




Technical Report 17

# Pre-Construction Noise Level Survey

## Revision History

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## Document Acceptance

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Prepared by	Bill Wood (Marshall Day Acoustics)		15 April 2011
Reviewed by	Siiri Wilkening (Marshall Day Acoustics)		24 May 2011
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on behalf of	Marshall Day Acoustics		

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## Executive Summary

Marshall Day Acoustics (MDA) has undertaken ambient sound level monitoring in the vicinity of the MacKays Crossing to Peka Peka Expressway alignment. The survey results will be used as baseline noise levels for the assessment of noise effects and for the verification of the computer noise modelling of the proposed alignment.

The noise level survey results showed that ambient sound levels in the vicinity of the proposed Expressway are generally low due to the lack of noise sources such as infrastructure or industry. Where the proposed Expressway crosses local roads, e.g. Kāpiti and Te Moana Roads, ambient sound levels are slightly elevated. At either end of the proposed Expressway, where the new alignment merges with the existing State Highway 1, ambient sound levels are high due to the significant traffic volume of the existing roading network.

A glossary of technical terms is attached in Appendix 17.A.

## 1. Introduction

This report provides a summary of ambient sound level surveys undertaken for the MacKays to Peka Peka Expressway Project (the Project). The noise level survey results are intended to provide an understanding of the ambient sound levels prior to the implementation of the Project. The contents of this report will also inform the assessment of noise effects of the Project by providing a base noise level with which future predicted noise levels can be compared.

## 2. Survey Methodology

### 2.1. Survey requirements

Noise level surveys should be undertaken at representative locations along a road alignment to be assessed. This means that not every group of dwellings requires a noise level survey, but that sufficient data is collected to gain a sound understanding of the ambient noise environment along the alignment.

Noise level surveys used to determine the ambient noise environment in the vicinity of any road are generally required for locations that are representative of the location of the road. For existing roads, a large number of surveys may be required. This may be necessary in order to capture all existing environments, including those areas where existing traffic volumes vary or where existing roads intersect.

For new roads, noise sources controlling the environment are generally natural sounds that do not vary considerably from one area to the next along a proposed road alignment. This is the case for the proposed Expressway, where large extents of the proposed road will traverse areas of rural and rural residential character.

When determining noise survey locations, areas with residential activities were chosen as these are the areas of interest where residents may be affected by the proposal. In addition, some noise level surveys were undertaken for areas where intermittent dwellings may be located. The measured noise levels for these areas are representative for a large number of remote dwellings.

Following the determination of the long duration noise level survey positions, an extensive number of short duration attended surveys were undertaken to complete the ambient noise

environment picture. These surveys do not require long durations to provide suitable data. These surveys were undertaken during daytime and represent an average noise level at that time. When reviewing the long duration noise level surveys, it can be seen that the ambient noise levels for all locations except those in the vicinity of SH1 receive noise levels varying from 35 dB  $L_{Aeq}$  during night-time and 50 dB  $L_{Aeq}$  during daytime. The short duration surveys were compared with the long duration surveys and generally support the long duration survey results.

## 2.2. Survey types

Current ambient sound levels were determined by measurement at selected representative sites along the Project alignment. Twelve site inspections have been undertaken over the period spanning Wednesday 6<sup>th</sup> April to Tuesday 19<sup>th</sup> April, and Tuesday 3<sup>rd</sup> May to Thursday 20<sup>th</sup> May 2011.

Noise level surveys were undertaken at eight locations by means of continuous data logging extending from five to eight days' duration. In addition, short duration attended noise level surveys were undertaken at 39 locations. These surveys were undertaken during daytime for generally between 15 and 30 minutes' duration.

## 2.3. Survey methodology

Noise level surveys have been undertaken in accordance with the requirements of NZS6806:2010 Acoustics – Road-traffic noise – New and altered roads. Section 5.2.2 of the Standard sets out the methodology for noise level surveys of ambient sound.

This includes the requirement for contiguous  $L_{Aeq}$  measurements over at least a 24 hour period, with a preferred sample duration of 15 minutes. The long duration surveys were undertaken over several days with the recommended sample duration.

The duration of the long duration surveys also ensured that suitable meteorological conditions were included. The short duration noise level surveys were undertaken to complement the long duration surveys and provide background information for other parts of the alignment where no noise logger surveys were undertaken. Weather conditions were noted for all locations.

## 2.4. Short duration noise level survey locations

Short duration attended noise level survey locations MP1 to MP39 are shown on the figures included as Appendix 17.B.

During the surveys, the weather conditions were as follows:

- 06/04/11: Partially overcast (5/8), approximately 15o C, light SW breeze 0-1 m/s;
- 07/04/11: Overcast (7/8), approximately 12o C, light SE breeze 0-2 m/s;
- 08/04/11: Overcast (7/8), approximately 16o C, S wind 2-4 m/s;
- 11/04/11: Overcast (7/8), approximately 17o C, light N breeze 0-1 m/s;
- 12/04/11: Fine, clear, approximately 17o C, light NW breeze 0-1 m/s;
- 13/04/11: Overcast (8/8), approximately 17o C, light N breeze 0-1 m/s;
- 19/04/11: Partially overcast (5/8), approximately 14o C, light NE breeze 0-1 m/s;
- 03/05/11: Overcast (7/8), approximately 19o C, little or no wind;
- 11/05/11: Overcast (8/8), approximately 16o C, light NW breeze 0-0.5 m/s. Occasional drizzle;
- 12/05/11: Overcast (7/8), approximately 14o C, no wind;
- 19/05/11: Fine, clear, approximately 16o C, light NW breeze 0-2 m/s;
- 20/05/11: Partially overcast (2/8), approximately 16o C, light NW breeze 0-2 m/s.

These conditions are generally well suited for environmental noise level surveys in accordance with NZS6801:2008 'Acoustics – Measurement of Environmental Sound'.

Appendix 17.C notes the GPS location of each satellite measurement position as well as the actual noise levels measured at each position.

