Tonkin+Taylor

Job No: 84466.0050
29 October 2020

Hutt City Council
Private Bag 31-912
Lower Hutt 5040

Attention: Team Leader, Resource Consents

Dear Hutt City Council – Enforcement (c/- Parvati Rotherham)

Wainuiomata Cleanfill - Detailed Noise Monitoring Report 29 September 2020

1 Introduction

This letter report presents analysis of the noise measurements made at Wainuiomata Cleanfill on 16 September 2020. A separate monitoring report[1] has been prepared which provides the results and findings of the noise survey. These measurements satisfy the requirement of quarterly noise monitoring specified in Condition 16 of Resource Consent RM190050. Cleanfill noise limits at the notional boundary of nearby receivers are contained in Condition 12 and reproduced below for reference:

a Monday to Friday (excluding public holidays) 7.30 am to 5.00 pm – 50 dB LAeq

b Saturday (excluding public holidays) 7.30 am to 12.00 pm – 50 dB LAeq

c All other times - 40 dB LAeq

d 10.00 pm to 7.00 am (all days) – 75 dB LAfmax.

The consent condition noise limits are based on the average noise level (LAeq,t) between the stated hours (t= 9.5 hours for operational weekdays and 4.5 hours for Saturday mornings). This detailed analysis follows the requirements of NZS 6802:2008 for determining the LAeq(t) from short duration individual noise events of cleanfill activity. This is necessary to identify the overall daily noise level (LAeq,t) from the cleanfill due to the variation in activity throughout each operational day.

2 Survey

The noise monitoring report should be referred to for details of the monitoring and results. A glossary of terms is included for reference in Table 2.1.The locations and results are reproduced in Figure 2.1 and in Table 2.2 respectively.

[1] Tonkin & Taylor Ltd letter report "Wainuiomata Cleanfill noise monitoring results September 2020" dated 14 October 2020

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During the monitoring, site activity was observed in the general area shown in Figure 2.1. The nearest receiver location to the works was 199 Coast Road.

Continuous LAeq, 1sec sound levels were measured during each measurement.

Table 2.1: Glossary of terms

Term	Definition
dB	A unit of measurement on a logarithmic scale which describes the magnitude of sound pressure with respect to a reference value (20 µPa).
LAeq(t)	The A-weighted time-average sound level over a period of time (t), measured in units of decibels (dB).
LAmax	The maximum A-weighted sound pressure level over a period of time or of a particular noise event, measured in units of decibels (dB).
LA90	The A-weighted 90th percentile sound level over a period of time (t), measured in units of decibels (dB). The LA90 is indicative of the underlying noise level. For a constant noise source, the LAeq(t) and the LA90 will be similar.
LA10	The maximum A-weighted 10th percentile level over a period of time or of a particular noise event, measured in units of decibels (dB).
Ambient noise	All sound in a given situation at a given time, usually including many sources from near and far.
Residual noise	The ambient sound remaining when noise from a specific source or sources is supressed.

