
# Appendix AA Aviation Safeguarding

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# Memorandum

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| To | **Elissa Howie** | From | **Melanie Zamudio** |
| Copy | **Stephanie Clarke** | Reference | **505018** |
| Date | **2021-03-19** | Pages (including this page) | **166** |
| Subject | **Sydney Water - Aviation Safeguarding** | | |

## 1 Introduction

Sydney Water engaged Aurecon to prepare an aviation safeguarding response to Secretary's Environmental Assessment Requirement (SEARs) requirement 37 for the Upper South Creek Advanced Water Recycling Centre (USC AWRC) (referred to as AWRC) Environmental Impact Statement. The subject site at Kemps Creek is in close proximity to the Western Sydney International (Nancy-Bird Walton) Airport (referred to as the airport).

A condition of the SEARs, specifically condition 37, requires an assessment of the "project impact on the 24-hour operations of Western Sydney International (Nancy-Bird Walton) Airport (Airport) considering the project's location within a flight path for the future Airport and airport safety matters".

This safeguarding advice is provided considering a proposed land use activity and development, and an assessment of a non-operational airport site under construction. Stage 1 AWRC construction will occur before the airport is operational, however subsequent stages of the AWRC development will be after the airport is operational. The safeguarding advice is provided in relation to the AWRC project and the site and does not apply to the associated pipelines below ground.

This memo provides safeguarding content that will be transferred to the full EIS document. Therefore, the full project description, site details and background are not covered in this memo.

## 2 Purpose

The intent of this memo is to provide safeguarding and aviation content for the Environmental Impact Statement addressing the SEARs requirement number 37 on airport safeguarding and strategic context.

The aviation safeguarding assessment involved:

- Identifying hazards with the potential to affect aviation and airport operations, including issues covered by the National Airports Safeguarding Framework
- Review of the following strategic documents including:
    - Western Sydney Aerotropolis State Environmental Planning Policy (SEPP)
    - Western Sydney Aerotropolis Development Control Plan 2020 – Phase 1 (DCP)
    - NSW State Government, Draft Aerotropolis Precinct Plan 2020
    - National Airport Safeguarding Framework (NASF)
    - Civil Aviation Safety Authority (CASA) regulations; and
    - Avisure Wildlife Hazard Assessment.

- Assessing the potential for the project to intrude into the prescribed airspace of Western Sydney Airport using the WSA OLS tool online, and a desktop review of other protected surfaces using the Western Sydney Aerotropolis SEPP;
- Assessing the potential impacts of lighting and glare based on a desktop review of relevant plans and design standards;
- Assessing other considerations identified during the safeguarding assessment, such as noise impacts on the subject site; and
- Identifying measures to manage and mitigate the identified impacts.

***Limitations***

- This assessment has been limited to the previously prepared aeronautical mapping.

## 2.1 Background and Policy context

The protection of aviation operations is an important consideration in future land use planning in close proximity to aerodromes. There are a number of activities that can limit or prevent the airport's use, including:

- Penetration of protected airspace;
- Industrial activities that generate smoke or similar hazards;
- Building heights or cranes that may impose in the airports airspace and cause potential safety concerns; and
- Other activities, such as agriculture, animal husbandry or wetland developments, may attract birds and wildlife species that pose a hazard to aircraft.

There are several legislative and policy guidance documents in force to ensure the ongoing safe operation of airports and associated land use and development in close proximity. This safeguarding assessment has been undertaken in accordance with the SEARs with reference to the following:

- Relevant legislation, including the Airports Act and regulations, and the Civil Aviation Act 1988 and regulations;
- National Airports Safeguarding Framework (Department of Infrastructure, Regional Development and Cities, 2018b); and
- Manual of Standards Part 139 – Aerodromes (CASA, 2019)

### *2.1.1 National Airport Safeguarding Framework (NASF)*

The NASF is a national land-use planning framework that aims to:

- Improve community amenity by minimising aircraft noise-sensitive developments near airports; and
- Improve safety outcomes by ensuring aviation safety requirements are recognised in land-use planning decisions.

The NASF applies at all airports in Australia and affects planning and development around airports, including development activity that might affect windshear, lighting, operational airspace or navigational procedures for aircraft.

The purpose of the NASF is to enhance current and future safety, viability and growth of aviation operations, by supporting and enabling:

- The implementation of best practice in relation to land use assessment and decision making in the vicinity of airports and strategic helicopter landing sites;
- Assurance of community safety and amenity near airports and strategic helicopter landing sites;
- Better understanding and recognition of aviation safety requirements and aircraft noise impacts in land use and related planning decisions;
- The provision of greater certainty and clarity for developers and land owners;
- Improvements to regulatory certainty and efficiency; and
- The publication and dissemination of information on best practice in land use and related planning that supports the safe and efficient operation of airports and strategic helicopter landing sites.

The NASF guidelines have formed a key component of this safeguarding review and are further discussed and assessed in section 2.2.

### *2.1.2 Western Sydney Aerotropolis Development Control Plan 2020 – Phase 1*

The Phase 1 Development Control Plan (DCP) identifies the Western Sydney aerotropolis precinct planning principles, objectives and performance outcomes to allow precinct planning to progress.

The DCP provides controls which guide development to achieve connectivity, liveability, productivity, and sustainability by:

a) giving effect to the Greater Sydney Region Plan and Western City District Plan;

b) encouraging development that responds to its context and is compatible with the Principles set out in the Western Sydney Aerotropolis Plan (WSAP);

c) recognising and reinforcing the distinctive characteristics of the Western Parkland City;

d) adopting the principles set in the Government Architect NSW's Better Placed and Greener Places;

e) building upon the objectives and principles under the WSAP and State Environmental Planning Policy (Western Sydney Aerotropolis) 2020;

f) protecting and enhancing the green and blue assets of the area;

g) safeguarding the airport operations of Western Sydney International (Nancy-Bird) Airport;

h) encouraging design that maintains and enhances the character and heritage significance of Aboriginal and European heritage items and heritage conservation areas; and

i) encouraging ecologically sustainable development and reducing the impacts of development on the environment.

*Section 4 – Risk Minimisation and management* details a number of potential risks, one of which is applicable is airport safeguarding and lists the following objectives:

a) Safeguard the future operations of the Airport, including 24-hour operations and provide appropriate protections for the surrounding community;

b) Ensure compatible development that exhibits design excellence occurs on surrounding land; and

c) Development does not introduce or intensify noise sensitive uses.

There are a number of performance outcomes that development applications must address such as, heights, noise, protected operational airspace, lighting, airport public safety areas, emissions, wildlife hazards and communications, navigation and surveillance facilities. The requirements must address NASF, the Airports Act 1996 and Airports (Protection of Airspace) Regulations 1996.

### *2.1.3 NSW State Government, Draft Aerotropolis Precinct Plan 2020*

The Western Sydney Aerotropolis Precinct Plan (Draft) establishes the strategic vision and objectives for the proposed land uses, performance criteria for the development of land and outlines the approach for both infrastructure and water cycle management. They have been developed consistent with the objectives of the Western Sydney Aerotropolis Plan and support the Aerotropolis' place within the Western Parkland City

The Precinct Plan achieves the placed- based planning principles and themes in the Western Sydney Aerotropolis Plan, including sustainability, connectivity, productivity, liveability, place and built form.

The Precinct Plan is required under part 7 of the Aerotropolis SEPP and is to be read in conjunction with the Western Sydney Aerotropolis Development Control Plan (DCP).

The draft plan acknowledges the proposed USC AWRC in the structure plan, and the site is identified within the environment and recreation and enterprise zoned land. The USC AWRC will also support the Circular Economy via the production of renewable energy and bioresources.

Section 5 of the draft plan discusses the infrastructure delivery and staging for the following precinct areas; Aerotropolis Core, Badgerys Creek, Wianamatta-South Creek which identifies

- Water: “recycled Water is expected to be an option for the precinct as Sydney Water are creating the new water recycling centre at Upper South Creek”.
- Sewer “The region is ultimately to be serviced by the new advanced water recycling centre to be constructed in Upper South Creek. The expected delivery of the facility is in 2025 and temporary intimin solutions are being explored by Sydney Water to supply growth in the short term before the AWRC comes online”

### *2.1.4 State Environmental Planning Policy (SEPP) Western Sydney Aerotropolis 2020*

The SEPP provides legislative requirements for projects in the Aerotropolis, simplifying the process and delivery and controlling land use and development. The SEPP is an environmental planning instrument that reflects the same objectives and requirements of the National Airport Safeguarding Framework to ensure the ongoing safe operation of Western Sydney Airport.

Planning for future land uses around the aerotropolis requires consideration of the need to mitigate impacts associated with the operation of the airport, and to locate compatible land uses. The SEPP specifies compatible land uses using a planning framework to facilitate the achievement of State planning objectives for the aerotropolis that will deliver the Aerotropolis Plan.

