MARSHALL DAY Acoustics

DARGAVILLE RACECOURSE
PROPOSED RE-ZONING ACOUSTIC ASSESSMENT

Rp 001 20210194A | 21 February 2021

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Project: **DARGAVILLE RACECOURSE**
PROPOSED REZONING ACOUSTIC ASSESSMENT

Prepared for: **Dargaville Racing Club**
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Cover Photo: Marshall Day Acoustics

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1.0 INTRODUCTION

Marshall Day Acoustics (MDA) has been engaged to provide advice on the proposed rezoning of the Dargaville Racing Club through a private plan change. The scope of our advice covers noise and vibration.

The submission seeks to rezone a 45-hectare site that is currently zoned *Rural* in the Kaipara District Plan. The proposed change would provide *Light Industrial*, *General Residential* and *Large Lot Residential Areas*[1] to the bulk of the site. An *Open Space* Area would also be provided. A *Haurora Hub* Area is proposed centrally.

This assessment provides an analysis of the potential noise effects that could arise as a result of the proposed changes to the District Plan.

This report should be read in conjunction with the Section 32 report prepared by Lands and Survey.

2.0 SUMMARY OF LAND AND SURROUNDS

The subject site is the existing Dargaville Racecourse. This is a large site approximately 45 ha in size. It is located in the Awakino Point area, east of Dargaville.

State Highway 14 (SH14) is near to the site and the closest existing dwellings. State Highway 14 is the main route that connects Whangārei and Dargaville. The highway carried only 2562 vehicles per day with 11% heavy vehicles[2] in 2020.

The land is best described as flat alluvial plains, although the topography rises to the north, forming a small hill. The Wairoa River winds around Awakino Point at around 1.4 kilometres to the north, east and south of the site, however the river is not visible from the site. The site currently contains a large, grassed oval racetrack which was used for horse racing for more than a century. Stables are the main buildings currently on site, with clubrooms, a dwelling and ancillary buildings also located on site. These would be removed if the site is developed.

The nearest existing dwellings are to the north, west and south of the site[3]. Dwellings in this area are located on large rural properties - some are located adjacent to milking sheds and other agricultural buildings. The proposed landuse Areas on the racecourse site would generally be around 50 to 200 metres from dwellings adjacent to the site.

The operative District Plan zoning for the site is *Rural*. The proposed change would provide "Areas" within the site, these would include a *Light Industrial* Area to the west. *General Residential* and *Large Lot Residential* Areas would apply to the central-east. An *Open Space* Area would also be provided within the site at the north-eastern corner. A *Haurora Hub* Area is proposed to the central-east: we understand that this Area is intended as a mix of activities (largely implemented through three future proposed Areas within the hub[4]). The *Hauora Hub* is well described in the Section 32 report. Refer Figure 1 and Figure 2 overleaf for the Areas proposed.

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[1] The word "Areas" is used to describe the proposed landuse on the subject site. We understand that the racecourse site would be subject to a specific chapter in the District Plan, and as such the individual landuse areas are not described as "zones". The word "zones" is of course used to describe zoning of the sites in the operative District Plan.

[2] From Waka Kotahi public data https://www.nzta.govt.nz/resources/state-highway-traffic-volumes

[3] This report refers to compass directions using the "project north orientation" with SH14 assumed to run north-south (refer to Figure 2)

[4] The Hauora Hub denotes that the spatial extent within which a mix of three land use Areas will establish, being the *Neighbourhood Centre* Area, a connected *Open Space* Area, with the remaining spatial area being taken up with the *General Residential Area*. We understand the Hauora Hub is largely an implementation tool.

Figure 1: Site and Surrounds (with proposed Area overlay)

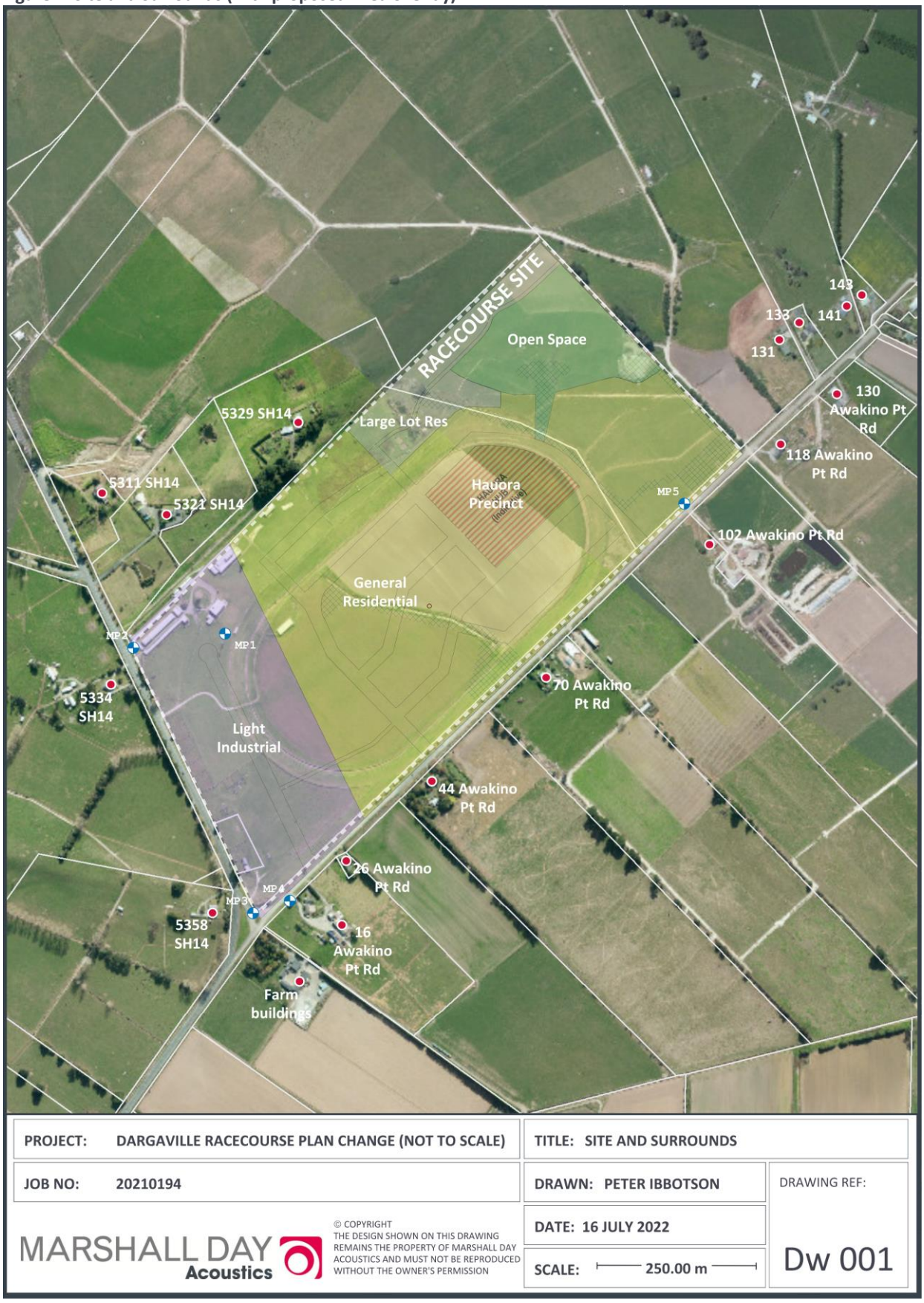
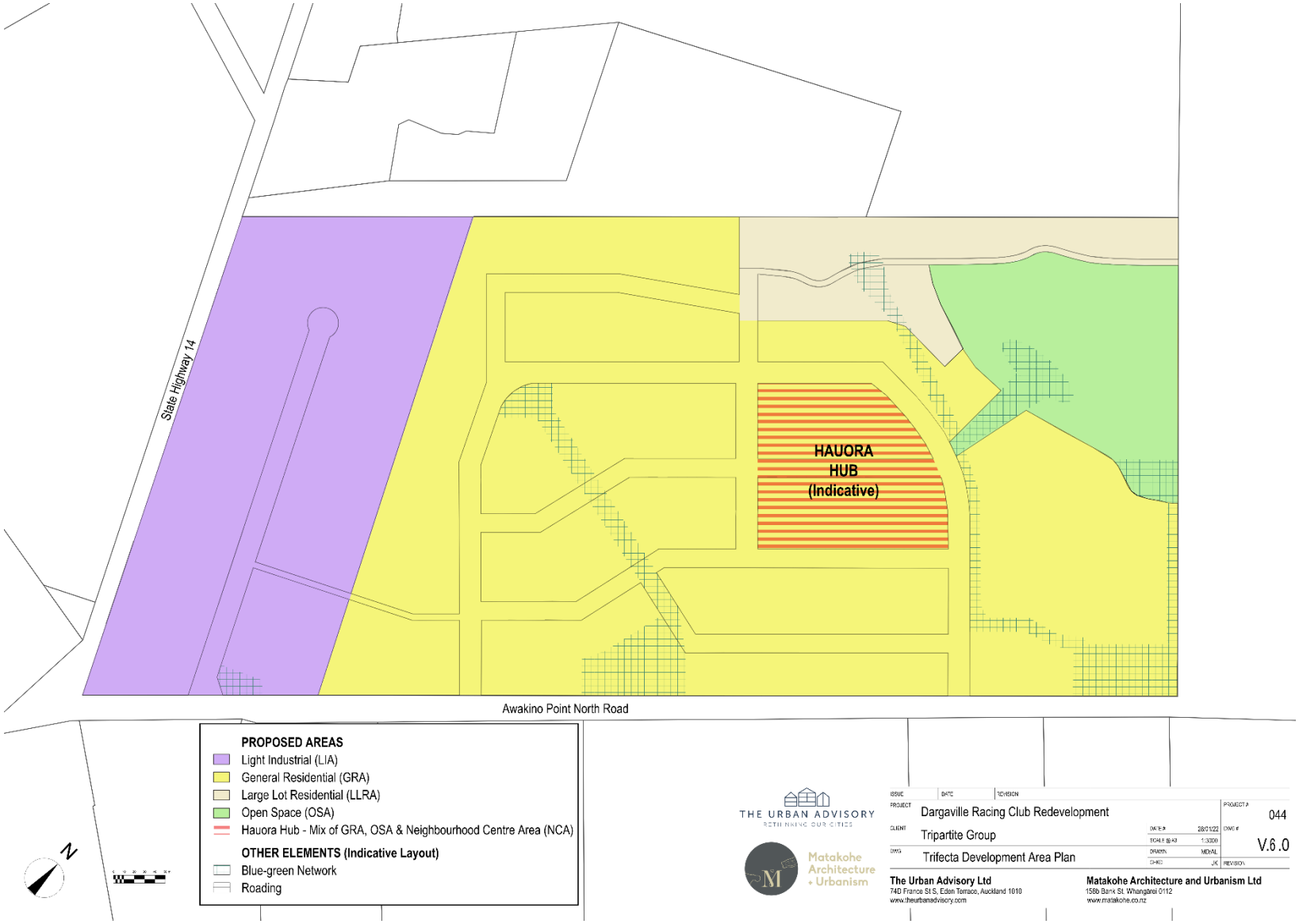


