Tonkin+Taylor

Job No: 84466.0050
3 May 2021

Hutt City Council
Private Bag 31-912
Lower Hutt 5040

Attention: Team Leader, Resource Consents Enforcements (c/- Parvati Rotherham)

Dear Parvati Rotherham

Noise monitoring results 24-26 March 2021

1 Introduction

This letter report presents the results of recent noise monitoring conducted at Wainuiomata Cleanfill between 24th and 26th March 2021. Monitoring is undertaken on a 3-monthly basis to fulfil Condition 16 of Resource Consent RM190050. Noise limits for the cleanfill are contained in Condition 12 and reproduced below:

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.

These noise limits apply at the notional boundary of nearby receivers. The relevant noise limit is the time averaged sound level for the operating period, i.e. 9.5 hours on weekdays and 4.5 hours on Saturdays[1].

This is the fourth round of noise monitoring undertaken for this resource consent.

The following definitions in Table 1.1 may be useful for interpreting the results of the noise level monitoring completed at Wainuiomata Cleanfill.

Table 1.1: Glossary of terms

Term	Definition
dB	Decibel - a unit of measurement on a logarithmic scale which describes the magnitude of sound pressure with respect to a reference value (20 µPa).
$L_{Aeq(t)}$	The A-weighted time-average sound level over a period of time (t), measured in units of decibels (dB).
L_{Amax}	The maximum A-weighted sound pressure level over a period of time or of a particular noise event, measured in units of decibels (dB).

[1] Defined by NZS 6802:2008 as the 'prescribed time frame'.

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Term	Definition
Residual noise	The ambient sound remaining when noise from a specific source or sources is supressed.
Specific sound	The component of total sound that can be identified as associated with a specific source.
Prescribed time frame	'Daytime', 'night-time', 'evening', or any other relevant period specified in any rule or national environmental standard.
Reference interval	A shorter time interval for assessing the noise, this is usually 15-minutes per NZS 6802:2008

2 Survey

As described in the noise monitoring protocol (submitted to Council on 23rd March 2021), unattended noise monitoring was undertaken between 2pm Wednesday 24th March and 2.15pm Friday 26th March. A 01dB Fusion sound level meter was set up at the closest residential property – a clearing in the front garden of 200 Coast Road. At the end of the unattended monitoring, attended measurements were undertaken on the driveway of 199 Coast Road using the same equipment for a period of one hour.

Figure 2.1 shows the monitoring locations in relation to the cleanfill site and surrounding area. The two residential dwellings are the closest noise sensitive receivers to where cleanfill activities currently take place.

2.1 Meteorological conditions

Meteorological conditions during the survey are shown in Table 2.1.

Table 2.1: Meteorological conditions during survey (source wunderground.com)

	Wednesday 24th	Thursday 25th	Friday 26th
Wind speed	22-24km/h from S	6-19km/h from S	9-26km/h from N
Cloud cover	Light	Light	Light
Temperature	Up to 17 °C	Up to 19°C	Up to 22°C
Precipitation	None	None	None

2.2 Monitoring equipment

A 01dB Fusion sound level meter was used for the noise survey. It was calibrated before and after measurements and no drift was observed between the calibrations. Measurements were undertaken at 1.5 m above ground level. All measurements were performed in accordance with NZS 6801:2008.

The equipment continuously logged the $L_{Aeq, 1sec}$ and recorded audio for the whole duration of the measurements. The recorded data was post processed using dBTrait Expert software. Noise from traffic was excluded from the calculations using threshold coding in dBTrait.

