



Consultant Advice

From: Richard Finley **Date:** 24 Feb. 16 **File No:** A92644\002\J-121\ca141121a0009 **Pages:** 9
Project: Flatbush School Proposed site - Notice of Requirement **No:** J-001[6.0]

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Acoustics - Draft NoR conditions

Catherine,

The advice sets out the support of the environmental noise basis of the proposed Flatbush School in Manukau, Auckland. This document supports the establishment of a Notice of Requirement (NOR) for a school situated along Flatbush School Rd. The site is on the south side of Flatbush School Rd (no. 187), just to the east of Murphys Rd. It is known as Site G in the Ministry of Education site selection report.

METHODOLOGY

The following aspects are relevant for planning purposes and have been undertaken/assessed.

- Current District and Proposed Unitary Plan provisions
- Historical precedents of schools in the surrounding areas
- Technological trends for quieter aircraft as they relate to Planning Maps
- Site observations and measurements of aircraft landings into Auckland International Airport.
- Control of noise emissions from school and childcare activity on future surrounding uses.
- Recommended conditions for the Notice of Requirements for establishing a school on the site.

BACKGROUND

The site straddles two noise zones (Figure 1) used to describe future aircraft noise under the Auckland Council District plan (ex Manukau District Plan). These two zones are the ANNA (Aircraft Noise Notification Area) and MANA (Medium Aircraft Noise Area).

The site and surrounding land is currently zoned Residential 3 in the Flat Bush Structure Plan. Its current underlying use is rural in nature but is expected to be developed into residential suburbs within the foreseeable future - as is the trend throughout much of the Flatbush/Ormiston Rd area.

Previously to this NOR, Plan Change 20 was lodged as a change to the Auckland Council District Plan (Manukau Section). Plan Change 20 originally nominated the site as a possible future school. This attracted appeals from a range of aviation entities including AIAL, Air NZ and BARNZ. This appeal was subsequently resolved through mediation such that the site definition reverted to residential 3 but it clearly identifies a level of concern from these entities relating to potential reverse sensitivity effects from aircraft over-flights.

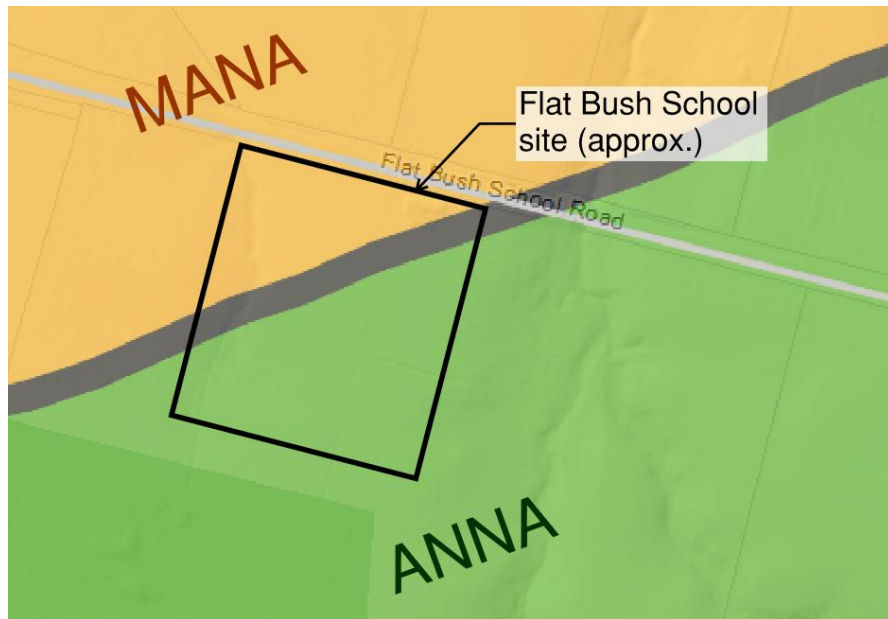


Figure 1: Topographical view of proposed Flatbush School site with ANNA and MANA contours overlaid.

