



Noise Assessment

320A Cumnor Tce Container Yard

Acoustic

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Table of Contents

1.	Introduction.....	3
2.	Criteria.....	4
2.1	Resource Management Act	4
2.2	Christchurch District Plan	4
3.	Site Layout.....	6
3.1	Current Layout.....	6
3.2	Proposed Layout	7
4.	Noise Measurements.....	9
4.1	Tunnel Rd Noise Measurements	10
4.2	Site-wide Noise Measurements.....	11
4.3	Specific Activity Noise Measurements.....	12
5.	Noise Modelling	12
5.1	Full Site Screening	12
5.2	Partial Site Screening	13
6.	Assessment.....	15
6.1	Compliance with District Plan Noise Limits	15
6.2	Model Validation	15
6.3	Recommended Conditions.....	16
6.4	Impact of Off-site Noise Sources.....	16
7.	Summary.....	16

1. Introduction

Powell Fenwick has been commissioned by Pinnacle Corporation Ltd (the client) to undertake a noise compliance assessment for a container handling and processing facility (hereafter referred to as the container yard) located at the northern end of 320A Cumnor Tce in Woolston, Christchurch (Christchurch District). 320A Cumnor Tce covers 12 Ha of land, with the container yard covering an area of 4.4 Ha. A site plan of the container yard is shown in Figure 1.1. Pinnacle Corporation Ltd are the operators of the container yard, while 320A Cumnor Tce itself is owned by Braeburn Property Ltd.

The site is boarded by the Heathcote river to the north and west, and Tunnel Rd to the east. Land to the southwest and southeast is zoned Industrial (General and Heavy) and land to the east is zoned Open Space Natural Zone. Across the Heathcote river to the northwest and north is land zoned Residential Suburban Density Transition Zone. Further to the east across Tunnel Rd and Ferry Rd is land zoned Residential Suburban Zone. The closest residential sites are along Long St and Gould Cres.

The container yard processes and stores shipping containers, which are transported to and from the Port of Lyttelton and other sites in the Canterbury area. Containers are delivered by truck, which move through the centre of the site. Containers are taken off/placed onto trucks by specialist container hoist vehicles (hereafter referred to as hoists). The hoists transport containers around the site, where they are stored in stacks up to six containers high. The facility processes both 20 foot and 40 foot containers. Up to two hoists will operate on the site at any one time.

The main noise generating activities on the site are trucks transporting containers to and from the yard, and hoists which move containers to and from and around the yard. Noise from the hoists is predominantly from their diesel engines, however a secondary noise source is the impact made when containers are stacked on top of each other. Other sources of noise on the site include refrigerated containers and activities associated with the cleaning and maintenance of containers.

The purpose of this report is to fulfil a Council request for a noise assessment. The request for a noise assessment has been triggered by noise complaints made by residents to the north of the Heathcote River. 320A Cumnor Tce, despite being zoned Industrial, has only recently been developed for industrial activities, and prior to the establishment of the container yard was an open field. While this does not impact compliance of activities on 320A Cumnor Tce against District Plan rules, the significant and sudden change in land use has likely amplified the impression of noise on neighbouring residential properties.

We note that other matters of complaint have been made by residents against the container yard that accompany the noise complaints but are unrelated to noise. These other matters of complaint are not addressed within the scope of this report.

The container yard is currently operational over a reduced area, with the intention to expand the operation of the facility subject to resource consent RMA/2022/3611 being granted to the landowner Braeburn Property Ltd. Noise measurements that are presented within the context of this report have been conducted with the container yard in this reduced operation layout, however our assessment only considers the proposed layout, which is consistent with the intentions of the resource consent application (RMA/2022/3611) by Braeburn Property Ltd. The container yard operates only during daytime hours, nominally from 0700h to 1800 h.

In this report we present both measured and calculated noise levels at residential properties from container yard activities and assess noise levels against District Plan criteria.

Criteria relevant to the project are presented in Section 2. A description of the current and proposed site layout is presented in Section 3. Noise measurements relevant to the assessment are presented in Section 4. Noise levels from container yard activities are calculated in Section 5. Calculated noise is assessed against District Plan criteria in Section 6. A summary is presented in Section 7.