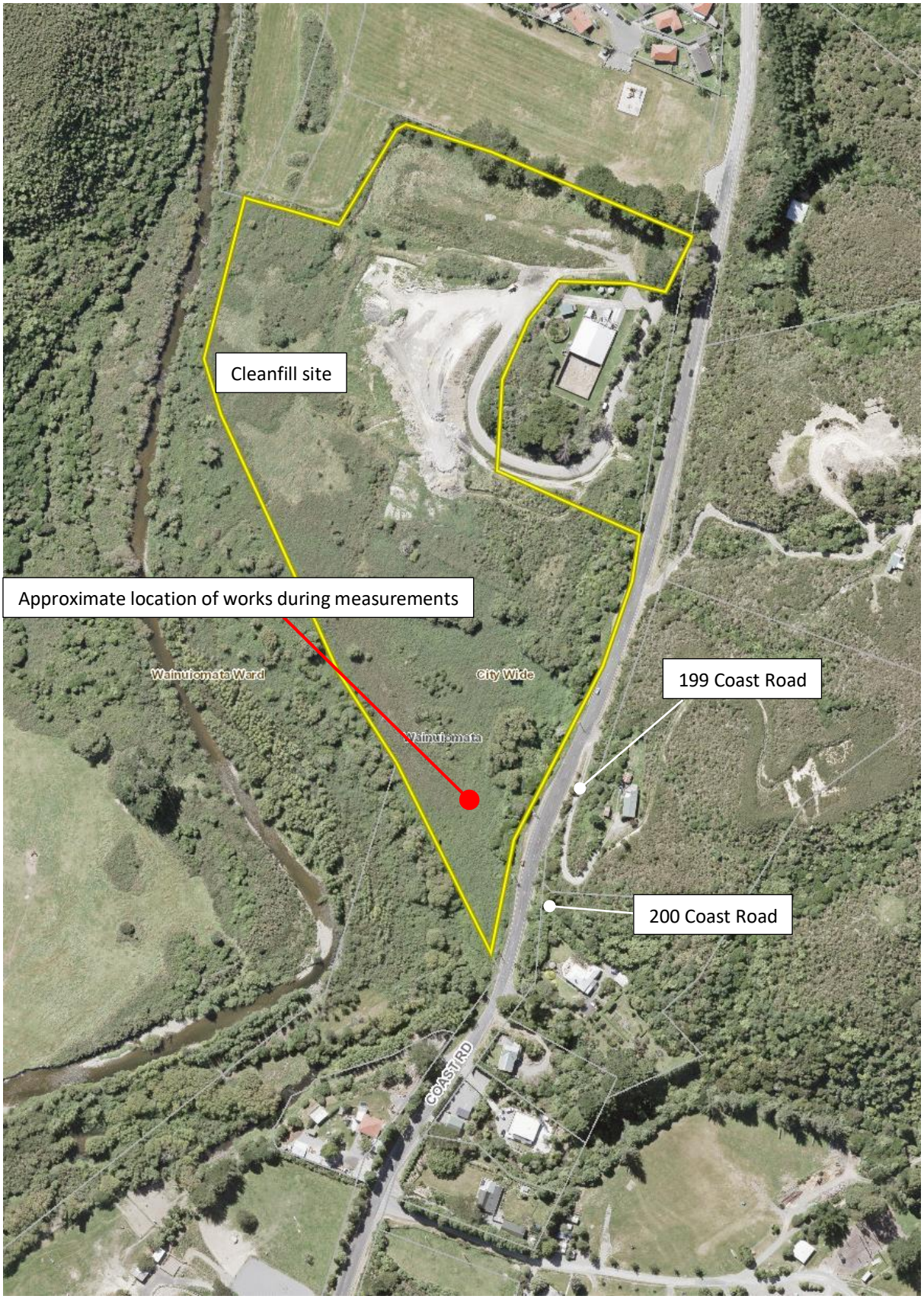

Figure 2.1: Noise monitoring locations (source HCC)

2.3 Monitoring locations

Noise monitoring locations are shown in Figure 2.1. Noise measurement locations are consistent between each round of noise monitoring and are described below.

Condition 12 states that the noise limit applies at the notional boundary, which is a line 20 m from any side of any dwelling or the legal boundary where this is closer than 20 m. For some of the monitoring locations it was not possible to monitor at the notional boundary.

Measurements at 200 Coast Road were taken approximately 20 m closer to the cleanfill than the notional boundary, as the ground of the notional boundary was covered in dense foliage, see Figure 2.2. The area chosen for the measurement was a clearing with line of site to the cleanfill, as shown in Photograph 2.1. A correction is therefore necessary to adjust the measured sound levels to the notional boundary location.

Measurements at 199 Coast Road were taken approximately 6 m closer to the cleanfill than the notional boundary. At this property, the notional boundary is on a steep slope covered with vegetation to the point that it is not reasonably accessible. The nearest amenity area to the cleanfill within the notional boundary is approximately 6 m further from cleanfill operations than the notional boundary. A correction has therefore been applied to adjust the measured sound levels to the notional boundary location. Levels received by residents at the amenity area may be lower than this.