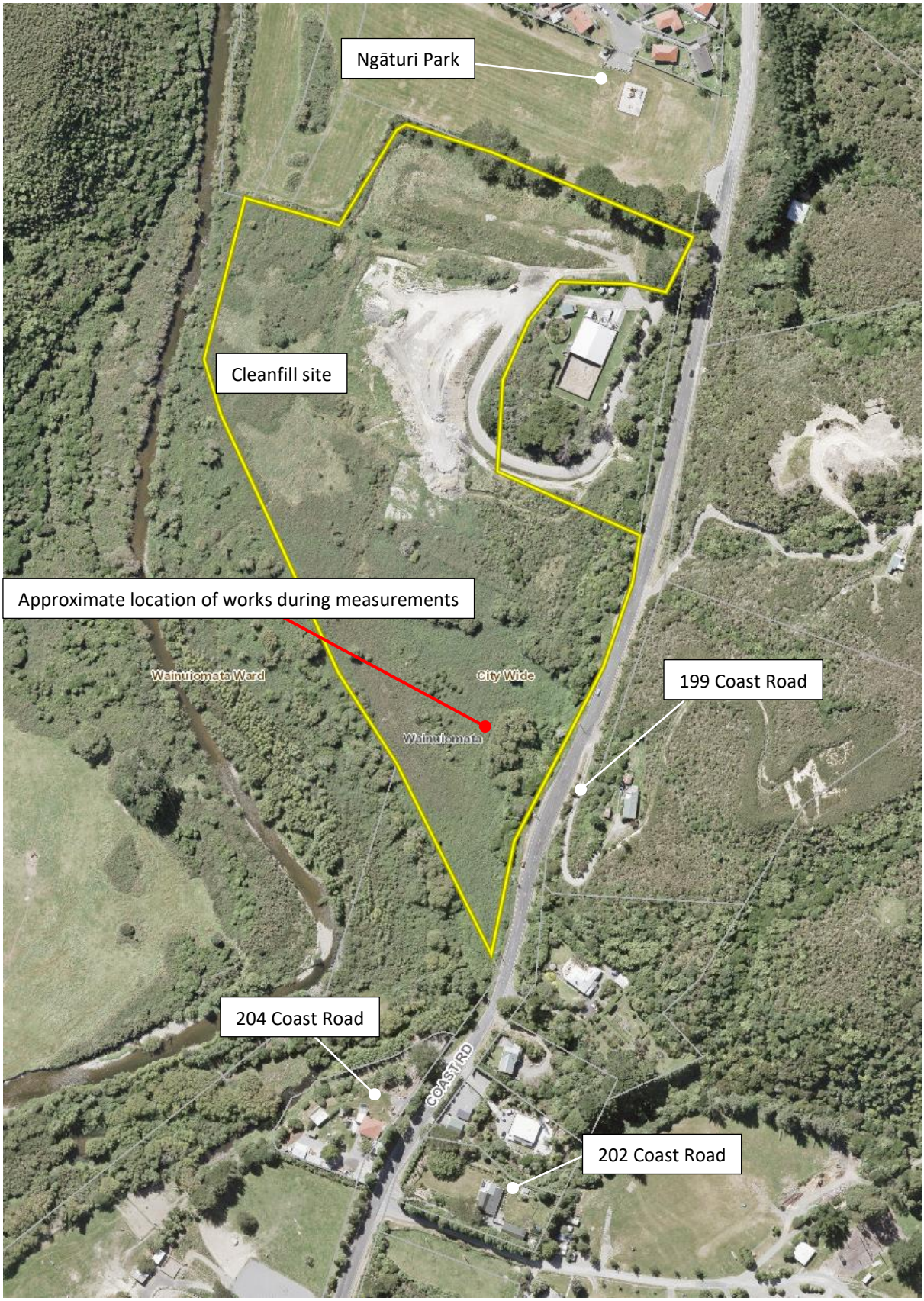


Figure 2.1: Noise monitoring locations

Table 2.2: Noise monitoring data

Measurement	Time	LAeq(t)	LAmax	LA90	LA10	Cleanfill equipment operating & other sources of sound heard at measurement location
Ngāturi Park Measurement 1	1:45 – 1:59	49	58	42	51	Trucks observed on site but not audible. Ambient noise included music from nearby houses, hammering from home construction, aircraft noise and road noise. Background noise has not been excluded.
199 Coast Road Measurement 1	2:14 – 2:46	59	70	42	64	Trucks moving about the site and tipping fill as well as use of the bulldozer and front-end loader. Noise from traffic passing was excluded from noise data. No other noise was notable.
199 Coast Road Measurement 2	4:01 – 4:22	53	75	41	55	All site work noise is from trucks moving around and dumping fill. All notable other noise is from traffic and has been excluded from presented data.
204 Coast Road Measurement 1	3:04 – 3:23	49	65	45	50	All noise on site from truck movements and tipping. All notable other noise is from traffic and geese and has been excluded from presented data.
204 Coast Road Measurement 2	4:27 – 4:42	54	67	46	57	No cleanfill operations occurred during this measurement – site was inactive. Local noise environment dominated by road traffic noise.
202 Coast Road Measurement 1	11:41 – 11:56	48	67	45	50	Regular cleanfill activity, including trucks dumping and use of either front-end loader or bulldozer. All notable other noise is from traffic and has been excluded from presented data. Background noise level controlled by birds and rustling of bushes in times when other more dominant sounds were not present.
202 Coast Road Measurement 2	3:37 – 3:49	48	63	45	49	Trucks operational on site, front-end loader and dozer were not operating.

3 Analysis

Operations on site were split into three different activities: trucks delivering fill, use of the front-end loader, and operation of the bulldozer.

When on site visiting trucks drive into the site, reverse up to near the edge of the cleanfill tipping face and dump their cleanfill. The resource consent permits a maximum of 75 truck movements each day.

The front-end loader and bulldozer are operated by the cleanfill to push the dumped fill over the edge. They were observed to work interchangeably and perform the same role on site. The cleanfill has advised that they may be used for up to a combined two hours each day. During wet weather, the bulldozer is the preferred choice of plant due to site conditions (surface traction).

The total daily noise level can be calculated based from the noise contribution of each activity and the time over the day for which it runs. This is easiest to calculate based off the measurements at

199 Coast Road because the proximity of measurements allowed noise sources to be easily identified using video footage recorded using a Go-Pro. Noise from plant will be less masked by background noise as it is the closest noise sensitive location to the current work area.

Noise from each activity measured at 199 Coast Road was isolated and is presented below.

Four separate items of plant were identified to have distinct noise levels which could be isolated. These are small single trucks, large truck and trailers, the front-end loader and the bulldozer. Measurement segments were truncated when plant was working individually and therefore the noise could be isolated. The measurement segments, along with images of the plant operating on site at that time are included in Appendix C.

The noise level from each item of plant along with the duration of measurement is presented in Table 3.1.

Table 3.1: Measured noise levels from equipment use

Plant	LAeq,t / dB	Duration of measurement, t (seconds)
Small single trucks	53	90
Large truck and trailer	56	288
Front end loader	54	289
Bulldozer	65	261

4 Daily Noise

The LAeq level for the whole day (LAeq,t) can be calculated by determining the sound level of each activity and the proportion of the day that the activity is active for. NZS 6802 has a method for adjusting the measured sound level based on the duration, see Table 4.1.

Table 4.1: Duration adjustments from NZS 6802

Percentage duration of specific sound in the prescribed time frame	Adjustment value
Less than 80%	1 dB
Less than 60%	2 dB
Less than 50%	3 dB
Less than 40%	4 dB
Less than 30%	5 dB

The background noise level can have a significant contribution to the measurements if it is of similar noise level to the source of interest. Table B1 in NZS 6802 is reproduced below in Table 4.2 to show the measurement correction based off the difference between the measured and residual sound level.

Table 4.2: Residual noise adjustment from NZS 6802

Difference between measured total sound level L_{meas} and residual sound level L_{resid} dB	Adjustment k_1 to be subtracted from total measured level L_{meas} dB
8 – 10	0.5
6 – 8	1.0
4.5 – 6	1.5
4 – 4.5	2.0
3.5	2.5
3.0	3.0
<3.0	Valid assessment cannot be done

For transparency, the overall noise level at 199 Coast Road has been calculated in a similar format to the example calculations in NZS 6802. The format breakdowns the derivation of the overall noise level into individual steps from the measured data and the various adjustments for duration, residual noise etc.

In this calculation, measurements on site have been broken down to isolate individual items of equipment, and a full day noise level calculated based off the maximum use of all equipment.

Parameter	Value	Comments
Specific sound	Cleanfill	The cleanfill operations include the use of trucks, a front-end loader and a bulldozer. The timing and duration of the equipment use varies significantly between days.
Residual sound	Background environment – road traffic is excluded	Rural sounds such as trees moving in the breeze, bird sounds, and distant cars control the background level when the cleanfill is not in use and no cars are passing by.
Prescribed time frame	0730 h to 1700 h	The cleanfill only has consent to operate within these hours. This totals 9.5 hours on weekdays and 4.5 hours on a Saturday morning.
Measurement time interval	(a) 109 seconds (b) 72 seconds (c) 288 seconds (d) 289 seconds (e) 261 seconds (f) 243 seconds	Four measurements were isolated where individual plant could be assigned to the noise. These are: (a) Truck (sample 1) (b) Truck (sample 2) (c) Truck and trailer (d) Front-end loader (e) Bulldozer (f) Background (g) Residual It is not possible on the site to easily predict when any of these activities occur so they were selected out of longer 30-minute and 20-minite monitoring recordings.
Representative case	19 truck and trailer movements 56 truck movements 1.5 hours front-end loader use 0.5 hours bulldozer use	The operation limit for the cleanfill is 75 truck movements each day, it has been advised that more of the trucks are single trucks rather than truck and trailer units. A ratio of 3:1 has been used for the calculations.

