MARSHALL DAY Acoustics

WESTERN SYDNEY INTERNATIONAL AIRPORT EIS ACOUSTIC PEER REVIEW

Rp 001 20230536 | 21 December 2023

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Project: **Western Sydney International Airport (WSI) EIS – Acoustic Peer Review**

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Report No.: **Rp 001 20230536**

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Final	-	Issued	21 December 2023	A. Morabito/ M. Ottley	M. Ottley/ A. Morabito

Cover photo by: Clay Banks

EXECUTIVE SUMMARY

The construction of Western Sydney International (Nancy-Bird Walton) Airport (WSI) is on track to commence aircraft flying operations in 2026.

An environmental assessment for the project in 2015-2016 informed measures to mitigate and manage the effects of the airport's operation on surrounding communities. An updated preliminary design and environmental assessment phase for single runway operations has since been undertaken, with a *draft EIS* including details of the preliminary flight paths, released in October 2023. Importantly, this draft EIS considers operations and associated impacts based on single runway (direction 05/23) operations only.

With noise impacts identified a key consideration, both stakeholders and key decision makers require complete understanding of the net impact of future aircraft operations.

Marshall Day Acoustics Pty Ltd has undertaken this peer review, to assess the reliability and technical accuracy of the aircraft noise assessment presented in the draft EIS, in turn assisting members of Western Sydney Regional Organisation of Councils Ltd (WSROC) to reach an informed view on potential aircraft noise impacts within their respective Local Government Areas (LGA).

This peer review considers:

- An evaluation of whether the noise assessment has been undertaken in accordance with relevant guidelines and methods with respect to aircraft noise
- A review of whether the underlying assumptions used to inform the assessment (including operational assumptions, and modelling assumptions where appropriate) are plausible
- A review of the mitigation and management measures proposed and advising on their adequacy
- An evaluation whether the conclusions reached in the studies are valid, i.e. whether the predicted impacts are in accordance with published standards and guidelines, and
- Whether the conclusions of the assessment are a realistic reflection of the actual impacts.

The peer review considers the broader assessment of noise impacts presented in other related sections of the draft EIS including airspace architecture, health and social impacts. The review of these additional sections has been concerned solely with matters related to the aircraft noise.

The noise modelling is considered to generally provide a reasonable representation of the extent of noise impacts for the flight tracks and operating scenarios modelled. Specifically, predicted noise levels have been for a range of operating scenarios and aircraft noise information produced in a range of formats consistent with current guidelines for identifying areas potentially affected by aircraft noise.

Aircraft noise impacts are an unavoidable consequence of aircraft operations in urban environments. A balance therefore needs to be achieved between the development of infrastructure to respond to the growing demands of a major city and the protection of amenity for neighbouring sensitive land uses.

Determining whether this balance has been achieved is ultimately a matter for regulatory authorities. While this peer review has identified limitations in the present assessment, it is not intended to infer that the airport operations are unsuitable. Rather, given the residual uncertainties in the assessment, further information and assessments are considered warranted to address aircraft overflight noise impacts, prior to finalisation of the EIS.

This peer review has identified several limitations concerning the content of the draft EIS, and therefore further information and assessments are recommended, as follows:

- The preliminary design of the flight paths for WSI is understood to have been based broadly on not impacting existing operations of the broader Sydney Basin airspace, i.e. designed independently of existing Sydney Basin airspace flight paths, including interface with Sydney (Kingsford Smith) Airport flight paths. The exceptions are the proposed alternative flight path options during Sydney (Kingsford Smith) Airport curfew hours (night-time defined, 11 pm to 5:30 pm), noting less congestion/constraint.

  The WSI preliminary flight paths are such that they do not impact existing flight paths. There is an opportunity to consider a wholistic approach to broader Sydney Basin airspace flight path design, such that potential noise impacts around WSI could be mitigated further.

- Noise predictions are provided for various time periods, including 24 hour, Day (defined as 5:30 am to 11 pm) and Night (defined 11 pm to 5:30 am to align with Sydney (Kingsford Smith) Airport curfew hours) period. The night defined hours that form the basis of the impact assessment do not align with industry standard / accepted practice for describing aircraft noise impacts. This includes alignment with thresholds typically used for the assessment of impacts such as sleep disturbance (i.e. L_{night}), which adopts a broader night defined period, 8 hours 11 pm to 7 am.

  It is recommended that noise prediction information and subsequent assessment of impact and mitigation for the night period considers a broader defined night period.

- Regarding assessment of impact within the Greater Blue Mountains World Heritage Area:

  Noting the low ambient sound environment, the assessment considers a threshold of 60 dB L_{Amax} which does not adequately account for the impacts in wilderness areas.

  It is recommended that the final EIS provide noise level information at lower thresholds, supported by validation work to improve the reliability of predicted noise level data at low sound pressure levels that are below the validated range of practical noise modelling tools. The analysis should account for the amount of time aircraft noise will be audible in these areas.

  Monitoring is recommended so that aircraft noise impacts as a result of the introduction of new airport operations are proactively identified and addressed where issues arise. This should include user experience and aircraft noise surveys be carried out to develop a dose-response relationship specific to the Greater Blue Mountains World Heritage Area.

- As part of finalising the flight path design ongoing consultation should occur with the community and stakeholder reference group to minimise to the extent practicable the impact of aircraft overflight noise, having consideration to Overflight avoidance, Overflight dispersion, and Overflight mitigation procedures.

Conducting these assessments as part of the final EIS process represents an opportunity to:

- Provide clarity to affected communities and stakeholders about the nature of the noise impacts,
- Provide clarity to regulators about the form of noise controls which will be needed in the project approval to ensure that noise is appropriately managed, and
- Reduce the potential for unforeseen impacts and the associated risk of reactionary noise management procedures which could subsequently jeopardise the operational flexibility of the airport.

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1.0 INTRODUCTION

The construction of Western Sydney International (Nancy-Bird Walton) Airport (WSI) is well underway and on track to commence aircraft flying operations in 2026.

An environmental assessment for the project in 2015-2016 informed measures to mitigate and manage the effects of the airport's operation on surrounding communities.

An updated preliminary design and environmental assessment phase for single runway operations has since been undertaken, with a draft EIS including details of the preliminary flight paths, [1] released in October 2023.

With noise impacts identified a key consideration, both stakeholders and key decision makers require complete understanding of the net impact of future aircraft operations.

This document outlines findings of Marshall Day Acoustics' (MDA) peer review of the aircraft noise assessment presented in the draft EIS.

1.1 Scope

The objective of the peer review was to assess the reliability and technical accuracy of the aircraft noise assessment presented in the draft EIS, in turn assisting members of Western Sydney Regional Organisation of Councils Ltd (WSROC) to reach an informed view on potential aircraft noise impacts within their respective Local Government Areas (LGA).

The scope associated with this peer review are as follows:

- Evaluation on whether the noise assessment has been undertaken in accordance with relevant guidelines and methods with respect to aircraft noise,
- Reviewing the underlying assumptions used to inform the assessment (including operational assumptions, and modelling assumptions where appropriate) are plausible,
- Review of the mitigation and management measures proposed and advising on their adequacy,
- Evaluating whether the conclusions reached in the studies are valid, i.e. whether the predicted impacts are in accordance with published standards and guidelines, and
- Whether the conclusions of the assessment are a realistic reflection of the actual impacts.

