Appendix 10: Acoustic Assessment

Level 2, 518 Colombo Street
Christchurch 8011
PO Box 549, Christchurch 8140
Email: office@aeservices.co.nz
Phone: 03 377 8952
www.aeservices.co.nz

Report Number: AC18334 – 02 – R3

Private Plan Change, Farmer's Corner, 12 Longbeach Road, Tinwald: Assessment of Environmental Noise Effects

Prepared for:

Incite
PO Box 25289
CHRISTCHURCH 8144

5 August 2019

Acoustic Engineering Services
Level 2, 518 Colombo Street
Christchurch 8011
PO Box 549
Christchurch 8140
Phone: 03 377 8952
Email: office@aeservices.co.nz

Revision History

Reference	Status	Date	Prepared by
AC18334 – 02 – R1	Rev 1	28 November 2018	Rewa Satory
AC18334 – 02 – R2	Rev 2	12 March 2019	Rewa Satory
AC18334 – 02 – R3	Rev 3	5 August 2019	Rewa Satory

Document Acceptance

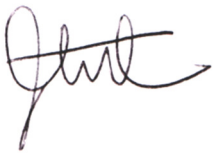
Author:

Rewa Satory
BE (Mech).
Acoustic Engineer

Reviewer:

Clare Dykes
M.BSc. MASNZ
Senior Acoustic Engineer

Approved:



Dr Jeremy Trevathan
Ph.D. B.E.(Hons.) Assoc. NZPI® MASNZ
Managing Director

On behalf of Acoustic Engineering Services Limited
5 August 2019

Table of Contents

1.0 BACKGROUND

Acoustic Engineering Services (AES) have been engaged to provide acoustic engineering advice in relation to a Private Plan Change application. The Private Plan Change will involve the rezoning of Rural Zoned land to a new Rural Tourism Zone to allow for the development of visitor accommodation and associated developments for Farmer's Corner on the corner of Longbeach Road and Hinds Highway (State Highway 1) in Tinwald, Ashburton. The Private Plan Change requires an assessment of the environmental noise effects, with regard to section 104(1) of the Resource Management Act (RMA), which requires the potential effects of the activity on the environment to be considered.

Details of the expected operation of the proposed development have been supplied by Incite, including the following documentation:

- Architectural concept drawings titled *Farmers Corner Development*, as prepared by Don Donnithorne Architects Ltd and Robert Watson Landscape Architects Ltd. and dated the 11th of March 2018.
- Architectural site schematic drawings titled *Farmers Corner*, as prepared by Don Donnithorne Architects Ltd and dated the 16th of March 2018.

The Plan Change proposal is set out in full in the Plan Change application, and we have used the concept plans as an example of the type of development that the Plan Change will facilitate.

1.1 Site and surrounding area

The site is located at 12 and 22 Longbeach Road (legal description Lot 1 DP 83802, and Lots 1 and 2 DP 407897), and are currently zoned Rural B, as outlined in the Ashburton District Plan. The site is bounded by State Highway 1 to the northwest, Longbeach Road to the east, and rural properties to the south and west. The properties generally to the south are also zoned Rural B and properties to the north zoned Rural A.

On the opposite side of State Highway 1 is a railway line with associated land designated for Railway Purposes.

The nearest dwellings are located to the south at 54 Longbeach Road, to the west at 361 Hinds Highway and also to the east at 31 Longbeach Road. 31 Longbeach Road is where the owner of the site lives. The site and surrounding area are shown in figure 1.1 below.