Parameter	Value	Comments
		The cleanfill advised that the front-end loader and bulldozer may work a combined 2 hours over a busy day.
Method	Detailed	
Measured levels	Truck: (1) 52.1 dB LAeq(109sec) (2) 53.2 dB LAeq(72sec) Truck and trailer: (3) 56.2 dB LAeq(288sec) Front end loader: (4) 53.9 dB LAeq(289sec) Bulldozer: (5) 64.5 dB LAeq(261sec) Residual: (6) 43.8 dB LAeq(243sec) The two measurements of trucks are averaged to account for some variation in measurements. $10*\log10(1/(2*181s)*(109*10^{(52.1*0.1)}+72*10^{(53.2*0.1)})$ = 52.6 dB LAeq(91sec)	
Free-field	No correction applicable as measurement position was over 3.5 m from any reflecting surface other than the ground (refer to 6.1.2 of NZS 6801)	
Residual sound	The averaged truck measurement of 52.6 dB LAeq(91sec) is within 8-10 dB of the residual noise level and therefore is decreased by 0.5 dB as per Table B1 in NZS 6802. The truck noise is now considered to be 52.1 dB LAeq(91s). All other recorded levels are more than 10 dB above the residual level.	
Detailed method	Over a 15-minute period it would be reasonable to expect three trucks and one truck and trailer, or 8 minutes of front-end loader, or 8 minutes of dump truck. Conservative 15-minute periods are considered to account for times over high use throughout the day. The front-end loader and bulldozer may each work for a continuous 15-minute period. Therefore, the LAeq(15 min) is the same as the measured sound level. In a 15-minute period it was considered reasonable to have three trucks, and one truck and trailer. $10*\log10(1/(666.5s)*(3*90.5s*10^{(52.1*0.1)}+288s*10^{(56.2*0.1)})$ = 54.7 dB LAeq(560s) There are 900s in 15 min $10*\log10(1/(900)*(560s*10^{(54.7*0.1)})$ Truck use of representative 15 minutes = 52.6 dB LAeq(15 min)	
Characteristics	No equipment was judged to have a distinct tonal sound therefore the +5dB Special Audible Characteristic (SAC) penalty is not applied. Certain events such as tailgate slamming are distinct and unpleasant, however due to the very short duration of these impulse events the contribution to the 15-minute or daily LAeq values is not significant, and placing a 5dB SAC penalty would not be a suitable way to treat the impulse noise. Noises such as these should be controlled	

Parameter	Value	Comments
	with a management approach to minimise occurrences. This requirement is already detailed in the site's noise management plan.	
Duration	A total of 75 trucks daily is equivalent to 18.75 x 15-minute periods with three trucks and one truck-and trailer. The total duration of this is 18.75*15 min = 281 min Trucks: 52.6 dB(A) for 281 minutes The front-end loader is assumed to work for 1.5 hours Front-end loader: 53.9 dB(A) for 90 minutes Bulldozer: 64.5 dB(A) for 30 minutes Average sound level for all work 54.4 dB(A) over 9.5 hours at 199 Coast Road. Reducing bulldozer use to 10 minutes daily and replacing the 20 minutes of use with the front-end loader would decrease the overall noise level. It has been advised by the cleanfill that the bulldozer use can be decreased and only used for large dumps of concrete where the front-end loader does not possess the required traction to move or during wet weather when greater traction is required. Sound level with 10 min of bulldozer: 52.7 dB(A) over 9.5 hours at 199 Coast Road. Replacing use of the bulldozer by the front-end loader would decrease the overall noise level further still. 51.5 dB(A) over 9.5 hours at 199 Coast Road. Restricting use of the front loader to within 140 m of the measurement location at 199 Coast Road would result in an overall daily noise level of 50 dB(A) when assessed at 199 Coast Road. (No use of bulldozer). If there were half number of truck movements in a single day, normal use of the front loader and no use of the bulldozer the overall noise level would be: 49.9 dB(A) over 9.5 hours at 199 Coast Road. For days when the surface traction of a bulldozer is needed, 50 dB(A) at 199 Coast Road would be achieved with a maximum of 40 truck movements in a single day, and the bulldozer operating at 170 m from 199 Coast Road or 20 truck movements in a single day, and the bulldozer operating at 80 m from 199 Coast Road. The overall noise level is therefore dependent upon usage of the bulldozer, location of plant and the number of truck movements on site.	
Noise limits	50 dB(A) over 9.5 hours	

5 Discussion

The full day cleanfill noise contribution was calculated for a number of different scenarios. For both worst case scenarios, the cleanfill is operating at maximum capacity of 75 truck movements and 2 hours of combined front-end loader and bulldozer use. One scenario assumes 30 minutes of bulldozer use, while the other assumes 10 minutes of bulldozer use. 10 minutes is an estimate of the minimum time the bulldozer could operate daily to push large dumps of concrete over the edge.

Limiting the bulldozer use was selected as it is the loudest equipment by a significant margin and a portion of its daily use can be taken up by the front-end loader.

For the situations where there are approximately half the number of truck movements (~40 movements) the overall site noise level is less than 50 dB LAeq but still allowing for use of the bulldozer.

There are therefore a number of options to meet compliance of the consent's noise limit at 199 Coast Road. Restrictions etc are not needed to ensure compliance at any of the other assessment locations.

5.1 Position of measurements

The resource consent requires that noise measurements should be made at the notional boundary of the property. All measurements analysed in this report are made on the driveway of 199 Coast Road, outside the front fence and driveway gate. This is closer to the cleanfill than the notional boundary due to accessibility constraints as the notional boundary of the property is on a steep hillside with dense foliage. In this situation it is suggested that noise should instead be considered at the nearest amenity area of the property to the cleanfill. At 199 Coast Road this would be in the cleared area on the same level as the house. This is approximately 14 m further from the cleanfill works at the time of measurement than the location of the sound level meter as displayed below in Figure 5.1.