Specifically, *Part 3 – Development controls – Airport safeguards* outlines the following objectives:

(a) to prevent certain noise sensitive development on land near the Airport, and

(b) to minimise the impact of aircraft noise for other noise sensitive development, and

(c) to ensure that land use and development near the Airport do not hinder or have other adverse impacts on the ongoing, safe and efficient 24 hours a day operation of the Airport.

Part 3 lists development controls and the following requirements must be considered:

- Aircraft noise;
- Building wind shear and turbulence;
- Wildlife hazards;
- Wind turbines;
- Lighting;
- Airspace operations; and
- Public safety.

### *2.1.5 NSW Ministerial Directions*

**Ministerial Direction 3.5 Development Near Regulated Airports and Defence Airfields**

This direction applies to all relevant planning authorities to ensure the effective and safe operation of regulated airports and defence airfields, specifically to ensure that operations is not compromised by development that constitutes an obstruction, hazard or potential hazard to aircraft flying in the vicinity. If development does occur on noise sensitive land that appropriate noise mitigation measures are incorporated so that the development is not adversely affected by aircraft noise.

**Ministerial Direction 7.8 Implementation of the Western Sydney Aerotropolis Plan**

The objective of this direction is to ensure development within the Western Sydney Aerotropolis is consistent with the Western Sydney Aerotropolis Plan dated September 2020. This direction states that a planning proposal is to be consistent with the Western Sydney Aerotropolis Plan, unless otherwise deemed that the inconsistencies are minor in significance or the proposal achieves the overall intent of the Western Sydney Aerotropolis Plan and does not undermine the achievement of its objectives, planning principles and priorities for the Western Sydney Aerotropolis.

## 2.2 Potential risks identified

Due to the proximity of the AWRC to the new Western Sydney Airport and associated flight paths, a preliminary desktop study of design and policy constraints was undertaken.

Initial discussions have commenced with the planning team at Western Sydney Airport to ensure adequate stakeholder consultation has been undertaken in managing the identified risks below.

**Noise** - Section 4.1 Airport Safeguarding of the DCP states that the development should not introduce or intensify noise sensitive uses. In addition, Part 3(19) of the SEPP also states any development must minimise the impact of aircraft noise for other noise sensitive development and to ensure that land use and development near the Airport do not hinder or have other adverse impacts on the ongoing, safe and

efficient 24 hours a day operation of the Airport. This proposed development does not introduce any noise sensitive uses and the land use is classified as industrial activity and is compliant with the requirements of the DCP and SEPP.

**Windshear** – NASF is the only policy document that details potential windshear impacts. The subject site is outside of any windshear envelopes for Western Sydney Airport.

**Wildlife** – the landscaping and NASF bird strike guidelines have been considered in the Avisure Report and the NASF requirements are aligned with the principles in the Western Sydney Aerotropolis Plan.

**Lighting** – Section 4.1 (PO7) of the DCP states to ensure the development does not impact on the operational aspects of the Airport with regard to light emission and reflective surfaces. In addition, Part 3 (23) of the SEPP states to safeguard Airport operations from the risk of lighting and reflectivity distractions for pilots. The SEPP Lighting Intensity and Wind Shear Map is based on the guidelines as detailed in the NASF Guideline E. The design of the AWRC have considered the lighting requirements in the relevant legislation.

**Airspace** – Section 4A of the DCP states to safeguard the future operations of the Airport, including 24-hour operations and provide appropriate protections for the surrounding community. Similarly, Part 3(C) of the SEPP states "to ensure that land use and development near the Airport do not hinder or have other adverse impacts on the ongoing, safe and efficient 24 hours a day operation of the Airport". The airspace particularly relates to obtrusions either permanent or temporary of either the Obstacle Limitation Surface (OLS) and/ or Procedures for Air Navigational Services – Aircraft Operations (PANS-OPS) intrusions. This safeguarding memo addresses the relevant controls in the DCP, SEPP and NASF to ensure the safe ongoing operation of WSA.

Further specifics are discussed below in Table 1 and demonstrated that each NASF guideline has been appropriately managed in the design and discussed through the stakeholder consultation process.

The following key areas were identified relating to the National Airport Safeguarding Framework (NASF) guidelines:

**Table 1: National Airport Safeguarding Framework – Guideline Assessment**

| NASF Guideline | Identified risk | Comment |
|---|---|---|
| **Guideline A: Measures for Managing Impacts of Aircraft Noise** | Potential risk, discussed in 2.2.1. | Minor noise considerations in context of the subject site employees. |
| **Guideline B: Managing the Risk of Building Generated Windshear and Turbulence at Airports** | Not applicable. | The subject site is outside the windshear envelopes of Western Sydney Airport. |
| **Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports** | Yes, discussed in section 2.2.2. | Assessment of potential wildlife strike and attraction has been undertaken. |
| **Guideline D: Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation** | Not applicable. | The proposal is not for a wind turbine. |

| | | |
|---|---|---|
| **Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports** | Yes, discussed in section 2.2.3. | The project has been assessed in terms of the light intensity levels and associated requirements. |
| **Guideline F: Managing the Risk of Intrusions into the Protected Airspace of Airports** | Yes, discussed in section 2.2.4. | The existing design of the project (including lighting) does not result in any intrusions into the prescribed airspace. The project will ensure the final detailed design complies with Guideline F and all operational facilities are located below the OLS. |
| **Guideline G: Protecting Aviation Facilities — Communications, Navigation and Surveillance** | Not applicable. | The proposal will not adversely impact the performance of any existing Airservices Precision/Non-Precision Nav Aids, Anemometers, HF/VHF/UHF Comms, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links. |
| **Guideline H: Protecting Strategically Important Helicopter Landing Sites** | Not applicable. | A Helicopter Landing Site is an area not located on an aerodrome. |
| **Guideline I: Public Safety Areas** | Not applicable. | The Public Safety areas are contained within Western Sydney Aerotropolis boundary, and this project is not within those boundaries. |

### *2.2.1 Guideline A: Measures for Managing Impacts of Aircraft Noise*

By their very nature, airports cause considerable noise events that could cause disturbance to some people. Over the long-term inappropriate development around airports can result in unnecessary constraints on airport operations and negative impacts on community amenity.

In the SEPP, Western Sydney Airport has draft noise contours that reflect the ultimate noise scenario for the eventual two runway airport, refer to Figure 1 for the SEPP Noise Contour map.

Guideline A refers to the Australian Noise Exposure Forecast (ANEF) System and the Australian Standard AS 2021-2015 Acoustics – Aircraft Noise Intrusion – Building Siting and Construction (AS2021) which sets noise attenuation requirements based on the ANEF contour.

AS2021-2015, specifies various building types and the acceptability of the land use and development within the airport noise contours. Refer to table 2, for the applicable building type for the subject site and proposed development:

- the administrative building component of the site is considered a ‘commercial building’ which is acceptable within the 20-25 ANEF contour
- the outdoor classroom is considered ‘school, university’ and is considered unacceptable within the 25-30 ANEF contour
- the remainder of the site activities are classified as ‘light industrial’ and acceptable.

**Table 2: AS 2021 Building Site Acceptability Based on ANEF Zones**

| Building Type | Acceptable | Conditionally acceptable | Unacceptable |
|---|---|---|---|
| **House, home unit, flat, caravan park** | Less than 20 ANEF | 20 to 25 ANEF | Greater than 25 ANEF |
| **Hotel, motel, hostel** | Less than 25 ANEF | 25 to 30 ANEF | Greater than 30 ANEF |
| **School, university** | Less than 20 ANEF | 20 to 25 ANEF | Greater than 25 ANEF |
| **Hospital, nursing home** | Less than 20 ANEF | 20 to 25 ANEF | Greater than 25 ANEF |
| **Public building** | Less than 20 ANEF | 20 to 30 ANEF | Greater than 30 ANEF |
| **Commercial building** | Less than 25 ANEF | 25 to 35 ANEF | Greater than 35 ANEF |
| **Light industrial** | Less than 30 ANEF | 30 to 40 ANEF | Greater than 40 ANEF |
| **Other industrial** | Acceptable in all ANEF zones | | |

**Management of noise risks identified**

The AWRC has been classified as a mixture of commercial, light industrial and school, representing the proposed land use activities on the site. The AWRC has relatively low employment numbers, anticipated to be up to 15 operational staff on site daily. The proposed administration building will include the control room, laboratory, lunchroom, meeting rooms and amenities.

The subject site is located across both noise contours ANEC 20-25 and ANEC 25-30, refer to Figure 1 and inset below.

With regard to the outdoor classroom, even though it is considered unacceptable, there can be no noise mitigation measures. However, it should be acknowledged aircraft noise may interrupt classroom activities. The administration building is within the 20-25 ANEC and considered acceptable, therefore there is no requirement under the AS2021-2015 for the building to be noise attenuated.

The remaining land use is industrial, which is acceptable under the ANEF 30 contour and no applicable noise attenuation requirements.

In addition, the operation of the site will follow relevant work health and safety guidelines with respect to ‘Managing Noise and Preventing Hearing loss’.