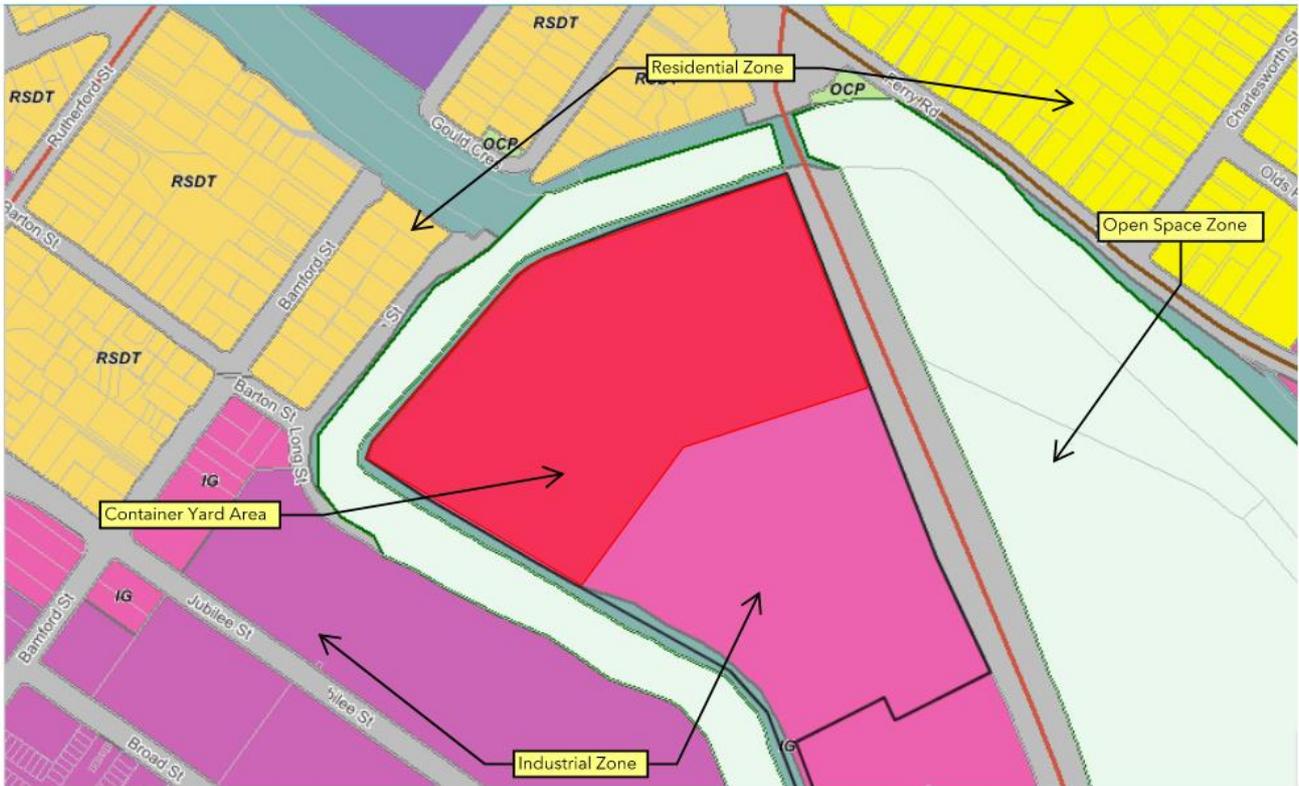


Figure 1.1: Site plan of the container yard (red area) within 320A Cumnor Tce (black outline)

2. Criteria

2.1 Resource Management Act

Under the Resource Management Act 1991, local authorities are required to put in place district plans to manage the effects of land use activities. The principal tool in New Zealand to manage noise impacts is by zoning land to both sensitive and noise-producing areas and separating them, providing reasonable mitigation (acoustic insulation), and setting noise limits such that they are compatible and do not unreasonably interfere with each other's amenity and/or business operation.

Section 16 of the RMA also places a duty on the land occupier to avoid creating unreasonable noise effects by using the best practicable option for mitigation; this is additional to any district plan rule.

2.2 Christchurch District Plan

The Christchurch District Plan (CDP) sets a framework for sustainable development and management of resources in the District. It includes objectives, policies and rules for the management of environmental effects of land use activities. The container yard is located amongst Residential, Industrial and Open Space zones.

The container yard is subject to CDP Rule 6.1.5.2.1 Noise Standards (reproduced in part only):

6.1.5.2.1 Zone noise limits outside the Central City (part only reproduced)

- a. Outside the Central City, any activity that generates noise shall meet the Zone noise limits in Table 1 below at any site receiving noise from that activity, as relevant to the zone of the site receiving the noise.

Table 2.1: Zone noise limits outside the Central City

Zone of site receiving noise from the activity	Time (h)	Noise Limit (dB)	
		L _{Aeq}	L _{Amax}
a. All residential zones (other than in the Accommodation and Community Facilities Overlay)	07:00 - 22:00	50	n/a
	22:00 - 07:00	40	65
e. All commercial zones	07:00 - 22:00	55	n/a
f. All open space zones	22:00 - 07:00	45	70
l. Industrial General Zone Except that noise levels shall not exceed 50 dB L _{Aeq} /75dB L _{Amax} at any residential unit lawfully established prior to 6 March 2017 during the hours of 22:00 to 07:00	07:00 - 22:00	70	n/a
	22:00 - 07:00	70	n/a
n. Industrial Heavy Zone Except that noise levels shall not exceed 50 dB L _{Aeq} /75dB L _{Amax} at any residential unit lawfully established prior to 6 March 2017 during the hours of 22:00 to 07:00	07:00 - 22:00	75	n/a
	22:00 - 07:00	75	n/a

Rule 6.1.4.1 is relevant to the assessment of noise against the criteria of Rule 6.1.5.2.1 and is as follows:

6.1.4.1 Measurement and assessment of noise

'Unless otherwise specified elsewhere in this District Plan, noise shall be measured in accordance with NZS 6801:2008 "Acoustics - Environmental Noise" and a Section 16 of the RMA assessed in accordance with NZS 6802:2008 "Acoustics - Environmental Noise", except that provisions in NZS 6802 referring to Special Audible Characteristics shall not be applied'

2.3 World Health Organisation Guidance Criteria

The World Health Organisation (WHO) publishes noise level guidance, including for residential properties to protect against annoyance and sleep disturbance. Table 4.1 from Guidelines for Community Noise published in 1999 is reproduced in Table 2.2 below.

Table 2.2: WHO guideline noise levels for residential activities

Specific Environment	Critical health effect(s)	LAeq [dB]	Time base [hours]	LAm _{ax, fast} [dB]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-

As per WHO guidance, it is desirable to have an outdoor living area where noise exposure is below 55 dB L_{Aeq(16 hr)} to protect against serious annoyance for the majority of people.

3. Site Layout

Currently the site is only partially in use with containers set back from the site boundary. As per discussions with the client, this is a temporary layout that has been implemented to address non-noise related complaints. In this section we describe the current and proposed layout of the container yard and the impact on noise transmission to residential properties.

In both layouts the general operation of the site from a noise generation perspective is as follows:

- Trucks enter the site from Kennaway Rd and stop with engines idling.
- A hoist will either remove a container and take it nearby in a holding area, or place a container from the holding area onto the truck (or both).
- Trucks turn around and exit onto Kennaway Rd.
- Additionally, hoists will move containers between the holding area and long term stacks continuously during the day.

