



MARSHALL DAY  
Acoustics 

PEKA PEKA TO ŌTAKI EXPRESSWAY  
COMPLIANCE MONITORING - NOISE

Rp 001 r02 20230306 | 5 December 2023

Project: **PEKA PEKA TO ŌTAKI EXPRESSWAY**

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Report No.: **Rp 001 r02 20230306**

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## 1.0 INTRODUCTION

The Peka Peka to Ōtaki (PP2Ō) Expressway is a four-lane expressway, located on the Kāpiti Coast, forming a 13 kilometre long section of the Kāpiti Expressway and is part of the Wellington Northern Corridor project.

Fletcher Construction has requested that Marshall Day Acoustics carry out post-construction noise monitoring, following the opening of the PP2Ō Expressway in December 2022.

The purpose of this report is to present the results of the post-construction noise monitoring, in accordance with the relevant Noise Management Plans, and provide verification of the current noise model. This report may require an update should the as-built noise model differ from the current noise model. Any update to the noise model is required to be undertaken within 12 months of the expressway opening.

This report does not constitute a full post-construction review of the PP2Ō Expressway or confirmation that the Best Practicable Option for noise mitigation has been implemented. However, the information within this report may be included as part of the post-construction review.

Noise surveys and analysis have been carried out as required by Section 8.4 of the *Peka Peka to Ōtaki (Northern Section) Noise Mitigation Plan* (the “NNMP”) and Section 6.3 of the *Peka Peka to Ōtaki (Southern Section) Noise Mitigation Plan* (the “SNMP”), with additional guidance taken from the Waka Kotahi document *NZTA Noise Monitoring Requirements* (the “NZTA document”).

This report summarises the findings of the post-construction compliance monitoring and a discussion around validation of the noise model only.

A glossary of terminology used in this report is included in Appendix A.

## 2.0 PERSONNEL AND QUALIFICATIONS

The noise monitoring, analysis and reporting has been supervised by Steve Arden of Marshall Day Acoustics (15+ years’ experience, post-graduate Diploma in Acoustics and Noise Control, Member of the Acoustical Society of New Zealand and Member of the Institute of Acoustics (UK)).

Assistance in noise surveys, analysis and reporting has been provided by Sue Elton and Sato Koyamo of Marshall Day Acoustics. Further support has been provided by Siiri Wilkening of Marshall Day Acoustics (Auckland).

## 3.0 DESIGNATION CONDITION

Designation Condition DC73 c) requires that the Noise Mitigation Plan provides methods for post-construction validation of the noise assessment predictions. This condition is reproduced below: [Source: NNMP and SNMP, Appendix A]:

### **DC73**

*A Noise Mitigation Plan shall be prepared by an independent and suitably qualified acoustics specialist 15 Working Days prior to the Commencement of Construction, and shall include details of:*

*[...]*

- c) Methods for post-construction validation of the Noise Assessment and to ensure the Selected Options retain their noise reduction performance.*

The Noise Mitigation Plans (the NNMP and the SNMP) provide the following information in respect of verification of predicted noise levels.

*PR A15.1.7-8 requires that noise measurements are conducted at three locations to verify predicted noise levels. Noise measurements would be conducted at locations on:*

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[https://mdahq-my.sharepoint.com/personal/steve\\_arden\\_marshallday\\_co\\_nz/Documents/Rp 001 r02 20230306 SE-SK-SA \(PP2O Compliance Monitoring\).docx](https://mdahq-my.sharepoint.com/personal/steve_arden_marshallday_co_nz/Documents/Rp 001 r02 20230306 SE-SK-SA (PP2O Compliance Monitoring).docx)

- Sutton Road
- Old Hautere Road, and
- County Road

Measurements would be conducted by Marshall Day Acoustics for a period of 7 days at each location, during the period between 6 and 9 months after the expressway opens, as required by A15.1.7.

PR A15.1.7-8 is in reference to the Principal’s Requirements, the relevant sections of which are reproduced below:

**A15.1.7** The post-construction review shall include noise measurements for a period of at least seven days at each of three locations, for the purpose of verifying the noise model. The noise measurements shall be made between six and nine months after the expressway has opened to traffic. The measurements and analysis shall be in accordance with the NZ Transport Agency Noise monitoring requirements.

The results of the measurements shall be compared to the predicted road-traffic noise levels. If discrepancies are found, these shall be investigated and findings reported in the post-construction review report.

**A15.1.8** The three locations for noise measurements shall be determined by the Principal following agreement with property owners. It is intended that the measurements will be at houses on Suttons Road, Old Hautere Road and County Road.

#### 4.0 NOISE LEVEL SURVEYS

Post-construction noise surveys were carried out in July 2023 at three locations, approximately seven months after the opening of the road. These locations were within the boundaries of three properties located on the roads, as described in the SNMP and the NNMP.

