Australian Government

Department of Infrastructure, Transport, Regional Development, Communications and the Arts

Western Sydney International (Nancy-Bird Walton) Airport – Airspace and flight path design

Environmental Impact Statement

Technical paper 14: Greater Blue Mountains World Heritage Area

October 2024

Contents

Contents (continued)

List of tables

List of figures

List of figures (continued)

Appendices

Abbreviations

Abbreviation	Description
AIRAC	Aeronautical Information Regulation and Control
Airports Act	*Airports Act 1996*
Airport Plan	*Western Sydney Airport – Airport Plan*
CASA	*Civil Aviation Safety Authority*
dB(A)	A-weighted decibel
DECC	Department of Environment and Climate Change
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DITRDCA	Australian Government Department of Infrastructure, Transport, Regional Development, Communications and the Arts
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
FOWSA	Forum on Western Sydney Airport
GMBA	Greater Blue Mountains Area
GHG	greenhouse gas
IUCN	International Union for Conservation of Nature
KPA	key performance areas
LGA	local government area
Km	km
MNES	Matters of National Environmental Significance
NHL	National Heritage List
nm	nautical mile
NO_x	oxides of nitrogen
NPWS	National Parks and Wildlife Services
RAAF	Royal Australian Air Force
RRO	Reciprocal Runway Operations
SCA	State Conservation Areas
SHR	State Heritage Register
UNESCO	United Nations Educational, Scientific and Cultural Organization
WSI	Western Sydney International (Nancy-Bird Walton) Airport

Executive summary

Introduction

This technical paper investigates the potential impacts that may arise from the Western Sydney International (Nancy-Bird Walton) Airport (WSI) airspace and flight path design (the project) on the Greater Blue Mountains Area (GBMA) and the World and National heritage values that are attributed to this area through its World Heritage listing. This report has been prepared to address the EIS Guidelines relating to impacts that may occur to, or on, the GBMA including consideration of impacts to:

- the Outstanding Universal Value of the site and its integrity, and the values of any additional World Heritage properties and National Heritage places identified
- Aboriginal cultural heritage connections associated with the area
- biodiversity associated with the area
- other relevant issues such as visual, noise, health, social and economic.

Legislation/policy/guidelines

The preparation of this assessment has taken into account a range of policies and guidelines relating to the consideration of impacts to World Heritage including:

- the provisions in the *2021 Operational Guidelines for the Implementation of the World Heritage Convention* (UNESCO, 2021) which outline Australia's obligations under the World Heritage Convention
- the *Guidance and Toolkit for Impact Assessment in a World Heritage Context* (UNESCO, 2022a)
- the *Greater Blue Mountains World Heritage Area Strategic Plan* (NSW DECC, 2009) and *Greater Blue Mountains World Heritage Area Strategic Plan Addendum 2016* (NSW Office of Environment and Heritage, 2018) which provide the framework for the GBMA integrated management, protection, interpretation and monitoring. The key management objectives set out in the Strategic Plan (NSW DECC, 2009) provide the basis for the management of the Greater Blue Mountains and guidance for operational strategies in accordance with requirements of the World Heritage Convention and its Operational Guidelines (UNESCO, 2021)
- the *2013 IUCN advice note on environmental assessments* (IUCN, 2013)
- the Australian World Heritage management principles (Schedule 5 of the EPBC Regulations).

Existing environment

At its closest point, the GBMA is around 4 nm (7 km) from WSI. It is a deeply incised sandstone tableland that encompasses around 1.03 million hectares of eucalypt-dominated landscape just inland from Sydney (UNESCO, 2022b). The GBMA comprises one of the largest and most intact regions of protected bushland in Australia and is noted for its representation of the evolutionary adaptation and diversification of the eucalypts in post-Gondwana isolation on the Australian continent (UNESCO, 2022b). It also supports an exceptional representation of the taxonomic, physiognomic and ecological diversity that eucalypts have developed: an outstanding illustration of the evolution of plant life. Several rare and endemic species, including relict flora such as the Wollemi Pine, also occur within its boundaries. The GBMA also includes an outstanding diversity of habitats and plant communities that support its globally significant species and ecosystem diversity.

The Greater Blue Mountains was inscribed on the World Heritage List in 2000 for both its fauna and flora values. This listing formally recognises that the area has Outstanding Universal Value under the World Heritage Convention.

Summary of impacts to the GBMA

Key impacts that have been identified as a result of the project on the GBMA and its associated World Heritage values are summarised below.

Biodiversity

Potential direct impacts to biodiversity as a result of the project would include:

- potential for wildlife strikes during operation, including possible impact on a range of species (including Grey-headed Flying-fox and other bird species) which provide contributing attributes to the World and National Heritage values of the GBMA
- the potential for an aircraft crash to result in an impact on flora and fauna. Whilst this potential impact is likely to only affect a localised area, such an occurrence may result in direct impact on the values and attributes of the GBMA.

Other potential indirect impacts to biodiversity as a result of the project would include:

- noise impacts – most anticipated noise related impacts on biodiversity would be concentrated within the wildlife buffer for WSI (up to around 13 km from the WSI runway). Most other noise impacts outside these locations (including within the GBMA) would likely be intermittent and unlikely to disturb fauna within the GBMA or affect the habitats of this fauna. Sensitive species within the GBMA which may be susceptible to alterations in current noise levels would include Regent Honeyeater and flying-fox populations
- night-time lighting effects – even though there may be a slight increase in light (resulting from warning and other lighting indicators on aircraft at night), existing biodiversity associated with the GBMA is unlikely to be significantly affected and would therefore not impact on the biodiversity attributes and values associated with the GBMA.

Visual and landscape

Some visual impacts resulting from the preliminary flight paths, including those that would pass over the GBMA, would be unavoidable due to the introduction of new aircraft operations at WSI. With respect to potential impacts:

- iconic landscape character features of the Blue Mountains, such as the dramatic system of vertical cliffs, sandstone canyons, pedestals and pagoda rock formations that fringe the plateaus such as the Kanangra Walls, The Three Sisters and the long ridge lines of Narrow Neck and Mount Solitary would experience potentially High-Moderate impacts due to the visibility of aircraft passing within the viewsheds of these locations. Similarly, areas further away from these iconic areas, such as adjacent reserves including the Burragorang and Nattai State Conservation Areas, would also have potentially moderate impacts due to the visibility of aircraft passing over these locations
- as a popular tourist destination, many areas within the GBMA offer highly scenic views, as well as opportunities for stopping to appreciate the view from Lookouts or other vantage points. While each Lookout would have differing impacts, generally aircraft would have some form of visibility from Lookouts across the GBMA resulting in a range of amenity impacts. Depending on the significance of the viewpoint, their location and the spatial extent of the preliminary flight paths, impacts may vary from generally minimal (where aircraft would be viewed at high altitudes in an open and expansive sky or viewed in the backdrop of an urban fringe area) to High-Moderate visual impacts (as in the case of potential impacts from the Echo Point Lookout towards The Three Sisters and Mount Solitary and from the Burragorang Lookout)
- the effect of lighting from the proposed night-time flight paths on areas such as Lookouts and other GBMA features would generally be minimal, as these locations would not typically be utilised at night, and impacts from the project would only be seen as distant flashing lights at high altitudes. Where these areas are used at night (such as Katoomba Falls Night-lit Walk and around Echo Point and the Three Sisters) existing lighting at these locations would also minimise potential impacts. Similarly, the effect of night-time flight paths on GBMA users at locations such as campgrounds would be considered to be negligible, given the minimal level of change and the few number of people that may experience this change

- within the more remote and wilderness areas of the GBMA, there are scattered day use facilities and campgrounds. The camp sites are generally located in areas of high scenic quality and are generally considered to have a high sensitivity to impact. The effect of the project on campgrounds and day use areas would result in a slight reduction in the amenity of views resulting in Moderate overall visual impacts.

Noise

Increased levels of noise resulting from the preliminary flight paths, including those that would pass over the GBMA, are a consequence of the introduction of aircraft operations at WSI. With respect to impacts on the GBMA:

- the assessment identified that, while the vast majority of the overall GBMA would not experience significant noise increase, there would be some areas of the GBMA that would experience maximum noise levels of 60 dB(A) and greater. The areas of greatest impact would typically be in the region between the Great Western Highway and Lake Burragorang (Warragamba Dam). Within the GBMA, locations within these contours include sites such as The Rock Lookout, the Nepean Lookout, The Oaks area, Murphys Glen, Ingar Campground, Katoomba River campground, Clearly Memorial Lookout, Ruined Castle Lookout, Wynnes Rock Lookout, Mount Banks picnic area and Lookout, Anvil Rock Lookout, Baltzer Lookout, Victoria Creek Cascades, Victoria Falls, and Burra Korain campground

  At night, sites such as The Oaks picnic area, the Nepean Lookout, the Burragorang Lookout and the Ruined Castle Lookout would be the key locations impacted by the RRO mode of operation (noting that these areas would not typically be frequented by visitors during night-time periods)

- when taking into account the frequency of movements associated with the noise increases, the section of the GMBA generally to the south of the Great Western Highway would be the most overflown areas during the day and night due to their location in relation to WSI, with the Nepean Lookout and the Rock Lookout near the eastern boundary of this area likely to see the most noticeable changes in amenity

- noise levels over 70 dB(A) L_{Amax} may be experienced occasionally by users of walking trails and camp sites within the areas of the Blue Mountains National Park near the Nepean River, and Warragamba dam. However, maximum sound exposure levels would more typically range from below 50 dB(A) to 60 dB(A) based on the aircraft type, with some noisier wide-body jets reaching closer to 65 dB(A) near the flight paths.

Aboriginal and non-Aboriginal heritage

Many Aboriginal sites such as artefact occurrences which currently exist within the GBMA would not be directly/ physically impacted by the project. However, there are places within the GBMA where the connection to a place or the physical fabric of a place may have the potential to be impacted. These include:

- potential disruption to places of significant spiritual values, for example, the potential for disruption of the land-sky connection between the 'Emu in the sky' constellation through the intrusion of aircraft

- amenity impacts resulting from aircraft noise which may affect the cultural values of some sites, for example sites whose values include the need for peace, tranquillity, and spiritual connection. In relation to specific Aboriginal Places, including locations such as Emu Cave, The Three Sisters, Euroka Clearing, Nye Gnorang and at Shaws Creek in Yellomundee, the development of the flight path design sought (and would continue to seek) to avoid impacts on Aboriginal Places as far as possible

- potential impacts to Aboriginal rock engravings/pigment art which typically occur on sandstone surfaces. These places may be affected physically through additional dust or chemical interaction of pollutants on these rock surfaces

- amenity impacts to visitors to non-Aboriginal sites/items. Notably, the Blue Mountains walking tracks of which there are 37 walking tracks listed on the State Heritage Register under this collective title. While the fabric and functionality of the tracks would not be impacted by the project, the potential for intrusion (particularly noise but also to some extent visual) would have the potential to reduce the intangible values of these tracks (i.e. serenity, connection to nature, etc.).

Social and economic

Consideration of the potential social and economic impacts as a result of the project concluded that there are potential impacts on the existing use or values attributed to the GBMA. These impacts may include potential:

- changes to the use and enjoyment of social infrastructure. It is anticipated that those who visit and use walking tracks, Lookouts and other sensitive areas, in areas where an increase in potential noise levels and/or visual intrusion from aircraft may be experienced, would be likely to experience a moderate change to their use and enjoyment of these areas
- detrimental effect to Aboriginal cultural values due to tangible and intangible impacts, with noise and visual intrusion having the potential to result in moderate change to Aboriginal cultural values associated with GBMA
- minimal detrimental effects to wellbeing as a result of changes to amenity (in particular to GBMA visitors to lookouts and walking tracks)
- potential economic impacts on tourism, including ecotourism, with both potentially positive and negative impacts identified
- potential risk to the visitor economy and livelihoods associated with Blue Mountains World Heritage Listing, noting that potential social and economic impacts are considered unlikely.

Air quality and greenhouse gases

Consideration of the potential air quality and greenhouse gas impacts as a result of the project concluded that:

- the project's impact on the concentrations of the assessed potential pollutants and their impact on areas of the GBMA would be negligible and unlikely to be discernible or measurable within the existing background concentrations
- overall, the emissions of CO_2e attributed to WSI from main engine use by aircraft operating along WSI's flight paths (including those that would travel over the GBMA) in either 2033 or in 2055 would not be considered sufficient to result in significant impacts or inhibit the achievement of net zero economy targets set by the Australian or NSW Government for 2050.

Conclusion

Given the nature of the project, complete avoidance of potential impacts on the GBMA would not be possible. However, the design of the preliminary flight paths is such that impacts expected to result from the project would have minimal direct impacts on the World Heritage or National Heritage values of the area, including the Outstanding Universal Value which contributes to its World Heritage status. The project is unlikely to have a significant impact on the biodiversity values, and the integrity of those values, for which the GBMA was listed. It would not result in the loss of any elements necessary for the GBMA to express its Outstanding Universal Value with respect to its size, biodiversity condition, ability to maintain connectivity or provide protection to its geological, geomorphology and water systems.

Overall, the implementation and operation of the preliminary flight paths is considered to be a critical component to the operation of WSI, and therefore in meeting the long-term needs for increased aviation capacity for Sydney. This assessment has shown that the project is not expected to result in unacceptable significant impacts on the GBMA, including the elements which comprise the World Heritage values of the GBMA. However, despite efforts to avoid and minimise impacts through design, residual impacts remain due to the unavoidable nature of flight path design within an already highly utilised airspace.

Chapter 1 Introduction

This chapter outlines provides an outline of, and background to, the Western Sydney International (Nancy-Bird Walton) airport (WSI) project and also identifies the proponent for the current project (operational flight paths for WSI). This chapter also outlines the structure of this report and identifies the contributors who have been involved in the preparation of this report.

1.1 Western Sydney International (Nancy-Bird Walton) airport

1.1.1 Background

In 2016, the then Australian Minister for Urban Infrastructure approved development for a new airport for Western Sydney, now known as the Western Sydney International (Nancy-Bird Walton) Airport (WSI), under the *Airports Act 1996* (Commonwealth) (Airports Act). The site of the new airport (the Airport Site) covers approximately 1,780 hectares (ha) at Badgerys Creek, as shown in Figure 1.1. The Airport Site is located within the Liverpool local government area (LGA).

Following the finalisation of the *Western Sydney Airport – Environmental Impact Statement* (2016 EIS), the Western Sydney Airport – Airport Plan (Airport Plan) was approved in December 2016. The Airport Plan authorised the construction and operation of the Stage 1 Development (a single runway and terminal facility capable of initially handling up to 10 million passengers per year). It also set the requirements for the further development and assessment of the preliminary airspace design for WSI. The Australian Government has committed to develop and deliver WSI to be ready for scheduled flight operations by the end of 2026.

The design and assessment process for the next phase of the airspace design (referred to as the preliminary airspace design) was set by Condition 16 of the Airport Plan. This included the future airspace design principles and the establishment of an Expert Steering Group to guide the development of the preliminary airspace design. Key to these design principles was the need to minimise the impact on the community and other airspace users while maximising safety, efficiency and capacity of WSI and the Sydney Basin airspace. The airspace design must also meet the requirements of Airservices Australia and civil aviation safety regulatory standards.

Led by the Australian Government Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA), the Expert Steering Group developed the preliminary flight paths and airspace design for WSI (the project). The preliminary airspace design is the subject of the EIS and this assessment on the impacts to the Greater Blue Mountains World Heritage Area.

1.1.2 Objectives of the project

The project is an integral part of WSI, ensuring that the benefits of WSI are realised. In noting this, the overall objectives of WSI are to:

- improve access to aviation services for Western Sydney
- resolve the long-term aviation capacity constraints in the Sydney Basin
- maximise the economic benefit for Australia by maximising the value of WSI as a national asset
- optimise the benefit of WSI for employment and investment in Western Sydney
- deliver sound financial, environmental and social outcomes for the Australian community.

The project will assist in achieving these overall objectives as it would enable single runway operations to commence at WSI, including the introduction of new flight paths and a new controlled airspace.

Since the exhibition of the Draft EIS, refinements to the project have been incorporated into the preliminary flight path design. The final preliminary flight path design is presented in Chapter 7 (The project) of the EIS.

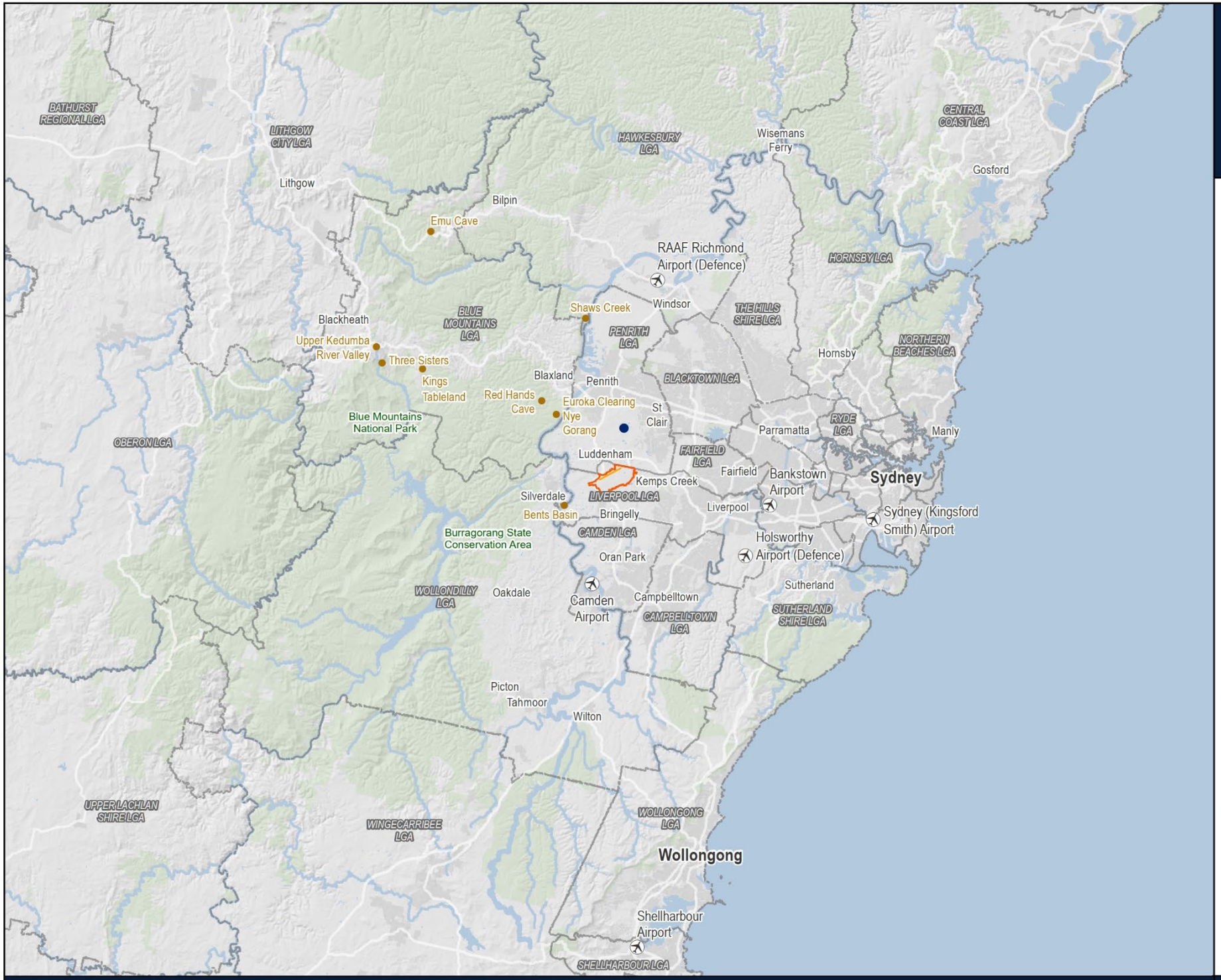


Figure 1.1

The Western Sydney International (Nancy-Bird Walton) Airport and other key airports in the Sydney Basin

Legend

- WSI Runway
- Western Sydney International (Nancy-Bird Walton) Airport land boundary
- Orchard Hills Defence Establishment
- Aboriginal Gazetted Places
- Local Government

0 10 20 km

Coordinate system: GDA 1994 NSW Lambert

Scale ratio correct when printed at A4

1:800,000 Date: 9/05/2023

1.1.3 The Airport

WSI will be a 24-hours, 7 days a week, curfew free international airport and will:

- cater for ongoing growth in demand for air travel, particularly in the rapidly expanding Western Sydney region, as well as providing additional aviation capacity in the Sydney region more broadly
- provide a more accessible and convenient international and domestic airport facility for the large and growing population of Western Sydney
- provide long term economic and employment opportunities in the surrounding area
- accelerate the development of critical infrastructure and urban development.

1.1.3.1 Stage 1 Development

The Stage 1 Development of WSI has been approved and is limited to single runway operations. It is expected to handle up to 10 million annual passengers and around 81,000 air traffic movements per year by 2033 including freight operations (a movement being a single aircraft arrival or departure). This equates to approximately a maximum of 25 air traffic movements per hour during busy peak-demand periods. The approval provides for the construction of the aerodrome (including the single runway), terminal and landside layout and facilities, and ground infrastructure such as the instrument landing systems and high intensity approach lighting arrays. Construction of the Stage 1 Development commenced in 2018.

The single runway is 3,700 metres long and 45 metres wide, and is capable of handling both domestic and international services. The runway is orientated on an approximately north-east/south-west axis (refer to indicative schematic in Figure 1.2), which reflects the physical alignment of the runway and compass heading for aircraft operating to or from it – in this case 50 degrees north-east and 230 degrees south-west (magnetic).

The Airport Plan also contains operational conditions that govern the operational phase of the Stage 1 development, including the requirement of a series of Operational Environment Management Plans and a Community and Stakeholder Engagement Plan.

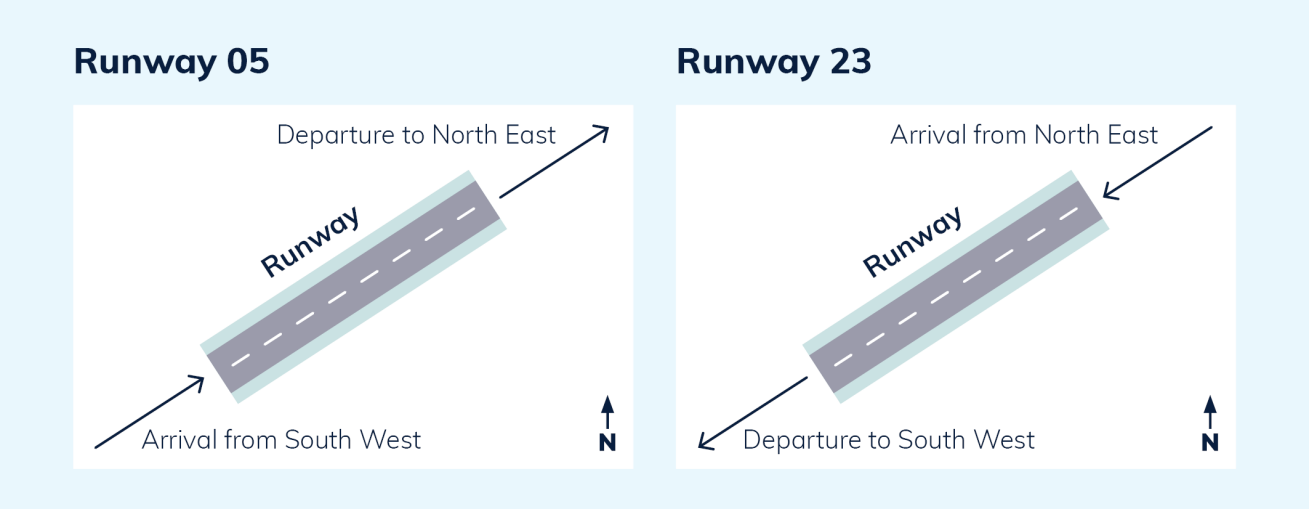


Figure 1.2 Runway 05 and Runway 23

1.1.3.2 Long term development

Incremental development and expansion of WSI facilities will be required at various stages as passenger demand increases. As demand grows over time and subject to future regulatory approvals, WSI is expected to include an expanded terminal, further supporting passenger and commercial facilities. When single runway operations approach capacity at around 37 million annual passengers and around 226,000 air traffic movements per year in 2055 (or approximately a maximum of 52 air traffic movements per hour during busy peak-demand periods), a second parallel runway is expected to be required (DITRDC, 2021).

By around 2063, under an ultimate capacity for a two-runway system, the total aircraft traffic movements per year is forecast to be around 370,000, servicing approximately 82 million annual passengers. Future development will be subject to separate regulatory approvals in accordance with the Airports Act, including any required environmental assessment.

1.2 Key terms

The following key terms relating have been used within this report:

- **airport site:** defined as the physical land/boundary of land subject to an EIS finalised and approved in 2016 by the then Minister for the Environment under the EPBC Act
- **flight paths** – the actual or planned course of an aircraft for either arrival to, or departure from, WSI. Due to the actual dispersion of where aircraft fly, the actual path would progressively widen to notionally 2 km either side of the nominal centre line of the flight path. If aircraft fly within the flight path corridor, they are considered to be on track
- **Greater Blue Mountains Area** (GMBA) – The Greater Blue Mountains Area is located in the Blue Mountains of New South Wales, Australia and is one of the largest and most intact tracts of protected bushland in Australia. The area is listed on both the World Heritage List and the National Heritage List. The 1,032,649-hectare area was placed on the World Heritage List at the 24th session of the World Heritage Committee
- **runway modes of operation** (RMO) refers to the direction in which aircraft take off and land. Operating modes are informed by assessing runway orientation and availability against factors such as forecast meteorological conditions (especially wind direction and strength), runway surface status, aircraft profile and capability, demand and traffic volumes, airspace management procedures, and potential impacts on surrounding communities, such as noise. For WSI, the RMO include:
  - all aircraft arrive from the south-west and take-off to the north-east (Runway 05)
  - all aircraft arrive from the north-east and take-off to the south-west (Runway 23)
  - all aircraft arrive from the south-west onto Runway 05 and take-off to the south-west off Runway 23 (Reciprocal Runway Operations (RRO))
- **the project** – consists of the development and implementation of preliminary flight paths for single runway operations at WSI. The project also includes the associated air traffic control and noise abatement procedures for eventual use by civil and commercial passenger and freight aircraft. The project does not include any physical infrastructure. No construction works or changes to the previously approved physical ground infrastructure (currently under construction) are required for the project. This includes the airfield, terminal, landside layout and facilities, instrument landing systems and high intensity approach lighting arrays
- **Western Sydney Airport – Airport Plan** (Airport Plan) – The *Western Sydney Airport – Airport Plan* (Airport Plan) outlines the approach to the design and development of Western Sydney International (Nancy-Bird Walton) Airport
- **Western Sydney International (Nancy-Bird Walton) Airport** (WSI) – proposed new international airport to be constructed within Western Sydney at Badgerys Creek.

1.3 Proponent and acknowledgements

1.3.1 The proponent

DITRDCA, Airservices Australia and the Civil Aviation Safety Authority (CASA) each have a role in the development and/or approval of the project. However, for the purposes of the approval process, DITRDCA has been nominated as the proponent.

DITRDCA administers the Airports Act (and its associated Regulations) and the Australian Minister for Infrastructure, Transport, Regional Development and Local Government is responsible for the approval of all major developments at federally leased airports across Australia as defined by the Airports Act. DITRDCA is responsible for leading the airspace design for the proposed airspace arrangements for single runway operations at WSI. Once the environmental assessment and community consultation process is complete, DITRDCA alongside Airservices Australia will be responsible for the detailed design of the flight paths.

As the principle proponent, DITRDCA was responsible for the review, funding and commissioning of this report.

1.3.2 Contributors

This report has been prepared by WSP to support the EIS for the project in accordance with the EIS Guidelines issued for the project. Contributors to the preparation of this report have included:

- Jarryd Barton (lead author)
- Caitlin Bennett (technical review)
- Bruce Lean (technical review)
- Toby Lambert (ecology lead)
- Tanya Bangel (ecology specialist).

1.4 Dependencies and interactions with other studies

The information presented in this report has also been reliant upon information and data within the project's following documents:

- *Technical paper 1: Aircraft noise* (Technical paper 1): considers potential significant noise and vibration impacts from aircraft overflights within a 45 nautical mile (nm) (around 83 kilometre (km)) radius from WSI. Noise contours from this assessment were used to assist the assessment of noise and vibration impacts associated with the project on the GBMA.
- *Technical paper 2: Air quality* (Technical paper 2): considers the assessment of air quality impacts associated with the project that may lead to impacts on various values for the GBMA.
- *Technical paper 3: Greenhouse gas emissions* (Technical paper 3): considers the assessment of climate change impacts associated with the project which may have indirect on various values or attributes of the GBMA.
- *Technical paper 4: Hazard and risk* (Technical paper 4): considers the assessment of potential hazards and risks to the GBMA such as 'water catchment' values and 'uncontrolled and inappropriate use of fire'.
- *Technical paper 7: Landscape and visual amenity* (Technical paper 7): considers the assessment of potential visual impacts from the project on the GBMA including 'scenic and aesthetic' and 'recreation and tourism' values.
- *Technical paper 8: Biodiversity* (Technical paper 8): considers the potential impacts on biodiversity values with potential to be impacted by the project. The assessment also considers potential wildlife strike and noise impacts on biodiversity within a 13 km radius of the WSI runway. This assessment was used to inform the to inform existing environment and the assessment of biodiversity values for the GBMA, specifically with reference to potential impacts to the listed Outstanding Universal Value of the site and its integrity.

- *Technical paper 9: Heritage* (Technical paper 9): considers assessment of potential Aboriginal cultural heritage connections and non-Aboriginal heritage related to elements with aesthetic, historic, scientific or social significance with respect to the identified GBMA values.
- *Technical paper 10: Social* (Technical paper 10): considers assessment of potential social impacts associated with the project, including with respect to the identified GBMA values such as 'recreation and tourism' values.
- *Technical paper 11: Economic* (Technical paper 11): considers assessment of potential economic impacts associated with the project, including with respect to the identified GBMA values such as 'recreation and tourism' values.

The authors and supporting specialists that have contributed to this report have no identified conflicts of interest regarding the project or other works associated with the Greater Blue Mountains.

1.5 Study area

Potential impacts to the GBMA (consisting of the World Heritage Area and National Heritage Place) associated with airspace operations extend well beyond the WSI boundary. The study area for the project comprises the whole of the GBMA and the areas adjoining this site where aircraft movements would be located above them.

1.6 Purpose and structure of this technical report

This report has been prepared to address the requirements relating to impacts that may occur to or on the GBMA including any consideration of impacts to:

- the Outstanding Universal Value of the site and its integrity, and the values of any additional World Heritage properties and National Heritage places identified
- Aboriginal cultural heritage connections associated with the area
- Biodiversity associated with the area
- other relevant issues such as health, social, economic and visual.

As identified in Section 1.1, refinements to the project have been incorporated into the preliminary flight path design. The assessment of these changes has been presented in Appendix G (Assessment of the refinements to the project) of the EIS.

1.6.1 Assessment requirements

The project was referred to the Minister for the Environment and Water in 2021 (EPBC 2022/9143) in accordance with Section 161 of the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) and Condition 16 of the Airport Plan. In response, the delegate for the Minister for the Environment and Water determined that an EIS would be required and issued the EIS Guidelines on 26 April 2022.

The assessment requirements relating to World Heritage impacts, in particular to the GBMA, as specified in the EIS Guidelines are summarised in Table 1.1.

Table 1.1 EIS requirements – impacts to World Heritage

Reference	Summary of requirements	Where addressed in this technical paper
6.0 – Description of the environment	The EIS must include a description of the environment, land uses and character of the proposal site and the surrounding areas that may be affected by the action. It must include the following: (d) Identify any listed World Heritage properties and National Heritage places that may be impacted by the proposed action. i. Provide information about location, physical features, condition, historical context, current uses, and social, economic and cultural aspects of the property; and ii. Provide a description of the World Heritage and National Heritage values of the Greater Blue Mountains Area World Heritage property and National Heritage Place (GBMA), as described in the Statement of Outstanding Universal Value, and the values of any additional World Heritage properties and National Heritage places identified. Include references to the listing criteria, as well as integrity, including Aboriginal cultural connections with the land and any wilderness heritage of the property.	Chapter 3 provides an overview of the project setting with respect to the GBMA. In particular, consideration of the Statement of Outstanding Universal Value is provided in Section 3.3.1 and the Statement of integrity in Section 3.3.2. The values of any additional World Heritage properties and National Heritage places is provided in Technical paper 9.
7.1 – Describe and assess relevant Impacts	The EIS must include a description of all the relevant impacts of the action (including direct, indirect, facilitated and cumulative), including the magnitude, duration and frequency of the impacts.	Chapter 5 outlines the potential direct and indirect impacts of the project on the GBMA. Facilitated impacts are considered in Section 5.4.3. Cumulative impacts are considered in Section 5.4.4.
7.3.4 – Heritage	A discussion of impacts on the natural, cultural, heritage and socio-economic values of the GBMA. This discussion must include, but not limited to, the consideration of: • habitats, species and ecological communities within the GBMA, and the processes that support their connectivity, productivity and function • the benefit of national parks for people, businesses and the economy • living and historic cultural heritage recognising Aboriginal beliefs, practices and obligations for country, places of cultural significance and cultural heritage sites • non-Aboriginal heritage that has aesthetic, historic, scientific or social significance.	Chapter 5 outlines the potential direct and indirect impacts of the project on the GBMA. In particular, Section 5.3.2 outlines the impacts on the natural, cultural, heritage and socio-economic values of the GBMA.

Reference	Summary of requirements	Where addressed in this technical paper
7.3.5 – Heritage	For World Heritage, discuss how the proposed action adheres to, and is not inconsistent with: • Australia's obligations under the World Heritage Convention and the provisions in the 2021 Operational Guidelines for the Implementation of the World Heritage Convention • The Australian World Heritage management principles (Schedule 5 of the EPBC Regulations) • The 2009 Greater Blue Mountains World Heritage Area Strategic Plan and 2016 Addendum and any future iterations in place at time of report preparation • The 2013 IUCN advice note on environmental assessments.	Chapter 3 outlines the legislative context of the project.
7.4 – People and communities (part 7.4.2)	A discussion of social and economic impacts, including both positive and negative impacts for a range of stakeholders and communities. Include a discussion of impacts to existing and proposed urban, industrial, rural and tourism activities within areas that may be affected by the proposal.	Discussion of social and economic impacts is provided in Section 5.3.2.5.
8.0 – Proposed safeguards and mitigation measures	The EIS must provide information on proposed safeguards and mitigation measures to deal with the relevant impacts of the action.	Mitigation measures are discussed in Chapter 6.

1.6.2 Structure of the technical report

The structure and content of this technical report is outlined in Table 1.2.

Table 1.2 Structure of the technical report

Chapter	Description
Chapter 1	**Introduction** Provides a background to the project, an overview of the legislative context for assessment of impacts to the GBMA and outlines the key contributors to this report. The chapter also outlines the purpose and content of the assessment.
Chapter 2	**Approach to impact assessment** Provides a description of the overall approach and methodology used to undertake the assessment of impacts to the GBMA presented in this report.
Chapter 3	**Project setting baseline** Provides a description of the Matters of National Environmental Significance relating to the GBMA, including an overview of the Outstanding Universal Value and a statement of integrity of the area. The chapter also provides an overview of the Sydney Basin airspace and general biophysical and socio-economic environment within which the project would be located.
Chapter 4	**Project overview and alternatives** Provides an overview of the key features of the project including a description of the preliminary flight paths during various operating modes and provides a summary of the options and alternatives process considered during the development of the project. The chapter also provides an overview of the needs and benefits of the project.

Chapter	Description
Chapter 5	**Identification and evaluation of impacts** Describes the results of the assessment of the project against key issues including consideration against the Outstanding Universal Value and a statement of integrity of the area. The assessment includes consideration of potential direct and indirect impacts as a result of the project.
Chapter 6	**Mitigation and management** Provides a description of the proposed approach to environmental management, and a compilation of the mitigation measures to minimise impacts on the GBMA as a result of the project.
Chapter 7	**Conclusion and recommendations** Provides a conclusion for the project and suggested recommendation in consideration of the potential impacts.
Chapter 8	**References** Provides a list of references used to inform the technical paper.
Appendices	
Appendix A	Detailed visual impact discussion

Chapter 2 Approach to impact assessment

2.1 Introduction

Assessment of impacts on the values of a World Heritage Area involves determining whether the project would affect the Greater Blue Mountains Area's Outstanding Universal Value and other heritage/conservation values. A key focus of the assessment has been to consider the potential impacts of the project on the Outstanding Universal Value of the GBMA and the associated attributes of the site identified within the Outstanding Universal Value and Statement of Integrity.

This chapter summarises the approach to the impact assessment of the project with respect to the Outstanding Universal Value and integrity of the GBMA and its other heritage/conservation values.

2.2 Impact assessment process

The assessment of potential impacts from the project on the GBMA was undertaken in consideration of the requirements outlined in the *Guidance and Toolkit for impact assessments in a World Heritage Context* (UNESCO, 2022a) Reflecting the guidance, the assessment of impact on the GBMA involved the following key processes:

- identification of the World Heritage and National Heritage values of the Greater Blue Mountains Area, as outlined in the Statement of Outstanding Universal Value and integrity (Section 3.3.1 and Section 3.3.2 respectively)
- identification of the other values that complement and interact with the World Heritage and National Heritage values of the Greater Blue Mountains Area (Section 3.3.4)
- collation of baseline environmental information including (Chapter 3)
  - confirmation of existing ecological features of key significance that contribute to the Outstanding Universal Value of the site
  - identification of key social, recreation, and tourism attributes of the Greater Blue Mountains Area whose contributing values may be impacted as a result of the project
- identification of the potential impacts that may arise as a result of the preliminary flight paths. This included screening of the potential elements that may be impacted as a result of the project (e.g., biodiversity, noise, air quality, heritage and visual) (Section 5.3)
- assessment of the impacts of the project against their potential to impact on the World Heritage and Natural Heritage values and integrity of the World Heritage property based on the Statement of Outstanding Universal Value for the GBMA (Section 5.4.1)
- assessment of impacts of the project against their potential to impact on the other values of the GBMA (Section 5.4.2)
- identification of recommended mitigation measures (Chapter 6).

A summary of the process of an impact assessment conducted for World Heritage is shown in Figure 2.1. Additionally, specific assessment methodologies were undertaken for each of the individual assessments to support the impact assessment presented in Chapter 5 of this report. Detailed descriptions of each of the methodologies undertaken for these studies are presented in the respective technical papers (refer to Section 1.4).

Adapted from Figure 5.1 Guidance and Toolkit for impact assessments in a World Heritage Context (UNESCO, 2022a)

Figure 2.1 The process of an impact assessment conducted for World Heritage

2.2.1 Stakeholder and community engagement

2.2.1.1 Pre-exhibition engagement

Community and stakeholder engagement has been undertaken to support the development and exhibition of the EIS. The engagement approach considered identification of impacts that the project may have on the GBMA. Engagement throughout the development of the project with respect to potential impacts on the GBMA has included:

- interviews/meetings with relevant government agency stakeholders such as Department of Climate Change, Energy, the Environment and Water (DCCEEW), local Members of Parliament and Blue Mountains City Council
- interviews/meetings with special interest groups and organisations including:
  - Blue Mountains Accommodation & Tourism Association
  - Greater Blue Mountains Area World Heritage Advisory Committee
- interviews/meetings with First Nations groups and individuals
- general community engagement as part of community information sessions during the pre-exhibition engagement activities.

2.2.1.2 Summary of issues raised and responses to feedback received

The key stakeholder engagement that has been undertaken focusing on the impacts to the GBMA identified a series of key issues. The issues raised by government agencies, authorities, key stakeholders and the community during the preparation of the EIS are summarised in Table 2.1.

Table 2.1 Summary of key issues raised regarding impacts to the GBMA

Summary of issue raised	Section where addressed
Concern regarding the loss of the GBMA UNESCO World Heritage status. It was noted that should the World Heritage listing be lost as a result of the project, this would likely detract from one of the main reasons that people visit the region.	Chapter 7 – Conclusion
The potential loss of the 'wilderness area' feel of the area and the expectations that visitors have of the area providing a certain degree of tranquillity.	Section 5.3.2.3 (Noise) Section 5.3.2.5 (Social and economic) Section 5.4.2
Impacts to outdoor activities including: • the visual intrusion of flights visible from locations such as Govetts Leap or Echo Point • recreational activities such as hang gliding.	Section 5.3.2.2 (Visual amenity) Section 5.3.2.5 (Social and economic) Section 5.4.2
The noise impacts of the project and the potential impact of noise on the wilderness and wildlife, in particular impacts to endangered species.	Section 5.3.2.3 (Noise) Section 5.4.2
The potential negative impacts the project would have on ecotourism.	Section 5.3.2.5 (Social and economic) Section 5.4.2
Increased risk of bushfire in the area and potential impacts of the preliminary flight paths on the ability of organisations such as the NPWS or Rural Fire Service to continue to undertake firefighting operations (for wild fires) or fire hazard reduction burns.	Section 5.2
Potential impacts of the project on the Aboriginal heritage of the area.	Section 5.3.2.4 (Heritage) Section 5.4.2
Increased pollution, including air and water pollution. In particular, this issue was identified in the context of pollution becoming trapped in the Western Sydney Basin and impacting the Blue Mountains' reputation for fresh air.	Section 5.3.2.6 (Air quality) Section 5.2 Section 5.4.2
Overdevelopment and the loss of green space, with a focus on Blue Mountains heritage, wilderness and recreation.	Section 5.3.2.5 (Social and economic) Section 5.4.2

2.2.2 Identified knowledge gaps or uncertainties

The preparation of this assessment has relied upon data, surveys, analyses, designs, plans and other information provided to support the assessment. In particular, this includes reliance upon data and information contained within other technical papers prepared for the project as specified in Section 1.4.

Except as otherwise stated, the preparation of this assessment has not included verification of the accuracy or completeness of this data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this study (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data.

Chapter 3 Project setting

This chapter provides:

- general details on the regional environment in which the project and associated GBMA are located
- an overview of the Outstanding Universal Value and other heritage/conservation values of the GBMA
- a summary of the statutory and legislative context of the project, in particular with respect to the relevant legislation applicable to areas of World Heritage.

3.1 Overview

There are 6 World Heritage areas potentially impacted by the operation of the project:

- The Greater Blue Mountains World Heritage Area, which would be located below a number of the preliminary flight paths that travel to the north, west and south of WSI
- Australian Convict Sites (Old Great North Road and Buffer Zone)
- Australian Convict Sites (Old Government House and Domain)
- Australian Convict Sites (Cockatoo Island Convict Site)
- Australian Convict Sites (Hyde Park Barracks)
- Sydney Opera House.

These World Heritage areas and their existing values of importance are described in greater detail in the following sections. It should be noted that the focus of the assessment is on the Greater Blue Mountains World Heritage Area as impacts to the remaining 5 sites are expected to be negligible due to the locations of these sites in relation to the preliminary flight paths and the altitudes at which aircraft would be within the vicinity of these sites. Therefore, detailed assessment of impacts to these sites has not been considered further as part of this assessment.

3.2 Greater Blue Mountains Area

3.2.1 Greater Blue Mountains World Heritage Area

At its closest point, the GBMA is around 4 nm (7 km) from WSI. It is a deeply incised sandstone tableland that encompasses around 1.03 million hectares of eucalypt-dominated landscape just inland from Sydney (UNESCO 2022b). The Greater Blue Mountains comprises one of the largest and most intact regions of protected bushland in Australia and is noted for its representation of the evolutionary adaptation and diversification of the eucalypts in post-Gondwana isolation on the Australian continent (UNESCO 2022b). It also supports an exceptional representation of the taxonomic, physiognomic and ecological diversity that eucalypts have developed: an outstanding illustration of the evolution of plant life. Several rare and endemic species, including relict flora such as the Wollemi Pine, also occur within its boundaries. The GBMA also includes an outstanding diversity of habitats and plant communities that support its globally significant species and ecosystem diversity. Ongoing research continues to reveal the rich scientific value of the area as more species are discovered.

The Greater Blue Mountains was inscribed on the World Heritage List in 2000 for both its fauna and flora values. This listing formally recognises that the area has Outstanding Universal Value under the World Heritage Convention (refer to Section 3.3.1).

The GBMA comprises a combination of 8 protected areas (refer to Figure 3.1):

- Blue Mountains National Park
- Wollemi National Park
- Yengo National Park
- Nattai National Park
- Kanangra-Boyd National Park
- Gardens of Stone National Park
- Thirlmere Lakes National Park
- Jenolan Caves Karst Conservation Reserve.

The geology and geomorphology of the site, which includes up to 300 metre cliffs, slot canyons, and waterfalls, provides physical conditions and a visual backdrop to support these outstanding biological values. The Greater Blue Mountains Area includes large areas of accessible wilderness near Sydney's population of 4.5 million people. Its exceptional biodiversity values are complemented by numerous others, including Aboriginal and historic cultural values, geodiversity, water production, wilderness, recreation and natural beauty.

The Greater Blue Mountains makes up a significant representation of Australia's biodiversity with around 10 per cent of the country's vascular flora and significant numbers of rare or threatened species (UNESCO, 2022b). In addition to the outstanding eucalypt species, the area also contains relict species of global significance including the ancient Wollemi Pine, one of the world's rarest species that was thought to have been extinct for millions of years. The few surviving trees are known only to occur in 3 small populations located in remote, inaccessible gorges within the Greater Blue Mountains (DCCEEW, 2022a).

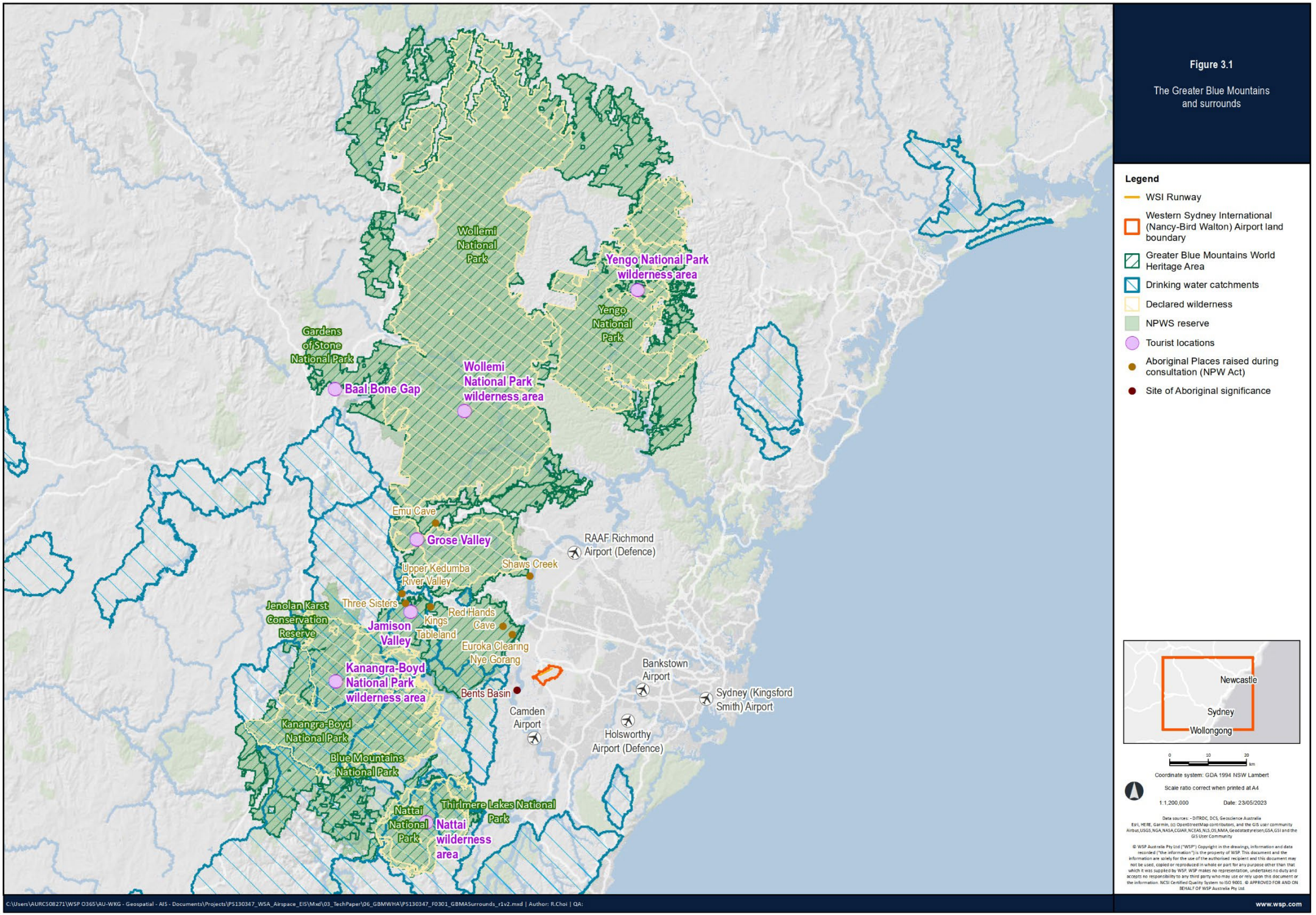
3.2.1.1 Wider setting of the Greater Blue Mountains

Every World Heritage property is surrounded by a wider setting, which is the immediate and extended environment that is part of, or contributes to, its significance and distinctive character. The wider setting can also play an essential role in protecting the authenticity and integrity of the property, and its management is related to its role in supporting the Outstanding Universal Value of a site. While adjacent areas are acknowledged to be important in protecting the Greater Blue Mountains, the GBMA does not have a formal buffer zone included as part of the World Heritage listing (noting that under the EPBC Act, any action that has, will have, or is likely to have an impact on the World Heritage values of a World Heritage property must be referred to the responsible Australian Minister for consideration).

A number of areas outside of the designated boundary for the GBMA however provide a buffer between the World Heritage item and its surrounding land uses. These include adjoining areas of:

- National Parks such as Goulburn River National Park, Capertee National Park and the Dharug National Park
- State Forests such as the Newnes, Pokolbin, Coricudgy, Nullo Mountain, Gurnang, Wolgan, Ben Bullen, Jellore, McPherson and Putty State Forests
- other Protected Areas such as the Bargo, Yerranderie, Natti, Burragorang and Parr State Conservation Areas.

These protected areas surrounding the formal area of the GBMA assist in maintaining and protecting the overall natural setting of the site, thereby reducing pressure on the region from adjoining land uses which may cause negative impact(s) to the Outstanding Universal Value of the site.


Wollemi National Park
Yengo National Park wilderness area
Yengo National Park
Gardens of Stone National Park
Baal Bone Gap
Wollemi National Park wilderness area
Emu Cave
Grose Valley
RAAF Richmond Airport (Defence)
Upper Kedumba River Valley
Shaws Creek
Jenolan Karst Conservation Reserve
Three Sisters
Kings Tableland
Red Hands Cave
Jamison Valley
Euroka Clearing
Nye Gorang
Kanangra-Boyd National Park wilderness area
Bents Basin
Bankstown Airport
Sydney (Kingsford Smith) Airport
Camden Airport
Holsworthy Airport (Defence)
Kanangra-Boyd National Park
Blue Mountains National Park
Thirlmere Lakes National Park
Nattai National Park
Nattai wilderness area
Figure 3.1
The Greater Blue Mountains and surrounds
Legend
WSI Runway
Western Sydney International (Nancy-Bird Walton) Airport land boundary
Greater Blue Mountains World Heritage Area
Drinking water catchments
Declared wilderness
NPWS reserve
Tourist locations
Aboriginal Places raised during consultation (NPW Act)
Site of Aboriginal significance
Newcastle
Sydney
Wollongong
0
10
20
km
Coordinate system: GDA 1994 NSW Lambert
Scale ratio correct when printed at A4
1:1,200,000
Date: 23/05/2023
Data sources - DITRDC, DCS, Geoscience Australia
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community
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www.wsp.com

3.2.2 National Heritage place

Under the EPBC Act, all World Heritage properties in Australia were automatically included on the National Heritage List (NHL) for their World Heritage Outstanding Universal Value in 2007. The National Heritage values identified for the listing are the same as the values recognised for the World Heritage Area. As such the following assessment against the World Heritage values is taken to address both the World Heritage and National Heritage values of the Greater Blue Mountains.

3.2.2.1 Proposed National Heritage Area extensions

The Australian Heritage Council is currently assessing whether the Greater Blue Mountains National Heritage place has additional nationally significant heritage values, and whether to expand it to include adjacent areas. The values relate to geodiversity, biodiversity and historic values that satisfy the National Heritage criterion of events and processes, rarity and aesthetic characteristics. The Australian Heritage Council has identified engagement with First Nations People is required before it can identify any Aboriginal cultural heritage values that satisfy National Heritage criteria. Consent would also be sought to list any such values.