When containers are stacked they form an effective noise barrier that can reach significantly higher above ground than a typical acoustic fence. The nature of the site is such that containers can be stacked along site boundaries and therefore be used to screen noise from site activities occurring in the centre of the site.

3.1 Current Layout

While the entire site is developed and operational, currently only the eastern side of the site is fully operational, with the western side used only for occasional container storage. Refer to Figure 3.1 for a schematic of the current site layout. Trucks currently enter and exit the site from the same vehicle crossing.

Containers are currently stacked perpendicular to the northern boundary and set back from the edge of the sealed boundary by approximately 15 m. This is due to non-noise related complaints made by residents against the container yard. As a result, large gaps exist between container stacks for hoist access. When hoists and/or trucks are operating within these gaps there is minimal screening of noise to residential properties across the Heathcote river. Refer to Figure 3.2.



Figure 3.1: Current site layout (now asphalted)



Figure 3.2: Current container arrangement

3.2 Proposed Layout

The proposed layout utilises the entire site with trucks entering and exiting the site from separate vehicle crossings (both onto Kennaway Rd). Refer to Figure 3.3 for a schematic of the current site layout.

Containers will be stacked right up to the edge of the seal (no setback) and will be placed parallel to the boundary in all cases similar to Figure 3.4 with gaps between stacks minimised as far as practicable. The intention is to stack containers designated for long term storage along the northern boundary to form an acoustic barrier between the noise generating activities on the site and residential properties. We expect that containers at the boundary will be stacked 2-4 containers high, rising to up to 5 containers high 3-4 rows back. As is shown in later sections, to effectively screen noise the container barrier must rise to a height of at

least 5 containers, however this can occur several rows back from the northern edge of the seal as is necessary for operation of the facility and for compliance with other conditions of the resource consent.

The proposed operation of the site will have the boundary containers in place semi-permanently for the purpose of screening noise from site activities. On occasion stacks of containers up to the boundary will need to be removed, which the client has informed us will happen once every 2-3 months on average. When a boundary stack is removed, the intention is to immediately rebuild the stack to keep the noise barrier intact for the majority of operational time. The client has informed us that to deconstruct and rebuild a boundary container stack will take approximately 1-2 hours.

We note that a lower section of containers (three high and one deep) is proposed directly in front of the truck route to provide space for truck manoeuvres. Hoists will not operate directly in front of this area.