Figure 2: Proposed Area Plan ("project north" as used in this report to top of page)



3.0 DISTRICT PLAN RULES

3.1 Operative Zoning

The application site is situated on land zoned *Rural* in the Kaipara District Plan – Operative Version (District Plan), as are all surrounding sites for several kilometres.

We understand that the Kaipara District Plan will be updated in the near future. When updated, the District Plan will include reference to the requirements of the National Planning Standards. The National Planning standards set out the noise and vibration standards that are required to be referenced by the District Plan, but do not provide direct recommendations on what the permitted noise limits in each zone should be[5].

We expect that any future change to the Kaipara District Plan would see the same (or similar) noise limits applied to the *Industrial* and *Residential* zones as are currently applied to the operative zones[6]. This is because the noise rules in the Operative District Plan are broadly consistent with national and international guidelines for community noise (including the guidelines given in the New Zealand Standards) and there is unlikely to be much impetus for change. Our report has been prepared on that basis. However, it should be recognised that there is some risk that the future District Plan review may apply alternative noise limits and some further review of the appropriateness of noise limits may be required. The following sections summarise the noise limits in the Operative District Plan.

3.2 Noise Standards – Rural

The site is currently located in the *Rural* zone of the Kaipara District Council. However no rural landuse is proposed within the subject site. The existing noise rules are nonetheless relevant as a consideration of what can currently be expected from activity on the site when received at existing nearby dwellings.

The Kaipara District Council Chapter 12 contains the following rule regarding noise from Rural zones:

> ***12.10.14 Noise***
>
> *Any activity is permitted if noise from the site does not exceed the following limits, as measured either at or within any other site zoned Residential, or within the 'notional boundary' of a dwelling in the Rural or Maori Purpose zoned site:*
>
> *a) 7:00am – 7:00pm: 50 dB L_{Aeq}; and*
>
> *b) 7:00pm – 10:00pm: 45dB L_{Aeq}; and*
>
> *c) 10:00pm – 7:00am: 40dB L_{Aeq} and 70 dB L_{AFmax}.*
>
> ***Note 1:** Provided that the abovementioned noise limits may be exceeded for activities periodically required by farming and forestry practice, such as crop protection and harvesting that may need to be carried out for these activities.*
>
> ***Note 2:** Sound levels shall be measured in accordance with NZS 6801:2008 Acoustics – Measurement of Environmental Sound, and assessed in accordance with NZS 6802:2008 Acoustics – Environmental Noise.*

[5] Refer to Chapter 15 of the National Planning Standards for a list of New Zealand standards that plan rules are required to adopt. https://environment.govt.nz/assets/Publications/Files/national-planning-standards-november-2019.pdf

[6] Note that the operative Kaipara District Plan noise rules for *Industrial* and *Residential* zones are similar to those adopted by the recent Urban and Services Plan Change in Whangārei.

3.3 Noise Standards – Residential

Large areas (c 23.7 Ha total) of *General Residential* and *Large Lot Residential Areas* are proposed. The proposed naming of the areas are based on the requirements of the National Planning Standards. The Kaipara District Council Chapter 13 currently contains the following rule regarding noise from *Residential* zones.

> ***13.10.14 General Noise***
>
> *Any activity is permitted if noise from the site does not exceed the following limits, as measured either at or within any other site Zoned Residential, or within the notional boundary of a dwelling in a Rural or Maori Purpose Zoned Site:*
>
> *a) 7:00am – 7:00pm: 50 dB L_{Aeq}; and*
>
> *b) 7:00pm – 10:00pm: 45dB L_{Aeq}; and*
>
> *c) 10:00pm – 7:00am: 40dB L_{Aeq} and 70 dB L_{AFmax}.*
>
> ***Note 1:** Sound levels shall be measured in accordance with NZS 6801:2008 Acoustics – Measurement of Environmental Sound, and assessed in accordance with NZS 6802:2008 Acoustics – Environmental Noise.*

The above rules show that the *Residential* noise limits are the same as the *Rural* zone noise limits (50 dB L_{Aeq} during the daytime). Dwellings currently near the proposed racecourse site could expect to receive the same permitted noise levels from *Rural* lots (under the current zoning) as they can from *Residential* lots (under with the *Residential* Areas proposed). We consider that the operative *Residential* noise rules are suitable for the proposed *General Residential* and *Large Lot Residential* Areas and will ensure a good level of amenity is provided.

It is important to note that residential sites are typically smaller than rural sites and while only the same level of noise can be generated by each site, areas of *Residential* land are likely to be more intensively developed than *Rural* land. This has the potential to add to noise generated from the proposed *Residential Areas* however it is potentially balanced by the fact that farming and forestry activities are exempt from the *Rural* noise limits currently.

Overall, it is likely that a change from a *Rural* zoning to *Residential Areas* would result in little change in permitted noise *level* for existing dwellings in the area. A change in the potential *character* of the ambient environment is more likely, with sources of a *residential* character (people, children, passenger vehicles, pets, lawnmowers) replacing potential sources with a *rural* character (tractors, vehicles, stationary plant, animals).

3.4 Noise Standards – Industrial

Activity within *Industrial* zones in Kaipara are subject to the following noise limits

> ***14.10.14 General Noise***
>
> **…(2) Industrial zone only**
>
> *Any activity is permitted if noise from the site does not exceed the following limits:*
>
> *a) 75dB L_{AFmax} as measured within the boundary of any other site in the same Zone:*
>
> *i. 7:00am – 7:00pm (Mon-Sat): 55dB L_{Aeq};*
>
> *ii. 7:00pm – 10:00pm (Mon-Sat), and 7:00am to 10:00pm (Sunday and Public Holidays): 50dB L_{Aeq}; and*
>
> *iii. 10:00pm – 7:00am (any day): 45dB L_{Aeq} and 75dB L_{AFmax}*
>
> *as measured within any other site Zoned Residential, or within the notional boundary of a residential activity in a Rural or Maori Purpose Zoned site.*

The above rule means that noise generated in *Industrial sites,* when received at adjacent *Residential* or *Rural* dwellings, is required to meet noise limits that are 5 decibels higher than the noise limits that apply between *Rural* and *Residential* sites[7]. This means that dwellings zoned *Rural* can expect to only receive noise levels of up to 50 dB L_{Aeq} during the daytime from adjacent *Rural* or *Residential* activity but could expect to receive up to 55 dB L_{Aeq} from future *Industrial* activity[8].

