria for Road Traffic Noise criteria:	
Type of development:	New residential affected by freeway/arterial traffic noise
Daytime Criteria:	55
Nighttime Criteria:	50
Measurement Descriptor:	Leq(15hr)/Leq(9hr)

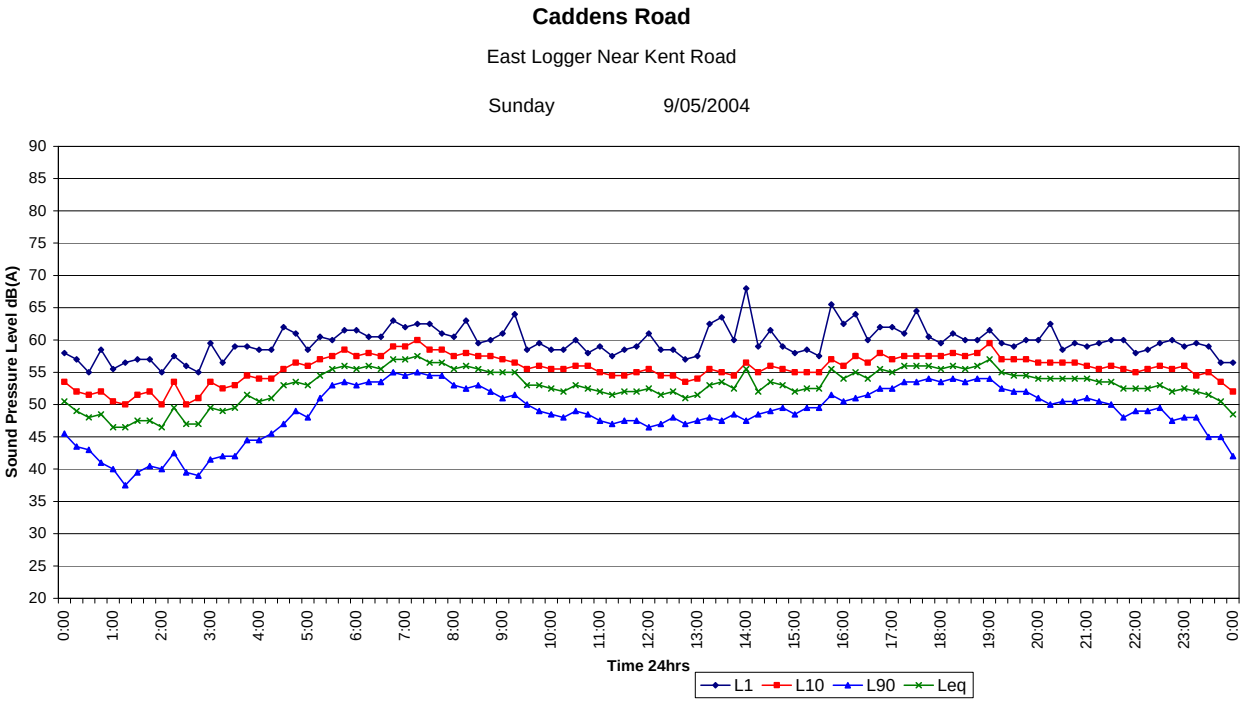

Caddens Road
East Logger Near Kent Road
Tuesday 4/05/2004
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq

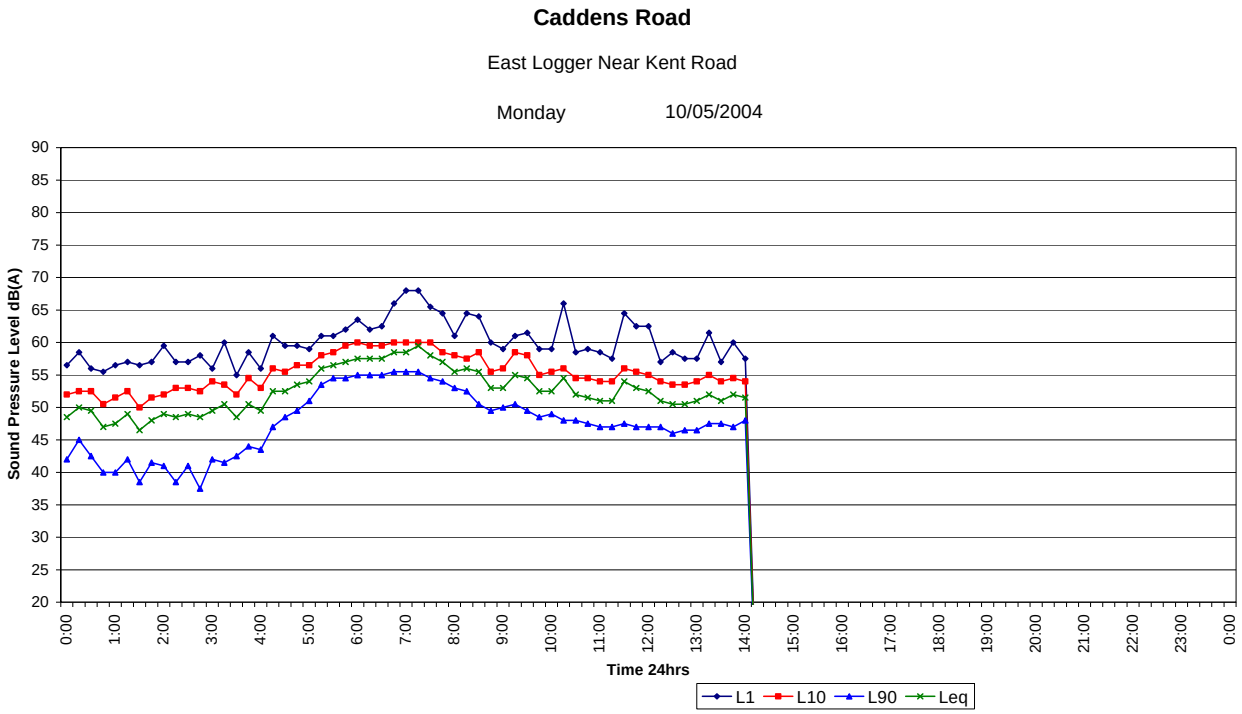

Caddens Road
East Logger Near Kent Road
Wednesday 5/05/2004
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


Caddens Road
East Logger Near Kent Road
Thursday 6/05/2004
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


Caddens Road
East Logger Near Kent Road
Friday 7/05/2004
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


Caddens Road
East Logger Near Kent Road
Saturday 8/05/2004
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


Caddens Road
East Logger Near Kent Road
Sunday 9/05/2004
Sound Pressure Level dB(A)
Time 24hrs
L1
L10
L90
Leq


Caddens Road
East Logger Near Kent Road
Monday 10/05/2004
Sound Pressure Level dB(A)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time 24hrs
L1
L10
L90
Leq