#### 4.1 Noise Survey Locations

Locations 1 and 3 are described within the SNMP, while location 2 falls within the of NNMP. The addresses are described in Table 1.

Aerial views of each noise survey location are shown in Appendix B.

#### 4.2 Noise Survey Details

Table 1 presents details of the post-construction noise surveys and includes the start and end times for data collection at each position.

Table 2 details the equipment used for the noise surveys along with dates of the most recent laboratory calibration. Field checks were carried out using a handheld calibrator prior to and after each noise survey. All field checks were within allowable tolerances, as described in New Zealand Standard NZS 6801:2008 ‘Acoustics – Measurement of environmental sound’.

Microphones were installed at approximately 1.5 metres above ground level and in free-field positions.

**Table 1: Details of noise surveys**

Position	PPF Number	Start date and time	End date and time
9 Old Hautere Road	R100 (outlined in the SNMP)	17 July 2023, 13:18	25 July 2023, 09:44
46 County Road	R049 (outlined in the NNMP)	17 July 2023, 13:46	25 July 2023, 10:41
36 Sutton Road	R149 (outlined in the SNMP)	17 July 2023, 14:58	25 July 2023, 10:11

**Table 2: Equipment used during the noise surveys**

Manufacturer	Type	Serial Number	Date of most recent laboratory calibration
01 dB	Cube	12218	14 November 2022
01 dB	Cube	10933	13 May 2022
01 dB	Cube	11190	7 December 2021

Appendix B includes photos of the deployed noise loggers at each of measurement location. Table B1 in Appendix B includes a description of the surrounding area.

## 5.0 DATA ANALYSIS AND RESULTS

The noise survey data was analysed in accordance with the NZTA document. We have included the relevant sections of the NMPs and the NZTA document's analysis procedures in Appendix C.

The noise loggers measured  $L_{Aeq}$  levels in 15-minute intervals for the duration of their deployment. We derived the  $L_{Aeq(24\text{ hr})}$  intervals through post-processing of the data.

The following adjustments were made to the measured and predicted data prior to comparing the results of the surveys and predictions.

### 5.1 Adjustments to measured noise levels

#### 5.1.1 Weather

Weather data for corresponding dates and times was sourced from the closest NIWA electronic weather station at Levin. We removed any noise measurement data points where weather conditions were outside the allowable meteorological window prescribed in the NZTA document – that is, during rain, or when windspeeds were above 5 m/s. Appendix D presents this information as graphs for each noise survey location.

#### 5.1.2 Traffic volumes

The noise measurements were adjusted for the design year AADT, using traffic flow count data from the nearest expressway location to each noise monitoring site [source: HTS Group, 31 July 2023] aligned with the dates and times of our noise survey period. Appendix E sets out the traffic data totals from the counts nearest to each of the three noise survey locations.

### 5.2 Adjustment to predicted noise levels

The predicted noise levels were based on 2031 traffic flows and with a speed of 110 km/h. However, the posted speed limit at the time of the noise survey was 100 km/h. Therefore, we have adjusted the predicted noise levels based on this speed difference. This results in a reduction in the predicted noise levels of 0.7 dB.

### 5.3 Results

As required by the NZTA document, we have used a minimum of two days' noise data (including at least one weekday) to derive the average  $L_{Aeq(24\text{ hr})}$  value at each location.

The results for each property surveyed are presented in the subsequent tables. For each property, we have presented the following:

- Location of noise logger.
- Approximate distance to nearest lane of the Expressway.

- Predicted noise level at logger location (2031 traffic conditions with 110 km/h speed limit).
- Predicted noise level (2031 traffic flows) with speed adjustment applied and safety factor removed. This is the noise level used for comparison with the measured noise level (adjusted in accordance with the NZTA document).
- Measured daily noise level (range provided for accepted days).
- Adjustment to daily noise level (as per the NZTA document)
- Average adjusted measured noise level, made in accordance with the NZTA document.

The predicted noise levels at logger locations may differ slightly from what was reported in the NMPs. This is because the NMPs report the noise level incident on the façade of a PPF, whereas the NZTA document states “Microphones must be at least 3.5 metres from any reflecting surface”. These different locations can result in slightly difference predicted noise levels.

To verify the computer noise model, comparison must be made between the adjusted predicted and measured noise levels. We have bolded these levels for ease of reference.

Details of the adjustments to the measured noise levels, made in accordance with the NZTA document, is included in Appendix C.

