

Resonate

Kialla Lakes - Stages 40 and 43

Acoustic Design Report

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Glossary

ANEF	Australian Noise Exposure Forecast as defined in AS/NZS 2021. A single number index for predicting the cumulative exposure to aircraft noise in communities near aerodromes during a specified time period (normally one year).
ANR	Aircraft Noise Reduction as defined in AS/NZS 2021. For design purposes, the arithmetic difference between the aircraft noise level at a site and the indoor design level.
A-weighting	A spectrum adaption that is applied to measured noise levels to represent human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies.
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. We typically perceive a 10 dB increase in sound as a doubling of loudness.
dB(A)	Units of the A-weighted sound level.
R _w	Weighted Sound Reduction Index—A laboratory measured value of the acoustic separation provided by a single building element (such as a partition). The higher the R _w the better the noise isolation provided by a building element.

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1 Introduction

Resonate Consultants were commissioned by Kavant Nomanees Pty Ltd to determine building envelope construction to suitably attenuate aircraft noise for the residential estate at Kialla Lakes - Stages 40 and 43.

The subdivision site is adjacent to the Shepparton Aerodrome and an assessment conducted in accordance with AS2021:2015¹ is required as per the *Planning Permit 2011-6/1(AMENDED)* from Greater Shepparton City Council. The following summarises the Condition 2(c) of Aerodrome Requirements in the planning permit:

For lots located in between the ANEF 20 and 25 contours:

- Any part of a dwelling that is located between the ANEF 20 and ANEF 25 contours must be constructed so as to comply with any noise attenuation measures required by the Australian Standard AS2021:2015 (Acoustic Noise Intrusion – Building Siting and Design).

This report has been prepared for submission to the Greater Shepparton City Council for the relevant approvals process.

¹ Australian Standard AS2021:2015 Acoustic Noise Intrusion – Building Siting and Design

2 Site description

The proposed subdivision sites of Stage 40 and Stage 43 consist of a large group of residential properties including 30 lots for each stage subdivision. Figure 1 shows the development plan.