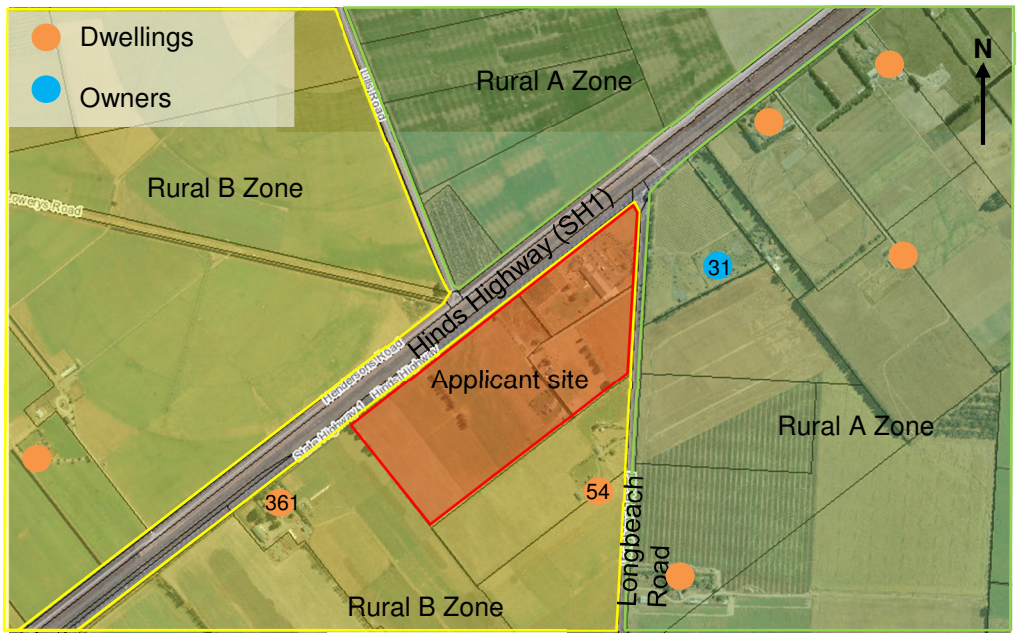


Figure 1.1 – Applicant site location plan (excerpt from Canterbury Maps)

1.2 Current and expected activity

The existing tourism business has been operating from the 12 Longbeach Road portion of the site since 2004. The current business is based around a large retail store and restaurant with seating for up to 140 people. A large carpark has its entrance from Longbeach Road. The retail and restaurant are located on the northern half of 12 Longbeach Road and an alpaca farm and lavender fields cover the remainder of the site. The operation primarily caters to international tourists with a large proportion travelling by bus.

The remainder of the entire site currently contains at least two dwellings and several ancillary buildings, and is primarily used for rural activities. The majority of this site is undeveloped and it is expected that the buildings will be moved or demolished to allow for development of the site.

The request for a Plan Change is to allow for the following development with reference to the Outline Development Plan (ODP) shown in figure 1.2 below.

- Limited further expansion of the same type of activities and facilities in the portion of the site marked Area 1 of the ODP.
- Up to 80 visitor units located in the portion of the site marked Area 2 in the ODP subject to the setback requirements.
- Establishment of a Visitor Accommodation Central Hub with a Controlled Activity status in the location indicated in purple hatching in the ODP.
- The remainder of the site marked Area 3 of the ODP to allow development in accordance with a Rural B zoning.

Figure 1.2 – Outline Development Plan

A concept plan has been produced to indicate the scale and style of the development and is shown in figure 1.3 below including the following activities:

- Area 1 development may include an agricultural museum or the like.
- Visitor units in Area 2 may include those such as; motel style units, glamping sites and silo style accommodation units.

- Other activities in Area 2 that are associated with the visitor units may include lookouts, follies, a chapel and tennis courts.

- The Visitor Accommodation Central Hub may comprise of an iSite, restaurant and bar areas and a function centre, the building may contain several outdoor areas and a rooftop viewing deck or similar.

- The remainder of the site marked Area 3 to be landscaped and planted naturally allowing for open space for alpaca grazing, and a bike/walking track at the perimeter of the site.

The concept also allows for a new driveway access from Longbeach Road to a drop off area for the accommodation that is some 300 m to the south of the existing building/carpark

The concept plan is shown in figure 1.3 below.

Figure 1.3 – Overview of the proposed development (Concept Plan)

2.0 ACOUSTIC CRITERIA

The Resource Management Act requires consideration of the significance of any adverse effects associated with the proposal. Guidance as to the significance of any adverse noise effects may be obtained from several sources.

2.1 District Plan noise standards

The site is currently zoned Rural B. Surrounding properties are zoned Rural A and B with a designated Railway on the opposite side of State Highway 1 to the northwest. Therefore the noise standards which currently apply for the site and at neighbouring sites are those described in the Ashburton District Plan, *Section 11.8 Noise Standards for zones*, and are as follows:

Measurement location	***Daytime (0700 to 2200 hours inclusive)***		***Night-time (all other times)***	
	$L_{Aeq\ (1\ hr)}$	$L_{AF,max}$	$L_{Aeq\ (1\ hr)}$	$L_{AF,max}$
At or within the boundary of any site zoned Rural A or Rural B	*65 dB*	*85 dB*	*45 dB*	*70 dB*
At the notional boundary of any residential unit on an adjoining site zoned Rural A or Rural B	*50 dB*	*75 dB*	*40 dB*	*65 dB*

The various sound measurement and assessment terms and parameters used in the Ashburton District Plan and this report are described fully in NZS6801:2008 *Acoustics - Measurement of Environmental Sound*, and NZS6802:2008 *Acoustics - Environmental Noise*.