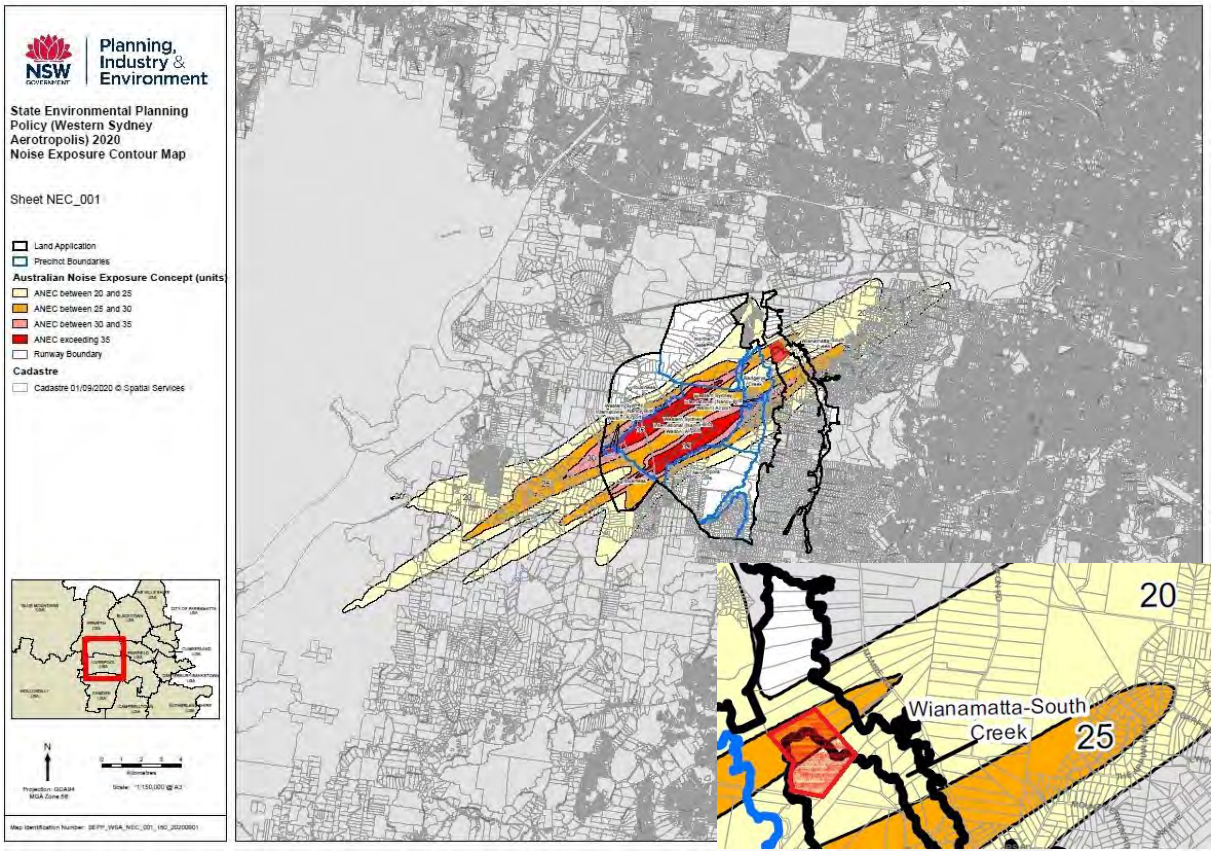



**Figure 1: SEPP – Noise Contour map with subject site *Source: DPIE & Aurecon***

### *2.2.2 Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports*

Wildlife strikes can cause major damage to aircraft and / or reduction of safety. The consequences of wildlife strike can be influenced by the number and size of wildlife involved, phase of flight and the aircraft part hit by the wildlife. Land use planning decisions and the way in which land use is managed in the vicinity of airports, can significantly influence the risk of wildlife hazards.

NASF Guideline C provides actions for existing, changes to existing and proposed developments based on the land use (agriculture, conservation, recreation, etc.) and the buffer zone category, as detailed below.

The Western Sydney Aerotropolis SEPP details requirements for 3km, 8km, and 13km radius, refer Figure 2 below. The subject site is within the 8km radius. The SEPP specifies relevant developments requiring consideration as listed below relevant for the 13km radius, including the 8km radius:

- agricultural produce industries;
- aquaculture;
- camping grounds;
- eco-tourist facilities;
- garden centres;
- intensive livestock agriculture;

- intensive plant agriculture;
- livestock processing industries;
- plant nurseries;
- recreation facilities (major);
- recreation facilities (outdoor);
- sewage treatment plants;
- waste or resource management facilities that consist of outdoor processing, storage or handling of organic or putrescible waste; and
- water storage facilities.

**Management of wildlife risks identified**

The proposed AWRC includes land uses sewerage treatment plant that require consideration.

Understanding the sensitivities of the proposed development, Sydney Water engaged Avisure to undertake a risk assessment addressing NASF Guideline C, refer to Appendix B. The investigation concluded the primary cause of concern is the increased risk of bird and fruit bat activity in the airport flight path due to the AWRC infrastructure.

The report notes that the consideration of bird strike is based on an assessment of a proposed land use and a non-operational airport.

There are several key elements of the Reference Design that have potential to increase the activity of birds on the site, which could increase the risk of bird strike, including:

- open bodies of water, such process tanks, bioreactor ponds;
- nesting places, such as building eaves; and
- trees for screening and water sensitive urban design planting.

The wildlife assessment identified the need to minimise open water surfaces that may be attractive to birds. This risk has been addressed by design requiring tanks with a permanent body of still water to be covered. The bioreactor was not considered attractive to birds due to the continuous aeration process. Other tanks such as the chlorine contact tank which contain water only for short periods of time were not considered to increase the risk.

Additional measures identified in the Avisure report that will be incorporated into the final design include:

- Wetlands:
    - Establish slopes at 4V:1H, steepening the sides of the basins and wetlands will further deter wildlife;
    - Arrange macrophyte coverage to minimise areas of open water;
    - Establish a regular and standardised monitoring regime (to assess if the distance of the wetland relative to WSA diminishes the contribution to the strike risk;
- Covering of all permanent open bodies of water (not bioreactor ponds);
- Specific design of building eaves and the use of spikes to minimise the opportunity of nesting places;
- All waste receptacle areas will be enclosed, providing an additional barrier to bird access; and

- Planting of the site will be cognisant of the Western Sydney Airport planting guidelines which are currently in development and will be used as a reference of species to minimise bird attraction.

Once the site is developed and the airport operational the following recommendations were provided:

- Establish a Wildlife Management Plan monitoring plan when the site is operational and engage with Western Sydney Airport; and
- Adoption of wildlife deterrent technologies to reduce hazardous bird populations (if required).

A monitoring regime will observe birdlife at the site, the effectiveness of the design elements incorporated and drive changes or modification of the site infrastructure in the event that birdlife exceeds the criteria set out in the Avisure assessment contained within Appendix B.

The AWRC has been designed to prevent attraction of birds and to minimise the associated airport safety risk.