1.2 Limitations

The primary documents considered as part of this review are as follows:

- Part C: Environmental impact assessment, specifically *Chapter 11 Aircraft noise*, referred herein as the *EIS noise chapter*
- Technical Paper 1: Aircraft Noise, referred herein as the *Technical Paper 1 (TP 1)*
- Additional sections of the draft EIS, to provide commentary of the broader assessment of noise impacts presented in other related sections, e.g. airspace architecture, health and social impacts.

The peer review considers the broader assessment of noise impacts presented in other related sections including airspace architecture, health and social impacts. The review of these additional sections has been concerned solely with matters related to the aircraft noise. In particular, the review of these specialist sections was limited to technical matters concerning noise modelling scenarios, noise level information and noise mitigation measures.

[1] *Western Sydney International (Nancy-Bird Walton) Airport – Airspace and flight path design, Draft Environmental Impact Statement*, https://www.wsiflightpaths.gov.au/digital-draft-eis/, released for public exhibition 24 October 2023

This peer review has been conducted based solely on the public available documentation. Tasks not conducted as part of this peer review include:

- Consultations with any members of the project team involved in preparing the draft EIS
- Review of noise modelling files, or
- Noise modelling for the purpose of validating any of the results presented in the draft EIS.

2.0 NOISE ASSESSMENT

2.1 Operating modes

The environmental assessment for the project prepared in 2016,[2] considered a range of operating scenarios as follows:

- Stage 1 development comprising a single 3,700 m runway with 63,000 aircraft movements per year which are projected to occur by 2030;
- Longer term development of the single runway to facilitate 164,000 aircraft movements per year which are projected to occur by 2050; and
- Longer term development with an additional parallel runway to enable additional capacity increases to 370,000 aircraft movements per year which are projected to occur by 2063.

Importantly, **the updated draft EIS (2023) is based on single runway (direction 05/23) operations only** but considers a range of scenarios depending on the planned activity level (PAL) and year in which that is expected/forecast to occur, i.e.:

- PAL 1 2033 – 81,000 air traffic movements
- PAL 2 2040 – 107,000 air traffic movements
- PAL 3 2050 – 226,000 air traffic movements (near capacity for single runway)

Noise prediction information and therefore subsequent description of impact and mitigation is provided for the above PAL. Additionally, each scenario considers various runway modes, including the use of preferred runway direction during day/night and reciprocal runway operations (RRO) (night period only, and suitable weather and traffic conditions), which allow for arrivals on runway 05 (from the south-west) and departures on runway 23 (towards the south-west).

Operating modes, including runway and flight path choice, are noted as only being suitable during Sydney (Kingsford Smith) Airport curfew hours, i.e. night-time defined hours, 11 pm to 5:30 pm.

TP 1 does not appear to provide sufficient information about the frequency of each operating modes, though it is acknowledged this would primarily be driven by meteorological conditions as to which runway could be used. Accordingly, the resultant overall predicted noise exposure contours are provided based on the annualised average over the year.

It is recommended that discussion is provided in the final EIS on the frequency and feasibility of the operating modes, including RRO, noting the limited meteorological conditions under which this could occur (less than 10 %).

Matters relating to the suitability of the operating modes have not been considered as part of this review, and like aircraft fleet, would be subject to the technical review process by Airservices Australia once an Australian Noise Exposure Concept (ANEC) is put forward for endorsement as an Australian Noise Exposure Forecast (ANEF), i.e. contours to be adopted and used for land use planning.

[2] https://www.westernsydneyairport.gov.au/media-resources/resources/environmental-assessment

2.2 Aircraft fleet and operations

The aircraft noise modelling has been based on a range of different aircraft types to represent the overall mix of aircraft that is expected to operate from 2026. The selected aircraft types that have been included in the modelling are considered appropriate, described in section 8.6 of *TP 1*.

Further, the noise modelling has opted for a conservative approach by assuming that all future aircraft operations are characterised by the noise emissions of existing aircraft. The draft EIS and *TP 1* acknowledge that future aircraft types are likely to be quieter than existing and those considered in the modelling. The draft EIS and resultant predicted noise contours are therefore based on current aircraft types with higher noise emissions; this is considered reasonable and conservative.

Matters relating to the suitability of the aircraft types and fleet mix are outside of our area of expertise and have not been considered as part of this review. It is noted that these would be subject to the technical review process by Airservices Australia, once an ANEC is put forward for endorsement as an ANEF.

2.3 Flight paths

The preliminary design of the flight paths for WSI is understood to have been broadly based on not impacting existing operations of the broader Sydney Basin airspace.

As such, the preliminary flight paths have been designed independently of existing Sydney Basin airspace flight paths, including interface with Sydney (Kingsford Smith) Airport flight paths. The exceptions are the proposed alternative flight path options during Sydney (Kingsford Smith) Airport curfew hours (night-time defined, 11 pm to 5:30 pm), noting less congestion/constraint.

As the WSI preliminary flight paths are such that they do not impact existing flight paths, this presents an opportunity to consider a wholistic approach to broader Sydney Basin airspace flight path design, such that potential noise impacts around WSI could be mitigated further.

It is noted the authors of this peer review are not aviation experts, and therefore matters relating to the suitability of the flight paths have not been considered as part of this review. The following sections outline preliminary airspace management strategies for minimising aircraft noise impacts and should be considered in the broader context the whole Sydney Basin airspace.

2.3.1 Conditions of approval

The original approval conditions[3] for the Stage 1 Development of a Western Sydney Airport include requirements to minimise the impact of aircraft overflight impacts through the flight path design process. Specifically, elements of Conditions 16 state the following:

> *16. Airspace design process*
>
> *(2) The airspace and flight path design are to be developed by a steering group led by the Infrastructure Department and involving Airservices Australia and the Civil Aviation Safety Authority. After an Airport Lease is granted the ALC will also be invited to participate in the steering group. The Infrastructure Department must establish a community and stakeholder reference group (Forum on Western Sydney Airport) which will operate until the end of the detailed design stage identified in Table 10 in Part 2 of the Airport Plan.*
>
> *(3) In developing the airspace and flight path design, the steering group must conduct public consultation with stakeholders who include the aviation industry, the community and state and local government authorities.*

[3] Australian Government, 2016, *Conditions for the Stage 1 Development of a Western Sydney Airport*

(5) The airspace and flight path design must take account of the following principles, in addition to the principles in section 2.2.5 of the Airport Plan:

(d) airspace and flight path design must minimise to the extent practicable the impact of Aircraft Overflight Noise on the following:

(i) residential areas;

(ii) Sensitive Receptors;

(iii) the Greater Blue Mountains World Heritage Area – particularly areas of scenic or tourism value; and

(iv) Wilderness Areas

It is recommended that as part of finalising the flight path design, the above condition remains in place, i.e. that ongoing consultation occurs with the community and stakeholder reference group to minimise to the extent practicable the impact of aircraft overflight noise.