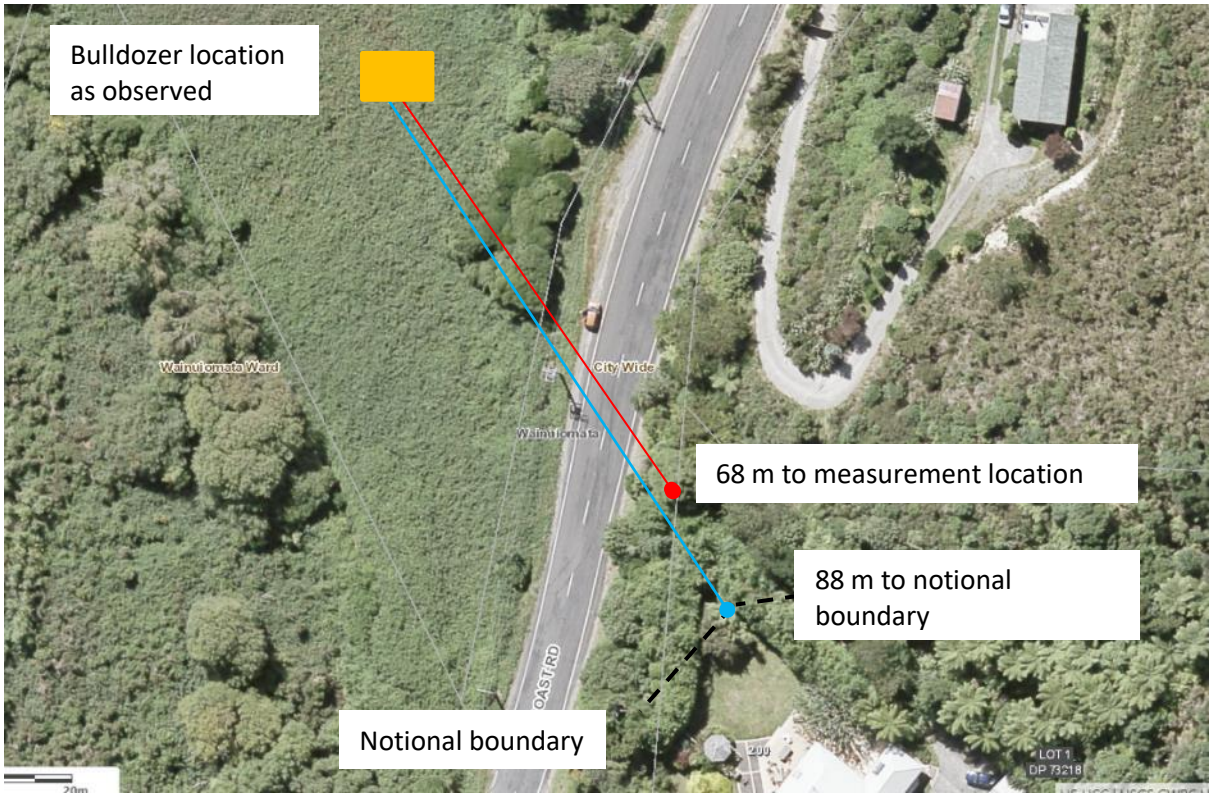

Figure 2.2: 200 Coast Road (source HCC)

Photograph 2.1: 200 Coast Road monitoring location

2.4 Site activity

It was established prior to the survey that the site would be operating as normal during that week. Site personnel were not notified of the measurements in advance. It is unlikely that cleanfill personnel would have noticed the unattended noise monitor as view of the location is partially obscured by trees.

Non-cleanfill related noise was predominantly from vehicles on Coast Road, these noise events were effectively excluded from the measurements in post-processing the measured $L_{Aeq,1sec}$ data.

Noise from cicadas in the surrounding trees was significant and masked noise from the cleanfill operations at times. Other sounds including crickets, dogs, neighbouring construction, and sound from trees in the wind also influenced the measurements at times. These events were not excluded from the cleanfill noise unless the noise level over a reference period warranted more detailed investigation. In these cases, the ambient noise sources were only excluded if they could be clearly attributed to a non-cleanfill related source and no cleanfill activity was audible. When a non-cleanfill related source was dominant and cleanfill sound was just audible at the same time, a 3 dB reduction was applied to account for the influence of background noise.

The 5 dB penalty for Special Audible Characteristics (SAC) has not been applied to any of the measurements as tailgate slams and reversing beepers were very infrequent over the 19 active site hours measured (the loudest 15-minute period recorded two tailgate slams). A site management approach has been effective in reducing the occurrence of these events and is continuously in action.

3 Assessment

The cleanfill's assessment time period (prescribed time period) is over a full day with activity varying and sometimes reducing significantly for long periods. Accordingly, the method outlined in clause 6.4.6 of NZS 6802:2008 was used to assess compliance. Clause 6.4.6 allows for the rating level to be determined using two methods. Method 1 calculates the rating level from the average sound level over the entire prescribed time frame. Method 2 calculates the rating level from the representative sound level from specific 15-minute periods minus 5 dB.

The prescribed time frame is the 9.5 hour consented period between 7.30am and 5.00pm each day (and 4.5 hours on Saturdays). The reference time interval is any 15-minute interval within the prescribed time frame. To comply with the noise rating requirements of NZS 6802, cleanfill noise must be below 50 dB $L_{Aeq(9.5h)}$ over the prescribed time frame, and below 55 dB $L_{Aeq(15min)}$ over all reference intervals (clause 6.4.6 of NZS).