The notional boundary is a line 20 metres from any residential unit on any neighbouring site, as defined in *NZS6802:2008 Acoustics - Environmental Noise*.

The daytime noise limits are intended to provide amenity for outdoor activities. Night-time noise limits are intended to allow for sleep amenity.

2.2 New Zealand Standard 6802

NZS 6802:2008 *Acoustics – Environmental noise* outlines a guideline daytime limit of 55 dB $L_{Aeq\ (15\ min)}$ and a night-time noise limit of 45 dB $L_{Aeq\ (15\ min)}$ for "the reasonable protection of health and amenity associated with the use of land for residential purposes". The standard states that the notional boundary of dwellings in rural areas as the appropriate assessment location.

The standard also describes how a duration adjustment may be applied to sound received for less than the whole daytime period. For example, a 2 dB adjustment may be applied to sound received for less than 60 % of the daytime period and a 5 dB adjustment may be applied to sound received for less than 30 % of the daytime period.

The Standard explicitly states that an L_{max} noise limit should be set where sleep protection is required, and should only be set for night-time hours. It goes on in clause C7.2 to state that *"the intention of L_{AFmax} noise limits is to provide protection against the effects of 'typical maxima' of the specific sound and not the 'absolute maxima'. A noise nuisance does not generally arise from a single isolated incident. A single isolated noise event which exceeds an applicable limit might not be representative of the sound under investigation and should not be used as the sole basis for compliance action."*

2.3 World Health Organisation

Guidelines for Community Noise[1], a document produced by the World Health Organisation based on extensive international research recommends a guideline limit of 55 dB $L_{Aeq\ (16\ hours)}$ to ensure few people are seriously annoyed in residential situations. A guideline limit of 50 dB $L_{Aeq\ (16\ hours)}$ is recommended to prevent moderate annoyance.

A guideline night-time limit of 45 dB L_{Aeq} and 60 dB L_{Amax} at the façade of a dwelling is recommended to allow occupants to sleep with windows open.

2.4 Other District Plan noise limits

We are familiar with existing noise rules for many other District Plans throughout New Zealand, and consider these to provide some context.

The adoption of a daytime L_{AFmax} noise limit is not consistent. Where there is a daytime L_{AFmax} limit, this is typically set around 85 dB. More recently updated District Plans do not typically include daytime L_{AFmax} limits, as an L_{Aeq} limit alone has been found to be adequate for managing amenity effects.

Therefore, the current Ashburton District Plan daytime L_{AFmax} noise rule of 75 dB L_{AFmax} at the notional boundary is unusually restrictive both as it applies during the daytime, and in terms of the decibel level.

2.5 Discussion regarding appropriate noise limits

Noise expected from the proposed development is of a different character to noise expected in the rural environment and therefore could potentially be more noticeable to receivers in Rural Zones than noises that are typical in the rural environment.

Based on the guidance described above, we observe that the Ashburton District Plan (Table 11-1, under Standard 11.8.1) noise limits for noise received in Rural Zones are generally more stringent than recommended by WHO and NZS 6802:2008. For example, noise levels of 45 dB L_{Aeq} are not expected to cause sleep disturbance when received at the façade of dwellings with windows open, however the Ashburton District Plan night-time noise standard is 5 dB more stringent than this, and it is assessed at a distance of 20 metres from the façade.

We consider that the Ashburton District Plan standards for Rural Zones are appropriately conservative such that; where noise levels from the subject site comply with these standards, the effects on neighbouring properties in the Rural Zones will be acceptable. Therefore we recommend the current noise limits are carried over to the new Rural Tourism Zone.