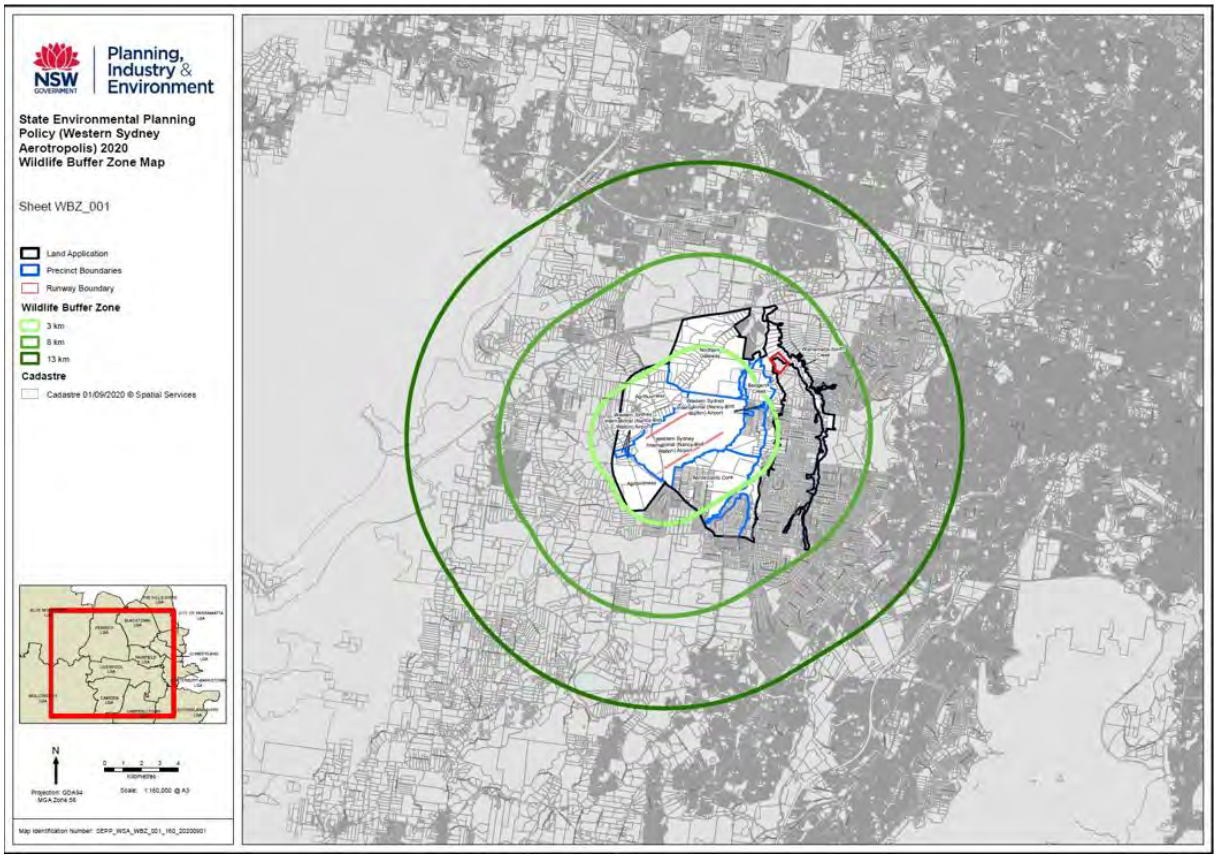



**Figure 2: SEPP Wildlife Buffer Zone map with subject site *Source: DPIE & Aurecon***

### *2.2.3 Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports*

Aeronautical ground lights, such as runway lights and approach lights, play a vital role in enabling pilots to align their aircraft with the runway in use. Pilots are reliant on the specific patterns of aeronautical

ground lights during inclement weather and outside daylight hours. They also enable the pilot to land the aircraft at the appropriate part of the runway.

It is extremely important the lighting in the vicinity of airports does not compromise any airport operations, and that does not affect pilots by being distracted or mistaking off-airport lighting as ground lighting from the airport.

Under the Civil Aviation Regulations 1988, CASA has the authority to control ground lights where they have the potential to create a safety hazard. CASA has established guidelines (in the Manual of Standards 139) on the location and permitted intensities of ground lighting within a six-kilometre radius of an airport.

The NASF Guideline E provides guidance and details lighting lux levels around airports, to manage off-airport lighting accordingly to minimise any potential pilot distraction. The lighting lux levels are:

- Maximum intensity of light sources measured in candela (cd) at 3$^{o}$ above the horizontal:
  - Zone A = 0cd
  - Zone B = 50cd
  - Zone C = 150cd
  - Zone D = 450cd

Examples of lighting developments that are likely to cause interference, which include the following:

- Motorway/freeway lighting;
- Sea container yards;
- Wharves;
- Refinery flare plumes;
- Stadium flood lighting; and
- Construction lighting.

The intensity of external lighting and reflected sunlight (as well as smoke, dust or particulate matter) may be considered controlled activities under the Airports (Protection of Airspace) Regulations.

The Civil Aviation Act 1988 grants CASA the power to regulate any potentially dangerous extraneous lighting, by having it extinguished or modified.

**Management of lighting risks identified**

According to the currently available WSA planning maps, the USC AWRC site location is directly under the approach/departure flight path from the new airport, and therefore a limit of 450 candela on light intensity is required as the subject site is within Zone D, refer to Figure 3: SEPP Lighting Intensity and Windshear map with subject site *Source: DPIE & Aurecon*. The site is just outside the boundary of the 6km Lighting Intensity Radius.

During the detailed design process future lighting will be assessed and once light fittings have been chosen for installation, the iso-candela diagram should be examined to ensure the fitting will satisfy the zone requirements. For installations where the light fittings are selected because their graded light emission above horizontal conform to the zone requirement, no further modification is required.

NASF does not contain detail or specification on reflectivity of solar panels, but Sydney Water will treat solar panels with anti-glare coatings to reduce any reflectivity that may be a distraction to pilots.

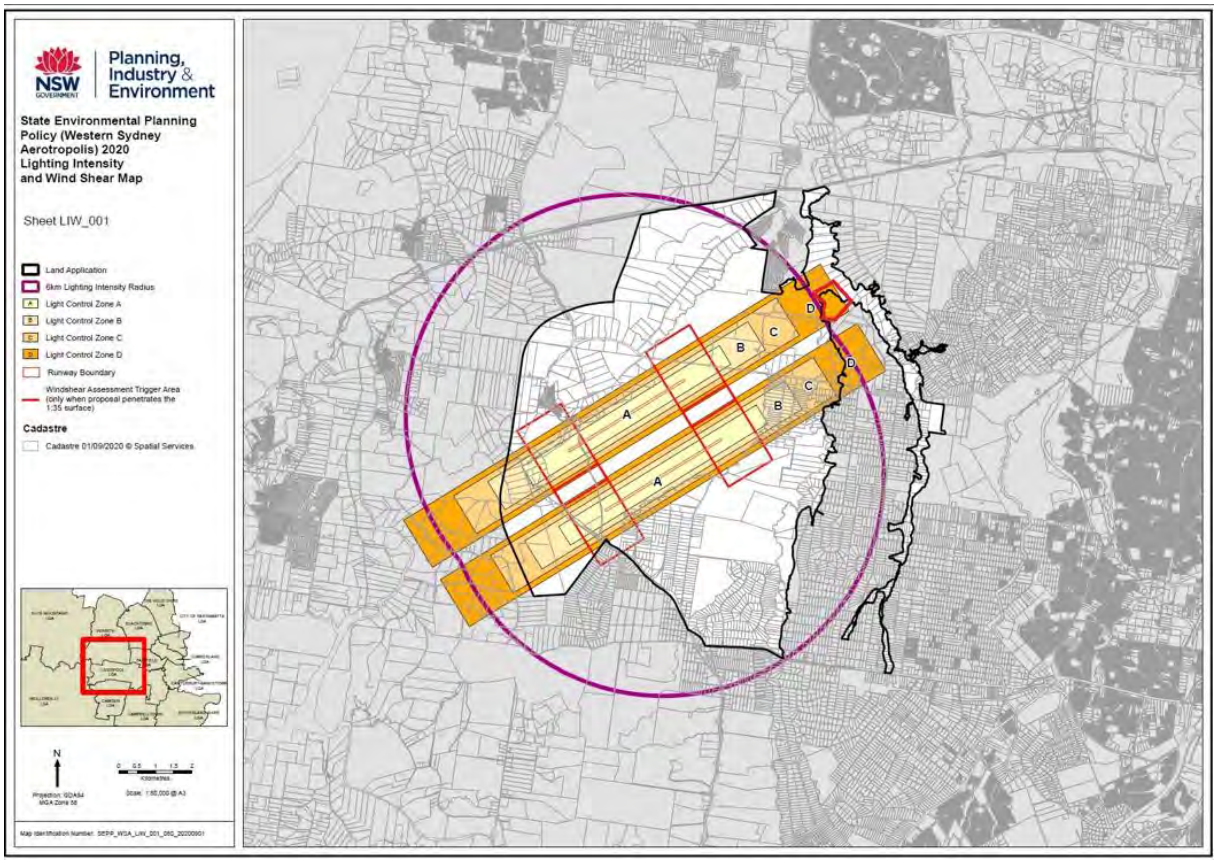



**Figure 3: SEPP Lighting Intensity and Windshear map with subject site *Source: DPIE & Aurecon***

### *2.2.4 Guideline F: Managing the Risk of Intrusions into the Protected Airspace of Airports*

The airport operational airspace is the volume of airspace above a set of imaginary surfaces, and the requirements are set by criteria established by the International Civil Aviation Organisation. These surfaces are to protect aircraft from obstacles or activities that could be a threat to safety, in particular, high-rise buildings, crane operation or plume rises.

Guideline F provides advice for working within and around protected airspace, including Obstacle Limitation Surface (OLS) and Procedures for Air Navigational Services – Aircraft Operations (PANS-OPS) intrusions. Figure 4 shows the SEPP Obstacle Limitation Surface Map.

The heights refer to the airspace requirements and ensure that no structures, either permanent or temporary protrude into the airspace.

#### Management of airspace risks identified

The consideration of Guideline F in the AWRC design, is the constraint of the OLS which informs building height restrictions and other risks relating to the protected airspace. It should be noted that objects penetrating the OLS does not in itself exclude a proposed development from occurring but is used as a guideline to assess potential impact to aircraft operation.

The building heights for the AWRC were checked using the online WSA OLS online tool. The proposed heights of all structures on the AWRC site do not penetrate the OLS, with the tallest structure proposed being approximately 25m above ground level, with approximately 75m clearance to the airspace.

This clearance height is also considered adequately sufficient for the use of cranes during AWRC construction.

In addition to structures potentially impacting the airspace, NASF Guideline F also details requirements on potential plumes rising and penetrating the airspace, which could be considered a safety risk depending on the plume velocity.

Potential plume emitting sources on the AWRC site include:

- Odour control discharge stack;
- Cogeneration engine exhaust stack(s); and
- Waste gas burners/flares.