2.3.2 Management strategies

As part of finalising flight path design, it is recommended that the following airspace management strategies for minimising aircraft noise impacts be considered:

- Overflight avoidance
- Overflight dispersion, and
- Overflight mitigation procedures.

Overflight Avoidance

The preferred method of managing aircraft noise intrusion is to avoid overflying sensitive locations at a noise level which is audible.

Inevitably there are practical challenges to implementing this strategy in all instances; redirected flights will have impacts in other potentially sensitive locations and these alternative impacts must be weighed against the benefits afforded to the areas that are avoided. It is recommended to identify areas of higher value (including sensitive/wilderness), and therefore locations where avoidance of overflight should be prioritised.

The extent of the areas to be ideally avoided is therefore likely to be large. Nonetheless, the most sensitive areas should be identified with consideration to the following, but not limited to:

- Typical sensitivity of use (e.g. residential areas including for sleep, education facilities, areas sought after for their natural heritage, character and environment)
- Existing background/ambient noise levels
- Areas of remoteness from transportation and other anthropogenic noise sources, and
- Consultation with relevant stakeholders, including where flight paths are over national park areas, the relevant authorities.

As well as avoidance of locations, consideration should be given to how avoidance of sensitive time periods could be practically implemented – in terms of sensitive times of the day (such as Night time sleep periods), as well as potential weekly and seasonal changes in sensitivity associated with time of use.

Overflight Dispersion

If and where aircraft overflight of sensitive areas cannot be practically avoided, flight tracks are recommended to be dispersed across the widest practical range to avoid concentration of audible aircraft overflights in particular areas, and to maximise the period between audible aircraft overflights at any given location.

Overflight Procedures

If and where aircraft overflight of sensitive areas cannot be practically avoided, flight procedures should be selected to reduce the noise experienced at ground level. These procedures are broadly similar to those which may be considered for urban areas, however the following specific options for the Blue Mountains area and national park areas should be evaluated, given their proximity to WSI:

- Flight routing in combination with departure and arrival procedures which enable the aircraft to reach or maintain the greatest possible altitude over sensitive areas, and
- Adoption of reduced thrust (engine power) procedures and maximising altitude of overflights where safety permits, e.g. for arriving aircraft, the adoption of constant descent procedures, and for departing aircraft, climb straight along the runway centreline as far as practical before turning to their destination. However, assessing these procedures will require a trade off, i.e. while reducing thrust leads to reducing noise levels, there is the potential to increase the duration that the aircraft event is audible.

2.3.3 Sydney (Kingsford Smith) Airport flight paths changes

While the preliminary design of the flight paths for WSI is broadly exclusive of changes to Sydney airspace basin, there will be limited changes to existing Sydney (Kingsford Smith) Airport (KSA) flight paths. These changes are described in *Technical Paper 13: Facilitated changes* (hereafter *TP 13*).

Proposed changes to existing Sydney (Kingsford Smith) Airport flight paths are described in Appendices A-E of *TP 13*. Quantitative data includes dwelling and population counts within noise contours (N60 and N70, i.e. number of aircraft events above maximum noise level 60 dB L_{Amax} and 70 dB L_{Amax} respectively) associated with the proposed change in flight paths.

Of note are the proposed KSA Runway 25 jet departure flight path changes to the west:

- Increase in aircraft movements (above level of 60 dB L_{Amax}) over areas north-west of KSA, e.g. Parramatta and surrounding area,
- Decreased movements over areas south-west of KSA, e.g. Mortdale, Oatley, and
- Net change of 73 % increase in population within N60 10 event contours

The Runway 34L jet departures demonstrate changes that are broadly similar to existing flight paths, with a small increase in aircraft movements (above level of 60 dB L_{Amax}) over areas north-west, e.g. Paramatta and surrounding area.

While proposed changes to existing KSA flight paths are described, the extent of impact may warrant further investigation of residual impacts, especially in areas not previously impacted by aircraft noise. Additionally, the assessment and description of change in aircraft noise presented in *TP 13*, does not appear to consider the cumulative impact of KSA and WSI impacts on areas newly impacted by WSI aircraft and also subject overflight of KSA aircraft operations as a result of flight path changes.

2.4 Method

Environmental noise may result in several different direct and indirect impacts. *TP 1* addresses the range of aircraft noise impacts as follows:

- Assessment of the extent of potential aircraft noise impacts based on a range of modelling scenarios and metrics used to present aircraft noise information.
- Assessment of the effect and significance of these noise impacts in other sections/stand alone technical papers related to land use and planning, social, including property values and human health.

This is not an uncommon approach, particularly given the assessment of the effect and significance of noise impacts often requires specialist knowledge beyond the areas of expertise of acoustic consultants. A complete appreciation of noise related impacts therefore requires reference to a range of distributed sections throughout the overall EIS.

Accordingly, while *TP 1* provides the primary basis for the comments in this peer review, additional commentary is provided in relation to technical noise matters as they are presented in the assessment of noise effects in other chapters and specialist reports.

2.4.1 Noise model

Noise modelling in the draft EIS has been undertaken using the Aviation Environmental Design Tool (AEDT) developed by the United States Federal Aviation Authority, version 3e.

AEDT is a computer model designed to predict long term noise levels in the areas surrounding an airport. The long term noise level is calculated using the concept of an annual average day, accounting for the number of operations of each aircraft type, using a given runway, and flying in a given direction, averaged throughout the year. Calculations are performed in accordance with recognised US[4] and European[5] documents.

AEDT can be configured to calculate the Australian Noise Exposure (ANE) metric, used solely for land use planning purposes in Australia. As such, the program is almost exclusively used in Australia and is the program currently approved by Airservices Australia, the government-owned corporation responsible for endorsing civil inputs and resultant ANEF contours for Australian airports.

Beyond calculating the ANE metric, AEDT can also calculate other noise exposure and time-based metrics, including equivalent noise level (L_{Aeq}), day night noise level (DNL), time above (TALA), time audible (TAUD) etc. as well as maximum noise level metrics (L_{ASmax}).

The prediction of single-event metrics such as the L_{ASmax} is important, as these provide the basis for the types of additional noise information such as single event maximum noise level and N-Contour maps which are used to describe aircraft noise impact throughout the draft EIS. However, these predictions are to be regarded as indicative only, noting the potential for variation in noise levels for the same aircraft operation for a variety of reasons. The use of AEDT for calculating maximum noise levels is considered reasonable, however such calculations should be primarily used for understanding the *range* of potential noise levels and for comparison of different scenarios, rather than the direct prediction of the maximum noise level expected to be measured in practice.

[4] Society of Automotive Engineers, 1986, Committee A-21, *Procedure for the Computation of Airplane Noise in the Vicinity of Airports*, SAE-AIR-1845

[5] European Civil Aviation Conference, December 2005, ECAC-CEAC Doc 29 3rd Edition, *Report on Standard Method of Computing Noise Contours around Civil Airports Volume 2: Technical Guide*

2.4.2 Aircraft noise metrics

As discussed in Section 2.1 of this peer review, noise prediction information and therefore subsequent assessment of impact and mitigation is based on single runway (direction 05/23) operations only.