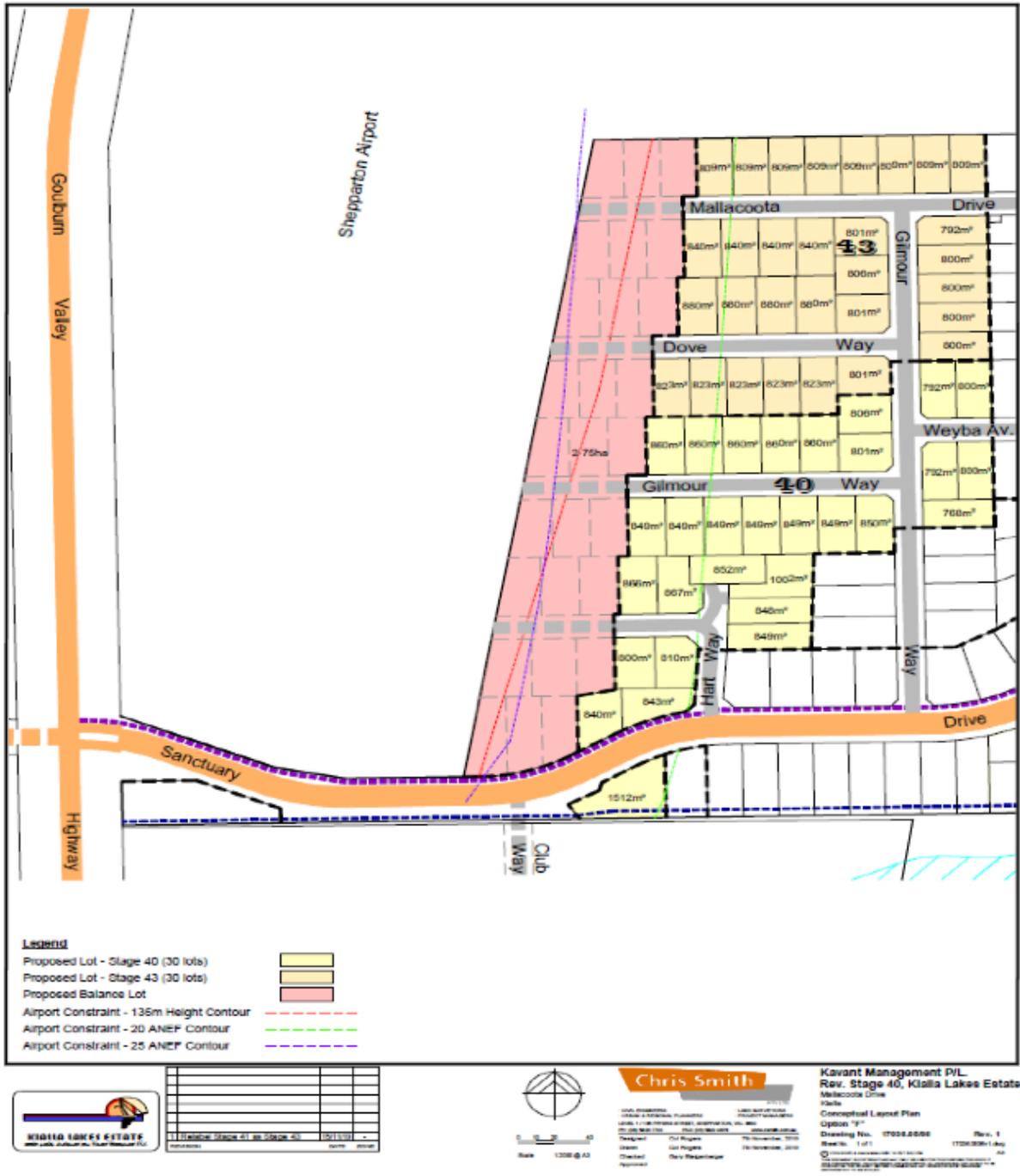


Figure 1 Proposed subdivision layout for Stages 40 and 43 (Source: Chris Smith & Associates)

As shown in Figure 1, the westernmost lots of the development site are located between the 20 ANEF (dashed green line) and 25 ANEF (dashed purple line) contours. These lots are listed in the development plan drawing *Plan of Proposed Subdivision Kialla Lakes Estate: Stages 32 – 40, Rev. 26, 29/06/2020* and are summarised below:

Lot 1356	Lot 1406	Lot 1185	Lot 1190	Lot 1375
Lot 1376	Lot 1407	Lot 1186	Lot 1284	Lot 1402
Lot 1377	Lot 1408	Lot 1187	Lot 1300	Lot 1371
Lot 1378	Lot 1162	Lot 1188	Lot 1371	
Lot 1405	Lot 1163	Lot 1189	Lot 1374	

The building envelope construction for the lots above will be assessed in accordance with AS2021:2015 as required by the amended Planning Permit 2011-6/I(AMENDED).

Figure 2 shows the site location and surroundings.



Figure 2 Site location and surroundings

3 Aircraft noise assessment

3.1 Noise criteria

3.1.1 Aircraft noise impact

Assessment of the impact of aircraft noise on building sites is conducted in accordance with AS2021:2015. Under AS2021, the acceptability of a development site is dependent on the ANEF (Australian Noise Exposure Forecast) zone that it is located in. The relevant zones for different building types are presented in Table 1.

Table 1 Building site acceptability based on ANEF zones, AS 2021:2015

Building type	ANEF zone of site		
	Acceptable	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park	< 20 ANEF	20 – 25 ANEF	>25 ANEF
Hotel, motel, hostel	< 25 ANEF	25 – 30 ANEF	>30 ANEF
School, university	< 20 ANEF	20 – 25 ANEF	>25 ANEF
Hospital, nursing home	< 20 ANEF	20 – 25 ANEF	>25 ANEF
Public building	< 20 ANEF	20 – 30 ANEF	>30 ANEF
Commercial building	< 25 ANEF	25 – 35 ANEF	>35 ANEF
Light industrial	< 30 ANEF	30 – 40 ANEF	>40 ANEF
Other industrial	Acceptable in all ANEF zones		

Acceptable

If from the table above the building site is classified as 'acceptable', there is usually no need for the building construction to provide protection specifically against aircraft noise. However, it should not be inferred that aircraft noise will be unnoticeable in areas outside the ANEF 20 contour.