Short duration measurements have been adjusted to obtain approximate 24-hour noise levels. This is noted in the tables of Appendix 17.C.

The adjustment was undertaken by applying the difference between the 24-hour  $L_{Aeq}$  and the measured level at the specific time of day to the short duration noise level result. For example, a long duration noise level survey (refer Section 3.5 below) was undertaken and a diurnal variation of noise level values obtained (refer Appendix 17.D). A short duration noise level survey was undertaken at 9 am in the general vicinity of the long duration survey. The diurnal variation of the long duration survey shows that the measured level at 9 am is 2 decibels above the 24-hour  $L_{Aeq}$ . Therefore, the short duration survey result was adjusted by adding 2 decibels to obtain an approximate  $L_{Aeq(24h)}$ .

Where no long duration survey was undertaken in the vicinity, the diurnal variation of a similar survey position was used. This was particularly the case for survey positions unaffected by local road noise. Natural noise (e.g. animals, wind in vegetation etc) does not vary considerably from one location to another in a region. Therefore, survey locations such as MP18, 19, 28 and 29 were adjusted by using the diurnal variation of LT7, which is well removed from any major noise source.

Overall, judgement was used in how to adjust the short duration results to obtain an approximation of 24-hour noise levels. No adjustments exceeded 2 decibels, with some adjustments being 0 or 1 decibel, depending on location. The tables in Appendix 17.C show the adjusted noise levels. It is noted that these values are approximate and are used to gain a fuller understanding of the ambient noise level along the alignment. Where a long duration survey was undertaken, then this value is always used in preference of the adjusted short duration survey results.

## 2.5. Long duration survey locations

Eight measurement sites were selected for continuous long term measurements (LT1 to LT8) using unattended noise loggers over the following periods:

- LT 1: 115 Leinster Avenue 06-11/04/11;
- LT 2: 100 Kāpiti Road 06-11/04/11;
- LT 3: 22 Chilton Drive 06-11/04/11;
- LT 4: 28 Puriri Road 12-19/04/11;
- LT 5: 164 Te Moana Road 12-19/04/11;
- LT 6: 88 Raumati Road 03-11/05/11
- LT 7: 155 Otaihanga Road 03-11/05/11
- LT 8: 32 Peka Peka Road 03-11/05/11

These long term measurement sites were at the positions marked LT 1 to LT 8 on the figures included as Appendix 17.B. The measurement positions were selected as being representative of a group of houses potentially affected by noise from the proposed Expressway.

Each logger was positioned in free field conditions, and located on the aspect of the property that would be most affected by noise from traffic on the proposed Expressway. GPS co-ordinates and photographs of the measurement setup were taken at each location.

Where meteorological conditions were found to be unsuitable for environmental noise surveys, these periods were excluded from the surveys. This is the case when wind exceeded 5 m/s and rainfall 6 mm/h. The diurnal variation of noise level for each long duration survey in Appendix 17.D shows the data suitable to be used as a basis of ambient noise levels in blue. Other data which was adversely affected by meteorological conditions is shown in orange. Only suitable data was used to determine the ambient  $L_{Aeq(24hrs)}$ .

Ambient noise data from the loggers was converted to  $L_{Aeq(24hrs)}$  sound levels. Appendix 17.D shows the long term noise levels for each location, together with the diurnal variation in sound level and a photo of the survey site.

### 3. Noise level survey summary

#### 3.1. Sector 1

##### 3.1.1. Leinster Avenue

For houses located on Leinster Avenue and adjacent streets such as Sydney Crescent and for houses located on the existing SH1 route further north of Leinster Avenue, the main noise source is traffic on the existing SH1 route, with some contribution from rail traffic on the adjacent North Island Main Trunk (NIMT).

For houses closest to the existing SH1 route, the current noise level has been measured as being **65 dB**  $L_{Aeq(24hrs)}$ . This is considered an elevated noise level for residential properties and is already in excess of the least stringent noise level Category C<sup>1</sup> in accordance with NZS6806:2010.

The current noise level at the houses potentially most exposed to noise from traffic on the proposed Expressway but further removed from the existing SH1 route has been measured as being **56 dB**  $L_{Aeq(24hrs)}$ . This noise level is considered well suited for residential use and is within the most stringent noise level Category A<sup>2</sup> in accordance with NZS6806:2010.

Noise level survey locations within this area include LT1 and MP9, 10, 11, 13, 14, 15, shown on Figures B1 to B3 in Appendix 17.B. Short duration sound level survey results are shown in Table C1 in Appendix 17.C and long duration results in Appendix 17.D.

##### 3.1.2. Between Leinster Avenue and Raumati Road

For the houses in Sam's Way, Harry Shaw Way, and Fincham/Gavin Roads, as well as the rear properties off Matai Road backing onto the existing WLR designation, the current ambient sound level has been measured as being **46 dB**  $L_{Aeq(24hrs)}$ . The noise sources in this area include traffic on the distant roading network including SH1, and small aircraft, including helicopters. The ambient noise environment for these houses is considered to be low, as would be expected in a rural environment removed from infrastructure and industrial noise sources.

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<sup>1</sup> Dwellings in Category C are predicted to receive noise levels from an assessed roading project of more than 67 dB  $L_{Aeq(24hrs)}$  and would be considered for building modification mitigation such as improved insulation and alternative ventilation.

<sup>2</sup> Dwellings in Category A are predicted to receive noise levels from an assessed roading project of 57 dB  $L_{Aeq(24hrs)}$  or less.

Raumati Road itself has a mix of asphaltic and chipseal surfaces. The dwellings closest to Raumati Road experience higher noise levels than those further removed from the road. Houses fronting onto Raumati Road are currently in an ambient noise environment that has been measured as being **46 to 68 dB**  $L_{Aeq(24hrs)}$ , with the lower levels for houses more distant from the road.