The current design has estimated exhaust velocities at the AWRC stacks will likely exceed the critical velocity of 6.1 m/s outlined in the CASA Advisory Circular AC 139-05 v3.0 on plume rise assessments.

Following the process outlined in CASA's Advisory Circular, a formal application was lodged to CASA to undertake a preliminary screening assessment of the proposed facilities on site to assess. The application detailed the 'worst-case' configuration with all plume emitting sources located in close proximity on the site for assessment. The application determination concluded that 'given the relatively low exit velocities and the margins under the OLS, further detailed analysis by a specialist consultant is not warranted. Appendix C includes a copy of CASA's response.

The final OLS and PANS-OPS airspace design is expected to be confirmed closer to the opening of the airport. If any of the design elements and plume velocities change considerably during detailed design, an additional Western Sydney Airport OLS and CASA plume rise assessment will be conducted.

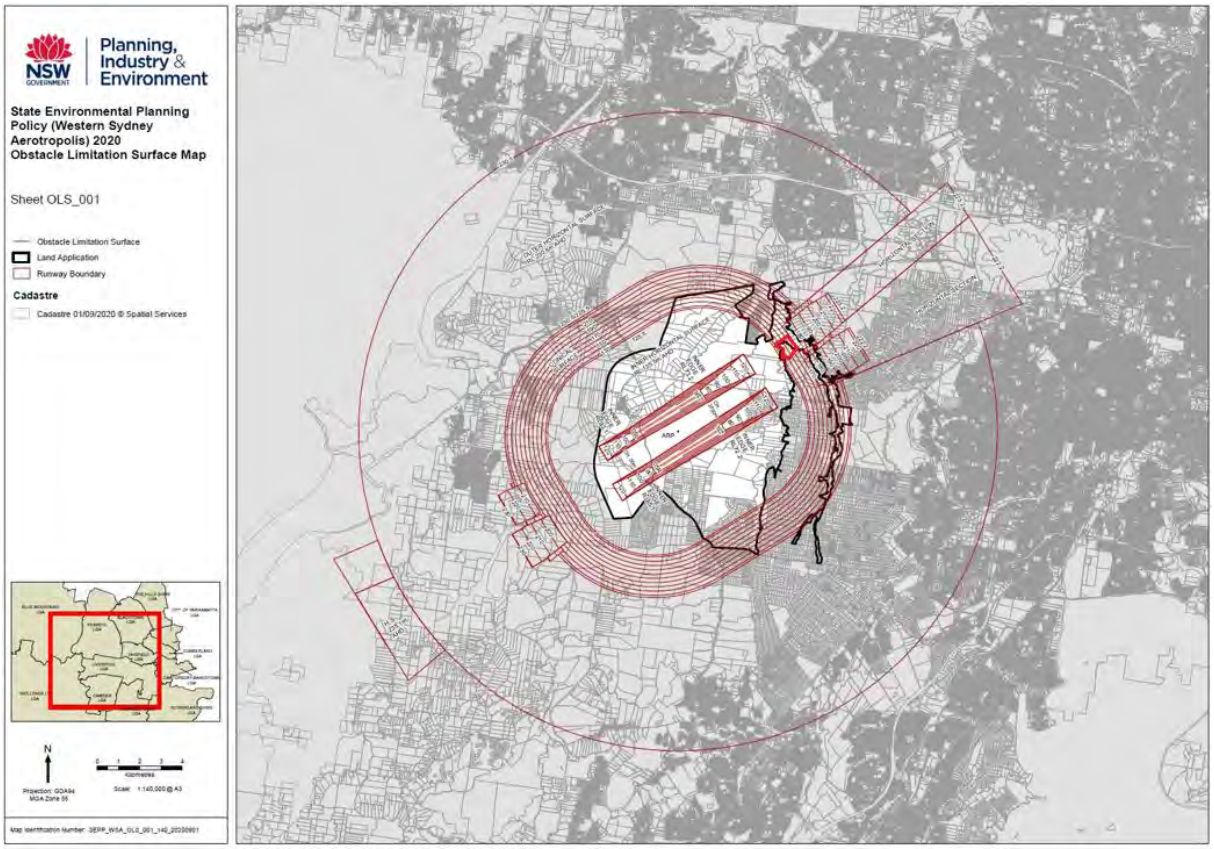



**Figure 4: SEPP Obstacle Limitation Surface map with subject site** ***Source: DPIE & Aurecon***

## 3 Conclusion

This safeguarding assessment highlights the proposed development is consistent with the objectives and requirements of the relevant policies, such as the SEPP, Development Control Plan, Aerotropolis Plan and the NASF.

This assessment concludes that the AWRC design has effectively managed any potential risks of protrusions in the airspace, lighting and noise impacts. The AWRC project has been, and will continue to be, designed to minimise the potential for impacts on operations at Western Sydney Airport.

The majority of potential aviation hazards have been avoided by design considering the NASF requirements. Sydney Water is continually managing the potential of wildlife risks and bird strike and implementing a number of mitigation measures in the design. As detailed design progresses, the project will continue to have regard to necessary safety requirements, including those defined by the guidelines and requirements described in this safeguarding assessment.

Noting the site and administration building  is within the 30 ANEF noise contour, it is considered suitable for light industrial development and is not required to be noise attenuated. The noise considerations of the site will also be monitored when operational.

Sydney Water will continue to engage with Western Sydney Airport on safeguarding considerations, particularly wildlife and bird strike, relevant to the development of the site.

Appendix A:

SEPP Maps (full scale)

Appendix B:
Avisure Wildlife Hazard Assessment

Appendix C:
CASA Correspondence

Appendix D:

Airservices Correspondence

Planning, Industry & Environment

NSW GOVERNMENT

# State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 Noise Exposure Contour Map

Sheet NEC_001

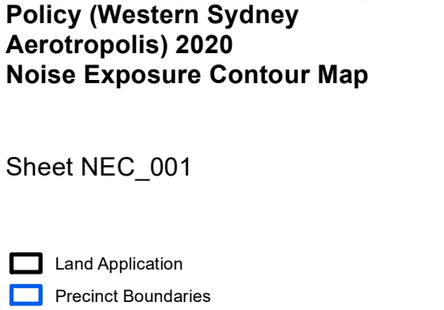
- Land Application
- Precinct Boundaries

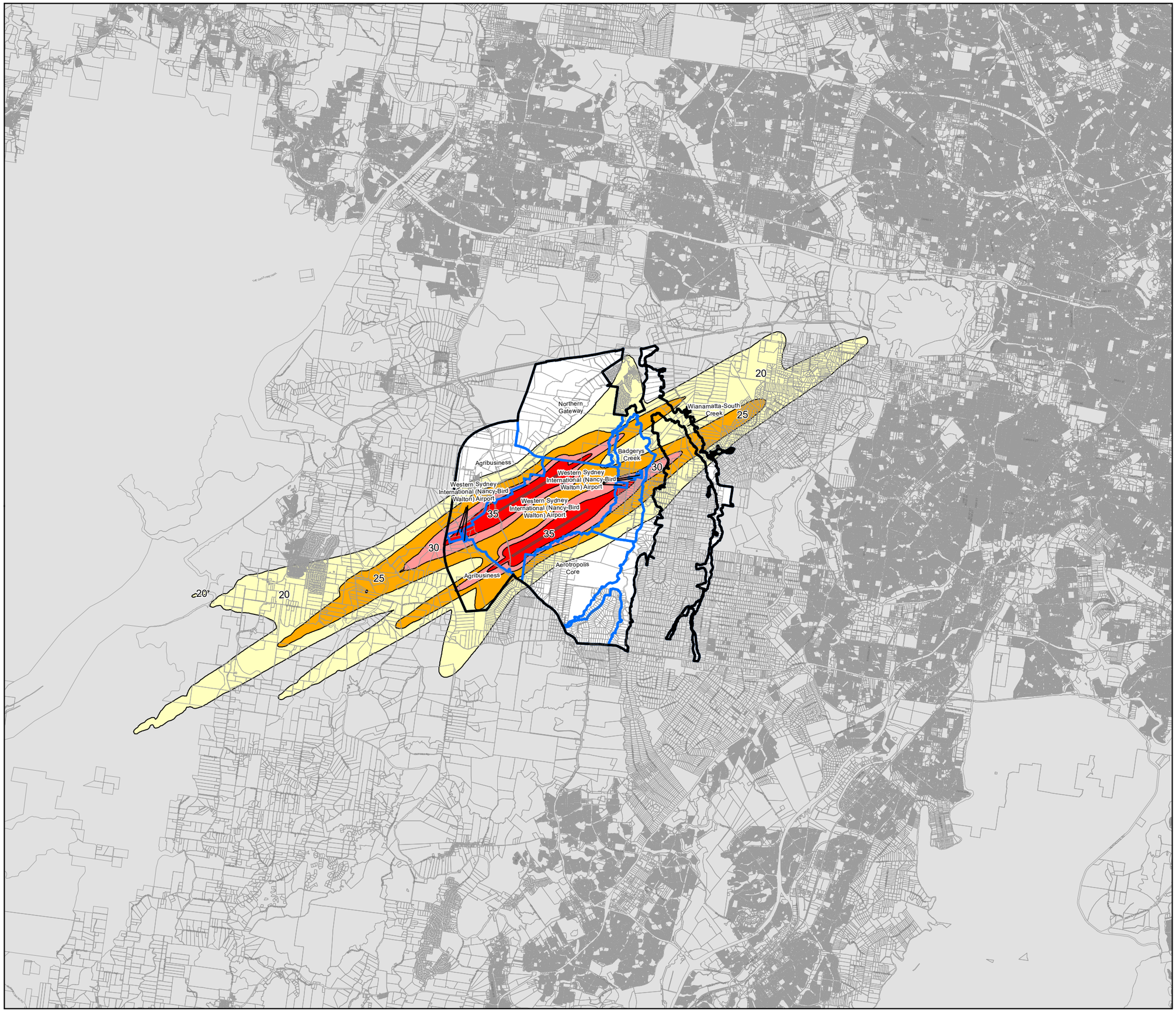
**Australian Noise Exposure Concept (units)**