**Table 3: Predicted and measured noise levels at the three survey positions**

<b><u>9 Old Hautere Road (PPF R100)</u></b>		
Easting: 1780397	Northing: 5483025	
Approximate distance to nearest lane:	90 metres	
Predicted noise level at logger location (as built; includes 1.5dB safety factor)		56 dB L <sub>Aeq(24h)</sub>
Adjustment to remove safety factor		- 1.5 dB
Adjustment for speed change from 110 km/hr to 100 km/hr		- 0.7 dB
<b>Predicted noise level for comparison (adjusted for speed, safety factor removed)</b>		<b>54 dB L<sub>Aeq(24h)</sub></b>
Measured daily noise level		48 - 53 dB L <sub>Aeq(24h)</sub>
Adjustment to daily noise level (as per NZTA document)		+ 1 to 2 dB
<b>Average measured noise level (adjusted as per NZTA document)</b>		<b>53 dB L<sub>Aeq(24h)</sub></b>
No. of days meeting weather requirements of NZTA document		3

<b><u>46 County Road (PPF R049)</u></b>		
Easting: 1782459	Northing: 5485752	
Approximate distance to nearest lane:	70 metres	
Predicted noise level at logger location (as built; includes 1.5dB safety factor)		59 dB L <sub>Aeq(24h)</sub>
Adjustment to remove safety factor		- 1.5 dB
Adjustment for speed change from 110 km/hr to 100 km/hr		- 0.7 dB

<b>Predicted noise level for comparison (as built; adjusted for speed reduction, safety factor removed)</b>	<b>57 dB L<sub>Aeq(24h)</sub></b>
Measured daily noise level	55 - 56 dB L <sub>Aeq(24h)</sub>
Adjustment to daily noise level (as per NZTA document)	+ 0 to 1 dB
<b>Average measured noise level (adjusted as per NZTA document)</b>	<b>56 dB L<sub>Aeq(24h)</sub></b>
No. of days meeting weather requirements of NZTA document	3

<b>36 Sutton Road (PPF R149)</b>		
Easting: 1778331	Northing: 5479605	
Approximate distance to nearest lane:	180 metres	
Predicted noise level at logger location (as built; includes 1.5dB safety factor)		56 dB L <sub>Aeq(24h)</sub>
Adjustment to remove safety factor		- 1.5 dB
Adjustment for speed change from 110 km/hr to 100 km/hr		- 0.7 dB
<b>Predicted noise level for comparison (as built; adjusted for speed reduction, safety factor removed)</b>		<b>54 dB L<sub>Aeq(24h)</sub></b>
Measured daily noise level		50 - 52 dB L <sub>Aeq(24h)</sub>
Adjustment to daily noise level (as per NZTA document)		+ 1 to 2 dB
<b>Average measured noise level (adjusted as per NZTA document)</b>		<b>52 dB L<sub>Aeq(24h)</sub></b>
No. of days meeting weather requirements of NZTA document		3

## 6.0 DISCUSSION AND SUMMARY

Table 4 presents a summary of the modelled noise levels for the as-built scheme, and the measured noise levels. The measured noise levels include the adjustments as set out in the NZTA document.

The measured noise levels (adjusted) at all locations were 1 to 2 dB below that of the modelled noise levels.

**Table 4: Summary of noise monitoring results**

Location	Noise level, L <sub>Aeq(24hr)</sub>		Noise level difference
	Predicted Design year 2031* (as-built)	Measured Adjusted as per NZTA document	
9 Old Hautere Road (PPF R100)	54 dB	53 dB	1 dB
46 County Road (PPF R049)	57 dB	56 dB	1 dB
36 Sutton Road (PPF R149)	54 dB	52 dB	2 dB

\* Safety factor removed, speed corrected



## 7.0 VERIFICATION OF NOISE MODEL

The noise monitoring results set out in Table 4 confirm that noise levels at the three monitored locations are below their corresponding as-built design year predictions by 1 to 2 dB.

Section 5.3.4 of NZS 6806:2010 describes the requirements of Project-model calibration. The wording is detailed below:

### 5.3.4 Project-model calibration

5.3.4.1 Modelling of existing ambient sound levels should be compared with measured levels for model calibration purposes where practicable.

5.3.4.2 The difference between measured and predicted levels should not exceed  $\pm 2$  dB (see 5.3.2(b)).

For each noise survey location, the adjusted measured noise levels and the design year noise levels are within the  $\pm 2$  dB allowance described in NZS 6806:2010, providing validation of the noise model.

## APPENDIX A GLOSSARY OF TERMINOLOGY

<b>dB</b>	Decibel. The unit of sound level.
<b>L<sub>Aeq</sub></b>	The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB.
<b>L<sub>Aeq(24hr)</sub></b>	The L <sub>Aeq</sub> sound level averaged over a 24-hour period from midnight to midnight.
<b>AADT</b>	Annual Average Daily Traffic. Calculated by adding the total vehicle volume of a road for a year and dividing by 365 days.
<b>Noise</b>	A subjective term used to describe sound that is unwanted by, or distracting to, the receiver.
<b>NIWA</b>	National Institute of Water and Atmospheric Research.
<b>NMP</b>	Noise Mitigation Plan.
<b>NZTA</b>	Waka Kotahi New Zealand Transport Agency.
<b>PPF</b>	Protected Premises and Facilities. In this context, a representative noise-receiving location from which to measure and assess road-traffic noise from new or altered roads.
<b>Traffic Flow</b>	The number of vehicles passing a given point during a specified period of time.