Noise level survey locations in this area include LT6 and MP16, 17, 25 and 26, shown on Figures B1 to B3 of Appendix 17.B. Short duration sound level survey results are shown in Table C1 in Appendix 17.C and long duration results in Appendix 17.D.

## 3.2. Sector 2

### 3.2.1. Raumati Road to Kāpiti Road

In this area the location of the proposed Expressway generally follows the existing WLR designation.

East of the proposed Expressway alignment, for houses on Rata Road immediately north of Raumati Road (including 20 to 30 Rata Road), the current ambient sound level has been measured as being **52 dB**  $L_{Aeq(24hrs)}$ .

On the western side of the proposed Expressway the current ambient sound level at the Kiwi Road properties backing onto the designation has been measured as being **68 dB**  $L_{Aeq(24hrs)}$  close to Raumati Road and opposite Rata Road, reducing to **56 dB**  $L_{Aeq(24hrs)}$  at the north end of Kiwi Road, nearer Quadrant Heights. The noise sources in this area include traffic on the distant roading network including SH1, as well as small aircraft, including helicopters.

Further north, the current ambient sound level has been measured as being **42 to 43 dB**  $L_{Aeq(24hrs)}$  in the vicinity of the houses backing onto the designation in Quadrant Heights, Datum Way, Observation Place, and **44 dB**  $L_{Aeq(24hrs)}$  for the Milne Drive houses closer to Kāpiti Road. The noise sources in this area include traffic on the distant roading network including SH1. However, the dominant daytime noise source was observed to be small aircraft, including helicopters, due to the proximity of Paraparaumu Airport.

The ambient noise environment in this area is considered to be low to very low for a residential area and well within the most stringent Category A of NZS6806:2010.

Noise level survey locations in this area include MP8, 18, 19, 24, 27, 28, 29 and 37 shown on Figures B4 to B8 in Appendix 17.B. Short duration sound level survey results are shown in Table C2 in Appendix 17.C.

### 3.2.2. Kāpiti Road to Mazengarb Road

The topography in this area is undulating due to sand dunes. Therefore, the current ambient sound levels quickly reduce with distance from Kāpiti and Mazengarb Roads due to shielding of sound by the dunes. For most houses between Greenwood Place and St James Crescent, the main noise sources include traffic on the distant roading network and aircraft approaching and departing Paraparaumu Airport, as well as typical suburban sounds of occasional dogs barking, traffic on the local roads, and birds.

In this location the alignment of the proposed Expressway generally follows the existing WLR designation.

For houses potentially most exposed to traffic noise from the proposed Expressway, and located behind the commercial buildings fronting onto Kāpiti Road, the current ambient sound level has been measured as being **49 dB**  $L_{Aeq(24hrs)}$ .



For the houses in Greenwood Place (backing onto the designation), the current ambient sound level has been measured as being **45 dB**  $L_{Aeq(24hrs)}$ .

For the houses in Elder and Cypress Grove (backing onto the designation), the current ambient sound level has been measured as being **43 dB**  $L_{Aeq(24hrs)}$ .

For the houses in Spackman Crescent, Makarini Street, Palmer Crescent and St James Crescent, as well as for the potentially most exposed houses in Cheltenham Drive and Oxford Crescent, the current ambient sound level has been measured as being approximately **41 dB**  $L_{Aeq(24hrs)}$ .

These are low ambient sound levels for an urban environment and are well within the Category A criterion of 57 dB  $L_{Aeq(24hrs)}$ .

Nearest to Mazengarb Road, current ambient sound levels for the Chilton Drive houses have been measured as ranging between **52** and **44 dB**  $L_{Aeq(24hrs)}$ , with the lower sound level for the houses more distant from Mazengarb Road (including 37-45 Chilton Drive). The house closest to Mazengarb Road (No. 20 Chilton Drive) is comparatively more exposed to the noise of Mazengarb Road traffic, due to the undulating dune topography in this area. The current ambient sound level at ground floor level for this house has been measured as being **52 dB**  $L_{Aeq(24hrs)}$ .

The current ambient sound levels for the houses immediately north of Mazengarb Road have been measured as being **56 dB**  $L_{Aeq(24hrs)}$  for the closest house and **47 dB**  $L_{Aeq(24hrs)}$  for houses more removed from Mazengarb Road.

While dwellings closest to Mazengarb Road experience higher noise levels than those removed from the road, all measured noise levels are within the most stringent Category A of NZS6806:2010.

Survey locations in this area include LT2 and 3, and MP1 to 7, 20 and 21, shown on Figures B4 to B8 in Appendix 17.B. Short duration sound level survey results are shown in Table C2 in Appendix 17.C and long duration results in Appendix 17.D.

### 3.3. Sector 3

#### 3.3.1. North of Mazengarb Road to the Waikanae River

Relatively few houses are currently located in the area immediately north of Mazengarb Road. For these houses, mainly located between Otaihanga Road and the Waikanae River, the main noise source is traffic on Otaihanga Road, with some contribution from the more distant roading network including SH 1, and aircraft.

The current ambient sound level has been measured as being **46 dBA**  $L_{Aeq(24hrs)}$  midway between Mazengarb and Otaihanga Roads, and **47 dB**  $L_{Aeq(24hrs)}$  at houses closest to Otaihanga Road. Further north towards the Waikanae River, the current ambient sound level has been measured as being **46 dB**  $L_{Aeq(24hrs)}$ .

The ambient sound environment for these houses is considered to be low, as would be expected in a rural environment removed from infrastructure and industrial noise sources, with levels well within the most stringent Category A criterion of 57 dB  $L_{Aeq(24hrs)}$ .

Noise survey locations in this area include LT7 and MP30, 31 and 33 as shown on Figures B9 to B12 in Appendix 17.B. Short duration sound level survey results are shown in Table C3 in Appendix 17.C and long duration results in Appendix 17.D.