- ANEC between 20 and 25
- ANEC between 25 and 30
- ANEC between 30 and 35
- ANEC exceeding 35
- Runway Boundary

**Cadastre**

- Cadastre 01/09/2020 © Spatial Services

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Projection: GDA94
MGA Zone 56

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Kilometres

Scale: 1:150,000 @ A3

Map Identification Number: SEPP_WSA_NEC_001_150_20200901

# State Environmental Planning Policy (Western Sydney Aerotropolis) 2020
# Wildlife Buffer Zone Map

Sheet WBZ_001

Land Application
Precinct Boundaries
Runway Boundary

**Wildlife Buffer Zone**

3 km
8 km
13 km

**Cadastre**

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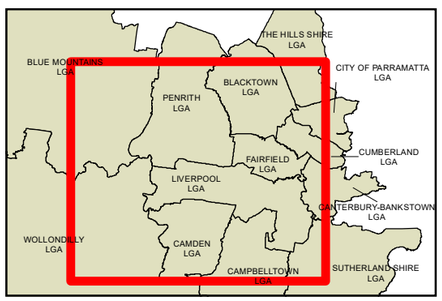


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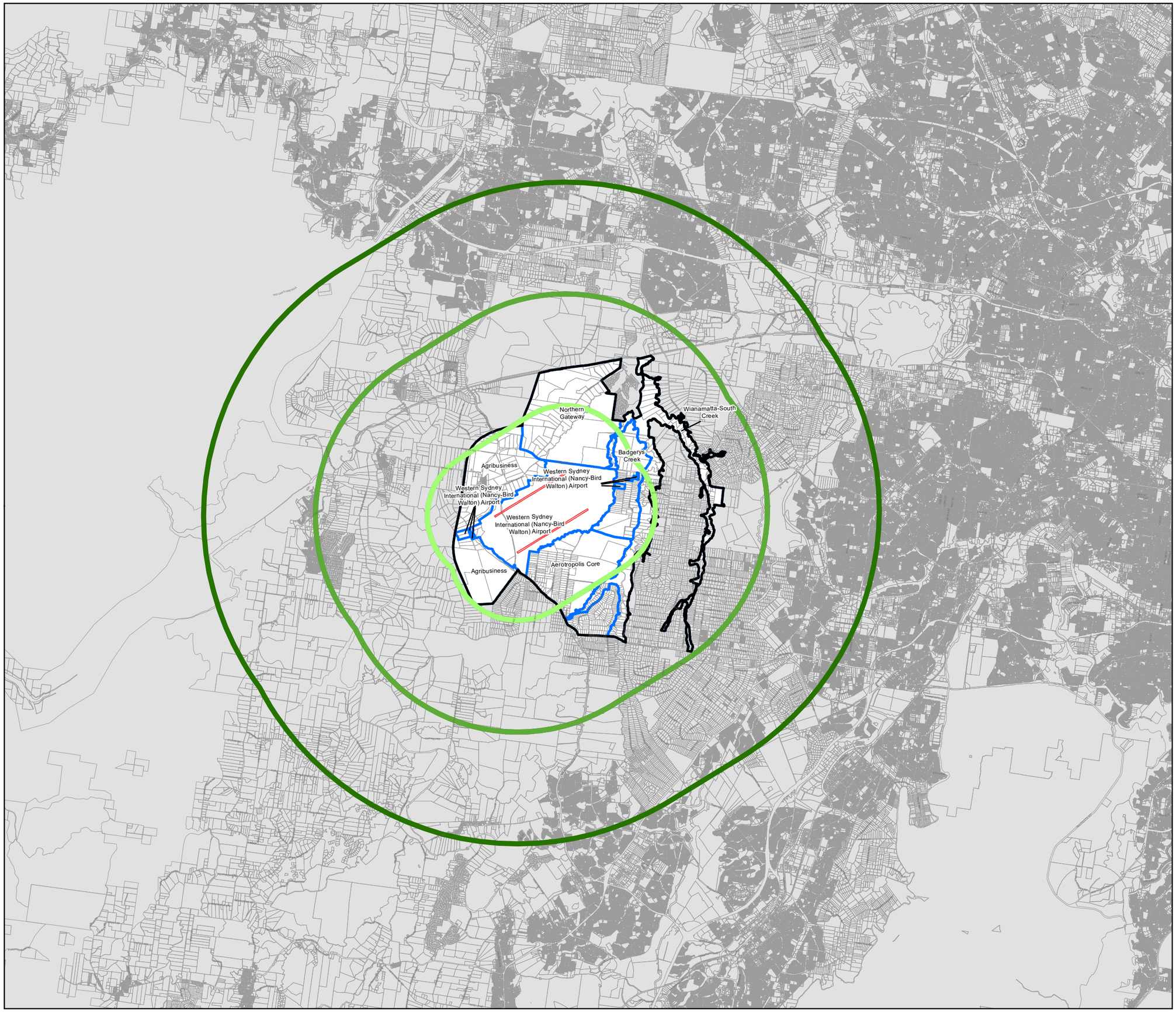


Planning, Industry & Environment

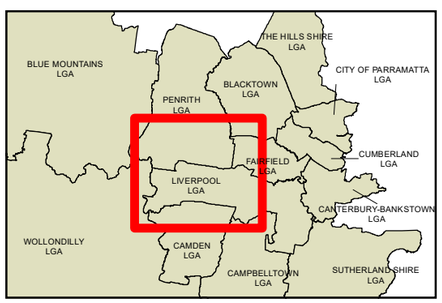
# State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 Lighting Intensity and Wind Shear Map

Sheet LIW_001

- Land Application
- 6km Lighting Intensity Radius
- A Light Control Zone A
- B Light Control Zone B
- C Light Control Zone C
- D Light Control Zone D
- Runway Boundary
- Windshear Assessment Trigger Area (only when proposal penetrates the 1:35 surface)

**Cadastre**

Cadastre 01/09/2020 © Spatial Services

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Projection: GDA94
MGA Zone 56

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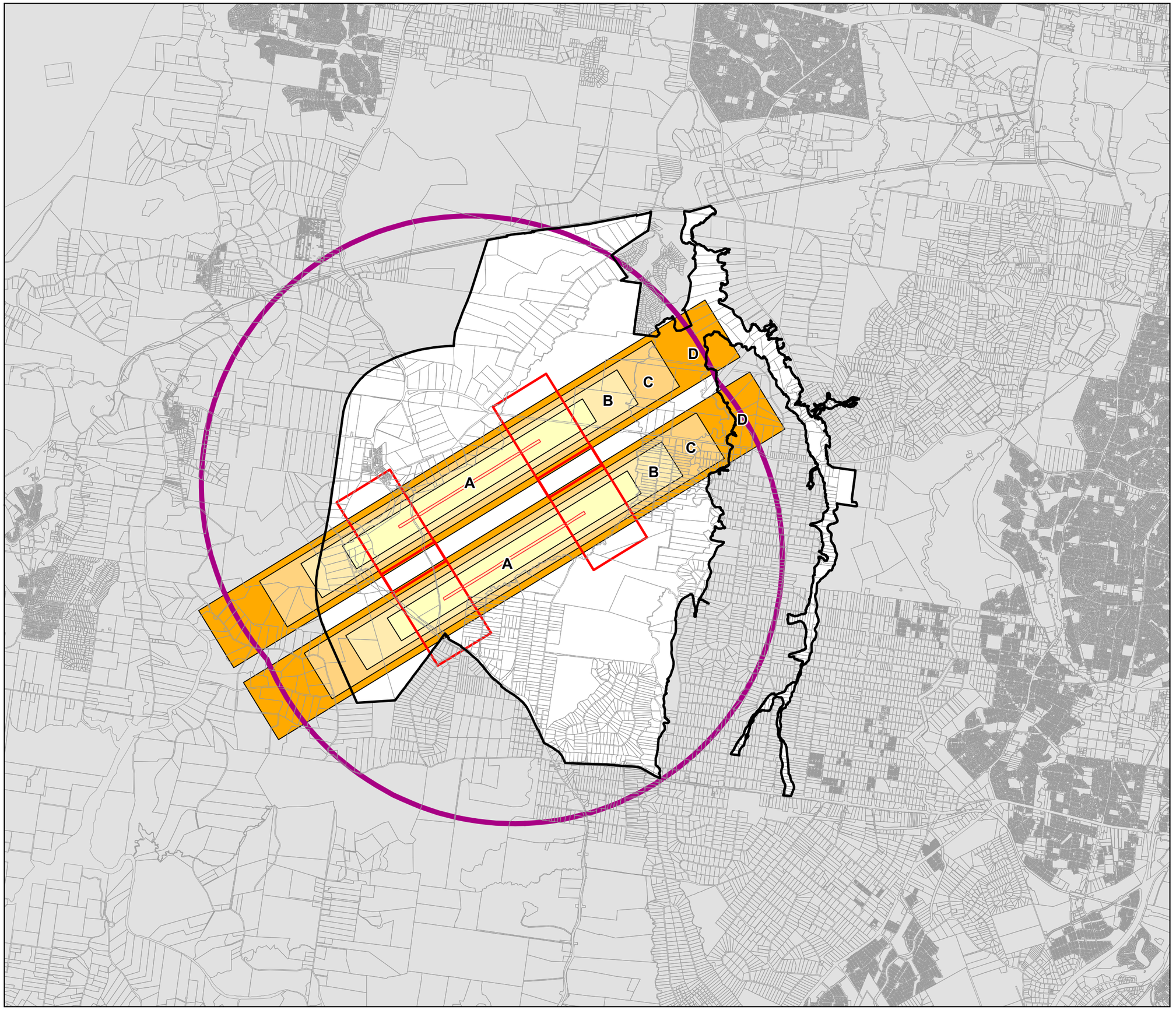