HISTORICAL PRECEDENTS

Road traffic noise has not been identified as an issue for the school at this stage. Murphys Rd is a significant arterial road for the area with an 80km/hr speed limit. However it is only single lane and is no closer than 300m. Site observations are discussed in more detail later in this document but during a typical fine day, the Murphys Rd traffic was only occasionally audible over the sound of insects, rustling trees etc. Accordingly, it has not been considered further for this NOR.

Of more interest is the effect of aircraft overhead approaching Auckland Airport from the East. The site is mostly located in the ANNA with only the North western portion being located in the noisier MANA zone. It is worth noting that a number of other schools have been recently established or expanded in the local area (less than 7km) on sites that are also subject to noise from aircraft.

- Ormiston Senior College was recently established and is located almost entirely within the ANNA along Ormiston Road. A small portion of the designation sits within the MANA but no buildings are in that zone at this time.
- Mission Heights Primary was recently established and is located entirely within the ANNA along Jeffs Road
- Papatoetoe South School was recently expanded and is located entirely within the MANA along Milan Rd
- Kia Aroha College (previously known as Te Whānau o Tupuranga and Clover Park Middle School) was recently expanded and is located entirely within the MANA.

WHAT DO ANNA AND MANA ZONES ACTUALLY SIGNIFY?

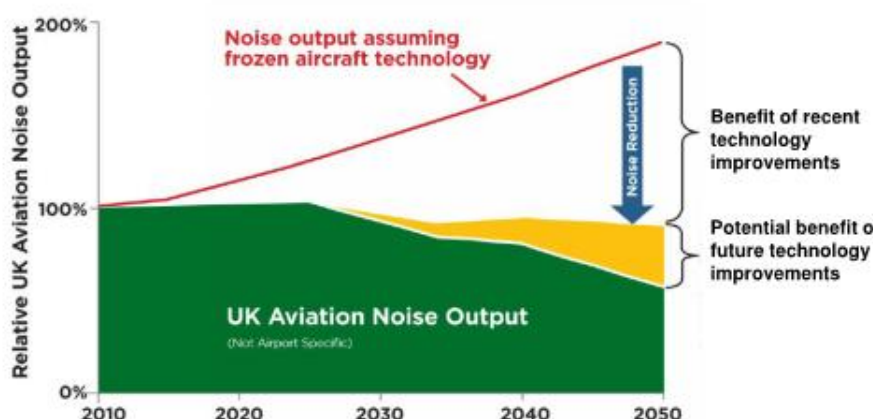
The ANNA and MANA zones are simply planning designations that reflect what the airport operator feels could be their noise output at year 2030¹. The zones are essentially a reflection of the predicted day-night weighted noise level from aircraft, more commonly known as the L_{dn} . The MANA area defines the zone expected to be exposed to L_{dn} 60-65 dB in 2030 while the ANNA defines the future L_{dn} 55-60 dB zone. The L_{dn} metric is used worldwide as a good measure of predicting reaction to noise for residential uses as it penalises night flights with a correction factor to reflect the need to avoid sleep disturbance. A side effect of this however is to potentially overstate day time effects if the noise model consists of significant night time movements (any noise produced between 10pm and 7am). While a distinct boundary line between the MANA and ANNA areas is shown on the planning maps, this should not be considered a clear demarcation of perceived noise differences between one side of the boundary and the other. The boundary is simply an arbitrary modelling output with the real spread of noise being a gradual decay away from the higher levels along the MANA centreline.

We understand that the AIAL produced contours reflect a 30 year timeframe based on current noise output's from the existing aircraft fleet using AIAL but with traffic rates that show the future growth in aircraft movements. Eg. The assumption is that newer aircraft are not going to be quieter than the existing fleet.

Recent research published by Sustainable Aviation UK (SAUK) indicates that this assumption (used in NZ for noise modelling such as this) does not recognise the benefits of reduced noise from future aircraft. As such, the contours are based on conservative assumption. While we are not aware of a set planning regime to account for the benefits of quieter aircraft, there can be no doubt that the benefits are proven and real. A recent summary of the works by SAUK, ICAO², ACARE³ and others has been prepared and presented at Inter-noise 2014 by Professor Jeremy Astley. A snapshot of the overall trend is shown in Figure 2. While this is not specific to Auckland Airport, the modelling methods that have resulted in the current ANNA/MANA boundaries are synonymous with the red 'frozen technology' line while actual technology improvements are reasonably expected to bring noise down to the yellow zone. This indicates actual present day noise levels are unlikely to increase despite more people being moved.