### 3.3.2. Kauri Road to Te Moana Road

Houses on Kauri and Puriri Roads currently receive noise from traffic to and from the holiday camp located at the end of Kauri Road. The current ambient sound levels for houses on Kauri Road have been measured as ranging between **43 dB**  $L_{Aeq(24hrs)}$  for the houses more distant from the road, and **46 dB**  $L_{Aeq(24hrs)}$  for those fronting the road.

Houses on Puriri Road are generally closer to the street than in Kauri Road. The current noise level for houses on Puriri Road has been measured as **50 dB**  $L_{Aeq(24hrs)}$ .

Further removed from the traffic flows in this area, the current ambient sound level at the end of Puriri Road adjacent to the Urupa area has been measured as **43 dB**  $L_{Aeq(24hrs)}$ .

These are relatively low ambient sound levels for an urban environment and are well within the Category A criterion of 57 dB  $L_{Aeq(24hrs)}$ .

Further north, the sound environment for houses fronting on to Te Moana Road is currently controlled by traffic noise from Te Moana Road. The surface of Te Moana Road in the area of the proposed Expressway is a mixture of asphaltic and chipseal surfaces. For houses in the vicinity of the asphaltic surface, current noise levels have been measured as **53 dB**  $L_{Aeq(24hrs)}$ . For houses in the vicinity of chipseal, the current noise level has been measured as being **56 dB**  $L_{Aeq(24hrs)}$ .

There are some houses located at the rear of sections, behind houses fronting the road. The current ambient sound level for these rear houses has been measured as being between **53 dB**  $L_{Aeq(24hrs)}$  for those in the vicinity of chipseal, and **49 dB**  $L_{Aeq(24hrs)}$  for those houses in the vicinity of asphalt. These lower sound levels are due to shielding from intervening structures.

While dwellings closest to Te Moana Road experience higher noise levels than those further removed from the road, all measured sound levels are within the most stringent Category A of NZS 6806: 2010.

Survey locations in this area include LT4 and 5, and MP12, 22 and 32, shown on Figures B9 to B12 in Appendix 17.B. Short duration sound level survey results are shown in Table C3 in Appendix 17.C and long duration results in Appendix 17.D.

### 3.4. Sector 4

Sector 4 is the northern most sector of the proposed Expressway, extending from just north of the Te Moana Interchange to Peka Peka Road, where the proposed Expressway rejoins SH1. The character of this sector is rural, with few houses.

For houses at some distance from SH 1, such as those off Ngarara, Smithfield, End Farm and Greenhill Roads and Kensington Drive, the current ambient sound level has been measured as being **45 dB**  $L_{Aeq(24hrs)}$ . The ambient sound environment for these houses is considered to be low, as would be expected in a rural environment removed from infrastructure and industrial noise sources.

Houses off Peka Peka Road near the northern end of the proposed Expressway alignment are currently in a sound environment that has been measured as being **53 dB**  $L_{Aeq(24hrs)}$  for the houses closest to SH 1 (such as 20 Peka Peka Road) and **52 dB**  $L_{Aeq(24hrs)}$  for 32 Peka Peka Road.

Houses in Peka Peka Road at greater distances from SH 1 are currently in a comparatively lower noise environment.

The noise levels in Sector 4 are considered well suited for residential use and are all within the most stringent noise level Category A in accordance with NZS 6806: 2010.

Survey locations in Sector 4 include LT8 and MP23, 34, 35, 36, 38 and 39 as shown on Figures B13 to B16 in Appendix 17.B. Short duration sound level survey results are shown in Table C4 in Appendix 17.C and long duration results in Appendix 17.D.

#### 4. Conclusion

A comprehensive noise level study has been undertaken in the vicinity of the proposed Expressway. Ambient sound levels were measured along the alignment, using both unattended long duration noise loggers and attended short duration surveys.

The results show that generally, the ambient sound environment is low, with the exception of those parts of the alignment merging with the existing SH1 and where the alignment crosses major arterial roads. Apart from dwellings at the southern end of the alignment which are adjacent to SH1 and the dwellings on Raumati Road adjacent to chipseal, all other dwellings currently receive noise levels at and below the most stringent noise category of NZS6806:2010 – the Category A criterion of 57 dB  $L_{Aeq(24hrs)}$ .

Appendix 17.A  
Glossary of Terminology

## Appendix 17.A: Glossary of Terminology

<b>dB(A)</b>	A measurement of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
<b>L<sub>eq</sub></b>	The time averaged sound level (on a logarithmic/energy basis) over the measurement period (normally A-weighted).
<b>L<sub>95</sub></b>	The sound level which is equalled or exceeded for 95% of the measurement period. L <sub>95</sub> is an indicator of the mean minimum noise level and is used in New Zealand as the descriptor for background noise (normally A-weighted).
<b>L<sub>10</sub></b>	The sound level which is equalled or exceeded for 10% of the measurement period. L <sub>10</sub> is an indicator of the mean maximum noise level and is used in New Zealand as the descriptor for intrusive noise (normally A-weighted).
<b>L<sub>max</sub></b>	The maximum sound level recorded during the measurement period (normally A-weighted).
<b>Noise</b>	A sound that is unwanted by, or distracting to, the receiver.
<b>Ambient Noise</b>	Ambient Noise is the all-encompassing noise associated with any given environment and is usually a composite of sounds from many sources near and far.
<b>NZS 6801:2008</b>	New Zealand Standard NZS 6801:2008 " <i>Acoustics - Measurement of environmental sound</i> "
<b>NZS 6802:2008</b>	New Zealand Standard NZS 6802:2008 " <i>Acoustics - Environmental noise</i> "
<b>NZS 6806:2010</b>	New Zealand Standard NZS 6806:2010 " <i>Acoustics - Road-traffic noise - New and altered roads</i> "

Appendix 17.B  
Ambient Noise Measurement Locations

## Appendix 17.B: Ambient Noise Measurement Locations

Note 1: "MP" = Measurement Position; "LT" = Long Term logger position.