Figure 3.1 shows the logged sound levels with excluded road traffic shown in red. The blue line indicates the 50 dB(A) sound level which the $L_{Aeq,\ 9.5hrs}$ over the relevant prescribed time period must be below. Figure 3.2 shows the 15-minute averaged sound levels over the measured period. The blue line indicates 55 dB(A) (clause 6.4.6 of NZS 6802). All 15-minute periods above this 55 dB(A) line were investigated to determine if noise was from cleanfill operations. In both figures the two vertical lines show the bounds of the consented hours on Thursday 25th March.

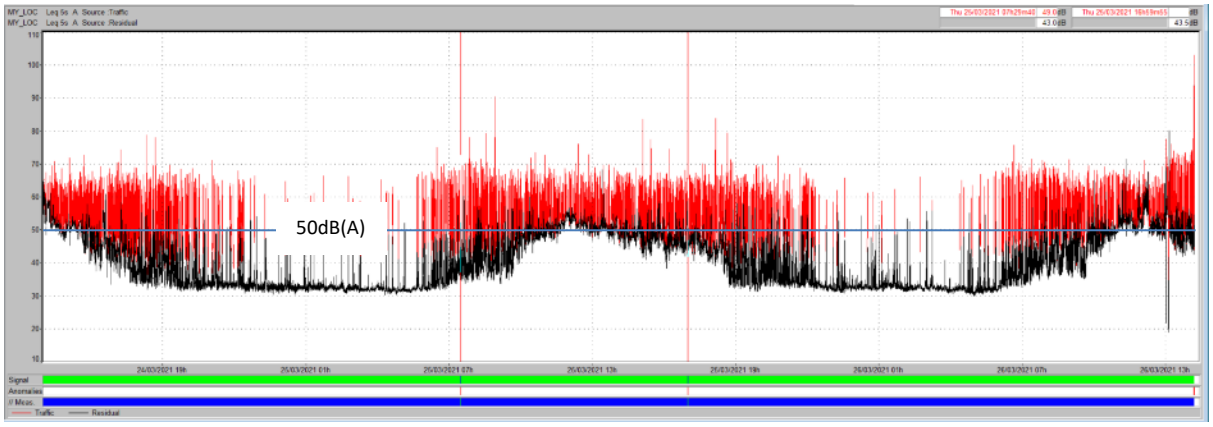

Figure 3.1: Sound over whole measurement logged in 5s intervals.

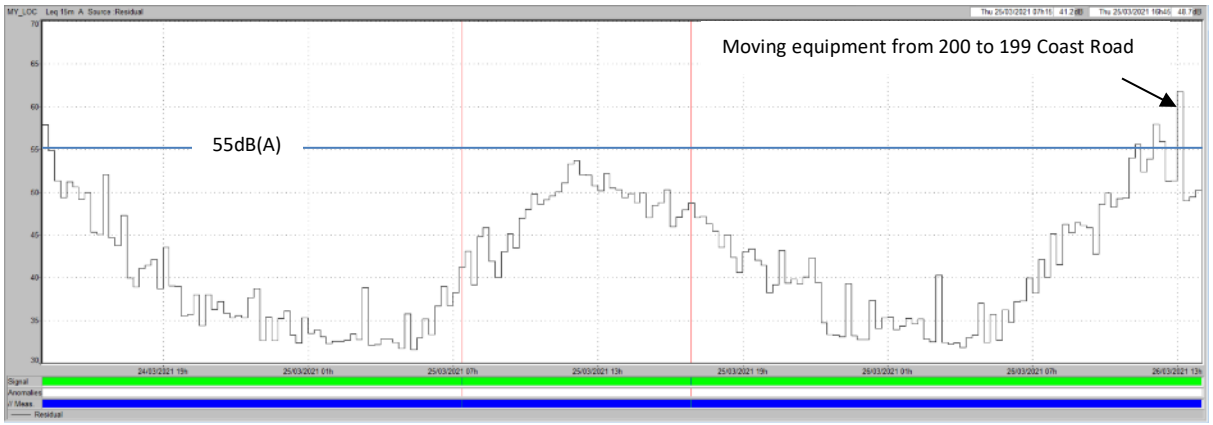

Figure 3.2: Sound level over whole measurement logged in 15min intervals.

3.1 Prescribed time frame

The only full prescribed time frame captured in the measurements was on Thursday 25th March. The $L_{Aeq(9.5h)}$ was 49.2 dB, i.e. below the 50 dB(A) noise limit over the prescribed time period.

Measurements are summarised below in Table 3.1.

Table 3.1: Total sound level measurements

Location	Period	Duration of measurement during site operating hours, t	Total sound less contribution from passing vehicles $L_{Aeq,t}$ (dB)	Total sound $L_{Aeq,t}$ (dB)	Sound level of traffic $L_{Aeq,t}$ (dB)
200 Coast Road	Wednesday 24th March	3h	52.1	56.8	60.4
	Thursday 25th March	9.5h	49.2	58.4	62.9
	Friday 26th March	5.5h	49.4	56.7	60.6
199 Coast Road	Friday 26th March	1 h	49.5	62.2	66.2

3.2 Reference intervals

Reference intervals are 15-minute periods within the consented hours. In accordance with clause 6.4.6 of NZS 6802, all reference intervals must be below 55 dB(A). Following the removal of traffic noise four reference intervals greater than 55 dB(A) were identified. These measurements were analysed to determine the contribution of cleanfill activities to the noise. The audio recordings of each 15-minute interval were used to identify the noise sources.