While the authors of the works have been careful to identify that any particular airport could vary from the overall trends, the overall trend of quieter aircraft is highly relevant to a site like Auckland International where most operators are using relatively new aircraft.

Figure 2: Predicted changes in UK aviation noise output between 2010 and 2050⁴



¹ Auckland Council District Plan (Manukau Section) 17.6.5, Strategy For Aircraft Noise Management And Land Use Planning Of Areas Affected By Aircraft Noise

² International Civil Aviation Organization (ICAO)

³ Advisory Council for Aeronautics Research in Europe (ACARE)

⁴ RJ Astley, *Can technology deliver acceptable levels of aircraft noise?* Proceedings from Internoise 2014, Figure 9



School Layout within ANNA/MANA Zones

As yet there has been no decision made as to the layout of the learning spaces of the school. In this regard, learning spaces may potentially be located in either the ANNA or the MANA. As stated above, there is no clear demarcation of perceived noise across the school site. In reality the difference in noise received at varying locations across the site are likely to be minimal; as such any noise insulation measures that may be implemented are likely to be similar across the site. We confirm that acoustic insulation that is designed for school buildings will be sufficient to control noise intrusion from aircraft, regardless of whether the buildings fall in the ANNA or MANA zones.

ACCEPTABLE LEARNING ENVIRONMENTS

Aside from the District Plan recommendations, there is a wide body of research that identifies appropriate targets for aviation noise. Some of these are set out in the MoE's own design requirements.

The MoE Designing Quality Learning Spaces (DQLS) document refers to AS/NZS 2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors for internal noise level guidelines, which specifically excludes aircraft noise from its scope due to its transient nature. For aircraft noise, AS/NZS 2107 refers to AS 2021-2000 Acoustics – Aircraft Noise Intrusion – Building siting and construction and NZS 6805:1992 Airport Noise Management and Land Use Planning, but does not stipulate adherence.

AS 2021 stipulates “maximum dB(A) level from an aircraft flyover which, when heard inside a building by the average listener, will be judged as not intrusive or annoying by that listener”. The standard gives this level as L_{max} 55 dBA for school teaching areas, and L_{max} 50 dBA for noise sensitive areas (in this case this may include rooms for students with hearing impairments). This standard is a “worst-case scenario” standard, where the design is based on the loudest aircraft.

We consider these internal design levels to be an appropriate target for this development and therefore recommend L_{max} 55 dBA for school teaching areas, and L_{max} 50 dBA for noise sensitive areas.

SITE MEASUREMENTS

Aircraft noise measurements were made over 2 hours during mid-afternoon of 6 November 2014 at the Flatbush School Rd frontage in the centre of the site – just inside the MANA area. Aircraft were generally aligned with the runway and were on approach to the main runway 23L.

**Table 1: Site Measurements of aircraft flyovers**

Measurement start time	Duration (s)	Aircraft type observed	LAFmax ⁵	SEL ⁶
14:13	21	ATR 72 or Q300	73	80
14:16	23	B1900	63	69
14:29	37	737/A320	75	81
14:31	29	ATR 72 or Q300	69	77
14:36	27	A340 or similar	76	85
14:39	30	ATR 72 or Q300	68	75
14:42	33	A380	79	88
14:46	27	737/A320	78	86
15:03	30	737/A320	74	82
15:35	36	737/A320	78	84
15:43	38	B1900	74	79
15:58	28	737/A320	76	85
16:00	38	737/A320	75	81
16:03	51	ATR 72 or Q300	69	76
16:05	42	737/A320	72	80
16:08	36	737/A320	75	81
16:10	35	737/A320	78	84
16:13	46	B1900	72	77
Average	34		73	80
Upper Quartile	n/a		76	84
Maximum	n/a		79	88
Two hour average Leq due to aircraft				56 dBA

⁵ LAFmax – maximum dBA level observed during aircraft pass-by.

⁶ SEL – Single Event Level – The combined equivalent energy of the pass-by compressed into 1 second – useful for averaging.