[1] *Edited by Berglund, B et al. Guidelines for community noise. World Health Organization 1999*

3.0 NOISE GENERATED BY THE ACTIVITY

We expect that it is realistic for the activities likely to take place on the subject site to comply with the Ashburton District Plan noise limits. We have considered a scenario in line with the concept plan and expected level of activity in order to demonstrate that compliance with the Ashburton District Plan rural noise limits is realistic. Based on the concept design the potential noise sources associated with the proposed development of the site are as follows:

- Noise from peak occupancy of the facilities, including people and music noise
- Noise from people in the outdoor areas of accommodation units and associated activities
- Noise from vehicles as they travel on site
- Noise from external plant associated with the activities

3.1 Noise from people and music

SoundPlan computational modelling based on ISO 9613 *Acoustics – Attenuation of sound outdoors – Part 2: General method of calculation* has been used to calculate the propagation of noise from the site, taking into account the topography of the area, worst-case downwind conditions, and sound power levels for each of the noise sources.

3.1.1 Expected noise levels during daytime period of 0700 to 2200 hours

In order to examine what may be required to ensure that compliance is achieved, we have considered the following scenario:

- A total of 200 occupants in outdoor areas of the Central Hub in both the roof top deck area and the lower deck area, with half speaking in raised voices along with outdoor speakers in operation, played at background levels.
- High occupancy, conversation, and music through the PA system, in the proposed restaurant, bar and function areas of the Central Hub.
- Low occupancy and background music in other parts of the Central Hub (iSite and Lobby).
- Typical building envelope constructions comprising of at minimum two solid layers of material (ie façade and lining both solid) with fibrous insulation to the cavity (minimum STC 38). Noting that materials such as perforated ceilings or warm roof constructions may compromise the analysis.
- A set of external double doors to each space in the Central Hub fixed open.
- A total of 240 people in the respective outdoor areas of their accommodation units with half speaking in normal voices. This allows for 40 staff and an average of 2.5 guests in each of the 80 accommodation units (including the chalets, glamping silos, and standard motel type rooms). We consider it to be conservative as it is unlikely all guests and staff would be outside at the same time.
- Eight people on the tennis courts with half speaking in raised voices.
- Marquee (200 m^2) with high occupancy, conversation, and music through the PA system, located at least 25 metres from any boundary.
- Full occupancy of the chapel with music through the PA system and doors closed.

With regards to people and music inside the bar or restaurant, marquees and in the chapel noise sources are expected to be conversation and music through the PA system. On this basis,

and also based on noise measurements undertaken at similar establishments, we have assumed that internal noise levels of up to 90 dB L_{Aeq} may be experienced within any of the venues including, the function room, marquee, chapel, restaurant and bars, including a +5 dB penalty for Special Audible Characteristics that may be applied under NZS6802:2008 for music with distinctive bass content).

With regard to people in the outdoor areas, expected noise levels due to the conversation of people has been based on the American National Standards Institute Standard ANSI S3.5 – 1997 *Methods for calculation of the Speech Intelligibility Index*, which contains information on the typical speech levels for both male and female speakers. Based on average values, for a normal voice effort, the sound power of a speaker may be deduced to be 71 dB L_{wA} and 78 dB L_{wA} for raised voices. For the purposes of this study it was assumed that the conversational voices do not contain Special Audible Characteristics, and that the sound pressure level produced by conversation is constant enough to allow the consideration of L_{eq} (energy average) level only.

The resulting noise contours are shown below in figure 3.1 with the outer contour indicating a noise level of 50 dB L_{Aeq} (the Ashburton District Plan daytime notional boundary limit) and a bold line at the 65 dB L_{Aeq} contour (the Ashburton District Plan daytime boundary limit).