Table 3.2 details the results of this investigation and further details are provided below.

Table 3.2: Reference intervals exceeding 55 dB(A)

Interval	15min period above 55 dB(A)	Initial sound level (dB(A))	Cleanfill sound level (dB(A))	Site activity	Source of ambient noise
1	Wednesday 14.00-14.15	57.9	56.4	Bulldozer with broadband reversing alarm, not squeaking. Single truck with tonal alarm briefly. Tailgate slam.	Cicadas
2	Friday 11.15-11.30	55.5	54.5	Trucks, brief reversing beeper, tailgate slam, bulldozer	Cicadas
3	Friday 12.00-12.15	58.0	58.0	Consistent bulldozer use, low frequency bang of bucket	Cicadas audible before bulldozer starts. Diesel vehicle idling, may be residential ute

4	Friday 12.15-12.30	55.9	54.6	Bulldozer first 3 mins, engine idle/light construction sound (around 50 dB), front end loader moving	Cicadas, dog, birds

Each of the four intervals involved use of the bulldozer. It was observed on Friday 26th March during collection of the equipment that the dozer was operating at the location shown in Figure 2.2.

The reference interval with the highest noise level without bulldozer activity was also investigated – see section 3.2.5.

3.2.1 Interval 1 - Wednesday 24th March 2:00 – 2:15 pm

Figure 3.3 shows the time history of the 15-minute interval. The measured $L_{Aeq,15min}$ was 57.9 dB. There are four distinct sections of noise in this measurement, as summarised in Table 3.3.

Sources of sound over the interval were investigated. A range of activities were found to be present, with most noise coming from the bulldozer (section 1 of the measurement interval). Noise from cicadas was also significant and often masked cleanfill noise. The 4-minute section where only cicadas were audible (section 3) was removed as any cleanfill activity in that time was significantly below the sound level of the remainder of the recording. In section 4, cleanfill noise was audible but cicada noise was dominant. Therefore, a reduction of 3 dB has been applied to account for removing cicada noise. This reduction is appropriate when the sound source of interest (cleanfill) is equally as loud as another noise source. In this case the cicadas are clearly louder, so the 3 dB reduction is conservative. Accounting for these reductions the cleanfill sound level of this reference period is 56.4 dB(A).

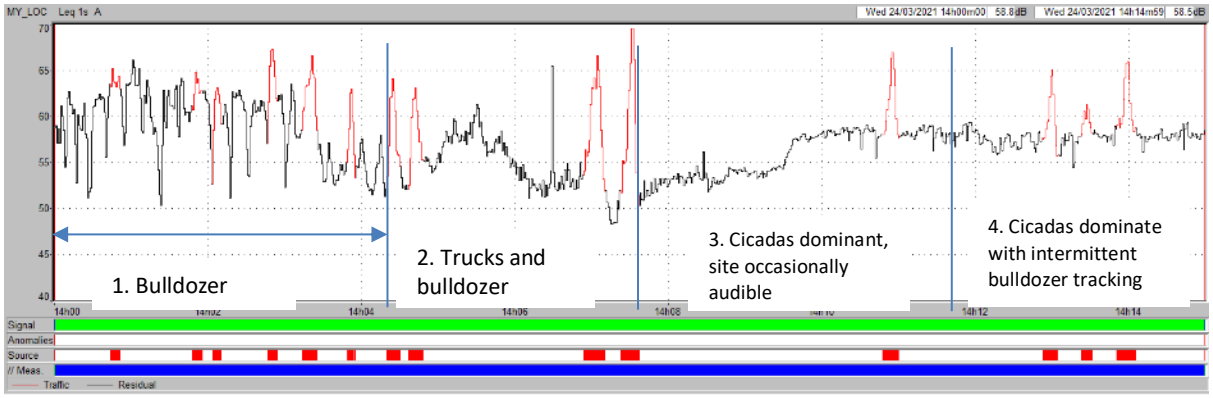

Figure 3.3: Interval 1.