Planning, Industry & Environment

NSW GOVERNMENT

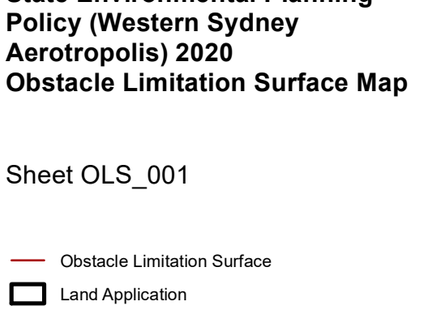
# State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 Obstacle Limitation Surface Map

Sheet OLS_001

- Obstacle Limitation Surface
- Land Application
- Runway Boundary

**Cadastre**

Cadastre 01/09/2020 © Spatial Services

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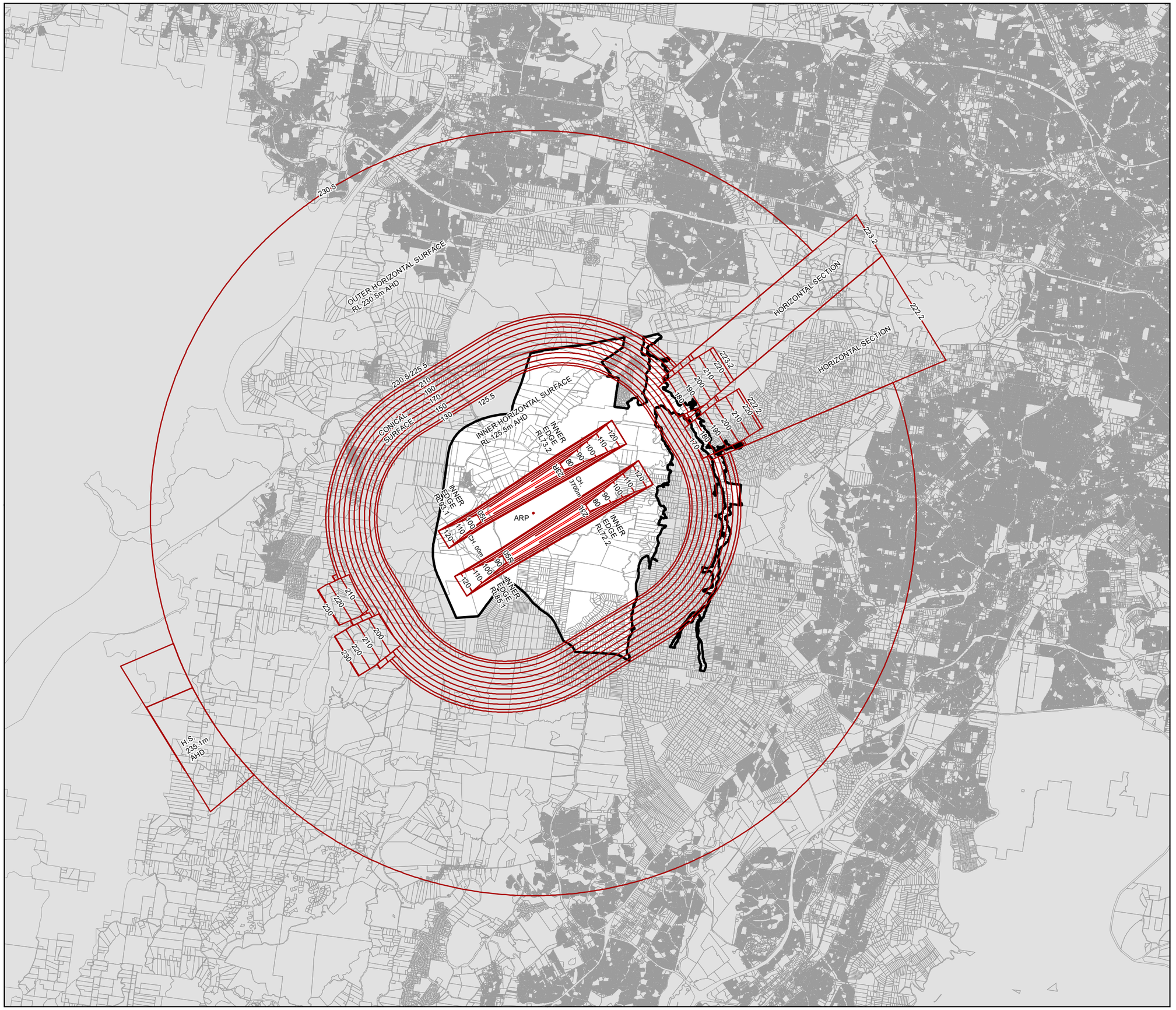


# Sydney Water

## Wildlife Hazard Assessment

### Upper South Creek Advanced Water Recycling Centre

Revision 2

November 2020

# Executive Summary

Sydney Water engaged Avisure in February 2020 to assess the potential wildlife hazards and risks associated with the proposed Upper South Creek Advanced Water Recycling Centre located close to Western Sydney Airport. Situated approximately 4.5km from the runway threshold, the site has potential to attract hazardous wildlife into the airport's vicinity, contributing to the strike risk once the airport is operational. Effective management of wildlife-attracting land uses adjacent to airports is imperative for safe aircraft operations.

Avisure prepared this Wildlife Hazard Assessment report following a review of various documents that form the Western Sydney Aerotropolis planning framework, along with relevant aviation regulations and standards, and a range guidance material specific to managing off-airport wildlife hazards.

This report:

- Describes the legal framework and summarises a variety of support and guidance documentation.
- Assesses the facility's potential wildlife risk level.
- Lists mitigation options to help Sydney Water manage potential wildlife hazards, including for stormwater management infrastructure proposed for the western Sydney region.
- Describes case studies where off-airport land use assessments determined the contribution to the wildlife strike risk.

The assessment was well-informed by recent wildlife surveys at Western Sydney Airport, wildlife strike data available for NSW and Australia, the National Airport Safeguarding Framework, Avisure's risk assessment method for off-airport land uses, and recent/ongoing work with the Western Sydney Planning Partnership regarding planning principles for western Sydney. This information, when combined and evaluated, showed the Upper South Creek Advanced Water Recycling Centre would likely present a very high risk given the availability of open water, the composition of wildlife species likely to use the site, its proximity to Western Sydney Airport, and the projected aircraft movement rates.

Sydney Water can effectively manage this risk by considering the mitigation options recommended, not just for the water treatment infrastructure itself, but any on-site

landscaping works. Monitoring the site once it's operational will determine, with greater accuracy, the level of wildlife activity and its contribution to the airport's strike risk profile.

Avisure delivered the initial report in May 2020. Revision 1 (delivered in September 2020) accounts for the additional review of stormwater facilities (Appendix C) and changes to the Upper South Creek Advanced Water Recycling Centre's infrastructure since the initial review. Avisure notes that the site's infrastructure changes since our initial assessment are unlikely to create any additional risks to those indicated in the initial report. Revision 2 (this report) appends details of the risk assessment method used.