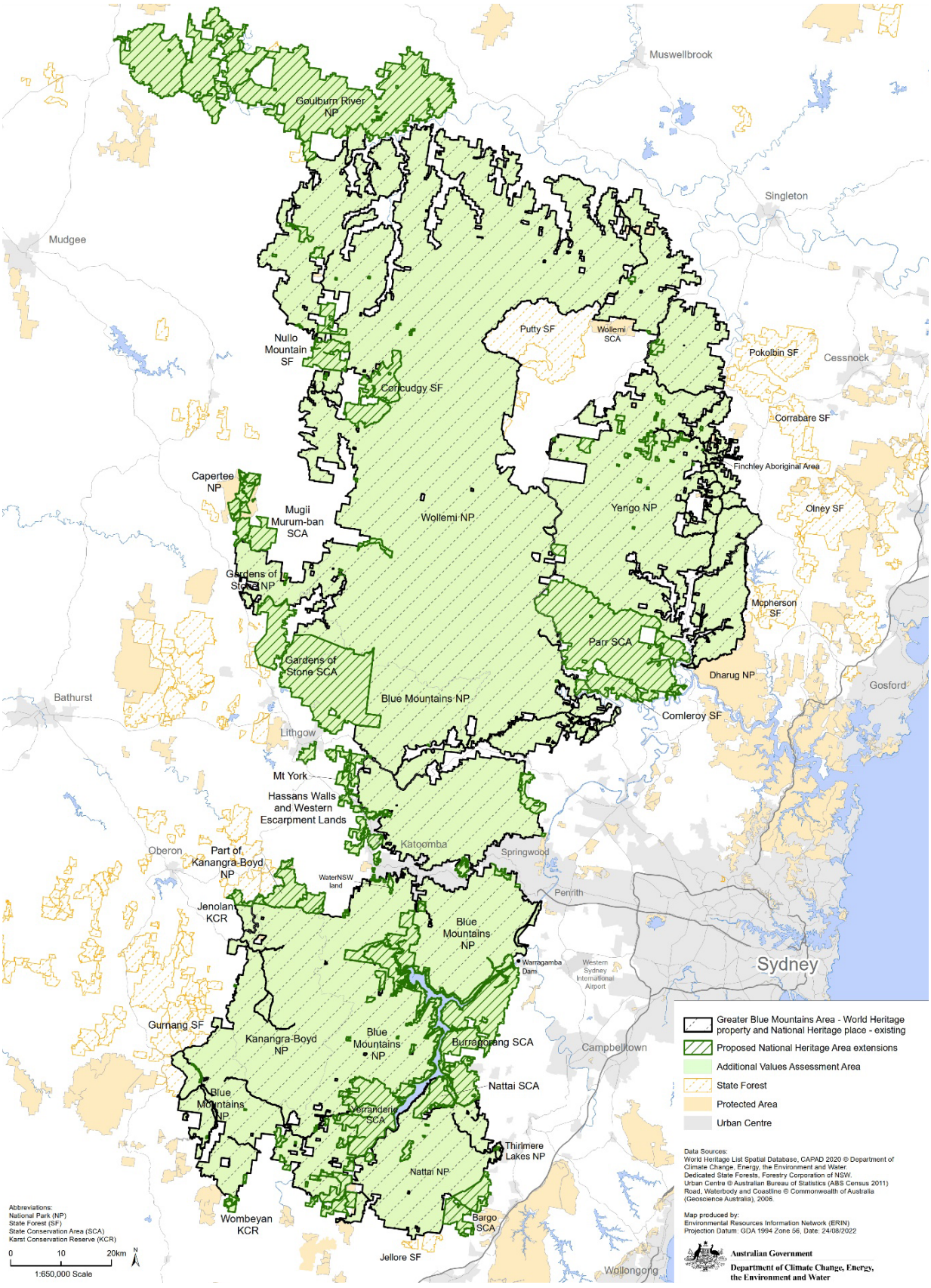
In 2014–15, the Greater Blue Mountains Area World Heritage Advisory Committee and the NSW Government recommended that the National Heritage List assessment be updated to include additional lands which are contiguous with or close to the GBMA and act as buffers to the GBMA. An initial assessment by the Australian Heritage Council identified that the Greater Blue Mountains Area National Heritage Place and some adjacent lands may have additional nationally significant heritage values, and therefore should be considered for included in an expanded National Heritage Area.

These areas included the following sites (or expansion of parts of existing areas) (refer to Figure 3.2):

- Bargo State Conservation Area
- Blue Mountains National Park
- Burragorang State Conservation Area
- Capertee National Park
- Comleroy State Forest
- Coricudgy State Forest
- Gardens of Stone State Conservation Area
- Goulburn River National Park
- Hassans Walls and Western Escarpment Lands
- Kanangra-Boyd National Park
- Mugii Murum-ban State Conservation Area
- Nattai State Conservation Area
- Nullo Mountain State Forest and Flora Reserve
- Parr State Conservation Area
- Wollemi National Park
- Wombeyan Karst Conservation Reserve
- Yengo National Park
- Yerranderie State Conservation Area.

The opportunity to provide comment on the proposed changes was made available to the public in late 2022 with comments closing in November 2022. As at the time of this assessment, the Australian Heritage Council was reviewing the information gathered during the consultation period. Based on the outcomes of this consultation, it is noted that additional (or refined) areas to those shown in Figure 3.2 may be confirmed for inclusion in the listing.

The final outcomes of this assessment will not change the World Heritage listing.



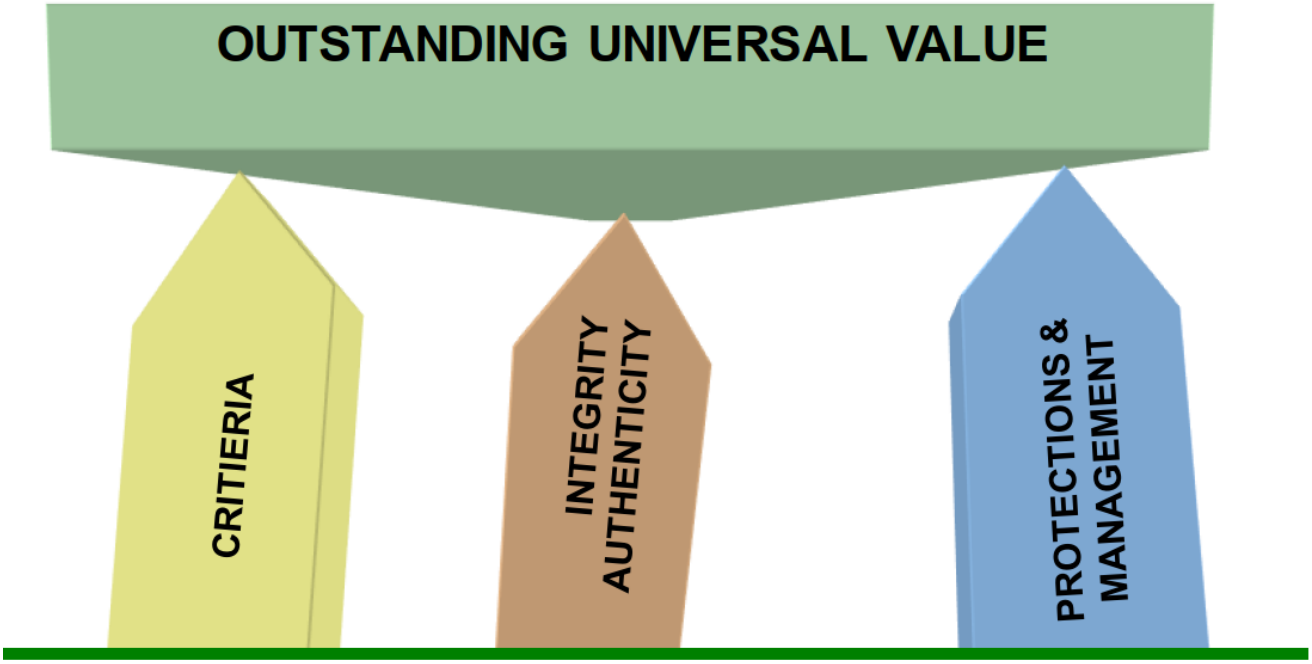
Sourced from National Heritage assessment for the Greater Blue Mountains Area (DCCEWW, 2022c)

Figure 3.2 Greater Blue Mountains Area – proposed National Heritage Area extensions (under consideration)

3.3 World Heritage values

Outstanding Universal Value is the basis for a site's inscription on the World Heritage List and is defined in the Operational Guidelines (UNESCO, 2021) as '*…natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity.'* Outstanding Universal Value comprises of 3 components which are values; integrity; and protection and management. These are summarised below and illustrated in Figure 3.3.

1. *Values*: There are 4 natural criteria which embody the values of natural World Heritage Sites. These relate to superlative natural phenomena and exceptional natural beauty (criterion vii), earth processes (criterion viii), ecosystems (criterion xi), and threatened species and their habitats (criterion x).
2. *Integrity*: Integrity is a measure of 'wholeness' and requires assessment of the extent to which the site; i) includes all elements necessary to express its values; ii) is of adequate size to ensure the complete representation of features and processes which convey its significance; and iii) is not affected by developments and/or neglect.
3. *Protection and management*: Protection and management is intended to ensure that the site's values and the conditions of integrity at the time of inscription are maintained and enhanced in the future. The key elements of protection and management are; i) long-term legislative, regulatory, institutional and/or traditional protection; ii) delineated and appropriate boundaries; iii) buffer zones and/or wider protection of the site from threats outside its boundaries and iv) effective management systems.



Source: 2013 IUCN Advice Note (IUNC, November 2013)

Figure 3.3 The three pillars of Outstanding Universal Value

Each of the components of the Outstanding Universal Value, and their applicability to the Greater Blue Mountains World Heritage area is described in greater detail in the following sections.

3.3.1 Outstanding universal value

The Greater Blue Mountains was inscribed on the World Heritage List because it satisfies 2 of the criteria for natural values of Outstanding Universal Value related to both its fauna values as well as flora values. While the criteria for Outstanding Universal Value have changed over time, the underlying concepts have remained constant (UNESCO, 2022b). The 2 criteria for which the Greater Blue Mountains is listed are described below.

Criterion ix

Criterion ix is defined in the *Operational Guidelines for the Implementation of the World Heritage Convention* (UNESCO, 2021) as follows:

> *to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals*

The Greater Blue Mountains include outstanding and representative examples in a relatively small area of the evolution and adaptation of the genus *Eucalyptus* and eucalypt-dominated vegetation on the Australian continent.

The site contains a wide and balanced representation of eucalypt habitats including wet and dry sclerophyll forests and mallee heathlands, as well as localised swamps, wetlands and grassland. It is a centre of diversification for the Australian scleromorphic flora, including significant aspects of eucalypt evolution and radiation. Representative examples of the dynamic processes in its eucalypt-dominated ecosystems cover the full range of interactions between eucalypts, understorey, fauna, environment and fire.

The site includes primitive species of outstanding significance to the evolution of the earth's plant life, such as the highly restricted Wollemi Pine (*Wollemia nobilis*) and the Blue Mountains Pine (*Pherosphaera fitzgeraldii*). These are examples of ancient, relict species with Gondwanan affinities that have survived past climatic changes and demonstrate the highly unusual juxtaposition of Gondwanan taxa with the diverse scleromorphic flora (UNESCO, 2022b).

Criterion x

Criterion x is defined in the *Operational Guidelines for the Implementation of the World Heritage Convention* (UNESCO, 2021) as follows:

> *to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation*

The Greater Blue Mountains includes an outstanding diversity of habitats and plant communities that support its globally significant species and ecosystem diversity (152 plant families, 484 genera and c. 1,500 species). A significant proportion of the Australian continent's biodiversity, especially its scleromorphic flora, occur in the area. Plant families represented by exceptionally high levels of species diversity here include Myrtaceae (150 species), Fabaceae (149 species), and Proteaeceae (77 species).

Eucalypts (*Eucalyptus*, *Angophora* and *Corymbia*, all in the family Myrtaceae) which dominate the Australian continent are well represented by more than 90 species (13 per cent of the global total). The genus *Acacia* (in the family Fabaceae) is represented by 64 species. The site includes primitive and relictual species with Gondwanan affinities (*Wollemia, Pherosphaera, Lomatia, Dracophyllum, Acrophyllum, Podocarpus* and *Atkinsonia*) and supports many plants of conservation significance including 114 endemic species and 177 threatened species.

The diverse plant communities and habitats support more than 400 vertebrate taxa (of which 40 are threatened), comprising some 52 mammal, 63 reptile, over 30 frog and about one third (265 species) of Australia's bird species. Charismatic vertebrates such as the platypus and echidna occur in the area. Although invertebrates are still poorly known, the area supports an estimated 120 butterfly and 4,000 moth species, and a rich cave invertebrate fauna (67 taxa) (UNESCO, 2022b).

3.3.2 Integrity

In addition to meeting at least one of the criteria for Outstanding Universal Value, a World Heritage Area that is listed for natural values also needs to meet conditions of integrity. Integrity is a measure of the 'wholeness and intactness' of the natural heritage and its attributes (UNESCO, 2022b). Examining the conditions of integrity requires the assessment of the extent in which the area:

- includes all elements necessary to express it Outstanding Universal Value
- is of adequate size to ensure the complete representation of the features and processes which convey the area's significance
- suffers from adverse effects of development and/or neglect.

The statement of integrity for the GBMA also included a component connected to cultural associations, specifically the need to conserve:

- the ongoing cultural practices by First Nations people and their continuing custodial relationship with the GBMA
- physical evidence of the longevity of the strong Aboriginal cultural connections to the land.

The *Greater Blue Mountains World Heritage Area Strategic Plan* (NSW DECC, 2009) states, with respect to objective of integrity, '… to maintain, and wherever possible improve, the current and future integrity of the Greater Blue Mountains World Heritage Area…' including, seeking 'to ensure that adjoining land uses are sympathetic to the conservation and presentation of World Heritage values'.

The Statement of Outstanding Universal Value for the GBMA (UNESCO, 2022b) states that the 7 adjacent national parks and single karst conservation reserve that comprise the Greater Blue Mountains Area are of sufficient size to protect the biota and ecosystem processes, although the boundary has several anomalies that reduce the effectiveness of its 1-million-hectare size. This is explained by historical patterns of clearing and private land ownership that preceded establishment of the parks. However, parts of the convoluted boundary reflect topography, such as escarpments that act as barriers to potential adverse impacts from adjoining land. In addition, much of the Greater Blue Mountains Area is largely protected by adjoining public lands of State Forests and State Conservation Areas. Additional regulatory mechanisms, such as the statutory wilderness designation of 65 per cent of the area, the closed and protected catchment for the Warragamba Dam and additions to the conservation reserves that comprise the area further protect the integrity of the Greater Blue Mountains Area.

Most of the natural bushland of the Greater Blue Mountains Area is of high wilderness quality and remains close to pristine. The plant communities and habitats occur almost entirely as an extensive, largely undisturbed matrix almost entirely free of structures, earthworks and other human intervention. Because of its size and connectivity with other protected areas, the area will continue to play a vital role in providing opportunities for adaptation and shifts in range for all native plant and animal species within it, allowing essential ecological processes to continue. The area's integrity depends upon the complexity of its geological structure, geomorphology and water systems, which have created the conditions for the evolution of its outstanding biodiversity and which require the same level of protection.

An understanding of the cultural context of the Greater Blue Mountains Area is fundamental to the protection of its integrity. First Nations people from 6 language groups, through ongoing practices that reflect both traditional and contemporary presence, continue to have a custodial relationship with the area. Occupation sites and rock art provide physical evidence of the longevity of the strong Aboriginal cultural connections with the land. The conservation of these associations, together with the elements of the area's natural beauty, contributes to its integrity.

The current statement of integrity (UNESCO, 2022b) says that since World Heritage listing, proposals for a second Sydney airport at Badgerys Creek, adjacent to the Greater Blue Mountains Area, have been abandoned. This statement is no longer current. In 2012, the Joint Study on Aviation Capacity in the Sydney Basin airspace confirmed a second airport would be required and the location at Badgerys Creek was announced in 2014 by the Australian Government. In 2016, the then Australian Minister for Urban Infrastructure approved development for WSI. This comprised the Stage 1 Development works required for single runway operations including the terminal and landside layout and facilities, and ground infrastructure such as the instrument landing systems and high intensity approach lighting arrays.

3.3.3 Management and protection

3.3.3.1 Management of the Greater Blue Mountains

The Australian Government, as signatory to the World Heritage Convention, works in cooperation with the NSW Government (and other states) to ensure that the ongoing management of World Heritage is consistent with the requirements of the Convention. The Australian Government also administers the EPBC Act under which World Heritage is a matter of national environmental significance (MNES).

All properties inscribed on the World Heritage List must have adequate protection and management mechanisms in place, the nature of which can vary so long as they are effective (DSEWPC, 2012). Both the Australian and NSW governments are responsible for managing and protecting World Heritage properties within NSW, with the NSW State Government being directly responsible for the day-to-day management of the GBMA through an established management committee.

An advisory committee also provides input to the management committee on matters relating to the identification, protection, conservation, and presentation of World Heritage values. The committee also considers and provides advice on issues that may have a significant impact on the Greater Blue Mountains or on natural and cultural heritage conservation for the site (NSW Department of Planning and Environment, 2022).

The Greater Blue Mountains World Heritage Area Advisory Committee currently has 13 members and is represented by areas including:

- archaeological/cultural heritage
- botanical/ecological sciences
- zoological/ecological sciences
- local First Nations/traditional owners
- local government (Hawkesbury City Council and Blue Mountains City Council)
- National Parks and Wildlife Service (NPWS) Blue Mountains Region Advisory Committee
- non-government conservation/heritage organisation
- outdoor, self-reliant, nature-based recreation
- tourism
- water quality/aquatic environment.

3.3.3.2 Protection of the Greater Blue Mountains

World Heritage properties are protected under the EPBC Act and are considered 'matters of national environmental significance'. The EPBC Act provides for the development and implementation of management plans for World Heritage properties, which describe aspects of the Greater Blue Mountains Area and how it will be managed.

The NSW Office of Environment and Heritage manages the GBMA. The GBMA is protected and managed primarily under the following State legislation:

- *National Parks and Wildlife Act 1974* (NSW) (NP&W Act)
- *Wilderness Act 1987* (NSW) (Wilderness Act).

These Acts cover the protection and management of areas such as national parks, nature reserves and wilderness. Other relevant legislation includes the NSW *Biodiversity Conservation Act 2016*, the *Environmental Planning and Assessment Act 1979*, and the *Heritage Act 1977*.

The *Greater Blue Mountains World Heritage Area Strategic Plan* (NSW Department of Environment and Climate Change (DECC) 2009) and *Greater Blue Mountains World Heritage Area Strategic Plan Addendum 2016* (NSW Office of Environment and Heritage, 2018) provide frameworks for the area's integrated management, protection, interpretation and monitoring. The key management objectives set out in the Strategic Plan (NSW DECC, 2009) provide the basis for the management of the Greater Blue Mountains and guidance for operational strategies in accordance with requirements of the World Heritage Convention and its Operational Guidelines (UNESCO, 2021).

The Strategic Plan and Addendum identifies the following threats to the integrity of the area that require protection measures to be identified for:

- uncontrolled and inappropriate use of fire
- inappropriate recreation and tourism activities, including development of tourism infrastructure
- invasion by pest species including weeds and feral animals
- loss of biodiversity and geodiversity
- impacts of human enhanced climate change
- lack of understanding of heritage values.

3.3.4 Other values of the Greater Blue Mountains

In addition to the attributes recognised by the World Heritage Committee in 2000, the Greater Blue Mountains has several other important values that complement and interact with its World Heritage values. Protection of these values is integral in managing individual protected areas and the Greater Blue Mountains as a whole (Department of Environment and Climate Change, 2009).

Table 3.1 provides a summary of the values, identified by the NPWS in the GBMA Strategic Plan, that contribute to the overall values of the area.

Table 3.1 Other important values of the GBMA

Value	Description
Geodiversity and biodiversity	In addition to the outstanding biodiversity features of the GBMA which form the basis of its listing, the site also has a diverse landscape and series of geological features. This includes the most extensive sandstone canyon system within eastern Australia. The area also contains karst landscapes with several cave systems including the world's oldest open cave system, Jenolan Caves. Other features include prominent basalt-capped peaks, quaternary alluvial deposits and a series of perched perennial freshwater lakes of considerable geomorphological and biological significance.
Water catchment	The GBMA protects a large number of pristine and relatively undisturbed catchment areas, some of which make a substantial contribution to maintaining high water quality in a series of water storage reservoirs supplying Sydney and adjacent rural areas. The catchments also make an important contribution to the maintenance of water quality and natural flow regimes in the Hawkesbury-Nepean and Goulburn-Hunter river systems.

Value	Description
Cultural values (Aboriginal)	Known sites provide evidence of at least 14,000 (and possibly 22,000) years of Aboriginal occupation of the area, but traditional beliefs connect First Nations people with the landscape even further. Although no comprehensive surveys have been undertaken of the whole of the GBMA site, numerous Aboriginal sites within the area are known to be widespread, diverse and include landscape features of spiritual significance and rock art sites. Recorded sites of archaeological significance include a widespread sample of the Sydney Region's distinctive Aboriginal rock art, on a scale unique in Australia. Given the wilderness nature of the area and the limited survey to date, there is high potential for the discovery of further significant Aboriginal sites throughout the GBMA, including areas below the preliminary flight paths, however these sites are unlikely to be discovered as a direct result of the implementation of the preliminary flight paths.
Cultural values (historic heritage)	The GBMA includes a large number of places of historic significance some of which date back to the early years of European settlement and exploration in Australia. Recorded sites within the area demonstrate a range of post-1788 human use are associated with rural settlement, pastoral use, timber getting, mining, transport routes, tourism and recreation. The sites include small graziers' huts, logging roads, stock routes and the ruins of mines.
Recreation and tourism	The GBMA provides settings for recreation and tourism that have outstanding value and are increasingly rare by world standards. The high recreational values are primarily derived from the area's intrinsic beauty, natural features and accessibility from major population centres. A wide range of recreational opportunities existing within the site include canyoning, canyoning, bushwalking, rock climbing, nature observation, caving, picnicking, camping, photography and scenic driving. The regional economy surrounding the GBMA is also heavily supported by tourism with the area contributing both directly and indirectly to the employment, income and output of much of the region (through elements such as forma accommodation and camping, food, nature-based tours and activities, visitor centres and other attractions).
Wilderness	The extraordinary wilderness quality of much of the GBMA considerably contributes to its World Heritage values, ensures the integrity of its ecosystems and the retention and protection of its heritage value. Protection of wilderness was one of the main reasons for the establishment of many of the national parks within the GBMA. The GBMA contains some of the largest forested wilderness areas in eastern mainland Australia. As noted in the Integrity statement for the GBMA, 65 per cent of the area is designated as statutory wilderness. These areas are located primarily in the northern section of the site. The Greater Blue Mountains park system includes 5 declared wilderness areas through formal recognition of the Wilderness Act (Wollemi, Kanangra-Boyd, Nattai, Yengo and Grose) which encompasses over 551,000 hectares of wilderness areas in the GBMA. The Blue Mountains wilderness areas also protect 3 of only 6 streams declared as 'Wild Rivers' in NSW under the NP&W Act: the Colo, Grose and Kowmung. As stated in the GBMA Strategic Plan, the wilderness qualities of the site also have many cultural values, providing not only opportunities for solitude and self-reliant recreation, but also aesthetic, spiritual and intrinsic value.
Social and economic	The regional economy surrounding the GBMA is substantially supported by various forms of tourism, in particular people accessing the various towns along the Great Western Highway and Bells Line of Road, as well as various recreational activities within the bushland areas. The reserves within the GBMA have considerable social and economic value and contribute directly and indirectly to the employment, income and output of the regional economy. Although visitation to specific locations can be highly variable, both in time (due to seasonal effects) and location (given the broad area of the property), overall visitation to the GBMA is considered to be generally increasing (outside the recent impacts of COVID) – reflecting the region's importance as a tourist destination for both day and longer trips.

Value	Description
Research and education	The GBMA is ideal for research and educational visits due to the variety of ecological communities, landscape and associated cultural sites. Information arising from the scientific research conducted within the GBMA was a key supporting component for its World Heritage nomination. The high scientific value reflects what has been discovered and what remains to be discovered, including large gaps in knowledge which still remain with respect to Aboriginal use and occupation in the area and the ecological needs of threatened species and communities.
Scenic and aesthetic	The GBMA includes some of the most dramatic scenery in Australia, with its best known landscapes dominated by striking vertical cliffs and waterfalls. With many vantage points on ridges and escarpments, the GBMA offers outstanding vistas, from uninterrupted views of forested wilderness covered by natural vegetation to the contrasts of steep forested slopes surrounding cleared valleys. The area's scenic and aesthetic values are demonstrated in a variety of ways, for example the large body of contemporary art and photography inspired by the landscape and the significant levels of visitation to scenic vantage points.
Bequest, inspiration, spirituality and existence.	One of the goals of World Heritage management is to ensure that future generations can experience and appreciate the uniqueness of these areas. This goal explicitly recognises an area's bequest values and the importance of Aboriginal cultural continuity. The wild and rugged landscapes, diverse flora and fauna, and opportunities for solitude and quiet reflection are attributes that promote inspiration, serenity and rejuvenation of the human mind and spirit.

3.3.5 Land use and tenure

The GBMA comprises 8 reserves ranging in size from around 641 hectares (Thirlmere Lakes National Park) to around 499,879 hectares (Wollemi National Park). Tenure of these sites include 7 national parks and one karst conservation reserve (Jenolan Caves Karst Conservation Reserve).

The perimeter of the GBMA is around 5,000 km. This means that the adjacent land uses to the site have a potentially significantly impact with respect to the values of the GBMA. In addition to a number of adjacent protected areas (such as the Goulburn River National Park and a number of State Conservation Areas (SCA) that surround the GBMA listing), the GBMA adjoins a substantial number of freehold properties, including areas of significant urban development regulated by a number of local government areas. Other land uses adjacent to or near the reserves include tourism facilities, forestry, agriculture, grazing, manufacturing, mining and some military activities.

Where the GBMA are in places contiguous with other protected areas and Crown reserves, the management of the adjacent areas needs to be consistent with the protection of the World Heritage values in the listed areas. The GBMA is divided by a corridor of urban development comprising the urbanised portion of the Blue Mountains (generally between Penrith and Lithgow). This corridor includes infrastructure such as the Great Western Highway and the Blue Mountains railway line which connects the region and areas further west to Greater Sydney. The majority of the urban area is located along a central spine corresponding with the highway.

The Warragamba Dam, which resulted in the creation of Lake Burragorang, also forms an adjacent land use to the GBMA. The reservoir does not form part of the area covered by the World Heritage Area listing (though as noted previously, many areas surrounding the formal area of the GBMA assist in maintaining and protecting the overall natural setting of the site). Lake Burragorang currently covers an area of around 75 square km and supplies much of the Greater Sydney region's water supply.

3.3.6 Key sensitive tourist and recreation areas

While COVID impacted on the level of annual tourism to the Blue Mountains region generally, for the prior 12 months to December 2022, the Blue Mountains received around 3.8 million total domestic visitors, with around 1.4 million domestic overnight visitors (contributing to around 3.5 million total nights of visitation), and around 2.5 million total daytrip visitors (Destination NSW, 2022). Bushwalking/rainforest walks and visiting National Parks/State Parks were 2 of the top 5 activities identified by visitors to the Blue Mountains during this time.

Key sensitive tourism and recreation areas were identified for this assessment based on the identification of important attractions and associated viewing locations within the GBMA (Table 3.2) and in consideration of the tourism and recreation areas previously considered as part of the 2016 EIS. The assessment considered the remoteness, accessibility and accommodation options as an indication of the type of tourism and recreational experiences available at each location.

Table 3.2 Key sensitive tourist and recreational areas, viewing locations and accessibility

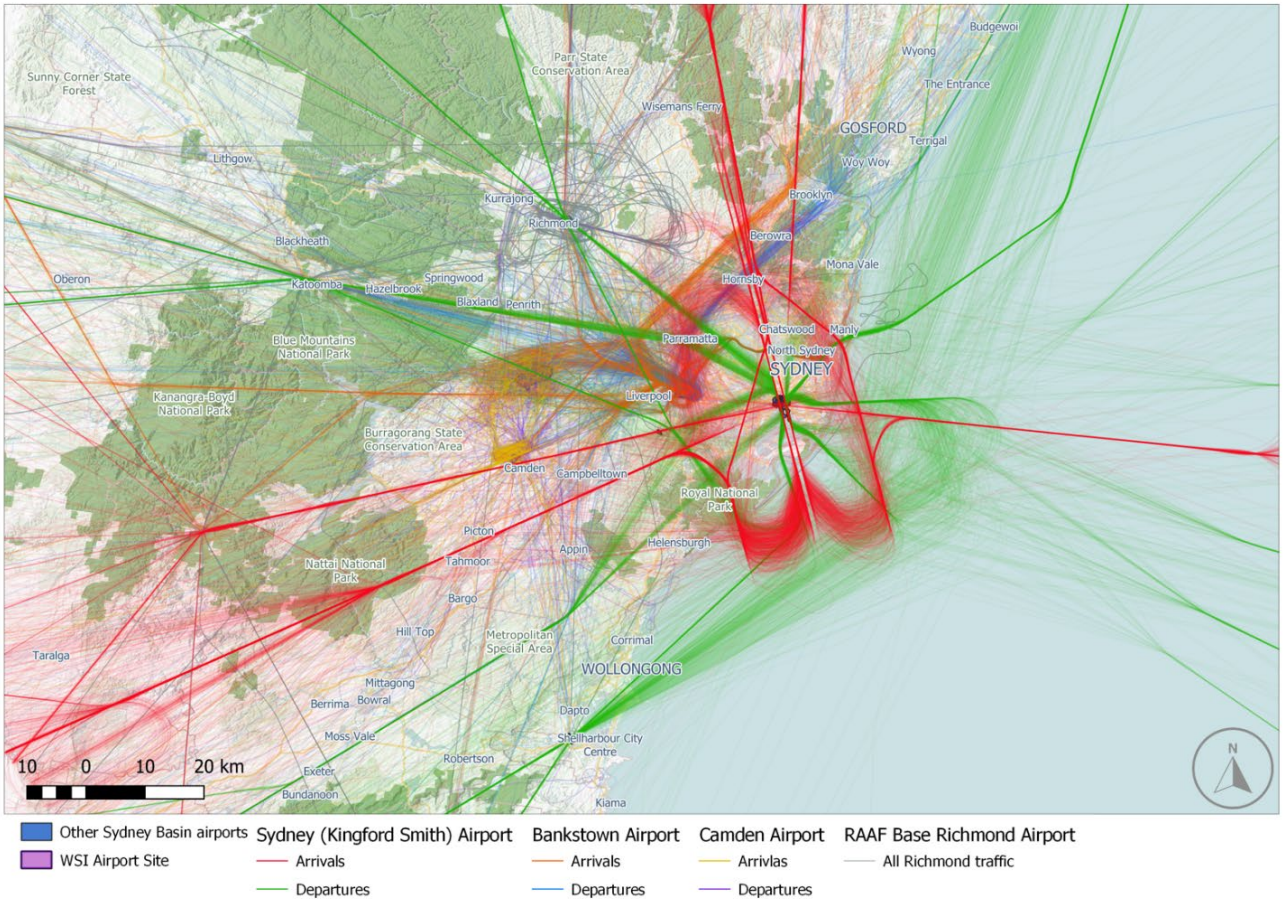
Location	Key attribute	Key viewing locations	Location
Blue Mountains National Park	Jamison Valley including the Three Sisters	Echo Point Lookout, Sublime Point Lookout, Perrys Lookdown, Evans Lookout, Mount Hay, Lockleys Pylon, Pulpit Rock Lookout, Gladstone Lookout, Moya Point Lookout, Sunset Rock Lookout, Cleary Memorial Lookout, Honeymoon Lookout, Queen Elizabeth and Drum Lookouts, Scenic Cableway and Scenic Railway, Narrowneck Lookout, Castle Head Lookout, Cahills Lookout, Peckmans Plateau Lookout, Eaglehawk Lookout, Hildas Lookout, Norths Lookout, McMahons Lookout, Peckmans Plateau Lookout, Norths Lookout, Nepean Narrows Lookout, Nepean Gorge Lookout, Nepean Lookout, Freds Lookout, Erskine Lookout, Mount Portal Lookout, Rileys Lookout, The Rock Lookout Greenfields Lookout, Melville Lookout, Wynnes Rocks Lookout, Point Pilcher Lookout, Du Faurs Lookout, Mount Banks Lookout, and Walls Lookout.	Katoomba
	Wentworth Falls waterfall	Wentworth Falls Lookout	Wentworth Falls
	Grose Valley	Evans Lookout; Govetts Leap Lookout	Blackheath
	Wilderness, bushwalking, rock-climbing, trail bike riding, picnicking and remote camping	Views from walking tracks such as National Pass, Federal Pass, Mount Solitary, and Narrowneck Fire trail Campgrounds and day use areas including: • Euroka Campground, Glenbrook • Perrys Lookdown, Blackheath • Dunphys Campground, Megalong Valley • Ingar, Wentworth Falls • Murphys Glen, Woodford.	Southern section of the national park
Wollemi National Park	Wilderness, bushwalking, rock climbing, canoeing, picnicking	Deanes Lookout; Crawfords Lookout	Not identified
Yengo National Park	Wilderness, bushwalking, horse riding, trail bike riding, picnicking	Finchley Lookout; Mount Yengo Lookout	50 km south-west of Cessnock
Nattai National Park	Wilderness, bushwalking, remote camping	Kanangra-Boyd Lookout, Kowmung Lookout, Rigby Rock Lookout, Moorilla Lookout, Mount Dingo Lookout, and Kanangra Walls Lookouts	30 km north of Mittagong

Location	Key attribute	Key viewing locations	Location
Kanangra-Boyd National Park	Kanangra Walls Mount Cloudmaker	Wollondilly Lookout; Starlights trail; Couridjah Corridor walk	50 km south-east of Oberon
	Wilderness, bushwalking, rock-climbing, trail bike riding, picnicking and remote camping	Not applicable	Southern sections of the park
Gardens of Stone National Park	Baal Bone Gap, 4-wheel driving	Baal Bone Gap picnic area	35 km north of Lithgow
Thirlmere Lakes National Park	Birdwatching, picnicking, walking and swimming	Werri Berri picnic area	Couridjah
Jenolan Caves Karst Conservation Reserve	Jenolan Caves	Not applicable	Jenolan
Burragorang State Conservation Area	Warragamba Dam	Burragorang Lookout, Warragamba Dam	Nattai
Prospect Reservoir	Prospect Reservoir	George Maunder Lookout, Prospect Reservoir	Prospect
Various	Scenic and tourist drives	Scenic and tourist drives including the: • Warragamba Waters scenic drive • Greater Blue Mountains scenic drive • Greater Blue Mountains Drive • The Bells Line of Road	Various

3.4 The Sydney Basin airspace

The Sydney Basin airspace refers to the airspace area within the Greater Sydney region, generally bordered by Sutherland and Bargo in the south, Lake Macquarie and the Hawkesbury River in the north and Mount Victoria in the west. It encompasses an extensive network of flight paths associated with existing airports, Defence facilities, recreational aviation activities (gliders, ballooning and parachuting), emergency aviation activities (for example, medical or bushfire), helicopter activity and transiting flights.

The Sydney Basin airspace is likely the most complex and busiest in Australia. In 2019, there were over 710,000 air traffic movements in the Sydney Basin airspace. The actual flight tracks of individual aircraft within the Sydney Basin airspace are recorded by Airservices Australia using information from surveillance radars operated by air traffic control. Most parts of the Sydney Basin, including much of the Greater Blue Mountains, currently experience some level of daily overflight. The level of existing aircraft activity within the Sydney Basin airspace is evident in reviewing actual flight tracks flown by aircraft from Sydney (Kingsford Smith) Airport, RAAF Base Richmond, Camden Airport and Bankstown Airport over a one week period in 2019 (refer to Figure 3.4).



Note: This figure does not include other airports that operate aircraft within the Sydney Basin such as RAAF Base Richmond, the Defence Establishment Orchard Hills or Australian Army Holsworthy Airport.

Figure 3.4 One week sample of flight track activity in the Sydney Basin (March 2019)

Figure 3.4 emphasises the already congested and blanketing nature of overflight activity in the Sydney Basin. This encompasses airspace that extends out to Katoomba to the west, the Hawksbury River to the north, the southern boundary of the Royal National Park to the south and 20 km to the east, including much of the Greater Blue Mountains. The aircraft already operating within this area range from large widebody jets (such as the Airbus A380, Boeing B777 and Boeing B787) through to narrowbody jets (such as the Boeing B737 and Airbus A320), turboprops (such as the Dash 400 and ATR72), military aircraft, to single/twin-engine piston aircraft and various helicopter models.

3.5 Statutory and legislative context

3.5.1 The World Heritage Convention

The Convention Concerning the Protection of World Cultural and Natural Heritage 1972 (the World Heritage Convention) aims to promote cooperation among nations to protect heritage around the world that is of such Outstanding Universal Value that its conservation is important for current and future generations. The World Heritage Convention also sets out the criteria that a site must meet to be inscribed on the World Heritage List.

The World Heritage Convention provides State Parties (i.e. the Australian Government) with direction regarding the identification of potential sites for inscription onto the World Heritage List, and what is required to be undertaken in order to preserve and protect such sites if they are added. Signatories to the World Heritage Convention agree to conserving World Heritage sites within their jurisdictions, and that they will take the required measures in order to protect their recognised National Heritage. Article 5 of the World Heritage Convention identifies that, in so far as possible, the protection of world and National Heritage should be integrated into relevant planning processes and programs, and provide sufficient resourcing to protect, conserve, and communicate the significant values of each place.

The UNESCO (UNESCO, 2022b), summarises the importance of the World Heritage Convention by stating:

> *The most significant feature of the 1972 World Heritage Convention is that it links together in a single document the concepts of nature conservation and the preservation of cultural properties. The Convention recognizes* [sic] *the way in which people interact with nature, and the fundamental need to preserve the balance between the two.*

The Committee is responsible for the implementation of the World Heritage Convention, defines the use of the World Heritage Fund and allocates financial assistance upon requests from States Parties. It has the final say on whether a site is inscribed on the World Heritage List.

3.5.1.1 World Heritage List

The World Heritage Convention identifies the criteria that a site must meet in order for it to be inscribed on the World Heritage List and the role of State Parties (i.e. the Australian Government) in protecting and preserving this heritage. Places on the World Heritage List are protected in Australia through the EPBC Act. Given the nature of the project, the study area covers a large portion of the Sydney Basin airspace and areas beyond. The study area includes the curtilages of a number of places listed on the World Heritage List, as summarised in Table 3.3 and illustrated on Figure 3.1.

Table 3.3 World Heritage places within the Project study area

Name	Place ID [1]	Status	World Heritage Criteria [2]	Address	Relationship to the study area
The Greater Blue Mountains	105127	Declared property	ix, x	Great Western Hwy, Katoomba NSW	A number of the preliminary flight paths would travel directly over areas of the Greater Blue Mountains at a range of altitudes between around 2,000 and 10,000 feet (ft), depending on the location of the flight path over the GBMA. The lower altitudes would typically be towards the eastern boundary of the property where aircraft would be on the initial parts of their ascent or final approach/decent.

Name	Place ID [1]	Status	World Heritage Criteria [2]	Address	Relationship to the study area
Australian Convict Sites (Old Great North Road)	106209	Declared property	iv, vi	The Old Great Northern Rd, Wisemans Ferry NSW	Flights travelling north over the Richmond region of Sydney would occur around 6 nm (11 km) to the west of this site, and generally at a height of greater than 20,000 ft.
Australian Convict Sites (Old Great North Road Buffer Zone).	106209	Buffer zone	iv, vi	The Old Great Northern Rd, Wisemans Ferry NSW	
Australian Convict Sites (Old Government House and Domain)	106209	Declared property	iv, vi	Corner of Pitt Street and Macquarie Street, Parramatta NSW	Flights travelling north over the western parts of Greater Sydney would occur around 2 nm (4 km) to the west of this site at the closest point and generally at a height of greater than around 17,500 to 18,000 ft.
Australian Convict Sites (Cockatoo Island Convict Site)	106209	Declared property	iv, vi	Cockatoo Island, Sydney Harbour	Flights travelling east over the Sydney CBD would occur around 5 nm (10 km) to the south of this site at the closest point and generally at a height of greater than around 17,500 to 18,000 ft.
Australian Convict Sites (Hyde Park Barracks)	106209	Declared property	iv, vi	Queens Square, Macquarie Street, Sydney	Flights travelling east over the Sydney CBD would occur around 3 nm (6 km) to the south of this site at the closest point and generally at a height of greater than around 17,500 to 18,000 ft.
Sydney Opera House	105914	Declared property	i	Pitt Street and Macquarie Street, Parramatta	Flights travelling east over the Sydney CBD would occur around 4 nm (8 km)to the south of this site at the closest point and generally at a height of greater than around 17,500 to 18,000 ft.

1. Australian Heritage Database ID Number
2. Criterion descriptions:
   - Criterion i - to represent a masterpiece of human creative genius;
   - Criterion iv - to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history
   - Criterion vi - to be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance
   - Criterion ix – to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals
   - Criterion x – to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation.

3.5.1.2 Operational Guidelines for the Implementation of the World Heritage Convention

As identified above, the World Heritage Convention is the international agreement on the protection of World Heritage. In support of this convention, the *Operational Guidelines for the implementation of the World Heritage Convention* (UNESCO, 2021) (Operational Guidelines) have been prepared to provide essential reference in how to protect and manage World Heritage properties. The Operational Guidelines are regularly updated by the World Heritage Committee to reflect new concepts, knowledge or experiences (with the current version being 2021).

Paragraphs 96 to 119 of the Operational Guidelines deal with protection and management of World Heritage properties and paragraph 132(5) provides detail about what protective legislation, management plans and/or arrangements are required in a nomination document.

Protection of World Heritage in Australia is done using 2 key methods:

- Through regulation – The EPBC Act is Australia's main instrument for implementing its obligations under the World Heritage Convention. The EPBC Act regulates actions that may have a significant impact on the World Heritage values of declared World Heritage properties. The EPBC Act provides that a person must not take an action that has or will have or is likely to have a significant impact on the World Heritage values of declared World Heritage properties.

  With respect to regulation, a referral for the project was made under Section 161 of the EPBC Act by DITRDCA, Airservices Australia and the Civil Aviation Safety Authority in 2021 (EPBC 2022/9143). The delegate for the Australian Minister for the Environment determined on 28 January 2022 that the project would be assessed by way of an EIS and in doing so issued relevant EIS Guidelines.

- By management plans – in accordance with paragraph 108 and132.5 of the Operational Guidelines, the *Greater Blue Mountains World Heritage Area Strategic Plan* (Department of Environment and Climate Change (DECC) 2009) and *Greater Blue Mountains World Heritage Area Strategic Plan Addendum 2016* (Office of Environment and Heritage, 2018) have been prepared to provide a frameworks for the area's management, protection and monitoring (as described in greater detail previously in Section 3.3.3.2).

  The Strategic Plan (and 2016 Addendum) was prepared to assist in meeting Australia's international responsibilities under the World Heritage Convention. It identifies and ensures that appropriate consideration is given to the GBMA's World Heritage values when developing management prescriptions for the GBMA reserves, and that they are developed and implemented in a consistent and coordinated way. This report has identified and considered each of the values and potential threats to the integrity of the area that require protection measures, including those that provide for the GBMA Outstanding Universal Value, and the other values of the property.

The preparation of the EIS prepared for the project, to which this technical report is a supporting document, has been prepare to meet the EIS guidelines and takes into account the values and management strategies as identified in the relevant management plans for the GBMA. It is therefore considered that the assessment that has been undertaken is consistent with the requirements of the World Heritage Convention and the obligations of the Australian Government to consider potential impacts to its listed World Heritage properties.

3.5.2 International Union for Conservation of Nature

The International Union for Conservation of Nature (IUCN) is an international organisation involved in nature conservation and the sustainable use of natural resources. There are over 1,400 member organisations including a number from Australia such as Department of Climate Change, Energy, the Environment and Water, the Blue Mountains World Heritage Institute and the Australian Foundation for Wilderness (IUCN, 2022).

3.5.2.1 2013 IUCN Advice Note

The IUCN in November 2013, published an Advice Note (IUCN, 2013) to provide guidance on integrating natural World Heritage sites into environmental assessments. Section 3 of the Advice Note states:

> *An Environmental Assessment for a proposal affecting, or with the potential to affect, a natural World Heritage Site is intended to ensure that the proposal's likely impacts on the Outstanding Universal Value of the site are fully considered in land-use planning decisions with the objective of preserving these exceptional places for future generations. The assessment should also consider the site's links with the surrounding landscape as a natural World Heritage Site cannot be considered separately from the wider ecosystem.*

Section 4 of the Advice Note states that the IUCN' position is that infrastructure and other development proposals located within, or outside the boundaries of a natural World Heritage Site, should be considered in terms of whether they are compatible with the long-term objective of preserving the Outstanding Universal Value of the site for future generations.

The section also notes that where developments affecting a natural World Heritage Site are under consideration, these should be subject to a rigorous environmental assessment in line with the 8 World Heritage Impact Assessment Principles. The 8 World Heritage Impact Assessment Principles are as follows:

- Principle 1: All proposals that may adversely affect a natural World Heritage Site must undergo a rigorous Environmental Assessment early on in the decision-making process, whether they are located within or outside its boundaries
- Principle 2: Experts with World Heritage, protected area and biodiversity knowledge must be closely involved in the assessment process in order to identify the issues that will need to be assessed
- Principle 3: The likely environmental and social impacts of the development proposal on the site's Outstanding Universal Value must be assessed, including direct, indirect and cumulative effects
- Principle 4: Reasonable alternatives to the proposal must be identified and assessed with the aim of recommending the most sustainable option to decision-makers
- Principle 5: Mitigation measures should be identified in line with the mitigation hierarchy, which requires first avoiding potential negative impacts and secondly reducing unavoidable residual impacts through mitigation measures
- Principle 6: A separate chapter on World Heritage must be included in the Environmental Assessment
- Principle 7: The assessment must be publicly disclosed and subject to thorough public consultation at different stages
- Principle 8: An Environmental Management Plan must be proposed, implemented and independently audited.

The preparation of the EIS prepared for the project, to which this technical report is a supporting document, has been prepared in consideration of the principles outlined in the Guidance note.

Specifically, the preparation of this report meets the following principles:

- Principle 1 in that the report presents a detailed environmental assessment of the project and its potential impacts in accordance with the decision making requirements outlined in the EIS Guidelines issued for the project
- Principle 2 in that it has been prepared by qualified authors as outlined in Section 1.3.2 and Section 1.4, including experts in biodiversity and heritage impacts
- Principle 3 through consideration of all likely environmental and social impacts, as detailed in Chapter 5
- Principle 4 through consideration of all alternative options, as detailed in Section 4.3
- Principle 5 through identification of any reasonable and feasible mitigation measures, as outlined in Chapter 6
- Principle 6 through the preparation of this separate Technical paper that addresses potential impacts on World Heritage (and which is summarised as part of a consolidated chapter on Matters of National Environmental Significance in the EIS – Chapter 23)

- Principle 7 as this report, along with the Draft EIS was placed on public exhibition for review and comment between October 2023 and January 2024. The EIS (which this technical paper forms part of) and associated Submissions Report also considers the submissions that were received during the exhibition period. The Draft EIS was also referred to the World Heritage Committee via the UNESCO World Heritage Centre by DCCEEW (as lead agency in the IUCN interaction) for review in accordance with section 6 of the Guidance note. As of the time of this report, comment from UNESCO and the IUCN was still pending
- This report, and the overarching EIS that it supports, is also not considered to be inconsistent with the Principle 8 in that it has considered the existing management plans which have been prepared for management of the GBMA.

3.5.3 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides the national framework for protecting and managing nationally (and internationally) important flora and fauna, ecological communities and heritage places (including World Heritage) that are defined under the EPBC Act as 'matters of national significance'. In particular, the EPBC Act is Australia's main legislative instrument for implementing its obligations under the World Heritage Convention. The EPBC Act also confers jurisdiction over actions that have the potential to make a significant impact on the environment where the actions affect Commonwealth land or are undertaken on behalf of Commonwealth agencies.

Under Section 160 of the EPBC Act, an Australian agency (or employee) must obtain and consider advice from the Australian Environment Minister before a plan for aviation airspace management is adopted or implemented where the aircraft operations will have or is likely to have a significant impact on the environment. The preliminary airspace design for the project is a plan for aviation airspace management within the meaning of the EPBC Act.

A referral was made under Section 161 of the EPBC Act by DITRDCA, Airservices Australia and CASA in 2021 (EPBC 2022/9143). The delegate for the Australian Environment Minister determined on 28 January 2022 that the project would be assessed by way of an EIS and in doing so issued the EIS Guidelines, and DITRDCA is the nominated proponent for the project.

3.5.3.1 Matters of National Environmental Significance

The EPBC Act considers 9 matters of environmental significance (MNES). They are outlined below:

- World Heritage properties
- National Heritage places
- wetlands or international importance (listed under RAMSAR Convention)
- listed threatened specifies and ecological communities
- migratory species protected under international agreements
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines), and
- a water resource (in relation to a coal seam gas development and large coal mine development).

Under Part 3, Division 1 of the EPBC Act, a project (or action) that will or is likely to have a significant impact on MNES requires an approval from the Australian Environment Minister (referred to as a 'controlled action'). However, as the project is subject to Section 160(2) of the EPBC Act, this approval is not required. While this approval is not required, the assessment of the project has still considered the impacts on the 'whole of the environment'. That is, the assessment has assessed impacts to MNES but it will not be limited to those considerations.

3.5.3.2 World Heritage

Part 15, Division 1 of the EPBC Act sets out the requirements for the management of properties on the World Heritage List. This includes the identification of management principles and the requirement to prepare a management plan for a World Heritage property or area that is consistent with Australia's obligations under the World Heritage Convention or the Australian World Heritage management principles.

The *Greater Blue Mountains World Heritage Area Strategic Plan* (Department of Environment and Climate Change (DECC) 2009) and *Greater Blue Mountains World Heritage Area Strategic Plan Addendum 2016* (Office of Environment and Heritage, 2018) have been prepared to provide a framework for the area's management, protection and monitoring. The key management objectives set out in the Strategic Plan (NSW DECC, 2009) provide the basis for the management of the Greater Blue Mountains and guidance for operational strategies in accordance with requirements of the World Heritage Convention and its Operational Guidelines (UNESCO, 2021). The Strategic Plan and the 2016 Addendum are discussed further in Section 3.5.4 below.

3.5.3.3 Environment Protection and Biodiversity Conservation Regulations 2000

Schedule 5 of the Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations) also identifies principles regarding the management of Australian World Heritage. These principles include ensuring that:

- management of natural heritage and cultural heritage of a declared World Heritage property must be in accordance with Australia's obligations under the World Heritage Convention
- management should provide for public consultation on decisions and actions that may have a significant impact on the property.

Schedule 5 also provides for principles that apply to the environmental impact assessment and approval of an action. This technical assessment has been prepared in line with the assessment principles outlines in Schedule 5 (3) of the EPBC Regulations including:

- identifying the World Heritage values of the property that are likely to be affected by the action; and
- examining how the World Heritage values of the property might be affected; and
- providing for adequate opportunity for public consultation (through the exhibition of the Draft EIS between October 2023 and January 2024).

3.5.4 NSW legislation

As described above, the EPBC Act provides for the development and implementation of management plans for World Heritage properties, which describe aspects of the Greater Blue Mountains Area and how it would be managed. The NSW Government, through the NSW Department of Planning and Environment (Environment and Heritage Group) is responsible for the day-to-day management of the GBMA. The GBMA is protected and managed primarily under the following State legislation:

- *National Parks and Wildlife Act 1974* (NSW) (NP&W Act) – The NPW Act provides for the protection and reservation of certain lands, the protection of Aboriginal objects and places, the protection of fauna and the protection of native vegetation. It also provides for the declaration of wild rivers. Within the GBMA, the Grose River (Blue Mountains National Park), Colo River (Wollemi and Blue Mountains National Parks) and Kowmung River (Kanangra-Boyd National Park).
- *Wilderness Act 1987* (NSW) (Wilderness Act) – The Wilderness Act makes provisions for the identification, protection and management of wilderness areas in NSW. Kanangra-Boyd, Nattai, Yengo, Grose and Wollemi national parks, which form part of the GBMA, are declared wilderness areas. The management of wilderness areas is to restore and protect the unmodified state of wilderness areas, preserve its capacity to evolve in the absence of significant human interference and permit opportunities for solitude and appropriate self-reliant recreation.

These Acts cover the protection and management of areas such as national parks, nature reserves and wilderness. Other relevant legislation includes the NSW *Biodiversity Conservation Act 2016*, the *Environmental Planning and Assessment Act 1979*, and the *Heritage Act 1977*.