The proposed rezoning of the western part of the subject site to a *Light Industrial Area* therefore represents a potential increase in permitted noise levels in comparison to the current *Rural* zoning. However, the *Industrial* noise limits are still in-line with national and international guidance on what an appropriate upper level of noise for a reasonable standard of amenity is. While the Plan Change may allow for an increase in noise *level* and a change in ambient *character* to occur at dwellings near the proposed *Light Industrial* Area, the District Plan noise limits that would apply to light industrial sources on this land would still provide a suitable level of control of noise emissions.

The *Industrial* zone rules require only 75 dB L_{AFmax} to be met between *Industrial* sites at any time of the day or night. This is a relatively liberal noise limit, however as industrial activities are not noise sensitive such a rule is not inappropriate.

3.5 Noise Standards – Hauora Hub

A *Hauora Hub* Area is proposed. The Hauora Hub denotes the spatial extent within which a mix of three land use Areas will establish, being the *Neighbourhood Centre* Area, a connected *Open Space* Area, with the remaining spatial area being taken up with the *General Residential* Area. The final location of the *Neighbourhood Centre* Area and *Open Space* Area will be determined at a future stage (through resource consent)

The *Hauora Hub* is intended to be the heart of the neighbourhood. The *Neighbourhood Centre* Area within the hub would provide for access to neighbourhood community shops, services and facilities to meet the day to day needs of the surrounding community. Specific activities may include local shops, halls, marae, early childhood facilities and health care facilities. Dwellings will also be located within the *Hauora Hub*, through the provision of a *General Residential* Area (with some specific provisions). The *Hauora Hub* bears some "mixed-use" similarities due to the co-location of dwellings and commercial activities, albeit one that has predominantly "community based" activities rather than a true "commercial based" mixed-use zone.

While the *Neighbourhood Centre* Area within the hub is not intended to be a true *Commercial* zone, some activities will be commercial in nature[9]. The operative District Plan *Commercial* zone noise limits are relatively high (60 dB L_{Aeq} at all times of the day and night), which enables commercial activity (e.g. cafes, conference centres, bars, busy shops, childcare centres, churches) to operate without undue restriction. Even though high noise levels are permitted in *Commercial* zones, dwellings can still be constructed there provided noise levels do not exceed 35 dB $L_{Aeq\ (24\ hr)}$ inside bedrooms and living areas. Because the external noise levels may be high in *Commercial* zones, the corresponding sound insulation rules require any dwellings to have ventilation systems to achieve compliance with section G4 of the NZ Building Code. Therefore if the *Commercial* zone rules were

[7] We note that the drafting of the KDC *Industrial and commercial* rules 14.10.14 (1 and 2) could be improved for clarity. However the intention of the rule is clear: i.e. that noise levels **between** *Industrial* sites should be no greater than 75 dB L_{Aeq} at any time, and that noise levels received at Zoned *Residential,* or within the notional boundary of a residential activity in a Rural or Maori Purpose Zoned site should be no greater than 55 dB L_{Aeq} daytime, 50 dB L_{Aeq} evening and 45 dB L_{Aeq} / 75 dB L_{AFmax} night-time.

[8] The night-time noise limits that apply to noise received in *Rural or Residential* zones from *Industrial* areas are also 5 decibels higher than noise received from *Rural or* Residential zones (45 dB L_{Aeq} vs 40 dB L_{Aeq}).

[9] Activity within *Commercial* zones may make up to 60 dB L_{Aeq} at adjacent sites at any time (day or night), but only up to 50 dB L_{Aeq} (daytime), 45 dB L_{Aeq} (evening) and 45 dB L_{Aeq} / 70 dB L_{AFmax} (night) in residential zones.

applied across the *Hauora Hub,* this would increase the cost of construction for dwellings[10]. However as the *Hauora Hub* is intended to only have "community based" uses within it, we consider *Commercial* zone rules may not be suitable for the *Hauora Hub* as they may permit higher-than-desired daytime and night-time noise limits.

In contrast, if the *Residential* noise rules were applied, this would provide for a more onerous level of control to commercial activity. Applying the *Residential* rules to the *Neighbourhood Centre* Area would mean that café and childcare centre outdoor areas may be constrained to areas further from dwellings or may not be able to operate on small sites. Marae and conference centres may not be able to hold outdoor events in some areas. External mechanical plant may also need to have onerous levels of noise control installed. As predominantly "community based" commercial activity is proposed in the hub, the *Residential* zone rules may therefore be overly restrictive for the precinct.

We recommend that a set of specific rules are developed for the *Hauora Hub* to provide for the activities within the *Neighbourhood Centre* Area. These rules should be as follows:

[x] Any activity in the Neighbourhood Centre Area is permitted if noise from the site does not exceed the following limits, as measured within any other site in the Neighbourhood Centre Area, General Residential Area, Large Lot Residential Area, other Residential zone, or within the notional boundary of a dwelling in a Rural or Maori Purpose Zoned Site:

i. 7:00am – 7:00pm (Mon-Sat): 55dB L_{Aeq};

ii. 7:00pm – 10:00pm (Mon-Sat), and 7:00am to 10:00pm (Sunday and Public holidays): 50dB L_{Aeq};

iii. 10:00pm – 7:00am (any day): 45dB L_{Aeq} and 75dB L_{AFmax}.

These noise levels will be effective at limiting noise to reasonable levels for nearby dwellings, without requiring any dwelling façade sound insulation measures (which would add additional costs). As the limits are lower than would normally be applied to a *Commercial zone,* some noise control measures may be required to commercial activity, for instance:

- Early childhood education centres would require noise barriers around outdoor play areas
- Restaurant outdoor areas may not be able to operate during the night period.
- Cafes, shops and medical centres may need to attenuate mechanical services noise (e.g. attenuators on extract ducts, refrigeration condensers located well away from dwellings)
- Noise barriers may be required around loading docks and loading docks may not be able to be used before 7am.

These are not considered onerous requirements for local business. We consider that the above approach provides the best way to manage noise emissions from the *Neighbourhood Centre* given that its primary purpose is for any proposed commercial activities to be "community based" and to support the amenity of the residents who live there.

Consideration could be given to providing for a specific number of temporary events within the *Neighbourhood Centre* Area or *Open Space* Area per annum where noise limits are much more permissive or do not apply. This would allow festivals, music events, cultural activities, etc. to occur in the precinct without unreasonable restriction (and potentially without a resource consent being sought).

[10] Some façade improvements may also be required for some dwellings (e.g. additional layers of plasterboard). A thorough evaluation of costs would require a quantity surveyor. We have seen recent studies that suggest the additional costs for façade sound insulation and mechanical ventilation are in the order of up to 2% of the dwelling cost.

3.6 Measurement and Assessment Standards

The District Plan states that sound levels shall be measured in accordance with *NZS 6801:2008 Acoustics – Measurement of Environmental Sound*, and assessed in accordance with *NZS 6802:2008 Acoustics – Environmental Noise.* These are the most appropriate and up to date standards for the measurement and assessment of environmental noise. These standards should be used in the assessment of noise from the land use Areas proposed.

3.7 Construction Noise Limits

The limits of New Zealand Standard NZS 6803: 1999 *"Acoustics - Construction Noise"* form the appropriate construction noise rules in all zones. There is currently no construction vibration limit in the District Plan. Suitable future District Plan vibration limits could include reference to DIN 4150-3:1999 *"Structural Vibration - Effects of Vibration on Structures"* to avoid cosmetic building damage from construction works as well as limits to inform amenity effects of vibration.

4.0 EXISTING AMBIENT ENVIRONMENT

Marshall Day Acoustics visited the site or surrounding area on three occasions in 2021 to identify the existing noise sources in the area and measure the ambient noise levels. Figure 1 shows the locations of the ambient measurements discussed in the following sections.