The extent of potential aircraft noise impacts is based on a range of modelling scenarios and for different defined time periods. Different noise metric/outputs are used to assess the effect and significance of these impacts. The following provides a discussion of the key forms of information that have been provided in *TP 1* for the assessment of noise impacts.

N-contour / Number Above

N-contour or Number Above (NA) maps illustrate the number of aircraft events predicted to exceed a maximum noise level threshold in a specified time period. The noise level thresholds are 70 dB L_{Amax} and 60 dB L_{Amax}, resulting in calculated N70 and N60 values for different time periods and number of events, ranging 2 – 100+ events.

These threshold values are generally appropriate, with the following observations noted:

- The 70 dB L_{ASmax} threshold is commonly used for documenting aircraft noise operations during which are at a level that could give rise to speech interference within a dwelling with partially open windows.
- The 60 dB L_{Amax} threshold is generally suitable for assessing noise in urban areas. However, for the assessment of amenity impacts in quiet locations where natural soundscapes are valued (e.g. the Blue Mountains), lower predicted noise levels would be informative. It is acknowledged that the uncertainties associated with the prediction method increase with distance, meaning the lower values of predicted noise levels are subject to a greater degree of uncertainty. Predicted noise levels are however provided at discrete receptor locations in areas such as the Blue Mountains.
- The information concerning the number of events exceeding these thresholds is generally provided as 24-hour average (N70 and N60) or night-time values (11 am – 5:30pm, N60 only). Further data to address the number of events expected to occur during specific time periods could provide a useful indication of impacts during more sensitive times (e.g. typical sleeping hours, school times).

Population statistics / dwelling counts within each contour (aircraft event numbers above specified threshold) are provided for each modelled scenario and defined time period.

Single event maximum noise level contours

Single event maximum noise level contours are presented for a range of the loudest and most common aircraft proposed to operate, with contours ranging 60 – 90 dB L_{Amax}.

It is noted that the contours refer to a worst-case scenario of a single noise event occurring on any of the flight tracks used by the aircraft, i.e. where a departure track splits into two (2), the contour includes the maximum noise level on both tracks, thus providing an overestimate of the maximum level from a true single event, though equally show the highest noise level from a potential aircraft overflight at a given location from the aircraft on any flight track. This approach does introduce artefacts into the contours at positions at the outer extent.

Australian Noise Exposure Concept (ANEC)

An ANEC is provided for each scenario modelled and an overall 'composite' ANEC showing the greatest extent of each scenario.

The ANE metric is an exposure based noise metric, used solely for land use planning in Australia. However, the ANEC can be useful in understanding noise exposure around an airport.

A number of studies, including the study upon which the ANE was based, have determined a relationship between noise exposure around an airport and community annoyance.

The ANEC contours provide limited information regarding land use planning, as these would typically consider longer term, ultimate capacity scenarios. Notwithstanding, the overall 'composite' ANEC has been used as the contour set to inform the draft noise insulation program, refer Section 4.3.

Respite charts

Respite charts are used in *TP 1* as a means for describing the % of day/nights when no aircraft movements are expected on given flight corridors for given scenarios. In addition to overall respite charts, and consistent with SA HB 149,[6] it would be prudent to consider labelling flight corridors with the following:

- The daily range of movements, in the form of a minimum and maximum number of movements (noting average daily movements are included)
- Movements in that corridor as an annual percentage of all movements at the airport
- The percentage of days per year with no movements

Separate flight corridor maps may be necessary should the above information vary significantly for different times of the day, weekdays or seasons.

2.4.3 Time definition

Noise predictions, depending on the metric, are provided for various time periods, including 24 hour, Day and Night period.

TP 1 adopts the Day period as 5:30 am to 11 pm and the Night period 11 pm to 5:30 am, to align with Sydney (Kingsford Smith) Airport curfew hours, though it acknowledges that actual hours can vary.

The night defined hours that form the basis of the impact assessment do not strictly align with industry standard / accepted practice for describing aircraft noise impacts.

For example, the *National Airports Safeguarding Framework* consider number of night-time aircraft noise events for the period defined 11 pm to 6 am. It is acknowledged that the Safeguarding Framework proposes the use of these supplementary metrics for defining the extent of aircraft noise around airfields and assist in land use planning decisions, for rezoning of greenfield areas to permit noise sensitive uses, rezoning of brownfield areas to permit noise sensitive uses, and assessment of new development applications for noise sensitive uses within existing residential areas.

Importantly the night definition in *TP 1* paper does not align with thresholds typically used for the assessment of impacts such as sleep disturbance (i.e. L_{night}). This metric adopts a broader night defined period, 8 hours between 11 pm and 7 am.[7] Further discussion provided in Section 2.5.

It is recommended that noise prediction information and subsequent assessment of impact and mitigation for the night period considers a broader defined night period.

[6] Standards Australia, 2016, *Acoustics—Guidance on producing information on aircraft noise*, SA HB 149:2016, Standards Australia, Sydney

[7] World Health Organization (WHO) *Guidelines for Community Noise*

2.4.4 Seasonal variation

One of the most significant factors related to variations in aircraft noise is wind direction and speed, which will directly influence runway use and hence type of aircraft operation over a given area. This is described throughout the draft EIS, including associated noise predictions for the various runway operating modes, as discussed in Section 2.1.

AEDT noise model calculations require average atmospheric parameters for the airport to be defined, including average temperature, relative humidity and pressure. The effect of the atmospheric parameters can affect calculated noise levels through varying aircraft position (altitude and thrust influenced by air density) and varying the rate of absorption as sound propagates through the atmosphere. The selection of parameters is described and included in section 8.5 of *TP 1*, for the annual average and summer/winter conditions.

However, the noise prediction information is only provided for annual average conditions, and therefore subsequent assessment of impact does not consider periods of the year which give rise to increased aircraft noise levels.

It is recommended that discussion is provided in the final EIS on the frequency of periods of the year in which meteorological conditions would result in increased aircraft noise levels.

2.5 Health/social impacts

Health and social impacts are described in *TP 1*, with reference to noise metrics and threshold values for onset of impact, adopted from relevant guidelines, including World Health Organization (WHO). The authors of this peer review are not health experts and therefore can not comment on the appropriateness or otherwise of the trigger levels.

The health/social impacts considered are 'all adverse effects,' sleep disturbance (including percentage highly sleep disturbed), hearing impairment, cardiovascular effects (incidence of IHD), annoyance (percentage of highly annoyed), and cognitive impairment in children (reading and oral comprehension).

Noise modelling information does not appear to be provided for several of the noise metric/threshold values for health impact, which are described in subsequent sections.

2.5.1 Sleep disturbance

The health technical paper provides information concerning sleep disturbance, using a dose-response relationship between total noise exposure level during the night period, 11 pm – 7 am ($L_{night,\ 11pm\text{-}7am}$) and the percentage of a community highly sleep disturbed (%HSD).

The EIS assessment of sleep disturbance as a health impact notes there are no specific guidelines for determining what would be an acceptable, or unacceptable '%HSD' as a result of a new project. The health technical paper assessment adopts a 3% HSD change relative to existing conditions as a trigger for significance.