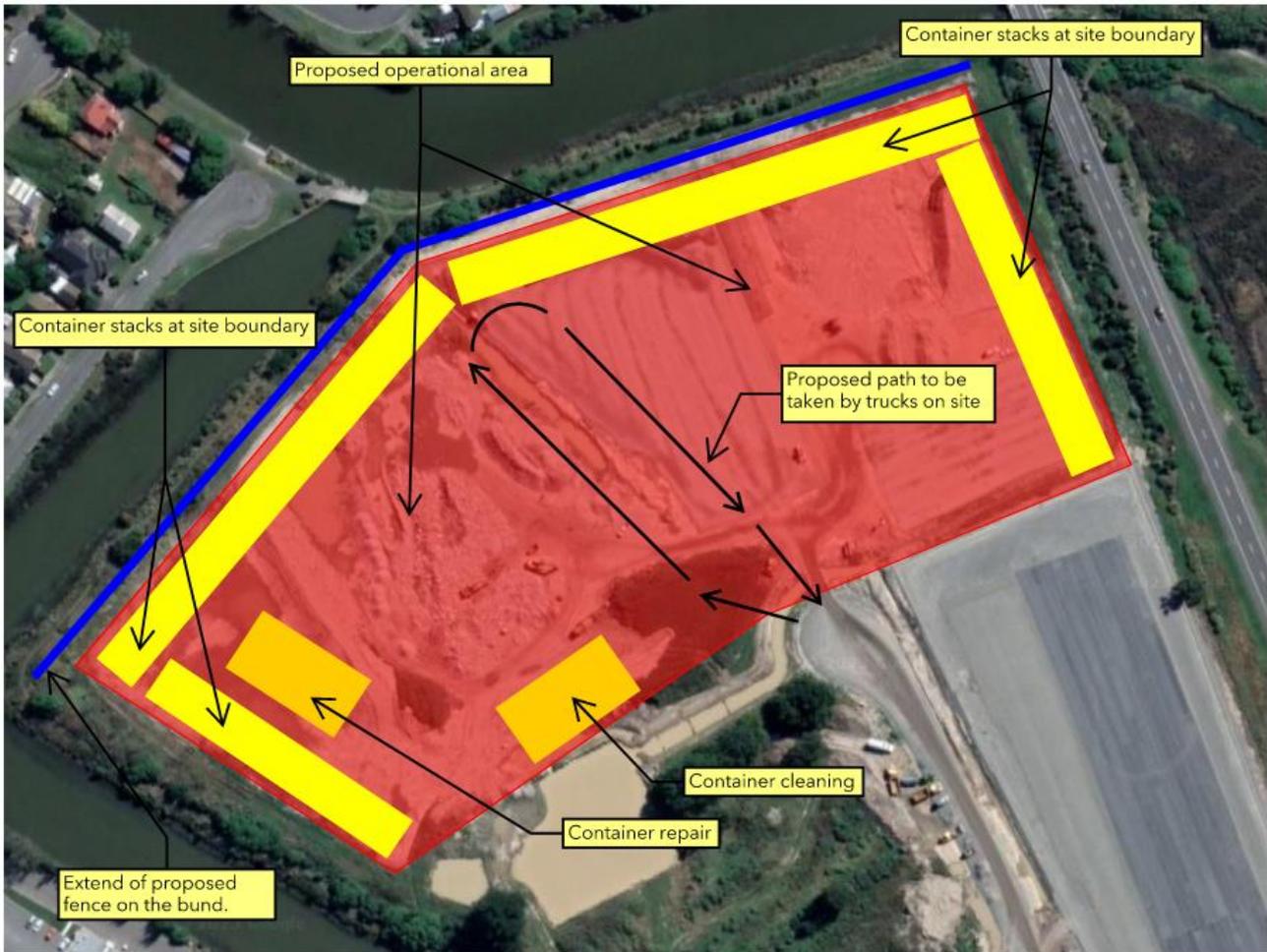


Figure 3.3: Proposed site layout

Additionally, Braeburn properties will be constructing an acoustic fence along the top of the bund that runs along the northern edge of the site. The fence will be 2.4 m high, with the bund itself being 2 m high. The fence will provide additional screening, particularly to the gaps that are inevitably formed between container stacks. The construction of the fence shall have a minimum surface mass of 10 kg/m², for example 21 mm thick timber palings or 19 mm thick plywood, and shall be maintained such that there are no gaps in the fence or between the fence and the ground.

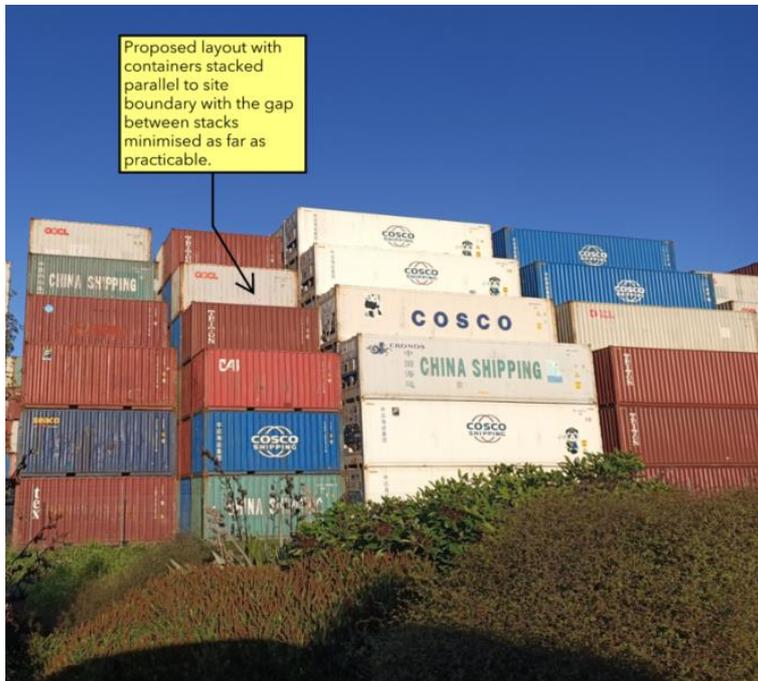


Figure 3.4: Proposed container arrangement

4. Noise Measurements

Noise measurements have been conducted at the container yard on multiple occasions. Measurements of site-wide activities were obtained at the boundary of the container yard and at residential boundaries on Long St and Gould Cres.

On all occasions the weather was clear with no significant wind or rain so was therefore suitable for measurement. Noise measurements and subsequent assessment has been conducted in accordance with NZS 6801:2008 and NZS 6802:2008 for outdoor noise. All measurements were taken using Class 1 sound level meters. The equipment used for testing is presented in Table 4.1 below.

Table 4.1: Schedule of equipment.

Item	Manufacturer	Model	Serial No.	Calibration Date
Sound level meter	NTi	XL2-TA	A2A-15282-E0	04 Dec 2022
Sound level meter	B&K	2250	2679615	15 Mar 2023
Calibrator	Svantech	SV33A	58057	15 Mar 2023
Calibrator	Svantech	SV 33B	102823	12 Sept 2022

The following measurements were conducted on the following occasions:

- 20 Sept 2022, 1145 h to 1315 h: Measurement of road traffic noise from Tunnel Rd plus initial residential boundary noise measurements from an unscreened hoist.
- 16 Dec 2022, 1000 h to 1200 h: Measurement of noise from a hoist in isolation plus residential boundary noise measurements from site activities.

- 23 Mar 2023, 0930 h to 1115 h: Further residential boundary noise measurements plus measurement of noise from truck movements in isolation.

4.1 Tunnel Rd Noise Measurements

Tunnel Rd is a major arterial road (as per the Christchurch District Plan) and a state highway and has significant traffic volume (7700 AADT) and in particular a high percentage of heavy vehicles (11.5%). Tunnel Rd is therefore a significant source of noise to residential properties along Gould Cres, and to a lesser extent along Long St. While the presence of road traffic noise from Tunnel Rd does not impact compliance with regards to noise levels at residential boundaries due to container yard activities, the presence of this noise source makes direct measurement for compliance purposes challenging. We have obtained measurements of road traffic noise for the purpose of correcting residential boundary noise measurements.

The following noise levels were measured at approximately 5 m from the nearest marked traffic lane (refer to Figure 4.1 for measurement locations). In both cases road traffic was the dominant noise source.

- Location 1 at 1240 h: 69 dB $L_{Aeq}(15 \text{ mins})$
- Location 2 at 1145 h: 61 dB $L_{Aeq}(15 \text{ mins})$

Based on these measurements we have modelled road traffic noise at representative residential properties as follows (refer to Section 5 for modelling software details):

- 44 Gould Cres: 55 dB L_{Aeq}
- 34 Gould Cres: 52 dB L_{Aeq}
- 30 Long St: 49 dB L_{Aeq}



Figure 4.1: Tunnel Rd noise measurement locations

We note that calculated road traffic noise levels will likely vary by several decibels throughout the day. For comparison to operational noise requirements, road traffic noise levels to properties on Gould Cres are generally above the District Plan daytime noise limits for residential zones, while road traffic noise levels to properties on Long St are marginally below daytime noise limits. We note that road traffic noise is not required to comply with District Plan noise limits.