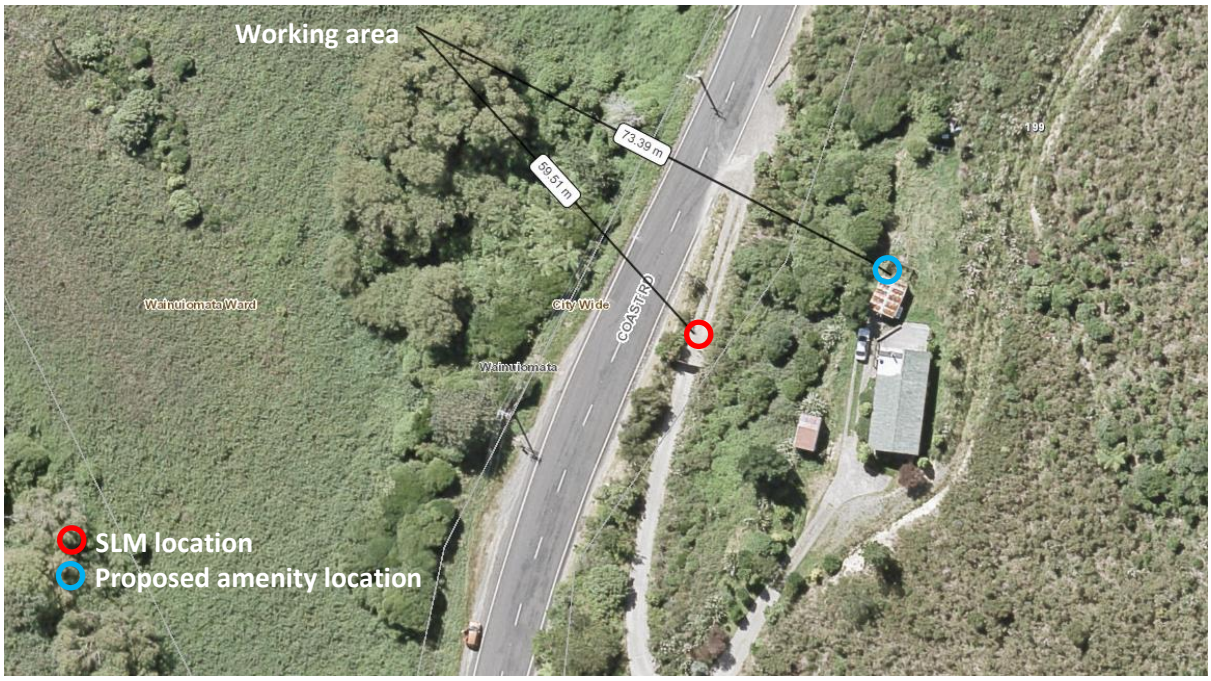


Figure 5.1: Approximate distance from works to SLM and amenity area. Image source: HCC Geomaps

The noise decay over this distance is equivalent to approximately 2 dB. Therefore the noise level in the amenity area is predicted to be 52.4 dB $LAeq_{(9.5h)}$ with 30 minutes of bulldozer use and 50.7 dB $LAeq_{(9.5h)}$ with 10 minutes of bulldozer use. Replacing the bulldozer with use of the frontend load entirely is anticipated to result in a noise level of 49.5 db.

If there were 50 truck movements in a day and 10 minutes use of the bulldozer the overall noise level would be below 50 dB LAeq. If there were 75 truck movements in a day and the bulldozer was restricted to a distance of 85 m from the amenity area of 199 Coast Road, then the overall noise level would also be below 50 dB LAeq.

These measurements are highly dependent on the location of works at the time. As the front edge of the cleanfill moves towards the west, the noise level at 199 Coast Road will decrease.

5.2 Conclusions

Within the amenity area of 199 Coast Road the cleanfill noise is predicted to exceed the 50 dB $LAeq_{(9.5h)}$ limit by approximately 2.5 dB based on normal operations and maximum number of truck movements.

Different scenarios are presented to demonstrate that compliance can be achieved at 199 Coast Road by the adoption of reduced number of truck movements, operating durations of plant or increased setback distances. These scenarios will be further developed to inform controls for use of site.

At all other locations, the cleanfill noise level will be compliant with the consent conditions noise limit due to the increased distance from the site.

During the September 2020 survey, measurements were recorded when works were in close proximity to 199 Coast Road. As the works move further to the west the noise level at the property will decrease.

6 Applicability

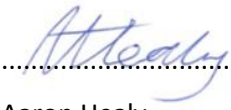
This report has been prepared for the exclusive use of our client Hutt City Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that this report will be used by Hutt City Council in undertaking its regulatory functions in connection with Wainuiomata Cleanfill site.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:



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Appendix A: Location Photos

Photograph Appendix A.1: Ngāturi Park

Photograph Appendix A.2: 199 Coast Road measurement 1

Photograph Appendix A.3: 199 Coast Road measurement 2

Photograph Appendix A.4: 204 Coast Road measurement 1

Photograph Appendix A.5: 204 Coast Road measurement 2

Photograph Appendix A.6: 202 Coast Road measurement 1

Photograph Appendix A.7: 202 Coast Road measurement 2

Appendix B: Plot of Noise Monitoring Results

1s logged LAeq noise levels are shown below for each measurement. The blue sections are excluded traffic noise.