The *Greater Blue Mountains World Heritage Area Strategic Plan* (NSW Department of Environment and Climate Change (DECC), 2009) and *Greater Blue Mountains World Heritage Area Strategic Plan Addendum 2016* (NSW Office of Environment and Heritage, 2018) provide frameworks for the area's integrated management, protection, interpretation and monitoring. The key management objectives set out in the Strategic Plan (NSW DECC, 2009) provide the basis for the management of the Greater Blue Mountains and guidance for operational strategies in accordance with requirements of the *2021 World Heritage Convention and its Operational Guidelines* (UNESCO, 2021).

The Strategic Plan and Addendum identifies the following threats to the integrity of the area that require protection measures to be identified for:

- uncontrolled and inappropriate use of fire
- inappropriate recreation and tourism activities, including development of tourism infrastructure
- invasion by pest species including weeds and feral animals
- loss of biodiversity and geodiversity
- impacts of human enhanced climate change
- lack of understanding of heritage values.

Chapter 4 Project overview and alternatives

This chapter outlines:

- the need for the project and its objectives
- a description of the key features of the project
- an overview of the key alternatives which were considered and design process that led to the development of the project, including consideration of a 'no project' alternative.

The project (as outlined in Section 4.2 below) consists of the operational flight paths associated with the approved WSI airport. Therefore, the primary need for the project is linked with the needs and benefits associated with the approved ground infrastructure of WSI. An outline of the needs and benefits of WSI as a whole is outlined in the following sections.

4.1 Need for WSI

The need for an airport in Western Sydney has been driven principally by the growing demand for aviation services in the Sydney region and the diminishing ability of existing airports (in particular Sydney (Kingsford Smith) Airport) to accommodate future growth. Sydney is reliant on the aviation system to maintain its status as a global city, tourist destination and major financial and services centre within the Asia Pacific region. There is expected to be an increase in the overall demand for aviation services to service the ongoing population growth, as well as economic growth from business-related activities, generally within the greater Sydney region.

In response to growing aviation demand, the Australian and NSW governments agreed in 2009 to develop a strategic plan to ensure sufficient future aviation capacity in the Sydney region. This led to the preparation of the *2012 Joint Study on Aviation Capacity in the Sydney Region* (the Joint Study). The Joint Study identified the need to increase airport capacity in the Sydney Basin (Department of Infrastructure and Transport, 2012). The Joint Study found that while Sydney (Kingsford Smith) Airport would remain an important airport for the Greater Sydney region and Australia, it would be unable to meet increasing passenger demand. An additional airport would be required by around 2030. The Joint Study found that without significant additional aviation capacity in the Sydney Basin airspace, the domestic airline sector would become increasingly constrained and new services from international markets would not be able to be accommodated (DITRDCA, 2021). It was estimated that annual demand for regular public transport services in the Sydney region would double to around 88 million passenger trips by 2035, then double again by around 2060.

Without the development of additional airport capacity close to Sydney to accommodate the increase in passengers, Sydney (Kingsford Smith) Airport would remain the only available alternative for servicing this demand. By 2035, Sydney (Kingsford Smith) Airport would need to accommodate close to 80 million passengers a year (equivalent to around a 50 per cent increase on 2010 flight movements). However, the Joint Study noted that due to capacity constraints, Sydney (Kingsford Smith) Airport would not be able to accommodate all of the forecast demand.

COVID-19 related aviation disruption since early 2020 has not affected the need for a new airport within the Sydney Basin.

4.2 Project overview

The following sections provide an overview of the key project elements related to the WSI airspace and operations. Further detail regarding the key elements of the project is provided in Chapter 7 (The project) of the EIS.

4.2.1 Overview

The project does not include any physical infrastructure. No construction works or changes to the previously approved physical ground infrastructure (currently under construction) are required for the project. This includes the airfield, terminal, landside layout and facilities, instrument landing systems and high intensity approach lighting arrays.

The project consists of the development and implementation of preliminary flight paths for single runway operations at WSI. The project also includes the associated air traffic control and noise abatement procedures for eventual use by civil and commercial passenger and freight aircraft. The airspace and flight paths would be managed by the Air Navigation Services Provider (ANSP), Airservices Australia.

To maintain the safety assurance of flight operations in the Sydney Basin airspace while meeting the requirements of efficiency, capacity and environment, adjustments to airspace are required for Sydney (Kingsford Smith) Airport, Bankstown Airport, Camden Airport, the Royal Australian Air Force (RAAF) Base Richmond (RAAF Base Richmond) and the Orchard Hills Defence Establishment (refer to Figure 1.1 for the location of these airports). For the Sydney (Kingsford Smith) Airport, this includes adjustments to existing arrival and departure routes. These changes need to occur incrementally prior to the opening of WSI in 2026.

4.2.2 WSI operations

4.2.2.1 Runway modes of operation

The runway modes of operation for WSI have been identified. These include operating modes for both day and night. The choice of a runway mode of operation is primarily informed by the weather (especially wind direction and strength). Other factors include the runway surface status, aircraft performance profile and capability, air traffic demand and airspace management procedures and potential impacts on surrounding communities, such as noise. For example, the flight paths in the night modes are different from those in the day modes to ensure that the night modes provide the lowest feasible noise footprint and enhanced efficiency.

The 2 principal runway operating modes (for day and night) are:

- Runway 05 – whereby all aircraft would be directed to approach WSI to land from the south-west and directed to take off to the north-east, before redirecting towards their ultimate destination, including some destinations to the south and west of WSI over the GBMA
- Runway 23 – whereby all aircraft would be directed to approach WSI to land from the north-east and take-off to the south-west, before redirecting to their ultimate destination, including some destinations to the south and west of WSI over the GBMA.

A third operating mode is also proposed, referred to as Reciprocal runway operations (RRO). RRO is a term given to a specific mode where aircraft depart in the opposite direction of flight to arriving aircraft. In the Airport Plan, this runway mode is often referred to as ‘head to head operations’. The RRO modes of operation would not be the only night time operational mode but could be used for WSI as an additional operating mode when it is safe to do so. This would involve all take-offs and landings occurring in opposing directions, to and from the south-west of WSI, resulting in flight paths crossing the GBMA (refer to detail below in Section 4.2.2.2).

4.2.2.2 Flight paths

Based on the different modes of operation, different flight paths would be adhered to within the airspace surrounding WSI. This would include flight paths that are over the GBMA. The patterns of movement would be relatively consistent but alter day to day according to weather conditions, and flights would operate generally within the bounds of flight path corridors. The corridors show flight-path widening to notionally 2 km either side of the nominal centreline of the departure flight path, transitioning to 5 km as the aircraft join the enroute flight network.

Flight paths for the operation of WSI are divided into day flight paths, night flight paths and RRO flight paths. The general description of each of these are summarised below. Further detailed descriptions of these flight paths is provided in Section 7.5 of the EIS.

Day flight paths

Day time flight paths (operating between 5:30 am to 11 pm (local time)) would be dependent on the selection of with a Runway 05 or Runway 23 operating direction for arrivals and departures. This would be weather dependent and largely governed by prevailing wind direction and speed.

The day arrival and departure flight paths for Runway 05 and Runway 23 (including their indicative altitudes) are shown on Figure 4.1 to Figure 4.2 respectively. Each of the preliminary flight paths would result in overflight of the GBMA.

Night flight paths

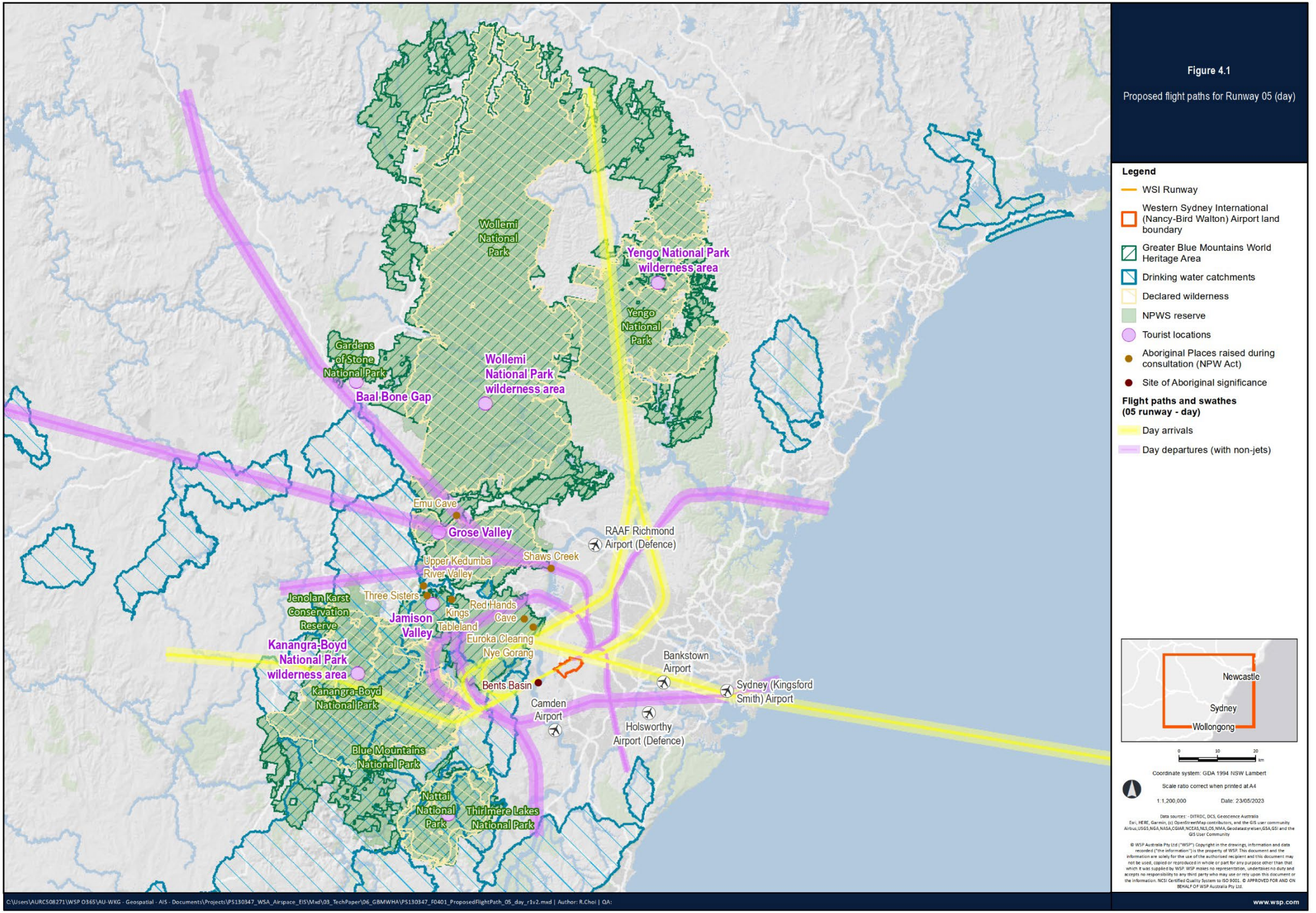
WSI night-time procedures (operating between 11 pm and 5:30 am (local time)) would allow for increased airspace flexibility and positioning options, compared to Sydney (Kingsford Smith) Airport, which has curfew operating restrictions. The night-time mode for WSI will only be available between 11 pm and 5:30 am local time to be compatible with the runway modes and associated flight paths for Sydney (Kingsford Smith) Airport. This ensures that WSI flight paths are separated from Sydney (Kingsford Smith) Airport flightpaths during daily operations, which commence at 6 am.

The night arrival and departure flight paths for Runway 05 and Runway 23 (including their indicative altitudes) are shown on Figure 4.3 to Figure 4.4 respectively. Each of the preliminary flight paths would result in overflight of the GBMA.

Night flight paths – RRO

When suitable weather and flight operation conditions permit (i.e. sufficiently low flight traffic etc), the RRO flight paths would land on Runway 05 from the south-west and depart from Runway 23 towards the south-west. The RRO flight paths would vary from the night flight paths described above. RRO flightpaths would be used during suitable night conditions to minimise overflight of more densely populated areas of the Sydney Basin during night time periods.

The night arrival and departure flight paths for RRO on Runway 05 (including their indicative altitudes) are shown on Figure 4.5. The proposed RRO flight paths would result in overflight of the GBMA both for arrivals and departures.


Wollemi National Park
Yengo National Park wilderness area
Yengo National Park
Gardens of Stone National Park
Baal Bone Gap
Wollemi National Park wilderness area
Emu Cave
Grose Valley
RAAF Richmond Airport (Defence)
Upper Kedumba River Valley
Shaws Creek
Jenolan Karst Conservation Reserve
Three Sisters
Kings Tableland
Red Hands Cave
Jamison Valley
Euroka Clearing
Nye Gorang
Kanangra-Boyd National Park wilderness area
Kanangra-Boyd National Park
Bents Basin
Bankstown Airport
Sydney (Kingsford Smith) Airport
Camden Airport
Holsworthy Airport (Defence)
Blue Mountains National Park
Nattai National Park
Thirlmere Lakes National Park
Figure 4.1
Proposed flight paths for Runway 05 (day)
Legend
WSI Runway
Western Sydney International (Nancy-Bird Walton) Airport land boundary
Greater Blue Mountains World Heritage Area
Drinking water catchments
Declared wilderness
NPWS reserve
Tourist locations
Aboriginal Places raised during consultation (NPW Act)
Site of Aboriginal significance
Flight paths and swathes (05 runway - day)
Day arrivals
Day departures (with non-jets)
Newcastle
Sydney
Wollongong
0
10
20
km
Coordinate system: GDA 1994 NSW Lambert
Scale ratio correct when printed at A4
1:1,200,000
Date: 23/05/2023
Data sources: - DITRDC, DCS, Geoscience Australia
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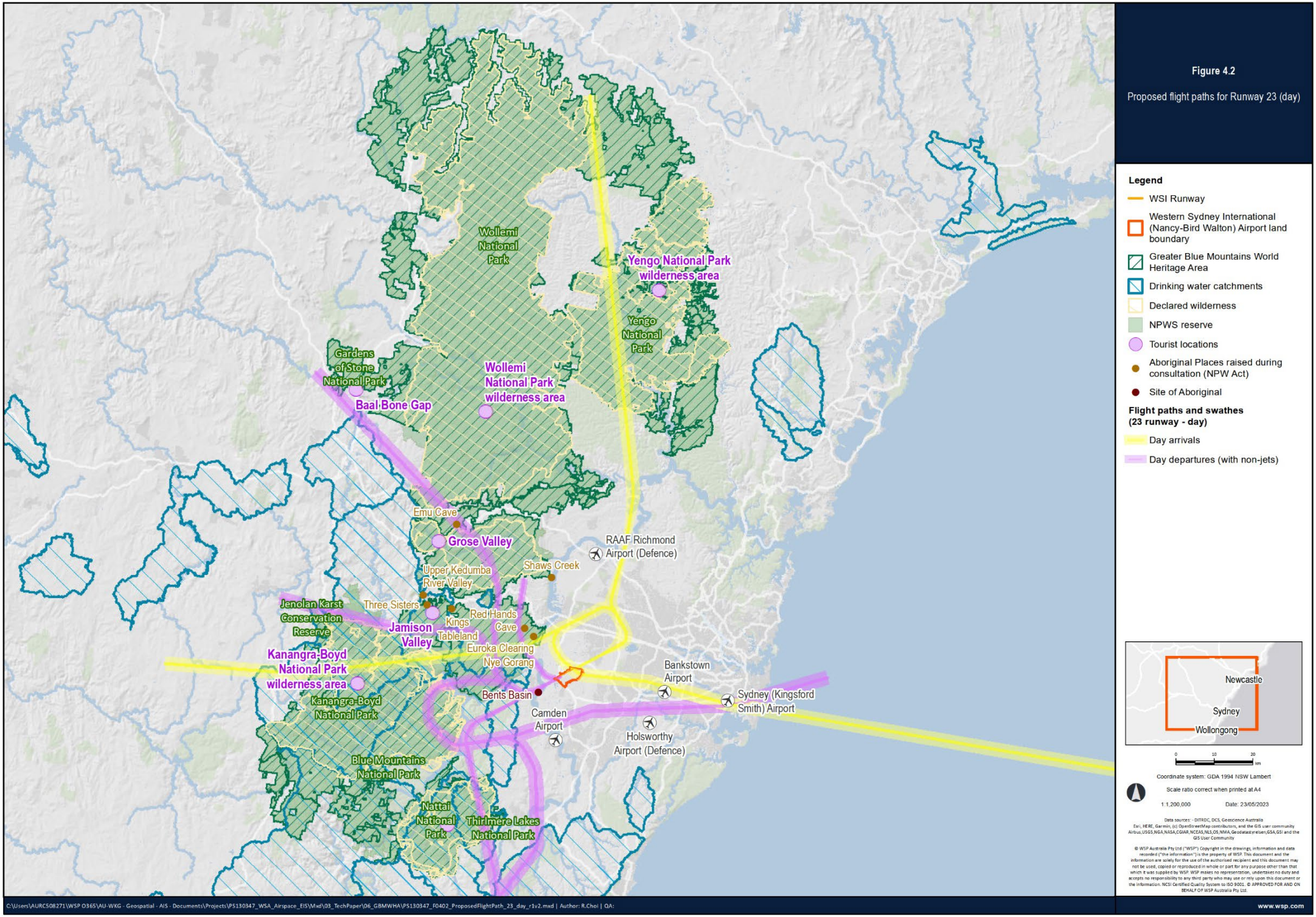
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Baal Bone Gap
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Grose Valley
RAAF Richmond Airport (Defence)
Upper Kedumba River Valley
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Jenolan Karst Conservation Reserve
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Euroka Clearing
Nye Gorang
Kanangra-Boyd National Park wilderness area
Kanangra-Boyd National Park
Bents Basin
Bankstown Airport
Sydney (Kingsford Smith) Airport
Camden Airport
Holsworthy Airport (Defence)
Blue Mountains National Park
Nattai National Park
Thirlmere Lakes National Park
Figure 4.2
Proposed flight paths for Runway 23 (day)
Legend
WSI Runway
Western Sydney International (Nancy-Bird Walton) Airport land boundary
Greater Blue Mountains World Heritage Area
Drinking water catchments
Declared wilderness
NPWS reserve
Tourist locations
Aboriginal Places raised during consultation (NPW Act)
Site of Aboriginal
Flight paths and swathes (23 runway - day)
Day arrivals
Day departures (with non-jets)
Newcastle
Sydney
Wollongong
0
10
20
km
Coordinate system: GDA 1994 NSW Lambert
Scale ratio correct when printed at A4
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Date: 23/05/2023
Data sources: - DITRDC, DCS, Geoscience Australia
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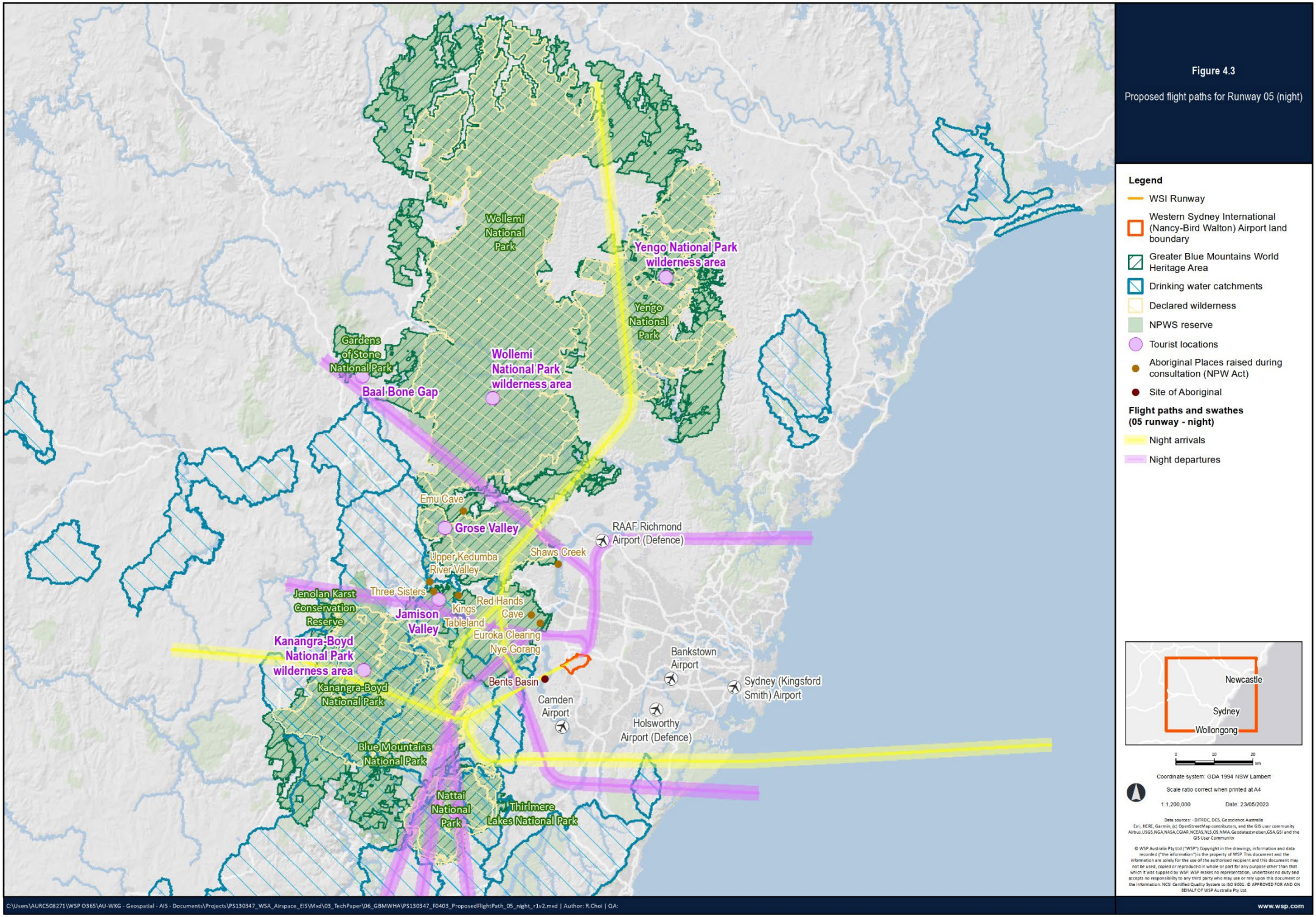
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Kanangra-Boyd National Park
Bents Basin
Bankstown Airport
Sydney (Kingsford Smith) Airport
Camden Airport
Holsworthy Airport (Defence)
Blue Mountains National Park
Nattai National Park
Thirlmere Lakes National Park
Figure 4.3
Proposed flight paths for Runway 05 (night)
Legend
WSI Runway
Western Sydney International (Nancy-Bird Walton) Airport land boundary
Greater Blue Mountains World Heritage Area
Drinking water catchments
Declared wilderness
NPWS reserve
Tourist locations
Aboriginal Places raised during consultation (NPW Act)
Site of Aboriginal
Flight paths and swathes (05 runway - night)
Night arrivals
Night departures
Newcastle
Sydney
Wollongong
0
10
20
km
Coordinate system: GDA 1994 NSW Lambert
Scale ratio correct when printed at A4
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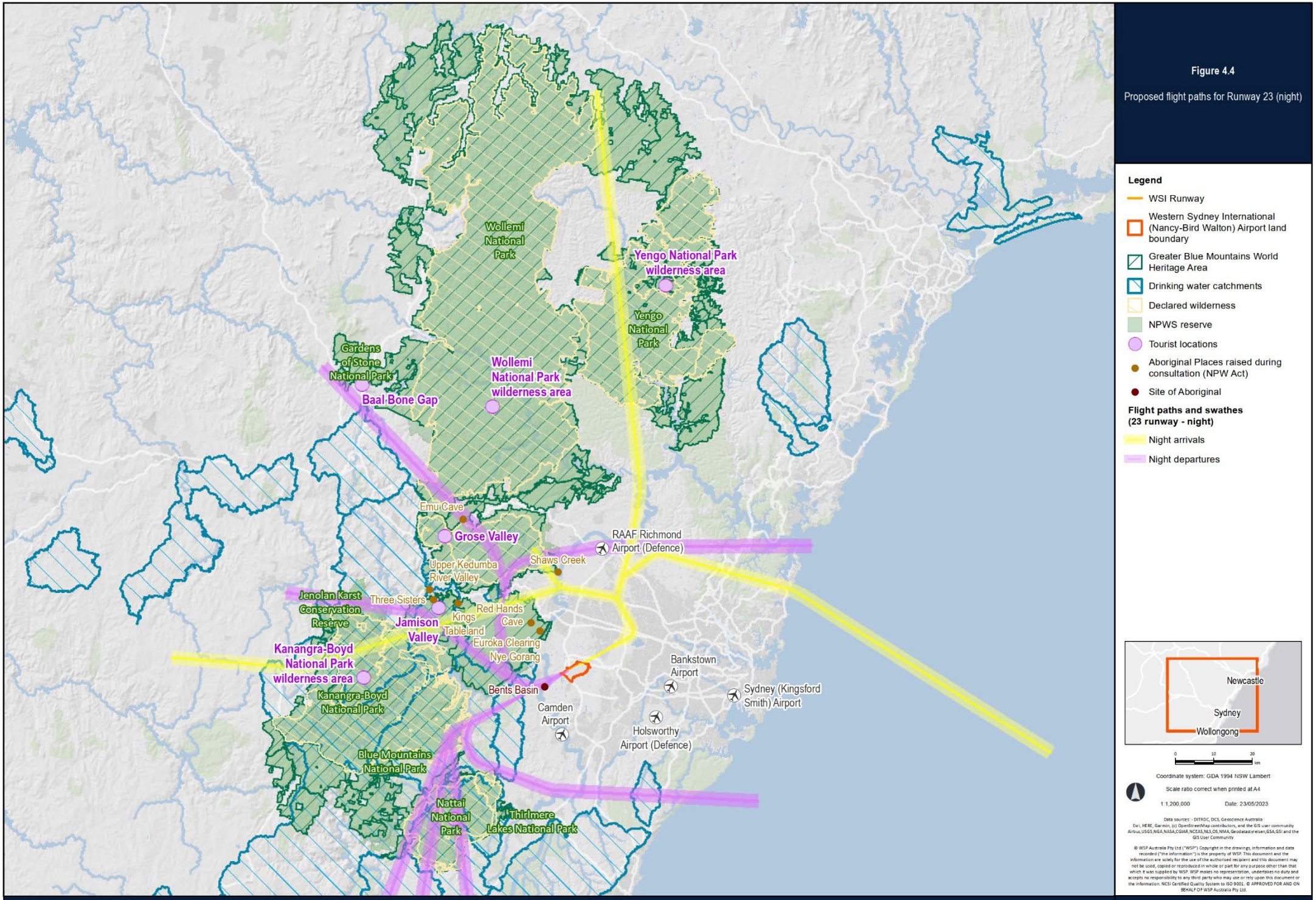
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Jamison Valley
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Nye Gorang
Kanangra-Boyd National Park wilderness area
Kanangra-Boyd National Park
Bents Basin
Bankstown Airport
Sydney (Kingsford Smith) Airport
Camden Airport
Holsworthy Airport (Defence)
Blue Mountains National Park
Nattai National Park
Thirlmere Lakes National Park
Figure 4.4
Proposed flight paths for Runway 23 (night)
Legend
WSI Runway
Western Sydney International (Nancy-Bird Walton) Airport land boundary
Greater Blue Mountains World Heritage Area
Drinking water catchments
Declared wilderness
NPWS reserve
Tourist locations
Aboriginal Places raised during consultation (NPW Act)
Site of Aboriginal
Flight paths and swathes (23 runway - night)
Night arrivals
Night departures
Newcastle
Sydney
Wollongong
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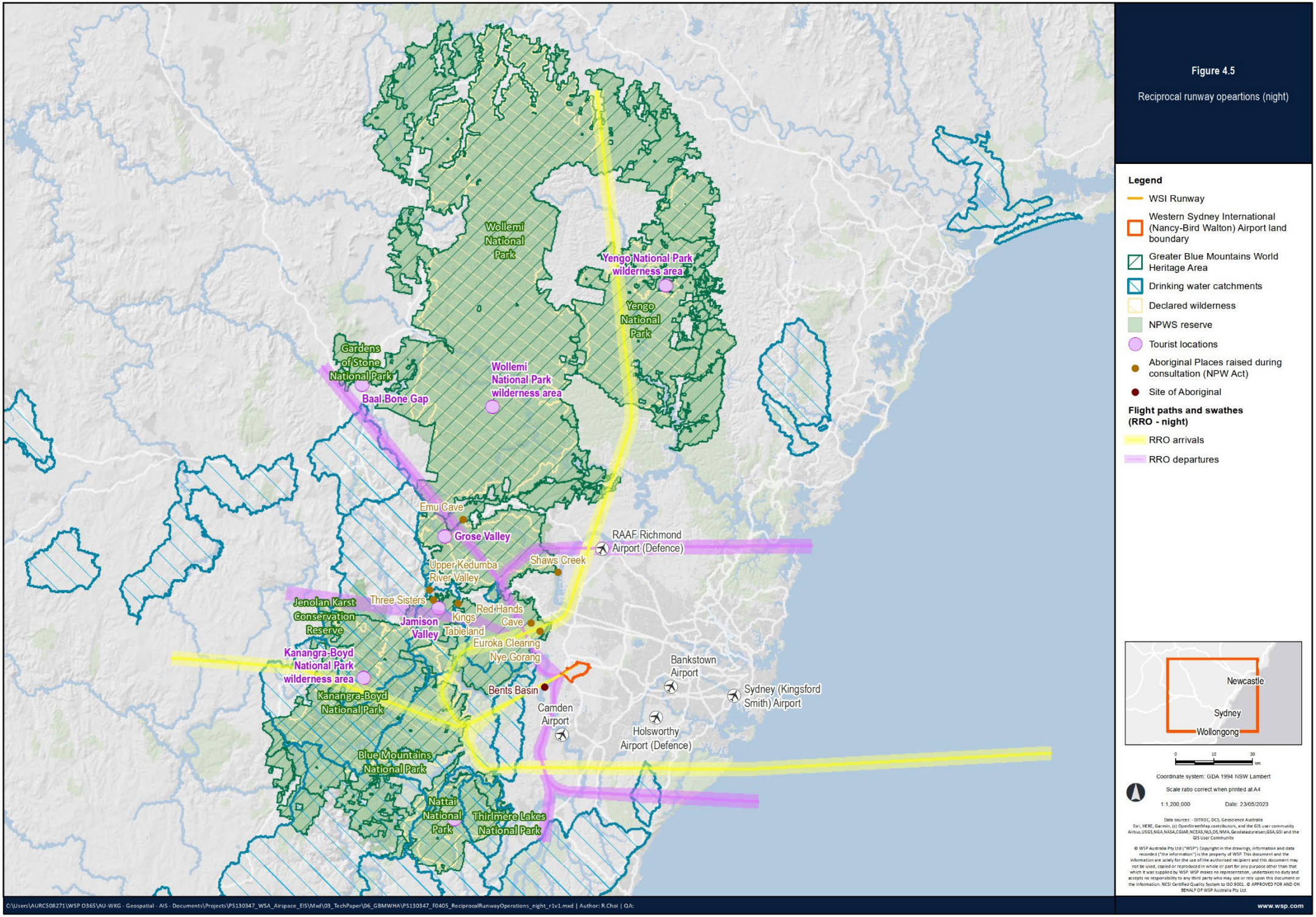
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Kanangra-Boyd National Park wilderness area
Kanangra-Boyd National Park
Bents Basin
Bankstown Airport
Sydney (Kingsford Smith) Airport
Camden Airport
Holsworthy Airport (Defence)
Blue Mountains National Park
Nattai National Park
Thirlmere Lakes National Park
Figure 4.5
Reciprocal runway opeartions (night)
Legend
WSI Runway
Western Sydney International (Nancy-Bird Walton) Airport land boundary
Greater Blue Mountains World Heritage Area
Drinking water catchments
Declared wilderness
NPWS reserve
Tourist locations
Aboriginal Places raised during consultation (NPW Act)
Site of Aboriginal
Flight paths and swathes (RRO - night)
RRO arrivals
RRO departures
Newcastle
Sydney
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4.2.2.3 Aircraft operations

Predicted future numbers of aircraft using the preliminary flight paths have been based on a forecast schedule of aircraft operations for a 'typical busy day' as they are greater than the annual average. This estimate breaks down each predicted movement by the type of aircraft (grouped by aircraft family), operation type (arrival or departure), time of operation and port of origin or destination. The year 2033 has been selected as being representative of the early years of operation. From opening in 2026, operations at WSI are expected to steadily increase. The volumes predicted for 2033 provide a more appropriate representation of activity (and therefore potential impact) than those predicted in 2026. The year 2055 has also been selected as being representative of the year when the single runway would be operating close to capacity.

Number of flights

An aircraft movement is defined as a single landing or take-off event. The approval for WSI is limited to single runway operations with the capacity to handle up to 10 million annual passengers and around 81,000 air traffic movements per year, including freight operations. In the longer term, WSI would be expanded incrementally to handle up to 37 million annual passengers and around 226,000 air traffic movements per year in 2055. This will include both jet and non-jet aircraft.

Predicted total daily aircraft movements (freight and passenger) are presented in Table 4.1 based on the forecast schedules. These figures represent a typical busy day as they are greater than the annual average.

Table 4.1 Total predicted daily aircraft movements at 2033 and at 2055

Single runway operations	Aircraft movements per day (typical busy day)		
	Passenger	Freight	Total
Early years (2033)	195 (88%)	27 (12%)	222
Approaching capacity (2055)	569 (91%)	53 (9%)	623

Aircraft fleet mix

Most aircraft, nearly 80 per cent, at WSI under single runway operations are anticipated to be narrowbody (single aisle, twin-engine) jets (seating between 150 and 250 passengers), with the remainder consisting of widebody jets and non-jet (turboprop) aircraft. The proportion of widebody jets operating in the fleet mix at WSI is expected to increase by approximately 18 per cent between 2033 and 2055 from 13 per cent to 31 per cent of all movements (noting that no widebody jets are proposed to serve the domestic markets at WSI in the early years up to 2033).

Further detailed descriptions of the expected aircraft operations is provided in Section 7.2 of the EIS.

Emergency fuel jettison

Emergency fuel jettisoning (or fuel dumping) is a relatively uncommon, non-standard operational procedure and refers to an emergency situation where an aircraft must jettison fuel in order to land safely. Fuel jettisoned at a sufficient altitude would volatise (changes from a liquid to vapour state) as it falls and is completely dispersed as vapour before any liquid reaches ground level. Typically is occurs when there is the need for an emergency landing. Most domestic aircraft are incapable of performing this procedure, as it is not necessary for safe landing.

Fuel jettisoning in accordance with appropriate procedures (i.e. at altitude where practicable) generally results in no impacts at ground level. The rules require that pilots take reasonable precautions to ensure the safety of people and property (including the natural environment) and, where possible, conduct a controlled jettison at an altitude of above 6,000 ft. Fuel jettisoned at a sufficient altitude will volatise as it falls and is completely dispersed as vapour before any liquid reaches ground level. It is mandatory for fuel jettisoning events to be reported.

Based on reported fuel jettisoning (within Australian airspace between 2010 and 2020) and estimated movement rate for WSI (as single runway operations approach capacity) it is estimated to that there would be on average slightly less than one fuel jettisoning event per annum.

Given the rarity of fuel jettisoning events, a fuel jettisoning incident resulting in ground level impacts in the vicinity of WSI, including in areas above the Sydney Basin and/or over the GBMA, is estimated to be extremely remote. As a fuel jettisoning incident that results in ground level impacts in the vicinity of WSI is estimated to be extremely remote, events with tangible impacts on potentially sensitive receiving environments would be even less likely and therefore would be exceedingly remote. Overall, fuel jettisoning is a relatively uncommon non-standard operational requirement that will have no have ground level impacts if carried out in accordance with appropriate procedures.

4.2.2.4 Facilitated airspace changes

As described in Section 3.4, the Sydney Basin airspace is likely the busiest and most complex airspace in Australia. The introduction of new flight paths to be used by aircraft into and out of WSI has considered a multitude of factors to minimise any changes to existing flight paths in the Sydney Basin. However, in order to safely integrate the WSI control area and flight paths while providing for safe and efficient operations for all aircraft in the Sydney Basin, adjustments will be required to some existing flight paths (referred to as facilitated airspace changes).

The adjustments have been minimised to the extent practicable and have been considered in terms of safety, national security (Defence), efficiency, equity of airspace access, existing aircraft operating standards, and impacts on the surrounding communities and environment. For the Sydney (Kingsford Smith) Airport adjustments, particular consideration was given to minimising changes to tracks which exist to safely control the high volume of demand and the spread of noise in the Sydney Basin.

The changes are limited to affecting some flight paths for Sydney (Kingsford Smith) Airport, Bankstown and Camden Airports and RAAF Base Richmond, 3 flying training areas associated with Bankstown and Camden Airports, one transit over the Sydney Basin airspace and allowances for transit over WSI once operational.

The adjustments would be introduced in 2026 on a scheduled Aeronautical Information Regulation and Control (AIRAC) date, prior to the official opening of WSI. Introduction of these changes ahead of WSI's opening will allow pilots and air traffic control to adjust their systems and become familiar with changes to current procedures before WSI traffic is introduced, and minimise the likelihood of conflicts or incidents in the airspace.

Some of these changes will alter the distances of flight paths through either extensions or reductions, including some existing flight paths that currently overfly the GBMA. Consideration of the potential impacts facilitated by these airspace changes is presented in Section 5.4.3.

4.3 Project development and alternatives

The follow sections provide an overview of the development of the flight paths for the WSI airspace. Further detail regarding the options and alternatives considered for the flight paths is provided in Chapter 6 (Project development and alternatives) of the EIS.

4.3.1 Development of the airspace and flight path design for WSI

Designing flight paths for a new airport is a large, complex and technical task. While the new airport and airfield are a greenfield development (and are not the subject of this EIS), the Sydney Basin airspace already comprises an extensive network of flight paths associated with civilian and Defence airports within the Greater Sydney region. The Sydney Basin airspace also caters for flying training, emergency aviation activities (including medical and firefighting), recreational aviation activities (gliders, ballooning) and transiting flights.

As a result, the airspace and flight path design process for WSI sought to optimise flight paths based on safety, efficiency, capacity, and noise and environmental considerations, while minimising changes to existing airspace arrangements in the Sydney Basin to the greatest extent practical.

Airspace and flight path design is an iterative process informed by community and stakeholder engagement at each phase. There are 4 main phases to the airspace and flight path design process (see Figure 4.6). These phases were outlined in section 2.2.5 of the Airport Plan (refer to Section 4.3.2.2).

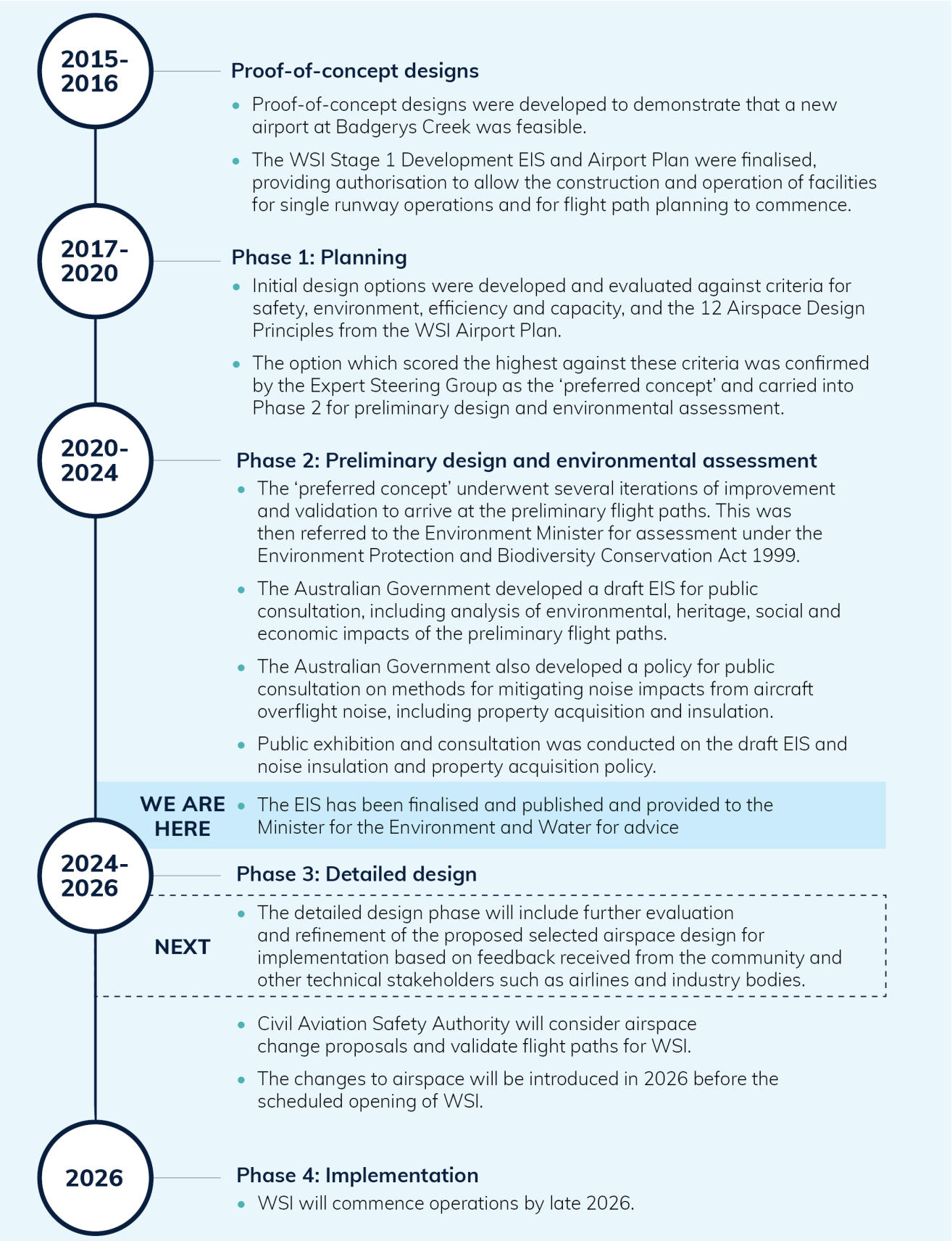


Figure 4.6 Flight path design pathway

4.3.2 Background to flight path development

4.3.2.1 The 2016 EIS airspace concept

The 2016 EIS developed for the development of the ground infrastructure of WSI depicted an indicative airspace concept for the flight paths associated with single runway operations at WSI (see Figure 4.7). The indicative flight paths identified for assessment in the 2016 EIS represented one possible airspace design (referred to as the 'proof of concept'), and included a preliminary assessment of key issues such as potential noise and air impacts for the proof of concept for flight path.

The main consideration for the 2016 EIS in its depiction of the indicative flight paths for WSI was to demonstrate air traffic management feasibility, particularly whether WSI flight paths could interact and synchronise with aircraft operating to or from Sydney (Kingsford Smith) Airport and other Sydney Basin airports, aerodromes and Defence facilities.

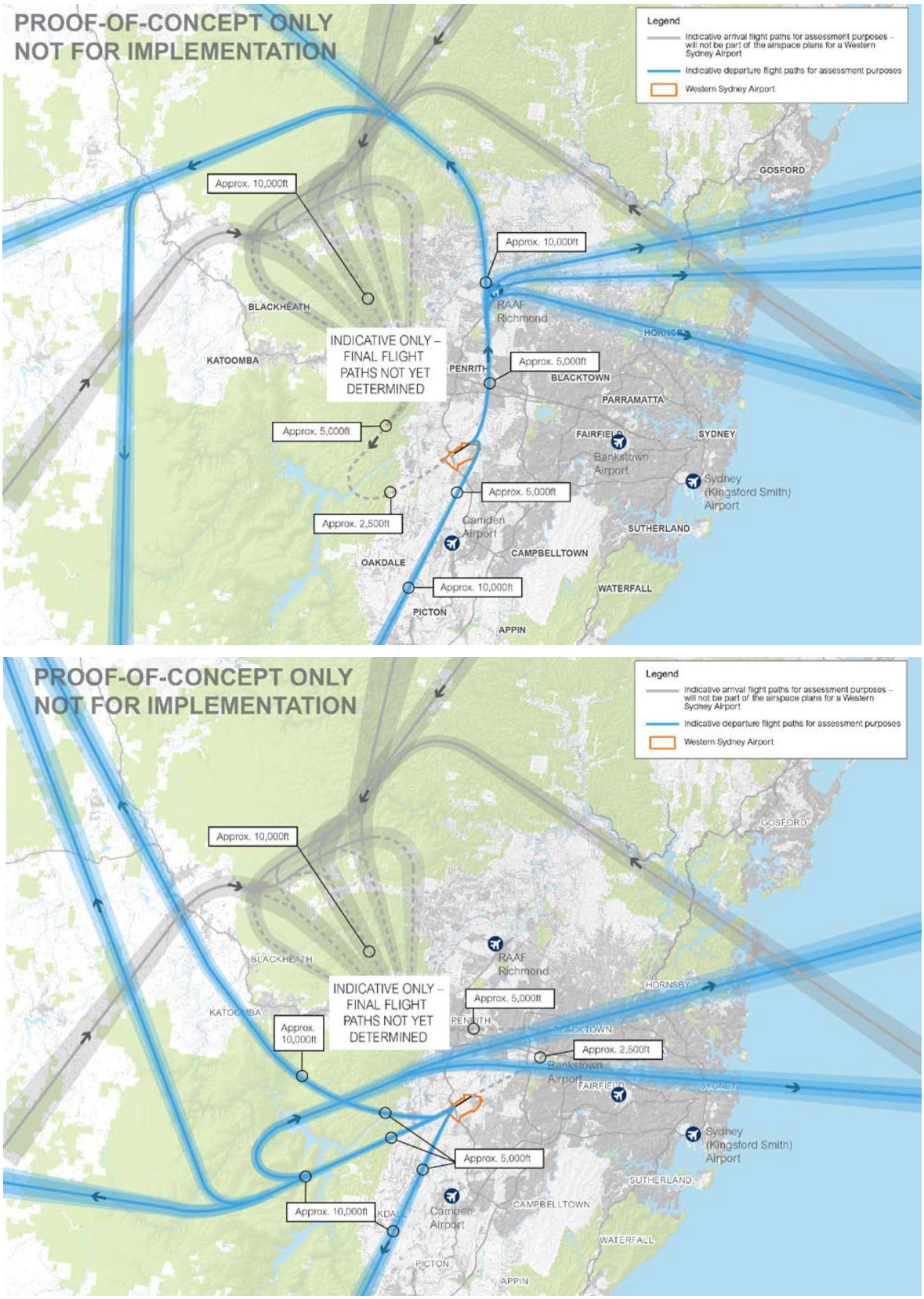
As part of the development of the 'proof of concept' flight paths for the 2016 EIS, a *Preliminary Airspace Management Analysis* was conducted by Airservices Australia (2015). The principal objective of this preliminary assessment was to establish whether safe and efficient operations could be introduced. Overall, the analysis indicated there was sufficient airspace capacity in the Sydney Basin and there was no apparent physical impediments that would prevent safe and efficient operations for aircraft arriving at or departing from WSI.

4.3.2.2 Airport Plan

Alongside the development of the 2016 EIS, an Airport Plan was prepared to outline the approach to the design and development of WSI as well as set out the intent for the operation of WSI. The Airport Plan also provided authorisation for the construction and operation of Stage 1 of WSI. Section 2.2 5 of the Airport Plan set out the formal design process for determining the airspace operations for WSI. Part 3 of the Airport Plan also sets out several conditions that must be completed prior to or as part of the construction of the Stage 1 Development. These conditions include (among other requirements):

- 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 in addition to public consultation with stakeholders who include the aviation industry, the community and state and local government authorities
- in developing the airspace and flight path design, airspace and flight path design must minimise to the extent practicable the impact of aircraft overflight noise on the following:
  - residential areas and other sensitive receptors;
  - the GBMA – particularly areas of scenic or tourism value; and
  - Wilderness Areas.

The planning and preliminary airspace design phases (Phases 1 and 2) of the airspace design process for single runway operations are the key phases which have been completed as part of the development of the project to date.



Source: Department of Infrastructure and Regional Development (2016)

Figure 4.7 Conceptual flight paths for the Runway 05 (top) and Runway 23 (bottom) operating mode as presented in the 2016 EIS

4.3.3 Development of the proposed airspace and flight paths for WSI

4.3.3.1 Planning phase

The initial 'proof-of-concept' flight path design developed for WSI and presented in the 2016 EIS triggered the commencement of the planning phase. The key activities that were undertaken throughout the planning phase which led to the selection of the preferred airspace concept are outlined in Figure 4.8 and described in the following sections.

Figure 4.8 Overview of planning phase airspace development process

Airspace design principles

The Airport Plan set out 12 Airspace Design Principles that the design process was required to follow. The principles were informed by and reflect community and industry feedback on the 2016 EIS. The principles seek to maximise safety, efficiency and capacity, while minimising impacts on the community and the environment. The 12 principles identified in the Airport Plan were applied to the planning phase of the process and were used to assist in guiding developing the preliminary flight paths.

Constraints and opportunities mapping

As part of the initial stages of the planning phase, DITRDCA identified key constraints and opportunities that were likely to impact on the development of the preliminary flight paths. This included key technical/flight constraints, Sydney Basin airspace impacts environment constraints as summarised below.

Technical and flight constraints

In developing the preferred airspace concept flight paths, the development of the design was guided by a range of matters which determine what is technically feasible for the design. These included:

- the need to maintain a safe airspace
- the final approach and initial departure paths are fixed given the fixed nature of the runway alignment approved in the 2016 EIS
- the height at which aircraft operate is constrained by a number of factors, including the aircraft type, weather conditions, safety requirements and international rules of aviation
- the presence of existing airports and other airspace requirements within in Sydney Basin including Sydney (Kingsford Smith) Camden, Bankstown, Richmond and Holsworthy.

Sydney Basin airspace

The Sydney Basin airspace is likely the most complex and busiest airspace within Australia. It comprises an extensive network of flight paths associated with the following:

- civilian airports including: Sydney (Kingsford Smith); Bankstown and Camden airports
- Defence airports and airspace including: RAAF Base Richmond; Australian Army Holsworthy Airport; the Tasman Sea Military Flying Training restricted area and the Orchard Hills Defence Establishment (which includes restricted airspace over the facility when in use)
- recreational aviation activities (gliders, ballooning, parachuting)
- transiting flights.

The majority of the Greater Sydney region and many part of the GBMA are overflown by some form of aircraft movement with flight tracks associated with the Sydney (Kingsford Smith) Airport being the dominant activity (refer to Figure 3.4). In particular, the preliminary airspace and flight path design has been developed through extensive collaboration with the Sydney (Kingsford Smith) Airport resulting in the evolution of the existing flight paths for WSI to minimise impacts to its future operations.

Environmental and social considerations

In addition to the airspace design constraints, key environmental and social impacts were considered, in particular potential noise and visual amenity impacts as result of aircraft overflights. The key environmental and social considerations in the flight path design process included:

- the GBMA
- sensitive tourist and recreation areas with the potential to receive impacts from aircraft overflights (both within and outside the GBMA) including:
  - Jamison Valley south of Echo Point Lookout and the Scenic Cableway at Katoomba and Wentworth Falls Lookout
  - Grose Valley east of Evans Lookout and Govetts Leap Lookout
  - the wilderness area between Deanes Lookout and Crawfords Lookout within Wollemi National Park
  - the wilderness area between Mount Yengo Lookout and Finchley Lookout within Yengo National Park
  - Nattai wilderness area
  - Kanangra Walls and wilderness area east of Kanangra-Boyd Lookout
  - Baal Bone Gap within Gardens of Stone National Park
- residential built up areas within the Sydney Basin and Blue Mountains region.

Development of the functional requirements

A series of functional requirements for the development of the flight path concept design options were then identified in consultation with a broad range of stakeholders including airline operators and . Overall, 48 functional requirements were identified that were applied to the planning phase (and subsequent stages of the design development). The functional requirements essentially comprised a series or requirements that each of the concept design options needed to achieve to allow for further consideration in the subsequent phases of testing and evaluation.

The design team jointly undertook an evaluation of each Concept Mode (a concept design specifically aligned to operations in a specified runway direction at WSI – i.e. Runway 05 or Runway 23) for compliance against the functional requirements. The respective Concept Modes were evaluated qualitatively as having ‘met’, ‘not met’ or ‘not yet met’ each functional requirement. Based on this evaluation, the technical design team established a series of concept design options for progression for further assessment.

Identification of initial concept design options and qualitative assessment

Performance assessment criteria scoring methodology

Preliminary assessment work was then undertaken for each concept design options against 4 key performance areas (KPAs) of

- *Safety* – Measured by minimising the flight path conflicts between WSI and Sydney (Kingsford Smith) Airport flight paths and ensuring all potential risks identified and addressed in the design.
- *Environment* – Assessed by measuring the numbers of people affected by aircraft overflight noise using relevant noise exposure measures and ensuring the design accounts for relevant environmental and social values and impacts visual elements such as impacts flight paths over sensitive tourist and recreational areas including the GBMA.
- *Capacity* – The capacity of WSI and Sydney (Kingsford Smith) Airport operations was assessed by measuring the amount of delay experienced by aircraft and the expected throughput of each airport.
- *Efficiency* – The efficiency of aircraft operations for flights accessing WSI and the effects of those operations upon other aircraft operating within the Sydney Basin was assessed by measuring track miles and fuel burn.