**APPENDIX B NOISE SURVEY – MAP LOCATIONS & LOGGER DEPLOYMENT PHOTOS**

All map images sourced from LINZ.

**B1 Southern Sector – at Otaki Gorge Road**

9 Old Hautere Road



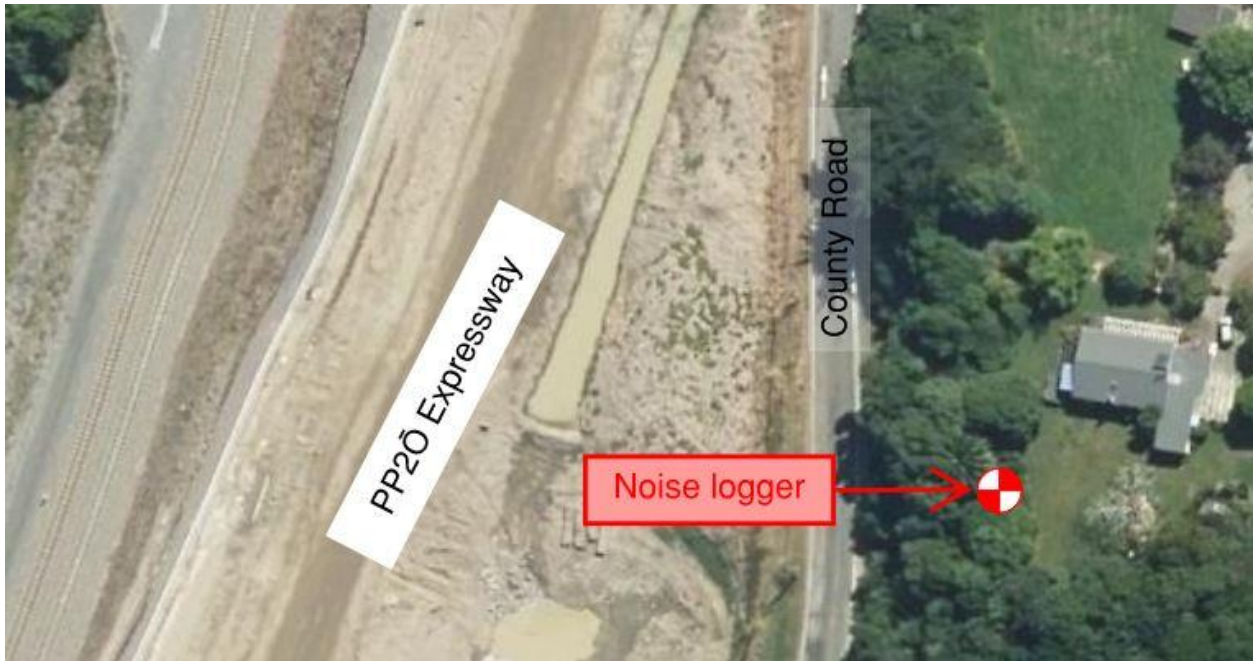






B2 Northern Sector – at Waitohu

46 County Road







**B3 Southern Sector – at Marycrest**

36 Sutton Road



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**Table B1: Noise Survey – Further details**

Location	Details
9 Old Hautere Road	Microphone located within garden lawn area of dwelling. Expressway not visible as trees line the property boundary. The intervening land is predominantly soft ground comprising fields and vegetation.
46 County Road	Microphone located at edge of garden lawn area of dwelling, beside shrubbery and trees. Expressway not visible. The intervening land is predominantly soft ground with vegetation. County Road sits between the noise survey location and the Expressway.
36 Sutton Road	Microphone located in line with façade of dwelling at edge of neighbouring paddock – to exclude both pump noise and garage influence. Expressway mostly not visible from paddock as trees and fencing line its boundary. The intervening land is predominantly soft ground, consistent with residential dwellings and sections.



## APPENDIX C NOISE MONITORING REQUIREMENTS AND ANALYSIS

The extract below is taken from the NNMP, and also appears in the SNMP at 6.2 and 6.3.

### 8.3 Noise modelling

Noise modelling of the as built alignment, surfaces, barriers and traffic data shall be conducted within 12 months of the expressway opening to traffic to confirm if there are significant changes from those detailed in the NMP.

Traffic monitoring shall be conducted to establish traffic volumes, including mix and speed. A traffic modelling specialist shall confirm whether these data measured shortly after opening correspond to the future design year conditions used in the noise model.