Note 2: Aerial photography closeup figures: Google Earth, Sector overview figures: Mackays to Peka Peka



**Figure B1:** Sector 1 overview



**Figure B2:** Sector 1 south





**Figure B3:** Sector 1 north



**Figure B4:** Sector 2 south overview



**Figure B5:** Sector 2 north overview



**Figure B6:** Sector 2 south.



Figure B7: Sector 2 mid.



**Figure B8:** Sector 2 north.



**Figure B9:** Sector 3 south overview



**Figure B10: Sector 3 north overview**





Figure B11: Sector 3 south.



**Figure B12:** Sector 3 north



**Figure B13:** Sector 4 south overview



**Figure B14:** Sector 4 north overview



**Figure B15:** Sector 4 south.



**Figure B16:** Sector 4 north

Appendix 17.C  
Short Duration Ambient Sound Level Measurements (free  
field)

## Appendix 17.C: Short Duration Ambient Sound Level Measurements (free field)

**Table C1: Sector 1**

Measurement Position	Coordinates (NZTM)		Measured Noise Levels dB		Measurement Duration T (minutes)	Approximate $L_{Aeq(24h)}$ dB
	Northing	Easting	$L_{Aeq(T)}$	$L_{A95}$		
MP 9	5466600	1767756	50	44	15	48
MP 10	5466477	1767871	58	50	15	56
MP 11	5466455	1767921	67	53	15	65
MP 13	5466628	1767631	46	41	15	44
MP 14	5466386	1767489	42	37	15	40
MP 15	5466145	1767502	54	46	15	52
MP 16	5467292	1767502	47	39	15	46
MP 17	5467018	1767403	47	38	15	46
MP 25	5467671	1767584	46	37	15	46



**Table C2: Sector 2**

Measurement Position	Coordinates (NZTM)		Measured Noise Levels dBA		Measurement Duration T (minutes)	Approximate $L_{Aeq(24h)}$ dB
	Northing	Easting	$L_{eq(T)}$	$L_{95}$		
MP 1	5469576	1768593	49	45	15	49
MP 2	5469647	1768669	46	42	15	45
MP 3	5469715	1768739	47	42	15	46
MP 4	5469811	1768836	45	40	15	44
MP 5	5469960	1768992	42	37	15	41
MP 6	5470310	1769344	44	40	15	43
MP 7	5470078	1769119	45	40	20	44
MP 8	5469254	1768026	44	39	15	42
MP 18	5469009	1767788	45	39	15	43
MP 19	5468964	1767817	44	37	15	42
MP 20	5470503	1769758	48	42	15	47
MP 21	5470521	1769567	53	49	25	52
MP 24	5468470	1767940	55	39	30	52
MP 26	5468095	1767493	70	49	15	68
MP 27	5468073	1767804	52	38	15	52
MP 28	5468854	1767721	44	40	15	42
MP 29	5468459	1767445	58	43	30	56
MP 37	5469296	1768156	46	43	30	44

**Table C3: Sector 3**

Measurement Position	Coordinates (NZTM)		Measured Noise Levels dBA		Measurement Duration T (minutes)	Approximate $L_{Aeq(24h)}$ dB
	Northing	Easting	$L_{eq(T)}$	$L_{95}$		
MP 12	5473246	1771057	42	34	15	43
MP 22	5473130	1771134	45	40	20	46
MP 30	5472493	1770820	50	40	15	49
MP 31	5472209	1770813	47	42	15	46
MP 32	5473680	1771505	53	41	30	53
MP 33	5471236	1769869	47	42	25	46

**Table C4: Sector 4**

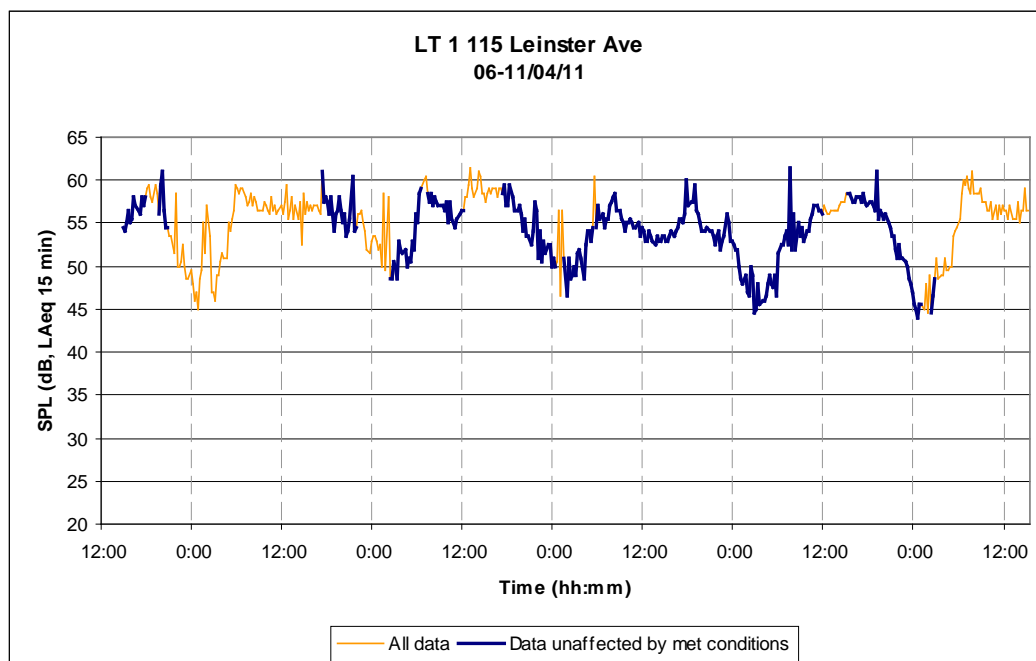
Measurement Position	Coordinates (NZTM)		Measured Noise Levels dBA		Measurement Duration T (minutes)	Approximate $L_{Aeq(24h)}$ dB
	Northing	Easting	$L_{eq(T)}$	$L_{95}$		
MP 23	5476762	1775034	44	35	30	43
MP 34	5474876	1772910	46	40	25	45
MP 35	5475270	1773792	46	40	25	45
MP 36	5475426	1773702	45	41	15	44
MP 38	5475578	1774704	47	40	30	46
MP 39	5476966	1775822	55	48	15	53