4.1 The noise logger showed moderate traffic noise levels at 160 metres from SH14

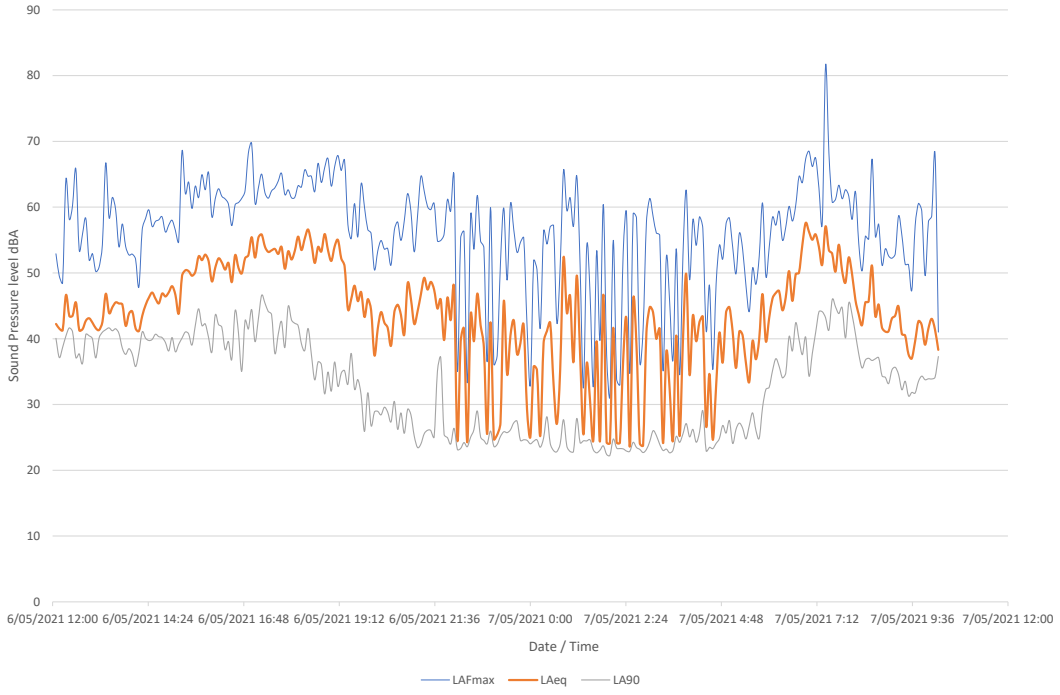
A noise logger was deployed on the 7 May 2021 over a day-night period to measure noise levels. The logger was located at MP1 at a distance of 160 metres from SH14. This distance is considered representative of the dwellings to the north of the subject site.

The purpose of this noise logger was to establish diurnal noise levels due to traffic and other ambient noise levels in the area. Weather conditions were suitable for measurements, with generally light winds occurring throughout most of the period. The measurement results are summarised in Table 1.

Table 1: Summary of logger measurements

		Measured levels (dB)		
Period	**Type**	$L_{AFmax(5min)}$	$L_{Aeq(5min)}$	$L_{A90(5min)}$
Daytime (7am – 10pm)	**Average**	**82**[11]	**50**	**37**
	Range	41 - 82	37 - 57	23 - 47
Night-time (10pm – 7am)	**Average**	**67**	**44**	**28**
	Range	31 - 67	24 - 58	22 - 42

Figure 3: Diurnal variation of ambient and background noise levels at logger position (refer also Appendix C)



[11] Maximum values are given for the L_{AFmax}

4.2 Traffic noise levels (modelled) show the variation of noise around the site

The ambient noise levels measured by the logger (in Figure 3 above) show noise levels at one location on site over a day-night period. In order to illustrate existing ambient noise levels over the wider area surrounding the site, we calculated traffic noise levels using the Calculation of Road Traffic Noise (CoRTN) methodology. The model is prepared based on the following noise inputs:

- 2562 vehicles per day with 11% heavy vehicles travelling at 100 kph[12]
- Flat ground assumption across entire site
- Chip seal two-coat grade 2/5 along road length
- Diurnal traffic noise levels based on those measured at the noise logger

The results of the modelled traffic noise levels are shown graphically in Appendix B. The model shows an acceptable correlation with the measured noise levels at the logger position. Using the graphical noise outputs, we have summarised traffic noise levels at the surrounding dwellings in the following table:

Table 2: Modelled traffic noise levels (free field)

Dwelling	24- hour traffic noise level dB $L_{Aeq\,(24\,hr)}$	Day traffic noise level 0700 – 2200 hrs dB L_{Aeq}	Night traffic noise level 0700 – 2200 hrs dB L_{Aeq}	Notes
5321 SH14	**50**	52	46	-
5311 SH14	**54**	56	50	-
5334 SH14	**60**	62	56	High noise level as close to SH14
5358 SH14	**60**	62	56	High noise level as close to SH14
16 Awakino Pt N Rd	**50**	52	46	-
26 Awakino Pt N Rd	**45**	47	41	-
44 Awakino Pt N Rd	**40**	42	36	-
70 Awakino Pt N Rd	**35**	37	31	Ambient L_{Aeq} noise levels east of this point are unlikely to be dominated by SH14 traffic noise during the daytime. Actual ambient noise levels will likely be in the order of 40 to 45 dB L_{Aeq} due to local noise sources (wind, local traffic, farming noise, human activity, birds, animals)
102 Awakino Pt N Rd	**<35**	~ 35	~30	

[12] Reference Waka Kotahi, https://www.nzta.govt.nz/resources/state-highway-traffic-volumes/

4.3 Attended measurements confirmed moderate noise levels around the site

To confirm the modelled noise level results, attended measurements were undertaken at five locations shown on the map on Figure 1. Measurements The measurement results are summarised in Table 3.

The weather during these measurements were typically easterly wind conditions and as such noise levels represent the quietest periods likely to be received at Awakino Point N Road.

Table 3: Summary of attended ambient measurements

		Measured levels (dB)			Dominant source
Position	**Date, time**	**L_{Aeq}**	**L_{A90}**	**L_{Amax}**	
MP1	Logger position, on site on racecourse 5 July 2021 ST: 16:14 pm DUR: 15:01 mm:ss	42	34	59	Distant traffic, insects. Note: upwind conditions from SH14 means that traffic noise level considerably reduced.
MP2	Near SH14 at entrance of racecourse, adjacent to 5334 SH14 5 July 2021 ST: 16:36 pm DUR: 15:12 mm:ss	66	39	82	Traffic on SH14
MP3	Intersection of SH14 and Awakino Point N Road 21 Jan 2021 ST: 10:45 am DUR: 10:01 mm:ss	64	51	84	Traffic on SH14
MP4	Around 50m east of SH14 intersection on Awakino Pt N Rd 21 Jan 2021 ST: 9:53 am DUR: 6:16 mm:ss	53	45	67	Traffic on SH14, cicadas
MP5	Near 102 Awakino N Pt Rd 7 May 2021 ST: 11:02am DUR: 15:01 mm:ss	40	34	62	Farming / agricultural noises including fixed and mobile plant, birds, insects. SH14 traffic mostly inaudible. Occasional traffic pass-bys on Awakino Pt N Rd largely excluded.
MP5	Near 102 Awakino N Pt Rd 5 July 2021 ST: 17:00 pm DUR: 15:01 mm:ss	40	31	61	Farming / agricultural noises including fixed and mobile plant, birds. Occasional traffic pass-bys on Awakino Pt N Rd largely excluded.

The measurement results show good correlation with the noise model results and confirm the predicted noise levels around the subject site.

4.4 Noise levels in Awakino Point vary from high to low with proximity to the State Highway

The following sections summarise measured and modelled noise levels for dwellings near the subject site and relate the existing level of environmental noise to the operative *Industrial* and *Residential* permitted standards.

Dwellings to the west: 5334 and 5358 SH14

Dwellings to the *west* of the racecourse site receive *high* levels of traffic noise due to the proximity to SH14. Daytime noise levels of 62 to 66 dB L_{Aeq} occur at these dwellings. Night-time noise levels are also relatively high at around 56 dB L_{Aeq}.

This level of traffic noise is already well above the permitted level of environmental noise that can be emitted from any zone in the district. Ambient noise levels are already around 10 dB higher than the level of noise that could be emitted from the proposed *Light Industrial* Area.

These existing high noise levels would serve to reduce the intrusiveness of activity on the subject site. For instance, truck movements in the proposed *Industrial* Area would be much quieter than the existing environmental noise levels and are unlikely to be distinguishable from general State Highway traffic noise when received at these dwellings.

The high ambient noise levels would also serve to reduce the intrusiveness and audibility of other *Light Industrial* noise such as plant and activity noise. Provided future *Light Industrial* activity complies with the District Plan noise limits, we do not expect there to be a significant change in the existing acoustic environment at the dwellings to the west of the subject site.

Dwellings to the north and south (near SH14): 5321 & 5311 SH14, 16 & 26 Awakino Pt N Rd

These dwellings are set back from the State Highway and receive *moderate* levels of traffic noise. Noise levels of 50 to 55 dB L_{Aeq} are typically expected at these dwellings during the daytime[13]

While this is a moderate level of noise, it is already similar to the level of noise that is permitted to be emitted from *Residential and Rural* (50 dB L_{Aeq}) and *Industrial* sites (55 dB L_{Aeq}) during the daytime.