Assessment against non-mandatory criteria:

AS:2021- Internal L_{max} 55

Typical maximums were in the order of 73-76 dBA L_{max}. This is 18-21dBA above the internal target. As a typical open window would generally only be expected to provide 15dBA reduction to internal classroom type spaces, relying on open hinged/sliding windows for ventilation will not work for typical maximums to comply with the implied MoE requirements.

Alternative means of natural ventilation such as the acoustically treated 'windcatcher' type of roof ventilator used at Ormiston Senior College may be a viable alternative but will need careful design attention to confirm suitability.

With closed windows and an appropriate ventilation/cooling system, facade ratings can be substantially increased through the use of double glazing and roof upgrades to readily meet the MoE objectives.

CONCLUSIONS REGARDING NOISE INTRUSION

Measurements have shown that the proposal can readily meet the MoE DQLS criteria (not part of the RMA planning process) with closed windows in the most exposed locations. A naturally ventilated system may prove viable with careful design.

Notwithstanding the above, any educational facilities located within the MANA shall be fitted with acoustic treatment measures (both architectural treatment and ventilation treatment) in order to achieve compliance with Rule 5.21.4(c) of the District Plan.

NOISE EMISSIONS FROM THE SCHOOL

Noise emissions from school activities will need to be controlled to reasonable levels to protect future neighbours. The Proposed Auckland Unitary Plan is perhaps the most informative document in this regard as the actual development of the school and surrounding residential works are still a number of years away which would be expected to give sufficient time for the PAUP to become operative.

6.2 Noise and vibration⁷

1. Land use controls

1.1 Noise arising from activities within zones

Residential zones – care centres and educational facilities

The noise arising from a care centre or educational facility in a residential zone when measured at or within the boundary of any adjacent property in the residential zones must not exceed the following levels.

Table 2

Monday to Saturday 7am-6pm 55dB LAeq (15min)

All other times 45dB LAeq (15 min)

10pm – 7am 75dB LAFmax

These levels do not apply to the noise from normal recreational activities occurring at a care centre or educational facility site in a residential zone between 8am-6pm on Monday to Friday and 9am-1pm on Saturday.

As a childcare centre is a possible use under the designation, we recommend that some clarity is provided around the dispensation for 'normal recreational activities' that could be construed to include typical outdoor play which operates for most of a day. The absence of any noise control for a childcare centres outdoor activities would clearly be insufficient to protect adjacent residents. Accordingly we recommend the PAUP requirements are adopted with the following additional clarification:

⁷ (from page 319 of the consultation document)



For the avoidance of doubt, outdoor play activities produced by a care centre shall be subject to the limits of Table 2, including any special audible characteristic corrections that apply under NZS 6802

In essence, the PAUP requires activities within the NoR to manage non-sporting noises from noisy activities such as carpark movements, ventilation fans, workshop activities etc. The methods for controlling these activities will vary depending on the extent and location of the noise source. The general suite of management methods to be applied during design could include.

- Careful siting of noisy activities to keep them away from sensitive receivers. This often involves the use of buildings to shield the most affected location
- Attenuators on fans and enclosures around heat rejection systems
- Improved facade constructions for noisy activities such as technology workshops.
- Barriers at boundaries.

SUMMARY & RECOMMENDED CONDITIONS

A school can be established on the site without causing reverse sensitivity effects due to aircraft over flights. Some conditions will assist this and other conditions are recommended for the suitable control of noise to boundary.

Recommended conditions are:

1. Where buildings containing *Activities Sensitive to Aircraft Noise* (as defined in the District Plan) are located wholly or partly within the MANA zone, the following acoustic and related treatment measures shall be installed in any new or relocated classrooms, libraries or halls or in any classrooms, libraries or halls that are the subject of additions or alterations:
 - a) Acoustic insulation and related ventilation and/or air conditioning systems to achieve an internal acoustic environment in each classroom, library and hall (with all external doors and windows of the classrooms, libraries and halls closed) of L_{dn} 40 dBA and
 - b) Internal noise level of L_{max} 55 dBA for school teaching areas, and L_{max} 50 dBA for noise sensitive areas from aircraft fly overs
 - c) In the case of classrooms and libraries, air conditioning and/or mechanical ventilation systems for each classroom and library that are:
 - Designed to achieve indoor air temperatures not less than 16 degrees Celsius in winter and not greater than 27 degrees Celsius in summer at 5% ambient design conditions as published by the National Institute of Water and Atmospheric Research (NIWA); and
 - Capable of providing outdoor air ventilation at the rate of 8 litres of air per second per person for the maximum number of people able to be accommodated in any such room at one time;
 - Capable of enabling, (in the case of classrooms or libraries in which mechanical ventilation systems are used to satisfy the above temperature and outdoor air requirements), the outdoor airflow to be controlled across the range, from the maximum airflow capacity down to the required airflow when all external doors and windows of the classroom or library are closed;
 - Otherwise complying with the New Zealand Standard NZS 4303:1990 *Ventilation for Acceptable indoor air*; and
 - Capable of creating no more than Leq 35 dBA in each classroom, no more than Leq 40 dBA in each library, and no more than Leq 40 dBA in any hallway or corridor. Noise levels from the mechanical system(s) shall be measured at least 1 metre away from any diffuser.
 - d) In the case of halls:

Either:

 - i. A mechanical ventilation system or mechanical ventilation systems for each hall capable of:



- Providing at least 12 litres of outdoor air per second per square metre with all external doors and windows of the hall closed;
- Enabling the outdoor airflow to be controlled across the range, from the maximum airflow down to the rate of 8 litres of outdoor air per second person for the maximum number of occupants able to be accommodated in the hall at one time;
- Otherwise complying with the New Zealand Standard NZS 4303:1990 Ventilation for Acceptable Indoor Air Quality; and
- Creating no more than Leq 35 dBA in each hall, and no more than Le1 40 dBA in any hallway or corridor. Noise levels from the mechanical system(s) shall be measured at least 1 metre away from any diffuser.

Or:

- ii. Air conditioning plus mechanical outdoor air ventilation design to provide 8 litres per second per person of outdoor air, and internal air temperatures in each hall not greater than 27 degrees Celsius at 5% ambient design conditions as published by NIWA. The mechanical system shall create no more than Leq 35 dBA in each hall and no more than Leq 40 dBA in any hallway or corridor. Noise levels from the mechanical system(s) shall be measured at least 1 metre away from any diffuser. These systems shall otherwise comply with NZS 4303:1990.
2. Where Condition 1 requires the Minister to install acoustic treatment and related ventilation measure the Minister shall obtain a certificate from a suitably qualified independent person certifying that the proposed acoustic treatment and related ventilation measures are sufficient to achieve the internal acoustic environment and ventilation requirements specified in this condition, and where the Minister installs any acoustic treatment and/or ventilation or air conditioning measures, the Minister shall:
 - a) Provide the Council with a certificate from an approved person that the installation has been properly undertaken in accordance with sound practice; and
 - b) Not be in breach of Condition 1 where the internal noise standard and related ventilation requirement are not met in each instance provided the relevant certificate required in sub-clause (a) of this Condition 1 has been provided to Council.
3. Prior to commencing any construction activities and as part of the establishment OPW, a Noise Management Plan shall be prepared and a copy provided to Council. This NMP will demonstrate how the construction work will be undertaken to ensure compliance with the requirements of NZS 6803:1999 Acoustics—Construction Noise.
4. Noise to boundary shall be controlled to the following limits: The noise arising from the school or early childhood education facility when measured at or within the boundary of any adjacent property in the residential zone must not exceed the following levels:

Monday to Saturday 7am-10pm 55dB $L_{Aeq(15min)}$

All other times 45dB $L_{Aeq(15min)}$

10pm-7am 75dB L_{AFmax}

These levels do not apply to the noise from normal school recreational activities occurring at the educational facility site in a residential zone between 8am–6pm on Monday to Saturday.

For the avoidance of doubt, outdoor play activities produced by a care centre shall be subject to the above limits, including any special audible characteristic corrections that apply under NZS 6802

We trust the above is of assistance. Please do not hesitate to contact the author if you have any further questions.

NORMAN DISNEY & YOUNG



A handwritten signature in black ink, reading 'R. Finley', with a long, sweeping underline.

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