4.2 Site-Wide Noise Measurements

Measurements were taken at the boundaries of residential properties on Gould Cres (34 and 44 Gould Cres) and Long St (30 Long St) to determine noise generated by the container yard. Noise measurements were taken for the cases where all activities were largely screened by container stacks and where hoists were operating near the site boundary without screening.

There were several sources of noise that contaminated the measurements, which are listed below:

- Road traffic noise from Tunnel Rd was a constant source of noise contamination that could not readily be removed from measurements (refer to Sections 4.1).
- Noise from other industrial sites was present at times, but generally observed to be significantly less than noise from the container yard. Time stamps were noted during periods of contamination, which were then excluded from assessment.
- Other background noise sources (mostly people walking past, dogs barking and birdsong) were a minor source of contamination. Time stamps were noted during periods of contamination, which were then excluded from assessment.

The following noise levels were measured, covering a total of approximately three hours of measurements over two separate occasions:

- Hoist and truck activities fully screened by containers (no direct line-of-sight):
 - Noise levels at 30 Long St were measured to be 49 dB $L_{Aeq(15\text{ mins})}$. Applying a correction for road traffic noise from Tunnel Rd (utilising modelled data based on measurements taken on 20 Sept 2022), noise from the container yard was estimated to be 47 dB $L_{Aeq(15\text{ mins})}$ and compliant with District Plan daytime noise limits.
 - Noise levels at 34 Gould Cres were measured to be 50 dB $L_{Aeq(15\text{ mins})}$. Applying a correction for road traffic noise from Tunnel Rd (utilising modelled data based on measurements taken on 20 Sept 2022), noise from the container yard was estimated to be 47 dB $L_{Aeq(15\text{ mins})}$ and compliant with District Plan daytime noise limits.
- Hoist operating near the northern boundary of the container yard with no screening from containers (direct line-of-sight):
 - Noise levels at the northern boundary of the container yard (south of the river on top of the bund) were measured to be 58 dB $L_{Aeq(5\text{ mins})}$, during which time a hoist was operating continuously and was clearly the dominant source of noise with minimal contamination from road traffic noise. Noise levels at 34 Gould Cres were calculated to be 53 dB $L_{Aeq(5\text{ mins})}$ during this time, above the District Plan daytime noise limits.

4.3 Specific Activity Noise Measurements

Further noise measurements of key noise generating site activities were obtained in isolation for the purpose of modelling noise transmission to neighbouring sites during multiple operational scenarios. Noise levels were measured as follows:

- Container lowered and placed onto asphalt (at 15 m, 1 minute duration): 63 dB L_{Aeq}
- Container latched and lifted up to maximum height (at 15 m, 1 minute duration): 69 dB L_{Aeq}
- Hoist drive-by carrying container (at 20 m, 20 second duration): 71 dB L_{Aeq}
- Hoist idling (at 15 m, 10 second duration): 62 dB L_{Aeq}
- Truck drive by (at 5 m, 10 sec duration): 73 dB L_{Aeq}

For the case of a hoist latching and lifting/placing a container, the main source of noise was observed to be from the engine, which would increase in output when the load on the hydraulic system was high. Impact noise from placing a container down (either onto asphalt or onto another container) was observed to produce the highest maximum noise level, however did not contribute significantly to the time averaged noise level.

5. Noise Modelling

We have used the specific activity noise measurements detailed in Section 4.3 to predict noise levels from site activities during typical operation once the proposed site layout (Section 3.2) has been implemented. Furthermore we use the measurements taken at residential site boundaries detailed in Section 4.2 to provide indicative validation of our modelling outcomes.

A noise model has been developed using SoundPlan, a proprietary noise modelling software which implements the principles of ISO 9613-2 *Attenuation of sound during propagation outdoors*. We have based our modelling on the following information provided to us by the client:

- Two hoists operating on site continuously during a 15 minute period stacking containers along the northern boundary. We have assumed the following breakdown of noise generating activities based on confirmation from the client of our own onsite observations of hoist activity:
 - Idling - 40%
 - Driving - 40%
 - Lifting container - 10%
 - Lowering container - 10%
- Up to 4 trucks driving through the site in a 15 minute period (equivalent to 16 trucks in 1 hour as provided to us by the client)
- Noise associated with container repair and cleaning is expected to be less than hoist and truck movements as these activities are inherently less noisy, set far back from the northern boundary and carried out at ground level. We do not anticipate these activities will contribute significantly to overall site noise when two hoists and trucks are operating continuously on site.

5.1 Noise at Residential Sites with Full Site Screening

In this scenario we assume a continuous stack of containers around the perimeter of the container yard site as detailed in Section 3.2. We have allowed for minimal gaps between container stacks. We have assumed that the continuous stack of containers is sufficiently high that hoists are entirely screened (i.e. the top of the hoist does not reach above the boundary container stack). This would be a stack rising to five containers high,

noting that the first few stacks to the edge of the sealed area will be lower. We have also included the bund and proposed fence in our model. A noise contour plot is presented in Figure 5.1.