Consequently, the operative District Plan standards for the *Industrial* and *Residential* Areas of the subject site are considered to be broadly suitable for these dwellings. Existing ambient noise levels are not so high that they would support higher noise limits, nor are they so low that the Operative District Plan noise limits would be unsuitable to protect existing levels of amenity. The existing traffic noise levels would provide some "masking" of distant activity on the subject site which will likely help to reduce annoyance. However ambient noise levels are not so high as to ensure that potential industrial activity would *never be* audible, nor ensure that industrial noise would *never be* intrusive if it was not constrained by the *Industrial* noise limits.

Activity within the proposed *Light Industrial* Area has the potential to add to environmental noise levels at these dwellings and to increase overall noise levels somewhat. *Industrial* land use that just complied with the daytime *Industrial* noise limit (55 dB L_{Aeq}) would be audible at these dwellings, at levels that are similar to the upper level of traffic noise currently experienced.

We consider that the rezoning represents a potential minor degradation in acoustic amenity for these dwellings, however provided future activities comply with the *Industrial* noise limits, we consider that noise levels would still be reasonable and would not result in unacceptable noise effects. Refer to Section 3.4 for further discussion on these noise rules.

If the Plan Change is approved, it would be possible to develop the site in such a way that *Industrial* noise emissions are minimised. This is discussed in later sections.

[13] The average is given. Louder and quieter levels are likely to occurring at times depending on meteorological conditions (typically wind direction and speed). Night-time noise levels of 45 to 50 dB L_{Aeq} occur at these dwellings.

Dwellings to the South-East (dwellings at the eastern end of Awakino Point North Road)

Dwellings at the eastern end of Awakino Point North Road currently receive *low* to *very low* levels of traffic noise (typically 40 dB L_{Aeq} and below) because of their distance to SH14. The consequence of these low ambient and background noise levels is that these residents may be more sensitive to a change in environmental noise levels due to new sources of environmental noise. However, these dwellings are located well away from the proposed *Light Industrial* area and are unlikely to receive appreciable noise from activity occurring there. These dwellings are closest to the proposed *Residential* Areas, and it is noise from these proposed Areas that requires the most consideration.

As discussed in Section 3.3, it is likely that a change from a *Rural* zoning to a *Residential* zoning would result in little change in permitted noise *level* emissions from the site. A change in the potential *character* of the ambient environment is more likely, with sources of a *residential* character (people, children, vehicles, pets, lawnmowers) replacing potential sources with a *rural* character[14]. In our opinion such changes in character are unlikely to result in significant ongoing noise effects on existing residents.

5.0 POTENTIAL SITE ACTIVITY AND COMPLIANCE WITH THE PROPOSED NOISE RULES

The preceding section discussed existing environmental noise levels and concluded that operation of the proposed landuse areas would be acceptable provided the operative District Plan noise limits (and proposed *Hauora Hub* rules) are complied with.

This section considers whether the potential activities in the proposed Areas *can comply* with the Proposed District Plan noise rules. The following sections discuss potential uses of the proposed Areas and discuss the likely level of noise emission from each.

5.1 Noise Emissions from Proposed Land Use: *Light Industrial*

9.5 hectares of land at the project western side of the site may be developed for *Light Industrial* purposes (refer to Figure 1 and 2). This land would be located within around 50 to 200 metres of the six dwellings to the north, west and south of the site.

Traffic access to this *Light Industrial* area are proposed to be via access/egress locations on Awakino Point North Road.

Potential use of the *Light Industrial* land cannot be determined with certainty at this stage, however the following examples are given of potential tenants based on other activities around Dargaville (this list is non-exhaustive[15]):

- Building products manufacture (e.g. doors, joinery, garage doors, kitchens)
- Agricultural, marine and automotive sales, servicing and repair
- Horticulture (e.g. nursery) / greenhouses
- Food packing and processing
- Brewery / distillery
- Mixed industrial / small-scale commercial and business park
- Innovation hub, including research and development, supporting services, employment / networking

[14] Tractors, vehicles, stationary plant, animals could occur in a *Rural* zone and it is probable that these have been audible from time to time from grazing / farming operations on the racecourse site (likely at a low level). Human activity noise from the racecourse operation and pony club operation will also have historically occurred (e.g. announcements, music)

[15] Refer to market demand analysis for further information on potential activities.

- House construction (incl. training)
- Parts shop
- Storage units / Warehousing
- Mechanic / Plumber / Electrician / Trades base
- Other product supply, sales and service

Industry activity on site is likely to predominantly operate during the daytime.

5.1.1 Noise Emissions from Potential Industrial Activities

The proposed *Light Industrial* Area is relatively large. Activity occurring centrally in this area would be located relatively far from existing dwellings and noise levels would be attenuated by distance and potentially screening from intervening buildings. Industrial activity around the northern and southern boundaries presents the highest risk of noise emission to existing rural dwellings. The proximity of the proposed *Residential* Area to the east would place a further constraint on *Industrial* noise.

We have analysed typical industrial activity that could occur on the site based on other light industry activity that we have been previously involved with. We have broadly sorted these into **high, moderate** and **low** noise generating activities as follows:

HIGH NOISE Light industrial manufacturing processes can generate high internal noise levels. Manufacture of prefabricated building components such as kitchens, joinery, doors and door frames, garage doors, building modules, etc can be expected to generate noise levels of 80 to 85 dB L_{Aeq} within the factory over protracted periods of manufacture. Other activities such as the construction of prefabricated houses, boats, heavy metalwork (equipment repair, panel beating) can also generate similar levels. Essentially any activity that involves significant production line, carpentry or metal work activity is considered a potential *high-noise* generator.

Buildings used for these purposes are often constructed with roller doors which are often open for ventilation and access for loading. The location and orientation of large roller doors with respect to dwellings can make a significant difference to noise emission from buildings – if these are located inward towards other industrial sites noise emissions to residential areas will be significantly reduced.

The above activities do not typically operate at night except in unusual situations, however occasional truck loading in the evening or night could potentially be required.

MODERATE Food packing and processing production lines (e.g. squeezing and bottling of culinary oil, packing of fruit) involve moderate noise levels, typically in the order of 70 to 75 dB L_{Aeq}. These activities can sometimes involve external plant which can require attention to noise emission (especially for refrigeration or washdown). Other activity (e.g. data centres) can require significant external plant. Some trade bases (e.g. automotive, engineering) or small workshops may also generate moderate transient noise levels.

These activities do not often operate at night, although evening and morning shifts can be required and stationary plant (e.g. condensers) may operate throughout the night.

LOW NOISE Commercial, retail and warehousing often involve relatively low noise levels, with most noise being generated from occasional deliveries including forklift and truck activity. Offices, shops, storage units, horticulture, plumbing and electrical bases will also typically generate similarly low levels of noise.

Based on the above we have determined the risk that future activities may breach the Operative District Plan noise limits. This is summarised in the following table.

Table 4: Activity Compliance Risk

	Risk that noise limit may be exceeded (LOW/MED/HIGH)			Potential mitigation required to comply
	Day 55 dB L_{Aeq}	Evening 50 dB L_{Aeq}	Night 45 dB L_{Aeq}	
HIGH NOISE GENERATOR - Manufacturing production line - Intensive carpentry - Heavy metalwork	**MED**	**MED**	**HIGH**	**Some or all of the following:** - Locate activity centrally - Avoid ventilation doors facing dwellings or keep doors closed - Enclose noisy processes - Avoid night operation
MODERATE NOISE GENERATOR - Food packing and processing - Louder trade bases - Automotive repair - Some warehousing - Data centre	**LOW**	**LOW**	**MED**	**Some or all of the following:** - Locate night operations appropriately - Select quiet external plant and utilise screening from building façades
LOW NOISE GENERATOR - Offices - Some warehousing - Greenhouses - Parts shops - Product supply, sales and service - Education and innovation hub - Some trades bases	**LOW**	**LOW**	**LOW**	None. These activities are most suitable to be located on the western, northern and southern side of the proposed Areas due to their low levels of noise emission.

KEY:

HIGH risk means that compliance is unlikely unless the activity is carefully planned to avoid noise emissions
MEDIUM risk means that compliance is possible / probable, but some consideration of noise emissions is still required
LOW risk means that there is little to no risk that noise will approach the industrial limits, event without consideration of noise

Based on the above, we expect that activities established in the *Light Industrial* Area would be able to comply with the operative District Plan Industrial noise limits during the daytime. We expect that high noise generators may not be able to operate on this site at night without a risk of breaching the night-time noise limit - if this is to be possible it would require careful design and operation. Other quieter activities may be able to occur at night. However light industrial activities do not often occur during the night-time, and this may not place significant constraint on the utility of the Area.

5.1.2 Management of Noise through Planning Controls in the *Light Industry* Area

The overarching control of noise from the *Light Industrial* area would be the zone noise limits. Activities that cannot meet the zone limits could not operate on the site.