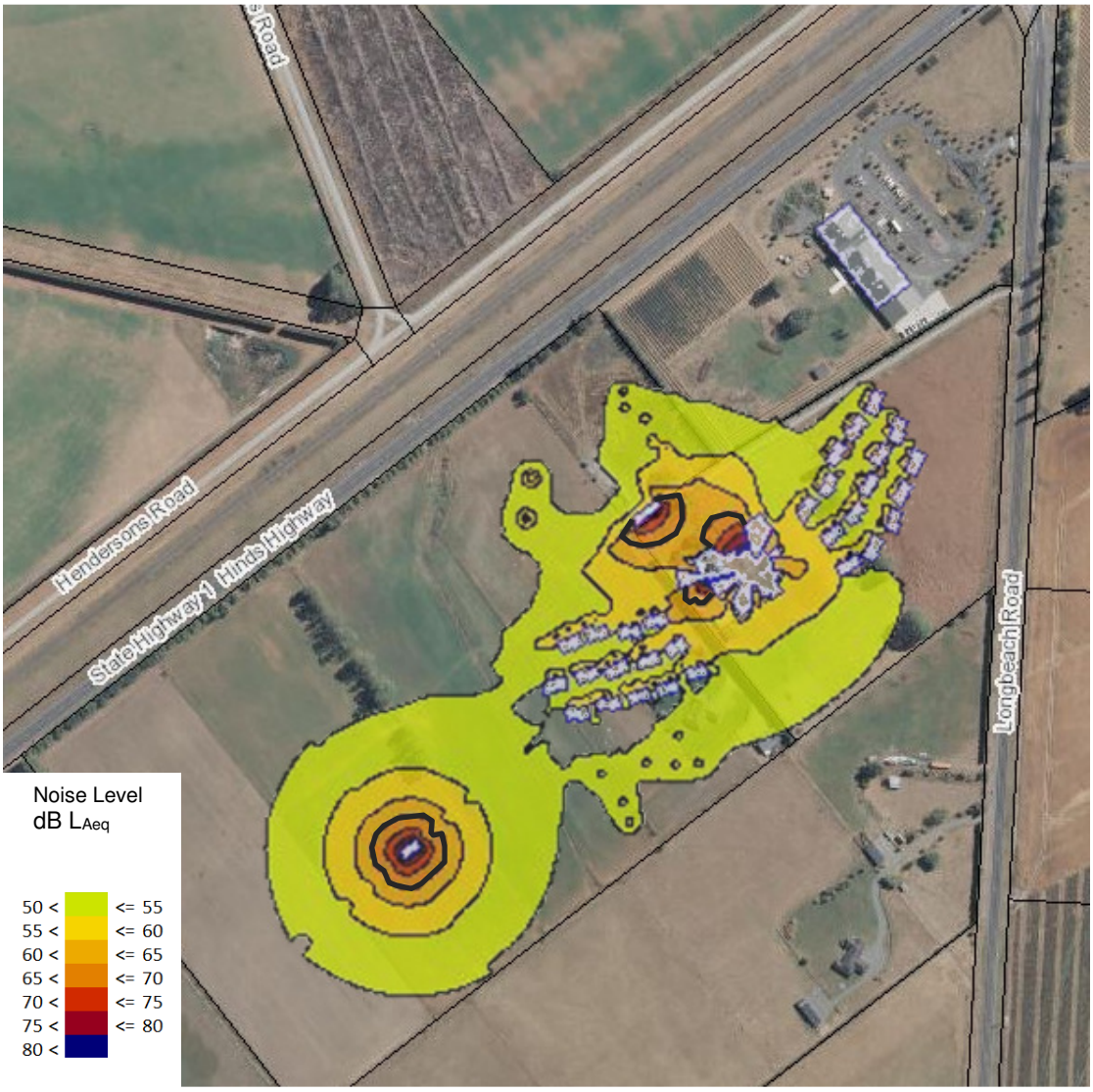


Figure 3.1 – Daytime noise emissions

We note that our analysis does not consider a duration adjustment as allowed for in NZS 6802:2008 and the Ashburton District Plan. We expect that even for an extended function

noise would not be expected for more than 60 % of the daytime period (9 hours). Therefore a 2 dB duration adjustment would likely be deducted from the contours shown above.

This analysis indicates that based on the above operating conditions noise levels are expected to be considerably lower than the District Plan standards of 65 dB L_{Aeq} at any neighbouring site boundary or 50 dB L_{Aeq}, any neighbouring notional boundary. We therefore consider it realistic that the proposed activity on the site will comply with the current Ashburton District Plan noise limit.

While the activity associated with the accommodation and bar or function venues will contain higher L_{AFMax} noise level events, such as occasional shouting or clapping, we do not expect the daytime L_{AFmax} noise standards to be exceeded where the L_{Aeq} noise standards are met.

Based on the assessed level of activity the following could be accommodated and compliance with the daytime noise standards would be readily achieved.