The paper then includes the percentage of population in areas surrounding the airport, where the calculated %HSD is considered of significance. While the actual predictive noise modelling information is not provided in the technical papers of the draft EIS, it is assumed that it was developed separately for the purpose of the detailed health impact assessment (i.e. the noise model was configured to calculate the $L_{night,\ 11pm\text{-}7am}$. This is however not explicit/clear, and it is recommended that the noise prediction information presented, and hence EIS assessment of sleep disturbance, is based on the adopted metric.

The additional maximum noise level, from individual aircraft overflights are also adopted for identifying areas where sleep may be disturbed. In this case, the World Health Organization (WHO) value 52 dB L_{Amax} (external level) is the trigger for considering potential impact, however the health technical paper does not specifically state the number of events exceeding this trigger, which are sufficient to represent an increased risk of sleep disturbance.

Information is provided in the technical noise paper for the total number of people (population count) exposed to even a relatively low number of events (i.e. down to 2 events) for the varying modelled scenarios. For context, the WHO guidelines[8] suggest that noise levels exceeding 60 dB L_{Amax} (external) (45 dB L_{Amax} internal) should ideally not occur more than 10-15 times per night when assessing dwellings with partially open windows.

A large number of the population are predicted to experience external maximum noise levels which are sufficient to result in internal noise levels corresponding to sleep disturbance thresholds. This indicates a large number of people may need to sleep with windows closed to maintain an acceptable internal amenity. The extent of this potential impact depends on the prevalence of existing ambient noise levels which could prompt an individual to sleep with closed windows, irrespective of the WSI.

Of note are the N60 10 event night contours which show an increase from 770 people (240 dwellings) in year 2033, to more than 28000 people (1000 dwellings) by 2055.

2.5.2 Community annoyance

The health technical paper provides discussion of potential annoyance, noting that annoyance is most prevalent response in a population exposed to environmental noise, though acknowledges the impact as 'less serious health effect than self-reported sleep disturbance.'

The assessment includes a discussion of a range of updated research studies (since the time of previous EIS) concerning dose-response relationships between total noise exposure levels (L_{den}) and the percentage of a community likely to be highly annoyed (%HA).

It is acknowledged that there are no specific guidelines for determining what would be an acceptable, or unacceptable 'annoyance' from a change in noise exposure as a result of a new project.

However, a number of recent comprehensive airport studies, two of the most significant studies, FAA Neighbourhood Noise Study 2021[9] and the Guski (WHO) Aircraft Noise Annoyance 2018,[10] which indicate that community annoyance from aircraft noise appears to have increased over the last 20 years by approximately 10 dB; a significant increase in sensitivity.

The health technical paper assessment includes discussion of annoyance by quantifying the percentage of population in areas surrounding the airport, where the calculated %HA is 6.5% or higher than existing conditions. This %HA is based on the Health Canada study, which also identified this threshold as the basis for considering noise mitigation measures.

[8] World Health Organization, 1999, *Guidelines for Community Noise*

[9] U.S Department of Transportation (FAA), 2021, *Analysis of the Neighbourhood Environmental Survey*. National Technical Information Service.

[10] Guski, R., Schuemer, R. and Schreckenberg, D., 2018, *Aircraft noise annoyance - Present exposure-response relations*. Euronoise 2018. Crete: European Acoustics Association.

3.0 GREATER BLUE MOUNTAINS WORLD HERITAGE AREA

3.1 Overview

This section provides a high level review of *Technical Paper 14: Greater Blue Mountains World Heritage Area* (hereafter *TP 14*). The draft EIS requirements require the assessment to provide Description of the Environment (reference 6.0) and Describe and assess relevant impacts (reference 7.1). This peer review has identified a number of areas where these have not been satisfactorily described for the Greater Blue Mountains World Heritage Area (GBMWHA).

In 2017, following the release of the Western Sydney Airport EIS in 2016, Blue Mountains City Council (BMCC) provided input into the airspace and flight path design for the airport. This was through a public consultation process facilitated through the community and stakeholder reference group, *Forum on Western Sydney Airport*, established as part of the development approval conditions for the operation of the Airport. As part of this work, BMCC commissioned MDA to prepare guidance for minimising aircraft overflight noise impacts over the GBMWHA. That review was published as the Guidelines For Minimising Aircraft Overflight Impacts (hereafter GFMAOI) in July 2017.[11]

The GFMAOI identified that ambient noise levels within the GBMWHA would be expected to be very low in locations that are remote from roads and water courses. For example, underlying background levels in the range of 20 to 40 dB L_{Aeq} would be expected to occur regularly in many areas. The draft EIS notes predicted aircraft noise levels would be typically in the range of 45 to 65 dB L_{Amax} (see Table 5.6 of *TP 14*) when flying at high altitude over the GBMWHA. These levels of overflight noise would generally be considered relatively low in an urban context, where ambient levels can vary between 40 to 60 dB L_{Aeq}. However, amidst the low ambient noise levels expected across large parts of the GBMWHA, an aircraft overflight would be clearly distinguishable (audible) and potentially prominent.

WSI is to operate 24 hours per day, these impacts are predicted to occur during both the day and night.

The GFMAOI identified from literature, particularly in relation to studies of user and visitor surveys of national park or tranquil areas, that noise impacts in national park or tranquil areas are not determined solely by the level of the noise, and are likely to relate to:

- Audible aircraft noise altering the perceived character of the area, i.e. a change from natural soundscape to a soundscape overlaid with regular man-made sources of intrusion,
- Increased awareness and sensitivity to noise intrusion in areas of the park which are valued for their tranquillity and natural soundscapes (e.g. areas where there is little to no intrusion from artificial sources of noise), and
- A reduction in the duration of periods that are free from audible artificial noise intrusion as a result of an increase in the number of aircraft movement.

These factors mean that the duration that an aircraft overflight is audible becomes more important when assessing the impact of aircraft overflights which result in relatively low noise levels. This is in contrast to impact assessments for urban areas that involve addressing relatively high noise levels which occur for briefer periods. It is therefore particularly important to account for the duration of the noise when assessing low noise level intrusion in quiet areas, as aircraft noise is present at these low noise levels but for a longer period.

[11] https://www.bmcc.nsw.gov.au/sites/default/files/docs/GuidelinesForMinimisingAircraftOverflightImpacts.pdf

The GFMAIO identified a range of actions that would be required to assess and mitigate impacts of the WSI on the GBMWHA. The recommended actions comprise:

- Quantitative noise assessments that should be carried out to assess alternative operating strategies,
- Operational noise mitigation measures that should be evaluated as part of the airspace design, and
- Longer term measures for managing the noise impacts of aircraft overflights.

The draft EIS response to these requirements is detailed in the following subsections.

3.2 Quantitative noise assessments

Noise data in the form of a variety of noise metrics needs to be collated and compared to assess the aircraft noise overflight impacts of flight path/airspace design and operating strategies.

The type of noise data used to compare and assess alternative operating strategies must be selected to reflect the type of impact that could occur as a result of aircraft overflight; i.e. a degradation in the experience of visitors to the Blue Mountains as a result of regular audible aircraft overflight noise intrusion on the natural soundscape. Data will therefore be needed to describe both the natural sound environment and aircraft noise intrusion.