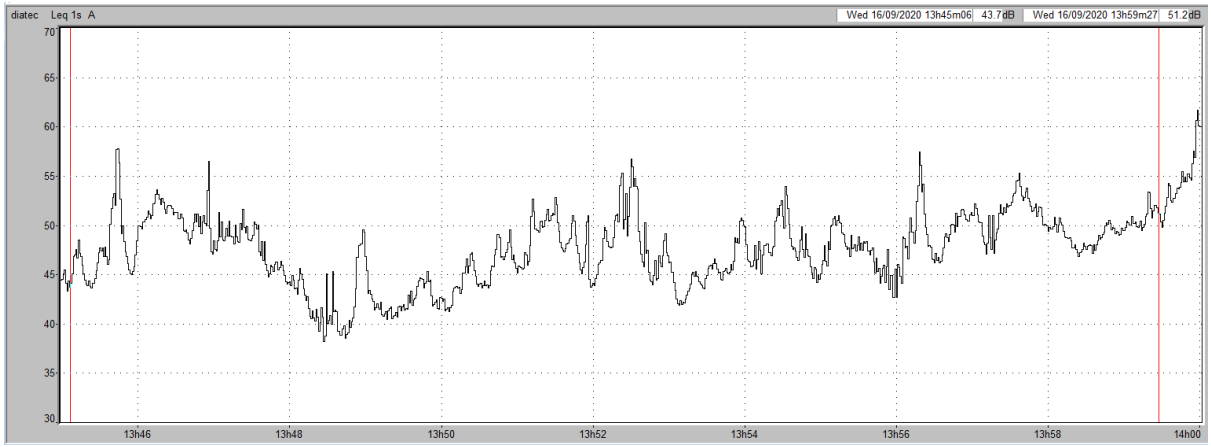

Figure Appendix B.1: Ngāturi Park

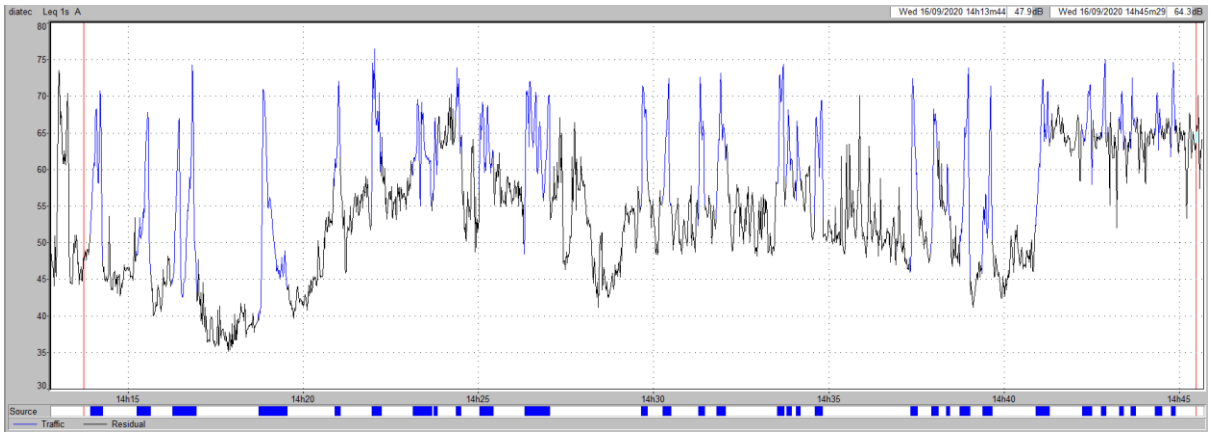

Figure Appendix B.2: 199 Coast Road measurement 1

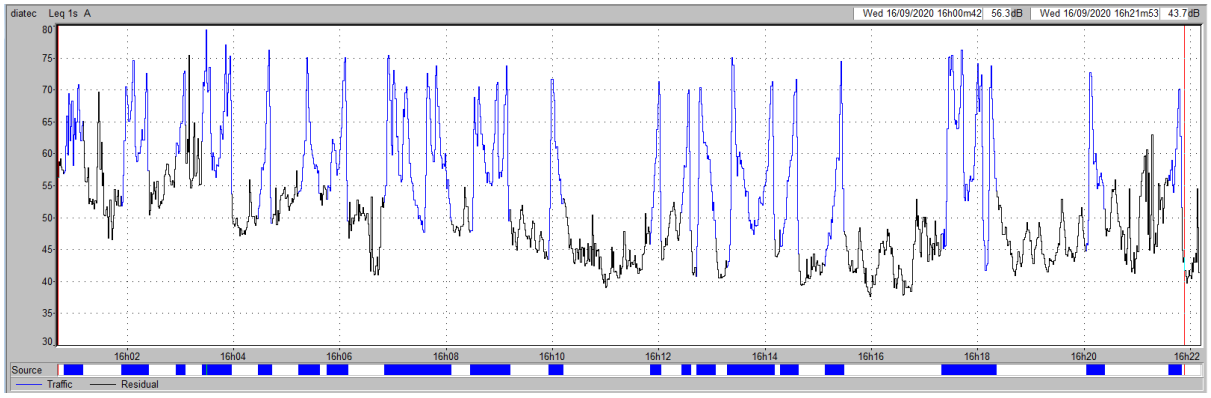

Figure Appendix B.3: 199 Coast Road measurement 2

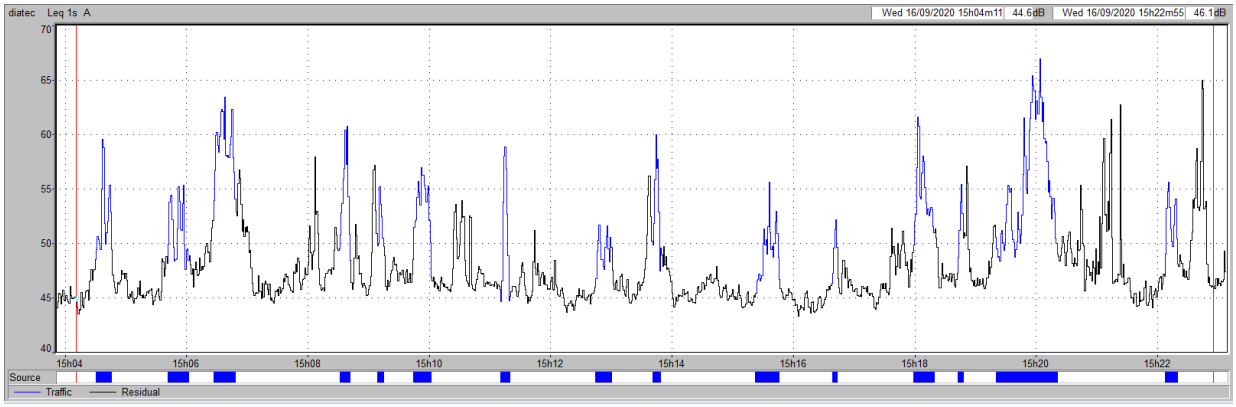

Figure Appendix B.4: 204 Coast Road measurement 1

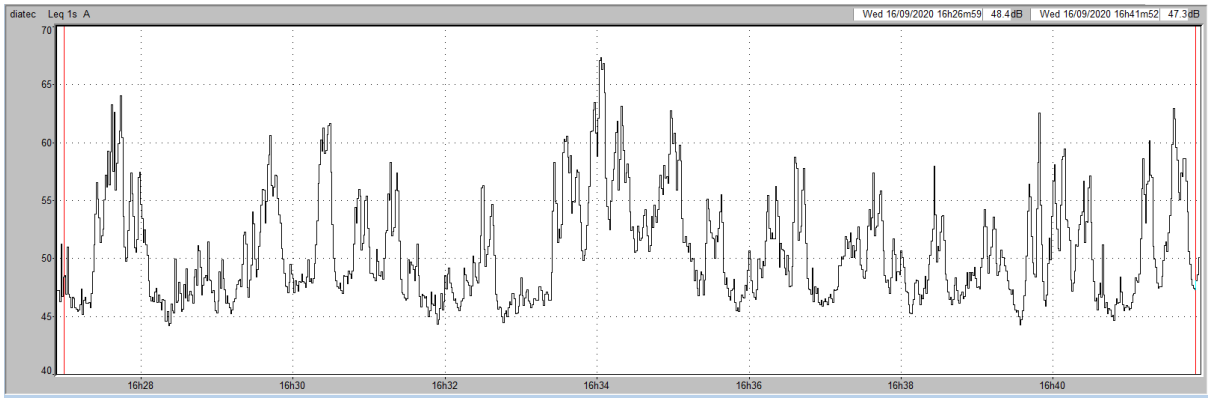