### 8.4 Verification measurements

PR A15.1.7-8 requires that noise measurements are conducted at three locations to verify predicted noise levels. Noise measurements would be conducted at locations on:

- Sutton Road
- Old Hautere Road, and
- County Road

Measurements would be conducted by Marshall Day Acoustics a period of 7 days at each location, during the period between 6 and 9 months after the expressway opens, as required by A15.1.7.

The extract below is taken from the NZTA document:

## 6. Analysis

Data must be analysed to produce an  $L_{Aeq(24h)}$  at each location using the following process:

- Data points during rain or average wind speeds greater than 5 m/s must be excluded or reasons provided as to why they should be included.
- Data points during upwind conditions (3–5 m/s) must be excluded. Upwind is defined as the wind direction being  $\pm 90^\circ$  of the direction between house and the closest point on the alignment.
- Abnormally high data points, indicated by high  $L_{AFmax}$  and/or centile levels must be excluded if they cannot be attributed to state highway road-traffic sources through listening to the audio recordings (if available).
- Excluded data points must be replaced by a linear interpolation of the surrounding points. If more than 5 hours during the day or 3 hours at night is excluded, then the day's measurement must be discarded. A minimum of two days' data including at least one weekday must be included in the analysis.
- Noise levels measured at a façade must be converted to free-field levels using a -2.5 dB correction. Only free-field levels are to be presented in reports and data files.
- To determine the  $L_{Aeq(24h)}$  from short-term measurements, the temporal profiles of nearby long-term measurements may be used, or alternatively the 'Shortened measurement procedure' from the Calculation of Road Traffic Noise (CRTN) may be used.
- Values for the  $L_{Aeq(24h)}$  must be corrected to the AADT for the nominated 'existing' year or forecasted 'design year' for the project. The  $L_{Aeq(24h, \text{nominated year})}$  must be calculated for each valid day, by correcting for traffic conditions. The final reported  $L_{Aeq(24h)}$  must be the energy average of all valid days. The correction for traffic conditions must be determined for each day as follows:

$$L_{Aeq(24h, \text{nominated year})} = L_{Aeq(24h, \text{measured})} + \text{Correction (1)} + \text{Correction (2)}$$

$$\text{Correction (1)} = 10 \log (Q_{\text{nominated year AADT}} / Q_{\text{measurement date}})$$

$$\text{Correction (2)} = 10 \log ((1 + 5p_{\text{nominated year AADT}}/V) / (1 + 5p_{\text{measurement date}}/V))$$

Q – total traffic volume over 24 hour period

V – mean traffic speed (km/h)

p – percentage of heavy vehicles

The adjustments made in accordance with the NZTA document are presented below (referred to as corrections in the NZTA document).