Table 3.3: Interval 1 summary

Section	Duration, t (mm:ss)	Sound level (dB(A))	Source
1	4:18	60.0	Cleanfill (bulldozer)
2	3:19	55.8	Cleanfill
3	4:07	56.4	Cicadas
4	3:16	57.7	Cleanfill + Cicadas
4* (section 4 but with 3 dB reduction assuming cleanfill and cicadas are equal level)	3:16	54.7	Cleanfill

Total cleanfill	10:52	56.4 – $L_{Aeq(15min)}$	Cleanfill

3.2.2 Interval 2 - Friday 26th March 11.15 - 11.30 am

Cleanfill activity during this measurement interval, see Figure 3.4, was continuous with cicadas consistently audible. A reduction of 1 dB is appropriate to account for residual noise up to 8 dB below the specific noise of interest. The resulting cleanfill sound level over the measurement is 54.5 dB(A).

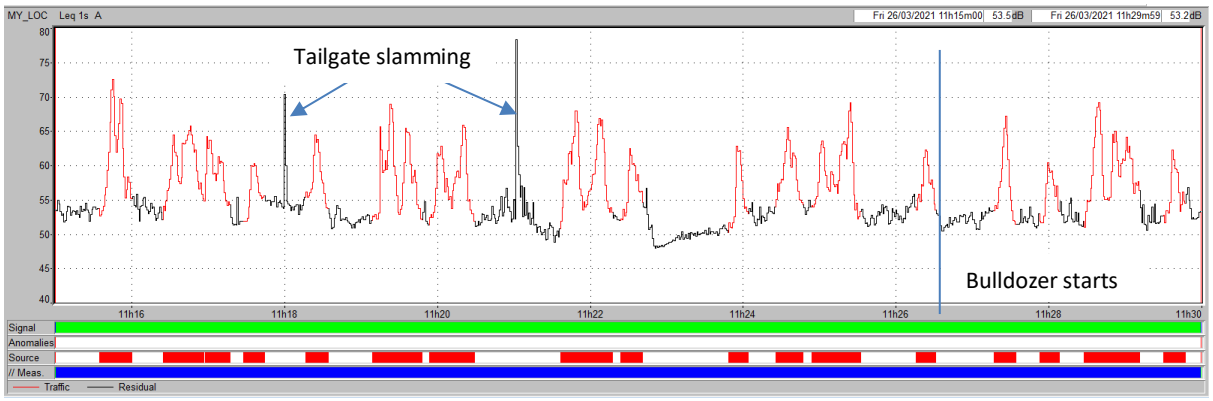

Figure 3.4: Interval 2.

3.2.3 Interval 3 - Friday 26th March 12:00 – 12:15 pm

All noise during this measurement interval, see Figure 3.5, was attributed to operation of the bulldozer – $L_{Aeq(15min)}$ 58 dB.

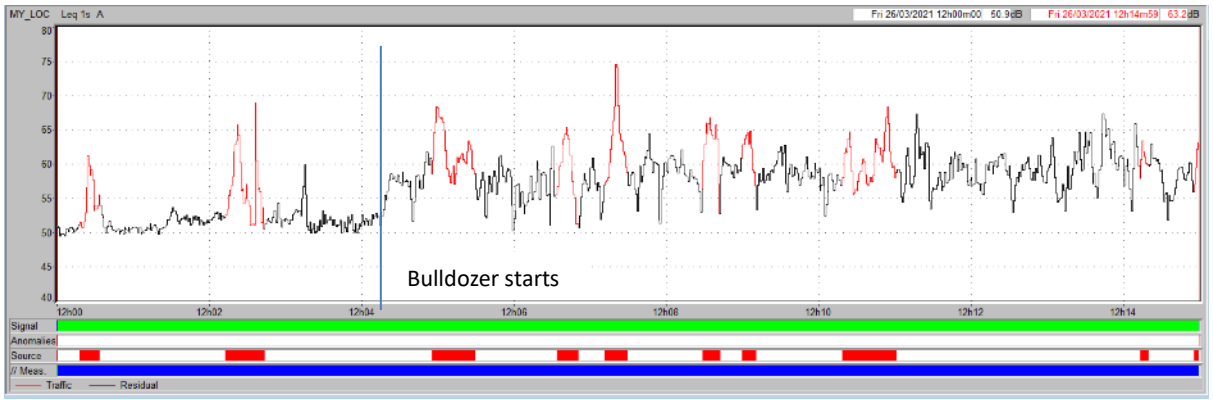

Figure 3.5: Interval 3.

3.2.4 Interval 4 - Friday 26th March 12.15 – 12.30pm

This measurement contained a short period of bulldozer use followed by little to no site activity.

The annotated recorded sound is shown in Figure 3.6 and the processed data is summarised in Table 3.4. There were three notable sections of the measurement interval.

The initial measurement of 55.9 dB(A) was reduced to 54.6 dB(A) after the removal of the contribution from cicadas. The adjusted sound level was less than the 55 dB(A) threshold, therefore this reference measurement does not exceed the compliance requirements. The adjustment to remove cicada noise from section 3 is conservative as the cicada noise is assumed to contribute half of the noise, equating to a sound level of 48.2 dB(A). This is less than the measured sound level of

cicadas individually. Much of the sound energy throughout the measurement is from bulldozer use within the first 3 minutes.