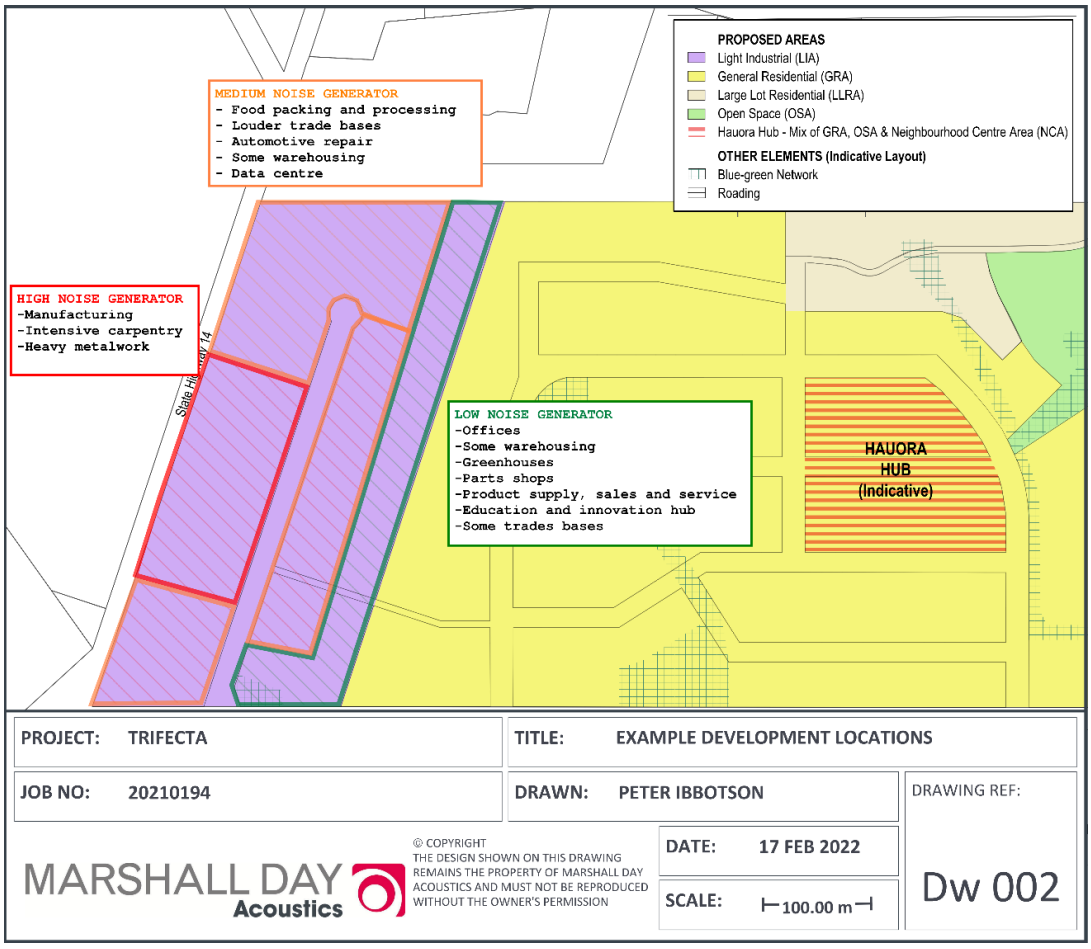
Because of this, some "high noise" generating activities may need to be managed, designed or located to ensure that noise emissions to the nearby *Rural* and proposed *Residential* dwellings do not exceed the daytime noise limits. This would typically be a matter for the due diligence for the proposed developer, owner and/or tenants. However it would also be possible to provide additional certainty through implementing additional prescriptive planning controls to the proposed *Light Industrial* zone.

We have considered options for providing these additional planning controls, these are set out overleaf.

Option 1: controlling location of activity thorough providing "sub-areas"

A prescriptive option to manage noise from the *Light Industry* Area would be to assign locations where Low, Medium, and High noise generators are allowed establish. The following mark-up provides an example of how development could be controlled on the basis of noise risks.

Figure 4: Industrial Area – Example Development Locations to Minimise Noise



If the above "sub-area" prescriptive method was used, it would permit activities within certain areas of the site[16]. If *Industrial* activity was proposed in an area that it was not permitted (e.g. a medium noise generator in the "green zone") it would be necessary to seek resource consent for that activity. In that situation, the proposed operation would need to implement noise mitigation to reduce noise to acceptable levels.

The main drawback to the above method is a lack of flexibility. Nominating specific locations for specific "categories" of activities can be problematic as commercial activities do not always fall easily into specific categories[17] and the ideal location of an activity may not always be in the location assigned for operational reasons. As with all prescriptive methods and rigid planning frameworks, it is inevitable that such an approach would provide reasonably well for some envisaged activities, but not so well for others.

[16] Subject to those activities meeting the Industrial noise rules

[17] For instance, "manufacturing" can be a high noise generator but is not always so. PCB or electronics assembly could be quite low noise and may be very suitable for the "green zone"

Option 2: providing a "setback" or "buffer"

As an alternative to assigning areas of the subject site for specific activities would be to establish a simpler "setback distance" or "noise buffer" between the *General Residential* Area and the noisier parts of the *Light Industrial* Area.

If this framework is used, some activity within the buffer would still be permitted provided it can be classified within a specific activity "category". A review carried out with the Trifecta project team has identified the following activity categories that would generate suitably low noise levels, enabling them to establish relatively close to adjacent dwellings.

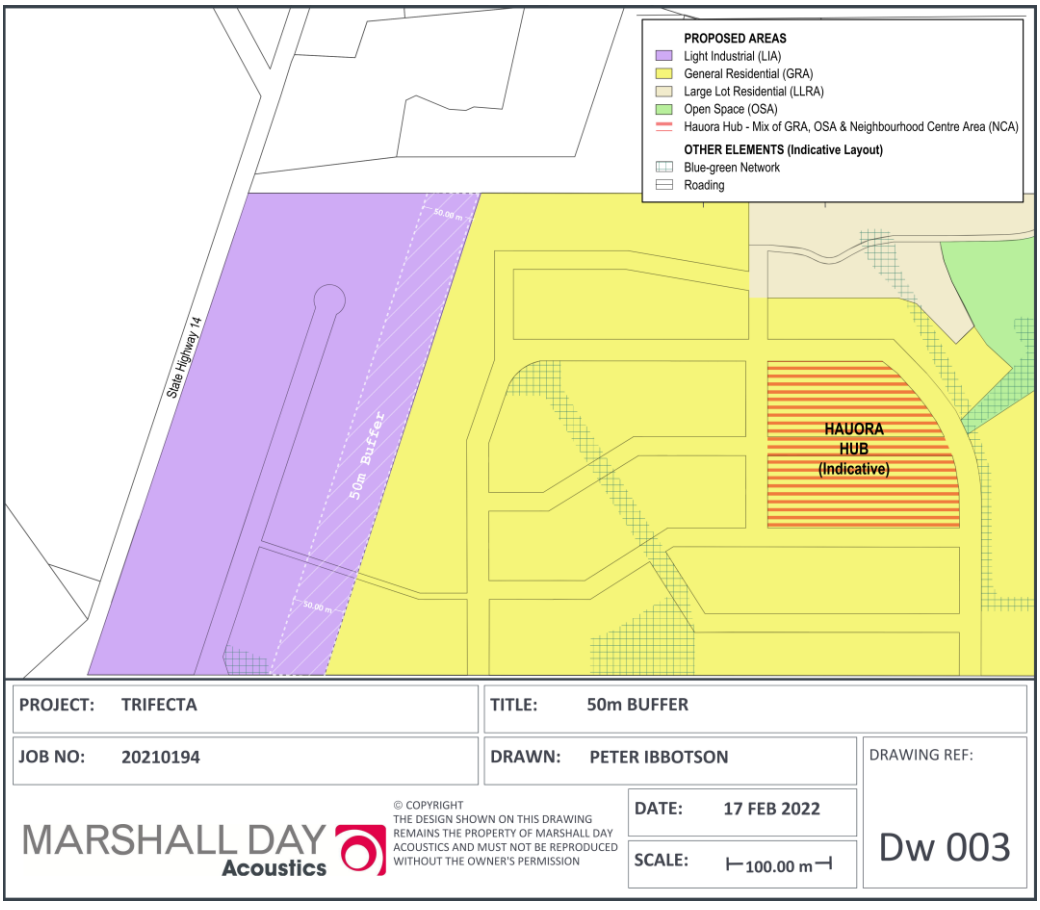
- Warehousing
- Storage
- Trade retail
- Food and beverage activities
- Community corrections activities

Based on the above categories, we have determined a suitable buffer distance to be 50 metres. The activities listed above should be able to operate within this distance without requiring onerous noise control measures to be adopted.