In relation to the natural sound environment, A-weighted background sound pressure levels represent the most common method of quantifying an environment which may be affected by the introduction of a new sound source. Background sound levels do not provide a measure of the intrinsic value of a soundscape that is composed entirely of natural sound sources. However, background sound levels are used in environmental noise policies throughout Australia, including NSW, as a baseline metric for gauging the intrusiveness of a new or altered noise source. The background sound level therefore has relevance when assessing the potential for aircraft noise to impact on quiet areas within the Blue Mountains. For consistency with established NSW policies, it is recommended that the background sound pressure levels are established at representative locations within the GBMWHA using the $L_{A90,T}$ noise metric – the sound level that is exceeded for 90 % of a measurement period of duration, T.

Section 4.5 of *TP 1* identifies that **none of the monitoring locations selected for the draft EIS are within wilderness areas of the GBMWHA** and there is no evidence of any quantification of ambient soundscape in the GBMWHA, which would be required to appropriately assess impacts.

In relation to aircraft noise levels no single aircraft noise metric can be relied upon in isolation to provide a complete representation of the potential impact. A range of aircraft noise metrics should therefore be collated and considered as part of the assessment, and account for:

- The level of aircraft noise overflights,
- The duration of audible noise associated with individual aircraft overflights, and
- The regulatory of aircraft overflight noise.

The above factors are commonly accounted for through the use of exposure metrics (e.g. average or equivalent noise levels) which combine the total sound energy of the noise in question, and therefore implicitly account for the noise levels, event durations and event frequency. However, the previous literature review indicated that exposure metrics are unlikely to be suitable for this type of assessment. Similarly, experience in aircraft noise assessment in Australia has shown that exposure metrics are not well suited to describing the noise in a way that individuals experience the noise or in a way that stakeholders can readily interpret. For these reasons, it is not recommended to adopt solely exposure metrics for assessing aircraft noise overflight impacts in the GBMWHA and national park.

3.2.1 Maximum noise level

Instead, adopt maximum noise levels L_{Amax} of aircraft overflights, as presented in the draft EIS. However, maximum levels significantly lower than the ranges considered in the EIS would need to be assessed (i.e. well below 60 dB L_{Amax}) to account for events at sound pressure levels which, although would generally be considered low in a typical urban setting, have the potential to significantly alter the character of the soundscape in quiet wilderness areas. *TP 14* states that "*Overall, no specific aircraft noise criteria for conservation and wilderness areas has currently been developed. In Australia, assessments of new airport developments use the 70 dBA L_{Amax} and 60 dBA L_{Amax} noise exposure levels as impact thresholds for day and night time operations respectively.*"

The basis and background for these thresholds are not provided. As outlined above these thresholds are not considered appropriate for the assessment of impact in the GMBWHA. The draft EIS does present predictions below 50 dB L_{Amax}, however **the assessment of impact considers a threshold of 60 dB L_{Amax}** (*TP 14* Section 5.3.2.3 and Table 5.7) **which does not adequately account for the impacts in wilderness areas.**

It is recommended that the final EIS provide noise level information at lower thresholds, supported by validation work to improve the reliability of low sound pressure levels that are below the validated range of practical noise modelling tools.

3.2.2 Event numbers

A measure of the number of audible aircraft events expected within key periods - as a minimum, the day, evening and night periods and also periods of expected visitor duration to the areas. This type of metric is similar to the Number Above metric used in the draft EIS (e.g. the N60 and N70), but rather than present the number of aircraft events above a sound pressure level that is defined as a threshold for disturbance or annoyance, this should indicate the number of times that aircraft noise intrudes on the natural soundscape. In practice, generating this type of information will require defining a practical sound pressure level threshold, based on a measure of background noise conditions, above which audible aircraft noise is likely to be audible for a significant portion of an overflight (i.e. as opposed to momentarily audible). The draft EIS does not present a practical sound pressure level threshold specific to the GBMWHA, instead comparing impact to an N60 threshold, which does not capture all audible noise events in wilderness locations.

The number of events calculated to be audible at key sensitive areas (Table 5.6 of *TP 14*) therefore significantly underestimate the number of audible aircraft overflights.

As noted in Section 3.2.1, including noise level information at lower thresholds in the final EIS will provide greater clarity on the number of audible aircraft overflights at key areas within GBMWHA.

3.2.3 Time-based metrics (event duration and respite periods)

A measure of the amount of time that aircraft noise will be audible (e.g. the TAA or %TAA) relate to audibility as judged by comparisons with the ambient sound level. The ambient sound level is generally taken to represent an average of all sound sources other than the source being investigated. However, in natural soundscapes, average parameters are highly prone to variations and higher frequency sound sources which are less relevant when judging the audibility of intrusive transportation type sounds. For this reason, the background sound level referred to earlier is recommended to be adopted as a representation of the underlying ambient level during quiet periods.

The draft EIS does not include any analysis of the amount of time aircraft noise will be audible, and it is recommended that the final EIS include this analysis.

3.2.4 Monitoring

In 2017 BMCC commissioned MDA to carry out monitoring of existing aircraft noise levels at two locations within the Greater Blue Mountains area. The purpose was to provide an indication of the baseline level of aircraft noise intrusion as a result of existing aircraft overflight associated with operations of Kingsford Smith Airport. The data obtained as part of that study provides an example of the type of baseline information which may need to be obtained more broadly across the GBMWHA when evaluating future impacts associated with the planned Western Sydney Airport.

The report was published in December 2017.[12] **No monitoring or quantification of wilderness soundscapes in the GBMWHA is included in the draft EIS.**

Quantifying impacts at the relatively low sound pressure levels required for the GBMWHA is beyond the intended scope of application of practical noise modelling tools (Section 2.4.1). At the low sound pressure levels recommended to be considered for the final EIS, noise modelling is subject to considerable uncertainties.

No validation work regarding low sound pressure level predictions from aircraft is included in the draft EIS. Validation work is therefore recommended to improve the reliability of predicted noise level data for this purpose. This should be based on comparison of measured and predicted data, in terms of sound pressure levels and event duration data, for aircraft altitudes and procedures that are comparable to potential future aircraft operations over the GBMWHA. Measurement data for existing aircraft movements in the vicinity of the area, similar to that which was obtained as part of the previous noise monitoring work by MDA, can also enable the duration of audibility for high altitude jet aircraft overflights to be quantified and used to inform the assessment of overall time-based metrics.

3.3 Operational noise mitigation measures

The GFMAOI recommended that during development of the airspace management, the following strategies for the control of aircraft noise impacts in the GBMWHA be considered, including Overflight avoidance, Overflight dispersion, and Overflight mitigation procedures (refer Section 2.3.1).