- Accommodation units, tennis courts, cycle-ways, museum and the like located anywhere on the site.
- Chapel and Central Hub in their current positions, with entertainment activities orientated to the northwest, a double set of doors to each space fixed open and comprised of standard building constructions.
- Marquee located at least 25 m from any boundary

We understand that the proposed development is at concept stage and the operation and detail of the development has not been finalised. However, we consider this to be a conservative analysis and based on peak operation of a development of this type. For example, based on the noise levels described above activities such as; amplified pre-recorded music, a small live band or DJ sets which makes use of electrical amplification could to be accommodated inside the function rooms, restaurant, bars, chapel, or marquee on-site.

If a higher level of noise was desired inside, such as live amplified performances, bands, karaoke and the like, daytime noise limits would still be able to be met if doors to outdoor areas were closed and visitors entered through the lobby. Alternatively if the music noise levels were lower, for example for dining activities with background music larger areas may be open (for example any large sliding or bi-fold doors). Due to the fact that the internal noise levels could vary considerably we consider it appropriate that the central hub, or any structure that is expected to contain amplified music is located in the purple hatched area of the ODP and break-out noise considered further in a Controlled Activity Resource Consent process.

Based on the above we expect that the noise levels from visitor accommodation and ancillary activities (excluding the central hub) that are located in Area 2 of the ODP (subject to the prescribed setbacks) will readily comply with the daytime District Plan noise limits. We would therefore expect the associated effects will be minimal.

3.1.2 Operation during the night-time period of 2200 to 0700 hours

We have also considered a night-time scenario for the proposed development. A situation as for the daytime scenario described above with some operational restrictions as follows:

- Outdoor deck and rooftop terrace areas of the Central Hub with limited occupancy
- Marquee and Chapel closed

The expected maximum cumulative noise level has been calculated within the worst affected neighbouring property boundaries during the night-time period, as shown below.

The resulting noise contours are shown below in figure 3.2, with the outer contour indicating a noise level of 40 dB L_{Aeq} and a bold line at the 45 dB L_{Aeq} contour showing the District Plan boundary limit.

Figure 3.2 – Night-time noise emissions

Based on this scenario, we expect noise levels will be able to meet the Ashburton District Plan limits of 45 dB L_{Aeq} at all neighbouring property boundaries, and 40 dB L_{Aeq} at the notional boundary of all neighbouring dwellings.

Similar to the daytime scenario we expect that the noise levels associated with a Plan Change allowing the development of visitor accommodation in Area 2 of the ODP (subject to the setbacks) will be able to comply with the District Plan night-time noise standards and where the noise standards are met we expect the effects of will be minimal.

We also expect that noise from a Central Hub located in the purple hatched area of the ODP will be able to comply with the District Plan night-time noise standards and where the noise standards are met we expect the effects of will be minimal. Due to the possible range of activities and variation of building form we consider that a Controlled Activity Resource Consent considering noise break-out from the Central Hub building will be appropriate to ensure compliance with the District Plan limits is achieved.

3.2 Noise from vehicles

As outlined above, another noise source which should be considered is the noise from vehicles. We have again considered a scenario in line with the concept plan and expected level of activity in order to demonstrate that compliance with the Ashburton District Plan noise limits is realistic. The current carpark at the northern corner of the site (with a drop off point parking for 22 small

vehicles and five buses) is to remain. An additional driveway with drop off point is proposed to access the accommodation and Central Hub. The entrance will be from Longbeach Road some 60 metres from the existing carpark entry/exit. The proposed driveway is approximately 350 metres long and generally follows the boundary set-back approximately 20 metres and finishes at a large turn-around drop-off point at the southwest of the Central Hub.

The expected maximum noise levels due to vehicles moving about on the site have been calculated based on peak traffic estimations where up to 50 buses per day will visit the site in the high season. Based on the daily peak traffic we have considered a situation where five buses arrive or depart the site in a worst-case 15-minute period such as may occur before or after a large event. Smaller private vehicles are also expected to use the site including those staff, locals and self-drive tourists; however these are not expected to affect the peak traffic noise levels.

Calculations have been based on previous measurements of bus movements. We have assumed a single vehicle movement has a sound power of 101 dB L_{wAE}, and noise levels generated by door slams and engine starts have been based a sound power of 92 dB L_{wAFmax}.