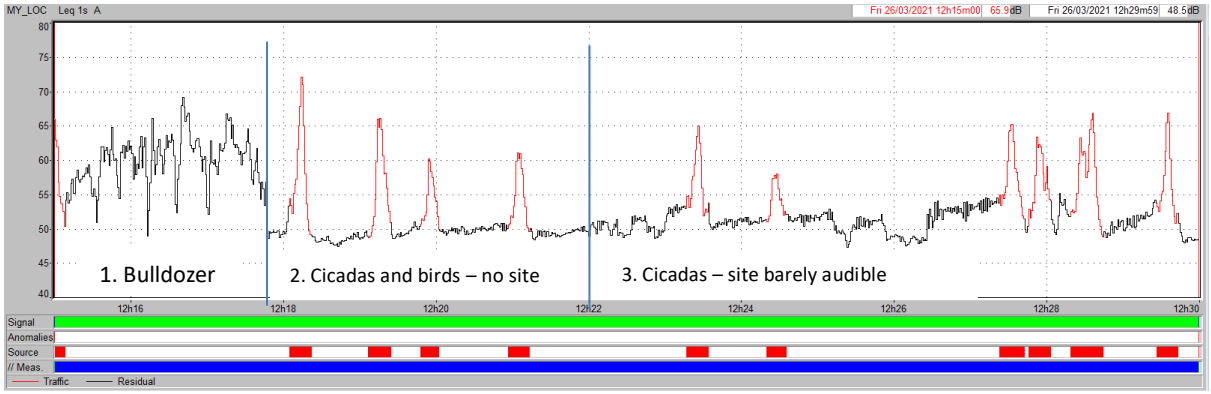

Figure 3.6: Interval 4.

Table 3.4: Processing for sound recorded on Friday 26 March between 12.15pm and 12.30pm

Section	Duration, t (mm:ss)	Sound level	Source
1	2:47	61.3	Cleanfill (bulldozer)
2	4:13	49.4	Cicadas
3	8:00	51.2	Cleanfill + Cicadas
3*(section 3 but with 3dB reduction assuming cleanfill and cicadas are equal level)	8:00	48.2	Cleanfill
Total cleanfill	10:47	54.6	Cleanfill

3.2.5 Thursday 25th March 12.00 – 12.15pm – loudest period without bulldozer active

The loudest 15-minute period without bulldozer use was from midday on Thursday 25th March. This measurement captured consistent site activity including multiple trucks and the front-end loader. Cicadas were clearly audible and increased in volume to dominate the soundscape at the end of the recording. Towards the end of the period, low frequency engine sound was somewhat audible, indicating cleanfill activity further from the measurement location or a vehicle outside the cleanfill site. The sound level over this reference interval was 53.7 dB(A). It is not appropriate to apply the distance correction to general cleanfill noise as the exact locations of the noise sources could not be determined with any degree of certainty.

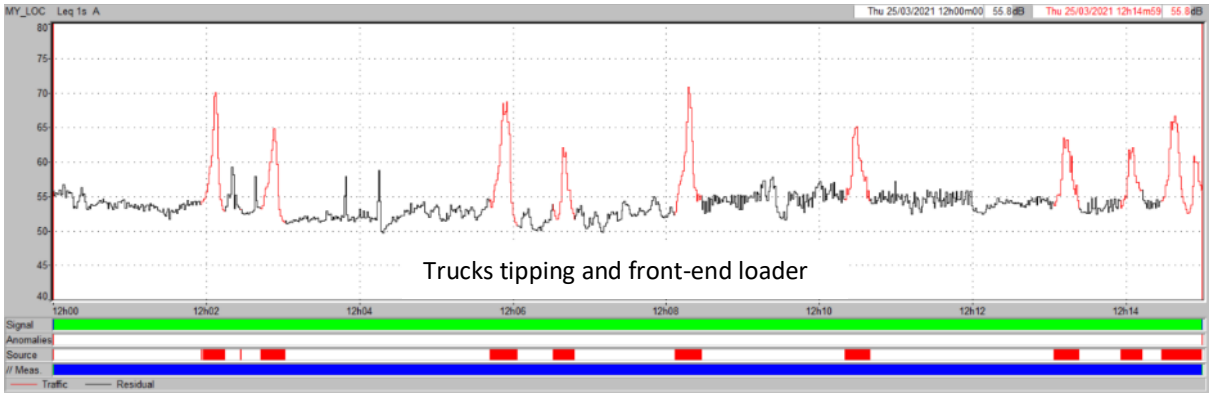

Figure 3.7: Sound recorded on Thursday 25th March between 12.00pm and 12.15pm.