Appendix 17.D  
Long Duration Ambient Sound Level Monitoring

## Appendix 17.D: Long Duration Ambient Sound Level Monitoring

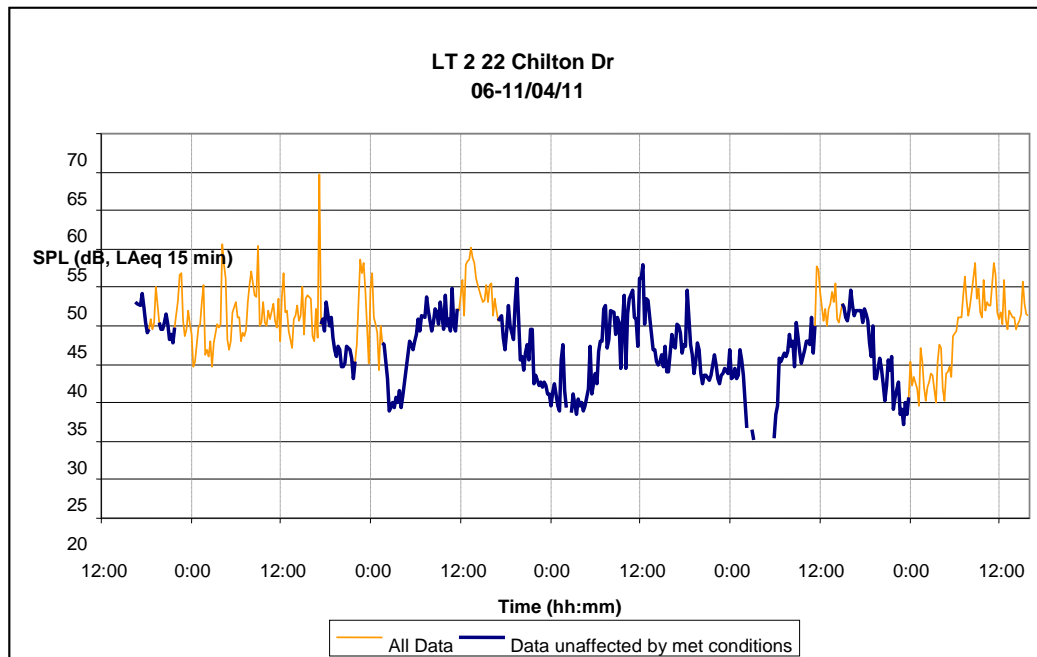
LT 1: 115 Leinster Avenue - 55 dB  $L_{Aeq(24hrs)}$

(Coordinates NZTM: N 5466588 E 1767889)



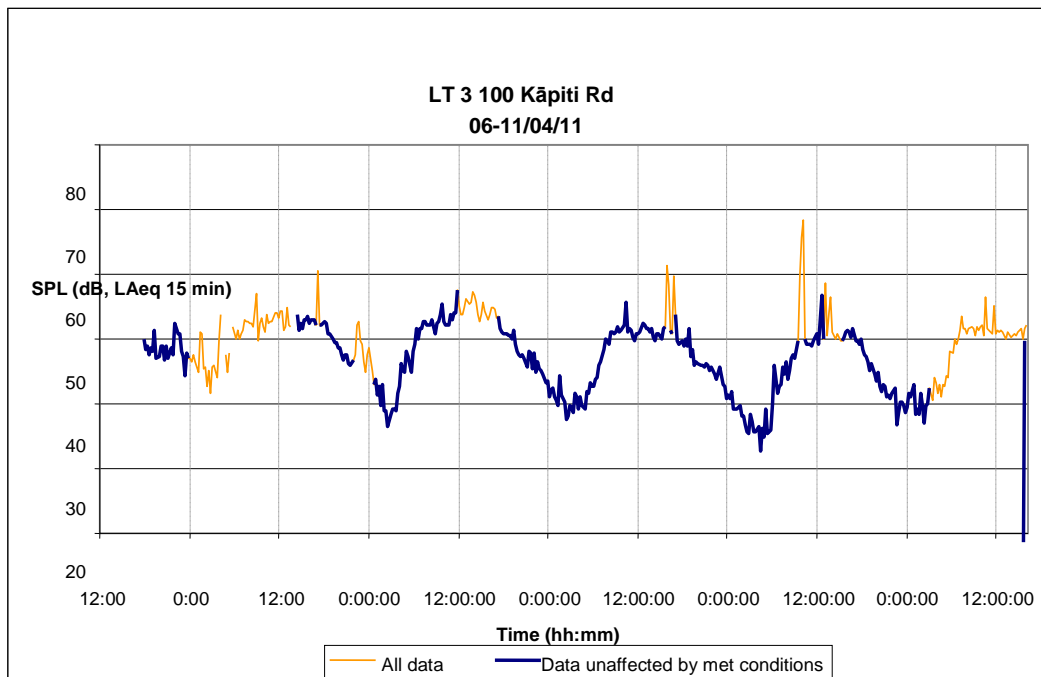
**LT 2: 22 Chilton Drive - 44 dB  $L_{Aeq(24hrs)}$**

(Coordinates NZTM: N 5470503 E 1769563)