Against each of the KPAs, a series of key performance assessment criteria were identified to assess the performance of each concept design option. Using this assessment criteria, the performance of each concept design option was assessed. The scores for each of the performance assessment criteria were tracked and combined into a single score for each of the 4 key performance areas.

Qualitative assessment of the initial concept design options

Twenty-two primary concept design options were initially identified and developed as potential WSI flight paths by the technical design team. It was considered that this high number of concept design options was needed to allow for consideration of a wide selection of ideas and solutions that could each be tested to inform the best possible design. Initial consideration of the 22 primary concept design options identified that 4 of the options failed to meet core safety requirements (in particular regarding the ability to provide safe flight operations). As a result, these 4 concept design options were not progressed any further in the options evaluation process.

The remaining 18 concept design options were progressed and were considered using a more rigorous assessment as well as preliminary environmental modelling (i.e. high level noise and visual impacts). Overall, each of the 18 concept designs underwent this evaluation, and were scored and ranked against the key assessment criteria. A summary of the combined, single score for each of the options against each of the performance assessment criteria is shown in Figure 4.9.

Based on the evaluation, the top 5 options (Hv, Fv, Jv, Cv and Dv) were identified for further consideration and refinement (highlighted in Figure 4.9 by the orange line which shows a clear break in the safety performance). Below this line, the air traffic controller workload required to manage the number of aircraft interactions was evaluated to be substantially greater and therefore would potentially reduce the safety aspect of that option. Therefore, the remaining concepts below the top 5 options were not progressed further from this point.

In summary, both concept option Hv and Fv were considered equally favourable with:

- concept option Hv providing the most favourable outcome from a safety perspective and the most favourable environmental outcome. This option also required the least variation to existing flight paths at Sydney (Kingsford Smith) Airport (a key functional requirement) compared to other options
- concept option Fv providing an equally favourable outcome from a safety perspective and the most favourable outcomes from efficiency and capacity perspectives (in addition to a reasonably favourable score for environment).

Detailed evaluation of concept designs

The better performing elements of each of the 2 best performing concept design options (concepts Hv and Fv) were then integrated into a single ‘preferred concept’ design (designated as ‘Concept W’). The integration of the 2 concepts into one was conducted as an iterative design process through a series of technical workshops leading to the incremental evolution of the design across 3 primary versions.

These technical workshops resulted in the creation of the initial Concept W which provided significant improvement in key performance criteria as follows:

- safety– in particular with respect to minimising air traffic control workload interactions
- efficiency – through improvements to the amount of level flight within the design and the reduction of the overall length of flight paths (referred to as track miles)
- environment – through minimising the areas of residential over-flight as far as possible.

The results of the refined Concept W resulted in the outcome being endorsed in November 2019 as the preferred concept design option for progression to the preliminary design phase.

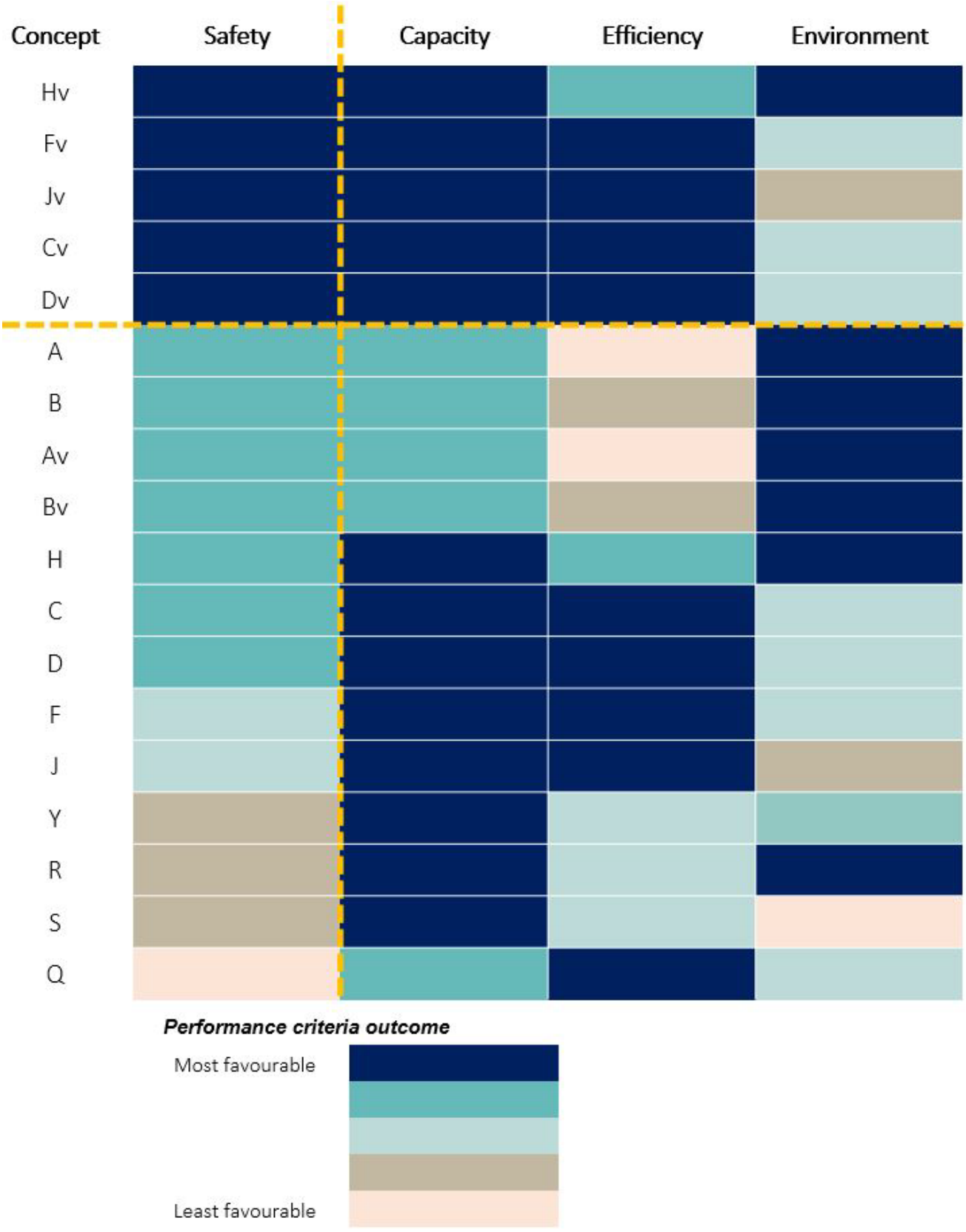


Figure 4.9 Long list ranking of initial concept design options

4.3.3.2 Preliminary airspace design and environmental assessment

The purpose of this phase was to progress the preliminary airspace design using an iterative flight path development process to create a complete airspace design for WSI day and night operations, and include the changes required to existing airspace elements for Bankstown, Camden and RAAF Base Richmond airports.

Iterative development of the preliminary design flight paths

Following identification of the preferred airspace concept flight paths, the Concept W design required further refinement as the design presented was only based on a peak day time period of operation. The refinement of the Concept W during the preliminary design phase included more detailed consideration of the factors that had previously been considered during the planning phase (such as non-peak periods and night time operations). As part of this consideration, the following fundamental parameters were applied to the flight path development during the preliminary design phase:

1. Safety – as with all of the design phases for the airspace development, the key performance assessment criteria of safety continued to be the paramount consideration in all flight path option development.
2. Environment – noise, and other environmental, visual and social impacts were minimised to the extent practical while still achieving safe and efficient operations.
3. Air Traffic Management requirements – consistent with the efficiency and capacity requirements, flight path options were refined to ensure they were fit for purpose and based on sound air traffic management requirements to deliver the required capacity in an efficient manner.

Preliminary assessments

In addition to ongoing refinements of the Concept W design, a series of preliminary environmental assessments were undertaken to identify more detailed constraints. These assessments considered each relevant runway operating mode and time period (i.e. night time periods). A summary of the key areas considered during the preliminary assessments is provided in the following sections.

Overflights of sensitive tourist, recreational and wilderness areas

The visual impacts on sensitive tourist and recreational areas by aircraft overflight was considered in each preliminary design refinement with the aim of minimising the potential visual impacts of aircraft flying over these areas. In particular, this included considering the impacts of flight paths over the GBMA and other wilderness areas as well as the identified sensitive tourist and recreation areas. Refinements during this phase assessment also sought to identify flight paths which would reduce potential day time visual impacts to wilderness areas as well as the identified sensitive tourist and recreation areas, in particular through minimising flight paths over the GBMA (where possible).

Socio-economic

While potential socio-economic impacts had been considered as part of the planning phase (such as impacts on sensitive community receivers such as major residential areas, schools, hospitals etc.), consideration of potential impacts was expanded during the preliminary design phase to include additional types of receivers such as tourist locations, sporting facilities and major outdoor reception-type facilities. Potential economic impacts to the values associated with tourist locations and facilities, in particular important tourism-related economic activities based in and around the GBMA, were also considered.

Noise impacts

Aircraft noise modelling was used to undertake preliminary environmental assessment of the design. Noise assessments for each of the refinements included an estimate of the number of dwellings which would be likely to be subject to different levels of overflight noise events. These assessments were produced for each relevant runway operating mode and time period. A more typical representation of an expected annual average day of operations, taking into account potential noise abatement operating mode priorities, was also developed.

Impacts to Defence sites

Defence operates a number of aircraft that regularly access the Sydney Basin. These include military transport, fast jet aircraft, and helicopter operations. Consultation was undertaken with the Department of Defence at regular intervals to confirm that the flight paths developed would support Defence operations and establish the suitability of the designs to provide a viable future access capability. Ongoing refinement of the preliminary airspace design took into account a range considerations with regards to existing defence sites including:

- interaction with RAAF Base Richmond
- interaction with Orchard Hills Defence Establishment
- equity of access – Interaction with Bankstown and Camden airports.

4.3.4 'No action' consideration and infrastructure constraints

Condition 16 of the Airport Plan requires the Australian Government to undertake an airspace design process and as such it is considered that a 'take no action' (i.e. to consider a no-flight path option) would not represent a feasible alternative.

The airfield geometry and infrastructure for WSI is now fixed and currently under construction consistent with the approved elements of the 2016 EIS. Therefore no alternatives were considered for runway direction and length, or for location of runway taxiway entries and exits. The initial and final flight path segments connecting to the runway are fixed by aircraft configuration and performance in safely making any turns from the immediate runway heading for take-off or stabilising on final approach to the runway for landing.

In accommodating departing aircraft, the flight path design has been limited to the consideration of alternatives once a departing aircraft commences its take-off roll, becomes airborne and is established in a stable configuration to safely execute turns to join the established higher level enroute airspace system. For arriving aircraft, the flight path must ensure that an aircraft is safely processed from the established higher level enroute airspace system to a landing onto the designated runway.

Chapter 5 Identification and evaluation of impacts

This chapter:

- outlines the potential impacts of the project, in particular with respect to potential impacts on the GBMA
- provides an assessment of the potential impacts of the project against the values and attributes identified in the GBMA Outstanding Universal Value and against other relevant values of the site.

5.1 Overview

This chapter provides an evaluation of the significance of potential impacts on the attributes which sustain the GBMAs' Outstanding Universal Value and other heritage/conservation values. It considers the potential positive and negative impacts of the preliminary flight paths on the GBMA and National Heritage values, including cumulative impacts. The chapter draws upon the series of detailed environmental and social assessments undertaken for the proposal as outlined in Section 1.4 of this assessment. A prediction of the characteristics of these potential impacts, including identification of any uncertainty with respect to the assessment, is provided.

5.2 Influence on existing threats

Table 5.1 provides a description of the proposed airport's influence on existing threats identified in the *2009 Greater Blue Mountains World Heritage Area Strategic Plan* and the *Greater Blue Mountains World Heritage Area Strategic Plan Addendum 2016* (NSW Office of Environment and Heritage, 2018) as outlined previously in Section 3.3.3.2.

Table 5.1 Operational impacts on other important values of the GBMA

Threat	Project influence
Uncontrolled and inappropriate use of fire	Operation of the project would not result in any inappropriate use of fire. Operation of flightpaths over the GBMA would also present a very low risk of introducing uncontrolled fire to the GBMA. The main potential risk associated with the operation of the flight paths with respect to uncontrollable fire may occur a result of an aircraft crash within the GBMA. This potential is however considered to be extremely rare and an unlikely event. As such, it is not considered to be a contributory factor in the overall threat of uncontrolled and inappropriate use of fire that may impact on the GBMA. Operation of the flight paths over the Blue Mountains are also not expected to impact on the ability of organisations such as the NPWS or Rural Fire Service to continue to undertake firefighting operations (for wild fires) or fire hazard reduction burns. With respect to the assessment of priorities, current regulations of flight (as identified in the Aeronautical Information Publication) notes that (among other conditions), if an aircraft is participating in an emergency action that has significant potential human and environmental consequences, including for life critical operations (such as firefighting operations or search and rescue operations) then they will have a nominated priority within the airspace they need to operate. This is consistent with the management of existing airspace for current flight paths across the Sydney basin and GBMA.

Threat	Project influence
Inappropriate recreation and tourism activities, including development of tourism infrastructure	The preliminary flight paths are an integral part of the development of WSI, ensuring that the benefits of WSI are realised. The tourism industry is recognised as an important part of the regional economy which sites adjacent to, and for some aspects within, the GBMA, noting that around 3.8 million domestic visitors access the region in the 12 months to December 2022 (Destination NSW, 2022). Bushwalking/rainforest walks and visiting National Parks/State Parks were 2 of the top 5 activities identified by visitors to the Blue Mountains during this time. Tourism businesses in the Blue Mountains are mostly concentrated in Leura, Katoomba, Springwood, Winmalee, Blaxland, Warrimoo and Lapstone. Mount Irvine, Blackheath, and Mount Victoria are also important tourism areas for the region. The development of WSI will provide an additional, closer access point in closer proximity to key tourist and recreation sites within the GBMA. This is likely to result in an overall increase in the overall volume of tourists accessing the GBMA. Such an increase in tourism may influence the potential for some additional tourism development within the Blue Mountains region. However, on their own, the operation of the project would not directly contribute to inappropriate development or uncontrolled visitor access. The project would not include the development of any new physical tourism infrastructure within or which may result in any indirect impacts on the GBMA or its values. Development controls within the context of existing management plans and local and State government planning controls are currently in place and would remain in order to protect the World Heritage Area.
Invasion by pest species including weeds and feral animals	All aircraft using the preliminary flight paths to access WSI from overseas would be subject to Australian biosecurity requirements that are currently administered for all Australian airports. No direct impacts or indirect threats associated with weed and/or pest species are expected as a result of the implementation of the preliminary flight paths associated with WSI.
Loss of biodiversity and geodiversity	Where the project intersected areas above the GBMA, the flight paths would typically occur at altitudes of greater than 1,000 ft and would therefore limit the potential for loss or impact to existing biodiversity and geodiversity. Subsequently impacts to biodiversity within these areas would be potentially limited to: • potential direct impact in the (unlikely) event of an aircraft crash that may result in the localised loss of habitat or in the event of an aircraft striking a bird/wildlife • indirect negligible noise, light and air quality impacts. With respect to the potential for localised loss of habitat due to an aircraft crash, it is very unlikely but there is a chance that over the lifespan of the WSI an aircraft crash could occur within the GBMA. In this rare circumstance, impacts would be largely localised and include vegetation removal, mortality of some animals, the potential to introduce/spread of chemicals and potential bush fire event(s). With respect to the potential for wildlife strike, within the airspace of the GBMA, at these locations the potential for impact would be infrequent and limited to species that occur at altitude of greater than 1,000 ft. These species include the Fork-tailed Swift and Grey-headed Flying-fox. Impacts to bird species are likely to be minimised through implementation of the recommended mitigation measures (refer to Chapter 6). It is not expected that there would be any other direct impacts on biodiversity that would lead to the loss of these values within the GBMA, or impact the values upon which the World Heritage Listing has been made.

Threat	Project influence
Impacts of human enhanced climate change	Reflecting the fuel consumption rates in Australia's latest *State Action Plan* published in October 2022, *Managing the Carbon Footprint of Australian Aviation*, aviation emissions were estimated to be 23.7 million tonnes in 2019, based on 9,057 megalitres of fuel use nationally. Broken down, domestic aviation in Australia emitted around 8.3 million tonnes of CO_2e accounting for around 35 per cent of Australia's total aviation emissions. In 2019, total GHG emissions from all sectors were reported by the NSW EPA to be around 136.6 million tonnes of CO_2e. GHG emissions from the NSW transport sector accounted for around 20 per cent of the state's carbon with 27.6 million tonnes of CO_2e. Approximately 1.7 per cent or 2.4 million tonnes of CO_2e emissions were attributed to the state's domestic aviation sector. The operation of the preliminary flight paths is expected to make a minimal contribution to national transport-related GHG emissions. WSI's projected emissions of CO_2e from aircraft main engine use on domestic flights operating in Australia have been compared to Australia's total emissions (for all WSI domestic flights) and NSW's total emissions (for WSI flights in NSW and ACT only). This identified that: • in 2033, the project's domestic flight departure emissions of CO_2e would represent 0.13 per cent for Australia's total projected economy wide emissions which is low whereas the project's intrastate flight departure emissions of CO_2e would represent around 0.04 per cent of NSW's total economy wide emissions, which is extremely low resulting in very minor adverse impacts to Australian and NSW Government's decarbonisation plans and transition to net zero carbon economies by 2050 • in 2055, the project's domestic flight departure emissions of CO_2e are projected to increase to 0.95 Mt CO_2e and would represent 0.5 per cent of Australia's total projected emissions which is moderately low whereas the project's intrastate flight departure emissions of CO_2e would represent around 0.2 per cent of NSW's total projected economy wide emissions, remaining low despite the significant increase in air traffic growth and increase in the number of domestic destinations being served. These changes are not expected to result in a noticeable impact to the GBMA.
Lack of understanding of heritage values.	This threat would be relevant if no assessment of potential impacts was undertaken. This technical paper, along with the preparation of other relevant supporting papers, including Technical paper 8 and Technical paper 9 (refer to Section 1.4) and the EIS, has provided an assessment and considered potential heritage values. As such the preliminary flight paths are not considered to present a lack of understanding of the heritage values associated with the GBMA.

5.3 Identification of potential project impacts

5.3.1 Direct impacts

As described previously, the project does not include any physical infrastructure. No construction works or changes to the previously approved physical ground infrastructure at WSI (currently under construction) are required for the project. There would therefore be minimal direct impacts on the GBMA or its values from the operation of the proposed fight paths for WSI.

A direct impact associated with the project is the potential for wildlife strikes during operation, including possible impact on a range of species (including Grey-headed Flying-fox and a range of bird species) which provide contributing attributes to the World Heritage and National Heritage values of the GBMA. Additionally, while highly unlikely, the potential for an aircraft crash may also, whilst likely to only affect a localised area, result in an impact on the values and attributes of the GBMA. Each of these potential impacts are briefly described in the following sections. Further detail regarding these potential impacts is provided in Chapter 7 of Technical paper 8 prepared for the EIS.

5.3.1.1 Wildlife strike

Altitudinal range of aircraft

Aircraft altitudinal ranges can be categorised into the following categories with respect to potential for wildlife strikes:

- 0 to 1,000 ft (around 300 m) above ground level: take-off and wheels up. Around 96 per cent of flying-fox strikes are recorded at or below 1,000 ft (around 300 m) above ground level
- between 1,000 to 3,500 ft (around 300 m to 1 km) above ground level: initial ascent. Around 93 per cent of wildlife strikes occur at or below around 3,500 ft above ground level
- between 3,500 to 10,000 ft (around 1 km to 3 km) above ground level: At this range there is potential for thermalling species (such as Australian Pelican and Wedge-tailed Eagle) to be impacted
- between 10,000 to 20,000 ft (around 3 km to 6 km) above ground level: cruising and maximum altitude: Generally limited impacts would occur at these altitudes.

The altitude figures show that aircraft take off and ascend relatively quickly in the scale of the assessment zones and that aircraft take-off and ascend primarily within the wildlife buffer assessment zone and the immediately adjoining environments. Approximately 93 per cent of any aerial strikes to birds or flying-foxes are most likely to occur within these zones (Parsons, Blair et al. 2008, Dolbeer 2011).

Potential impacts

Direct impacts associated with the project with respect to the GBMA are expected to be limited to wildlife strike leading to potential injury or mortality of fauna species, in particular strikes associated with various bird species. As identified above, most (up to around 93 per cent) of wildlife strikes in aviation occur at or below 3,500 ft (around 1 km). Therefore, the areas of primary concern for potential wildlife strikes from are along the approach and departure paths at this altitude or below. While bird strikes above this altitude can occur with thermalling species such as Australian Pelican (*Pelecanus conspicillatus*) and Wedge-tailed Eagle (*Aquila audax*), the frequency of high-altitude strikes is considered to be comparatively low.

Wildlife strike potential and risk are directly linked to the habitat values present within the vicinity of WSI which have the potential to attract species to the location, for example roosting and foraging opportunities. Within the immediate/local vicinity of WSI (outside the GBMA), the key habitat values providing the highest risk contributors include several waterbodies and the Elizabeth Drive Resource Recovery Facility. The future Western Sydney Aerotropolis also proposed to increase tree canopy cover, enhance riparian zones and wetlands and generally increase biodiversity values across the area which will further attract wildlife to the area surrounding WSI.

The *Wildlife Strike Risk Assessment* (included as an appendix of Technical paper 8), identified that the species with the highest overall risk of being impacted by wildlife strike are mammal and bird species, not listed as threatened or Migratory under the EPBC Act, and that commonly occur within the locality – such as Eastern Grey Kangaroos and waterfowl. The report did however identify one threatened (Grey-headed Flying-fox) and one Migratory (Glossy Ibis) species that have the potential to be affected by the project.

Wildlife strike impacts within or above the GBMA would be minimal and limited to species which occur at high altitudes greater than 1,000 ft (around 300 m) above ground level along the project's flight paths (refer to Section 4.2.2.2). In particular, with respect to the potential for impact of the Grey-headed Flying-fox, historical data indicates that around 96 per cent of flying-fox collisions occur below 1,000 ft (around 300 m) above ground level, with most strikes occurring below 500 ft (around 150 m) above ground level (Parsons, Blair et al. 2008). Typically, based on the preliminary flight paths, most of the flight paths over the Blue Mountains and GBMA would be at heights above ground level of 2,000 ft (around 610 m) or more above ground level. Although some species that utilise the GBMA may be at risk from aircraft wildlife strike (such as Australian Pelican and Wedge-tailed Eagle) the impacts associated with the project are considered to be minor, infrequent and rare.

Based on the limited use of WSI airspace by flying-foxes observed to date and the low mortality rate of the species at other Sydney based airports (as detailed in Section 7.3.2 of Technical paper 8), wildlife strike impacts considered likely to be possible, but the impact of these strikes on the species would be low.

5.3.1.2 Air crashes

Whilst very unlikely, there is a chance that over the lifespan of the operation of WSI an aircraft crash could occur within the GBMA. In this circumstance impacts would be largely localised and include vegetation removal, mortality of plants and animals, introduction/spread of chemicals and potential generation of a bush fire event. In the event of a bush fire or chemical spill, impacts could potentially spread and affect a somewhat larger areas. The low risk of an aircraft crashing could impact biodiversity attributes within the GBMA such as rare and locally endemic species but is unlikely to reduce the diversity of eucalypt species for which the site was listed.

5.3.2 Indirect impacts

Implementation of the preliminary flight paths as part of the operation of WSI may have a range of indirect impacts on the GBMA due to the overflight of aircraft over different parts of this area (i.e. both the urbanised locations predominantly associated with the areas along the Great Western Highway and Bells Line or Road areas and the bushland areas outside of the urban localities). This may result in potential impacts to one or more of the identified values associated with the GBMA. These potential impacts include impacts to:

- biodiversity
- visual amenity
- the existing noise environment
- heritage
- social and economic
- air quality.

5.3.2.1 Biodiversity

In addition to the potential direct impacts associated with wildlife strike and aircraft crashes (as described in Section 5.3.1), the project may have additional indirect impacts on the biodiversity attributes within the GBMA resulting from impacts such as:

- changes to existing noise
- changes to existing air quality
- changes to existing lighting.

Each of these potential impacts are briefly described in the following sections. Further detail regarding these potential impacts is provided in Chapter 7 of Technical paper 8 prepared for the project EIS.

Aircraft noise

Alterations to existing noise levels as a result of the preliminary flight paths would occur during operation (refer to Section 5.3.2.3 for details). Noise from aircraft flight operations is among the most significant of the environmental impacts associated with airports. Key impacts of noise on wildlife include:

- behavioural changes such as avoidance or dispersal from areas affected by noise
- communication interference such as hindering or masking of signals
- physiological impacts such as elevated levels of stress hormones that may affect breeding
- hearing loss for fauna species.

It is anticipated that most noise related impacts on biodiversity would be concentrated within the wildlife buffer for WSI (up to around 13 km from WSI runway boundary) and to a lesser degree areas outside the wildlife buffer. Most other noise impacts outside these locations would likely be minor or negligible given existing noise levels associated with the existing environment including other aircraft flights operating within the Sydney Basin airspace.

As described in Chapter 4, aircraft operating at WSI would include both jet and non-jet aircraft. The level of noise generated depends on aircraft engine type (i.e. propeller or jet), size, way the aircraft is flown, aircraft settings, rate of climb, aircraft altitude and meteorological conditions. Jet engines can exceed 150 dB(A) during departure however this decreases as the aircraft increase in altitude and transition into cruising mode generally generating less than 60 dB(A) once they exceed 10,000 ft above ground level.

The approximate altitude and distance from the Airport Site at which aircraft reach certain noise levels consists of:

- take-off and initial ascent (0 to 3,500 ft (0 m to around 1 km) above ground level): jet engines can reach over 150 dB(A) during take-off
- final ascent to cruising altitude (greater than 3,500 to 10,000 ft (around 1 km to 3 km) above ground level): aircraft usually reach noise levels of between 70 to 80 dB(A) during this period
- cruising and maximum altitude (greater than 10,000 to 20,000 (around 3 km to 6 km) ft above ground level): typically aircraft at altitudes above 10,000 ft (around 3 km) above ground level generally produce less than 60 dB(A).

Existing ambient noise levels within areas of the GBMA located within the wildlife buffer for WSI would typically be minimal and largely limited to noise generated from existing roads and urban development that are located within or adjacent to the GBMA. In proximity to the Nepean River, the GBMA would also be subject to noise generated by boats and recreation users. The area is also currently exposed to noise generated by existing light aircraft, helicopters and at higher altitudes commercial aircraft movements, similar those aircraft that would use the flight paths subject to this assessment. As such, the GBMA biodiversity attributes are already subject to low levels of ambient anthropogenic noise.

Although the peak noise levels associated with direct overflight of the GBMA may temporarily disturb some species, flight path associated with WSI would generally be at least 1,500 ft (around 460 m) above ground level or more at most locations in the GBMA, with noise levels not typically expected to exceed around 70 dB(A) (based on the L_{amax} value presented in Technical paper 1). Therefore, these intermittent noise levels are unlikely to disturb fauna within the GBMA, or affect the habitats of this fauna.

Biodiversity sensitive receivers within the GBMA which may be susceptible to alterations in current noise levels include:

- Regent Honeyeater important habitat – this species has potential to susceptible to noise impacts such as masking of calls, stress inducement or lead to avoidance of areas. The flight paths where they intersect with this habitat however typically exceed 8,000 ft (around 2.4 km) above ground level and occur outside the noise and vibration contours and are therefore likely to be negligible. As such, these areas are unlikely to be affected by the noise generated by the project
- Flying-fox foraging resources – as described above, flying fox populations associated with the GBMA are unlikely to be impacted
- large remnant intact areas of vegetation and associated habitats for numerous flora and fauna species – there would be no direct impacts on these habitats. As noted previously, the preliminary flight paths throughout the GBMA airspace would typically exceed at least 1,500 ft (around 460 m) above ground level, with noise levels not expected to exceed around 70 dB(A). Further, most parts of the Sydney Basin, including much of the GBMA, already currently experience varying levels of aircraft noise generated by a range of aircraft associated with existing airports including (Kingsford Smith) Airport (being the dominant activity) in addition to Bankstown, Camden and RAAF Base Richmond airports.

Overall, noise may indirectly result in some impacts, however given the altitudes at which aircraft would be flying at the points at which they have the potential to impact on the GBMA, these impacts are not considered to present a threat to the biodiversity values for which the site was listed. Increases or changes to existing noise levels associated with the project within the GBMA would be largely limited and the predicted noise levels are unlikely to be of a magnitude that would threaten the viability of biodiversity attributes within the GBMA.

Light pollution

Artificial light, including sources associated with the project such as aircraft light, can have adverse impacts on wildlife. The key impacts associated with light spill are behavioural changes that may be critical for a species life cycle for example migration or breeding. Physiological changes such as delays in reproduction or feeding patterns may occur in response to changes in light levels (DEE 2020, Ecosure 2021). These changes can lead to some species being more vulnerable to predation, wildlife strike via disorientation or other disturbances.

The project's operational light would be limited to lights on aircraft as they travel along the flight paths during nocturnal hours. The magnitude of visual impacts at night (including light spill) would be experienced across a small portion of the urban area and would not contrast substantially with the surrounding landscape at night, resulting in a low magnitude of change. Within the intrinsically dark landscapes which experience minimal existing light and where biodiversity values could be most sensitive to changes in light, including large areas of the GBMA, the magnitude of change and impact is considered to be negligible as a result of the project.

Overall, even though there may be a slight increase in light, existing biodiversity associated with the GBMA is unlikely to be significantly affected by the project's operational light impacts, and would therefore not impact on the biodiversity attributes within the GBMA.

Air quality

Aircraft operating along the flight paths would increase emissions that could result in local and regional reductions in air quality. The most critical aircraft emission pollutants include oxides of nitrogen (NO_x) due to the transformation into nitrogen dioxide (NO_2) and ozone (O_3), and $PM_{2.5}$.

Technical paper 2 found that minor elevated NO_2 levels are predicted to occur in 2055 when the single runway approaches capacity and elevated levels. These elevated levels would primarily occur immediately to the north-west of WSI aligning with the runway (outside the area of the GBMA). The project's impact on the concentrations of all other assessed pollutants would be negligible and unlikely to be discernible or measurable within the existing background concentrations (noting there are exceedances for $PM_{2.5}$ but these have no tangible impact) including areas above the GBMA. As it is likely there will also be improvements in fuel efficiency (for both aircraft and motor vehicles) and corresponding decreases in aircraft emissions in the future, no significant impacts on air quality are anticipated to arise. This is particularly the case for the GBMA given that any appreciable impacts would appear to be focused on and around the immediate vicinity of WSI and not further afield in the more elevated Blue Mountains region that the GBMA sits within.

Water quality

Aircraft pollutants are comprised of vapours, gases, and fine particles which are not expected to deposit to the ground. Despite this, there has been queries raised relating to the deposition of these pollutants and the potential for them to impact on water quality and subsequently aquatic ecosystems including those contained within the GBMA which provide habitat for disturbance-sensitive ecosystems.

Technical paper 12 estimated the deposition rates of the key pollutants relevant to project and their potential impacts on water quality using a highly conservative approach. It identified that aircraft pollutants likely to be generated are dominated by $PM_{2.5}$ which essentially act like a gas in the atmosphere with little or no deposition. Due to this, it is expected that the deposition of pollutants to the ground are highly unlikely to ever occur. Technical paper 12 identified that the project's potential impacts on water quality would be negligible and so low that they would not be measurable.

Impacts on aquatic ecosystems are therefore considered to be negligible and unlikely to impact on aquatic biodiversity values contained within the GBMA.

Evaluating impacts on GBMA

Potential impacts associated with the project on GBMA biodiversity values have been further assessed against the assessment matrix in the *Guidance and Toolkit for impact assessments in a World Heritage Context* (UNESCO, 2022a). Overall, the assessment concluded that the project is likely to have a negligible to minor negative impact on biodiversity values associated with the GBMA (Table 5.2).

Table 5.2 Impact identification and assessment matrix on GBMA biodiversity values

Element of proposed action	Attribute	Description of potential impacts	Frequency of action	Duration of action	Reversibility of action	Reversibility of change to the attribute	Longevity of change to the attribute	Degree of change to the attribute	Quality of change to the attribute	Severity significance category
Operation of WSI flight paths	Native plant and animal species (including threatened species) Important and significant natural habitats for in-situ conservation of biological diversity Outstanding examples representing significant on-going ecological and biological processes in the evolution and development	Wildlife strike	Intermittent – occasional	Long-term	Irreversible	Irreversible	Permanent	Some	Negative	Minor negative impact
		Air crashes	Unlikely – rare	Short-term	Reversible	Reversible	Temporary	Some	Negative	Minor negative impact
		Noise	Intermittent/ continuous	Long-term	Irreversible	Irreversible	Permanent	Some	Negative	Negligible
		Air quality – fuel jettisoning	Impulsive	Short-term	Reversible	Reversible	Temporary	Negligible	Negative	Negligible
		Water quality	Intermittent/ continuous	Short-term	Reversible	Reversible	Temporary	Negligible	Negative	Negligible
		Light spill	Intermittent	Long-term	Irreversible	Irreversible	Permanent	Negligible	Negative	Negligible

It is acknowledged that the EPBC Act recognises 92 fauna and 79 migratory species. As discussed in the biodiversity assessment (Technical paper 8), of these species, only 17 fauna and 28 migratory species were identified as having a high likelihood of occurrence in the assessment zone (including the GBMA).

Significant impact assessments were completed in accordance with the Australian Government's significant impact guidelines for all MNES biodiversity entities. The significant impact assessments were undertaken for each of the above noted species and the results presented in Appendix C of Technical paper 8. Overall, the SIAs completed for all threatened and migratory candidate species concluded that the project is unlikely to have a significant impact on threatened or migratory species listed under the EPBC Act.

The significant impact assessments identified that there was unlikely to be a significant impact on these species as:

- direct impacts would be restricted to occasional wildlife strike. This impact would likely be minor, infrequent and largely limited to airspaces within the wildlife buffer
- indirect impacts are unlikely to result in the loss or significant modification of habitats or populations as:
  - potential noise impacts are unlikely to result in changes that would alter fauna species behaviour or use of available habitats
  - potential changes in light, air quality and water quality are likely to be negligible
- given the extent of potential impacts and biodiversity values within the region already being exposed to similar impacts, the proposed action is unlikely to lead to a long-term reduction in the size of a population, reduce the area of occupancy of a population or adversely affect critical habitat for a species, nor would the project fragment a population, disrupt the breeding cycle of a population, introduce invasive species or pathogens that may cause a species to decline, impact on habitat to the extent that it would cause a species to decline, or significantly interfere with recovery plans' actions.

Overall, it is considered unlikely that operation of the preliminary flight paths would have a significant impact on biodiversity values of the GBMA for the following reasons:

- the potential direct impacts on vegetation or fauna habitats associated with the project are likely to be minor, infrequent and rare
- the operation of the preliminary flight paths are unlikely to result in the loss or significant modification of biological diversity, biological processes or integrity values within the GBMA for which it was listed as:
  - potential wildlife strike impacts on fauna within the GBMA are only likely to be minor, infrequent, rare and limited to a small number of bird species which occur at altitudes greater than 1,000 ft AGL
  - potential noise impacts are unlikely to result in changes that would alter fauna species behaviour or use of habitats available
  - potential impacts on the GBMA as a result of changes to air quality or resulting from the minor contribution to climate change are likely to be negligible.

5.3.2.2 Visual amenity

This section provides a summary of the potential visual and landscape impacts on the GBMA and its values. Further detail regarding these potential impacts is provided in Technical paper 7 prepared for the project EIS.

Overview

Air traffic will be visible as it flies over the Sydney Basin airspace, including the GBMA, passing through a range of views from this location. Given the nature of the aircraft movements, these views will naturally be transient, and typically of short duration and viewed at varying distances. It is generally assumed that the greater the distance from WSI, the higher aircraft will be and therefore the less visually prominent these aircraft are in views toward them. The patterns of movement would be relatively consistent but alter day to day according to weather conditions, and flights would operate generally within the bounds of the flight path corridors identified in Section 4.2.2.2.

Above the GBMA, aircraft may operate anywhere within the flight path corridors. The heights of some of the typical features within the GBMA and the indicative altitudes of the preliminary flight paths above these features are shown in Table 5.3.

Table 5.3 Indicative altitude of flight paths above the GBMA

Location	Height above sea level (metres)	Height above sea level (ft)	Flight path altitude (metres)	Flight path altitude (ft)	Height above landform (metres)	Height above landform (ft)
Nattai wilderness area:	540	1,772	1,500–4,000	5,000–13,300	1,450–3,460	3,228–11,528
Wilderness areas of the Nepean River:	100	328	7,500	2,500	7,400	2,172
Nepean River and urban areas of western Sydney:	30	98	1,500	5,000	1,470	4,902
Wilderness areas across Bowens Creek valley and Mt Tomah	900	2,952	3,200	10,500	2,052	2,300
Grose Valley north of Blue Gum Forest:	820	2,690	3,200	10,500	2,380	7,810
Jamison Valley south of Echo Point lookout and Katoomba across Mt Solitary:	200	656	4,000	13,300	3,800	12,644
Mt Solitary	927	3,041	3,200	10,500	2,273	7,459
Jamison Valley south of Wentworth Falls across Mt Solitary	235	770	3,200	10,500	2,965	9,730

Contrails

A contrail is a stream of condensed water from an aircraft flying at high altitude, sometimes seen as a white streak in the sky that eventually disappears(refer to Figure 5.1). Contrails form when aircraft are at very high altitudes (normally above 26,000 ft or 8,000 m), the air is very cold and there is a large amount of water vapor in the air (high humidity). Water droplets form ice particles, making up the white contrail. When atmospheric conditions become drier (lower humidity) the contrails evaporate and mix into the surrounding atmosphere.

Figure 5.1 Existing contrail visible above Wentworth Falls, Blue Mountains

Contrails can currently be seen in the sky over western Sydney and over the Blue Mountains/GBMA. At the altitudes contrails are formed, they form a small part of the view to the sky. While they can be seen in the context of clouds, which can reduces their visibility. However, as contrails typically form straight lines, they can be especially noticeable in sensitive natural areas such as the GBMA because they are linear features, unlike most natural clouds. While the formation of contrails is variable, when present they can draw attention to and increase the visibility of distant planes, particularly when there is heavy flight traffic, such as at peak times when there could be multiple contrails visible. Contrails can also remain for long periods of time after the plane has passed, from several seconds to hours, depending on atmospheric conditions.

Aircraft at night

The assessment of visual impacts at night has been undertaken based on all flights during the hours of darkness based on the 'night' flight paths, which are used between 11 pm and 5.30 am as well as the day-time flight paths used before and after this period, when its dark. Aircraft typically have at least 3 flashing red and white navigation lights, which are more visible at night, however, actual lighting can vary and include red, green and white lights on the wingtips and tail which may be steady or flash, appearing visible at night. During final approach there are also landing lights which be steady or pulse/strobe and can be visible at some distance. It is noted that these lights may also be used during dark conditions and not necessarily only at night.

Assessment of representative landscape character zones within the GBMA

The landscape of the Blue Mountains that has been considered in this assessment includes the GBMA and adjacent reserves, as well as the towns, villages and bushland areas alongside the Great Western Highway. While there is a diverse mosaic of landscapes within the landscape and visual study area of the GBMA, 3 broad landscape character zones were identified for the purposes of this assessment.

These are based on similar topography, vegetation type and cover, land use and built form (existing and emerging), including:

- Blue Mountains iconic features landscape character zone
- Blue Mountains forested hills and valleys landscape character zone.

Blue Mountains iconic features landscape character zone

Existing conditions

This landscape includes the striking landscape formations that are unique to the GBMA, are of Outstanding Universal Value, and contribute to its World Heritage status, including the dramatic system of vertical cliffs, sandstone canyons, pedestals and pagoda rock formations that fringe the plateaus such as the Kanangra Walls, The Three Sisters and the long lines of Narrow Neck and Mount Solitary (refer to Figure 5.2). There is currently air traffic passing over this zone, with flights from the Sydney (Kingsford Smith) Airport, and other airports in the region. Generally, the larger aircraft are travelling higher altitudes and some smaller aircraft and helicopters are seen generally at a lower altitude. These aircraft are visible but do not strongly influence the character of the zone.

The landscape character zone is considered to have a very high sensitivity now and in the future (2033 and 2055).

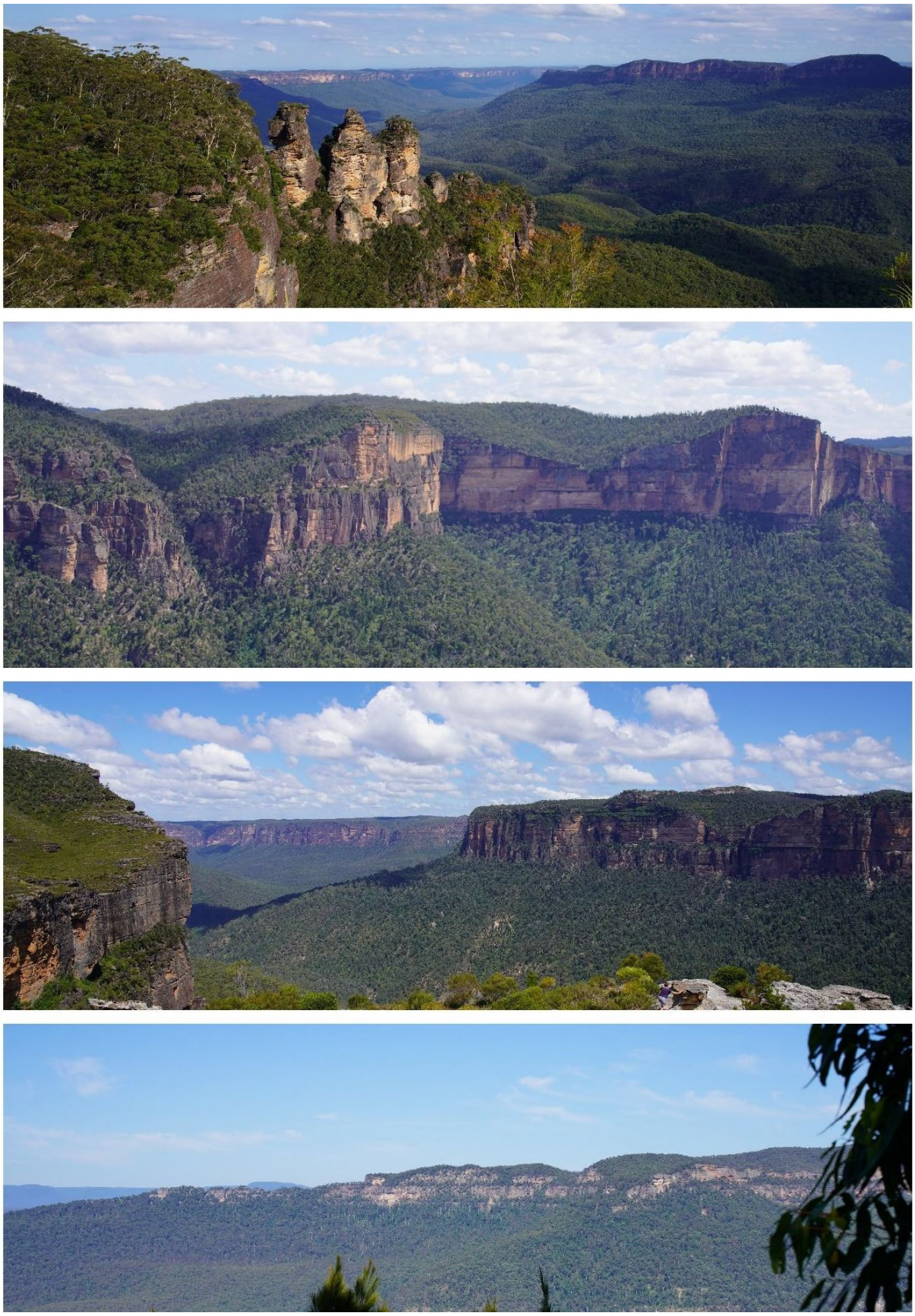


Figure 5.2 Examples of the existing character of the Blue Mountains iconic features landscape character zone

Landscape character zone impact

Some of the landscape features in this landscape character zone would be overflown or in close proximity to the preliminary flight paths. For example:

- Mount Solitary (927 m above sea level) would be overflown by runway 23 departures with around 10 flights on average, up to a maximum of about 19 flights, per day. Aircraft would likely be at an altitude of between 10,500 and 13,300 ft (around 3.2 and 4 km) above sea level (which would be around 7,500 ft (2.2 km) above Mount Solitary itself).
- Kings Tableland (about 700 m above sea level) would be overflown by:
  - departure flights from runway 05 with around 9 flights on average, up to a maximum of about 20 flights, per day. Aircraft would be at an altitude between around 13,300 and 17,500 ft (4 to 5.3 km) above sea level (which would be around 10,900 to 15,400 ft (3.3 to 4.3 km) above the tablelands
  - arrival flights from runway 23 with around 24 flights on average, up to about 51 flights per day, with planes at an altitude of around 8,000 to 10,500 ft (around 2.5 to 3.2 km) (which would be around 5,900 ft (1.8 km) above the tablelands.
- The Gross valley and surrounding escarpments (about 920 m above sea level) would be overflown by 1 departure flight path with about 3 flights on average (up to 8) in 2033 up to around and 18 (up to around 42) by 2055. Aircraft would be at an altitude of around 13,300 to 17,500 ft (around 4 to 5.3 km), and about 10,000 to 14,500 ft (about 3 to 4.5 km) above the escarpments.

The character of aircraft, and at times contrails, would contrast with the natural forms of clouds in the sky and natural features of the land. Overall, there would be several flight paths over this landscape character zone. Aircraft would be relatively high and passing over at a relatively low frequency. This would slightly alter the character of this zone.

The landscape character impact for the Blue Mountains iconic features landscape character zone is detailed in Table 5.4. Further detail of the potential impacts is provided in Table A.1 (Appendix A).

Table 5.4 Landscape character impact – Blue Mountains iconic features landscape character zone

Scenario	Sensitivity	Magnitude of change	Landscape impact
2033	Very high	Low	High-Moderate
2055	Very high	Low	High-Moderate

Blue Mountains forested hills and valleys landscape character zone

Existing conditions

This landscape includes the undulating forested hills and valleys located between and alongside the striking landscape formations. This area is dominated by eucalyptus species unique to the GBMA (and part of its significance in World Heritage listing), creating a highly natural and scenic landscape. This area also includes adjacent reserves such as the Burragorang and Nattai State Conservation Areas, which contain a similar character of undulating forested hills and valleys (refer to Figure 5.3).

The wide expanse of the forest and minimal built features also creates a strong sense of remoteness and tranquillity. There is air traffic visible across this zone, with flights from the Sydney (Kingsford Smith) Airport, Bankstown and other airports across the region. These overflights are high and do not strongly influence the character of the zone.

The landscape character zone is considered to have a high sensitivity now and in the future (2033 and 2055).

Figure 5.3 Examples of the character of the Blue Mountains forested hills and valleys landscape character zone

Landscape character zone impact

The north of the Great Western Highway would be overflown by 4 departure flight paths. The south of the Great Western Highway would be overflown by several departure and arrival flight paths. The aircraft would vary in altitude, with lower altitudes in eastern and central parts of the zone (up to about 2,500 to 8,000 ft or 750 metres to 2.5 km above sea level) including over Burragorang State Conservation Area, Lake Burragorang and the Erskine Range, increasing to higher altitudes in western and northern part of the zone (up to about 8,000 to 17,000 ft (2.5 to 5 km above sea level)) for example over Kanangra-Boyd National Park.

The character of aircraft, and at times contrails, would contrast with the natural forms of clouds in the sky and natural features of the land. Overall, there would be multiple flight paths over this zone, however, the aircraft would be relatively high across the majority of this zone and the aircraft would pass over at a relatively low frequency. This would slightly alter the character of this zone in 2033. Impacts during the 2055 scenario would generally be similar, however with an increase frequency of flights. Overall, the project would result in a moderate magnitude of change to the character of this zone, due to the increase in frequency.

The landscape character impact for the Blue Mountains forested hills and valleys landscape character zone is detailed in Table 5.5. Further detail of the potential impacts is provided in Table A.2 (Appendix A).

Table 5.5 Landscape character impact – Blue Mountains forested hills and valleys landscape character zone

Scenario	Sensitivity	Magnitude of change	Landscape impact
2033	High	Low	Moderate
2055	High	Moderate	High-Moderate

Assessment of representative view points within the GBMA

The Blue Mountains region is a popular destination, including by road, with many sections of the Great Western Highway and the Bells Line of Road offering highly scenic views to various parts of the GBMA as well as opportunities for stopping to appreciate the view from lookouts or other vantage points. Within the wilderness areas there are scattered day use facilities and campgrounds. The following sections provide an assessment of the visual impacts on representative locations within the GBMA including views from:

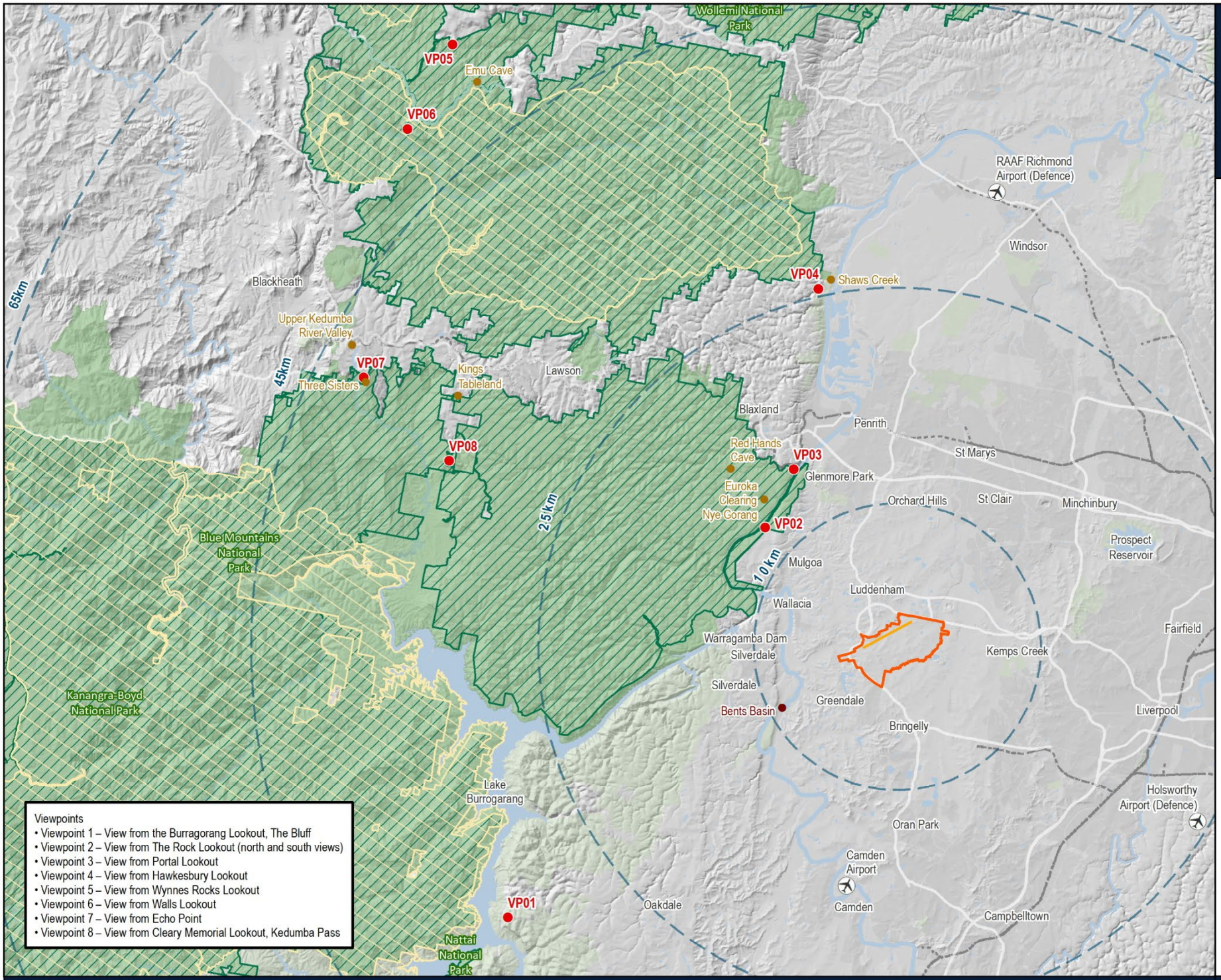
- lookouts
- campgrounds
- scenic routes.