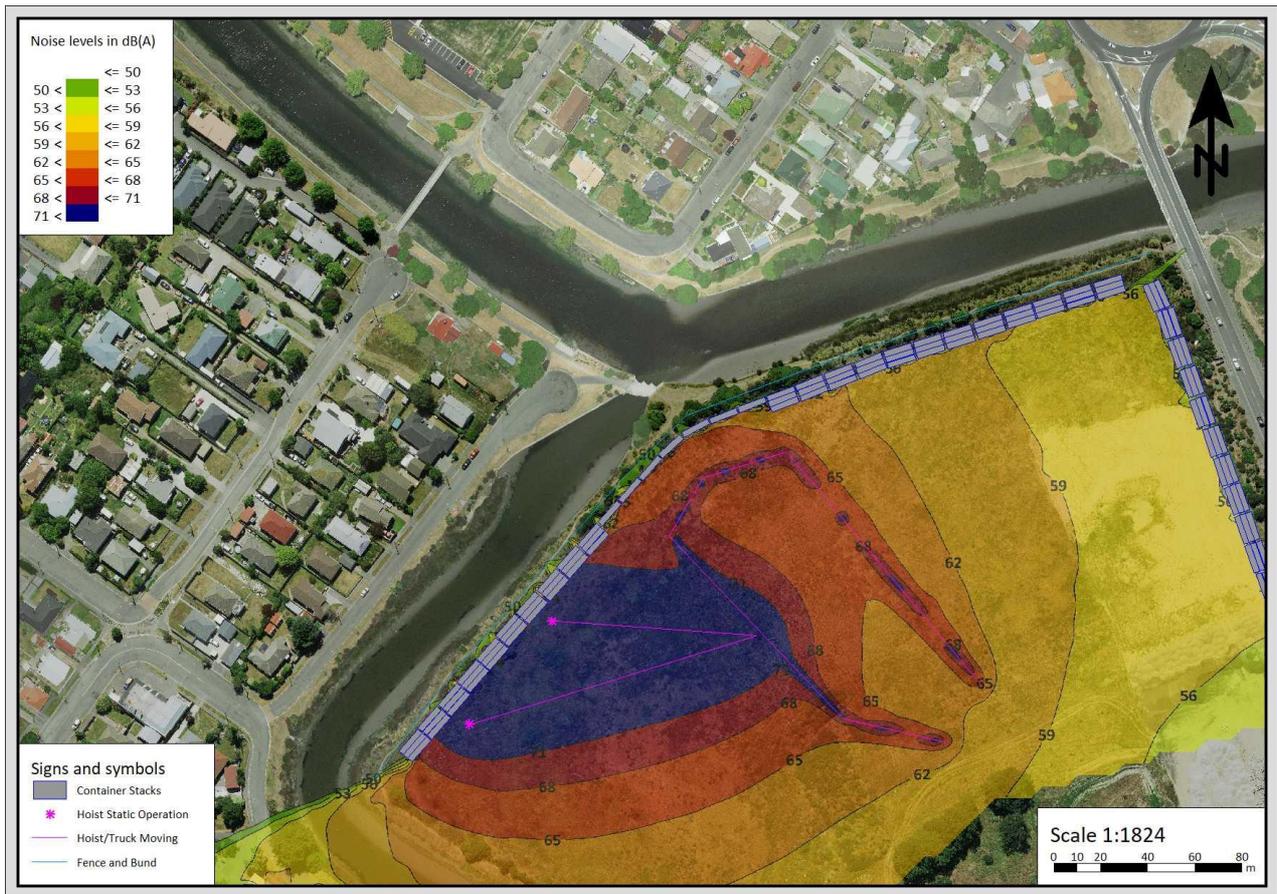


Figure 5.1: Noise contour plot of container yard activities with a continuous stack of containers along the perimeter.

Noise levels at the most exposed residential sites (Long St properties) are calculated to be 44 dB $L_{Aeq}(15 \text{ mins})$.

Without the addition of the fence, calculated noise levels at the most exposed residential sites (Long St properties) are 49 dB $L_{Aeq}(15 \text{ mins})$.

We have modelled reflections from other container stacks within the yard (in from the perimeter) and found that they do not significantly impact calculated noise levels at residential properties.

5.2 Noise at Residential Sites with Partial Site Screening

In this scenario we assume a gap has been made in the stack of containers along the perimeter of the container yard. This represents the situation described in Section 3.2 where a group of containers are taken out of long term storage and the perimeter barrier re-built over a 1-2 hour time frame. During this time we have assumed a conservative scenario of a hoist operating directly in front of the gap in the container stack for a 15 minute assessment period. We have also included the bund and proposed fence in our model. A noise contour plot is presented in Figure 5.2.