With regards to overflight avoidance, some sensitive locations have been identified (for example in Table 5.6 of *TP 14*) but the soundscapes at these locations have not been quantified. As outlined above, the estimated frequency of aircraft events at key sensitive areas within the GBMWHA (Table 5.7 of *TP 14*) is only based on N60 values. **As such any overflight avoidance strategies (if carried out) are based on inappropriate inputs.**

Regarding overflight dispersion, it is recommended that consideration is given to identifying the areas where natural soundscapes are likely to be most highly valued, and therefore the locations where avoidance of overflight should be prioritised. The GBMWHA covers extensive areas and the size of the areas to be ideally avoided is therefore likely to be large. Nonetheless, the most sensitive areas should be identified with consideration to the following, but not limited to, factors:

- Typical sensitivity of use (e.g. areas sought after for their natural heritage, character and environment),
- Background sound levels,
- Remoteness from transportation and other anthropogenic noise sources, and
- Consultation with relevant stakeholders (e.g. National Parks Authority, Aboriginal representatives and local government.

[12] https://www.bmcc.nsw.gov.au/sites/default/files/docs/GreaterBlueMountainsAircraftNoiseMonitoring.pdf

As well as avoidance of locations, consideration should be given to how avoidance of sensitive time periods could be practically implemented – in terms of sensitive times of the day, as well as potential weekly and seasonal changes in sensitivity associated with variations in visitor numbers and park usage.

As soundscapes within the GBMWHA have not been quantified and estimated frequency of aircraft at key sensitive areas based on N60 values, it does not appear that overflight dispersion is adequately addressed.

Regarding overflight procedures, it is not clear if impacts to GBMWHA have been taken into account, or is explicitly addressed. Table 5.6 indicates that the **Night time noise levels at some wilderness campground areas** including Acacia Flat Campground, Dunphys campground, Perrys Lookdown campground and Burra Korain **campground are higher during the Night period than during the Day period**. Ideally aircraft noise impacts to camping areas would be minimised during the Night period. There are other key sensitive locations within Table 5.6 where Night levels are up to 11 dB higher than during the Day. The RRO flight tracks are presumably giving rise to this increase in Night maximum noise levels, as all other flight tracks are included in both scenarios.

The finalisation of overflight procedures, particularly the RRO should consider the impacts on the key sensitive areas within the GBMWHA.

3.4 Longer term management of impacts

Recognising the complexities and uncertainties associated with the assessment of aircraft noise intrusion in wilderness areas, the magnitude of the residual impacts may not be able to be reliably quantified. In addition, problematic impacts, or intensification of impacts as aircraft movement numbers increase, may not be readily apparent to regulators or the Airport operators. This is in contrast to noise impacts which occur in urban areas where community dissatisfaction may be more vocal or monitored as a matter of course.

To address these issues, monitoring is recommended so that aircraft noise impacts as a result of the introduction of new airport operations are proactively identified and addressed where issues arise. This should comprise a combination of:

- Surveys of visitor and park user experiences – the viability, practicality and utility of this type of survey has been demonstrated by extensive work carried out in the US and New Zealand, and
- Surveys of aircraft noise levels at key sensitive wilderness locations to quantify noise levels using the recommended metrics presented in the preceding sections.

Ideally, these surveys should be conducted concurrently to investigate the possibility of establishing a dose-response relationship between aircraft noise levels and visitor/experiences that is specific to the context of the Blue Mountains which can be used as an objective reference for ongoing airspace management of the planned Airport.

The draft EIS has not carried out user experience surveys or aircraft noise surveys as outlined above. It is therefore recommended these be carried out to develop a dose-response relationship specific to the GBMWHA.

Finally, whilst the assessment of impacts on fauna are outside of the area of expertise of the authors of this review, it is noted that Section 5.3.2.1 regarding biodiversity states that "noise levels not typically expected to exceed around 70 dBA" (based on the L_{Amax} value presented in *TP 1*). Therefore, these intermittent noise levels are unlikely to disturb fauna within the GBMWHA, or affect the habitats of this fauna." No reference is provided as to how this trigger level for fauna was determined, and the basis for this should be provided.

4.0 MITIGATION MEASURES

The following sections outline the proposed mitigation measures included as part of the draft EIS as they pertain to aircraft noise matters.

4.1 Noise abatement

Chapter 10 of *TP 1* details aircraft noise management and mitigation opportunities. In broad terms, the draft EIS notes that noise abatement procedures are still to be developed in detail.

Section 10.2.1 states that "Unlike restrictions such as curfews, it is understood that in Australia noise abatement procedures are promulgated and applied as described above noting they are not legally enforceable." When assessing impacts on residential, sensitive and wilderness receivers, and determining required mitigation, the non-enforceable nature of abatement procedures should be considered.

In development of detailed noise abatement procedures, there are a number of areas that require consideration, that are not specifically committed to in the draft EIS, discussed below.

The WSI operational preferences are defined based on a 11 pm to 05:30 am Night period. The changeover times for flight operations are determined by airspace restrictions from Kingsford Smith Airport operations, and are not based on consideration of human response to noise or the need for respite. This is discussed in more detail in other sections of this document. With reference to noise abatement there should be consideration of additional noise abatement strategies to reduce impact on sensitive receivers in the 5:30 am to 6 am (or 7 am) and potentially between 10 pm to 11 pm, which form part of the typical Night periods from a receiver perspective.

When developing mitigation due consideration should be given to sensitive non-residential areas, including the GBMWHA (discussed in detail in Section 3.0), noting that Section 10.4 identifies that management of noise at night could be achieved by prioritising "night-time flights over wedges of low-density rural land and natural areas".

The development of flight path design is one of the six (6) mitigation and management measures for the project. Section 10.2.3 notes that "the complexity and high volume of air traffic in the Sydney Basin airspace and design criteria to minimise changes to existing Sydney Basin flight operations to the extent practical, there are limited design options for WSI flight paths and runway operational scenarios." The design constraint to not impact on existing Sydney Basin flight operations, particularly from Kingsford Smith Airport, is very restrictive in what mitigation WSI can implement. Significant advances could be to mitigate, equitably share noise and consider impacts holistically across the Sydney Basin were this restriction to be reconsidered. This would obviously require additional engagement with third parties, but it is recommended that this is pursued.

As one example of the effects of this approach Section 9.8.5 details hold down procedures for flights departing WSI (and some arriving) such that they fly at a lower altitude for longer to avoid Kingsford Smith aircraft. This has the effect of increasing the noise footprint of the departing aircraft over sensitive areas. The report notes that "hold downs may be occasionally cancelled when traffic permits but it is important to note that the opportunity to cancel procedures decreases as traffic levels at WSI increase beyond PAL 1 (2033)."

4.2 Land use planning

This section outlines key findings from *Technical Paper 6: Land use and planning* (hereafter *TP 6*), prepared to address land use planning implications.

Importantly the ANEC contours prepared in the draft EIS are based on single runway operations only and various PAL/forecast years. Assessment of land use planning should however be based on longer term forecasts and proposed future operations, in the case of WSI, inclusive of the two (2) runways.

The ANEC based on the previous (2015) EIS, representing the long-term, two (2) runway for WSI has been adopted in various State Environmental Planning Policies (SEPPS), including *SEPP (Western Sydney Aerotropolis) 2020 and SEPP (Precincts—Western Parkland City) 2021* for the management of land use planning in areas surrounding WSI.