As stated in Section 2.3, a distance correction is necessary to adjust the measured cleanfill noise levels to the notional boundary location. It is only appropriate to apply this distance correction to the known location of specific noise sources, i.e the bulldozer. By applying the distance correction[2] the adjusted sound levels for the four 15-minute intervals are detailed in Table 3.5.

Table 3.5: 200 Coast Road – notional boundary sound levels

Interval	15min period above 55 dB(A)	Initial sound level (dB(A))	Clean fill sound level (dB(A))	Adjusted sound level at notional boundary (dB(A))
1	Wednesday 14.00-14.15	57.9	56.4	54.2
2	Friday 11.15-11.30	55.5	54.5	52.3
3	Friday 12.00-12.15	58.0	58.0	55.8
4	Friday 12.15-12.30	55.9	54.6	52.4

The logarithmic average of all four measurements intervals is $L_{Aeq(15min)}$ 53.9 dB.

Intervals 3 and 4 are consecutive and the bulldozer was operating for approximately 14 minutes continuously (across both intervals). Removing the contribution from road traffic noise results in a $L_{Aeq(15min)}$ of 59.4 dB (approximately 12:04 to 12:18). The logarithmic average of this 15-minute period with measurement intervals 1 and 2 is 55.0 dB.

4 199 Coast Road

An hour of attended noise monitoring was undertaken on the driveway of 199 Coast Road on Friday 26th March. During this hour there were nine trucks dumping fill and two reversing beepers recorded. The overall sound level after the removal of traffic noise was 49.5 dB $L_{Aeq(1h)}$. The loudest reference interval was between 1.45 and 2.00pm which measured 50.2 dB $L_{Aeq(15min)}$.

The sound recorded over the total period at 199 Coast Road is included in Figure 4.1.

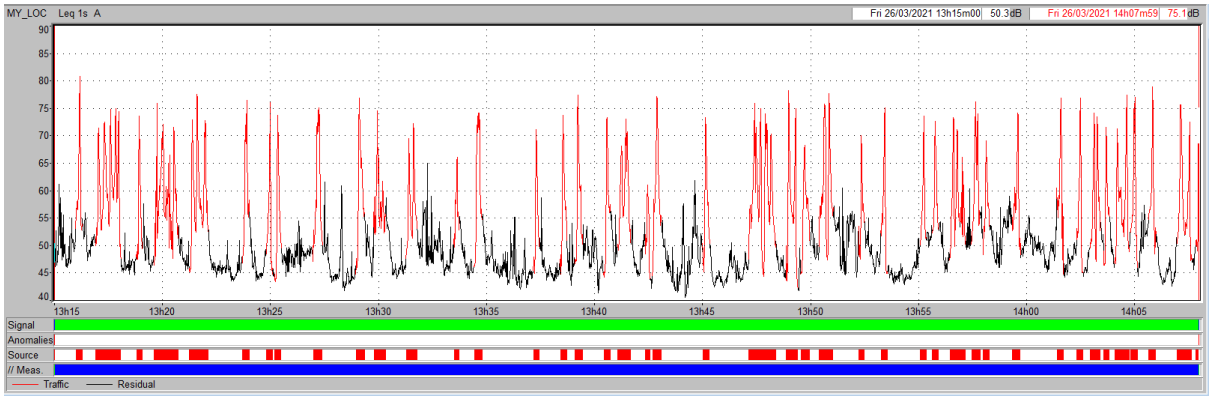

Figure 4.1: Sound recorded at 199 Coast Road on Friday 26th March.

5 Summary and discussion

Monitoring over a 48 hour period was conducted at 200 Coast Road.

Four 15-minute measurement intervals were identified to have average sound levels above 55 dB(A). All four of these intervals featured use of the bulldozer.

[2] Distance from bulldozer to monitoring location 68.0 m. Distance from bulldozer to notional boundary 87.6 m. distance correction 2.2 dB.

The average measured sound level when the bulldozer was operating was 57.2 dB. When adjusted for distance, the resulting sound level was no greater than 55.0 dB at the notional boundary. Applying the duration correction of -5 dB gives a rating level of 50.0 dB(A), i.e. compliant with Condition 12.

The loudest 15-minute average noise level when the bulldozer was not active was between 12.00 and 12.15 pm on Thursday 25th March, measuring 53.7 dB $L_{Aeq(15min)}$. Applying the duration correction of -5 dB gives a rating level of 48.7 dB(A).

The rating level over the whole of the prescribed time frame on Thursday 25th March was 49.2 dB(A) at 200 Coast Road and is therefore compliant with the consent condition noise limit of 50 dB(A).

Measurements were conducted at 199 Coast Road over a 1-hour period. Measured noise levels were less than 50 dB(A).

Cleanfill noise when assessed over the entire monitoring period is therefore compliant with the noise limit of 50 dB(A) using both methods prescribed in NZS 6802.

Ongoing management of noise generated by the bulldozer is required.

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

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