Views from lookouts

The following section provides an assessment of the potential visual impact on views from scenic lookouts during daytime hours on a representative selection of scenic Lookouts within the GBMA. These representative viewpoints are:

- Viewpoint 1 – View from the Burragorang Lookout, The Bluff
- Viewpoint 2 – View from The Rock Lookout (north and south views)
- Viewpoint 3 – View from Portal Lookout
- Viewpoint 4 – View from Hawkesbury Lookout
- Viewpoint 5 – View from Wynnes Rocks Lookout
- Viewpoint 6 – View from Walls Lookout
- Viewpoint 7 – View from Echo Point
- Viewpoint 8 – View from Cleary Memorial Lookout, Kedumba Pass.

The location of these viewpoints is shown on Figure 5.4 and Figure 5.5. A summary of the impacts to these locations is provided in the following section with further detail summarised in Table A.3 to Table A.10 (Appendix A) of this report.



Viewpoints
- Viewpoint 1 – View from the Burragorang Lookout, The Bluff
- Viewpoint 2 – View from The Rock Lookout (north and south views)
- Viewpoint 3 – View from Portal Lookout
- Viewpoint 4 – View from Hawkesbury Lookout
- Viewpoint 5 – View from Wynnes Rocks Lookout
- Viewpoint 6 – View from Walls Lookout
- Viewpoint 7 – View from Echo Point
- Viewpoint 8 – View from Cleary Memorial Lookout, Kedumba Pass

Figure 5.4

Viewpoint location plan in the Blue Mountains

Legend

- WSI Runway
- Western Sydney International (Nancy-Bird Walton) Airport land boundary
- Viewpoint locations
- Radial distances
- Greater Blue Mountains World Heritage Area
- Declared wilderness
- NPWS reserve
- Aboriginal Places raised during consultation (NPW Act)
- Site of Aboriginal significance

Viewpoint locations
VP01 - Burragorang Lookout, The Bluff
VP02 - The Rock lookout
VP03 - Portal lookout
VP04 - Hawkesbury Lookout
VP05 - Wynnes Rocks Lookout
VP06 - Walls Lookout
VP07 - Echo Point Lookout
VP08 - Cleary memorial lookout, Kedumba Pass

0 5 10 km

Coordinate system: GDA 1994 NSW Lambert

Scale ratio correct when printed at A4

1:350,000 Date: 26/06/2023

Data sources: - DITRDC, DCS, Geoscience Australia
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA, Geodatastyrelsen,GSA,GSI and the GIS User Community

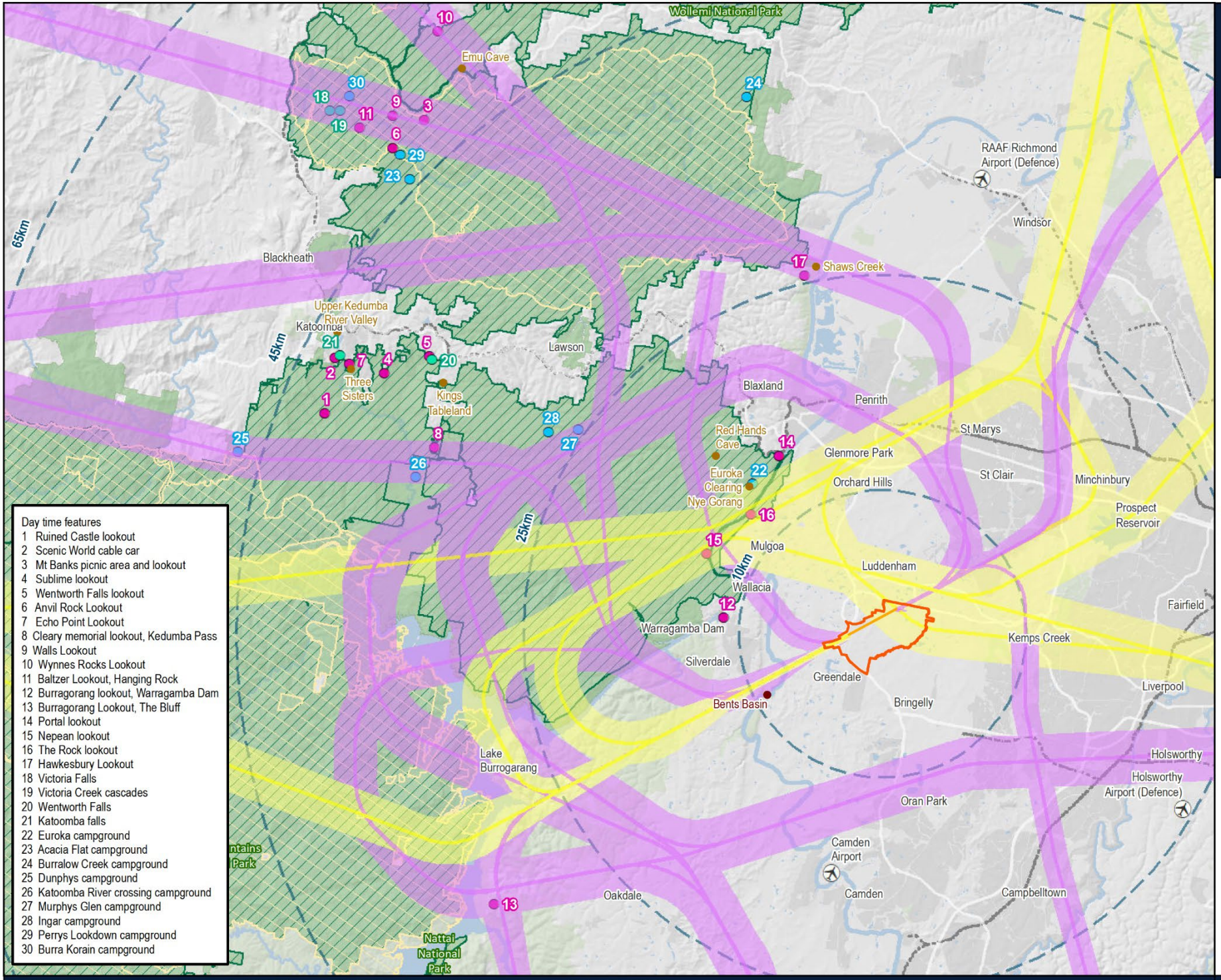


Figure 5.5

Daytime features

Legend

- WSI Runway
- Western Sydney International (Nancy-Bird Walton) Airport land boundary
- Radial distances
- Greater Blue Mountains World Heritage Area
- Declared wilderness
- NPWS reserve
- Aboriginal Places raised during consultation (NPW Act)
- Site of Aboriginal significance

Daytime features

- Campgrounds
- Lookouts
- Waterfalls

Day time flight paths and swathes

- Arrivals
- Departures

Coordinate system: GDA 1994 NSW Lambert

Scale ratio correct when printed at A4

1:350,000 Date: 23/05/2023

Data sources: - DITRDC, DCS, Geoscience Australia Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

Assessment of views from Lookouts

At Viewpoint 1, the Burragorang Lookout is located under a series of several flight paths and the project would result in a moderate visual impact in 2033 and High-Moderate impacts in 2055. Aircraft would be seen at altitudes between 3,200 ft (about 1 km) and up to 10,500 ft (around 3.2 km). Overall, due to the height in relation to the surrounding hills and increasing frequency of flights, there would not be a noticeable change to the amenity of this view.

The project would result in generally negligible impacts at viewpoints 3 and 6 (with the exception of viewpoint 5 in 2055 which would be High-Moderate) as aircraft would typically be viewed at high altitudes in an open and expansive sky or viewed in the backdrop of a rural and urban fringe (in the case of Viewpoint 3). This would reduce the prominence of the aircraft and would not noticeably intrude on the character or amenity of the view.

At Viewpoint 2 (refer to Figure 5.6 and Figure 5.7), the Lookout is located under and adjacent to several flight paths and the project would result in a moderate visual impact. Aircraft would be seen crossing the Nepean River valley and in close proximity. However the aircraft would be at higher altitudes (of over 7,000 ft (around 2.3 km) or greater) and would be less visually prominent. The addition of aircraft would somewhat intrude upon the wilderness character of the view, slightly reducing the amenity of the view and resulting in a low magnitude of change in 2033 and 2055.

Figure 5.6 View north from The Rock Lookout, Blue Mountains National Park (Viewpoint 2)

Figure 5.7 View south from The Rock Lookout, Blue Mountains National Park (Viewpoint 2)

At Viewpoint 4 (refer to Figure 5.8), the project would result in a Moderate-Low visual impact. The view would include aircraft departing Runway 05 at a distance of around 1 km and at a height of about 10,500 ft (about 3.2 km). In 2033, this would be around 55 flights per day and would increase to 158 flights per day by 2055. Aircraft would be seen at a lower altitude as they ascend and would be somewhat prominent in the view due to distance and altitude, and the expansive open sky. There would also be aircraft visible in the background, as they come into land on several flight paths from the north and east. This would result in a noticeable reduction in the amenity of the view, and a low magnitude of change.

Figure 5.8 View to the north-west from Hawkesbury Lookout, Yellomundee Regional Park (Viewpoint 4)

At Viewpoint 5, the Wynnes Lookout is located under a series of several flight paths and the project would result in a Moderate visual impact in 2033 and 2055. Aircraft would be seen at altitudes between 13,300 and 17,500 ft (about 4 to 5 km) above sea level, and about 10,100 ft (3 km) above Mount Tomah. Overall, due to the height in relation to the surrounding hills and increasing frequency of flights, there would be a noticeable change to the amenity of this view.

At Viewpoint 7 (refer to Figure 5.9 and Figure 5.10), while aircraft would be intermittent and small in size when viewed from this Lookout (around 10 km, and at an altitude of 8,000 ft (around 2.5 km) above sea level, or 5,000 ft about ground level (around 1.6 km)), aircraft would be moving and this has the potential to intrude upon the wilderness character of the view.

Aircraft would be seen crossing this view intermittently, beyond Mount Solitary. Aircraft would be viewed in an open and expansive sky, from an elevated vantage point, increasing their prominence in the view. By 2055, the frequency of movements would further increase the prominence of aircraft in this view. Overall, there would be a slight reduction in the amenity of this view and a low magnitude of change for both 2033 and 2055. However, as this view is of very high sensitivity, this would result in a High-Moderate visual impact in both 2033 and 2055.

Note: The photomontage image has been prepared to include lines showing the preliminary flight paths, and multiple planes in silhouette located along each flight path. The spacing of these planes does not represent plane frequency, but aims to illustrate the effect of planes that may be moving across the sky

Figure 5.9 Existing view south east from Echo Point Lookout to The Three Sisters and Mount Solitary (top) and photomontage of aircraft visible along preliminary flight paths associated with Runway 05 (bottom) (Viewpoint 7)

Note: The photomontage image has been prepared to include lines showing the preliminary flight paths, and multiple planes in silhouette located along each flight path. The spacing of these planes does not represent plane frequency, but aims to illustrate the effect of planes that may be moving across the sky

Figure 5.10 View south east from Echo Point Lookout to The Three Sisters and Mount Solitary (top) and photomontage of aircraft visible along preliminary flight paths associated with Runway 23 (bottom) (Viewpoint 7)

At Viewpoint 8 (refer to Figure 5.11), aircraft would be seen departing or arriving WSI. Departing aircraft would be visible overhead or passing across the middle ground of views from this Lookout and be closer than arriving aircraft, but both would be at high altitudes (around 10,500 ft (around 3.2 km) or greater) and generally infrequent. These flights would be seen in between overgrown vegetation, which currently partly encloses the Lookout, restricting views out, however, when seen they would be visible in an open and expansive sky slightly increasing their prominence in the view. Due to the close proximity and contrast with the wilderness view, the project would result in a low magnitude of change in 2033 and 2055. However, as this view is of high sensitivity, this would result in a moderate visual impact for both 2033 and 2055.

Figure 5.11 View from Cleary Memorial Lookout, Kedumba Pass (Viewpoint 8)

Views from campgrounds

There are many campgrounds throughout the GBMA offering opportunities for overnight stays, as well as for day use, including picnicking, hiking and swimming in the many rivers, creeks and waterfalls in the Greater Blue Mountains (refer to Figure 5.5). Many of the campgrounds are remote with limited access for vehicles. Some of these sites include the Euroka campground south of Glenbrook, Acacia Flat campground and Burralow Creek campground in the Grose Valley wilderness areas, Dunphys campground at the end of Megalong Valley, Katoomba River crossing campground in the Jamison Valley, and Murphys Glen campground south of Woodford. The Ingar campground, located between Wentworth Falls and Woodford, is also a popular campground and day use area offering picnic facilities and places to swim.

Some of the remote wilderness areas of the GBMA and other protected areas in the region, such as the Burragorang State Conservation Area, do not have designated campgrounds and would generally be used by people for day use only.

From most of the campground locations, views would be enclosed by trees so that the opportunity to view aircraft would be restricted to those overhead and within the area of visible sky. Aircraft are more likely to be visible from the Murphys Glen campground, Euroka campground, Wentworth Falls and Katoomba Falls, with flight paths located within 2 to 7 km of these locations and aircraft ranging from around 8,000 ft (2.4 km) to 17,500 ft (or 5.3 km). Some areas in the north-eastern parts of the Blue Mountains would be overflown by aircraft (for example the Mount Banks Picnic Area and Lookout), but aircraft would be less frequent and at high altitudes (about 10,500 ft (or 3.2 km).

The camp sites are generally located in areas of high scenic quality and are experienced by concentrations of recreational users and are therefore considered to have a high sensitivity to impact. The effect of the project on campgrounds and day use areas would result in a slight reduction in the amenity of views and a low magnitude of change in both 2033 and in 2055 and Moderate overall visual impacts.

Views from scenic routes

The Greater Blue Mountains scenic drive offers a 'winding, edge-of-the-world drive around the cliff tops' providing scenic views as well as opportunities to stop and appreciate the view from Lookouts or other vantage points.

The Greater Blue Mountains Drive Map (NSW Government, 2022) identifies 1,200 km of scenic drives and 'feature routes' in the Blue Mountains which skirts the GBMA's of Wollemi National Park and Blue Mountains National Park. The feature routes also include east-west connections from Penrith via the Great Western Highway as it winds through the Greater Blue Mountains, via the escarpment areas of Katoomba, and the Wentworth Falls area, and Blackheath, to a fork in the road (to Lithgow in the north, or Oberon, to the south). The section of Bells Line of Road also offers east-west 'feature routes' between Kurrajong via Bilpin and Mount Victoria, through the Grose Valley area, overlooking the Blue Gum Forest of Pierces Pass and the Grose River and its tributaries, to Lithgow.

The winding, undulating roads of the Great Western Highway and Bells Line of Road offer opportunities for open or semi-enclosed views to the Blue Mountains landforms. At the Great Western Highway, there are some flight paths which will fly over sections of the highway at Warrimoo, Linden, Medlow Bath and Hartley. These aircraft would range in frequency of movement (between around as 8 movements to 37 movements per day in 2033, and between 52 and 104 movements in 2055), and altitude (such as between 8,000 ft to 13,500 ft at Warrimoo and Linden, and over 20,000 ft at Hartley). At Bells Line of Road, aircraft may also be visible but would typically occur at higher altitudes compared to the Great Western Highway with maximums of around 8 to 36 movements per day in 2033, and between 42 and 97 movements in 2055.

Overall, aircraft flying over sections of the feature routes may be visible passing overhead (assuming there is no intervening vegetation), however they would generally be seen at high or very high altitudes between 8,000 to 17,500 ft (2.5 to 5 km) by few people, resulting in a low magnitude of change. Due to the moderate sensitivity, there would be Moderate to Low visual impact.

Assessment of night-time visual impacts

Two broad environmental zones within the landscape and visual study area have been used to assess the night time impacts of the project with respect to potential visual impacts on the GBMA. These include:

- areas of medium district brightness associated with the suburban areas in towns and localities alongside the Great Western Highway and Blue Mountains
- intrinsically dark landscapes within the GBMA and protected reserves such as National Parks/conservation areas.

The following sections summarise the assessment of visual impact at night.

Areas of medium district brightness

Existing conditions

Urban and semi-urban areas in the landscape and visual study area include towns along the Great Western Highway such as Woodford and Katoomba are of medium district brightness. This area includes the Katoomba Falls Night-lit Walk, a 1.3 km walk offering night-time viewing of several natural features including Orphan Rock, Witches Leap, Katoomba Falls and Katoomba Cascades, as well as the Three Sisters which is also lit at night. The lit trail connects these lit areas and includes lighting from the top of the Katoomba Falls Kiosk car park, around Reid's Plateau and down to the Duke and Duchess Lookout.

This area also includes the Linden Observatory. This observatory is located on the northern outskirts of Linden (outside of the GBMA) and is currently used by amateur astronomy groups. There are existing flights passing above these areas which would be generally at higher elevations and not strongly influence the character of views at night.

Visual and landscape character impacts at night

Urban and semi-urban areas include towns along the Great Western Highway such as Woodford and Katoomba. These residential areas generally include street lighting, and lighting from vehicles and dwellings. There is lighting associated with the night trails and lit features of the Katoomba Falls Night-lit Walk and around Echo Point and the Three Sisters. There would also be occasional night-time flight paths contributing to the light level.

There would be a low magnitude of change at night due to the low frequency and high altitude of aircraft. Due to the low visual sensitivity, there would be low visual impact.

With respect to the potential impacts on the former Linden Observatory, aircraft may be viewed in the night sky to the east of the former Linden Observatory, including one arrival flight path and 2 departure flights paths. There would be maximums of up to about 14 and 25 flights per night in total in 2033 and 2055 respectively. Aircraft are likely to be at relatively high altitudes of between 8,000 to 10,500 ft (2.4 to 3.2 km).

Overall, the effect of lighting from the proposed night-time flight paths would be experienced across a small portion of the landscape and seen as distant flashing lights at high altitudes, resulting in a low magnitude of change (noting this is an assessment of the amenity, not a technical assessment of the impact of additional lighting on the usefulness of the observatory). Due to the high sensitivity, there would be Moderate-Low visual impact.

Intrinsically dark landscapes

Existing conditions

This landscape includes large areas of remote wilderness areas including parts of the GBMA and other protected areas such as the Burragorang State Conservation Area. The scenic and aesthetic values of these landscapes, as well as recreational activities are generally experienced during the day time, from Lookouts, picnic areas and walking trails, and other recreational activities in the GBMA, such as canyoning and rock climbing. Apart from designated campgrounds, there would be limited activity in these areas at night.

There are however a number of campgrounds within this landscape, from which there may be views to the sky where aircraft using the preliminary flight paths may be seen. Noting that most of these campgrounds are enclosed by trees, so that only flights that pass directly overhead are likely to be visible, and these would only be seen when viewing the sky during activities which are otherwise not brightly lit. Campgrounds which are under the flight paths include as Euroka campground south of Glenbrook, Katoomba River crossing campground in the Jamison Valley, Ingar and Murphys Glen campgrounds south of Woodford, and Burralow Creek campground in the Lower Grose Valley area west of Kurrajong.

There are aircraft passing over these areas at night that may be visible, however, they are likely to be flying at higher altitudes and increase in frequency in locations such as on the approach to Katoomba.

Visual impacts at night

The scenic and aesthetic values of the nature reserve landscapes are generally experienced during the day-time from Lookouts, picnic areas and walking trails. Recreational activities in the GBMA, such as canyoning and rock climbing, would also occur during the day-time and are unaffected by the proposed night-time flight paths. There are a number of camp sites within this landscape that the preliminary flight paths may be seen at night, including:

- Euroka campground south of Glenbrook
- Katoomba River crossing campground in the Jamison Valley
- Ingar and Murphys Glen campgrounds south of Woodford
- Burralow Creek campground in the Lower Grose Valley area west of Kurrajong.

Aircraft may be viewed occasionally from these locations as a series of small moving lights in the sky. For example, Murphys Glen campground would be overflown by one arrival flight path, including maximums of up to about 17 and 53 flights per night in total in 2033 and 2055 respectively. Aircraft along this flight path are likely to be at higher altitudes.

Eastern parts of these reserves would experience views to departure and arrival flight paths, with aircraft at lower altitudes (due to the closer proximity to WSI). Such areas include the north-eastern parts of Burragorang State Conservation Area and eastern parts of the Greater Blue Mountains World Heritage Area. These areas, however, do not have any designated camp sites.

Overall, the effect of lighting from the proposed night-time flight paths would be experienced across a small portion of the landscape by few people, resulting in a negligible magnitude of change. In considering the very high visual sensitivity, there would be a negligible visual impact.

5.3.2.3 Noise

Changes in noise levels associated with the project may have indirect impacts on identified attributes within the GBMA such as impacts on some fauna species; recreation and tourism and the amenity of wilderness areas. A summary of the potential noise impacts associated with the proposal are briefly described in the following sections. Further detail regarding these potential impacts is provided in the Technical paper 1 (and additional Addendum report) prepared for the EIS.

Nature of noise

Sound is a vibration that propagates as an acoustic wave through the air. It is transmitted to the human ear where such waves are received and processed by the brain as a sound or noise.

The loudness of a sound depends on its sound pressure level, which is expressed in decibels (dB). Most sounds we hear in our daily lives have sound-pressure levels in the range of 30 dB(A) and 90 dB(A), where (A) is an adjusted dB reading (A-weighted sound level) to account for the varying sensitivity of the human ear to different frequencies of sound.

The daytime background indoor sound level in a typical home is about 40 dB(A) and the average noise level of conversation is about 60 to 65 dB(A). Typical aircraft noise levels measured by Airservices Australia's Noise and Flight Path Monitoring System are between 65 dB(A) and 95 dB(A), collected daily from noise monitors strategically located around communities close to Australian airports.

Figure 5.12 shows the A-weighted decibel (dB(A)) noise levels for a range of common situations and the comparison with spot aircraft departure noise levels for a typical aircraft (A320-200/B737-800).

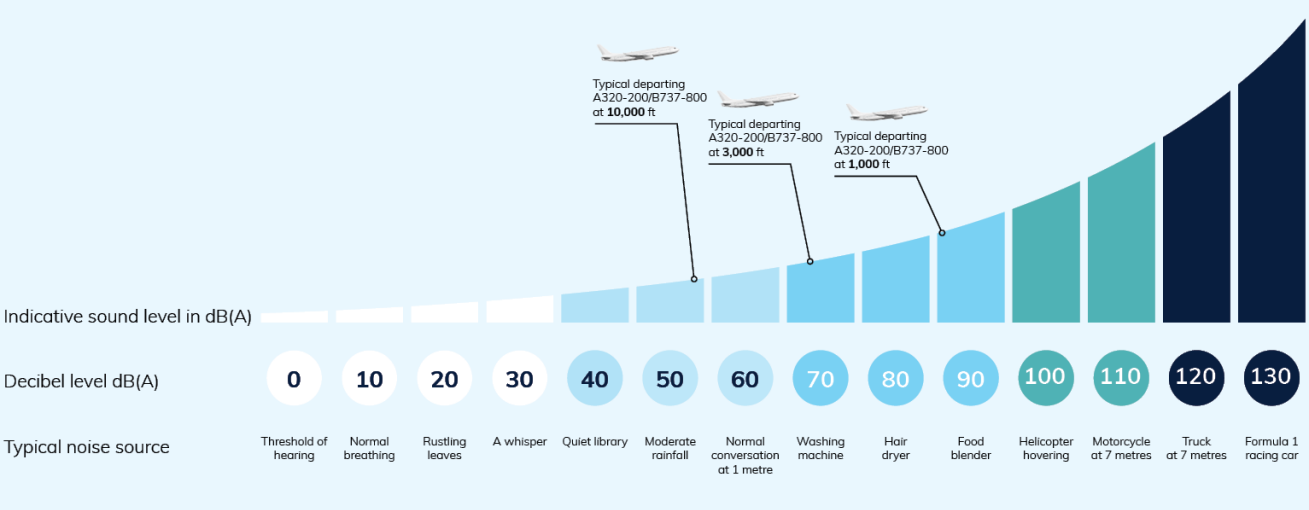


Figure 5.12 Indicative A-weighted decibel noise levels in typical situations

Between 2 and 3 decibels is typically the minimum change in sound level that most people can detect, while every 10 dB(A) increase in sound level is perceived as a doubling of loudness. Additionally, individuals may perceive the same sound differently and may be more or less affected by a particular sound.

The frequency of a sound is what gives it a distinctive pitch or tone – the rumble of distant thunder is an example of a low frequency sound and a whistle is an example of a high frequency sound. The human ear is more sensitive to high frequency sounds.

Most environmental sounds contain a broad range of frequencies. While middle to high frequency sounds tend to annoy most people, low frequency noise from aircraft-induced rattling, rumbling or vibration can also cause annoyance. Higher frequencies are absorbed at shorter distances, while lower frequencies can travel further before they are absorbed. As a result, an aircraft can sound different depending on how far away it is flying. For example, a distant jet aircraft is often heard as a low frequency rumble.

Experience has shown that many factors can influence an individual's response to aircraft noise, including:

- the specific characteristics of the noise (for example, the frequency, intensity and duration of noise events) and the time-of-day noise events occur
- background noise levels, and whether background noise is natural, industrial, desirable (for example, bird song) or undesirable (for example, road traffic)
- their personal circumstances and expectations about the number, frequency, loudness and timing of noise events
- their individual sensitivities and lifestyle (for example, whether they spend a lot of time outdoors, work from home or sleep with a window open)
- their reaction to a new noise source (in the case of a new airport or new runway) or to changed airport operational procedures
- their understanding of whether the noise is avoidable and their notions of fairness, and
- their attitudes towards the source of the noise (for example, general views about aviation activities and airports).

Ambient noise environments

There are a variety of acoustic environments within the GBMA and surrounding environments. Ambient noise environments range from urban areas (adjacent to the GBMA such as the various townships dotted along the Great Western Highway) to rural areas such as those along the Bells Line of Road and Putty Road areas and wilderness areas that are largely removed from human-induced noise to the natural environments within the defined boundaries of the GBMA.

Sensitive receivers

A number of different noise sensitive areas existing within and surrounding the GBMA. Noise sensitive areas are defined as specific sensitive receivers or geographic points that were selected to report on the maximum sound level and are representative of either a residential area, or a non-residential land use that is sensitive to noise – for example, a recreational area, hospital, school, library, church etc. Recreational areas range from sports areas used for active pursuits such as horse riding, bowling or golf to nature reserves which may be used for more passive activities such as camping or bushwalking.

Most of these receivers would generally be located outside of the formal boundary of the GBMA, however many of these receivers would located near or associated with World Heritage Area. An overview of the key noise sensitive receivers that have been identified are depicted in Figure 5.13. These are comprised of:

- recreational areas and noise-sensitive receivers defined in the 2016 EIS
- additional sensitive areas within a 15 km radius from WSI (residential and public buildings)
- additional sites up to 50 km in rural areas and Blue Mountains urban areas where aircraft noise is more likely to be noticeable due to the lower ambient soundscape.

Sites specific to the GBMA were also assessed using metrics specific to the unique features of the area (as described below).

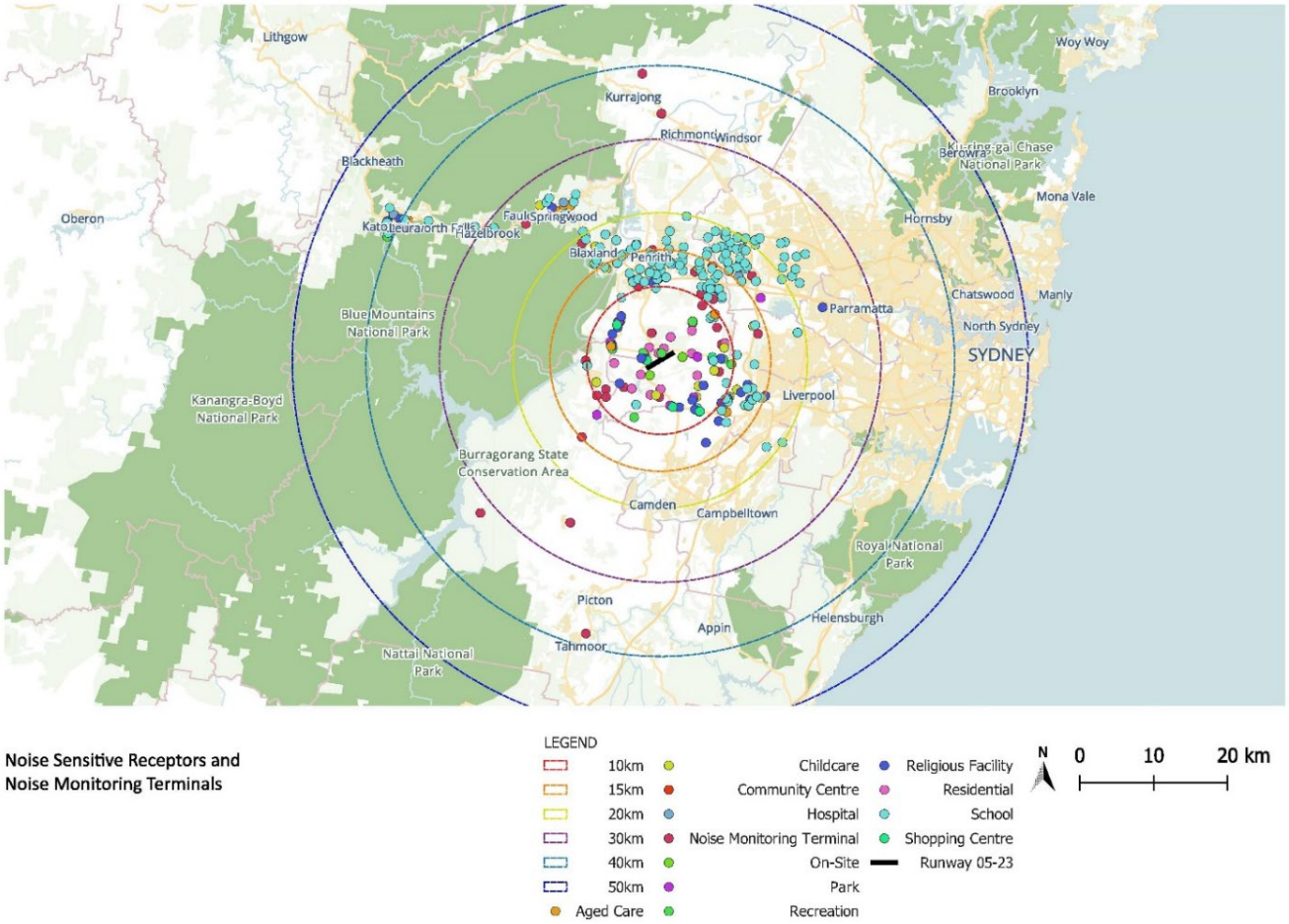


Figure 5.13 Noise sensitive areas including noise monitoring sites

Noise metrics

There are a wide range of noise metrics that have been used to describe aircraft noise impacts. A few are included in national regulatory standards for land use planning such as Australian Standard *AS2021:2015 Acoustics – Aircraft noise intrusion – building siting and construction* (AS2021), while others have evolved to become national or international accepted best practice in similar airspace and flight path environmental assessments and community information initiatives.

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 dB(A) L_{Amax} and 60 dB(A) L_{Amax} noise exposure levels as impact thresholds for day and night time operations respectively. The overflight noise assessment for the project shows that a majority of the broader GBMA is largely outside the area predicted to experience aircraft noise at or above these threshold values (with the exception of some sections of the Blue Mountains National Park and between Lake Burragorang and the Great Western Highway, which at times may experience slightly higher noise levels – as discussed in the sections below).

In order to recognise the natural amenity and wilderness values of the GBMA, the assessment has considered the topography of the area and as such, the height of aircraft above ground level as they overpass the GBMA. This captured the variance in noise across peaks and valleys within the GBMA. Furthermore, previous studies have highlighted the need for a tailored approach to quantitative noise assessment in the context of the Greater Blue Mountains World Heritage Area. This will include the following metrics:

- maximum sound pressure levels of individual aircraft overflights
- the number of audible aircraft overflights.

While the maximum sound pressure was assessed using the L_{Amax} metric, the number of audible aircraft overflights was assessed using the N60 metrics. Although modelling has limitations in terms of its validated range of assessment for lower noise thresholds, a review of sites of interest within this area exposed to a sound level of at least 50 dB(A) were identified to consider the lower ambient noise levels typically experienced in the GBMA.

Noise modelling and assessment

The noise modelling methodology is described in detail in the Chapter 7 of Technical paper 1 prepared to support the EIS for the project. Noise modelling for the impact on the GBMA incorporated the topography of the area and as such, the height of aircraft above ground level as they overpass the GBMA. This captured the variance in noise across peaks and valleys within the GBMA. Noise levels from 10 representative aircraft types were also modelled. Most activity in early operational years at WSI is anticipated to be short-haul operations serving domestic and regional routes. This comprises around 70 per cent of all movements in 2033 by narrow-body (single aisle) jets such as the Airbus 320 and Boeing 737 style aircraft. The proportion of WSI narrow body jet operations is forecast to decrease to 62 per cent by 2055 as the growth of international services is expected to exceed the growth in domestic services.

Aircraft noise would be experienced across a broad area of Western Sydney and the GBMA as a result of aircraft arrival and departures at WSI. Noise contour maps have been produced at to represent the geographic extent of potential exposure for each a range of assessment measures for example cumulative and single event noise impacts. 'Number above' contour measures (which represents the number of aircraft noise events that exceed a certain dB(A) within a day or a given period of time) have been considered as part of the assessment.

Assessment scenarios

The noise assessments were conducted for 3 key operating scenarios generally represented by:

- flight operation with no runway preference (No preference scenario)
- flight operation with a runway preference towards use of Runaway 05 (Prefer Runway 05 scenario)
- flight operation with a runway preference towards use of Runaway 23 (Prefer Runway 23 scenario).

Each of the scenarios were considered across 3 reference years in 2033, 2040 and 2055.

Potential impacts

Aircraft noise in the vicinity of flight paths is an unavoidable consequence of aircraft operations. The design process to date has focused on minimising the impact of aircraft noise on residents and sensitive areas, including the GBMA, through continuous assessment, consultation, and ongoing design development. As outlined in Section 4.3, the current flight paths have been developed to a preliminary design, with consideration of potential noise abatement opportunities, and feedback from community and other stakeholders. This has included minimising the impact of aircraft noise on the surrounding community by directing aircraft away from overflying populated areas and visually sensitive areas, including key points within the GBMA, wherever possible (while prioritising operational safety).

Noise levels over 24-hours (L_{Amax})

Composite scenario (i.e. no runway preference, Prefer Runway 05 and Prefer Runway 23 operating scenarios) L_{Amax} cumulative noise contours for both 2033 and 2055 are shown on Figure 5.14 and Figure 5.15 for assessment years 2033 and 2055 respectively. These contours present the maximum noise level for any single aircraft movement over a 24-hour period for L_{Amax} noise levels exceeding 60 dB(A).

The composite scenario is presented to provide a worst-case scenario based on using full suite of possible runway modes of operation (including RRO) rather than the consistent use of a single operating strategy or runway allocation scenario.

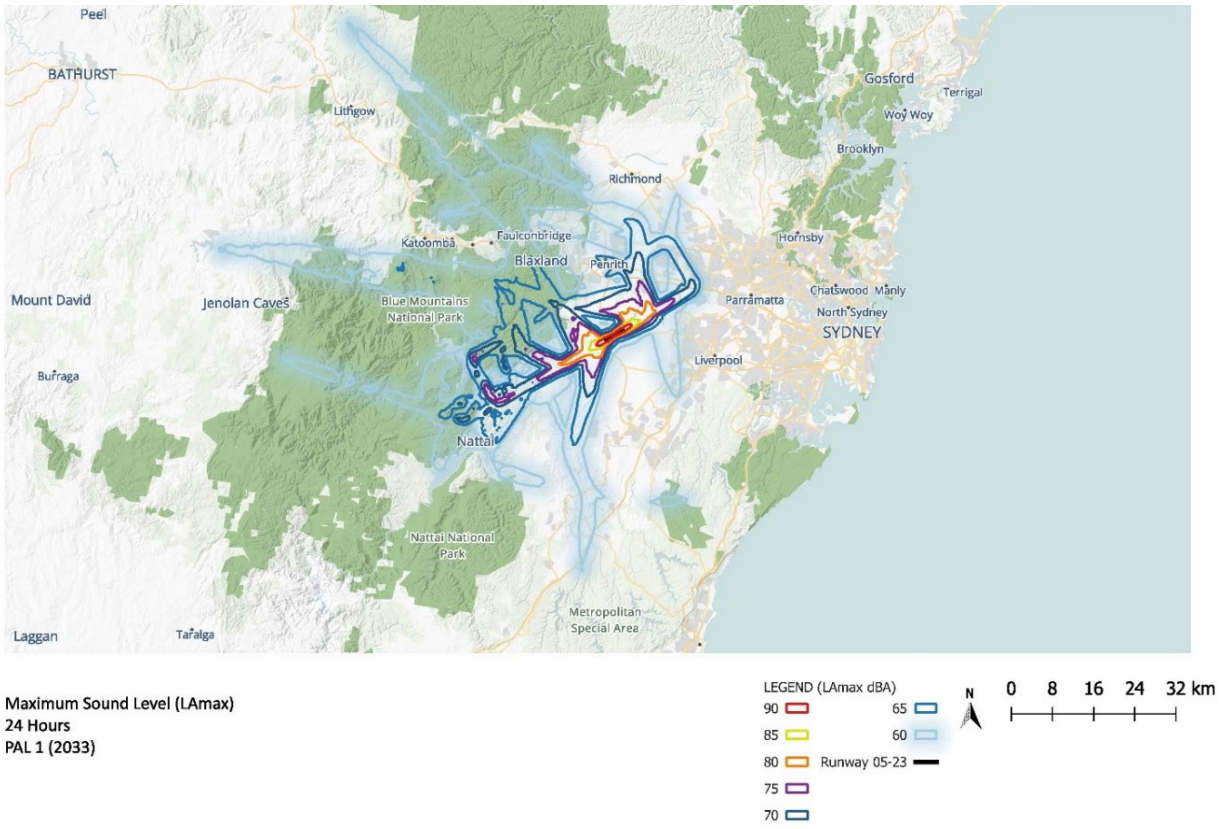


Figure 5.14 L_{Amax} 24-hour contours (cumulative) – 2033

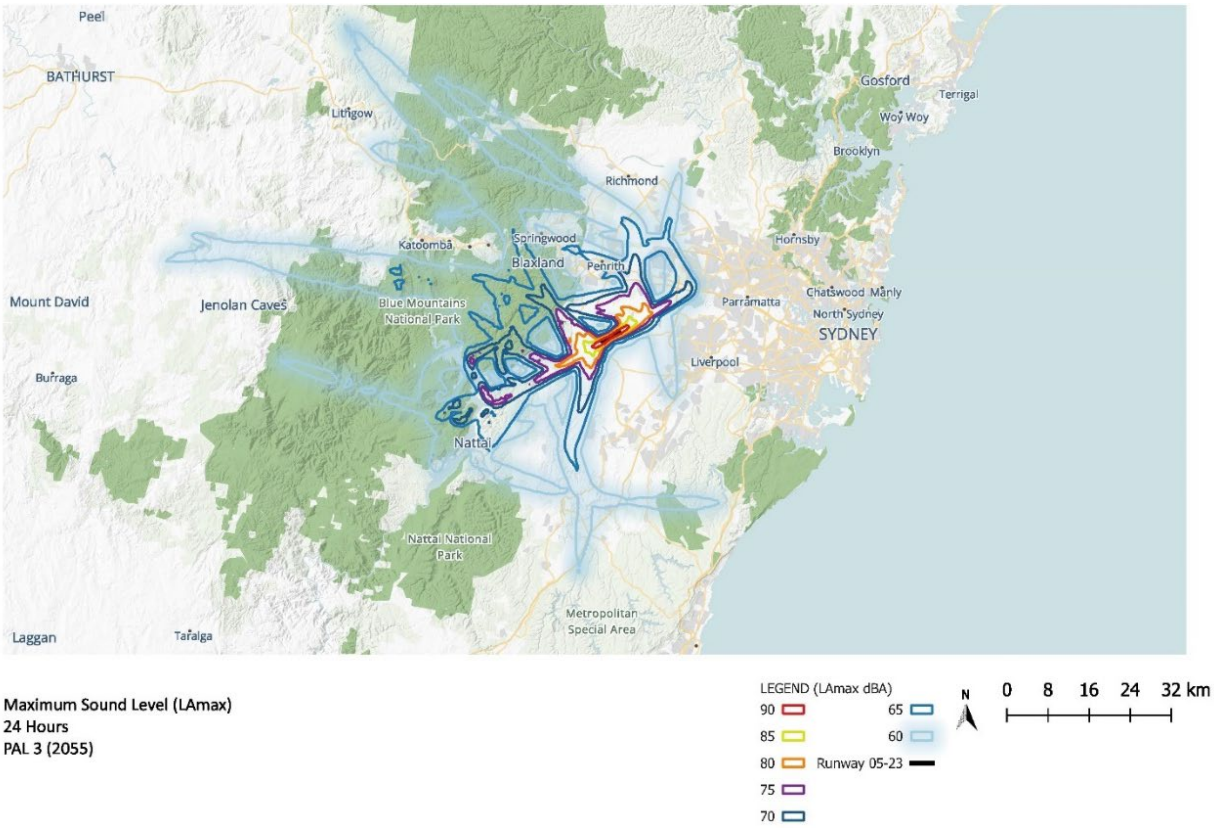


Figure 5.15 L_{Amax} 24-hour contours (cumulative) – 2055

Figure 5.14 and Figure 5.15 show that for 2033 and 2055, the areas of impact are almost identical as the fleet mix was conservatively assumed to remain consistent with changes driven by new services (additional frequency of aircraft) on specific flight paths. The figures also show extension of maximum noise levels of 60 dB(A) and greater extending into some areas above the GBMA, typically in the region between the Great Western Highway and Lake Burragorang (Warragamba Dam). Within the GBMA, locations within these contours include sites such as The Rock Lookout, the Nepean Lookout, The Oaks area, Murphys Glen, Ingar Campground, Katoomba River campground, Clearly Memorial Lookout, Ruined Castle Lookout, Wynnes Rock Lookout, Mount Banks picnic area and Lookout, Anvil Rock Lookout, Baltzer Lookout, Victoria Creek Cascades, Victoria Falls, and Burra Korain campground.

At night, sites such as The Oaks picnic area, the Nepean Lookout, the Burragorang Lookout and the Ruined Castle Lookout would be the key locations impacted by the RRO mode of operation (noting that these areas would not typically be frequented by visitors during night-time periods).

An overview of the maximum sound levels (for day and night flight paths) at key sensitive areas at specific sites of interest within the GMBA is provided in Table 5.6. Day has been defined as 5:30 am to 11 pm and night is defined as 11 pm to 5:30 am. Not all overflights would achieve the maximum noise levels identified.

Table 5.6 Estimated maximum sound levels at key sensitive areas within the GBMA

Location	L_{Amax} dB(A) – Day	L_{Amax} dB(A) – Night
Ruined Castle Lookout	62-64	57-58
Mt Banks picnic area and Lookout	51-62	60-62
Sublime Lookout	53-55	49-50
Wentworth Falls	47-50	48-49
The Three Sisters/Echo Point	42-43	50-51
Cleary Memorial Lookout, Kedumba Pass	62-63	62-63
Walls Lookout	47-58	59-62
Wynnes Rock Lookout	59-61	60-62
Baltzer Lookout, Hanging Rock	42-52	59-61
Burragorang Lookout, Warragamba Dam	48-65	47-53
Burragorang Lookout, The Bluff	66-67	60-62
Portal Lookout	49-51	49-52
Nepean Lookout	64-70	56-62
The Rock Lookout	64-65	53-58
Victoria Falls	41-50	59-61
Victoria Creek cascades	42-51	58-60
Wentworth Lookout	47-50	48-49
Katoomba falls	53-55	49-51
Euroka campground	56-57	50-55
Acacia Flat campground	42-53	54-56
Burralow Creek campground	57-57	45-47
Dunphys campground	57-58	61-63
Katoomba River crossing campground	61-61	60-61

Location	L_{Amax} dB(A) – Day	L_{Amax} dB(A) – Night
Murphys Glen campground	60-62	62-62
Ingar campground	55-61	60-60
Perrys Lookdown campground	43-54	58-60
Burra Korain campground	44-54	58-60
Jenolan Caves	47-49	49-51
Kanangra Walls Lookout	41-47	41-47
The Oaks Picnic area	62-69	49-52

As shown in Table 5.7, 12 of the 30 key sensitive areas identified would have the potential to experience noise levels at or above 60 dB(A) L_{Amax}, during the day, and 15 of those areas would at night.

When taking into account the frequency of these movements, Nepean Lookout and the Rock Lookout are the most overflown area during the day and night due to its location near the eastern boundary of the GBMA. The estimated frequency of aircraft overflight that results in noise above 60 dB(A) of areas of key sensitivity within the GBMA are presented in Table 5.7.

Table 5.7 Estimated frequency of aircraft at key sensitive areas within the GBMA (2055)

Location	N60 (24-Hours) – movements (mvt)			N60 (Night) – movements (mvt)		
	No preference	Prefer Runway 05	Prefer Runway 23	No preference	Prefer Runway 05	Prefer Runway 23
Ruined Castle Lookout	<10 mvts	<10 mvts	<10 mvts	2-4 mvts	2-4 mvts	2-4 mvts
Mt Banks picnic area and Lookout	<10 mvts	<10 mvts	<10 mvts	0 mvt	2-4 mvts	2-4 mvts
Sublime Lookout	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Wentworth Falls	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Echo Point	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Cleary Memorial Lookout, Kedumba Pass	<10 mvts	<10 mvts	10-19 mvts	<2 mvts	2-4 mvts	2-4 mvts
Walls Lookout	<10 mvts	<10 mvts	<10 mvts	0 mvt	0 mvt	0 mvt
Wynnes Rock Lookout	<10 mvts	<10 mvts	<10 mvts	<2 mvts	<2 mvts	<2 mvts
Baltzer Lookout, Hanging Rock	<10 mvts	<10 mvts	<10 mvts	0 mvt	0 mvt	0 mvt
Burragorang Lookout, Warragamba Dam	0 mvt	<10 mvts	<10 mvts	0 mvt	<2 mvts	<2 mvts
Burragorang Lookout, The Bluff	<10 mvts	<10 mvts	<10 mvts	<2 mvts	<2 mvts	<2 mvts
Portal Lookout	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Nepean Lookout	10-19 mvts	20-49 mvts	20-49 mvts	5-9 mvts	10-19 mvts	10-19 mvts
The Rock Lookout	<10 mvts	<10 mvts	<10 mvts	5-9 mvts	<2 mvts	<2 mvts
Victoria Falls	<10 mvts	<10 mvts	<10 mvts	0 mvt	0 mvt	0 mvt

Location	N60 (24-Hours) – movements (mvt)			N60 (Night) – movements (mvt)		
	No preference	Prefer Runway 05	Prefer Runway 23	No preference	Prefer Runway 05	Prefer Runway 23
Victoria Creek cascades	<10 mvts	<10 mvts	<10 mvts	0 mvt	0 mvt	0 mvt
Wentworth Lookout	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Katoomba falls	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Euroka campground	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Acacia Flat campground	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Burralow Creek campground	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Dunphys campground	<10 mvts	<10 mvts	<10 mvts	0 mvt	0 mvt	0 mvt
Katoomba River crossing campground	<10 mvts	<10 mvts	<10 mvts	<2 mvts	<2 mvts	<2 mvts
Murphys Glen campground	10-19 mvts	10-19 mvts	<10 mvts	<2 mvts	<2 mvts	<2 mvts
Ingar campground	<10 mvts	<10 mvts	<10 mvts	0 mvt	<2 mvts	<2 mvts
Perrys Lookdown campground	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Burra Korain campground	<10 mvts	<10 mvts	<10 mvts	0 mvt	0 mvt	0 mvt
Jenolan Caves	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
Kanangra Walls Lookout	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt	0 mvt
The Oaks Picnic area	<10 mvts	<10 mvts	<10 mvts	<2 mvts	<2 mvts	<2 mvts

Note: N60 refers to the aircraft noise exposure over a full day described by the number of aircraft noise events with L_{Amax} that exceed 60 dB(A)

Taking into account the estimated frequency of movements identified in Table 5.7, 12 of the 30 areas identified for this assessment do not experience noise levels at or above 60 dB(A) $L_A$max, during the day, and 18 of those areas at night. Three other areas are impacted specifically by RRO operations at night.

No areas of the GBMA would experience noise levels above the general assessment level of 60 dB(A) L_{Amax} on a regular basis during operation of the project for any aircraft type considered.

Predicted noise levels

The highest predicted noise levels are typically associated with widebody aircraft such as the Boeing B777-300ER, Boeing B747-8 and Airbus A330 aircraft. However, the more common and likely noise levels would be represented by Airbus A320neo and Boeing B737max aircraft.

Figure 5.16 and Figure 5.17 show the indicative noise contours for a single event departure and arrival (for both Runway 05 and Runway 23 directions) for the Boeing B777-300ER and Airbus A320neo respectively on all indicative arrival and departure flight paths during the day time period. Figure 5.18 and Figure 5.19 show the same noise contours for the night time period.

While the Boeing B777-300ER would be a critical aircraft in terms of noise exposure, it is important to note that only 2 daily movements of this aircraft type were modelled up to 2040, increasing to around 16 daily movements by 2055. The Airbus A320neo, which shows limited exposure to events above 60 dB(A) in the Blue Mountains, would operate over 30 daily movements by 2040, increasing to over 125 projected daily movements by 2055. Generally, across the GBMA, areas exposed to noise levels above 60 dB(A) from Airbus A320 operations would be limited (as shown in Figure 5.17).