Chapter 5 (Statutory context) of the overall draft EIS describes that the Airport Plan will eventually be replaced by a Master Plan. The Master Plan is required to include a number of measures relevant to noise including final flight paths and plans for managing land use in areas surrounding WSI. It is understood that an Australian Noise Exposure Forecast (ANEF) will be prepared as part of the final EIS for WSI (late 2024) and incorporated in the Master Plan. It is expected that this ANEF will supersede the ANEC contained in the SEPP Until the ANEF contour is approved for WSI, the ANEC contour presented as the Noise Exposure Contour Map in the Western Parkland City SEPP.

Accordingly, the land use planning assessment presented in the draft EIS is not based on any new information, beyond:

- Counts of dwellings within the modelling single runway ANECs, and
- Identification of areas beyond the current SEPP ANEC, but contained within the single runway ANECs

Of note, are the development controls contained in SEPP (Western Sydney Aerotropolis) 2020, Part 3, clause 19 (5), which requires:

> *(5) Development consent must not be granted to noise sensitive development on the following land unless the consent authority is satisfied the development will meet the indoor design sound levels—*
>
> > *(a) land shown on the Land Application Map that is not in an ANEF or ANEC contour of 20 or greater,*
> >
> > *(b) land shown on the Obstacle Limitation Surface Map.*

The SEPP requirements are inconsistent with the planning provisions in LGA surrounding the WSI airport site. Specifically, where planning provisions are provided in respective Local Environment Plans (LEP), the planning authority is to consider the use or potential future use of the Badgerys Creek site as an airport and that proposed noise-sensitive development be designed and constructed appropriately. The LEP refers to AS 2021 as the primary tool for guidance on land use planning in the vicinity of the WSI site, and notes that development consent for residences is required where the proposed development is within the ANEF 20 contour for the proposed airport. The construction of residential dwellings is prohibited in land where the ANEF is above 25.

Where a proposed development within LGA surrounding WSI (development application for construction of a dwelling) sits as well as within the relevant land control boundaries defined in the SEPP, it is not clear which planning control would take precedence, i.e. the SEPP or the LEP.

Furthermore, there is no precedence to support the use of an Obstacle Limitation Surface (OLS) for aircraft noise land use planning. The OLS is defined in Part 139 (Aerodromes) Manual of Standards 2019 (MOS 139) as follows:

> *..a series of planes, associated with each runway at an aerodrome, that defines the desirable limits to which objects or structures may project into the airspace around the aerodrome so that aircraft operations at the aerodrome may be conducted safely The OLS identifies the airspace to be protected for aircraft operating during the initial and final stages of flight, or when manoeuvring in the vicinity of the airport*

Aircraft noise is typically centred around flight tracks, due to the directionality and high level of attenuation at sideline locations to flight tracks. The OLS buffer would therefore be considered too conservative and a significant constraint on development in areas north and south of the WSI site. Conversely, the OLS buffer does not extend as far as the ANEC in line with the runway alignment.

Therefore in lieu of the OLS, it is recommended to adopt the N-contours and thresholds recommended in the *National Airports Safeguarding Framework* Guideline A as current interim guidance for

- Rezoning of greenfield areas to permit noise sensitive uses,
- Rezoning of brownfield areas to permit noise sensitive uses, and
- Assessment of new development applications for noise sensitive uses within existing residential areas, until such time that an ANEF is published.

4.3 Noise insulation program

A draft noise insulation and property acquisition policy (NIPA) is included as Appendix F and discussed in Section 11.8.1.2 of Chapter 11 of the draft EIS. The policy has been released for public consultation alongside the draft EIS. The NIPA is a high level draft policy only, with the detailed program eligibility requirements to be developed based on feedback provided and once the final fight paths are known.

The NIPA is based on the 2040 forecast year and not 2055 forecast. Section 11.8.1.2 notes that "In developing this policy, 2033 was considered too soon after establishment of the airport to reflect the time frame of the program, and 2055 did not take into account the potential second runway that is anticipated to be required around that time, nor any technological advances in aircraft."

The inference appears to be that a future (second) noise insulation program will be instigated prior to 2055 when construction of a second runway is completed. The draft EIS does not however commit to a second runway being constructed by this time, nor that a second noise abatement program will be instigated by 2040. In basing the NIPA on 2040 projections, there is a likelihood that beyond this time, sensitive receivers will be exposed to higher noise levels and will be without adequate insulation until if/when the second runway is constructed, the second NIPA developed and treatments rolled out. On this basis it is recommended that the NIPA relating to the single runway operations be based on the 2055 projections, with the single runway at close to capacity.

The eligibility criteria for noise insulation and property acquisition policy is set out in Table 11.11 of the draft EIS. Buildings within ANEC 20 are eligible for treatment. However, acquisition is only triggered within the ANEC 40 contour (or on a case by case basis). Whilst acquisition is not triggered until ANEC 40, Australian Standard AS 2021 deems new residential development 'Unacceptable' where greater than ANEF 25. The trigger of ANEC 40 is based on the Kingsford Smith Airport scheme, however that was developed in relation to expansion of an existing airport, within a more urbanised context and did not include night-time operations. It is recommended the acquisition criteria be re-examined to determine a trigger more suitable to the WSI context.

When assessing properties, the NIPA does not consider noise impacts from existing aircraft operations from other airports. Whilst overlap/cumulative impacts affecting eligibility criteria may not exist, this should be confirmed.

Land use planning restrictions around the airport site have been in place for several decades, including requirements to insulate new noise sensitive development against aircraft noise. Whilst the noise impact predictions from the airport have changed since the initial noise contours were developed, there will be some existing dwellings that fall under the eligibility criteria for noise insulation treatment that were constructed to insulate against noise. It is not clear from the NIPA how this will be recognised as dealt with, noting that public funding for upgrades to these buildings may not be required.

APPENDIX A GLOSSARY OF TERMINOLOGY

ANE	Australian Noise Exposure. A noise metric predominantly used to calculate noise exposure in areas around an airfield
ANEC	Australian Noise Exposure Concept. A forecast of aircraft noise exposure around an airfield used to evaluate alternative operations. It is based on a forecast of aircraft movement numbers, operating times, types, destinations and flight paths
ANEF	Australian Noise Exposure Forecast. An ANEC that has been reviewed and endorsed by Airservices Australia. It is the only contour map with status in land use planning decisions for aircraft noise exposure.
A-weighting	A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds. Sound levels using an "A" frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels are dBA or dB(A).
dB	Decibel. The unit of sound level.
$L_{A90,T}$	The A-weighted sound level exceeded for 90 % of the measurement period, T, measured in dB. Commonly referred to as the background noise level.
L_{Aeq}	The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB.
L_{Amax}	The A-weighted maximum sound level. The highest sound level which occurs during the measurement period.
L_{den}	The day-evening-night sound level calculated from the measured L_{Aeq} over a 24 hour period with a: • 5 decibel penalty applied to the evening period (6 pm - 10 pm) • 10 decibel penalty applied to the night-time period (10 pm – 7 am)
L_{night}	The equivalent continuous A-weighted sound level over a specified period during the night, e.g. eight-hour period between 11 pm and 7 am (averaged over a year).