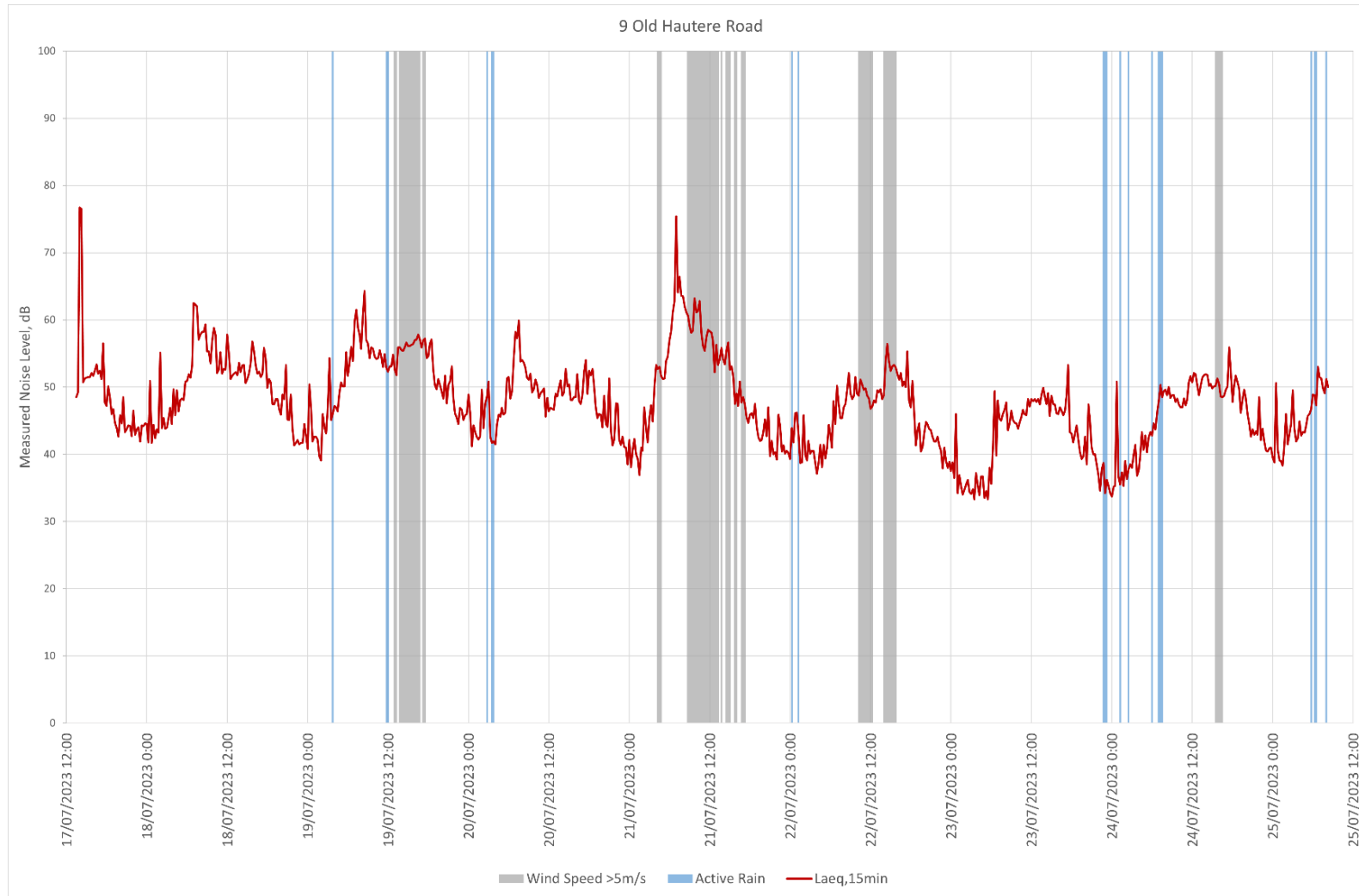
9 Old Hautere Rd									
Date	LAeqNom	LAeqMeas	Correction(1)	Correction(2)	Adjustment C(1) + C(2)	QNom	QMeas	HVC%Nom	HVC%Meas
17/07/2023	N/A	N/A	0.338	1.551	1.889	21212	19623	23%	10%
18/07/2023	55.1	53.4	0.330	1.347	1.677	21212	19659	23%	11%
19/07/2023	N/A	N/A	0.247	1.374	1.621	21212	20037	23%	11%
20/07/2023	51.5	50	0.076	1.409	1.486	21212	20843	23%	11%
21/07/2023	N/A	N/A	-0.286	1.573	1.286	21212	22658	23%	10%
22/07/2023	49.8	47.3	0.250	2.209	2.459	21212	20024	23%	6%
23/07/2023	48.0	44.8	0.740	2.410	3.151	21212	17887	23%	4%
24/07/2023	50.1	48	0.563	1.513	2.077	21212	18632	23%	10%
25/07/2023	N/A	N/A	0.196	1.357	1.554	21212	20275	23%	11%

46 County Rd									
Date	LAeqNom	LAeqMeas	Correction(1)	Correction(2)	Adjustment C(1) + C(2)	QNom	QMeas	HVC%Nom	HVC%Meas
17/07/2023	N/A	N/A	0.064	0.446	0.510	12050	11875	15%	12%
18/07/2023	56.3	55.9	0.259	0.107	0.366	12050	11352	15%	14%
19/07/2023	N/A	N/A	0.183	0.143	0.326	12050	11553	15%	14%
20/07/2023	55.7	55.6	-0.071	0.213	0.142	12050	12250	15%	13%
21/07/2023	N/A	N/A	-0.719	0.542	-0.177	12050	14219	15%	11%
22/07/2023	55.6	54.5	-0.125	1.202	1.077	12050	12402	15%	7%
23/07/2023	54.8	53.3	-0.015	1.532	1.517	12050	12093	15%	5%
24/07/2023	55.9	55	0.489	0.369	0.858	12050	10767	15%	12%
25/07/2023	N/A	N/A	0.035	0.150	0.185	12050	11952	15%	14%

36 Sutton Rd									
Date	LAeqNom	LAeqMeas	Correction(1)	Correction(2)	Adjustment C(1) + C(2)	QNom	QMeas	HVC%Nom	HVC%Meas
17/07/2023	N/A	N/A	0.195	1.627	1.822	20548	19646	23%	9%
18/07/2023	51.8	50.2	0.201	1.419	1.620	20548	19620	23%	11%
19/07/2023	N/A	N/A	0.108	1.453	1.562	20548	20042	23%	10%
20/07/2023	51.0	49.6	-0.061	1.472	1.411	20548	20839	23%	10%
21/07/2023	N/A	N/A	-0.403	1.656	1.253	20548	22547	23%	9%
22/07/2023	52.2	49.8	0.109	2.275	2.385	20548	20038	23%	5%
23/07/2023	50.5	47.4	0.605	2.474	3.078	20548	17878	23%	4%
24/07/2023	53.7	51.7	0.425	1.603	2.028	20548	18631	23%	9%
25/07/2023	N/A	N/A	0.060	1.426	1.486	20548	20267	23%	11%