Figure Appendix B.5: 204 Coast Road measurement 2

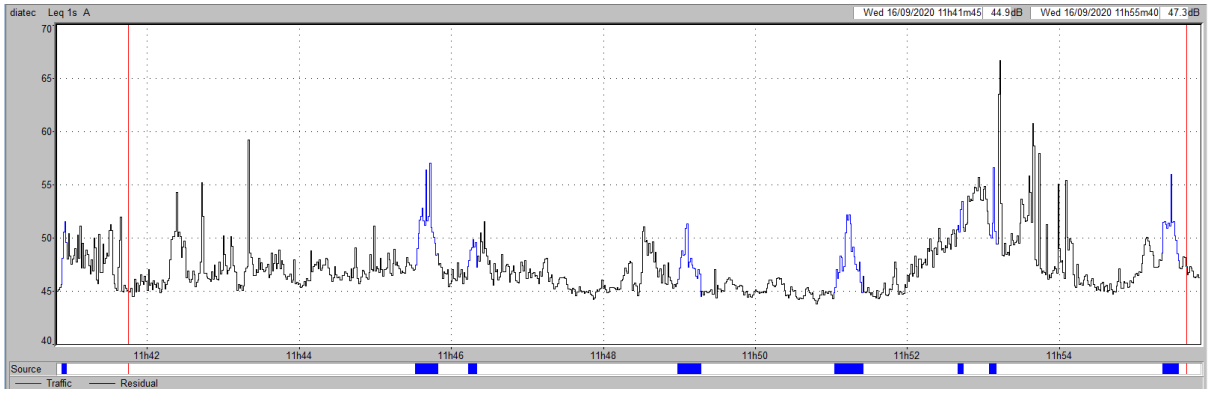

Figure Appendix B.6: 202 Coast Road measurement 1

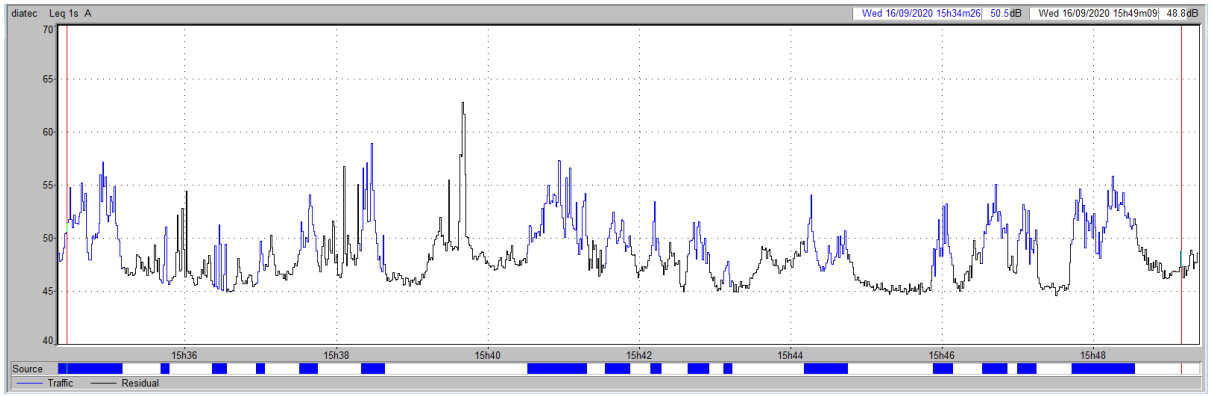

Figure Appendix B.7: 202 Coast Road measurement 2

Appendix C: Noise Segments Used in Analysis

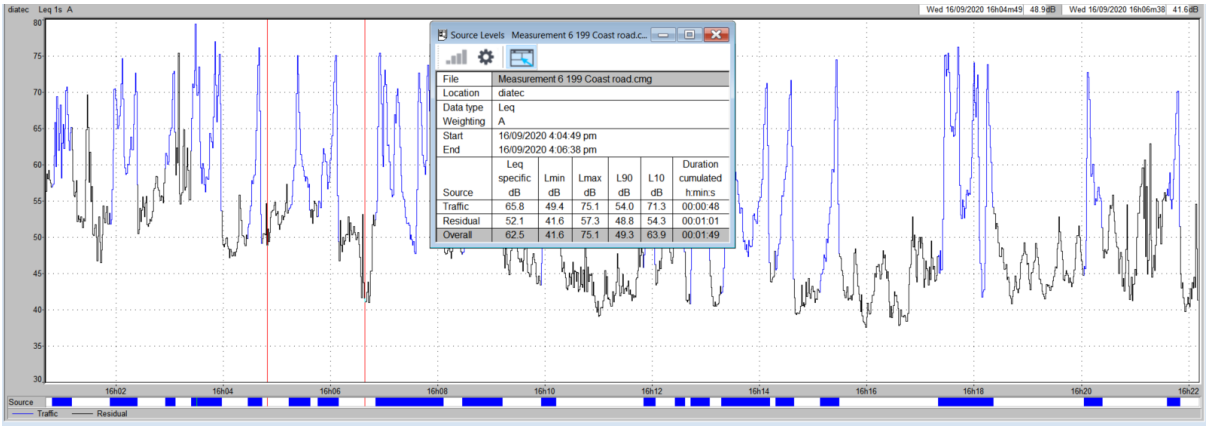

Figure Appendix C.1: Single truck dumping