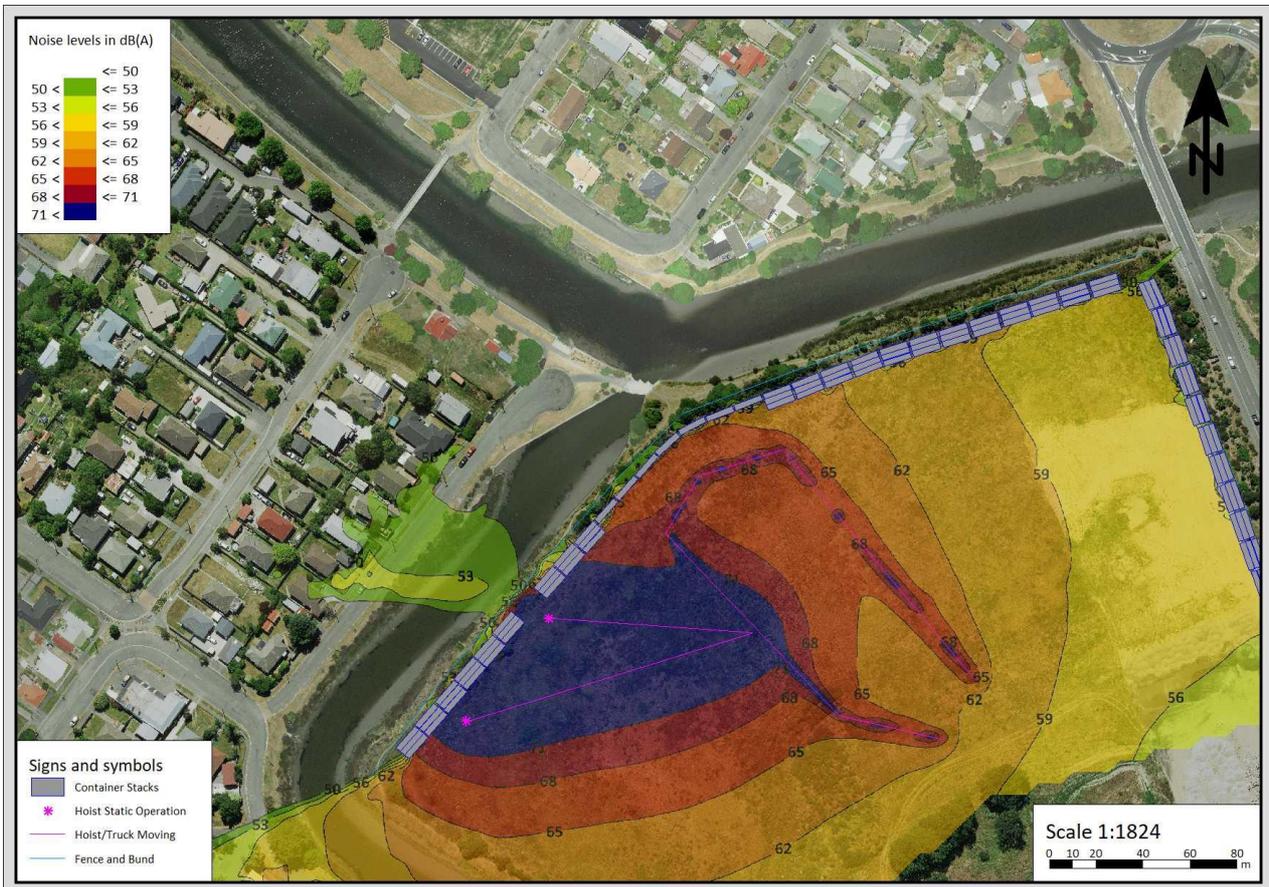


Figure 5.2: Noise contour plot of container yard activities with a gap in the stack of containers along the perimeter.

Noise levels at the most exposed residential sites (in this example 20-26 Long St) are calculated to be 54 dB $L_{Aeq}(15 \text{ mins})$.

Without the addition of the fence, calculated noise levels at the most exposed residential sites are 56 dB $L_{Aeq}(15 \text{ mins})$.

5.3 Noise to Open Space Zoned Land

Noise exposure to Open Space zoned land to the east of the container yard and across Tunnel Rd is calculated to be equivalent to noise exposure to residential properties, that is 48 dB $L_{Aeq}(15 \text{ mins})$ with full screening from containers (compliant with the District Plan limit of 55 dB $L_{Aeq}(15 \text{ mins})$), and 56 dB $L_{Aeq}(15 \text{ mins})$ with partial screening from containers (marginally non-compliant with the District Plan limit of 55 dB $L_{Aeq}(15 \text{ mins})$).

The road traffic noise exposure to the Open Space zoned land from Tunnel Rd is calculated to be above 60 dB $L_{Aeq}(15 \text{ mins})$ within 40 m of the nearest marked traffic lane, significantly above calculated noise from container yard activities. We consider any occasional non-compliance with District Plan daytime noise limits in this zone to be a technical non-compliance with no particular effect.

6. Assessment

6.1 Compliance with District Plan Noise Limits

As per the results in Section 5.1, with the proposed layout incorporating a continuous container barrier around the boundary of the container yard (with minimal gaps between stacks) and the addition of a 2.4 m fence on top of the existing bund, operation of the container yard is calculated to be compliant with the District Plan daytime noise limit of 50 dB L_{Aeq} (calculated to be 44 dB L_{Aeq}). As per feedback from the client, the container barrier will be intact for the majority of the time.

During times when a gap is formed in the container barrier, noise levels at residential boundaries are calculated to be 54 dB $L_{Aeq(15\text{ mins})}$, with the assumption that a hoist is operating directly in front of a single container gap. The actual noise levels could vary (although unlikely to be more than 3 dB higher due to the conservatism of the assumed hoist location in front of the gap) depending on operations within the container yard at the time, for example the size of the gap in the barrier and the location of the second hoist relative to the gap.

The gap in the container barrier will only be present for up to two hours when long term storage containers are removed and the barrier rebuilt, and noise levels are calculated to be significantly (10 dB) less at other times. As elevated noise levels will occur for less than 30% of the assessment period in a single day (1-2 hours during daytime hours of 0700 h to 2000 h), a duration adjustment of 5 dB can be applied as per NZS 6802:2008. Calculated noise levels at residential boundaries with a gap in the container barrier and with the applied duration adjustment are 49 dB $L_{Aeq(15\text{ mins})}$, marginally compliant with daytime noise limits.

The client has informed us that they expect containers forming the barrier to be moved once every 2-3 months only, and that the gap will only be present for 1-2 hours before being rebuilt with new containers designated for long term storage. Furthermore we have been informed by the client that this operation can be conducted in the middle of the day (between 0900 h and 1500 h) when residents are most likely to be out. While we calculate noise levels to be marginally compliant with an applied duration adjustment, they are within typical modelling error of ± 3 dB. If marginal exceedances do occur when there is a gap in the container barrier we expect the impact to be minimal given it is not expected to occur on a regular basis and only for 1-2 hours in the middle of the day.

The WHO recommends 55 dB L_{Aeq} as an appropriate noise level in outdoor residential areas as being the threshold for annoyance. If marginal exceedances do occur when there is a gap in the noise barrier, noise levels are expected to remain below the WHO recommended limit for annoyance. Furthermore elevated noise levels will only occur on occasion and for a short period of time, whereas the WHO limit for annoyance is a continuous level of noise exposure.

We note that in all cases, calculated noise levels are non-compliant with the District Plan night time noise limit of 40 dB L_{Aeq} . The site will only operate during daytime hours with no hoist or truck activities commencing prior to 0700 h.

As stated in Section 5.3, we consider any non-compliance with District Plan daytime noise limits in the Open Space zone to the east of the container yard to be a technical non-compliance with no particular effect.