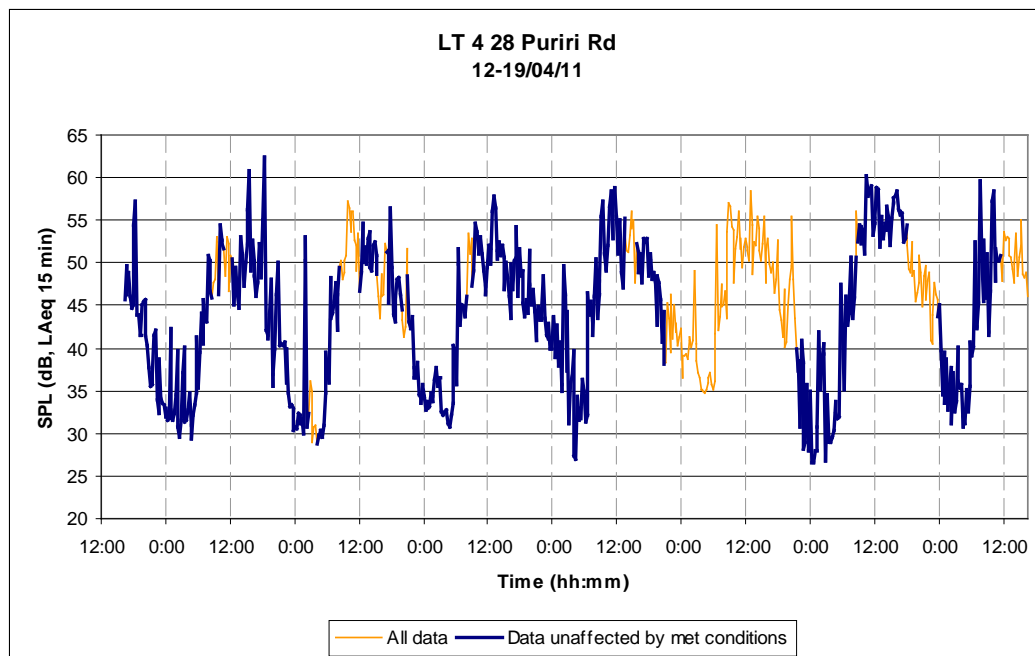
**LT 3: 100 Kāpiti Road - 49 dB  $L_{Aeq(24hrs)}$**

(Coordinates NZTM: N 5469497 E 1768489)



**LT 4: 28 Puriri Road - 50 dB  $L_{Aeq(24hrs)}$**

(Coordinates NZTM: N 5473223 E 1771186)

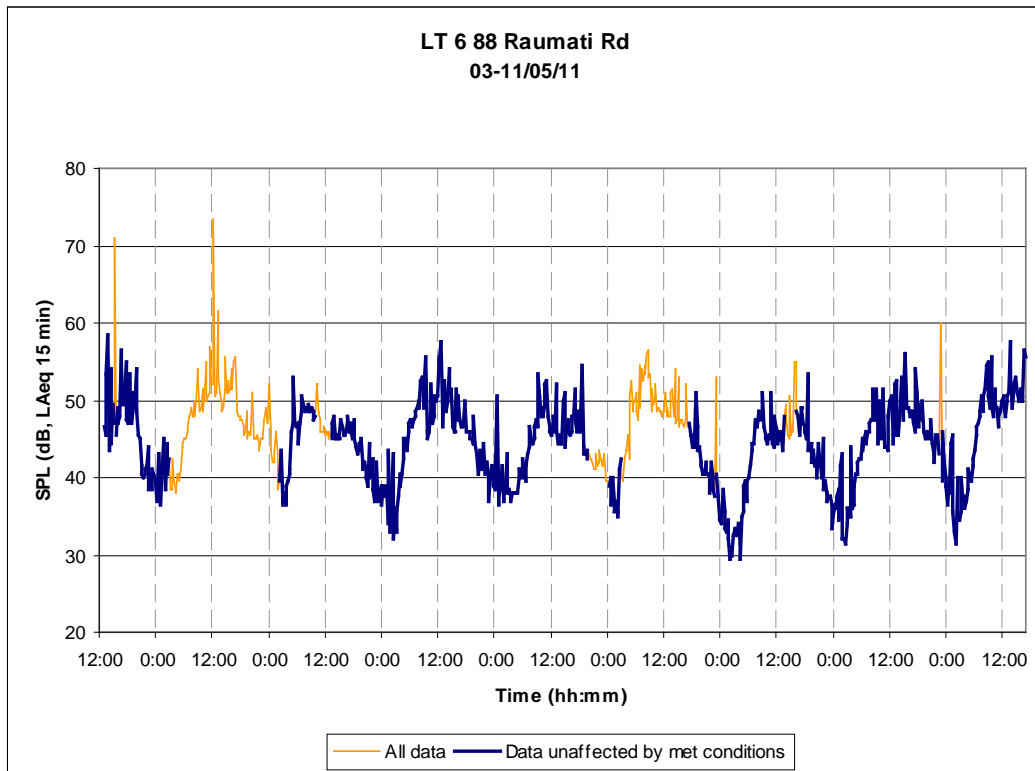






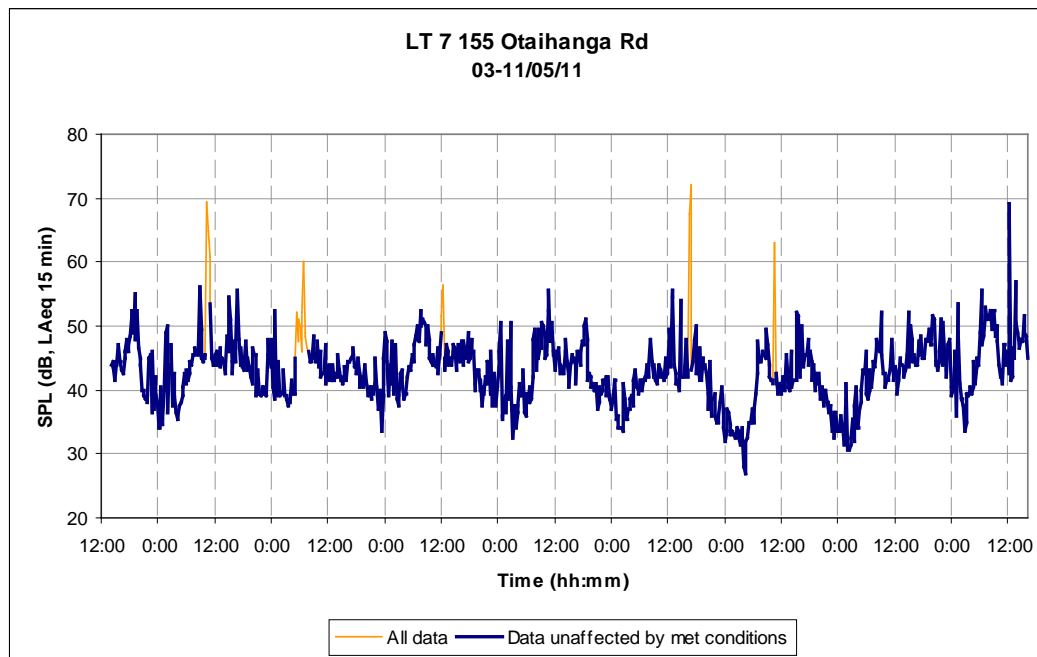
**LT 6: 88 Raumati Road - 47 dB  $L_{Aeq(24hrs)}$**