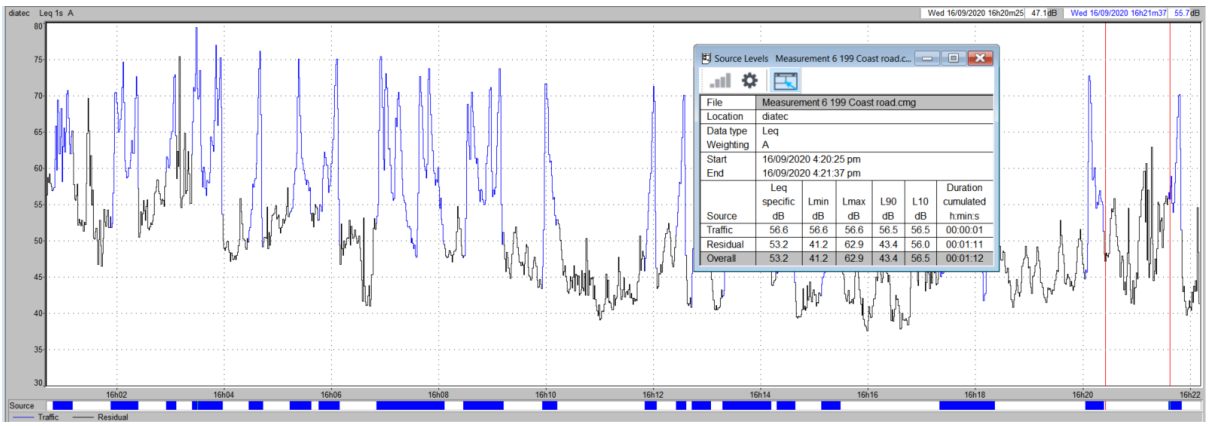

Figure Appendix C.2: Single truck dumping 2

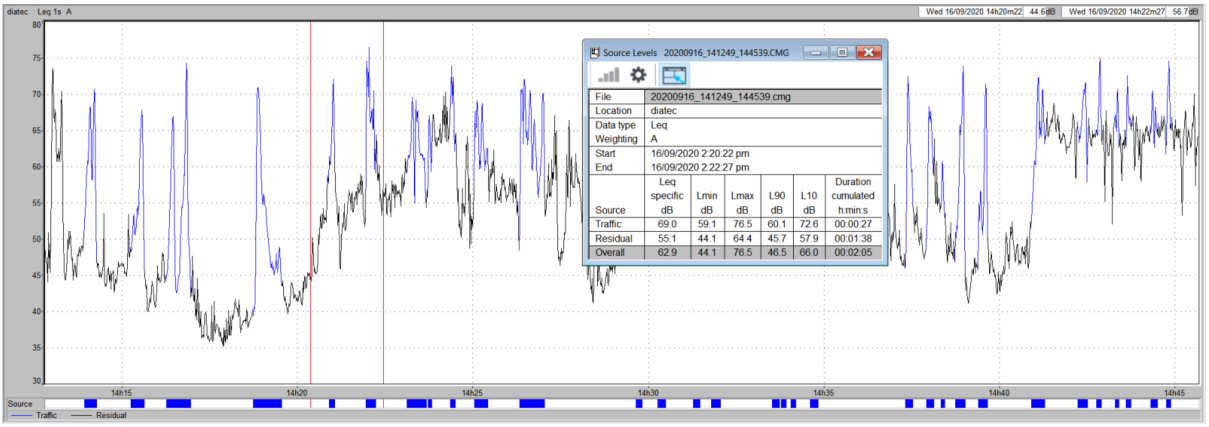

Figure Appendix C.3: Truck and trailer moving onto site and dumping trailer

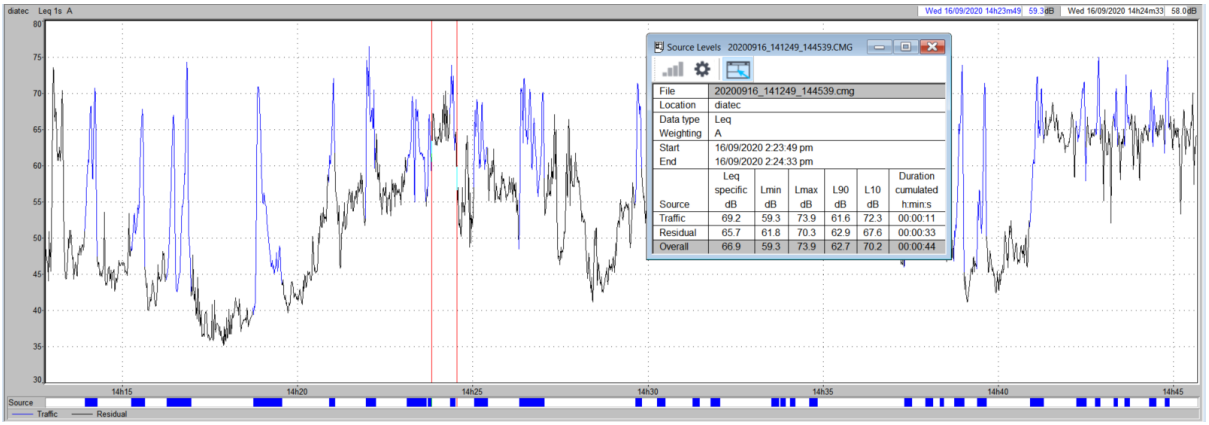

Figure Appendix C.4: Two trucks dumping trailers simultaneously

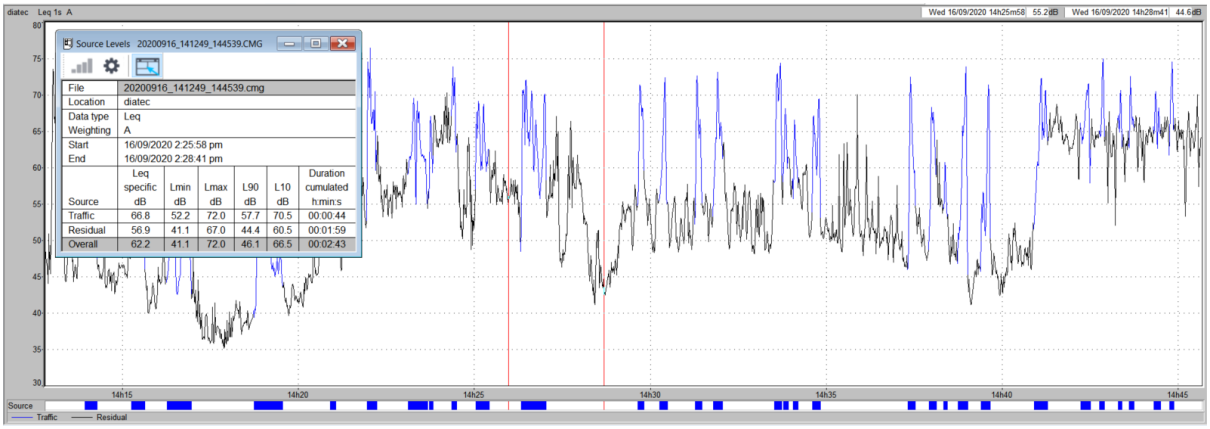