The buffer would ensure that potentially noisier activities are located further from residential dwellings than 50 metres and should result in some acoustic screening being provided by the intervening buildings within the buffer.

A potential buffer is shown in Figure 5 overleaf.

Figure 5: 50m Buffer



Our review of the activities listed above suggests that compliance with the daytime *Light Industrial* zone noise limits would likely be achieved without specific noise control measures being implemented within the buffer. Significant night-time activity is unlikely from the above activities and any such activity would need to comply with the night-time noise limit regardless.

We consider Option 2 is significantly simpler and more reliable. However regardless of whether Option 1 or Option 2 is considered, *Industrial* activity would still need to comply with the noise rules. Where there is risk of non-compliance, further noise mitigation would need to be implemented. This may take the following form:

- Noise mitigation by bunds or barriers may be required on the boundary
- Structural noise mitigation may be required to ensure that noise emissions from the site comply with the night-time rules. This may involve enclosing sources, loading trucks indoors or designing buildings to reduce noise emissions
- Activity may need to be restricted at night. Adequate planning and due diligence prior to the establishment of the activity would preclude unsuitable activities establishing if they cannot comply.

Industrial Truck Movements

Night-time truck movements on site roads would not technically breach the District Plan noise rules as roads would be vested in Council ownership. This is because vehicle movements on public roads is not assessed against the District Plan rules.

In any event, noise from some low-speed truck movements in the *Light Industrial* Area at night would not be significant in the context of the existing environment given that around 280 trucks already pass the site per day on SH14, of which a material percentage likely occur at night. We expect that occasional truck movements (e.g. 4 in any 15 minutes) within the *Light Industrial* area would generate noise levels of below 45 dB L_{Aeq} at surrounding *Rural and Residential* dwellings. More significant numbers of truck movements (e.g. from logistics yards) may not comply with the limits and as such those activities may not be able to operate in this area.

Noise from industrial area vehicle movements could be reduced further at the southern dwellings (e.g. 26 Awakino Pt Road) though the provision of a 2 to 2.5 metre high noise barrier[18] along the southern boundary of the industrial area. However this will not reduce noise from vehicles on Awakino Point Road.

5.2 Management of Noise in the *Residential* Area

23.6 hectares of residential land is proposed on the eastern side of the site. A mix of *General Residential* and *Large Lot Residential* Areas are proposed. This may allow around 435 residential allotments to be formed on the site. We expect this would likely comprise predominantly free-standing dwellings, notwithstanding that we understand that some multi-unit buildings could be constructed, likely if part of the site is developed for a retirement village.

The proposed *Residential* Areas would be adjacent to existing dwellings on Awakino Point North Road. The development of the site for *General Residential* and *Large Lot Residential* density development is likely to change the character of the ambient environment at the existing dwellings from one that is currently *Rural* in nature to one where *Residential* noise is audible at times.

The residential use of the proposed site can readily comply with the Proposed District Plan limits, and we consider overall noise levels would still be reasonable and would not result in residential amenity being significantly compromised.

[18] A bund, noise fence barrier or combination of both (noise fence barrier on top of bund) would be a suitable design.

5.3 Management of Noise from the *Hauora Hub* Area

The proposed use of this area has been discussed in previous sections. This is a relatively small part of the site which will include a *Neighbourhood Centre* providing accessible neighbourhood community activities, goods, services and facilities to meet the day to day needs of the surrounding community. It could include local shops, halls, marae, early childhood facilities and health care facilities. Being included and surrounded by a residential area, the range and scale of activities is intended to be compatible with the neighbouring residential activities and local amenity and character.

As discussed in Section 3.5, some noise control measures may be required to commercial activity in the *Hauora Hub*, however these are not considered onerous requirements for local business. We consider that this approach provides the best way to manage noise emissions from the *Hauora Hub* given the proximity of dwellings. The proposed limits will result in reasonable noise levels overall.

6.0 REVERSE SENSITIVITY AND EFFECTS FROM TRAFFIC NOISE

6.1 Reverse Sensitivity to Existing Rural Activities

We note that some *Rural* farming activities are exempt from compliance with the *Rural* zone rules. The Kaipara District rules state: *"…Provided that the abovementioned noise limits* [the rural zone noise rules] *may be exceeded for activities periodically required by farming and forestry practice, such as crop protection and harvesting that may need to be carried out for these activities."*

Our view is that the above exemptions would likely apply to most Rural mobile plant use, but may not apply to static plant (such as milking shed plant). However, all rural activity is still subject to the duties imposed by Section 16 and Section 17 of the RMA.

There is a reverse sensitivity risk that new residents near existing farming activity may constrain normal farming activity. We understand that existing farmers in the area have raised this as a concern, presumably noise emissions forms one aspect of these concerns.

We have measured noise from existing rural farming activity on Awakino Point North Road. Current noise sources include operation of tractors and other static machinery associated with milking shed operations. Our measurements showed that noise levels of 40 dB L_{Aeq} were generated at the future *Residential* site – this level of noise would be well below the current daytime and below night-time *Rural* noise rules.

In our view the reverse sensitivity risk posed by the plan change to existing *Rural* activity is not likely to be significant given the existing rule framework. Our measurements do not suggest that existing farming activity is causing significant noise emission on Awakino Point North Road and we do not consider existing rural noise to be *unreasonable.* Any reverse sensitivity noise risks likely relate to future expansion of existing rural operations, (for instance, the hypothetical establishment of future frost fans and bird scaring guns), rather than constraint on existing operations.

6.2 Reverse Sensitivity to Traffic Noise (NZTA / Waka Kotahi)

NZTA / Waka Kotahi has published a document entitled: "*Guide to the management of effects on noise sensitive land use near to the state highway network"*[19]. This document sets out how NZTA / Waka Kotahi considers that land should be managed in proximity to the State Highway network where it could be affected by road traffic noise. The guide sets noise and vibration "buffer and effects" areas which limit the distance within which noise sensitive development can occur without façade sound insulation in place.

[19] https://www.nzta.govt.nz/assets/resources/effects-on-noise-sensitive-land/effects-on-noise-sensitive-land-use.pdf

Table 5: "Buffer" and "Effects" Areas as per NZTA Guide to Management of Reverse Sensitivity Effects

Area	Explanation
Buffer Area	This is the NZTA / Waka Kotahi recommended "no build" area where traffic noise levels within the "buffer area" are above 64 dB $L_{Aeq, 24\ hr}$
Effects Area	This is the NZTA / Waka Kotahi recommended "dwelling sound insulation" area where traffic noise levels within the "effects area" are above 57 dB $L_{Aeq, 24\ hr}$

NZTA does not consider that the "effects" area is more than 100 metres, even for state highways carrying significant road traffic volumes. For the Dargaville Racecourse plan change, the closest area of proposed residential land will be in the order of 200 metres+ from SH14. SH14 carries only around 2,550 vehicles per day.

The level of noise at the closest part of the proposed *General Residential* zone will be around 45 dB $L_{Aeq\ (24\ hr)}$ (refer Appendix B). This is significantly lower than the NZTA / Waka Kotahi guideline requirements. Development of this land for residential purposes would not present a reverse sensitivity risk to the operation of SH14 and traffic noise levels will be acceptable for human health and amenity. There are no road traffic vibration risks.

6.3 Traffic Noise Effects from Local Roads

Our observation (from our three site visits) is that Awakino Point North Road currently carries few traffic movements per day. Given that there are only around 14 dwellings on this road, less than 150 traffic movements per day are likely[20].

Dwellings located at 44 and 70 Awakino Point North Road are considered likely to experience a considerable increase in traffic noise if the proposed area of *Residential* land is fully developed. Daytime traffic noise levels at these dwellings are calculated to be around 35 dB L_{Aeq} at present. This may increase to around 50 dB L_{Aeq} if the *Residential* area is fully developed. For these dwellings, the increase in traffic noise likely represents the most significant aspect of the proposed Plan Change. However, while a significant change in the character of the existing noise environment would occur, overall traffic noise levels of 50 dB L_{Aeq} are still considered reasonable for human amenity.

Dwellings located at the far eastern end of Awakino Point North Road would not experience such a significant change in noise level. Distant traffic noise on Awakino Point North Road may become audible, but traffic would not be the dominant source of environmental noise for these dwellings.

Dwellings at the western end of Awakino Point North Road are already exposed to moderate levels of road traffic noise from the State Highway. The additional traffic is likely to result in perceptible (but not significant) increases in overall noise level.

7.0 CONSTRUCTION NOISE

Industrial and commercial buildings and other site infrastructure would likely be constructed using concrete pours, crane operations, material deliveries and carpentry / metalwork tasks. It is expected that construction would occur during the daytime.