6.2 Model Validation

We have used noise measurements of current site activities taken at residential boundaries (Section 4.2) to provide indicative validation of modelled noise levels for the proposed site layout and activities (Section 5). While the current layout of the site is significantly different from what is proposed, the activities and therefore source noise is approximately the same (truck movements and two hoists operating on site).

When hoists and trucks were clearly screened by containers to residential boundaries, corrected noise levels (road traffic and other noise sources unrelated to the container yard) were measured to be 47 dB L_{Aeq} . This is in comparison to the scenario where the container yard is fully screened by containers (Section 5.1), for which

calculated noise levels are 49 dB L_{Aeq} without the addition of the acoustic fence on top of the bund, which is yet to be constructed. Both are below District Plan daytime noise limits.

When a hoist was operating near the northern boundary of the site with direct line-of-sight to residential properties, corrected noise levels were measured to be 53 dB L_{Aeq} , in comparison to calculated noise levels of 56 dB L_{Aeq} with the proposed layout with a gap in the container barrier and no acoustic fence, supporting our conclusion that our modelling assumptions are conservative and that noise levels would exceed District Plan daytime limits without construction of the fence and without a duration adjustment.

6.3 Recommended Conditions

The scenarios where noise exceedances would occur, and present the greatest risk from a compliance perspective, is if the boundary container barrier did not provide full line-of-sight screening from hoist activities (for example if in some cases the barrier was only 2-3 containers high in front of a hoist) and if the containers forming the barrier were moved on a regular basis. We therefore recommend that the following conditions be implemented by the container yard as part of their operation.

- During typical operation, stacks of containers parallel to the site boundary will be erected along the northern sealed edge of the site to form a noise barrier. The container stacks should be continuous with minimal gaps between them as necessary for access.
- The container stacks forming the noise barrier shall be minimum five containers high, except directly in front of the truck route, where container stacks shall be minimum three containers high.
- The container stacks that form the noise barrier should not be moved regularly. Containers that form the noise barrier should nominally only be moved once every 2-3 months on average, noting that this may need to occur more regularly (once per month) on occasion.
- When a gap in the noise barrier is made to access containers in long term storage, the barrier should immediately be rebuilt (within the same day). Moving of containers that are part of the barrier should only occur between 0900 h and 1500 h Monday to Friday.
- No hoist or truck activities shall take place during night time hours.

6.4 Impact of Off-site Noise Sources

As mentioned previously, there are multiple sources of noise in the area of the Heathcote river that are not related to the operation of the container yard, but which contaminate noise measurements made at residential properties. The following is a list of the observed major sources of noise contamination:

- Road traffic noise from tunnel road, specifically from the bridge passing over the Heathcote river.
- Industrial noise from sites to the south of the container yard on Kennaway Rd (predominantly other container processing facilities).
- Industrial noise from sites along Jubilee Street to the west of the container yard.

While the presence of other noise sources does not affect compliance with the District Plan noise limits, it makes it challenging to accurately determine compliance, especially when activities from the container yard are calculated to be only marginally compliant with the daytime limit. Any future noise measurements would need to account for this.

7. Summary

Powell Fenwick has been commissioned by Pinnacle Corporation Ltd to undertake a noise compliance assessment for a container handling and processing facility located at the northern end of 320A Cumnor Tce in Woolston, Christchurch.

The container yard processes and stores shipping containers, which are transported to and from the Port of Lyttelton. Containers are delivered by truck, which move through the centre of the site. Containers are taken off/placed onto trucks by specialist container hoist vehicles. Up to two hoists operate on the site at any one time, and up to 16 truck movements are expected to occur in an hour.

The main noise generating activities on the site are trucks transporting containers to and from the yard, and hoists which move containers to and from and around the yard. Noise from the hoists is predominantly from their diesel engines, however a secondary noise source is the impact made when containers are stacked on top of each other. Other sources of noise on the site include refrigerated containers and activities associated with the cleaning and maintenance of containers. Noise from these sources is expected to be less than hoist and truck movements as they are inherently less noisy, set back significantly from the northern boundary and carried out at ground level. We do not anticipate these activities will contribute significantly to overall site noise when two hoists and trucks are operating continuously on site.

As per the proposed site layout, there will be a semi-permanent stack of containers along the northern boundary of the container yard, forming a noise barrier to residential properties. Container stacks will be five containers high, and stacks will be placed next to each other with minimal gap for access. The containers that form the noise barrier will be for long term storage and will only need to be moved on occasion, nominally once every 2-3 months. When containers forming the noise barrier are moved out of storage, the barrier will immediately be rebuilt, with this process expected to take 1-2 hours.

We have measured source noise from key container yard activities. These measurements have been used to calculate expected noise levels at residential properties with the container yard in its proposed layout and mode of operation. We have also measured noise levels from existing site activities at residential boundaries to provide validation data for our noise model.

With a complete container noise barrier along the perimeter of the site, noise from container yard activities at residential properties on Long St and Gould Cres are calculated to be 44 dB $L_{Aeq(15\text{ mins})}$, within District Plan daytime noise limits.

When there is a gap in the container noise barrier to access containers in long term storage, and there is a hoist operating directly in front of the gap, noise from container yard activities to residential properties on Long St and Gould Cres are calculated to be 54 dB $L_{Aeq(15\text{ mins})}$. As the gap will be present for less than 30% of daytime hours (1-2 hours during daytime hours of 0700 h to 2000 h) and noise levels are significantly (10 dB) lower at other times, a duration adjustment of 5 dB can be applied as per NZS 6802:2008. Calculated noise levels with the duration adjustment are 49 dB $L_{Aeq(15\text{ mins})}$, marginally compliant with District Plan daytime noise limits.

We have provided recommended conditions that we consider will adequately mitigate the effects of noise from container yard activities to residential properties.

This report is suitable for submission to Council as part of a resource consent application.