Figure Appendix C.5: Truck and trailer dumping truck load

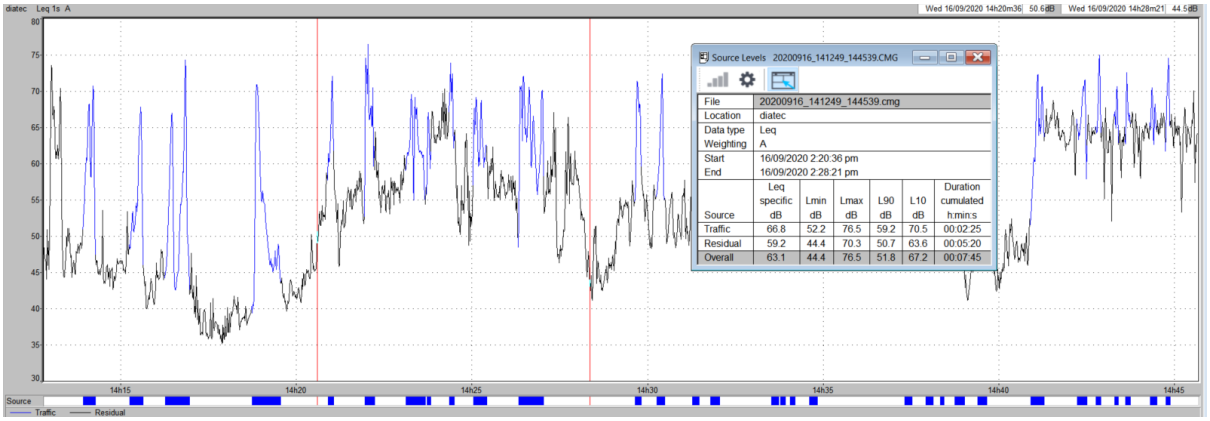

Figure Appendix C.6: All truck movements

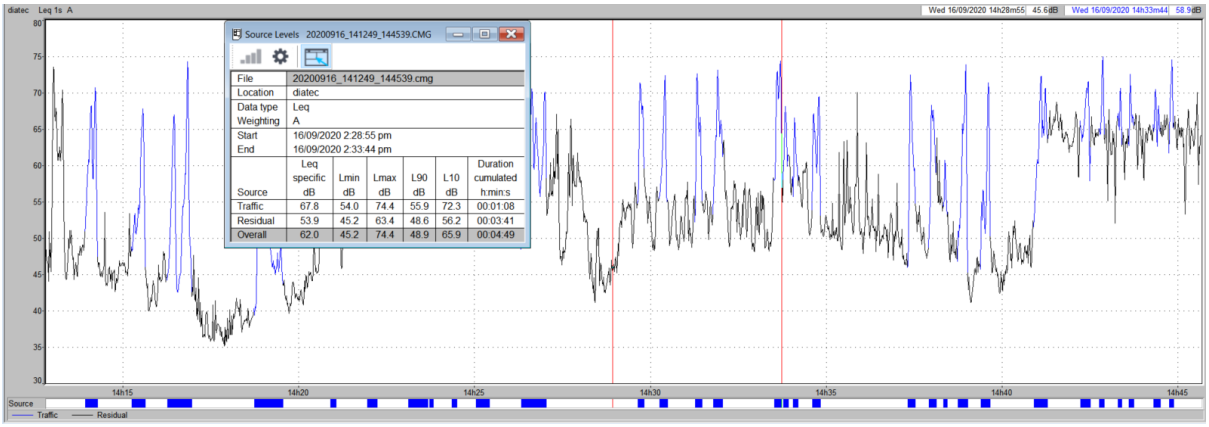

Figure Appendix C.7: Front-end loader isolated

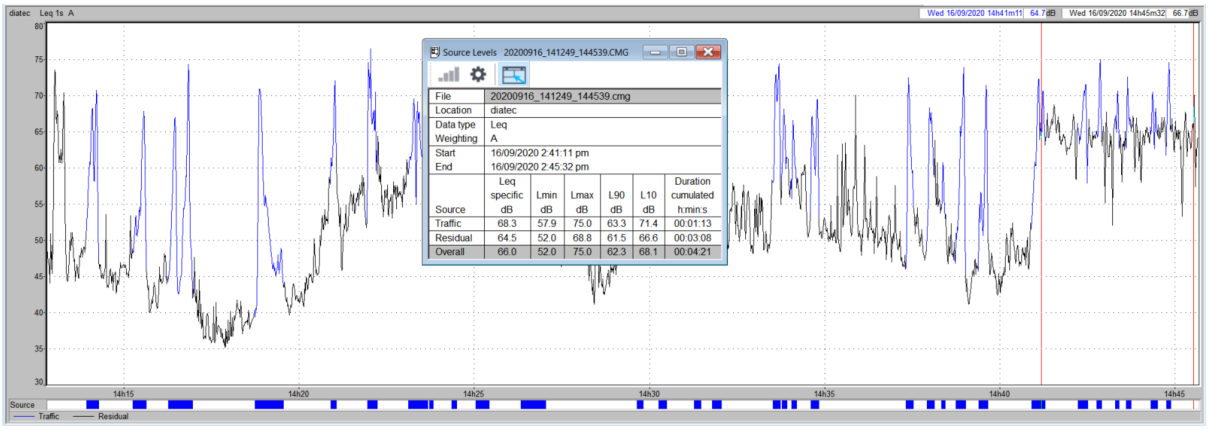

Figure Appendix C.8: Bulldozer isolated

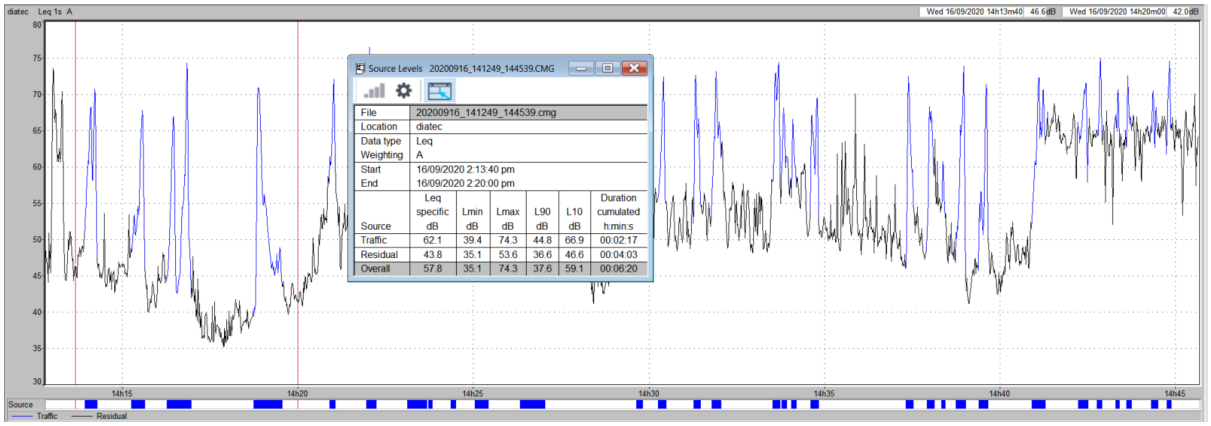

Figure Appendix C.9: Background noise sample