The expected worst-case noise levels are as follows:

East property boundary (31 Longbeach Road) –
45 dB L_{Aeq} / 34 dB L_{AFmax}

East property notional boundary (31 Longbeach Road) –
30 dB L_{Aeq} / 41 dB L_{AFmax}

South property boundary (54 Longbeach Road) –
45 dB L_{Aeq} / 48 dB L_{AFmax}

South property notional boundary (54 Longbeach Road) –
32 dB L_{Aeq} / 37 dB L_{AFmax}

This analysis indicates that the noise received from traffic moving about the site is able to meet the District Plan day and night-time L_{AFmax} and L_{Aeq} noise standards at all neighbouring notional and property boundaries at all times.

This analysis indicates that noise from traffic due to the proposed Plan Change is unlikely to result in an exceedance of the current noise standards and we therefore expect the adverse effect to be minimal.

3.3 Other noise sources

Other potential noise sources as a result of a Plan Change are

- Mechanical plant
- Noise from visitors leaving the establishment

Due to the distances from the site to the nearest boundaries and notional boundaries we expect that compliance with the District Plan daytime and night-time noise limits will be achieved by some margin and therefore the adverse effect of noise from these sources will be minimal.

4.0 SENSITIVE ACTIVITIES NEAR INFRASTRUCTURE

The Ashburton District Plan, Rural Zone Rule 3.9.4 a) states that any residential unit shall be set back 20 metres from the left edge of the nearest traffic lanes. Sub-clause c) of that rule states that

> *Any residential unit or additions of a habitable space or alterations resulting in additional habitable space, erected between 20 - 80m from the nearest traffic lane of SH1 and SH77 shall be required to comply with the international noise guidelines outlined in AS/NZS 2107: 2000.*

We note that the satisfactory recommended design level given in NZS 2107:2000 for sleeping areas of hotels and motels near major roads is 35 dB L_{Aeq}.

We consider that this rule would mitigate the noise effects from traffic on the State Highway to receivers in any accommodation units on the site. However, we note that the NZTA, the controlling authority of the nation's State Highways has developed guidelines[2] to mitigate effects on noise sensitive receivers near State Highways. The Performance Standards in the guide states the following:

> *To achieve a reasonable level of acoustic amenity, all noise sensitive activities in rural areas should be located outside of a buffer area, providing a setback from state highways. Beyond the buffer area buildings containing new noise sensitive activities within a wider 'effects area' may be allowed but need to be designed and constructed to achieve reasonable indoor acoustic amenity.*

The NZTA buffer area for this site is 40 metres and the effects area is 100 metres. The NZTA provides a design internal noise level of 40 dB $L_{Aeq(24\ hour)}$ for living and sleeping areas of visitor accommodation within the effects area. This noise level would equate to approximately 35 dB L_{Aeq} in the night-time and 40 dB L_{Aeq} in the daytime.

We recommend that for this site the NZTA guidelines are adopted and that no accommodation units are located closer than 40 metres to the State Highway and that any accommodation unit located between 40 and 100 metres from the State Highway (this would include all the water pavilions in the concept plan) is built such that habitable spaces have an internal noise level of 40 dB $L_{Aeq(24\ hour)}$. This would be in line with the NZTA requirements and the adoption of a 24 hour time period allows for simplicity of analysis (using 24-hour calculated noise levels from the State Highway).

However, we understand that for consistency the District Council may want to retain the provisions of Rule 3.9.4 and we consider that this will also be acceptable.

[2] *Guide to the management of effects on noise sensitive land use near to the state highway network*, Version 1.0, September 2015

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on our review of the District Plan noise limits, national and international guidance, and considering the character of the noise expected due to the Plan Change, we expect the Rural Zone noise limits would be appropriate to retain for the Plan Change site and will ensure a minimal effect

We expect it to be realistic for the activities allowed on the site under the new zoning to comply with the noise limits.

As an example we have considered the noise levels from a potential operating scenario from the proposed concept plan for the site. Based on this operational situation, as outlined in this report, we expect that compliance with the District Plan noise limits will be readily achievable for noise emitted from accommodation units located in Area 2 of the ODP, for vehicles moving on site, and also for mechanical plant.

However, physical and managerial noise mitigation would be required for louder noise sources, for example music and conversation in the Central Hub and other function spaces such as marquees. Therefore we recommend that any building that contains entertainment or function spaces is assessed by a suitably qualified acoustic engineer through a Resource Consent phase to ensure that the break-out noise emissions from the proposed activity within the building complies with the relevant District Plan noise standards.