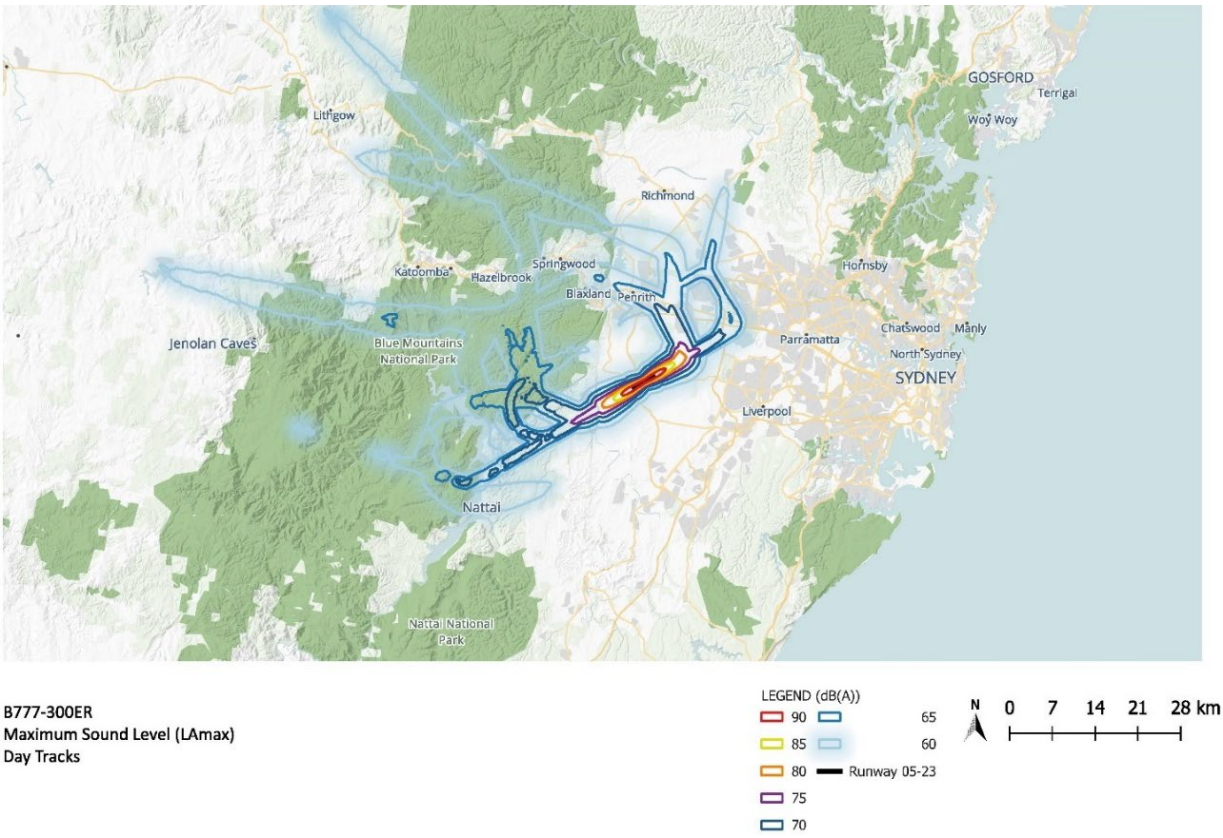


Figure 5.16 L_{Amax} Day flight paths for a Boeing B777-300ER

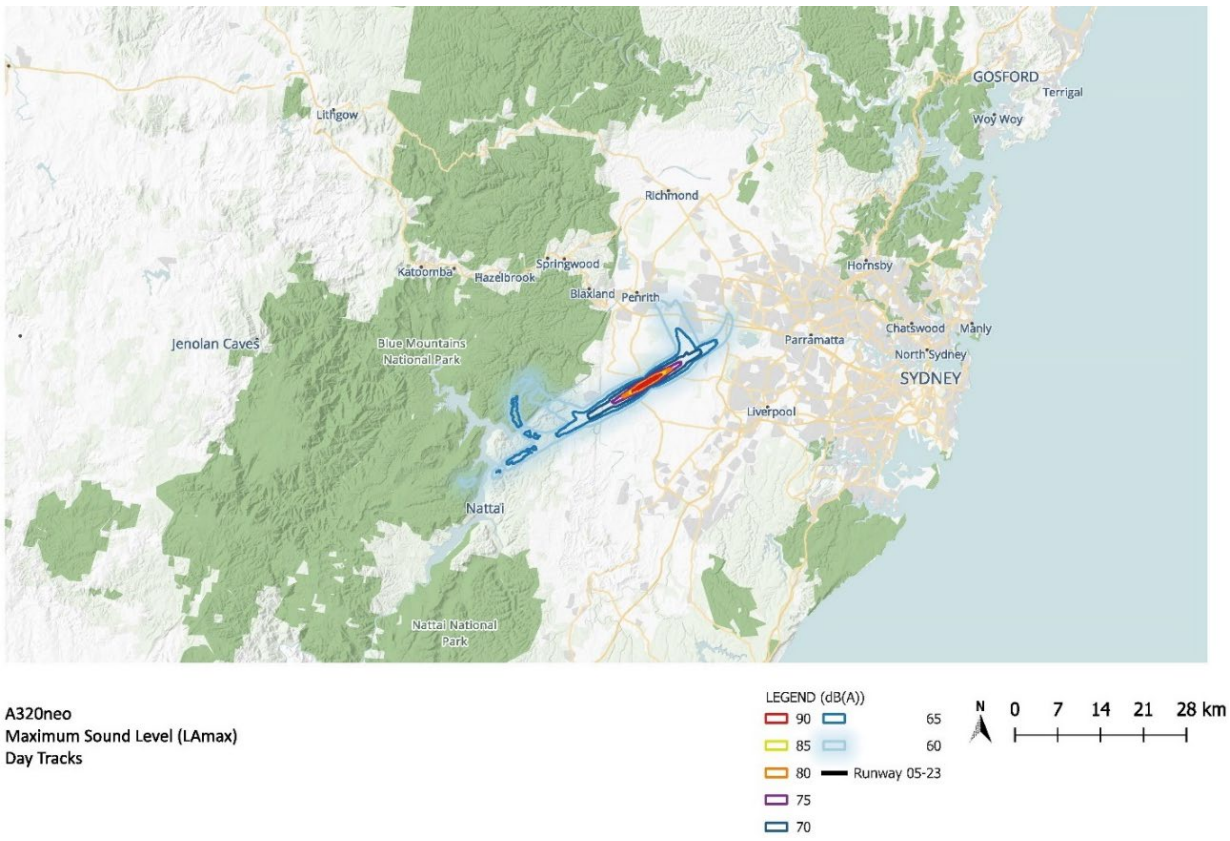


Figure 5.17 L_{Amax} Day flight paths for an Airbus A320neo

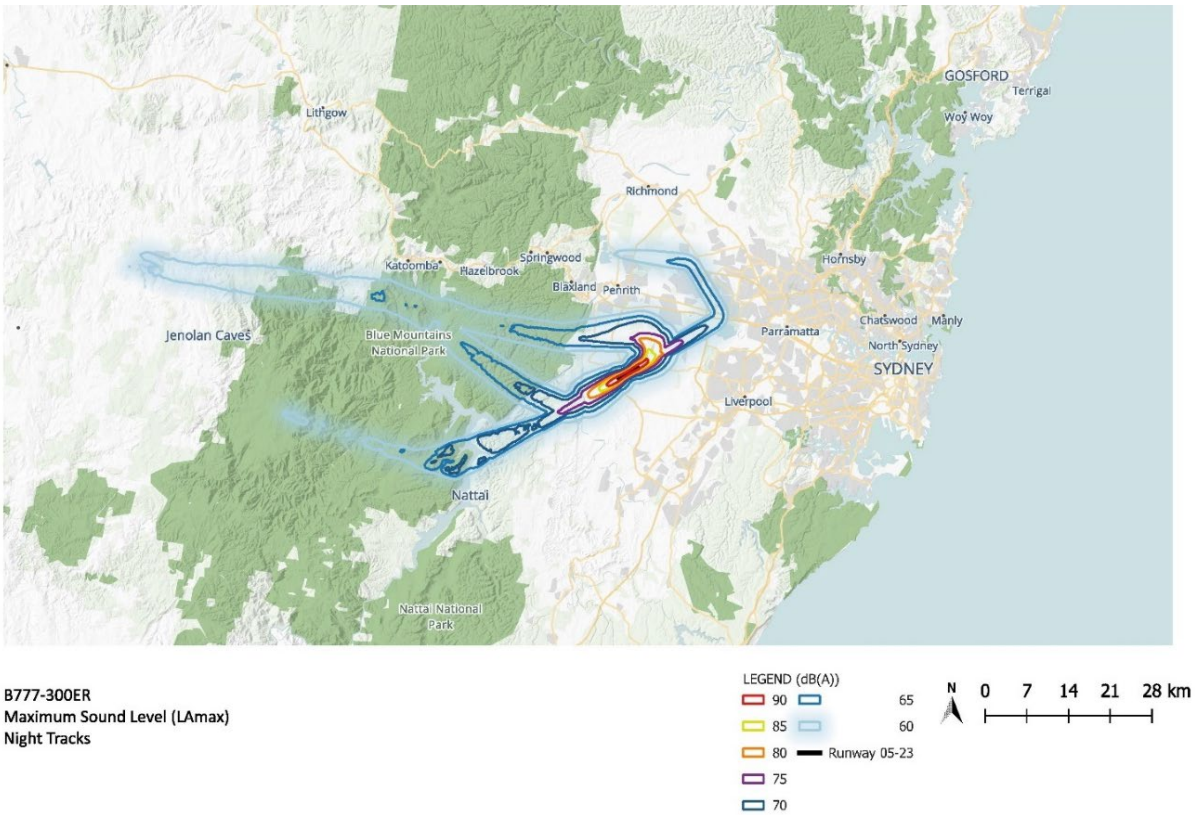


Figure 5.18 L_{Amax} Night flight paths for a Boeing B777-300ER

Figure 5.19 L_{Amax} Night flight paths for an Airbus A320neo

The estimated maximum sound levels (across 24-hours) at different sites of interest in the GBMA were also considered using the L_{Amax} cumulative 2055 contours, including an estimate of the exposure to noise levels as low as 50 dB(A) (refer to Figure 5.20). Noise levels over 70 dB(A) L_{Amax} may be experienced occasionally by users of walking trails and camp sites within the areas of the Blue Mountains National Park near the Nepean River, and Warragamba dam. However, maximum sound exposure levels would more typically range from below 50 dB(A) to 60 dB(A) based on the aircraft type, with some noisier wide-body jets reaching closer to 65 dB(A) near the flight paths.

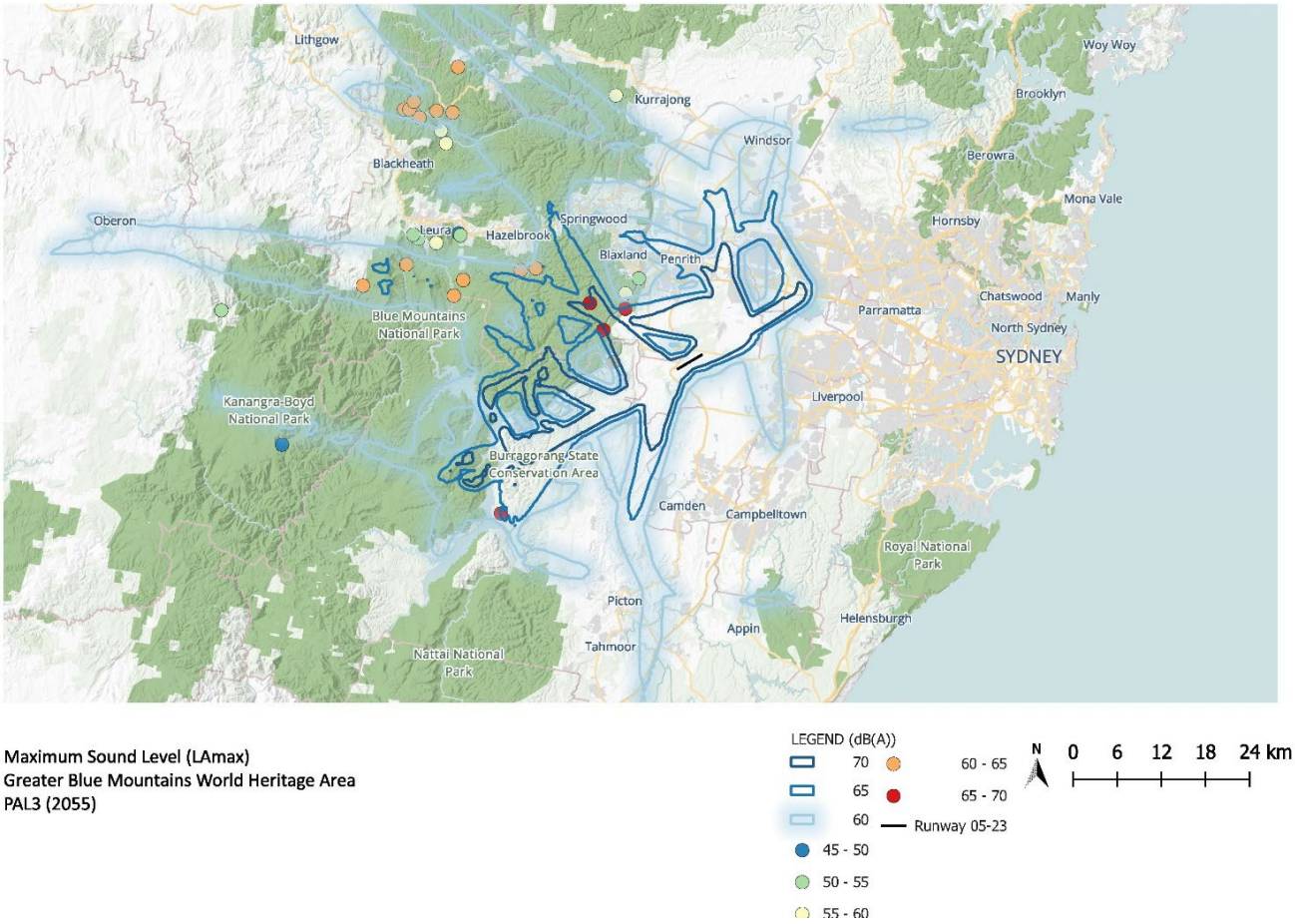


Figure 5.20 Estimated maximum sound level at key sensitive areas within the GBMA

Cumulative noise contours

Cumulative noise contours provide an assessment associated with the sustained exposure to aircraft noise. Cumulative contours relate either to the number of events above a noise level threshold (N-above), the maximum noise level (L_{Amax}), or to a calculation of the cumulative noise load that a receptor may be typically exposed to over a day or a night (L_{Asel}), or Australian Noise Exposure Concept (ANEC). For an ANEC which is a land-use planning metric, the metric includes a night weighting (in the case of an ANEC, night is considered 7 pm to 7 am) to reflect increased sensitivity to evening and night-time noise and the potential for sleep disturbance.

N70 and N60 contours

N-above contours are often used to provide easily understood information on noise exposure to community stakeholders. Potential noise impacts are described based on the number of overflights exceeding a certain noise level threshold for a receptor at ground level – 60 dB(A) or 70 dB(A). For example, a contour based on a threshold of 70 dB(A) and 10–19 movements during the day.

The N70 contours are typically used in daytime to reflect the likely impact of an outside noise event (such as aircraft flyover) resulting in an indoor sound level of 60 dB(A) when windows are opened. Night-time sleep disturbance potential is often assessed with N60-night contours that defines areas where an outside noise event results in indoor attenuated sound levels as low as 40 dB(A) when windows are closed.

For the assessment of the preliminary flight paths, N-above contours were developed for the full day (N60 24-hour and N70 24-hours contours) and night N60 contours. These were prepared for the 3 assessment years (2033, 2040, 2055) using the 3 operating scenarios.

Figure 5.21 and Figure 5.22 show examples of the N60 24-hour and N70 24-hour respectively, for a composite of the 3 operating scenarios for projected traffic levels in 2055. The composite scenario is developed to provide a worst-case scenario based on the use of noise-sharing strategies rather than the consistent use of a single operating strategy or runway allocation scenario.

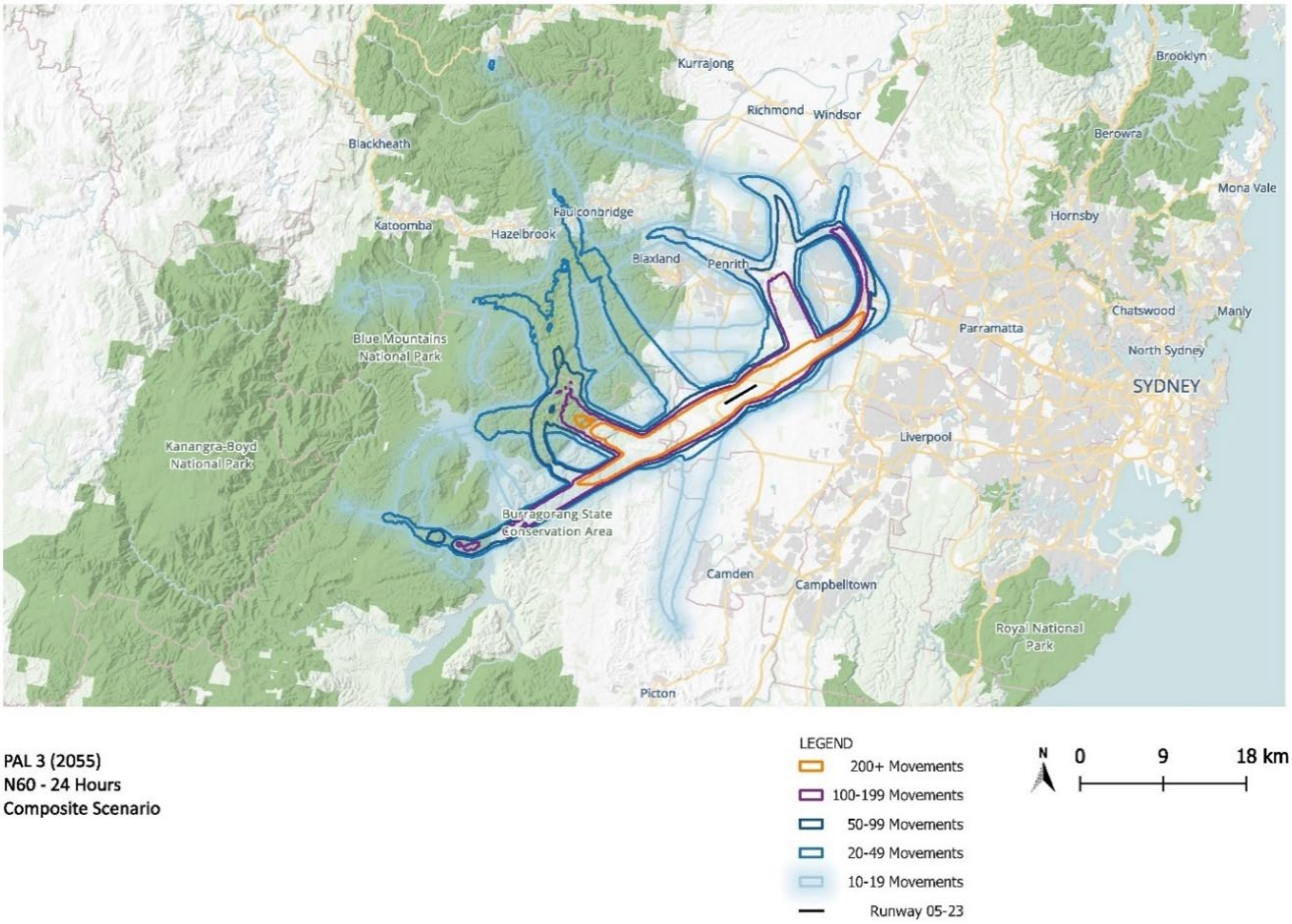


Figure 5.21 Example N60 24-hour – composite scenario – 2055

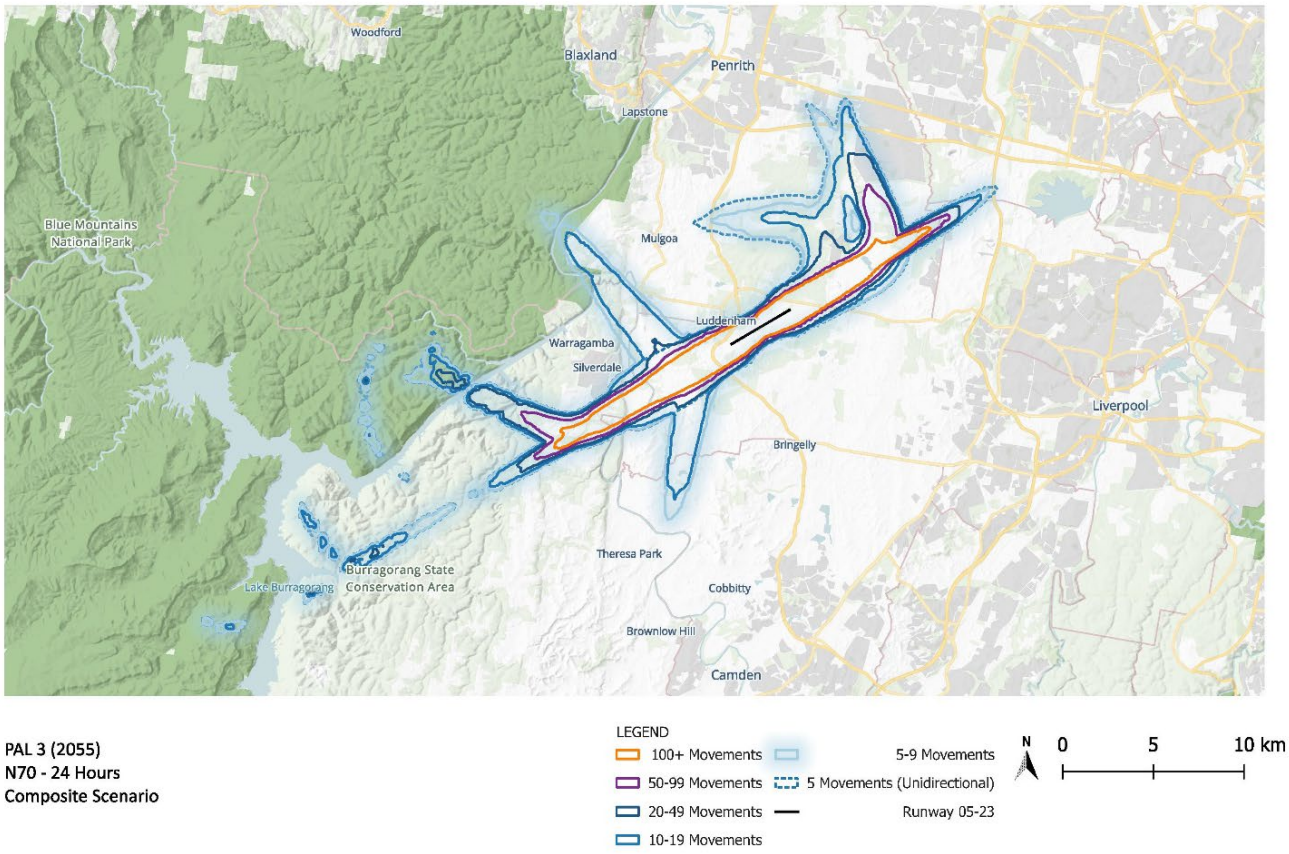


Figure 5.22 Example N70 24-hour – composite scenario – 2055

The complete suite of N-above contour charts are provided in Appendix C of Technical paper 1 – Aircraft noise.

5.3.2.4 Heritage

This section provides a summary of the potential heritage impacts on the GBMA and its values. The GMBA is listed on both the World Heritage List and the National Heritage List. Further detail regarding these potential impacts is provided in Technical paper 9 prepared for the project EIS.

Heritage environment

The assessment of potential heritage impacts involved a desk top review of the range and nature of heritage places that may be impacted by the project as well as consultation with Dharug, Gundungurra and Tharawal First Nations knowledge holders and a range of First Nations organisations including Local Aboriginal Land Councils with a mandate for cultural heritage protection.

Consultation with First Nations knowledge holders and stakeholders assisted in identifying places of particular cultural value. This consultation resulted in a list of places of particular cultural value that were considered in the design of the flight paths and where possible, direct over flight of these places has been avoided. These sites have also been considered as part of the impact assessment presented in this section of the report. Further details of the consultation undertaken with First Nations knowledge holders is provided in Section 4.2 of Technical paper 9.

Known Aboriginal heritage and values

World Heritage Areas are properties which have been recognised as having Outstanding Universal Value which go beyond the values that they hold for a single nation. The Outstanding Universal Value for which the GBMA is recognised are natural ecological values, and the boundary of the GBMA excludes the existing townships and settlements. Nevertheless, there are many sites, places and constructed features within the boundaries of the GBMA that have significant cultural value. There are also several historic heritage places, although most recorded significant historic heritage places lie outside the GBMA boundary in the adjacent townships.

When first considered for nomination as a World Heritage site, the area was originally nominated by the Australian government for both its natural and cultural values, although at the time the World Heritage Committee concluded that the case had not yet been made to substantiate a claim of Outstanding Universal Value under the cultural criteria, however cultural values were identified within the integrity statement for the site.

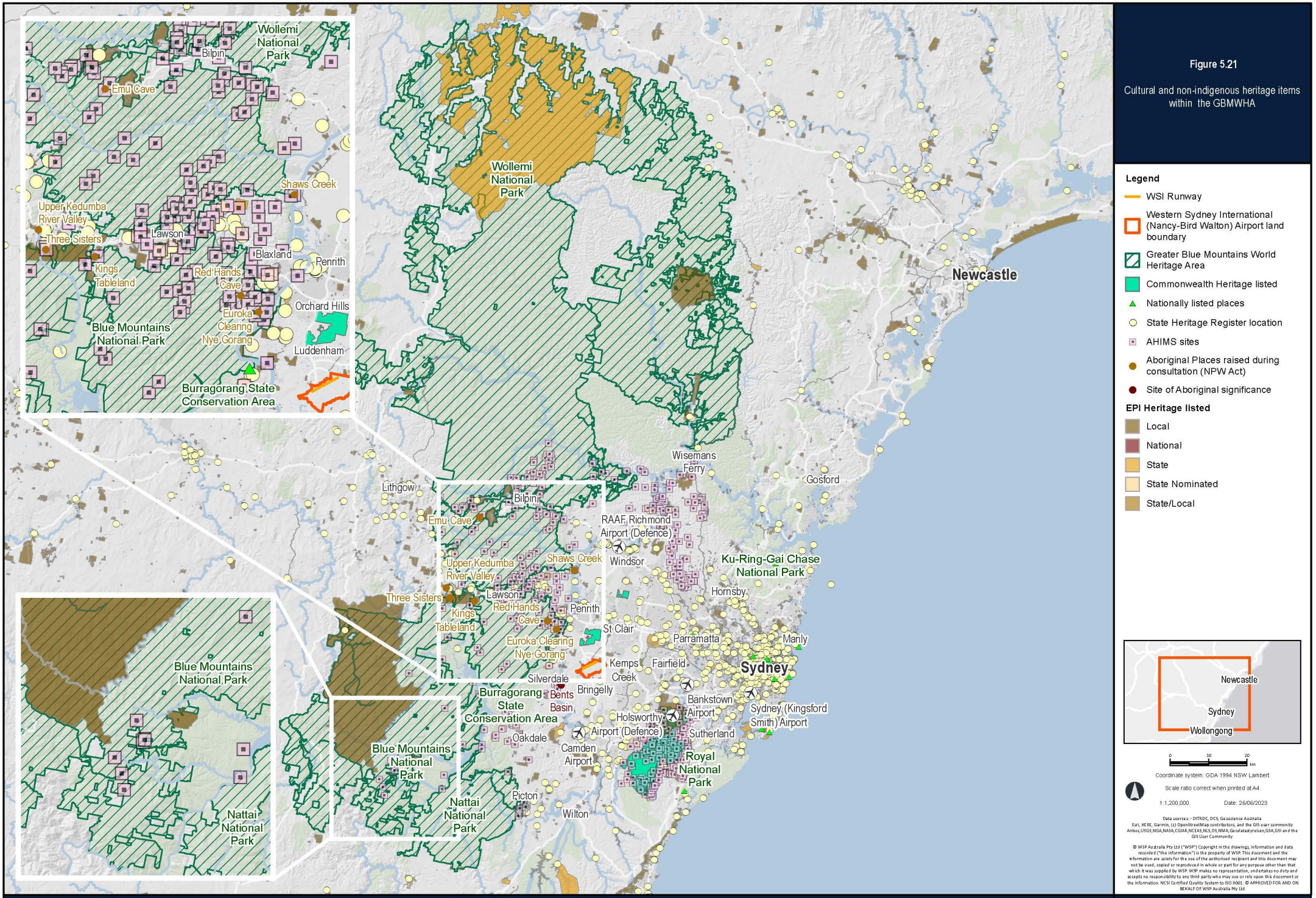
The evidence for cultural values includes many Aboriginal sites including occupation sites, stone arrangements, Aboriginal rock art sites and dreaming sites to which contemporary First Nations people have a deep connection. The Aboriginal cultural values within the Greater Blue Mountains are embodied in the rich resources of rock art and occupation sites scattered across the area.

There are also historic heritage places, many of which have not been formally recorded on lists and registers, which have cultural values. These include places connected with the early conservation movement in Australia such as the early network of cliff face walking tracks linking the east-west chain of Blue Mountains towns to their adjacent protected valleys and gorges, staircases and Lookouts.

The Greater Blue Mountains region contains 1,400 recorded Aboriginal sites (including 'isolated finds' 'artefact scatters', 'open camp sites' and sub-surface artefact distributions). This number is likely to be an under-representation of the actual sites that exist as the majority of the area which comprises the GBMA has not been systematically surveyed. Where surveys have occurred a wide range of site types have been identified including a number of sites that are often associated with spiritual and/or ceremonial values. These sites include shelters with pigment rock art, rock engravings, mythological sites or story places that are linked to Dreamtime beings, and ceremonial sites.

Of importance to the consideration of impacts on the GBMA, are those sites within or within close proximity to the site. Within the area of focus for this assessment are those sites closest to the WSI and include 6 Aboriginal Places within the Blue Mountains City LGA and another located nearby adjacent to the Nepean River at Yellomundee within the Hawkesbury LGA (refer to Figure 5.23). These 7 Aboriginal Places are:

- The Three Sisters and The Gully at Katoomba: The Three Sisters are connected to Aboriginal myth, legend and ceremony, and provide a visual testament to the dreamtime stories. The Three Sisters also contains Dreaming site values, set within its cultural landscape including the vistas from Echo Point and is a site which typifies natural places with spiritual and Dreaming values. While the 3 rock formations at this point may be central to the story, knowledge holders have identified that they were part of a much larger storyline.
- Emu Cave: Emu Cave is an important rock art site that continues to be of special significance to First Nations people. The Aboriginal Place protects the exact location of the cave within a general buffered area. The Emu rock engravings and Emu Cave are both associated with Dreaming stories related to Emu. The engraving site is identified as being linked to the 'Emu in the Sky' constellation.
- Euroka Clearing Nye Gnorang is located at Glenbrook within the Blue Mountains National Park.
- Kings Tableland near Wentworth Falls is a camping and meeting place of significance to Gundungurra people.
- Red Hands Cave near Glenbrook: Red Hands Cave is situated within the Blue Mountains National Park and was named because of red, orange and white First Nations people's hand stencils located within the cave. The hands [stencils] are considered to be representative of the children left there by the Great Spirit.
- Shaws Creek Aboriginal Place in Yellomundee Regional Park.
- Upper Kedumba River Valley is a former Aboriginal fringe settlement where the Gundungurra people established a permanent residential settlement in the Gully from at least 1894.


Wollemi National Park
Bilpin
Emu Cave
Shaws Creek
Upper Kedumba River Valley
Three Sisters
Lawson
Blaxland
Penrith
Kings Tableland
Red Hands Cave
Euroka Clearing
Nye Gorang
Orchard Hills
Blue Mountains National Park
Luddenham
Burragorang State Conservation Area
Newcastle
Wisemans Ferry
Gosford
Lithgow
RAAF Richmond Airport (Defence)
Windsor
Ku-Ring-Gai Chase National Park
Hornsby
St Clair
Parramatta
Manly
Sydney
Kemps Creek
Fairfield
Silverdale
Bringelly
Bents Basin
Bankstown Airport
Sydney (Kingsford Smith) Airport
Holsworthy Airport (Defence)
Sutherland
Oakdale
Camden Airport
Royal National Park
Nattai National Park
Picton
Wilton
Figure 5.21
Cultural and non-indigenous heritage items within the GBMWHA
Legend
WSI Runway
Western Sydney International (Nancy-Bird Walton) Airport land boundary
Greater Blue Mountains World Heritage Area
Commonwealth Heritage listed
Nationally listed places
State Heritage Register location
AHIMS sites
Aboriginal Places raised during consultation (NPW Act)
Site of Aboriginal significance
EPI Heritage listed
Local
National
State
State Nominated
State/Local
Newcastle
Sydney
Wollongong
0 10 20 km
Coordinate system: GDA 1994 NSW Lambert
Scale ratio correct when printed at A4
1:1,200,000
Date: 26/06/2023
Data sources - DITRDC, DCS, Geoscience Australia
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community
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C:\Users\AURC508271\WSP O365\AU-WKG - Geospatial - All - Documents\Projects\PS130347_WSA_Airspace_EIS\Mxd\03_TechPaper\06_GBMWHA\PS130347_F0518_CulturalHeritage_r1v1.mxd | Author: R.Choi | QA:
www.wsp.com

Known non-Aboriginal heritage and values

The GBMA also contains numerous historic heritage places, many of which have not been formally recorded on lists and registers, which have cultural values. These include places connected with the early conservation movement in Australia such as the early network of cliff face walking tracks linking the east-west chain of Blue Mountains towns to their adjacent protected valleys and gorges, staircases and Lookouts. Most recorded significant historic heritage places lie outside the formal GBMA boundary in the adjacent townships. A number of non-Aboriginal heritage sites do however lie within the boundaries of the GBMA, including State and locally listed items (refer to Figure 5.23).

State listed heritage places are properties of special interest to NSW and possess important significance to the State in its broadest sense. However there are 2 State Heritage Register (SHR) listed places within the boundaries of the GBMA (being the Jenolan Caves Reserve and the Blue Mountains Walking tracks). Locally listed heritage places are significant within the context of a local area, contributing to the uniqueness of a streetscape, townscape or landscape of a region or community. A number of locally listed heritage items are also located within the boundary of the GBMA with numerous sites also located outside the boundary of the GBMA, in particular along the spine of the Great Western Highway. While these non-Aboriginal cultural values are important values to the GBMA from a whole-of-environment perspective, they are not yet included in the National Heritage listing for the site.

The GMBA is also listed on the National Heritage List as a place containing valued Aboriginal and historic heritage sites.

Further details of the existing Aboriginal and non-Aboriginal heritage items within (and surrounding) the GBMA is provided in Technical paper 9.

Impact assessment

Many Aboriginal cultural sites that result from pre-invasion traditional activities such as campsites, quarries and artefacts scatters are robust to the impacts of noise and emissions and would not be affected by flight paths overhead. For example, stone tools which are a primary signature of Aboriginal activity across the Cumberland Plain are very unlikely to be impacted by noise or aircraft emissions. Similarly, direct or physical impacts to non-Aboriginal sites would not occur as a result of the proposal.

While the locations of some of these sites may once have held other intangible values to the people who lived there and created them, in the main the intangible values that these places may once have held have been lost over time or have been overwritten by post invasion land use activities that have modified the former cultural landscape.

Heritage sites would not be physically impacted by the project, but could be indirectly impacted. It is also relevant to reiterate that the GBMA is already overflown by aircraft flying to and from Sydney (Kingsford Smith) Airport, RAAF Base Richmond, Camden Airport and Bankstown Airport and, to date, this has not been raised as an issue that negatively impacts the existing World Heritage values of the site.

Potential indirect impacts to these sites and the values of these sites have been considered and discussed in the following sections.

The Greater Blue Mountains World Heritage Area

As noted in Section 3.3.1 the recognised Outstanding Universal Value for which the GBMA was listed are natural values rather than cultural values. However, there are a range of significant cultural values of the property which are widely recognised within the Australian community including the aesthetic, historic and Aboriginal heritage values of the area.

Many of the existing values associated with the GBMA, would be sufficiently resilient with respect to the potential impact of aircraft flying overhead as the characteristics of the specific cultural values would remain unaltered and inarguable (such as the outstanding historical value attributed to the Blue Mountains Crossing by Blaxland, Lawson and Wentworth expeditionary). This value would remain, regardless of any consideration of noise or emission and is not dependent in any way on the uninterrupted connections between land and sky. However other values are more vulnerable to potential impacts, and these are considered below.

Aboriginal heritage values

Since the GBMA was added to the World Heritage List in 2000, there has been a growing recognition that the cultural values of the site are more substantial than reflected in the original nomination for World Heritage listing. Amongst other changes, The Three Sisters, Kings Tableland, Red Hands Cave, Euroka and Mount Yengo have each received statutory recognition as 'Aboriginal places' (i.e., places of particular cultural significance to First Nations people) under the *NSW National Parks and Wildlife Act 1974*. Of these, all are within the areas for which flight paths would occur (with the exception of Mount Yengo which is further to the north in Darkinjung country).

As noted previously in Section 3.3.2, the existing statement of integrity for the GBMA does recognise the interconnectedness of Aboriginal values, traditional custodial relationship and the rich cultural landscape comprised of rock art and other sites, noting.

> *An understanding of the cultural context of the GBMA is fundamental to the protection of its integrity. Aboriginal people from 6 language groups, through ongoing practices that reflect both traditional and contemporary presence, continue to have a custodial relationship with the area. Occupation sites and rock art provide physical evidence of the longevity of the strong Aboriginal cultural connections with the land. The conservation of these associations, together with the elements of the property's natural beauty, contributes to its integrity.*

While there are likely to be many places that individuals and families visit to continue and deepen their relationship with the country and the spirits, there are some that have become important places for contemporary ceremony and practice. These include Kings Tableland Aboriginal Place, Euroka Clearing, 'Nye Gnorang' Aboriginal Place and Red Hands Cave. Activities at each of these places would be sensitive to noise volume and frequency, and therefore affect the integrity of these locations.

The preliminary flight paths for the project would not directly impact the existing use of or maintenance of existing Aboriginal cultural practices within the GBMA. It is acknowledged that the preliminary flight paths would fly over a number of significant cultural sites and places, however in many cases existing flight paths already traverse the airspace above these sites and places. In addition, it is however acknowledged that designing flight paths to avoid all Aboriginal and non-Aboriginal sites of cultural value would be impossible. In most cases aircraft would be at such a distance as to render the impact from these factors as minimal and are not expected to impact the overall integrity of the GBMA in relation to Aboriginal cultural values and custodial relationships.

Aboriginal cultural places and values that may be impacted

As noted above, many Aboriginal sites such as artefact occurrences which currently existing within the GBMA would not be directly/physically impacted by the project. However, there are places within the GBMA where the physical fabric of a place may potentially be impacted. These include Aboriginal rock engravings, and pigment art which typically occur on sandstone surfaces. These places may be affected physically through additional dust or chemical interaction of pollutants on these rock surfaces. Some rock engravings and pigment art sites along with stone arrangements, ceremonial sites, and natural mythological sites may also have intangible spiritual values that may be vulnerable to noise or visual intrusion.

Some places are significant for their spiritual values, and these were of particular concern to the knowledge holders interviewed. For example, the 'Emu in the sky' constellation is associated with several places on the ground and this connection is potentially disrupted by the intrusion of aircraft. Noise can also impact cultural values where for example those values include the need for peace, tranquillity, and spiritual connection. Noise can also impact values where those values are rooted in the role of the place as a site of intergenerational cultural education.

Further discussion of these potential impacts are provided in the following sections.

Disruption of land–sky connection

Some Aboriginal sites are connected to the Dreaming and have a spiritual value that extends beyond their physical fabric. This is reflected in Aboriginal sites that are connected to stories that link places on the land with the stories about the constellations. One such place raised during the development of the project was the Emu engraving at Ticehurst Park, in Faulconbridge. This engraving is reported by knowledge holders to be related to the Emu in the Sky constellation.

Stories about the Emu and the corresponding constellation are held by several First Nations peoples across Australia. The sites on the ground associated with these stories include engravings, stone arrangements and rock painting sites that are often associated with ceremony, initiation and the seasonal abundance of Emu eggs or the life cycle of the bird.

Emu engraving

Several Emu engraving sites in the greater Sydney have been recorded as associated with this story including, including in the GBMA at the Faulconbridge site in Ticehurst Park (located adjacent to the GBMA). Knowledge holders interviewed as part of the project stated that around March to May was the most important time for the connection between the emu and the sky and the engraving site at Faulconbridge. The intrusion of aircraft over head at this time could potentially result in detrimental indirect impacts to the cultural values of this site. This site is not directly under a preliminary flight path however the location is close to a proposed departure transition area for WSI which means it could be overflown. It is close to proposed daytime flightpaths for non-jet aircraft departing Runway 05 during the day-evening period however frequency of flight is anticipated to be low (around 2 to 6 flights).

The site is also close to overnight departure flights from Runway 23 however aircrafts will be relatively high climbing between around 10,500 ft and 13,300 ft and infrequent. When Runway 05 is in use it is anticipated that there would be an average of around 3 up to around 8 arrivals at night and when Runway 23 there would be an average of around 3 and up to around 6 departures overnight (in 2033). During March to May when the Emu in the Sky constellation is most visible, the visual intrusion would be likely to have some negative cultural impact to the existing land-sky connection.

Noise is expected to around 60 to 65 dB(A). While it was considered that although expected noise at the Emu rock engraving would only be around 60 to 65 dB(A), that the impact to cultural values would be moderate (and seasonably variable) due to the potential for disruption to the visual link between the site and the Emu in the Sky constellation at night (particularly between March and May when the constellation is reported to be most visible).

Emu Cave and Emu Cave Aboriginal Place

There is also a rock shelter associated with the Emu story at the Faulconbridge site. The wall of this rock shelter is engraved with numerous emu footprints and there are axe grinding grooves on the stone surface above the cave. This cave is believed by contemporary knowledge holders to be an important spiritual site associated with the Emu Dreaming. The rock shelter itself is close to a road cutting and is believed to have been used by convicts and other people in the past. It has been subject to various disturbances although the depth of the rock shelter has served to protect the emu track engravings from weathering. This factor is also likely to provide protection from any impact from impacts such as those from additional aircraft emissions.

The Aboriginal Place would be overflown by aircraft departing from Runway 05 and Runway 23 during the day-evening aircraft would be climbing between 13,300 ft and 17,500 ft above runway level at this location. Some aircraft may fly at a lower altitude depending on weather and operational conditions. There would be some, but less frequent flights overnight from runway 23.

The impact of noise and visual intrusion

The impact on cultural values of both Aboriginal and non-Aboriginal places from noise and visual intrusion would be dependent on a combination of the expected type of aircraft, height of the aircraft above the ground surface, the position of the heritage item in relation to topographic features that might mitigate noise or shield from site, the frequency of flights and whether an aircraft might be expected to be climbing in altitude, cruising or idling. In order to determine those places where noise and visual intrusion might impact cultural practices and/or current usage the discussions with the knowledge holders were reviewed. Places within or closely associated with the GBMA particularly were identified as key locations where noise and visual intrusions may result in detrimental impact to the significant cultural values. These were:

- The Three Sisters rock formation and the Kedumba Valley Aboriginal Place
- Yellomundee including Shaws Creek rock shelters and the camping area
- Emu Engraving sites at Faulconbridge (particularly at night when the Emu in the Sky constellation is strongest between March and May and is the most visible)
- Linden Ridge sites.

Table 5.8 provides a summary of the potential noise and visual intrusion impacts on these and other high cultural value sites within or in close proximity to the GBMA. The assessment of impacts was based on composite contours and reflect 3 different runway operating scenarios. Actual impacts at a given location may be lower, depending on the operating scenario that is ultimately adopted.

Table 5.8 Estimated noise and visual intrusion at a selection of First Nations sites of high cultural value within or associated with the GBMA

Heritage item	Noise range (average sound levels)	Visual intrusion	N60 (24-Hours) – number of movements	Comment
The Three Sisters/ Echo Point	50 to 55 dB(A)	Aircraft would be visible in the distance less than 5 km away. They would be at an approximate height greater than 10,000 ft (above WSI runway).	No movements at or above 60 dB(A)	While the expected noise levels are low, given the sweeping views from the lookout the visual impact is likely to be more noticeable than for other parts of the Blue Mountains. First Nations participants were concerned about any increase in noise or visual intrusion. Impact on cultural value is expected to be low to moderate given expected altitude and noise projections.
Shaws Creek Aboriginal Place, Yellomundee Regional Park	60 to 65 dB(A)	The place would be directly overflown when Runway 05 is in use. Aircraft will be frequent and visible (approximately 8,000 to 10,500 ft above WSI runway and climbing). Overnight aircraft into WSI on Runway 23 will be descending between 8,000 ft and 5,000 ft above runway level at this location. Some aircraft may fly at a lower altitude depending on weather and operational conditions.	Frequency is expected to be around 10 to 20 flights per day.	The main north south flight paths would overfly over Yellomundee. It is expected that only 1–2 overnight flights into Runway 23 would occur. Departing from Runway 05 an average of 23, up to a maximum of 55, departures, could overfly this location during the day – evening period. The impact on cultural values is expected to be significant.

Heritage item	Noise range (average sound levels)	Visual intrusion	N60 (24-Hours) – number of movements	Comment
Red Hands Cave Aboriginal Place	60 to 65 dB(A)	Flight path Runway 05 arrival North Night (RRO) overflies this location with an average of 4 arrivals up to a maximum of 8 during the overnight period (in 2033). Aircraft would be at 10,500 to 13,300 ft above runway level. Daytime flightpaths do not overfly these locations although when runway 23 is in use (RWY23 Departure North (Non-Jet) Day) is less than 1 km away so aircraft are likely to be visible and able to be heard at less than 42 decibels.	Less than 10 flights per day are expected by 2055.	The park gates are closed during the evening and therefore the expected impact from noise and visibility is low to moderate. The long-term impact of emissions on pigment and engraved art is currently unable to be estimated.
Euroka Clearing	Around 42 dB(A)	The site would be directly overflown with aircraft at an expected height ranging from 8,000 ft to 13,300 ft above runway. When Runway 23 Arrival West Day is in use an average of 24 arrivals up to a maximum of 51 arrivals could overfly this location during the day-evening period. At night when Runway 05 Arrival North Night (RRO) is in use, an average of 4 flights and up to 8 arrivals could overfly this location (in 2033).	No movements at or above 60 dB(A)	Even though noise levels are not expected to be high, overflight is expected to be relatively frequent and impact to the current First Nations cultural use of the site which includes mourning and smoking ceremonies is likely to be noticeable. Impact to cultural values is expected to be low to moderate.

Heritage item	Noise range (average sound levels)	Visual intrusion	N60 (24-Hours) – number of movements	Comment
Linden Ridge sites	60 to 65 dB(A)	Linden Ridge is overflown by the following flight paths Runway 23 Departure North Day; Runway 05 Arrival North Night and Runway 23 Departure North Night. Aircraft on all flight paths will be at an altitude between 10,500 and 13,300 ft above runway. The expected frequency of flights varies between the various flight paths however most flights are expected during the day i.e. an average of 18 departures up to a maximum of 36 during the day – evening period when Runway 23 is in use (in 2033), increasing over time.	Frequency is expected to be around 10 to 19 movements above 60 dB(A) by 2055.	There are many Aboriginal sites that are located along the Linden Ridge walking trail. Given that the sites are located along an elevated ridgeline, the visual and noise disruption at these sites is likely to be significant and with the impact increasing by 2055. There are multiple rock shelters with pigment art e.g. 4504-0220, and 45-4-0244; and ridge top engravings sites e.g. 45-5-0008, and 45-5-2272; stone arrangements e.g. 45-4-0222, 45-4-0223 as well as other site types including artefact scatters and axe grinding grove sites. Impact is expected to be moderate increasing to severe by 2055. The long-term impact of emissions on pigment and engraved art is currently unable to be estimated. Since the exhibition of the Draft EIS, refinements have been made to the preliminary flight path design which would reduce movements or increase the altitude of aircraft on certain flight paths at night. This would provide some visual and noise amenity improvement at night at this location. This is further discussed in Appendix G (Assessment of the refinements to the project) of the EIS.

Heritage item	Noise range (average sound levels)	Visual intrusion	N60 (24-Hours) – number of movements	Comment
Emu Cave Aboriginal Place. AHIMS #45-4-0018	60 dB(A)	The Aboriginal Place is directly overflown by aircraft on the following flight paths: Runway 05 Departure North Day, Runway 23 Departure North Day, Runway 23 Departure North Night. Aircraft would be visible but relatively high climbing between13,300 ft and 17,500 ft (above the runway).	<10 movements at or above 60 dB(A)	This site is a deep rockshelter, with the engravings inside on the cave walls. There is no direct visual connection between the engraved emu tracks and the sky as is the case with the emu engraving. The site is of spiritual significance – and given the frequency of flights the impact is expected to be low to moderate. Since the exhibition of the Draft EIS, refinements have been made to the preliminary flight path design to increase the lateral separation with this Aboriginal Place. This is further discussed in Appendix G (Assessment of the refinements to the project) of the EIS.

Heritage item	Noise range (average sound levels)	Visual intrusion	N60 (24-Hours) – number of movements	Comment
Emu Engraving Faulconbridge (AHIMS #45-5-0015)	60 to 65 dB(A)	An average of 18 departures up to a maximum of 36 departures could overfly this location during the day evening period using Runway 23 Departure north day. Aircraft will be between 10,500 and 13,300 ft above the runway level. Several nighttime flight paths also over fly this location. During the night when Runway 05 is in use, an average of 3 arrivals up to a maximum of 8 arrivals could overfly this location. Altitude of aircraft would range Runway 05 arrival north Night 13,300 ft to 17,500 ft and Runway 05 (RNP) North Night 8,000 ft to 10,500f t. When Runway 23 is in use – an average of 3 departures up to maximum of 6: Runway 23 departure Northeast Night and Runway 23 Departure North Night both at 10,500 ft to 13,300ft.	Frequency is expected to be less than 10 to 19 movements at or below 60 dB(A).	There are links to the Emu in the sky constellation from this location with the strongest times being March to May. The area is likely to be impacted by night-time flights during this time. The impact on cultural values is expected to be moderate. Since the exhibition of the Draft EIS, refinements have been made to the preliminary flight path design which would reduce movements or increase the altitude of aircraft on certain flight paths at night. This would provide some visual and noise amenity improvement at night at this location. This is further discussed in Appendix G (Assessment of the refinements to the project) of the EIS.
Emu Engraving Faulconbridge (AHIMS #45-5-4910)	~42 dB(A)	The site would not be directly overflown, with the closest flight paths being approximately one km to 2 km away. Aircraft would be visible. Altitude of aircraft at 8,000 ft AMSL or higher.	No movements above 60 dB(A)	Noise is likely to be a minor issue, however the link to the Emu in the Sky constellation is strongest March–May; likely to be impacted by night-time flights during this time. Impact – low.
Kings Tableland Aboriginal Place	~42 dB(A)	Aircraft would be less than 5 km away and visible from this Aboriginal Place but do not fly overhead. Aircraft would be at an altitude of greater than 10,500 ft above runway.	No movements at or above 60 dB(A)	Impact is expected to be negligible to low.

It is noted that avoidance of flight paths over the GBMA would be unavoidable and would therefore result in some impact from noise and/or visual intrusion. While aircraft might be visible from the sites identified, it is expected that noise and visual intrusion to these places would generally be minimal and have a negligible impact on their overall heritage values.

In relation to specific Aboriginal Places, including locations such as Emu Cave and The Three Sisters, the development of the flight path design sought to avoid impacts on Aboriginal Places as far as possible. Ongoing detailed design of the flight paths would seek, wherever possible, to consider options to further reduce the impacts (in particular acoustic and visual impacts) on Aboriginal Place locations including Emu Cave, Euroka Clearing, and at Shaws Creek in Yellomundee.

Air pollution and impacts to Aboriginal rock art sites

There is general acknowledgement that air pollution is likely to be detrimental to Aboriginal rock art however, there has been little direct research on sites within or close to Sydney. Internationally, research findings suggest that air pollution can accelerate the rate of stone deterioration in urban settings, by weakening the fabric of the stone, making it more susceptible to other stresses such as physical weathering.

Potential air pollution processes that have the potential to result in rock art deterioration can be attributed to elements including those potentially contributed from the proposal. Specifically this can include:

- acidification – acidity in rainwater (resulting from elements contributed to by air contaminants resulting from burning aircraft fuel) increase has the potential to dissolve constituent minerals from rock art supports and substrates, as well as the products of weathering and patinas on the rock surface, with the effect of weakening the rock matrix and increasing erosion rates and the loss of rock or pigment surfaces
- dust accumulation and surface nutrients – the settlement of airborne dust particles (potentially resulting from increased air traffic) onto rock art panels situated in rock shelters has a range of potentially detrimental impacts such as:
  - visual obscurement of the art pigments or marks, so that they appear to fade
  - in some cases, dust can be chemically reactive and even corrosive, causing chemical decay of the pigment.

The distribution of rock art sites relative to the WSI site and flightpath emissions

The distribution of the majority of known rock art sites occurs across a number of areas within the Sydney Basin, including throughout the GBMA. As outlined earlier in this section, the actual number and incidence of rock art sites within the GBMA is likely to be greater and higher than that already identified. This is because the conduct of archaeological recording (and the number of resulting site recordings) in these environmental reserves is much lower than on the Cumberland Plain where development proposals require archaeological assessments. For this reason, it should be assumed that the number of rock art sites across the sandstone topographies of the GBMA are likely to be much greater than indicated by the current database of known sites.

The impact of WSI aircraft emissions

Although it is possible to outline processes of potential rock art deterioration related to aircraft emissions, it is as yet, impossible to evaluate the risk presented by these processes, or indeed to identify and quantify any resulting damage. This is due to a lack of previous research and comparative data, as well as the difficulty in differentiating aircraft emission derived deterioration from other anthropogenic pollution sources via the same processes (such as acidity, nutrients and dust).

While a substantial number of both arrival and departure flightpaths overfly the sandstone ranges within the GBMA, given their height and distance from the WSI site, the impacts are unlikely to extend into the proximity of a majority of the rock art sites located within the GBMA. However, it is also recognised that the GBMA is typically comprised of large tracts of national park where there has been minimal industrial development in the past. As such, there is a potential impact that the introduction of new or increased emissions from the preliminary flight paths to these environments may potentially result in some impact to known (or previously undiscovered) rock art, in particular in areas under the more frequently flown sections of flightpaths, though the likelihood of this is considered to be generally minimal.

Fuel jettisoning

As discussed in Section 5.3.2.6, fuel jettisoning would be an extremely rare activity and the likelihood of fuel reaching the ground is very low. When undertaken in accordance with standard/appropriate procedures (the Aeronautical Information Package Australia, Part 2 – En Route (AIP ENR) (Airservices Australia, 2022)) it is considered that any potential impact to areas containing rock art sites would be very rare to negligible. If a fuel dumping event were to occur with the potential to impact rock art sites, that is, over sandstone dominated topography, and below 6,000 ft, it would be in contravention of established procedure and likely the result of a very rare and extreme emergency.

The likelihood of fuel reaching the ground is very low and it is unlikely that cultural heritage values of Aboriginal rock art sites would be impacted.

Non-Aboriginal heritage places and values

Perceived impacts to listed non-Aboriginal heritage places would relate to increased grime build up on buildings from aircraft emissions and noise that has the potential to diminish the values associated with peace, serenity and wellbeing of some sites that currently have such values, including those associated with the GBMA.

In most cases, listed heritage items are already located below the numerous flight paths that are currently utilised across the Sydney Bains (Figure 3.4). There are 2 SHR listed places within the boundaries of the GBMA (being the Jenolan Caves Reserve and the Blue Mountains Walking tracks). A number of State significance sites are also listed on the SHR within the immediate vicinity of the boundaries of the GBMA which would be located under the preliminary flight paths. A number of locally listed heritage items are also identified in and around/adjacent to the GBMA.