Conditionally acceptable

If from the table above the building site is classified as 'conditionally acceptable', the maximum aircraft noise levels for the relevant aircraft and required noise reduction should be determined in accordance with Clause 3.2, AS 2021:2015, and the aircraft noise attenuation to be expected from the proposed construction should be determined in accordance with Clause 3.3, AS 2021:2015.

Unacceptable

If from the table above the building site is classified as 'unacceptable', construction of the proposed building should not normally be considered.

According to the proposed subdivision layout shown in Figure 1, the westernmost lots listed in Section 2 are considered as Conditionally Acceptable for residential properties and the rest of properties which are in the less than 20 ANEF zone are considered as Acceptable.

3.1.2 Internal noise level (AS 2021:2015)

The targeted internal noise levels for the development were established in accordance with AS 2021:2015. These internal noise levels were implemented to derive the required Aircraft Noise Reduction (ANR). For design purposes, the ANR is the arithmetic difference between the aircraft noise level at a site and the indoor design level.

Table 2 presents the appropriate internal noise levels for this project.

Table 2 Indoor design sound levels (AS 2021:2015)

Room types	Indoor design sound level, L_{Smax} dB(A)
Sleeping areas, dedicated lounges	50
Other habitable spaces	55
Bathrooms, toilets, laundries	60

3.2 Aircraft type and noise levels

According to the Shepparton Aerodrome Impact Assessment report² the Shepparton Aerodrome supports aircraft below 5700 kg maximum take-off weight and operates mainly general aviation activities such as training, charter, private and aerial work, as well as limited air freight and emergency services such as Air Ambulance Victoria.

The Shepparton Aerodrome website³ mentions that main runway 18-36 was reconstructed in 1992 to withstand a turbo prop SAAB 340.

We have not been able to confirm the typical aircraft types that operate at the aerodrome. We would expect that typically it is only small light aircraft that are in operation although at times larger aircraft such as the SAAB 340 would operate. The approach of AS2021 is to assess all aircraft types that operate at the site and determine the highest aircraft noise level.

Analysis of the aircraft noise tables from AS2021 show that noise levels for the arrival and departure of the SAAB 340, and light aircraft such as the Beech Baron 58P are actually quite similar. Therefore, the noise levels for the SAAB 340 aircraft was adopted as the worst-case for maximum noise levels in the assessment as it has slightly higher aircraft noise levels as derived from AS2021 which we have also crosschecked against the Noise-Power-Distance curves from the Integrated Noise Model (INM) software used to produce these AS2021 aircraft noise tables.

Table 3 presents the aircraft noise levels at the affected lots of the subdivision site according to AS 2021:2015.

Table 3 Aircraft noise levels at the affected lots as per AS 2021:2015

Aircraft type	Aircraft noise level, dB(A)	
	Departures	Arrivals
SAAB 340	85	78
Beech Baron 58P	85	85

² Shepparton Aerodrome – Airport Impact Assessment (Kialla Lakes – Stages 40 and 43) Final Report, Rev 2, June 2020, ARCADIS

³ <https://greater-shepparton.com.au/region/aerodrome>

3.3 Building envelope constructions

The Aircraft Noise Reduction is the arithmetic difference between the aircraft noise level at a site and the indoor design level. The required (ANR) levels for the property lots listed in Section 2 are derived in accordance with AS 2021:2015 and they are presented in Table 4.

Table 4 Required ANR to comply during 100% of flight activity

Room types	ANR, dB(A)
Sleeping areas, dedicated lounges	35
Other habitable spaces	30
Bathrooms, toilets, laundries	25

Typically, information on the location & orientation of rooms, room volume and size of windows is required to determine the building envelope construction for a particular house. Given that the intent of this assessment is to provide general information on the type of construction for multiple residential lots at the site, the following assumptions were made to determine the building envelope construction.

- bedroom dimensions: 4m (L) x 4m (W) x 2.7m (H)
 - one exposed façade wall with one 2.5 m² glazed window
 - ceiling lining: plasterboard
 - floor cover: carpet
- living room dimensions: 5m (L) x 4m (W) x 2.7m (H)
 - two exposed façade walls with one 3 m² glazed window on each wall
 - ceiling lining: plasterboard
 - floor cover: timber
- bathroom dimensions: 3m (L) x 2m (W) x 2.7m (H)
 - one exposed façade wall with one 1.5 m² glazed window
 - ceiling lining: plasterboard
 - floor cover: tile

For the assessment, we have assumed that walls and windows are partially screened from aircraft noise and applied a mid-level orientation correction factor when determining the required building elements. We believe this to be an appropriate approach given the general nature of this assessment when it is unknown whether particular walls are facing west and directly exposed to the aircraft noise (no correction factor) or facing east and completely shielded from aircraft noise.