It is noted that the preliminary geotechnical analysis has identified settlement as a potential risk. Recommendations to avoid this involve potential piling works (for large structures), friction piles (for smaller structures), preloading soils, limiting multistorey construction and removal of unsuitable material.

[20] Based on our estimation.

Construction of buildings is likely to result in a protracted period of construction noise including significant earthworks over several seasons. Works would typically be located well away from dwellings and even if works such as piling are necessary it is likely that compliance with the District Plan construction noise rules would be achieved. Nonetheless, good construction noise and vibration management would be required to reduce the amenity effects on the environment given the scale and duration of works required.

8.0 CONCLUSIONS

Marshall Day Acoustics has reviewed the proposed Dargaville Racecourse Plan Change. The applicant seeks to rezone a site that is currently zoned *Rural*. The submission seeks to apply a mix of landuse controls suitable for *Industrial* and *Residential* use as well as an area of green/open space within the site.

The existing ambient and background noise levels in the area vary depending on proximity to the State Highway but are otherwise typical of sparsely populated rural areas. It is considered that the operative District Plan noise limits relevant to the rezoning would be appropriate and that compliance with these noise limits would result in reasonable noise levels.

An analysis of potential noise emission from the proposed Areas has been carried out. This has shown that:

- Compliance with the Proposed District Plan **daytime** noise rules at the *existing Rural* zoned properties is achievable. Some activities may need to carry out due diligence assessments to ensure their operation complies with the noise rules. There are many activities that can operate in the area without risk that noise levels would exceed the District Plan noise rules.
- The extent of **night-time** noise emissions would depend on whether any industries operate in the industrial area at night, as well as their location relative to the existing dwellings. Some activities may not easily comply with the noise rules and may not be able to operate in the Industrial zone at night. Resource consent may be required if such night-time activity was proposed to be established. In that situation, noise mitigation may be required.
- Night-time truck movements on site roads would not technically breach the District Plan noise rules as roads would be vested in Council ownership. In any event, noise from some low speed truck movements to the site at night would not be significant in the context of the existing environment. Occasional truck movements within the *Light Industrial* area would generate noise levels of below 45 dB L_{Aeq} at surrounding *Rural and Residential* dwellings. However activities with significant truck movements may not be able to operate in this area at night without generating noise levels of above 45 dB L_{Aeq}.
- Traffic movements on Awakino Point North Road may increase appreciably if the proposed *Residential* Areas are developed. The effect of this would vary – some dwellings may experience a significant increase in traffic noise levels and a consequential change in amenity. However, while a significant change in the character of the existing noise environment would occur, overall traffic noise levels would still be reasonable for human amenity.
- Reverse sensitivity effects on existing rural land use is considered relatively low-risk. Noise measurements of existing *rural* activity near the subject site do not suggest that existing rural activities would be at significant risk due to the proximity of the proposed *Medium Density Residential* Area.
- Construction noise and vibration can be managed and is expected to be compliant with the rules. Work occurring across the majority of the site would readily comply with the District Plan construction noise rules. Construction noise may be present in the area for a number of

earthworks seasons given the size of the site. Management of piling activities and other noisy construction sources would be necessary.

It is considered that there would be some change to the amenity of the area as a result of the proposed *Light Industrial* area, the increase in residential traffic movements on Awakino Point North Road and the period of construction noise from the site. However, overall we expect that the proposed Areas can operate within the existing environment while complying with relevant District Plan noise rules and maintaining an acceptable level of amenity at the surrounding dwellings.

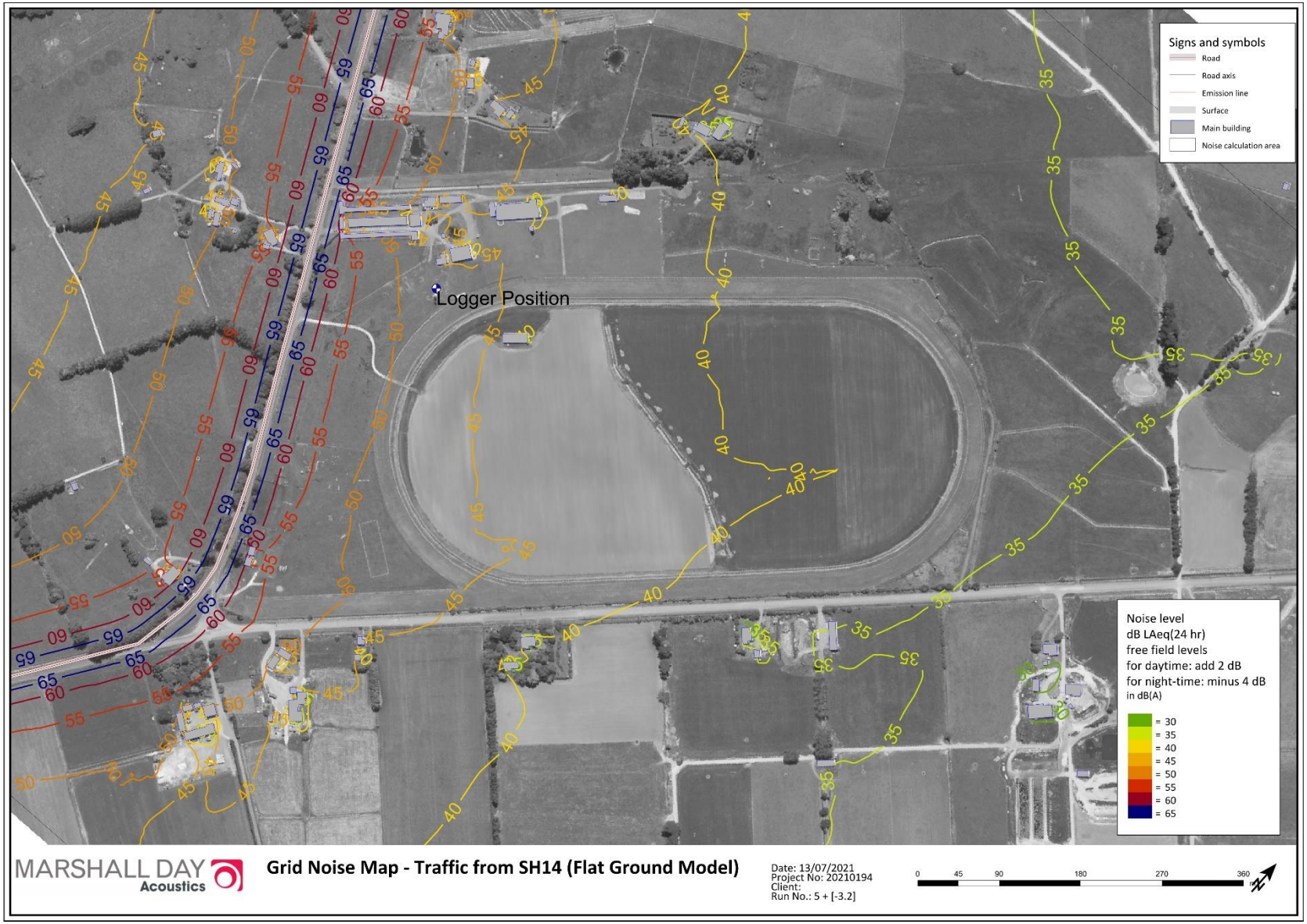
APPENDIX A GLOSSARY OF TERMINOLOGY

Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
Hertz (Hz)	Hertz is the unit of frequency. One hertz is one cycle per second. One thousand hertz is a kilohertz (kHz).
Octave Band	A range of frequencies where the highest frequency included is twice the lowest frequency. Octave bands are referred to by their logarithmic centre frequencies, these being 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz for the audible range of sound.
Noise	A sound that is unwanted by, or distracting to, the receiver.
Masking Noise	Intentional background noise that is not disturbing, but due to its presence causes other unwanted noises to be less intelligible, noticeable and distracting.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
Special Audible Characteristics	Distinctive characteristics of a sound which are likely to subjectively cause adverse community response at lower levels than a sound without such characteristics. Examples are tonality (e.g. a hum or a whine) and impulsiveness (e.g. bangs or thumps).
SPL or L_P	Sound Pressure Level A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 μPa RMS) and expressed in decibels.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 μPa i.e. dB = 20 x log(P/Pr)
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
$L_{Aeq\,(t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
$L_{A90\,(t)}$	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
$L_{A10\,(t)}$	The A-weighted noise level equalled or exceeded for 10% of the measurement period. This is commonly referred to as the average maximum noise level.

The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.

L_{AFmax} The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.

APPENDIX B TRAFFIC NOISE LEVELS MODELLED USING CORTN



APPENDIX C DIURNAL NOISE LEVELS ON SITE