At greater distances from WSI, noise and eventually the visibility of aircraft begins to diminish, and emissions are likely to disperse over a greater area and therefore be less concentrated. However, some cultural values remain sensitive to any additional noise and the frequency of flights could potentially exacerbate this. This would applies to the GBMA and many non-Aboriginal places within it that are valued for their serenity and their ability to connect people to nature.

Of the listed non-Aboriginal heritage items, the greatest potential for impact to the value of the item would be on the Blue Mountains Walking tracks. There are 37 walking tracks listed on the SHR under this collective title. While the fabric and functionality of the tracks would not be impacted by overhead flightpaths, it is important to note that these tracks are a key to facilitating visitor access and are how most visitors experience them. The potential for intrusion (particularly noise but also to some extent visual) would have the potential to reduce the intangible values of these tracks (i.e. serenity, connection to nature, etc.). Visitors may experience some changes to the use and enjoyment of walking tracks within the Blue Mountains as a result of the project. People who visit and use these walking tracks where they fall within the N60 and N70 contours may be likely to experience moderate changes to their use and enjoyment. There are no walking tracks in the GBMA within the N70 contours, however some tracks have been identified to be within N60 contours. The majority of the broader GBMA is also largely outside the area predicted to experience aircraft noise at or above 60 and 70 dB(A).

Air pollution impacts to non-Aboriginal heritage places

Air pollution has long been considered a cause of damage to built heritage in both urban and rural areas. While there are limited non-Aboriginal structures within the GBMA, the potential emissions impacts described above has a similar potential to impact on the physical fabric of buildings (in particular those comprised of materials such as sandstone which is a material used in many of our significant historical buildings).

Overall, it is acknowledged that designing flight paths to avoid all Aboriginal and non-Aboriginal sites of cultural value would be impossible. The preliminary flight paths would fly over a large number of significant sites and places, however in many cases existing flight paths already traverse the airspace above these sites and places. In addition, many types of heritage places are considered robust in the face of impacts such as air pollution, noise and visual impacts. In most cases aircraft will be at such a distance as to render the impact from these factors as minimal. However, the places closest to the Airport Site may experience proportionally greater impacts.

5.3.2.5 Social and economic

This section provides a summary of the potential social and economic impacts on the GBMA and its values. Further detail regarding these potential impacts is provided in Technical paper 10 and Technical paper 11 prepared for the EIS.

Social and economic context

Greater Blue Mountains World Heritage Area values

As identified throughout this report, the GBMA is an area of significant natural and cultural values. The Blue Mountains is a significant recreation area for residents in Greater Sydney and tourists visiting from elsewhere in NSW, Australia and overseas. The Nepean River in Penrith provides opportunities for boating, fishing, rowing, kayaking and numerous walking tracks along the river.

In engagement surveys conducted as part of the preparation of the EIS, the Blue Mountains was often described as peaceful, serene and wild. Wilderness values were most commonly noted, closely followed by biodiversity values, Aboriginal heritage, scenic values and the overall value of the area's status as a UNESCO World Heritage Area. Recreation activities, including bushwalking, hang-gliding and more passive forms of recreation, were also considered important. Detailed survey responses highlighted that the Blue Mountains are well-known for having fresh air and unpolluted environments, unique birdlife, and playing an important role in preserving biodiversity. The region's natural beauty and unique flora and fauna were highly valued, with the recognition that many of these are already endangered.

As described in Section 5.3.2.4, the GBMA also has both First Nations and non-Aboriginal cultural values. Intrinsic social and cultural values of the GBMA include connections to Country for 6 Aboriginal language groups through ongoing custodial relationships with the area. Physical evidence of cultural connections is present in numerous cultural sites and other examples such as rock art throughout the GBMA.

The Blue Mountains National Park was highlighted throughout consultation as a significant recreation area for residents in Greater Sydney as well as tourists visiting from elsewhere in NSW or Australia and overseas. Multiple suburbs of Blue Mountains LGA including Katoomba and Glenbrook are located close to the National Park.

Tourism

While COVID impacted on the level of annual tourism to the Blue Mountains region generally, for the prior 12 months to December 2022, the Blue Mountains received around 3.8 million total domestic visitors, with around 1.4 million domestic overnight visitors (contributing to around 3.5 million total nights of visitation), and around 2.5 million total daytrip visitors (Destination NSW, 2022). Bushwalking/ rainforest walks and visiting National Parks/State Parks were 2 of the top 5 activities identified by visitors to the Blue Mountains during this time.

There are multiple connections that tourism has to the wider economy especially for both hospitality and accommodation. Local vendors experience an increase in usage due to the proximity to the Greater Blue Mountains, this extends to hotels, camp sites, Airbnb's etc. as well as cafes, bars, pubs and restaurants. The commercial impact on local shops and markets is also a multiplier due to the tourism of the GBMA.

Potential impacts

Potential social and economic impacts associated the project may have direct or indirect impacts on the existing use or values attributes to the GBMA. These impacts may include potential:

- changes to the use and enjoyment of social infrastructure
- detrimental effect to Aboriginal culture due to impacts tangible and intangible Aboriginal cultural heritage
- detrimental effects to wellbeing as a result of changes to amenity
- diminished social values associated with Blue Mountains
- potential risk to the visitor economy and livelihoods associated with Blue Mountains World Heritage Listing
- economic impacts on tourism, including ecotourism.

Each of these potential impacts are briefly described in the following sections. Further detail regarding these potential impacts are provided in Technical paper 9 and Technical paper 10 prepared for the project EIS.

Changes to the use and enjoyment of social infrastructure

During consultation concerns were raised about the reduction in quality of open space from noise.

Within the GBMA, visitors may experience changes to the use and enjoyment of walking tracks and Lookouts. As described in Section 5.3.2.3, the majority of the GBMA would be largely outside the area predicted to experience aircraft noise at or above 60dB and 70dB.

A total of 5 Lookouts can be observed within N60 and N70 contours (refer to Section 5.3.2.3 for details of these contours) and another 15 Lookouts would be located in close proximity to these areas. Within the N60 contour a total of 30 sensitive areas within the GBMA, which includes Lookouts, picnic areas, campgrounds and areas of special interest such as waterfalls. Some of these areas include the Cleary Memorial Lookout, the Nepean Lookout, Mount Banks picnic area and Lookout, the Oaks picnic area, the Burragorang Lookout and the Ruined Castle.

Out of these 30 areas, 12 would not experience noise levels at or above 60 dB. Noise levels of 60 dB are expected to occur at the Cleary Memorial Lookout, the Nepean Lookout and Mount Banks picnic area and Lookout. Noise levels of 70 dB are also expected to occur at the Nepean Lookout and Warragamba Dam, however, maximum sound exposure levels would more typically range from below 50 dB(A) to 60 dB(A) based on the aircraft type, with some noisier wide-body jets reaching closer to 65 dB(A) near the flight paths.

Visual impacts at Lookouts situated in the Blue Mountains are expected to be low or negligible for the initial 2033 operating scenario. However, night light impacts are expected to result in a high-moderate visual impact due to the very high visual sensitivity. While it can be anticipated that by 2055 those who visit and use walking tracks and lookouts would be to some extent accustomed to aircraft noise and visuals, it is likely that visitors would continue to experience potential impacts to their use and enjoyment of the area.

As identified above, consultation highlighted a number of values associated with the GBMA, including peace and quiet, wilderness and recreation. Overall, it is anticipated that those who visit and use walking tracks, lookouts and other sensitive areas, in areas where increase in potential noise levels and/or visual intrusion from aircraft may be experienced, would be likely to experience a moderate changes to their use and enjoyment.

Detrimental effect to Aboriginal culture due to impacts tangible and intangible Aboriginal cultural heritage

Impacts to Aboriginal culture are understood by analysing the potential negative effects to tangible and intangible aspects of cultural heritage, and changes to First Nations people's experience and enjoyment during the exercise of cultural practices. During consultation concerns about impacts to the cultural and spiritual aspects of Country were raised by the Blue Mountains City Council and Wollondilly Shire Council.

As discussed in Section 5.3.2.4, the project would not result in Aboriginal sites would not have a direct negative impact as a result of the preliminary flight paths as a whole. The preliminary flight paths have avoided overflying the following Aboriginal places: Red Hands Cave, Kings Tableland, Euroka/Nye Gnorang, the Upper Kedumba Valley and the Emu engraving at Faulconbridge (AHIMS #45-05-4910). However, the project does not avoid complete impact to the Emu Cave Aboriginal Place, Linden Ridge sites, the Emu engraving at Ticehurst Park or Shaws Creek Aboriginal Place in the Yellomundee Regional which would experience overflights from some aircraft flight paths.

Visual intrusion is only likely to have a negative impact on a small range of places such as historic vistas and cultural landscapes and spiritual sites such as the Emu engraving, or the Three Sisters rock formation. It is estimated that flights would be over 10,000 ft above ground as they pass over Mount Solitary. In experiential terms, this means the planes would appear as small and distant. However, they are likely to still be heard from Echo Point. Impacts to Aboriginal rock engravings and paintings (through chemical interaction of pollutants on rock surfaces) was also identified as a potential impact, noting that a substantial number of flightpaths currently overfly the sandstone ranges within the GBMA, and given the preliminary flight paths proposed as part of the project, the impacts are unlikely to extend into the proximity of a majority of the rock art sites located within the GBMA.

As discussed in Section 5.3.2.4, flight paths could also disrupt the land-sky connection for First Nations peoples. This is most clearly reflected in sites that are connected to stories that link places on the land with the stories about the constellations, such as the Emu engraving at Faulconbridge.

With regards to the GBMA, it is almost certain that noise and visual intrusion would be experienced as a moderate magnitude of change on Aboriginal cultural values associated with GBMA.

Detrimental effects to wellbeing as a result of changes to amenity

Changes to wellbeing are determined by understanding the existing health and vulnerability conditions of people potentially affected by changes to amenity, including noise, air quality and night-light, as well as their level of concern regarding the specific issue.

The GBMHWA bring opportunity for recreation, spirituality, being in touch with wilderness, as well as social and economic benefits all of which contribute to some extent to the wellbeing of visitors and residents surrounding the GBMHWA. Noise and air emissions associated with the project components over the GBMA (as described in Section 5.3.2.4 and Section 5.3.2.6 of this report respectively) have the potential to affect the physical and mental health and wellbeing of residents, sensitive receptors and users of the area.

With respect to these issues, for the 2033 scenario, is considered that residents who may also be frequent visitors to the GBMA, are unlikely to experience noticeable changes to their wellbeing. With the increase frequency anticipated for the 2055 scenario, it is considered that GBMA visitors to Lookouts and walking tracks would possibly experience minimal changes to wellbeing (primarily due to the potential noise impacts associated with the project in these areas).

Diminished social values associated with Blue Mountains

During consultation stakeholders highlighted the importance of recreational and touristic values, as well as heritage and ecological values associated with the GBMA. Much of the area's value lies in the wilderness and quietness, with significant associated heritage and ecological values recognised in the World Heritage listing. The Blue Mountains is also a significant economic asset and a key contributor to the tourism and visitor economy.

As discussed throughout this report, while some noise and visual impacts may potentially occur to the wilderness areas, these are considered to be generally insignificant for a vast majority of wilderness areas and are not considered to be such that they would interfere with the values attributed to the wilderness nature of the GBMA. Potential indirect impacts may be observed for tourism and recreation values (refer section below).

Based on the altitude of aircraft overflying scenic areas and the distance of WSI from vantage points within the GBMA, it is not expected that a significant impact pm the social values associated with the GBMA would occur because of the project.

As described in Section 5.3.2.4, aircraft noise will result in changes to the existing levels experienced within the GBMA for the 2033 and 2055 scenarios. These will have the potential to impact social values associated with including:

- recreation and tourism values impacts to the way people enjoy and use open space within GBMA
- social and economic values resulting in potential impacts to the tourism and therefore livelihoods of people who rely on tourism as sources of income (refer to following section).

It is possible the combined effects on GBMA associated values would result in moderate changes to the way people enjoy, use and value the GBMA.

Economic impacts on tourism

Western Sydney and, in particular, the GBMA are expected to benefit from the development of WSI through increased access for tourists that want to access these areas. It is noted however that WSI and the associated infrastructure are the factors that will generate the benefits to the tourism industry. The consequential flight paths (i.e. the project) has the potential to affect the tourism industry if it results in loss in amenity to sensitive land uses.

As described in the sections above, the location of the flight paths over the GBMA have the potential to negatively affect the tourist experience of the area either through the visual location of planes or the noise they will generate. This negative effect could lead to a reduction to the number of tourists coming to the local area and in turn can reduce the tourist dollars being spent in the local economy.

While most tourists who visit the Greater Blue Mountains are day trippers, there are a number who stay overnight and longer. Noise affecting tourist accommodation such as hotels, motels and camping grounds could lead to fewer tourists staying for more than a day which could have a marked impact on the local tourist accommodation. A reduction in hotels could lead to price increases and a limited range of accommodation options. There are 26 short-stay accommodation places inside the N60 contour but none are inside the N70 contour. The majority of these places are in the St Marys to Penrith urban corridor with only one in the Blue Mountains (and not within the boundary of the GBMA).

As described previously, the impact to people visiting the Blue Mountains for a day could be impacted due to the noise while they're undertaking any outdoor pursuits (including overnight tourist activities such as camping). There could also be a reduction on the amount of tourists visiting local eateries, shops, and markets. This could lead to a reduction in the indirect benefits of the GBMA tourist areas.

The location of an international airport closer to the GBMA could provide a boost to the tourists within the area outweighing the potential impact of the flight paths. As planes fly over such a distinct and unique area of Australia, tourists will be able to gain an appreciation over the area and could choose to stay in the area for longer. The flights that will use WSI could bring more people into Western Sydney who may have always flown into Sydney (Kingsford Smith) Airport and therefore not been close enough to the area for a visit.

Potential risk to the visitor economy and livelihoods associated with Blue Mountains World Heritage Listing

During consultation concerns were raised about how outdoor activities in the Blue Mountains area would be affected, impacting visitation and the visitor economy in the area. Concerns were raised about the potential loss of the UNESCO heritage listing and its impacts on visitation numbers, particularly national and international visitors.

It is noted that there have been no examples in which a UNESCO heritage site has lost its status due to aircraft noise. The process of a site losing its World Heritage status is rare and typically involves significant concerns related to the site's conservation or management, and the decision to remove a site from the list is made by the UNESCO World Heritage Committee after careful evaluation.

Based on consideration of the potential social and economic impacts identified above, it is considered that impact to the visitor economy and livelihoods associated with the Blue Mountains World Heritage Listing is low.

5.3.2.6 Air quality and climate change

The operation of the project may have the potential to result in indirect impacts on the attributes within the GBMA due to changes in air quality, through the potential contribution it may have on current climate change or through emissions from fuel jettisoning. Each of these potential impacts are briefly described in the following sections. Further detail regarding these potential impacts is provided in the Technical paper 2 and Technical paper 3 prepared for the project EIS.

GHG emissions context

Aircraft wings are equipped with devices known as flaps, that can be extended and retracted to change the shape and size of the wing. This allows an aircraft to fly efficiently at high cruise speed and safely at low speed for landing and take-off. Sufficient engine power (thrust) to achieve speed through the air is another essential factor when considering the principles of flight.

For an aircraft to fly it must generate lift to overcome its weight. The generation of lift also produces drag, as does the movement of the airframe through the air. Drag is an impediment to an aircraft's forward motion. The combination of speed and wing shape produces lower pressure on the upper surface of the wing than the lower surface. The greater the pressure on the lower surface of the wing pushes up harder than the lower pressure on the upper surface pushes down. The net result is the upward force known as lift. The engines generate the thrust necessary to overcome drag and produce a speed where lift can occur. The greater the thrust required the more fuel is burnt and greenhouse gases (GHGs) emitted. Figure 5.24 shows the relationship between aerodynamic forces and GHG emissions.

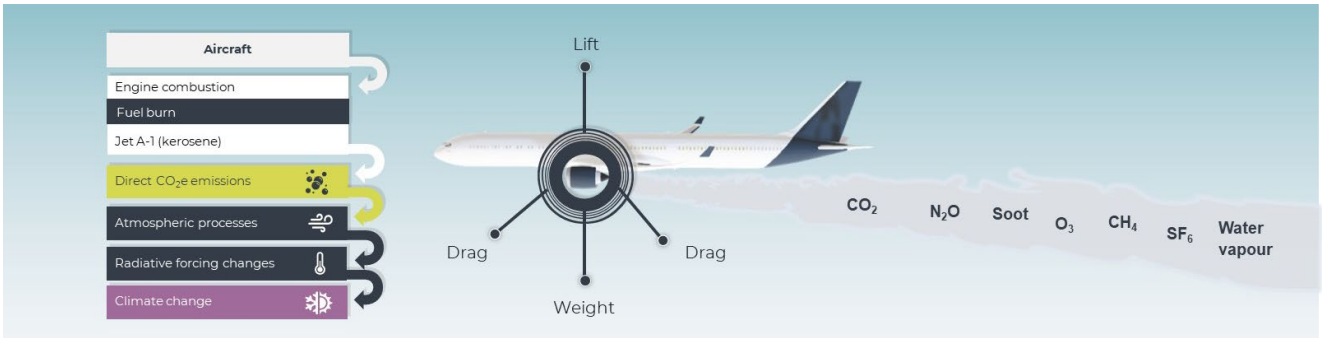

Figure 5.24 Aircraft aerodynamics and GHG emissions

GHGs are gases that trap heat in the atmosphere, with key contributors including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO_2), and fluorinated gases. Reducing GHGs could limit average global temperature rise to a level that would prevent dangerous interferences with the climate system. Water vapor is also a product of jet fuel consumption, making up about 30 per cent of the exhaust. The presence of water vapour in the exhaust plume from an aircraft has an indirect impact by contributing to the formation of contrails (refer to Figure 5.25).

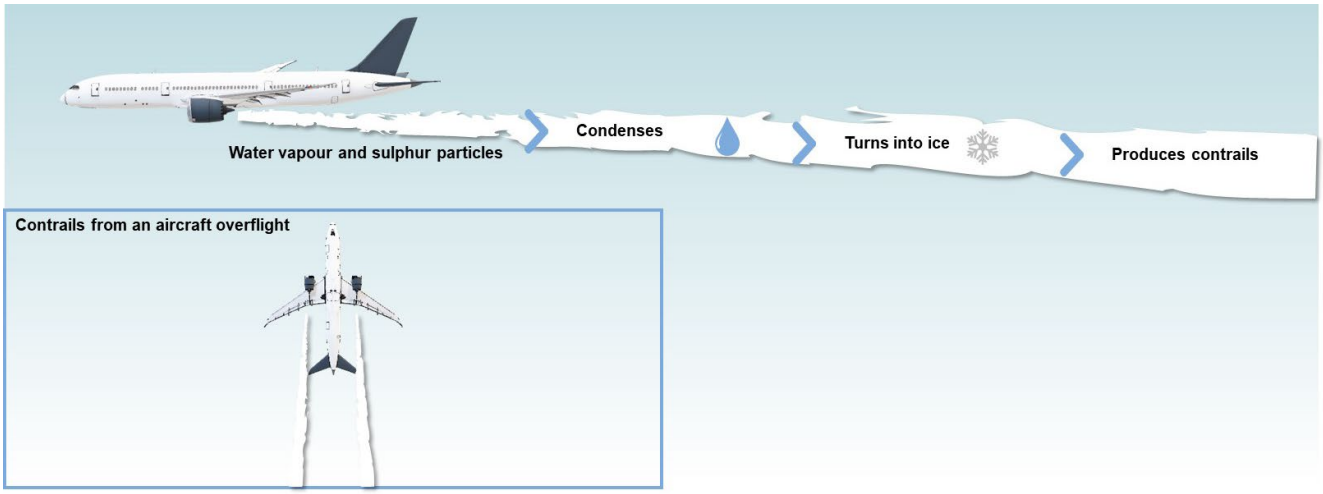

Figure 5.25 Condensation trail (contrail) formations

For a single, comparable value of GHG emissions, the total emissions of all emitted gases are converted to CO_2-equivalent (CO_2e) (CO_2e is used to describe different GHGs in a common unit. For any quantity and type of GHG, CO_2e signifies the amount of CO_2 which would have the equivalent global warming potential). The combustion or burning of jet fuel (kerosene) emits various gases and particles referred to as GHGs. CO_2 is the largest component of aircraft GHG emissions, accounting for approximately 70 per cent of the exhaust. The amount of GHG emitted from aircraft main engine use is directly related to the amount of fuel consumed.

Radiative forcing is a change in the balance of the sun's radiation reaching the earth, and heat leaving the earth from human-induced activities like aviation and natural factors. Changes in atmospheric GHG concentrations affect radiative forcing. Radiative forcing is a multiplier used for GHG emitted to the atmosphere from aircraft flying at altitude (i.e., 26,000 ft (around 7,925 m) and above). When GHGs are emitted at altitude they result in more potential heating than if the same amount was emitted at sea level. This is because higher altitudes affect fuel combustion and GHG emission characteristics.

Regional air pollutants

Key sources of air emissions within the greater Sydney area were included in the model, along with emissions that occur outside of the area but may blow in, for example natural biogenic emissions, such as volatile organic compounds from vegetation. Notably, the Blue Mountains are named after the blue haze that can sometimes been seen there, which is mainly comprised of such biogenic substances. The air quality assessment for the project modelled emissions of ozone, as well as precursor gases such as oxides of nitrogen (NO_x), volatile organic compounds, as well as other potential pollutants including sulfur dioxide (SO_2), carbon monoxide (CO), and $PM_{2.5}$ and PM_{10} (particulate matter less than 2.5 µm and 10 µm in diameter respectively).

Ozone

Ozone is formed through photochemical reactions of precursor gases. The regional air quality assessment considers the dispersion of ozone across the greater metropolitan region, which includes the GBMA. A review of existing data indicates that the annual average ozone concentrations for monitoring stations in Western Sydney (Bringelly, St Marys and Camden) regularly exceeded the relevant NSW EPA throughout the past 10 years, generally in the summer months. Some of these elevated levels are associated with the effects of bushfires, but exceedances of the criteria also arise at other times due to anthropogenic (man-made) emissions.

With respect to potential impacts on ozone levels, the project would make no significant difference to the impact that would arise without the project. The modelled contribution of emissions from the project to peak ozone levels is therefore unlikely to be significant in a regional context. On this basis, the project would not generate any unacceptable level of impact to the GBMA or adversely affect any of the attributes or amenity of this site.

Nitrous oxides

A review of existing data indicates that the annual average NO_2 concentrations for monitoring stations in Western Sydney (Bringelly, St Marys and Camden) were below the relevant NSW EPA throughout the past 10 years. Some of these elevated levels are associated with the effects of bushfires, but exceedances of the criteria also arise at other times due to anthropogenic (man-made) emissions.

The modelling for the regional air quality assessment with respect to potential NO_2 impacts identified that there would be minor changes to potential NO_2 levels within in close vicinity to the Airport Site in the longer term 2055 scenario, but this would not extend into the GBMA. The assessment identified that any discernible increases in NO_2 would however be limited to a radius of around 5 to 6 km of The Airport Site. This suggests that the impact of the project's emissions on ground level concentrations is primarily attributable to aircraft near or at ground level, primarily during take-off and landing and would not result in any impacts the regional air quality of the GBMA or adversely affect any of the attributes of this site. Additionally, the results indicated that the emissions released higher than a few hundred metres above ground level do not appear to have any significant influence on ground level concentrations.

On this basis, the project would not generate any unacceptable level of impact to the GBMA or adversely affect any of the attributes or amenity of this site from emissions of nitrous oxides.

Contribution to climate change

Climate change is identified as a threat to the GBMA due to its potential to alter the frequency and intensity of fires and for increased temperatures to impact upon biodiversity and ecosystem function (UNESCO 2015). GHG emissions are identified as a contributing factor to global climate change.

The combustion or burning of jet fuel (kerosene) emits various gases and particles that contribute to overall levels of GHG. Carbon dioxide (CO_2) is the largest component of aircraft GHG emissions, accounting for approximately 70 per cent of the exhaust. When GHGs are emitted at altitude they result in more potential heating than if the same amount was emitted at sea level. This is because higher altitudes affect fuel combustion and GHG emission characteristics.
The emissions from aircraft engines during all phases of flight alter the atmospheric concentration of GHGs, trigger the formation of condensation trails (or contrails – temporary white, cloud-like plumes composed of ice crystals formed in aircraft engine exhaust) and cause cirrus clouds to form (on occasions) all of which contribute to climate change.

Technical paper 3 considered the contributions of the project to the broader impact of emissions within NSW and Australia. WSI's projected emissions of CO_{2e} from aircraft main engine use on domestic flights operating in Australia have been compared to Australia's total emissions (for all WSI domestic flights) and NSW's total emissions (for WSI flights in NSW and ACT only). This identified that:

- in 2033, the project's domestic flight departure emissions of CO2e would represent 0.13 per cent for Australia's total projected economy wide emissions which is low whereas the project's intrastate flight departure emissions of CO2e would represent around 0.04 per cent of NSW's total economy wide emissions, which is extremely low resulting in very minor adverse impacts to Australian and NSW Government's decarbonisation plans and transition to net zero carbon economies by 2050
- in 2055, the project's domestic flight departure emissions of CO2e are projected to increase to 0.95 Mt CO2e and would represent 0.5 per cent of Australia's total projected emissions which is moderately low whereas the project's intrastate flight departure emissions of CO2e would represent around 0.2 per cent of NSW's total projected economy wide emissions, remaining low despite the significant increase in air traffic growth and increase in the number of domestic destinations being served.

The emissions of CO_2e attributed to aircraft operating from WSI in either 2033 or in 2055 would be unlikely to result in significant impacts or inhibit the achievement of net zero economy targets set by the Australian or NSW Government for 2050.

Given the small percentage of contribution, it is concluded the GHG emissions from the proposed airport would not represent a significant contribution to climate change or to the potential impact of global climate change on the GBMA, or present a threat to impacting the values for which the site was listed. It is probable that the percentage of emissions of CO_2e from WSI operations would also reduce over these time horizons as more fuel efficient, next-generation aircraft enter service and operate within the airline fleets serving WSI. Additionally, it is important to note that the project, along with several other recent and proposed projects in the locality, may incrementally exacerbate impacts on GHG emissions, there is an extensive network of existing flight paths over the Sydney Basin and GBMA that already produce GHG emissions.

Emissions from fuel jettisoning

As described in Section 4.2.2.3, emergency fuel jettisoning is a relatively uncommon, non-standard operational procedure and referring to an emergency situation where an aircraft must jettison fuel in order to land safely. If required, fuel dumping can be carried out safely and without any impacts at ground level when appropriate procedures are followed. Fuel jettisoning would occur in accordance with the AIP ENR (Airservices Australia, 2022a).

Given the strict regulations associated with its implementation and the high evaporation rate of the fuel at high altitudes potential, fuel jettisoning is very unlikely to have any impact on the GBMA due to both the rarity of such events, the inability of many aircraft to jettison fuel, the rapid vaporisation and wide dispersion of jettisoned fuel and the strict regulations on fuel jettisoning altitudes and locations (i.e. at higher altitudes wherever possible).

5.4 Assessment of potential project impacts

5.4.1 Impacts on World Heritage values

The assessment of significance is based on the requirements of the *EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (Commonwealth of Australia (2013a), which state that an action is likely to have a significant impact on the World Heritage values of a declared World Heritage Area if there is a real chance or possibility that it will cause:

- one or more of the World Heritage values to be lost,
- one or more of the World Heritage values to be degraded or damaged, or
- one or more of the World Heritage values to be notably altered, modified, obscured or diminished.

The implementation of the preliminary flight paths as part of the operation of WIS would not have any direct impact on the Outstanding Universal Value of the GBMA.

Indirect effects on the Outstanding Universal Value of the Greater Blue Mountains Area may include potential impacts to Aboriginal heritage, visual, noise and social (e.g., enjoyment of recreational facilities such as campgrounds and Lookouts). These potential impacts are described and their significance assessed in Table 5.9.

5.4.2 Other values of the Greater Blue Mountains

Table 5.10 provides an assessment of the potential operational impacts of the proposed airport on the additional values of the GBMA identified in the Strategic Plan (DECC, 2009). These values interact with and complement the World Heritage site values but are not part of the defined natural values for which the Greater Blue Mountains Area is listed (i.e. Outstanding Universal Value).

Table 5.9 Outstanding universal value impacts on the GBMA from the project

Criterion	Criterion description	Flight path impacts	Assessment of significance
Criterion (ix) ongoing evolutionary processes	The inscribed values of the GBMA for this criterion is associated broadly with: • Outstanding and representative examples of: – evolution and adaptation of the genus *Eucalyptus* and eucalypt-dominated vegetation on the Australian continent – products of evolutionary processes associated with the global climatic changes of the late Tertiary and the Quaternary • Centre of diversification for the Australian scleromorphic flora, including significant aspects of eucalypt evolution and radiation • Primitive species of outstanding significance to the evolution of the earth's plant life: – Wollemi Pine (*Wollemia nobilis*) – Blue Mountains pine (*Pherosphaera fitzgeralii*).	The significant aspects of scleromorphic flora and the existence of primitive species (including the *Eucalyptus* and eucalypt-dominated vegetation) present are representative of evolutionary processes for which the GBMA has been identified. Impacts on these attributes would only be anticipated to occur in instances where there was a direct impact to this flora as a result of ground disturbance or significant pollution resulting in loss of habitat or alteration to the existing evolutionary processes. Potential direct impacts from the operation of the flight paths are expected to be limited to the potential for wildlife strike to some bird species whose habitat is within the GBMA, or potential impacts associated with the unlikely event of an aircraft crash (and resultant potential impacts such as loss of vegetation, fire or potential pollution resulting) noting that, in the unlikely occurrence of such an event, the impact would only occur at a localised level. Ecologically, no operational activities are anticipated to result in impacts such that they would affect the existing inscribed values of outstanding ecological diversity for the GBMA or contribute to a decline in the habitat of the area that supports a significant range of species. As such, it is considered that the operation of the preliminary flight paths would result in no discernible impacts associated with the aspects of this criterion. Indirectly, noise and air emissions may result in some minimal impacts, however given the altitudes at which aircraft will be flying at the points at which they have the potential to impact on the GBMA, these impacts are not considered to present a threat to the values listed in this criterion values.	The preliminary flight paths would not result in any direct impacts on the attributes demonstrated within the GBMA relevant to evolutionary processes or to the potential for direct impact of primitive plant life species of outstanding significance such as the Wollemi Pine or Blue Mountains pine. Additionally, it is not considered that the operation of the proposed flight would result in any indirect impacts which may cause the World Heritage value to be being lost, degraded or damaged, or notably altered, modified, obscured or diminished. Accordingly, it is considered that the project is would not have a significant impact on the attributes identified for this World Heritage criterion.

Criterion	Criterion description	Flight path impacts	Assessment of significance
		Air emissions from the operation of aircraft utilising the preliminary flight paths are not expected to result in material contribution to global climate or overall air emissions that may impact on the evolutionary processes, or adaptation, of the existing environment. Additionally, direct emissions from fuel jettisoning are rare and, where undertaken in line with strict regulations guiding this process, disperses rapidly and evaporates prior to reaching the ground. As such, air emissions are not anticipated to have an impact on evolutionary processes of the GBMA. The expected noise emissions from overflights is not expected to affect the evolutionary processes associated with the GBMA. As discussed in Section 5.3.2.1, noise may indirectly result in some impacts to certain species currently existing within the GBMA, however given the altitudes at which aircraft would be flying at the points at which they have the potential to impact on the GBMA, the resultant noise impacts are not considered to present a threat to the biodiversity values for which the site was listed. Increases or changes to existing noise levels associated with the project within the GBMA would be largely limited and the predicted noise levels are unlikely to be of a magnitude that would threaten the viability of biodiversity attributes within the GBMA. The project's operational light would be limited to lights on aircraft as they travel along the flight paths during nocturnal hours. The magnitude of visual impacts at night (including light spill) would be experienced across a small portion of the urban area and would not contrast substantially with the surrounding landscape at night, and would not result in any impacts to the inscribed values of the GBMA for this criterion.	

Criterion	Criterion description	Flight path impacts	Assessment of significance
Criterion (x) biological diversity	The inscribed values of the GBMA for this criterion is associated broadly with: • outstanding diversity of habitats and plant communities • significant proportion of the Australian continent's biodiversity (scleromorphic flora) • primitive and relictual species with Gondwanan affinities • plants of conservation significance including 114 endemic species and 177 threatened species • habitat that supports 52 mammal species, 63 reptile species, over 30 frog species and about one third of Australia's bird species.	Ecologically, no operational activities are anticipated to impact on the existing outstanding ecological diversity of the GBMA or contribute to a decline in the habitat of the area that supports a significant range of species. As such, it is considered that the operation of the preliminary flight paths would result in no discernible impacts associated with the aspects of this criterion. Air emissions from the operation of aircraft utilising the preliminary flight paths are not expected to result in material contribution to global climate or overall air emissions that may impact on the evolutionary processes, or adaptation, of the existing environment. Additionally, impacts from fuel jettisoning are rare and, where undertaken in line with strict regulations guiding this process, disperses rapidly and evaporates prior to reaching the ground. As such, air emissions are not anticipated to have an impact on evolutionary processes of the GBMA. The assessment of potential noise emissions indicates that noise from overflights would not impact biological diversity values of the GBMA. Although the peak noise levels associated with direct overflight of the GBMA may temporarily disturb some species, flight path associated with WSI would generally be between at least 1,500 and 10,000 ft (or more) above ground level at most locations over the GBMA. A majority of the area within the boundaries of the overall GBMA site would not expected to have noise levels which exceed around 60 dB(A). Some smaller areas of the site (such as areas to the west of WSI and north of Lake Burragorang) may, at times, experience slightly higher levels of noise above 60 dB(A). As described in Section 5.3.2.3, these impacts are likely to be intermittent with generally low levels of aircraft movement and are unlikely to cause disturb to fauna within the GBMA, or affect the habitats of these fauna.	As discussed in Section 5.3.2.1, the preliminary flight paths would not result in any direct impacts on the examples of biological diversity present within the GBMA. Additionally, it is not considered that the operation of the preliminary flight paths would result in any indirect impacts which may cause the World Heritage value to be being lost, degraded or damaged, or notably altered, modified, obscured or diminished. Accordingly, it is considered that the project is would not have a significant impact on the attributes identified for this World Heritage criterion.

Criterion	Criterion description	Flight path impacts	Assessment of significance
Integrity	The integrity of the GBMA area is associated broadly with: • the level of protection (e.g., NPs and declared wilderness areas), size, topography and certain adjoining land uses (State Forests etc). • the size, condition (high wilderness quality) and connectivity of the natural bushland, plant communities and habitats. This extends to adaptation opportunities and ecological processes • its geological, geomorphology and water systems, which require the same level of protection • Aboriginal cultural values and custodial relationships	The implementation of the preliminary flight paths would not result in any change to the boundaries of the GBMA or the physical size of the area or the adjoining lands and buffer zones. The operation of the preliminary flight paths are not expected to have any impact on the plant communities and habitats within the Greater Blue Mountains Area to a level that would impact on the integrity of the existing environment. The project would not have a direct impact on the physical evidence of the cultural connection to the GBMA. Although it is possible to outline processes of potential rock art deterioration related to aircraft emissions, it is as yet, impossible to evaluate the risk presented by these processes, or indeed to identify and quantify any resulting damage as a result of the project. This is due to a lack of available research and comparative data, as well as the difficulty in differentiating aircraft emission derived deterioration from other anthropogenic pollution sources via the same processes (such as acidity, nutrients and dust). However, there remains a potential impact that the introduction of new or increased emissions from the preliminary flight paths to these environments may potentially result in some impact to known (or previously undiscovered) rock art, in particular in areas under the more frequently flown sections of flightpaths, though the likelihood of this is considered to be generally minimal. This is why the identification of test sites and the taking of baselines measurements and recordings has been recommended prior to flights commencing. Fuel jettisoning, should it impact rock art sites or other natural values within the GBMA, would be in contradiction of established procedures and likely the result of a rare and extreme emergency. Should such emergency occur immediate assessment of impacts to rock art should be considered in the environmental response.	The preliminary flight paths would not result in the loss of any elements necessary for the Greater Blue Mountains Area to express its Outstanding Universal Value, including potential impacts to the size, condition, ability to maintain connectivity or provide protection to its geological, geomorphology and water systems. The preliminary flight paths would not change the size or boundary of the GBMA and would not impact on any features and processes that convey the Greater Blue Mountains Area's Outstanding Universal Value or its existing integrity. While the project would not have a direct impact on the physical evidence of the cultural connection to the GBMA, it is inevitable that visual presence and aircraft noise would have the potential to impact the amenity of some Aboriginal sites within the GBMA, and the integrity of these areas with respect to custodial relationships.

Criterion	Criterion description	Flight path impacts	Assessment of significance
		It is inevitable that visual presence and aircraft noise would impact some Aboriginal sites within the GBMA, and the integrity of these areas with respect to custodial relationships. While flight paths associated with Sydney (Kingsford Smith) Airport already cross the Greater Blue Mountains Area, they currently do so at heights that minimise these intrusions. The preliminary flight paths would mean that aircraft are lower over areas of the Blue Mountains National Park, as they approach and depart WSI. The project would not affect all Aboriginal cultural places and practices throughout the much larger expanse of the GBMA, and First Nations people will continue to have a custodial relationship with the area. Sites considered in this assessment that are located within the GBMA (identified through engagement with stakeholders on sites of high cultural value) would not be severely impacted (with the exception of the Linden Ridge sites), and assessed sites would not be comprised to the level that comprises the values of the place, or would result in discontinuation of cultural practices at these sites. Mitigation includes a requirement for DITRDCA to ensure that the detailed design of flight paths considers Aboriginal places and sites of high cultural value, where safe and feasible. As such, it not expected that the project would have a significant impact on the overall integrity of the GBMA, with respect to ongoing custodial relationship with the GBMA. Many other Aboriginal sites are located in protected valleys that are overflown by WSI aircraft. Due to the complexity of terrain height and orientation of rock shelters in the rugged sandstone country it is not possible to predict to what extent noise and visual impact this will be an issue for many of these sites.	The project would not affect all Aboriginal cultural places and practices throughout the much larger expanse of the GBMA, and First Nations people will continue to have a custodial relationship with the area. Sites considered in this assessment that are located within the GBMA (identified through engagement with stakeholders on sites of high cultural value) would not be severely impacted, and assessed sites would not be compromised to the level that compromises the values of the place, or would result in discontinuation of cultural practices at these sites.

Table 5.10 Impacts on other values of the GMBA from the project

Values	Criterion attributes	Flight path impacts	Assessment of significance
Geodiversity and biodiversity	• Extensive dissected sandstone plateaus • Karst landscapes with several cave systems • Prominent basalt-capped peaks • Quaternary alluvial deposits • Specific sites of international or national significance	Potential impacts on this value would only occur in the unlikely event of an aircraft crash or from significant pollution resulting in loss of biota at a localised level (such as through fuel jettisoning). Any such impacts would be localised and are unlikely to have a significant impact on biota and habitats. No operational activities would have an impact on the identified criterion attributes and as such no impact on this overall value is expected to occur as a result of the project.	The preliminary flight paths are not anticipated to result in a significant impact on the geodiversity and biodiversity values associated with the GBMA.
Water catchment	• Wild rivers • Pristine and relatively undisturbed catchment areas • Substantial contribution to maintaining high water quality.	The GBMA contains numerous waterways and waterway catchments including major systems such as the Nepean, Hawkesbury and Grose Rivers in the east, Lake Burragorang and the Coxs, Kowmung and Abercrombie Rivers to the west and south, and the Wolgan, Wollangambe and Colo rivers towards the central area and the McDonald, Bylong and Goulburn Rivers to the north. Portions of the GBMA also includes part of the water catchment areas for the Warragamba Catchment. Four additional areas, which make up the Blue Mountains catchment (comprising the areas associated with Greaves Creek Dam, Medlow Dam, Cascade Dams and Woodford Dam) also adjoin areas of the GBMA. Potential impacts on this value would be anticipated to occur in the unlikely event there was an aircraft crash or through other operational actions resulting in potential harm to a waterway or water catchment (such as through fuel jettisoning).	While the contamination of the water is a possibility in the event of a crash, it is expected that the probability of a crash impacting on water quality or occurring within a large body of water such as Lake Burragorang is very low. For example, the likelihood of a potential impact in an area frequency of impact into am area such as Lake Burragorang is estimated to be around 1 in 240,000 years in 2033 and around 1 in 87,000 years in 2055. In the unlikely event of a fuel spillage from a crash, there may be some localised impacts water quality, however these are expected to be minimal given the dilution which would involve in such a large area of water, including portions of the Warragamba Catchment.

Values	Criterion attributes	Flight path impacts	Assessment of significance
			Additionally, while aircraft crashes are uncommon, the majority also occur along flight paths and close to the runway ends where the crash risk is more concentrated (i.e. not within the boundary of the GBMA). While a crash could occur, it would be remote and the likelihood that it would result in a significant impact on water quality or other water catchments or rivers would be expected to be similarly minimal. With respect to fuel jettisoning, this action is only required in extremely rare circumstances in the event of an emergency and is only relevant for certain types of aircraft. Fuel jettisoning may introduce harmful contaminants into the sensitive native terrestrial and aquatic ecosystems associated with the GBMA. If required, fuel jettisoning would be carried out safely in accordance with appropriate procedures. This would involve jettisoning fuel at sufficient altitude so fuel would volatise (change from liquid to vapour) as it falls and be completely dispersed as vapour before any liquid reaches the ground. Given the strict regulations associated with its implementation and the high evaporation rate of the fuel at higher altitudes, potential impacts are considered to be negligible and unlikely to have an immediate or future impact on water catchment values. Overall, the project is not anticipated to result in a significant direct or indirect operational impact on the water catchment values (or the extensive waterways) associated with the GBMA.

Values	Criterion attributes	Flight path impacts	Assessment of significance
Cultural values (Aboriginal)	• Prominent landscape features with spiritual significance: – Mt Yengo – Coxs River and Wollondilly River valleys • Aboriginal rock art • Potential for uncovering further significant sites.	The preliminary flight paths would also not directly or indirectly impact the existing use of or maintenance of existing Aboriginal cultural practices within the GBMA. There are places just outside the GBMA where cultural practices will be impacted and in the case of Bents Basin, that place is linked to other places in the GBMA. These impacts are discussed in further detail in Technical paper 9. The preliminary flight paths would fly over a number of significant cultural sites and places, however in many cases existing flight paths already traverse the airspace above these sites and places, including prominent landscape features with spiritual significance as well as known Aboriginal rock art sites. As described in Section 5.3.2.4, the distribution of the majority of known rock art sites occurs across a number of areas within the Sydney Basin, including throughout the GBMA. In the Sydney Basin, art sites generally only occur in sandstone-based topographies (formed on the Hawkesbury and Narrabeen sandstones) which support open sandstone platforms and overhangs. It should be noted that the actual number and incidence of rock art sites within the GBMA is likely to be greater and higher than those which have been formally identified through previous studies. The operation of the preliminary flight paths is also not expected to result in the potential for uncovering further significant sites.	It is acknowledged that there are prominent landscape features with spiritual significance within the GBMA that are important places for contemporary ceremony and practice. While the project would not directly impact the existing use of or maintenance of Aboriginal cultural practices within the GBMA, it is acknowledged that the preliminary flight paths would fly over a number of significant cultural sites and places. In many cases, existing flight paths already traverse the airspace above these sites and places. In addition, it is acknowledged that designing flight paths to avoid all Aboriginal and non-Aboriginal sites of cultural value would be impossible. In most cases aircraft would be at such a distance as to render the impact from these factors as minimal and are not expected to impact the overall integrity of the GBMA in relation to Aboriginal cultural values and custodial relationships. Although it is possible to outline processes of potential rock art deterioration related to aircraft emissions, it is as yet, impossible to evaluate the risk presented by these processes, or indeed to identify and quantify any resulting damage.

Values	Criterion attributes	Flight path impacts	Assessment of significance
			As a consequence of the relative location of the WSI on the distribution of rock art sites across the Sydney basin, it is considered that the higher concentrations of atmospheric pollutants associated with the proposal most likely to occur within the local area of WSI (within a 5 km radius). While a substantial number of both arrival and departure flightpaths overfly the sandstone ranges within the GBMA, given their height and distance from the WSI site, the impacts are unlikely to extend into the proximity of a majority of the rock art sites located within the GBMA.
Cultural values (historic heritage)	• Small graziers' huts • Cedar logging roads and stock routes • Ruins of oil shale mines and coal/shale mines • Road and transport routes • Recreation and tourism.	Operation of the proposed airport would not directly impact sites within the GBMA that have historic heritage values. Indirect impacts on recreation and tourism are considered below.	The preliminary flight paths are not anticipated to result in a significant impact on the historic heritage values associated with the GBMA. Of the listed non-Aboriginal heritage items, the greatest potential for impact to the value of the item would be on the Blue Mountains Walking tracks. There are 37 walking tracks listed on the SHR under this collective title. While the fabric and functionality of the tracks would not be impacted by overhead flightpaths, it is important to note that these tracks are a key to facilitating visitor access and are how most visitors experience them. The potential for intrusion (particularly noise but also to some extent visual) would have the potential to reduce the intangible values of these tracks (i.e. serenity, connection to nature, etc.). Indirect impacts on individual sites with historic cultural values (from impacts such as emissions and visual intrusion) are expected to be minimal.

Values	Criterion attributes	Flight path impacts	Assessment of significance
Recreation and tourism	• Vantage points on ridges and escarpments, offering 'outstanding vistas, from uninterrupted views of forested wilderness • Canyoning, bushwalking, rock climbing, nature observation, scenic driving, photography • Picnic sites and basic camping facilities • Catering, tours, accommodation	There are numerous vantage points on ridges and escarpments within the GBMA including: • Echo Point Lookout, Katoomba which offers panoramic views across GBMA including the Three Sisters, the Jamison Valley, Mount Solitary and Narrow Neck • Portal Lookout, offering views of the junction between Glenbrook Gorge and the Nepean River • Nepean Lookout, Nepean Lookout Trail • Walls Lookout, Bells Line of Road • The Rock Lookout, Mulgoa. Additionally, other recreation and tourism features which currently occur within the GBMA include: • campgrounds and day use areas such as: – Euroka Campground, Glenbrook – Perrys Lookdown, Blackheath – Dunphys Campground, Megalong Valley – Ingar, Wentworth Falls – Murphys Glen, Woodford • scenic and tourist drives such as: – 'Warragamba Waters scenic drive' along Silverdale Road and part of the 'Greater Blue Mountains Drive, identified by NSW NPWS. – 'Greater Blue Mountains scenic drive', including the Great Western Highway, from Sydney along the M4 towards the Blue Mountains and part of the 'Greater Blue Mountains Drive'.	While the line of sight between these vantage points to the forested wilderness would not be interrupted due to the height of the aircraft, there would be views where additional aircraft (to those associated with existing flight paths over the GBMA) would be seen flying overhead and across these views. The aircraft would range in height and distance from these locations but would be at least 1.5 km (5,500 ft) high and therefore of a relatively small scale. There may be locations where multiple aircraft are seen together, as the flight numbers increase over time (i.e. 2055 scenario), and where multiple flight paths intersect or overlap. The visual amenity and wilderness experience of these recreational activities would generally not be substantively impacted by the project. The visual impacts of the project have been concluded as being likely to be negligible to moderate-high. Walls Lookout and Echo Point would experience a moderate-high visual impact due to the high sensitivity of these views and the introduction of flights that would be perceptible moving across the view even though the altitudes are high. However, within the more remote and wilderness areas of the GBMA, there are scattered day use facilities and campgrounds. The camp sites are generally located in areas of high scenic quality and are generally considered to have a high sensitivity to impact. The effect of the project on campgrounds and day use areas would result in a slight reduction in the amenity of views resulting in moderate overall visual impacts. However, it is noted, these aircraft would be

Values	Criterion attributes	Flight path impacts	Assessment of significance
		There are also numerous historic Lookouts and walking tracks along the central Blue Mountains ridgeline. This includes many Lookouts between Wentworth Falls and Katoomba which are oriented to the south and towards the proposed WSI, including Echo Point Lookout, Wynnes Rocks Lookout, Walls Lookout (including the surrounding Victoria Falls, Mount Banks Picnic area and Lookout, Anvil Rock Lookout and the Baltzer Lookout).	at an altitude of over 1 km (5,000 ft), and would generally be visible only at a small scale in the sky. Additionally, there would be some tourist and recreational areas of the GBMA that would experience maximum noise levels of 60 dB(A) and greater. These location would include sites such as The Rock Lookout, the Nepean Lookout, The Oaks area, Murphys Glen, Ingar Campground, Katoomba River campground, Clearly Memorial Lookout, Ruined Castle Lookout, Wynnes Rock Lookout, Mount Banks picnic area and Lookout, Anvil Rock Lookout, Baltzer Lookout, Victoria Creek Cascades, Victoria Falls, and Burra Korain campground. The level of visitation in these areas is much lower than the Upper Blue Mountains. The noise impacts are not considered significant enough to result in any measurable economic impacts in terms of tourist visitation numbers to Blue Mountains area. Overall, the experience of some of these recreational activities may be slightly reduced by increased visual or noise intrusion associated with by aircraft movements.

Values	Criterion attributes	Flight path impacts	Assessment of significance
Wilderness	• Extensive natural areas • Absence of significant human interference • Opportunity to maintain integrity, gradients and mosaics of ecological processes • Opportunities for solitude and self-reliant recreation • Aesthetic, spiritual and intrinsic value.	As noted in the Integrity statement for the GBMA, 65 per cent of the area is designated as statutory wilderness. These areas are located primarily in the northern section of the site. The Greater Blue Mountains park system includes 5 declared wilderness areas through formal recognition of the Wilderness Act (Wollemi, Kanangra-Boyd, Nattai, Yengo and Grose) which encompasses over 551,000 hectares of wilderness areas in the GBMA. The Blue Mountains wilderness areas also protect 3 of only 6 streams declared as 'Wild Rivers' in NSW under the NP&W Act: the Colo, Grose and Kowmung. Access to these areas is predominantly limited to hikers and other low impact tourism activities. Aircraft operations would include various flight paths that would traverse above each of these wilderness areas. As a result of the operation of the flight paths, some areas of Wollemi National Park, Kanangra-Boyd National Park, Yengo National Park and Natti National Park (night time only) would have the potential to be affected by noise associated with infrequent overflights of aircraft. Aircraft over flying these areas would be able to be seen from these declared wilderness areas, including infrequent overflights at night.	The preliminary flight paths are not anticipated to result in a significant impact on the wilderness values associated with the GBMA. While some noise and visual impacts may potentially occur to the wilderness areas, these are considered to be generally insignificant for a vast majority of wilderness areas and are not considered to be such that they would interfere with the values attributed to the wilderness nature of the GBMA. As a result of the proposed overflights, a small proportion of the wilderness areas may be impacted by visual and lighting changes (night time), however, these are considered to be insignificant for a vast majority of wilderness areas. The proposed lighting from aircraft at night is considered to be minimal when considered in the context of their contribution to urban sky glow within the broader Sydney Basin.

Values	Criterion attributes	Flight path impacts	Assessment of significance
Social and economic	• Regional economy largely supported by tourism • The GBMA has considerable social and economic value and contribute directly and indirectly to the employment, income and output of the regional economy.	The location of the flight paths over the GBMA have the potential to negatively affect the tourist experience of the area either through the visual location of planes or the noise they will generate, as well as the social and economic value that tourists contribute directly and indirectly to the employment, income and output of the regional economy. Negative (or perceived negative) impacts associated with the project could lead to a reduction to the number of tourists coming to the local area and in turn can reduce the tourist dollars being spent in the local economy.	While most tourists who visit the Greater Blue Mountains are day trippers, there are a number who stay overnight and longer. Noise affecting tourist accommodation such as hotels, motels and camping grounds would have the potential to lead to fewer tourists staying for more than a day which could have a marked impact on the local tourist accommodation. It is noted however that there is only one short stay accommodation place within N60 contour within the Blue Mountains, meaning the potential of impacts on this type of accommodation would be minimal. The key impact that may affect people visiting the Blue Mountains for a day could be impacted due to the noise while they're undertaking any outdoor pursuits (including overnight tourist activities such as camping). There could also be a reduction on the amount of tourists visiting local eateries, shops, and markets leading to a reduction in the indirect benefits of the GBMA tourist areas. Conversely, it is expected that the location of an international airport closer to the GBMA could also provide a boost to the tourists within the area outweighing the potential impact of the flight paths. As planes fly over such a distinct and unique area of Australia, tourists will be able to gain an appreciation over the area and could choose to stay in the area for longer. The flights that will use WSI could bring more people into Western Sydney who may have always flown into Sydney (Kingsford Smith) Airport and therefore not been close enough to the area for a visit.