Table 5 presents the constructions of building envelopes for the proposed houses on the nominated lots. It should be noted that the building constructions in the table are general in nature and based on the above assumptions. Accordingly, a detailed assessment of the required building construction may be required when individual house designs are confirmed.

Table 5 Recommended construction for building envelope

Building element	Element Type / Location	Minimum acoustic rating, R_w	Construction elements
Wall	Masonry veneer – timber frame wall (CSR 5877 ⁴)	58	<ul style="list-style-type: none"> • Fire rated masonry veneer wall (minimum 90 mm thick and 170 kg/m²) • Sarking sheet • 40 mm minimum gap to timber frame • Cavity infill: 75 Gold batts R1.5 • Internal wall lining: 1 x 10 mm Gyprock Plus plasterboard
	Hebel PowerPanel wall constructions were considered but even robust wall constructions using Hebel PowerPanel do not meet the acoustic requirement.		
Roof	Steel roof CSR 6427 (Pitched steel roof with joist/truss & direct fixed plasterboard) or approved equivalent	51	<ul style="list-style-type: none"> • Non-ventilated steel sheet roof (min 0.42 mm) • Bradford Anticon 60 MD insulation over battens • 40 mm battens • Ceiling joists or trusses at 600 mm centre • Cavity infill: 215 Gold batts 4.1 • Ceiling lining: 2 x 13 mm Gyprock Fyrcek plasterboard
	Tile roof CSR 6520 (Pitched tile roof with joist/truss & direct fixed plasterboard) or approved equivalent	51	<ul style="list-style-type: none"> • Non-ventilated tile roof • 40 mm battens • Bradford Thermoseal Roof Tile sarking under battens • Ceiling joists or trusses at 600 mm centre • Cavity infill: 215 Gold batts 4.1 • Ceiling lining: 2 x 13 mm Gyprock Fyrcek plasterboard
Facade glazing	Bedroom 2.5 m ²	40	Single glazing: Vlam Hush 12.5mm; or Double glazing: 10mm / 12mm gap / 6.38mm
	Living room	38	Single glazing: Vlam Hush 8.5mm; or Double glazing: 10mm / 12mm gap / 6mm
	Bathroom	32	Single glazing: 6 mm

Alternative constructions for these building elements can be selected if the acoustic performance is equal to or greater than the minimum R_w rating.

⁴ <https://www.gyprock.com.au/resources/redbook>

3.4 Ventilation

Buildings on sites determined to be 'conditionally acceptable' will require that external windows and doors be kept closed, since if these are opened for ventilation purposes the aircraft noise reduction of the building envelope will be significantly reduced.

Therefore, the building ventilation for houses on these nominated lots should be in accordance with the National Construction Code and mechanical ventilation or air-conditioning systems should be installed that comply with AS 1668.2

3.5 Exposed facades, room layout and window sizes

It is recommended that consideration be given to the location of noise sensitive rooms such as bedrooms and living areas when designing residential houses for these lots. It would be prudent to locate the rooms on the eastern side of the lot and have windows facing east wherever possible. This will allow walls and windows to not have a direct line of sight to aircraft movements. The second best alternative for noise intrusion via windows is for them to face north or south.

Where noise sensitive rooms are located on the western side of lots, we recommend making the windows as small as possible, as acoustically the windows are the weakest building element of the house and will allow the most amount of aircraft noise intrusion.

4 Conclusion

This report was prepared for the assessment of aircraft noise from the Shepparton Aerodrome on proposed subdivision sites - Kialla Lakes Stages 40 and 43 in accordance with *Planning Permit 2011-6/1(AMENDED)* from Greater Shepparton City Council.

The envelop constructions of the buildings located between 20 ANEF and 25 ANEF were recommended based on the assumptions of building configurations. The recommended building facade and roof constructions comply with the internal noise requirements provided in AS 2021:2015.