(Coordinates NZTM: N 5467858 E 1767622)



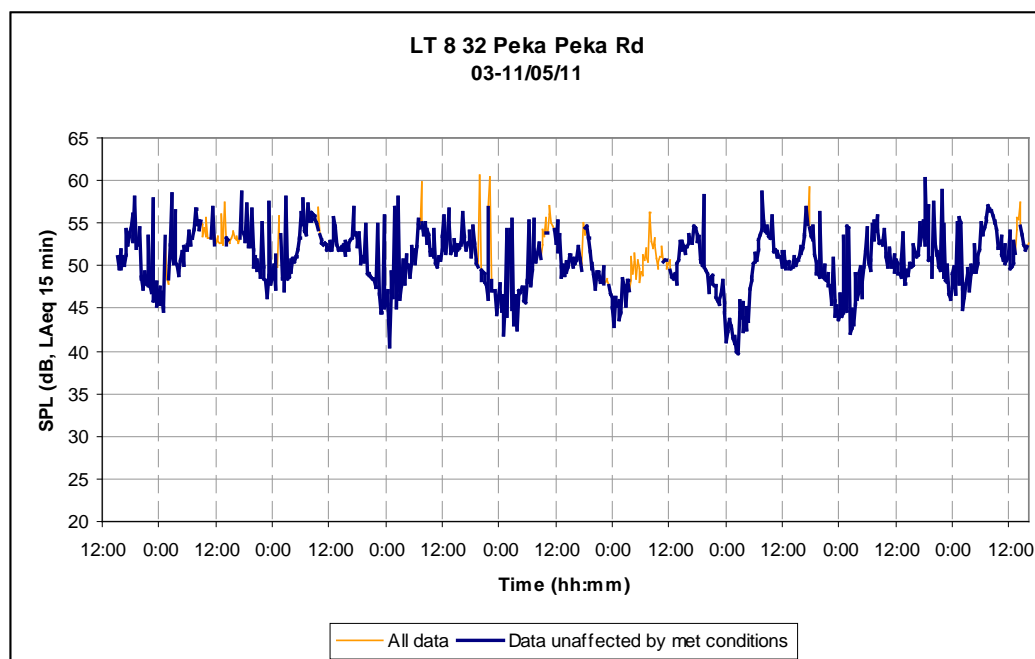
**LT 7: 155 Otaihanga Road - 47 dB  $L_{Aeq(24hrs)}$**

(Coordinates NZTM: N 5471647 E 1770453)



**LT 8: 32 Peka Peka Road - 52 dB  $L_{Aeq(24hrs)}$**

(Coordinates NZTM: N 5476985 E 1775760)



Appendix 17.E  
Information Accompanying Ambient Sound Measurements

## Appendix 17.E: Information Accompanying Ambient Sound Measurements

The following lists the key details of the noise survey:

Date & time: 6<sup>th</sup> April – 20<sup>th</sup> May 2011.

Personnel: Bill Wood, Marshall Day Acoustics

Weather: Mix of fine and settled weather, with periods of unsettled weather throughout measurement period. Some limited periods of rain.

Instrumentation: Short term measurements:  
 Brüel & Kjær Type 2260 Analyser, serial 2320956, calibration due 10/07/11  
 Brüel & Kjær Type 4230 Calibrator, serial 1472379, calibration due 21/10/11

Calibration: The analyser was calibrated before measurements, and the calibration checked after measurements. No significant change ( $\pm 0.1$ dB) was noted.

Unattended:

Logger Site	Location	Duration	Logger	Serial No.	Calibration Due
LT 1	115 Leinster Ave	06-11/04/11	ARL EL-215	194695	18/01/2012
LT 2	100 Kāpiti Rd	06-11/04/11	B&K 2238	2160281	30/03/2011 <sup>(1)</sup>
LT 3	22 Chilton Dr	06-11/04/11	B&K 2238	2354412	15/11/2012
LT 4	28 Puriri Rd	12-19/04/11	ARL EL-316	16207034	03/02/2013
LT 5	164 Te Moana Rd	12-19/04/11	ARL EI-215	194401	13/04/2012
LT 6	88 Raumati Rd	03-11/05/11	ARL EI-215	194401	13/04/2012
LT 7	155 Otaihanga Rd	03-11/05/11	ARL EI-215	194554	28/07/2012
LT 8	32 Peka Peka Rd	03-11/05/11	ARL EL-316	16207034	03/02/2013

Note: (1) This logger was due for calibration at the time of deployment. However it was in constant field use at that time and was regularly field calibrated. No anomalies were detected. Following calibration on 19/05/11 it was found that the equipment calibration remained unchanged. Consequently it was considered that the instrument was in acceptable condition at the time of its use at this location.

Microphone height above ground:

Long term loggers: 1.2m

Short term attended: 1.3-1.4m