Values	Criterion attributes	Flight path impacts	Assessment of significance
			Based on consideration of the potential social and economic impacts identified, it is expected that impact to the visitor economy and livelihoods associated with the Blue Mountains World Heritage Listing is low. The project is not expected to result in a substantial impact to the social and economic values that contribute directly and indirectly to the employment, income and output of the regional economy associated with the GBMA.
Research and education	• High scientific value discovered and undiscovered • Scientific research into the identification, conservation and rehabilitation of World Heritage values, best management practice and threat abatement • Education value for schools and universities.	Operation of the preliminary flight paths area not expected to have an impact on the biological diversity of the GBMA or the availability of the area for scientific investigation and research.	The preliminary flight paths are not anticipated to result in a significant impact on the research and education values associated with the GBMA.

Values	Criterion attributes	Flight path impacts	Assessment of significance
Scenic and aesthetic	• Vertical cliffs, waterfalls, ridges, escarpments. • Outstanding vistas, uninterrupted views of forested wilderness • Extensive caves • Sandstone canyons and pagoda rock formations.	Aircraft overflying key tourism and recreation areas would be more than 5,000 ft (1.5 km) above the relevant ground level and at this altitude, would have limited visual intrusion. Similarly, visual and lighting impacts of WSI are not considered to represent a significant change to existing conditions for scenic and aesthetic amenity.	Aircraft would be at least 1.5 km (5,000 ft) above the Blue Mountains, in the vicinity of key views and would not obstruct views to the sandstone canyons and pagoda rock formations. There are currently aircraft visible intermittently over the Blue Mountains, however, there would be more frequent flights and flights seen in key viewpoints and campgrounds across the GBMA including in views from Echo Point, Rock Lookout, Cleary Memorial Lookout and Portal Lookout. Views to narrow sandstone canyons and pagoda rock formations, such as in views to the 'Three Sisters' Lookout at Echo Point, Katoomba would include distant aircraft crossing views at a high altitude in the background. The scenic value of these views would be altered slightly reducing the visual amenity of these views. Due to the very high sensitivity of these views, a low magnitude of change would result in a high-moderate adverse visual impact. With respect to each of the other individual criteria attributes: • views to vertical cliffs and waterfalls, ridges and escarpments may include distant aircraft where they are overflown by air traffic, however these would not impact on the existing attributes of these features • there would be no direct or indirect impact on the cave networks as views to these features do not rely on views of the sky.

Values	Criterion attributes	Flight path impacts	Assessment of significance
Bequest, inspiration, spirituality and existence.	• Opportunities for solitude and quiet reflection • Aboriginal cultural connections • Ensuring that future generations can experience and appreciate the uniqueness of the areas associated with the GBMA.	Operation of the preliminary flight paths area not expected to have a direct impact on the existing inspiration, spirituality and existence values of the GBMA. A key concern raised by First Nations knowledge holders and by owners and managers of heritage properties as part of the preparation of the impact assessment for the project did identify the potential for increased noise at heritage places especially where the cultural values relate to connecting with nature, spirituality (including but not limited to connections between the skyscape and landscape), experiencing a sense of serenity and well-being.	Overall, it is acknowledged that designing flight paths to avoid all Aboriginal and non-Aboriginal sites of cultural value would be impossible, including those associated with the GBMA. The preliminary flight paths would fly over a large number of significant sites and places, however in many cases existing flight paths already traverse the airspace above these sites and places. In addition, many types of heritage places are considered robust in the face of impacts such as air pollution, noise and visual impacts. In most cases aircraft would be at such a distance as to render the impact from these factors as minimal. However, the places closest to WSI are likely to experience higher impacts.

5.4.3 Facilitated impacts

It is anticipated that the facilitated airspace changes would not result in any noticeable change to the values and attributes associated with the GBMA that currently occur from the extensive network of existing flight paths that currently operate over the Sydney Basin and GBMA. Potential impacts would occur within areas already subject to and expected to continue to be subject to routine flight paths associated with the Sydney (Kingsford Smith) Airport, Bankstown and Camden Airports, and RAAF Base Richmond.

Most alterations to existing flight paths would not result in any discernible change (extensions) in track distance lengths (i.e., greater than 1 nm or 1.852 km) or general location of which flights would pass over the GBMA. Key exceptions to this are the changes to:

- Sydney (Kingsford Smith) Airport Runway 25 KADOM SID, which would reposition this flight path further north and on a more confined corridor. Predicted N60 and N70 contours do not extend into the GBMA. The runway is also only used around 4 per cent of the year, or 15 days a year.
- Sydney (Kingsford Smith) Airport Runway 34L KADOM SID for southern departures via waypoint TONTO, which is infrequently used with around 1 to 2 flights per day. Noise from aircraft would be below 50 dB(A) as it flies over the GBMA.
- Sydney (Kingsford Smith) Airport non-jet departures to the west and north west which would result in a greater distance of overflight over the GBMA (up to around 5.5 nm (10 km) for aircraft heading west and around 10 nm (19 km) for aircraft heading north west). Around 20 aircraft per day on a busy day is expected to use the proposed SID, noting aircraft would be at 11,000 ft or higher by the time it flies over the GBMA and noise levels would be below 60 dB(A). The area of the GBMA that would be impacted would generally extend between Silverdale and north of Mount Victoria, nothing that these areas are currently subject to a number of existing flight paths associated with existing airports.
- STARs for Camden and Bankstown aircraft operating under IFR would position aircraft on a nominated approach path over the GBMA (laterally or at an altitude), noting aircraft from the west already pass over the GBMA. Noise at waypoints are predicted to be below 60 dB(A) except for twin-engine propeller aircraft where it could reach up to around 65–69 dB(A) (L_{Amax}) (depending on the aircraft) when aircraft at lower altitudes (around 2,500–3,600 ft above the underlying terrain).
- A proposed transit routes would fly over parts of the GBMA. For aircraft below 10,000 ft (non-pressurised piston-engine aircraft), noise levels could around above 70 dB(A) where aircraft is 1,000 ft above sea level to 60 dB(A) at 5,000 ft. These routes would be infrequently used or used by a low number of aircraft (around 10 flights per day).

It is anticipated that the facilitated airspace changes will not significantly impact the biodiversity values attributed to the GBMA site or any other identified values including those associated with cultural and heritage, recreation or tourism values as they will occur within areas already subject to, or close to, routine flight paths by similar aircraft types associated with existing airports within Sydney Basin.

5.4.4 Cumulative impacts

Cumulative impacts have the potential to occur when impacts from a project interact or overlap with impacts from other projects. These impacts can potentially result in a larger overall effect (positive or negative) on the environment.

5.4.4.1 Related actions, proposals and impacts

Table 5.11 summarises the proposals/projects or ongoing actions that have been identified, or are currently being taken within the broader vicinity of the project that may result in cumulative impacts on the GBMA.

Table 5.11 Related actions and proposals

Related action(s) or proposal	Overview
Warragamba Dam Raising project	The proposed Warragamba Dam Raising project proposes to increase the height of the existing Warragamba Dam wall in order to provide additional flood mitigation through increased temporary storage allowing for improved controlled water release. While not directly located within the GBMA site, the project would be located adjacent to the southern end of the GBMA within the Wollondilly Shire LGA. The project has been deemed to be a controlled action (reference number 2017/7940) and is subject to approval under the EPBC Act. Upstream areas that could be impacted by the project are located within the GBMA. On 8 June 2023, WaterNSW (as the proponent) provided an update on the status of Warragamba Dam on its website and stated that it is not NSW Government policy to raise the dam wall for flood mitigation or additional storage (WaterNSW, 2023). WaterNSW (2023) advised that it is now assessing what are the practical and reasonable ways to reduce risks to downstream communities associated with extreme floods and to adapt to climate change in line with contemporary dam safety regulatory standards. Investigations are now underway to explore what measures may be required to address these risks and as such the required work (which could be infrastructure or non-infrastructure related) is not known. As WaterNSW has stated that dam rising for the purposes of flood mitigation is no longer proceeding and any required future work (and therefore impacts) are undefined, this assessment has not considered this project further.
Great Western Highway upgrade program	Transport for NSW is currently working on a program to upgrade sections of the Great Western Highway throughout the Blue Mountains. The works currently in delivery include upgrades to locations such as Medlow Bath, Mount Victoria and between Little Hartley and Lithgow. These upgrades would provide important economic and safety benefits and will improve the connection between Central West NSW and Sydney for thousands of residents, commuters, tourists and freight operators who travel in, around and through the Blue Mountains. While providing important access improvements, the increased access is also likely to increase traffic within the region and may allow for increased urban development of the region. Additionally, the improved access may also result in increased levels of tourism accessing the region. These factors may result in indirect impacts to the GBMA (such as increased noise and air quality) and may potentially lead to contributing to diminishing of the values associated with the GBMA. Additional upgrade works have also been identified between Katoomba and Blackheath, and between Little Hartley and Lithgow that would generally split the existing road configuration into 2 lanes in each direction. Timing for the delivery of these works is however currently unknown.

Related action(s) or proposal	Overview
2019–2020 bushfire impacts	The 2019–20 bushfires in NSW were unprecedented in their extent and severity in recent history. They occurred during a period of record-breaking temperatures and extremely low rainfall with the Australian Government Bureau of Meteorology determining 2019 was Australia's warmest and driest year on record (DAWE, 2020). The GBMA was affected by bushfire from late October 2019 to early February 2020. During this time, more than 60 per cent of the GMBA was fire-affected and more than half of this burnt with high or very high severity (DCCEEW, 2022b). While assessment of the overall impacts of the fires on the GBMA Outstanding Universal Value are still to be fully quantified, it is estimated that a number of ecological communities known to occur in the Greater Blue Mountains Area are at high risk of decline due to the combined effects of high fire frequency and drought. Impacts of the fires identified to date have included impact to the following important environmental values within the Greater Blue Mountains Area (DCCEEW, 2022b): • 10 Threatened Ecological Communities including Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion, Temperate Highland Peat Swamps on Sandstone and Lowland Rainforests of Subtropical Australia • around 99 animals including the following threatened species (all of which have both NSW and Commonwealth status of either endangered and/or vulnerable): Blue Mountains Water Skink, Broad-headed Snake, Brush-tailed Rock-wallaby, Koala, Spotted-tail Quoll, Gang-gang Cockatoo and the Stuttering Frog • around 101 plant species including the Wollemi Pine, Benson's Stringybark, Kowmung Hakea, Fletcher's Drumsticks, and Paddys River Box.
Mining	At its 43rd session in 2019 the World Heritage Committee requested the Australian Government undertake an assessment of the potential cumulative impacts of all existing and planned mining projects in the vicinity of the Greater Blue Mountains Area. In response to this request, the Australian Government commissioned CSIRO to undertake a comprehensive review of the potential risks from mining near the Greater Blue Mountains Area, releasing the *Potential cumulative impacts of mining on the Outstanding Universal Value of the Greater Blue Mountains* Area in 2022 (DAWE, 2022). The report identified that at the time of preparation of the report, 15 existing and planned open-cut and underground coal mines and 3 sand mines within 20 km of the GBMA were identified as potential threats to its Outstanding Universal Value. The report identified a highly conservative potential cumulative impact area of 1,984-square km within the 10,438-square km GBMA, distributed across 6 discrete areas, where cumulative impacts from mining could occur in the absence of protection and management measures. Within the identified potential cumulative impact area, the risk of significant impacts to components of the property's Outstanding Universal Value is assumed to generally decrease with increasing distance from the mining areas. The report identified that the greatest mining-associated risk to the Outstanding Universal Value was potentially to the 'water systems' of the GBMA via water table lowering and changes in streamflow, water quality and channel condition. Water systems of the GBMA include streams, riparian areas and many groundwater-dependent ecosystems, occupying about 400 square km potential cumulative impact area. The Australian Government used the independent CSIRO analysis to determine residual risk of the identified mining operations to the 8 high-level components of the Outstanding Universal Value. Overall, the residual risk to the Outstanding Universal Value of the GBMA was assessed as 'low' because most potential impacts are currently effectively mitigated by strict environmental conditions imposed on mine operators.

5.4.4.2 Assessment of impacts

Potential cumulative impacts on the GBMA associated with the project and the related actions/impacts identified in Table 5.11 include:

- incremental increases in potential wildlife injury or mortality due to wildlife strike (in particular associated with cumulative impacts associated with Great Western Highway upgrades)
- incremental increases of noise and light exposure that may disrupt species within the locality for example lead to species relocating or alter species behaviour and communication
- alterations to air quality, greenhouse gas emissions and water quality (in particular associated with cumulative impacts associated with ongoing mining).

Potential cumulative impacts on the GBMA resulting from the project are considered to be minimal, as the project is not expected to result in significant on-ground impacts. Despite this, the project does however have the potential to result in contributing incremental increases in impacts such as wildlife strike, noise, light and alteration of the overall air quality within the GBMA.

Overall, aircraft operating from WSI concurrently with aircraft from other Sydney Basin airports have the potential to increase overall noise exposure of communities being directly overflown by the preliminary flight paths, immediately peripheral to and further surrounding WSI, and underneath or along the other flight paths in use. Overall noise exposure in a geographic area as large as the Sydney Basin does not necessarily translate into a quantifiable cumulative increase in impact. WSI will introduce additional aircraft into an already complex and heavily trafficked Sydney Basin airspace environment. In 2033, this additional traffic is projected to represent around 9 per cent of total projected Sydney Basin air traffic movements (estimated to be over 890,000 movements inclusive of the expected 81,000 movements projected at WSI in 2033). The cumulative contributions of impacts from the project in addition to the impacts that are expected from projects such as the Great Western Highway upgrades and ongoing mining projects in areas adjacent to the GBMA are considered to be minimal to negligible.

With respect to cumulative noise, it is important to note that a 60 dB(A) event in an area already experiencing for example 70 dB(A) would not result in an arithmetic addition of exposure. Rather, the resulting addition of sound waves reaching the human ear will be less than 71 dB(A) and the difference not discernible to the human ear.

Chapter 6 Management and mitigation measures

6.1 Existing management of GBMA

Strategic planning and management for the GBMA is guided by a number of policies and guidelines relating to the consideration of management of World Heritage including:

- the provisions in the *2021 Operational Guidelines for the Implementation of the World Heritage Convention* (UNESCO, 2021) which outline Australia's obligations under the World Heritage Convention
- the *Greater Blue Mountains World Heritage Area Strategic Plan* (NSW DECC, 2009) and *Greater Blue Mountains World Heritage Area Strategic Plan Addendum 2016* (NSW Office of Environment and Heritage, 2018)
- the *2013 IUCN advice note on environmental assessments* (IUCN, 2013)
- the Australian World Heritage management principles (Schedule 5 of the EPBC Regulations).

Of particular importance to the ongoing management of the GBMA are the *Greater Blue Mountains World Heritage Area Strategic Plan* (NSW DECC 2009) and *Greater Blue Mountains World Heritage Area Strategic Plan Addendum 2016* (NSW Office of Environment and Heritage, 2018). These plans provide the frameworks for the GBMA integrated management, protection, interpretation and monitoring.

The key management objectives set out in the Strategic Plan (NSW DECC, 2009) provide the basis for the management of the Greater Blue Mountains and guidance for operational strategies in accordance with requirements of the World Heritage Convention and its Operational Guidelines (UNESCO, 2021).

The Strategic Plan and Addendum identifies the following threats to the integrity of the area that require protection measures to be identified for:

- uncontrolled and inappropriate use of fire
- inappropriate recreation and tourism activities, including development of tourism infrastructure
- invasion by pest species including weeds and feral animals
- loss of biodiversity and geodiversity
- impacts of human enhanced climate change
- lack of understanding of heritage values.

To date, these strategic plans and guidelines have been an effective means of guiding appropriate management of impacts to date.

6.2 Project specific mitigation measures

No GBMA-specific management and mitigation measures have been identified, however, a number of measures identified as part of supporting technical papers have identified mitigation measures that would apply to impacts associated with the GBMA (refer Section 6.3).

6.3 Dependencies and interactions with other mitigation measures

As outlined in Section 1.4 this technical paper has interactions with other technical studies supporting the EIS for the project. Interactions between mitigation measures in these technical papers that are relevant to the impacts on the GBMA and include:

- Noise (Technical paper 1) including:
  - the development and review of noise abatement procedures in consultation with stakeholders, including aircraft operators, airlines, WSA and FoWSA/WSI Community Aviation Consultation Group (CACG) following a draft proposal developed by the Expert Steering Group
  - to establish a CACG to ensure appropriate community engagement on airport planning and operations
  - undertaking a post-implementation review (PIR) of the flight path design and implementation.
- Aircraft hazard and risk (Technical paper 4) including:
  - implementation of contingency planning to respond to the impacts of crash events as per Part 139 Aerodromes Manual of Standards 2019
  - application of existing procedures to deal with aircraft fuel jettisoning occurrences as per AIP ENR – Section 11.14.5 (Airservices Australia, 2022)
  - monitoring and control the presence of birds and other wildlife on or in the vicinity of WSI in accordance with Civil Aviation Safety Regulations (CASR) Part 139 MOS requirements and National Airports Safeguarding Framework (NASF) Guideline C.
- Biodiversity (Technical paper 8): including:
  - mitigation options and management recommendations for regional species associated with wildlife strike
  - monitoring and assessment measures for land uses which could attract wildlife strike species.
- Heritage (Technical paper 9): including:
  - ensuring that the detailed design phase considers Aboriginal cultural places and values, where safe and feasible
  - undertaking a research program to investigate the potential impact of aircraft emissions on historic and Aboriginal heritage sites (including rock art sites), with a particular focus on sites within the Greater Blue Mountains Area.
- Social and economic impact (Technical paper 10 and Technical paper 11) including:
  - ongoing community consultation and feedback
  - continue to consult with emergency services operators regarding priorities of airspace (in particular during emergency situations such as firefighting operations or search and rescue).

Chapter 7 Conclusion and recommendation

This chapter provides the justification and conclusion to the assessment and provides a concluding recommendation regarding the project.

7.1 Summary of project benefits and impacts

7.1.1 Benefits of the project

The project is an integral part of WSI, ensuring that the benefits of WSI are realised.

WSI (and the associated flight paths that allow for its operation) will be a major catalyst for investment and jobs growth in the Western Sydney region and will deliver benefits to the Australian economy more broadly. As described, demand for passenger journeys in the Sydney region is forecast to more than double from 2015 to 2035 (DITRDC, 2021). WSI will increase aviation capacity for Sydney, meaning more passenger and freight services and less congestion for travellers. WSI will cater for domestic, international and freight flights with airport terminal facilities designed for both low cost and full service carriers, providing the growing communities of Western Sydney with better access to aviation services.

The development and operation of WSI will support the population and economic growth in the Western Sydney region and broaden employment opportunities. It is estimated that an airport in Western Sydney would generate $24.6 billion in direct expenditure by 2060 and contribute a $23.9 billion increase in Gross Domestic Product (GDP) to the national economy (DITRDC, 2021). It will also support almost 28,000 direct and indirect jobs by 2031, increasing to around 47,000 direct and indirect jobs by 2041 (Ernst and Young, 2017). These job opportunities would span aviation, supporting services and non-aviation industries (DITRDC, 2021).

WSI will provide direct connections across the world, allowing opportunities to enhance Western Sydney's connection to world economies. The operation of WSI will allow for improved access to tourism opportunities, providing better accessibility to destinations across Western Sydney and the Greater Blue Mountains. New or upgraded transport infrastructure that would be built to service WSI would also provide benefit to local communities.

Further information regarding the needs and role of WSI (and the associated flight paths that allow for its operation), as well as its anticipated benefits, are discussed in Chapter 2 (Strategic context and need) of the EIS.

7.1.2 Summary of impacts to the GBMA

Key impacts that have been identified as a result of the project on the GBMA and its associated World Heritage values are summarised below.

7.1.2.1 Biodiversity

Potential direct impacts to biodiversity as a result of the project would include:

- potential for wildlife strikes during operation, including possible impact on a range of species (Grey-headed Flying-fox and other bird species) which provide contributing attributes to the World and National Heritage values of the GBMA
- the potential for an aircraft crash to result in an impact on flora and fauna. Whilst this potential impact is likely to only affect a localised area, such an occurrence may result in direct impact on the values and attributes of the GBMA.

Other potential indirect impacts to biodiversity as a result of the project would include:

- noise impacts. Most anticipated noise related impacts on biodiversity would be concentrated within the wildlife buffer for WSI (up to around 13 km from WSI runway). Most other noise impacts outside these locations (including within the GBMA) would likely be intermittent and unlikely to disturb fauna within the GBMA or affect the habitats of this fauna. Sensitive species within the GBMA which may be susceptible to alterations in current noise levels would include Regent Honeyeater and flying-fox populations

- night-time lighting effects – even though there may be a slight increase in light (resulting from warning and other lighting indicators on aircraft at night), existing biodiversity associated with the GBMA is unlikely to be significantly affected and would therefore not impact on the biodiversity attributes and values associated with the GBMA.

7.1.2.2 Visual and landscape

Some visual impacts resulting the preliminary flight paths, including those that would pass over the GBMA, would be unavoidable due to the introduction of new aircraft operations at WSI. With respect to potential impacts:

- iconic landscape character features of the Blue Mountains, such as the dramatic system of vertical cliffs, sandstone canyons, pedestals and pagoda rock formations that fringe the plateaus such as the Kanangra Walls, The Three Sisters and the long lines of Narrow Neck and Mount Solitary would experience potentially high-moderate impacts due to the visibility of aircraft passing within the viewsheds of these locations. Similarly, areas further away from these iconic areas, such as adjacent reserves including the Burragorang and Nattai State Conservation Areas, would also have potentially moderate impacts due to the visibility of aircraft passing over these locations
- as a popular tourist destination, many areas within the GBMA offer highly scenic views, as well as opportunities for stopping to appreciate the view from Lookouts or other vantage points. While each Lookout would have differing impacts, generally aircraft would have some form of visibility from Lookouts across the GBMA resulting in a range of amenity impacts. Depending on the significance of the viewpoint, their location and the spatial extent of the preliminary flight paths, impacts may vary from generally minimal (where aircraft would be viewed at high altitudes in an open and expansive sky or viewed in the backdrop of an urban fringe area) to high-moderate visual impacts (as in the case of potential impacts from the Echo Point Lookout towards The Three Sisters and Mount Solitary)
- within the more remote and wilderness areas of the GBMA, there are scattered day use facilities and campgrounds. The camp sites are generally located in areas of high scenic quality and are generally considered to have a high sensitivity to impact. The effect of the project on campgrounds and day use areas would result in a slight reduction in the amenity of views resulting in moderate overall visual impacts
- the effect of lighting from the proposed night-time flight paths on areas such as Lookouts and other GBMA features would generally be minimal, as these locations would not typically be utilised at night, and impacts from the project would only be seen as distant flashing lights at high altitudes. Where these areas are used at night (such as Katoomba Falls Night-lit Walk and around Echo Point and the Three Sisters) existing lighting at these locations would also minimise potential impacts. Similarly, the effect of night-time flight paths on GBMA users at locations such as campgrounds would be considered to be negligible, given the minimal level of change and the few number of people that may experience this change.

7.1.2.3 Noise

Increased levels of noise resulting the preliminary flight paths, including those that would pass over the GBMA, are a consequence of the introduction of aircraft operations at WSI. With respect to impacts on the GBMA:

- the assessment identified that, while the vast majority of the overall GBMA would not experience significant noise increase, there would be some areas of the GBMA that would experience maximum noise levels of 60 dB(A) and greater. The areas of greatest impact would typically be in the region between the Great Western Highway and Lake Burragorang (Warragamba Dam). Within the GBMA, locations within these contours include sites such as The Rock Lookout, the Nepean Lookout, The Oaks area, Murphys Glen, Ingar Campground, Katoomba River campground, Clearly Memorial Lookout, Ruined Castle Lookout, Wynnes Rock Lookout, Mount Banks picnic area and Lookout, Anvil Rock Lookout, Baltzer Lookout, Victoria Creek Cascades, Victoria Falls, and Burra Korain campground

  At night, sites such as The Oaks picnic area, the Nepean Lookout, the Burragorang Lookout and the Ruined Castle Lookout would be the key locations impacted by the RRO mode of operation (noting that these areas would not typically be frequented by visitors during night-time periods)
- when taking into account the frequency of movements associated with the noise increases, the section of the GMBA generally to the south of the Great Western Highway would be the most overflown areas during the day and night due to their location in relation to WSI, with the Nepean Lookout and the Rock Lookout near the eastern boundary of this area likely to see the most noticeable changes in amenity

- noise levels over 70 dB(A) L_{Amax} may be experienced occasionally by users of walking trails and camp sites within the areas of the Blue Mountains National Park near the Nepean River, and Warragamba dam. However, maximum sound exposure levels would more typically range from below 50 dB(A) to 60 dB(A) based on the aircraft type, with some noisier wide-body jets reaching closer to 65 dB(A) near the flight paths.

7.1.2.4 Aboriginal and non-Aboriginal heritage

Many Aboriginal sites such as artefact occurrences which currently exist within the GBMA would not be directly/ physically impacted by the project. However, there are places within the GBMA where the connection to a place or the physical fabric of a place may have the potential to be impacted. These include:

- potential disruption to places of significant spiritual values, for example, the potential for disruption of the land-sky connection between the 'Emu in the sky' constellation through the intrusion of aircraft
- amenity impacts resulting from aircraft noise which may affect the cultural values of some sites, for example sites whose values include the need for peace, tranquillity, and spiritual connection. In relation to specific Aboriginal Places, including locations such as Emu Cave, The Three Sisters, Euroka Clearing, Nye Gnorang and at Shaws Creek in Yellomundee, the development of the flight path design sought (and would continue to seek) to avoid impacts on Aboriginal Places as far as possible
- potential impacts to Aboriginal rock engravings/pigment art which typically occur on sandstone surfaces. These places may be affected physically through additional dust or chemical interaction of pollutants on these rock surfaces
- amenity impacts to visitors to non-Aboriginal sites/items. Notably, the Blue Mountains walking tracks of which there are 37 walking tracks listed on the State Heritage Register under this collective title. While the fabric and functionality of the tracks would not be impacted by the project, the potential for intrusion (particularly noise but also to some extent visual) would have the potential to reduce the intangible values of these tracks (i.e. serenity, connection to nature, etc.).

7.1.2.5 Social and economic

Consideration of the potential social and economic impacts as a result of the project concluded that there are potential impacts on the existing use or values attributed to the GBMA. These impacts may include:

- changes to the use and enjoyment of social infrastructure – it is anticipated that those who visit and use walking tracks, Lookouts and other sensitive areas, in areas where increase in potential noise levels and/or visual intrusion from aircraft may be experienced, would be likely to experience a moderate change to their use and enjoyment of these areas
- detrimental effect to Aboriginal cultural values due to tangible and intangible impacts, with noise and visual intrusion having the potential to result in moderate change to Aboriginal cultural values associated with GBMA
- minimal detrimental effects to wellbeing as a result of changes to amenity (in particular to GBMA visitors to Lookouts and walking tracks)
- potential economic impacts on tourism, including ecotourism, with both potentially positive and negative impacts identified
- potential risk to the visitor economy and livelihoods associated with Blue Mountains World Heritage Listing, noting that potential social and economic impacts are considered unlikely.

7.1.2.6 Air quality and greenhouse gases

Consideration of the potential air quality and greenhouse gas impacts as a result of the project concluded that:

- the project's impact on the concentrations of the assessed potential pollutants and their impact on areas of the GBMA would be negligible and unlikely to be discernible or measurable within the existing background concentrations
- overall, the emissions of CO_2e attributed to WSI from main engine use by aircraft operating along WSI's flight paths (including those that would travel over the GBMA) in either 2033 or in 2055 would not be considered sufficient to result in significant impacts or inhibit the achievement of net zero economy targets set by the Australian or NSW Government for 2050.

7.2 Concluding statement

The Greater Blue Mountains is an area of diverse landscapes comprised of important ecological, geological and cultural significance and is listed as a World and National Heritage place. The GBMA represents one of the largest and most intact tracts of protected bushland in Australia.

This assessment has been based on the preliminary flight path design as presented in the EIS for approval.
The preliminary flight paths have been designed, to the greatest extent possible to date, to avoid and minimise impacts (including impacts to the GBMA), and to respond to issues that have been previously raised by the community and other stakeholders. The continued refinement and finalisation of the flight path design would be further developed with the objective of further avoiding and minimising potential impacts on the local and regional environment, including the GBMA.

Given the nature of the project, the preliminary flight paths are expected to result in minimal direct impacts on the World Heritage or National Heritage values of the area, including the Outstanding Universal Value which contribute to its World Heritage status, with direct impacts primarily associated with the potential for wildlife strikes to species that utilise habitats within the GBMA and the potential for localised impacts in the unlikely event of an aircraft crash. Overall, these potential direct impacts on vegetation or fauna habitats associated with the project are likely to be minor, infrequent and rare. Additionally, preliminary flight paths would not change the size or boundary of the GBMA and would not significantly impact on any features and processes that convey the GBMA's Outstanding Universal Value or its existing integrity, including its:

- geological, geomorphology and water systems,
- size, condition (high wilderness quality) and connectivity of the natural bushland, plant communities and habitats, or
- connection to Aboriginal cultural values and custodial relationships.

Potential indirect impacts on World Heritage and National Heritage values from the operation of the preliminary flight paths have been assessed with respect to the identified qualities and attributes identified for the GBMA in its Statement of Outstanding Universal Value and the other corresponding values of the area as defined by the GBMA Strategic Plan. This assessment has considered a range of potential impacts from the preliminary flight paths including noise, visual amenity, air quality and cultural/heritage impacts as a result of aircraft overflights of the GBMA. This assessment concludes that the operation of the preliminary flight paths would not have a significant impact on the World Heritage and or other listed values of the GBMA. In particular, the indirect impacts of the flight path operations are not anticipated to result in the existing qualities of the GBMA being degraded, damaged, lost, or substantially altered, modified, obscured or diminished.

Overall, the project, including the proposed refinements following exhibition of the Draft EIS, is unlikely to have a significant impact on the biodiversity values, and the integrity of those values, for which the GBMA was listed. It would not result in the loss of any elements necessary for the GBMA to express its Outstanding Universal Value with respect to its size, biodiversity condition, ability to maintain connectivity or provide protection to its geological, geomorphology and water systems.

The implementation and operation of the preliminary flight paths is considered to be a critical component to the operation of WSI, and therefore in meeting the long-term needs for increased aviation capacity for Sydney. This assessment has shown that the project is not expected to result in unacceptable significant impacts on the GBMA, including the elements which comprise the World Heritage values of the GBMA. However, despite efforts to avoid and minimise impacts through design, residual impacts would remain, due to the unavoidable nature of flight path design within an already highly utilised airspace.

On balancing the need and benefits of the project with the potential residual impacts, the project is considered to be justified and warrants recommendation for proceeding and approval.

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Appendix A

Detailed visual impact discussion

A1 Representative landscape character zones within the GBMA

Table A.1 Blue Mountains iconic features landscape character zone

	Assessment level	Details
Baseline		
Sensitivity	Very high	This character zone contains the distinctive, unique and landscape features for which the Blue Mountains obtained World Heritage Area status, including dramatic landform (vertical cliffs, sandstone canyons, pedestals and pagoda rock formations) and native vegetation. This character zone comprises a high sense of tranquillity and wilderness with minimal evidence of human presence.
2033 Scenario		
Magnitude of change	Low	Some of the landscape features in this zone that would be overflown or in close proximity to the preliminary flight paths include: • Mount Solitary (927 metres above sea level), overflown by runway 23 departure flights containing about 10 flights on average, up to a maximum of about 19 flights, per day with planes likely to be at an altitude of between 10,500 to 13,300 ft (around 3.2 to 4 km) above sea level, representing around 7,500 ft (2.2 km) above Mount Solitary • Kings Tableland (about 700 metres above sea level) overflown by: – Runway 05 departures with about 9 flights on average, up to a maximum of about 20 flights, per day with planes at an altitude between 13,300 to 17,500 ft (around 4 to 5.3 km) above sea level, representing about 10,900 to 15,400 ft (around 3.3 to 4.3 km) above the tableland; and – Runway 23 arrivals, with around 24 flights on average, up to around 51 flights per day, with planes at an altitude of about 8,000 to 10,500 ft (around 2.5 to 3.2 km), representing around 5,900 ft (1.8 km) above the tableland – overflown by one departure flight path (containing about 20 flights per day) and one arrival flight path (containing about 50 flights per day), with aircraft from about 5,900 ft (1.8 km) above the tableland • The Grose valley and surrounding escarpments (around 920 metres above sea level), would be overflown by runway 05 departures, with around 3 flights on average, up to a maximum of 8 flights, with planes likely to be at an altitude of around 13,300 ft to 17,500 (around 4 to 5.3 km), representing around 10,000 to 14,500 ft (around 3 to 4.5 km) above the escarpments. The character of aircraft, and at times contrails, would contrast with the natural forms of clouds in the sky and natural features of the land. Overall, there would be several flight paths over this zone, however, the aircraft would be relatively high and passing over at a relatively low frequency. This would slightly alter the character of this zone.
2055 Scenario		
Magnitude of change	Low	Impacts during the 2055 scenario would generally be similar, however with an increase frequency of flights. Overall, while there would be a slight increase in flight frequency, the project would continue to result in a slight change to the character of this zone.
Landscape impact	High-Moderate (both 2033 and 2055 scenarios)	

Table A.2 Blue Mountains forested hills and valleys landscape character zone

	Impact level	Details
Baseline		
Sensitivity	High	This character zone typically includes undulating areas of native vegetation unique to the Blue Mountains and adjacent reserves such as Kanangra-Boyd National Park, with some unique and landscape features such steep hillsides, valleys, canyons and lakes. This character zone comprises a sense of tranquillity and wilderness with some presence of human presence e.g., small scale built development such as camp grounds, access roads and picnic areas.
2033 Scenario		
Magnitude of change	Low	To the north of the Great Western Highway, this zone would be overflown by 4 departure flight paths, including: • Runway 05 departures at an altitude of between 10,500 and 17,500 ft, with an average of 23 flights, up to a maximum of 55 flights, per day • Runway 23 departures at an altitude of between 10,500 and 13,300 ft (3.2 to 4 km) with an average of 18 flights, up to a maximum of 36 flights per day. To the south of the Great Western Highway, this zone would be overflown by: • Runway 05 departures at an altitude of between 10,500 and 13,300 ft (3.2 and 4 km) above sea level with an average of 15 flights, up to a maximum of 37 flights, per day passing over Kanangra-Boyd National Park • Runway 23 departures at an altitude of between 8,000 and 10,500 ft (2.4 and 3.2 km) above sea level with an average of about 46 flights, up to a maximum of 92 flights, per day • Runway 23 arrivals at an altitude of between 8,000 and 10,500 ft (2.4 and 3.2 km) above sea level with an average of about 24 flights, up to a maximum of 51 flights, per day. The aircraft would vary in altitude, with lower altitudes in eastern and central parts of the zone (up to about 2,500 to 8,000 ft or 750 metres to 2.5 km above sea level) including over Burragorang State Conservation Area, Lake Burragorang and the Erskine Range, increasing to higher altitudes in western and northern part of the zone (up to about 8,000 to 17,000 ft or 2.5 to 5 km above sea level) for example over Kanangra-Boyd National Park. The character of aircraft, and at times contrails, would contrast with the natural forms of clouds in the sky and natural features of the land. Overall, there would be multiple flight paths over this zone, however, the aircraft would be relatively high across the majority of this zone. This would slightly alter the character of this zone.
2055 Scenario		
Magnitude of change	Moderate	Impacts during the 2055 scenario would generally be similar, however with an increase frequency of flights. Overall, the project would result in a noticeable change to the character of this zone, due to the increase in frequency.
Landscape impact	Moderate (2033 scenario) High-Moderate (2055 scenario)	

A2 Assessment of representative view points within the GBMA

Viewpoint 1 – View from the Burragorang Lookout, The Bluff

Table A.3 Viewpoint 1: View from the Burragorang Lookout, The Bluff

Viewpoint	Assessment
Baseline	
Visual description	From the Burragorang Lookout and picnic area there are elevated views to The Bluff, which is located within the Burragorang State Conservation Area at the eastern side of GBMA, overlooks the deep waters of the Burragorang Valley and the Warragamba Dam. Surrounded by rocky escarpments and dense bushland, the Lookout provides expansive views containing landscapes of high scenic value. While this view includes forested wilderness covered by natural vegetation, it does not include the iconic landforms of the Blue Mountains being the striking vertical cliffs, waterfalls, ridges and escarpments, narrow sandstone canyons and pagoda rock formations. 
Elevation	About 590 metres (1,930 ft) above sea level
Visual sensitivity	High This is a unique view to an area with scenic values recognised by the State.
Magnitude of change	
2033 Scenario	Low Aircraft departing Runway 23 would fly adjacent to or overhead at a height of between 8,000 ft and 10,500 ft (about 2.5 to 3.2 km) above sea level, about 6,200 ft (1.9 km) above the nearby hills with about with about 19 flights on average, up to a maximum of 40 flights per day. Runway 05 arrivals to the north, at a distance of about 3.5 km, at an altitude of about 5,000 ft (about 1.6 km), about 3,200 ft (about 1 km) above the surrounding hills, with about 21 flights on average, up to 51 flights per day. Overall, due to the proximity of the flights to the surrounding hills and frequency of flights there would be a noticeable change to the amenity of this view and a moderate magnitude of change.
2055 Scenario	Aircraft departing the Runway 23 would follow the same paths and increase to around 56 flights on average, up to around 108 aircraft per day. Runway 05 arrivals would also increase to around 62 flights on average, up to around 136 aircraft per day. Overall, due to the height and frequency of flights, there would not be a noticeable change to the amenity of this view, and a moderate magnitude of change.

Viewpoint	Assessment
Impact	
Visual impacts	Moderate (2033 scenario) High-Moderate (2055 scenario)

Viewpoint 2 – View from The Rock Lookout (north and south views)

Table A.4 Viewpoint 2 – View from The Rock Lookout

Viewpoint	Assessment
Baseline	
Visual description	This view consists of an elevated view from The Rock Lookout (when looking both north and south), at the eastern side of GBMA, including the deep valley of the Nepean River, surrounded by dense bushland. The Lookout provides views of areas containing high scenic value, within an area of national importance. While this view includes forested wilderness covered by natural vegetation, it does not include the iconic landforms which form the World Heritage classification for the Blue Mountains being the striking vertical cliffs, waterfalls, ridges and escarpments, narrow sandstone canyons and pagoda rock formations. 
Elevation	About 140 metres (460 ft) above sea level
Visual sensitivity	High This is a unique view to an area with scenic values recognised by the State.
Magnitude of change	
2033 Scenario	Low <u>Looking north:</u> This view would include: • Runway 05 arrivals overhead at an altitude of about 10,500 ft (about 3.2 km), and about 10,100 ft (3 km) above the surrounding hills, with 23 flights on average, up to a maximum of 55 flights, per day • Runway 05 departures at a distance of 8 km and a height of 8,000 ft (about 2.4 km) above sea level, with 9 flights on average, up to a maximum of 20 flights, per day • Runway 23 arrivals would fly overhead at a height of 8,000 ft (about 2.4 km) above sea level, and about 7,600 ft (2.3 km) above the nearby hills, with 24 flights on average, up to a maximum of 51 flights, per day.

Viewpoint	Assessment
	Looking southwest: This view would include: • Runway 05 arrivals overhead at a height of 10,500 ft (about 3.2 km) above sea level, and about 10,100 ft (3 km) above the nearby hills, with 23 flights on average, up to a maximum of 55 flights, per day • Runway 23 arrivals overhead at a height of 8,000 ft (about 2.4 km) above sea level, and about 7,600 ft (2.3 km) above the nearby hills, with 24 flights on average, up to a maximum of 51 flights, per day • There may also be some departure flights visible in the background. This Lookout is located under and adjacent to several arrival flight paths. Aircraft would be seen crossing over the Nepean River valley, in close proximity to this viewpoint and likely in both directions. These aircraft would, however, be at higher altitudes (of over 7,000 ft, 2.3 km) and be less visually prominent. The additional aircraft visible in this area would somewhat intrude upon the wilderness character of this view, reducing the amenity of this view slightly. Overall, there would be a slight change to the amenity of this view, and a low magnitude of change.
2055 Scenario	Impacts during the 2055 scenario would generally be similar, however with an increase frequency of flights. The increasing frequency would intrude somewhat upon the wilderness character of this view, slightly reducing the amenity of this view. Overall, due to the height of the aircraft in this area, there would continue to be a slight change to the amenity of this view, and a low magnitude of change.
Impact	
Visual impacts	Moderate (both 2033 and 2055 scenarios)

Viewpoint 3 – View from Portal Lookout

Table A.5 Viewpoint 3 – View from Portal Lookout

Viewpoint	Assessment
Baseline	
Visual description	This view consists of an elevated view from the Portal Lookout, at the eastern side of GBMA, overlooking the junction between Glenbrook Gorge and the Nepean River. Located on the lower ridges of the Blue Mountains National Park, the view takes in the rocky outcrops and dense bushland of the ancient riverbed opening up to the Cumberland Plains on the western suburbs of Sydney. The Lookout provides expansive views containing very high scenic value of national importance. While this view includes forested wilderness covered by natural vegetation, it does not include the iconic landforms of the Blue Mountains being the striking vertical cliffs, waterfalls, ridges and escarpments, narrow sandstone canyons and pagoda rock formations. 
Elevation	About 165 metres (540 ft) above sea level
Visual sensitivity	High This is a unique view to an area with scenic values important to the region and State.
Magnitude of change	
2033 Scenario	Negligible This view would include: • Runway 05 arrivals at a distance of about 3 km and an altitude of about 10,500 to 8,000 ft (about 3.2 to 2.5 km), with 8 flights on average, up to a maximum of about 19 flights, per day • Runway 05 departures at a distance of about 4 km and at an altitude of about 8,000 ft (about 2.4 km), with about 15 flights on average, up to a maximum of about 37 flights, per day • Runway 23 arrivals at a distance of about 2 km and at a height of 8,000 ft (about 2.5 km) above sea level, with 32 flights on average, up to a maximum of about 68 flights, per day. There would be aircraft seen intermittently over the rural fringe areas of Penrith in the mid to background of this view (a distance of about 5 km) at higher altitudes (of over 8,000 ft, 4 km) and be less visually prominent due to the distance and altitude. The aircraft would be somewhat compatible with the rural and urban fringe areas and would not noticeably reduce the amenity of this view. Overall, there would be no perceived change to the amenity of this view and a negligible magnitude of change.

Viewpoint	Assessment
2055 Scenario	Impacts during the 2055 scenario would generally be similar, however there would be a slight increase in the frequency of aircraft visible over the rural fringe areas of Penrith in the mid to background of this view. There would be a slight reduction in the amenity of this view and overall, there would be no perceived change to the amenity of this view and a negligible magnitude of change.
Impact	
Visual impacts	Negligible (both 2033 and 2055 scenarios)

Viewpoint 4 – View from Hawkesbury Lookout

Table A.6 Viewpoint 4 – View from Hawkesbury Lookout

Viewpoint	Assessment
Baseline	
Visual description	This view consists of an elevated view from the Hawkesbury Lookout, located along Hawkesbury Road in between the Hawkesbury region and the Blue Mountains, within the Yellomundee Regional Park, near at the eastern edge of GBMA. The roadside Lookout offers southwestern views looking across the Cumberland Plain including the Nepean River, Wianamatta Park and Penrith, and is a popular rest-stop enroute to the Blue Mountains and is of regional importance. 
Elevation	About 220 metres (715 ft) above sea level
Visual sensitivity	Moderate This is a unique view to an area with scenic values important to the region.
Magnitude of change	
2033 Scenario	Low This view would include runway 05 departures which would fly overhead at a height of about 10,500 ft (about 3.2 km), with 23 flights on average, up to a maximum of about 55 flights, per day. These aircraft will be seen intermittently, crossing over the Cumberland Plain in the middle ground (a distance of about 1 km), and at a lower altitude as they ascend steeply towards a cruising altitude. These aircraft would be somewhat prominent in the view due to their distance and altitude, and the expansive open sky. There will also be planes visible in the background, as they come into land on several flight paths from the north and east. Overall, there would be a noticeable reduction in the amenity of this view, and a low magnitude of change.

Viewpoint	Assessment
2055 Scenario	During the 2055 scenario, there would again be increase in the frequency of aircraft visible across the middle ground of this view. Due to the proximity of the aircraft to this viewpoint, there would be a noticeable reduction in the amenity of this view and a low magnitude of change.
Impact	
Visual impacts	Moderate-Low (both 2033 and 2055 scenarios)

Viewpoint 5 – View from Wynnes Rocks Lookout

Table A.7 Viewpoint 5 – View from Wynnes Rocks Lookout

Viewpoint	Assessment
Baseline	
Visual description	This view consists of an elevated view from the Wynnes Rocks Lookout. Located on the ridgeline spur at the end of Wynnes Rocks Road south of Mount Wilson, it offers expansive views southeast over the GBMA across Bowen's Creek to the Blue Mountains towns and Mounts Tomah, Hay and Banks. While this view includes forested wilderness covered by natural vegetation, it does not include the iconic landforms of the Blue Mountains being the striking vertical cliffs, waterfalls, ridges and escarpments, narrow sandstone canyons and pagoda rock formations. 
Elevation	About 980 metres (3,200 ft) above sea level
Visual sensitivity	High This is a unique view to an area with scenic values important to the State.

Viewpoint	Assessment
Magnitude of change	
2033 Scenario	Low This view would include: • Runway 05 departures would fly overhead at a height between 13,300 and 17,500 ft (about 4 and 5 km) above sea level, and about 10,100 ft (3 km) above Mount Tomah (seen in this view), with 15 flights on average, up to a maximum of about 36 flights, per day • Runway 23 departures would fly overhead at a height between 13,300 and 17,500 ft (about 4 and 5 km) above sea level, and about 10,100 ft (3 km) above Mount Tomah, with 18 flights on average, up to a maximum of about 36 flights, per day. There would be aircraft seen intermittently overhead at relatively high altitudes. The aircraft visible in this area would be more frequent. Overall, the aircraft would not noticeably intrude upon the wilderness character of this view and there would be a negligible magnitude of change.
2055 Scenario	Impacts during the 2055 scenario would generally be similar, however with an increase frequency of flights. While this Lookout would be frequently overflown by aircraft in this scenario, due to the altitude these aircraft would not be prominent in this view. Overall, the aircraft would not noticeably intrude upon the wilderness character of this view and there would be a negligible magnitude of change.
Impact	
Visual impacts	Moderate (both 2033 and 2055 scenarios)

Viewpoint 6 – View from Walls Lookout

Table A.8 Viewpoint 6 – View from Walls Lookout

Viewpoint	Assessment
Baseline	
Visual description	This view consists of an elevated view from the Walls Lookout, at the western side of GBMA, overlooking the Grose Valley. Surrounded by rocky escarpments and bushland defining the Little Blue Gum canyon, the Walls Lookout is representative of several other Lookouts in the immediate area (including for example Mount Banks Picnic Area and Lookout, Victoria Falls Lookout, Baltzer Lookout and Anvil Rock Lookout). These Lookouts provide expansive views containing very high scenic value, of national importance. This view includes iconic landforms of the Blue Mountains including striking vertical cliffs and sandstone canyons. 
Elevation	About 865 metres (2,840 ft) above sea level
Visual sensitivity	Very high This is a unique and heavily experienced view to an area with scenic values of national and international importance.
Magnitude of change	
2033 Scenario	Very high This view would include aircraft departing on Runway 05 (to the southeast) overhead at a height of about 17,500 ft (about 5.3 km) above sea level, and about 15,100 ft (4.6 km) above the escarpments, with about 3 flights on average, up to a maximum of 8 flights, per day. This view would be overflown by aircraft infrequently, and due to the altitude. While these aircraft would be viewed in an open and expansive sky, these aircraft would not be prominent in this view and infrequently seen. Overall, these flights would not noticeably intrude upon the wilderness character of this view and there would be a negligible magnitude of change.

Viewpoint	Assessment
2055 Scenario	Impacts during the 2055 scenario would generally be similar, however with an increase frequency of flights. While from this Lookout aircraft would be seen at a relatively high altitude, they would be viewed in an open and expansive sky, and more likely to detract from the amenity of these views due to the increased frequency of their movement across the sky. As movement attracts the eye, and this is an otherwise still and expansive view, these flights have the potential to intrude upon the wilderness character of this view. Overall, due to the increased frequency, there would be a noticeable reduction in the amenity of this view.
Impact	
Visual impacts	Negligible (2033 scenario) High-Moderate (2055 scenario)

Viewpoint 7 – View from Echo Point

Table A.9 Viewpoint 7 – View from Echo Point

Viewpoint	Assessment
Baseline	
Visual description	This view consists of an elevated view from Echo Point Lookout, at Katoomba. It is listed as one of the 15 'best scenic Lookouts' (listed by Destination NSW, 2022) and offers panoramic views across GBMA including the Three Sisters, the Jamison Valley, Mount Solitary and Narrow Neck. The Lookout provides views of areas containing very high scenic value, of national importance. This view includes iconic landforms of the Blue Mountains including vertical cliffs, sandstone canyons and pagoda rock formations. 
Elevation	About 950 metres (3,110 ft) above sea level
Visual sensitivity	Very high This is a unique and heavily experienced view to an area with scenic values of national and international importance.

Viewpoint	Assessment
Magnitude of change	
2033 Scenario	Low This view would include: • aircraft departing on Runway 05 at a distance of about 11 km will fly at a height of between 13,300 and 17,500 ft (about 4 to 5 km), and about 10,200 ft (about 3 km) above the mountains, with about 15 flights on average, up to 37 flights, per day • aircraft departing Runway 23 at a distance of about 4.5 km at an altitude of 13,300 ft (about 4 km), and about 10,200 ft (about 3 km) above the mountains, with about 10 flights on average, up to 19 flights, per day. There would be aircraft seen intermittently crossing this view, beyond Mount Solitary (about 927 metres above sea level). These aircraft would be viewed in an open and expansive sky, from an elevated vantage point, increasing their prominence in the view. While the aircraft would be visible moving across the view, the scale of the aircraft at this distance, and their infrequency, would reduce the potential for them to noticeably intrude upon the wilderness character of this view. Overall, there would be a slight reduction in the amenity of this view and a negligible magnitude of change.
2055 Scenario	During the 2055 scenario, the frequency of aircraft visible would more than double. While the aircraft would be small in size when viewed at this distance, with only the flights following Runway 23 departure path being perceptible, these aircraft would be viewed in an open and expansive sky, from an elevated vantage point, increasing their prominence in the view. As movement attracts the eye, and this is an otherwise still and expansive view, these flights have the potential to intrude upon the wilderness character of this view. Overall, there would be a slight reduction in the amenity of this view and a low magnitude of change.
Impact	
Visual impacts	High-Moderate (both 2033 and 2055 scenarios)

Viewpoint 8 – View from Cleary Memorial Lookout, Kedumba Pass

Table A.10 Viewpoint 8 – View from Cleary Memorial Lookout, Kedumba Pass

Viewpoint	Assessment
Baseline	
Visual description	This view consists of an elevated view from the Cleary Memorial Lookout, at the Kedumba Pass. It is located off the fire trail and is currently overgrown, offering limited views across GBMA. The Lookout offers glimpsed views of areas containing high scenic value including views to Mount Solitary. However, this viewpoint is not formalised and would attract a relatively small number of visitors compared to the more accessible viewing locations. Aircraft flying over Katoomba and this part of the Blue Mountains are visible from this location. 
Elevation	About 620 metres (2,030 ft) above sea level
Visual sensitivity	High This is an infrequently experienced view to an area with scenic values of importance to the Nation.
Magnitude of change	
2033 Scenario	Low This view would include: • Runway 23 departures at a distance of 10,500 ft (about 3.2 km), and about 9,700 ft (2.9 km) above the ranges with 10 flights on average, up to 19 flights, per day • Runway 05 departures at a distance of about 3 km, at an altitude of about 13,300 ft (about 4 km), and about 11,300 ft (3.4 km) above the ranges. With about 15 flights on average, up to a maximum of 37 flights, per day • Runway 23 arrivals at a distance of about 6 km at an elevation of between 10,500 and 13,300 ft (about 3.2 to 4 km), and about 11,000 ft (3.3 km) above the ranges. With about 24 flights on average, up to a maximum of 51 flights, per day. Aircraft on the departing flight path from 23 Runway would be visible overhead or passing across the middle ground of views from this Lookout. However, these planes would be at a high altitude and relatively infrequent. These flights would be seen in between overgrown vegetation, which currently partly encloses the lookout, restricting views out.

Viewpoint	Assessment
	Overall, due to the relatively close proximity and contrast with the otherwise predominantly wilderness view, the project would be a slight reduction in the amenity of this view and a low magnitude of change in this view.
2055 Scenario	During the 2055 scenario, the frequency of aircraft travelling along departing flight path from Runway 23 would be slightly increased, with aircraft visible overhead or passing across the middle ground of this view. These flights would be several km overhead and infrequent but viewed in an open and expansive sky, slightly increasing their prominence in the view. Overall, due to the relatively close proximity and contrast with the otherwise predominantly wilderness view, the project would be a low magnitude of change in this view.
Impact	
Visual impacts	Moderate (both 2033 and 2055 scenarios)

Australian Government

Department of Infrastructure, Transport,
Regional Development, Communications and the Arts