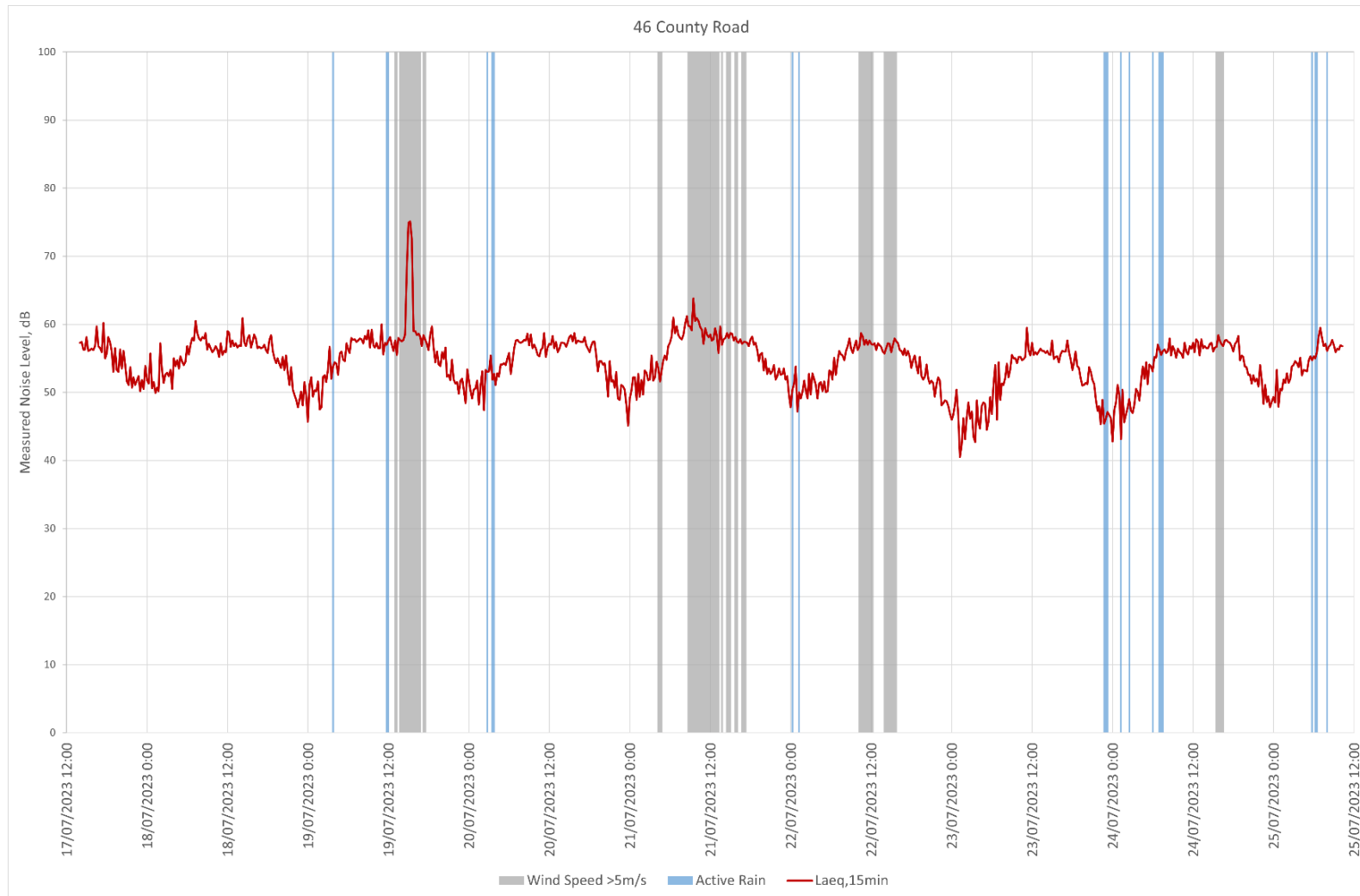
APPENDIX D NOISE AND WEATHER DATA FOR EACH PPF

9 Old Hautere Road

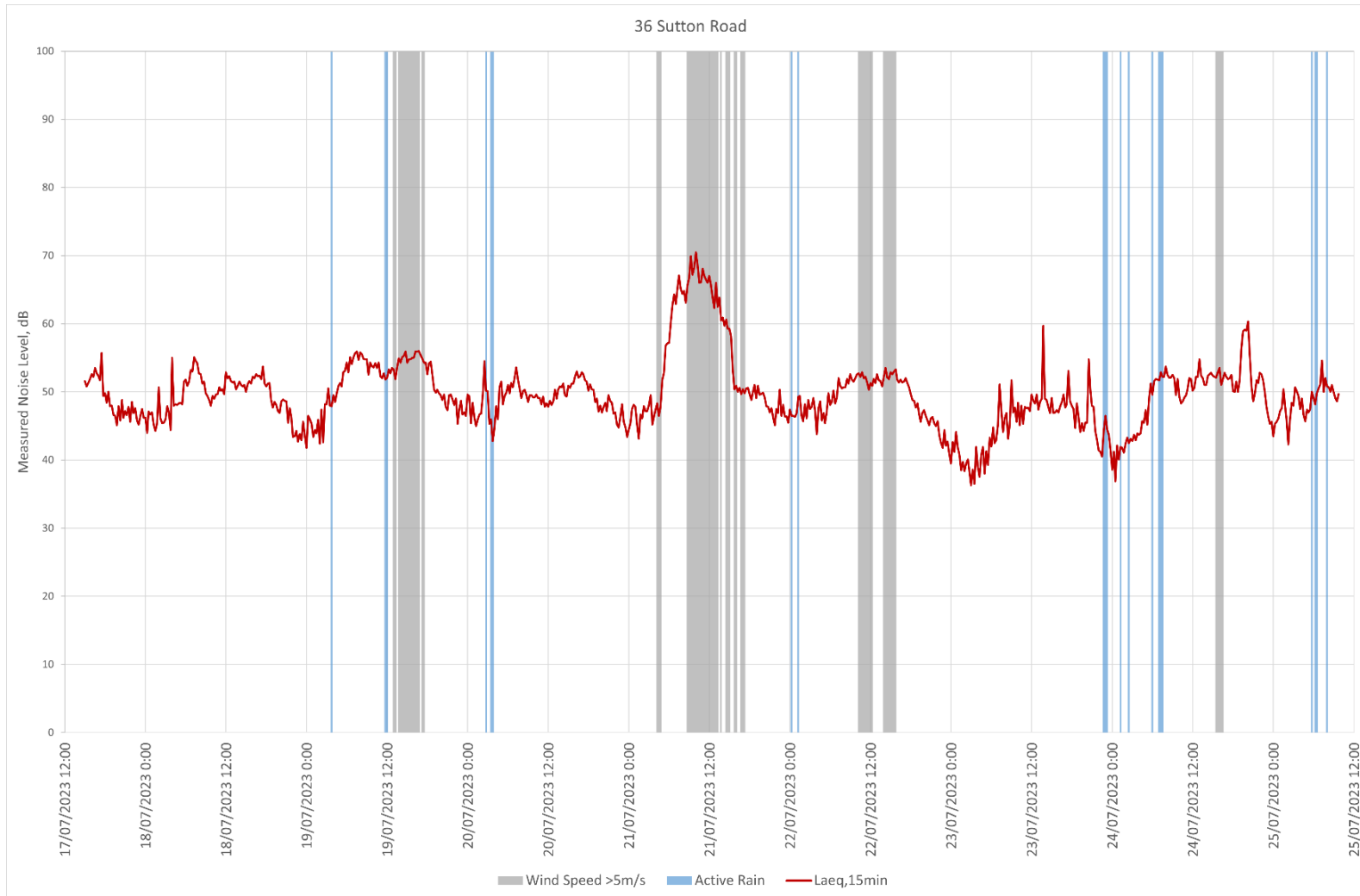




46 County Road



36 Sutton Road



APPENDIX E SURVEY: TRAFFIC VOLUMES & PERCENTAGE HEAVY VEHICLES

	At Otaki Gorge Rd – 9 Old Hautere Road				At Waitohu – 46 County Road				At Marycrest – 36 Sutton Road			
Date	Light	Heavy	Total	% Heavy	Light	Heavy	Total	% Heavy	Light	Heavy	Total	% Heavy
17/07/2023 - MON	17709	1914	19623	10	10494	1381	11875	12	17832	1814	19646	9
18/07/2023 - TUE	17461	2198	19659	11	9740	1612	11352	14	17527	2093	19620	11
19/07/2023 - WED	17835	2202	20037	11	9945	1608	11553	14	17952	2090	20042	10
20/07/2023 - THU	18605	2238	20843	11	10612	1638	12250	13	18693	2146	20839	10
21/07/2023 - FRI	20482	2176	22658	10	12663	1556	14219	11	20509	2038	22547	9
22/07/2023 - SAT	18909	1115	20024	6	11586	816	12402	7	19000	1038	20038	5
23/07/2023 - SUN	17098	789	17887	4	11533	560	12093	5	17153	725	17878	4
24/07/2023 - MON	16767	1865	18632	10	9454	1313	10767	12	16880	1751	18631	9
25/07/2023 - TUE	18023	2252	20275	11	10295	1657	11952	14	18115	2152	20267	11

Dates highlighted in green are those where weather conditions were suitable for noise monitoring.