# Table of Contents

# Abbreviations

| | |
|---|---|
| AC | Advisory Circular |
| AGL | Above Ground Level |
| AIP | Aeronautical Information Package |
| ATSB | Australian Transport Safety Bureau |
| CASA | Civil Aviation Safety Authority |
| FAA | Federal Aviation Administration |
| IBSC | International Bird Strike Committee |
| ICAO | International Civil Aviation Organization |
| MOS | Manual of Standards |
| NASF | National Airports Safeguarding Framework |
| NOTAM | Notice to Airman |
| USCAWRC | Upper South Creek Advanced Water Recycling Centre |
| WHA | Wildlife Hazard Assessment |
| WRC | Water Recycling Centre |
| WSA | Western Sydney Airport |
| WSAP | Western Sydney Aerotropolis Plan |
| WSPP | Western Sydney Planning Partnership |
| WSUD | Water Sensitive Urban Design |

# Glossary

| | |
|---|---|
| Active Management | The use of short-term management techniques such as distress calls, pyrotechnics, trapping and culling to disperse or remove birds. |
| Airport Safeguarding | Land use planning processes to manage the impact of development around airports to improve safety outcomes and community amenity. |
| Consequence | The outcome of an event expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. There may be a range of possible outcomes associated with an event. |
| Critical Area | Areas within or in close proximity to the flight strip, approach and landing paths, and movement areas of an airport. |
| Detention Basin | Basin that is usually dry except during or after precipitation. Their purpose is to slow down water flow and hold it for a short period of time (48 hours or less). |
| Foraging | When animals search for and obtain food. |
| Hazard | A source of potential harm or a situation with potential to cause loss. |
| Loafing | When animals rest. |
| Probability | The likelihood of a specific event or outcome, measured by the ratio of specific events or outcomes to the total number of possible events or outcomes. |
| Raptor | Birds of prey such as eagles and falcons. |
| Retention Basin | Basin that holds a permanent pool of water that fluctuates in response to precipitation and runoff from the contributing areas. |
| Risk | The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and probability. |
| Roosting | When birds repeatedly return to a particular place in numbers to loaf or spend the night. |
| Transit | When birds fly from one place to another. |
| Wildlife Strike | A **reported wildlife strike** is deemed to have occurred whenever:<br>• a pilot reports a strike to the ATSB<br>• aircraft maintenance personnel find evidence of a bird or animal strike on an aircraft |

| | |
|---|---|
| | • personnel on the ground report seeing an aircraft strike one or more birds or animals<br>• bird or animal remains are found on the airside pavement area, or within the runway strip, unless another reason for the bird or animals' death can be established.<br><br>A **suspected wildlife strike** is deemed to have occurred whenever a bird or animal strike has been suspected by aircrew or ground personnel but upon inspection:<br>• no wildlife carcass or remains are found, and<br>• there is no physical evidence on the aircraft of the strike having occurred.<br><br>A **confirmed wildlife strike** is deemed to have occurred whenever:<br>• aircrew report that they *definitely* saw, heard or smelt a bird strike<br>• bird or animal remains are found on the airside pavement area or within the runway strip, unless another reason for the bird or animal's death can be found<br>• aircraft maintenance personnel find evidence of a bird or animal strike on an aircraft.<br><br>A **wildlife near miss** is deemed to have occurred whenever a pilot takes evasive action to avoid birds or animals.<br><br>An **on-aerodrome wildlife strike** is deemed to be any strike that occurs within the boundary fence of the aerodrome, or where this is uncertain, where it occurred below 500 ft on departure and 200 ft on arrival.<br><br>A **wildlife strike in the vicinity of an aerodrome** is deemed to have occurred whenever a bird strike occurs outside the area defined as 'on aerodrome' but within an area of 15 kilometres radius from the aerodrome reference point (ARP) or up to 1,000 feet above the elevation of the aerodrome.<br><br>A **wildlife strike remote from the aerodrome** is deemed to have occurred whenever a bird strike occurs more than 15 kilometres from an aerodrome or more than 1,000 feet above the elevation of the aerodrome. |
| Wildlife Survey | Standardised high-level surveys that capture data regarding wildlife species, their behaviours, and their distribution. Usually completed by wildlife biologists or ornithologists. |

# 1. Introduction

## 1.1. The Wildlife Strike Issue

The consequence of wildlife strikes with aircraft can be very serious. Wildlife strikes have caused 532 human fatalities and 614 aircraft losses since the beginning of aviation (Shaw et al, 2019). Wildlife strikes cost the commercial civil aviation industry an estimated US$1.2 billion per annum (Allan, 2002) and involve more than just the repair of damaged engines and airframes. Even apparently minor strikes which result in no obvious damage can reduce engine performance, cause concern among aircrew and add to airline operating costs.

The main factors determining the consequences of a strike are the number and size of animals struck, the combined closing speed at which the strike occurred, the phase of flight when struck and the part of the aircraft hit. Generally, the larger the animal, the greater the damage. Large animals have the ability to destroy engines and windshields and cause significant damage to airframe components and leading edges. Strikes involving more than one animal (i.e. a multiple strike) can be serious, even with relatively small wildlife, potentially disabling engines and/or resulting in major accidents. While total mass struck and impact site on the aircraft are important strike consequence considerations, final impact speed is the most significant determinant as impact force varies exponentially with the square of closing speed.

Strike risk depends on the probability of colliding with wildlife and the consequence to the aircraft if collision occurs. The probability of a wildlife strike occurring increases as the number of wildlife and aircraft operating in the same airspace increases. Strike probability also increases with airspeed. In practice, this means that the likelihood of colliding with a bird inflight increases when operating at high speed below 5000’ above ground level (AGL), which is where the majority of birds operate. Wildlife density, and therefore strike probability, increases with decreasing height above the ground. Aircraft operating at low altitudes over, or near, wildlife attracting areas will significantly increase strike probability.

Historically, over 90% of reported strikes occur on or in close proximity to airports (International Civil Aviation Organization 1999). Consequently, it is important that surrounding land managers are aware of wildlife strike issues and that all stakeholders become involved in the process of reducing the hazard. Effective management of wildlife-attracting land uses adjacent to airports is imperative to safe aircraft operations.

## 1.2. Project Description

Construction and operation of Sydney Water's Upper South Creek Advanced Water Recycling Centre (USCAWRC), hereafter referred to as the Water Recycling Centre (WRC), and associated stormwater harvesting systems close to Western Sydney Airport (WSA) requires careful consideration regarding the potential wildlife attraction. Water treatment facilities can attract significant numbers of wildlife, which when close to aircraft flight paths and airport operational areas, can contribute to the wildlife strike risk. Due to the proximity and location wildlife attracted to this facility would likely present a risk to future aircraft operations at WSA. In response, Sydney Water requested advice from an aviation ecologist experienced in wildlife hazard management at airports to minimise the potential impact of the USCAWRC on future WSA wildlife strike risks.

### 1.2.1. Scope

Avisure assessed the proposed WRC located close to WSA. This included a review of the appropriateness of the facility's design and assets and the potential wildlife attraction, particularly as it relates to open water sources, vegetation, nearby land uses and aircraft flight paths. We also evaluated the initial stormwater management infrastructure designs. We applied a risk assessment based on several assumptions and scenarios, to determine the potential level of risk offered by the facility with and without mitigation.

Our recommendations are based on land use design principles around airports to mitigate any potential wildlife risks.

### 1.2.2. Limitations and assumptions

1. The airport and the surrounding Aerotropolis precincts are not constructed. Assumptions are made about wildlife species based on previous survey work on the WSA site and in its vicinity. The changing landscape during and after development will influence wildlife populations, however the existing information of which species are currently using the site and surrounds are a reasonable guide.

2. The WRC is not constructed. Assumptions are made based on our understanding of the proposed facilities (which are a reference design and may change as detailed design progresses) and the nature of the site's attraction to wildlife.

3. In the absence of site-specific wildlife surveys from the WRC, the risk assessment extrapolates the species observed at WSA in 2018. This assumes a similar suite of species are likely to use areas in the vicinity of the airfield.

4. The risk assessment excluded terrestrial mammals. Even if the WRC supports populations of goat, deer, kangaroos, etc. They are unlikely to influence WSA's strike risk profile given the distance from the airport.

5. The risk assessment did not consider flying-foxes because survey data was not available for input. However, given the potential flying-fox strike risk for WSA, we have considered this in our recommendations and conclusions.

6. The risk assessment is not designed to model minor variations in the types of open water facilities and specific plants used in landscaping on a single site. However, we have accounted for this in our recommendations and conclusions.

7. The risk assessment is more accurate when airport strike data is included. In the absence of strike data for WSA, the risk assessment considers strikes in NSW and Australia for the species included in the assessment.

Despite these limitations, this WHA assessed the potential wildlife hazard and provided a series of recommendation and guidance options to mitigate any identified risk in order to help safeguard WSA operations once operational.

### 1.2.3. Key Outcomes

1. Due to the likely attraction of high-risk species and the proximity to the airport flight paths the assessment identified the WRC, if wildlife mitigation measures are not applied, as a very high-risk site. It is noted that Sydney Water intend to mitigate given the proximity of the site to WSA.

2. At the facility itself, this mitigation should focus on: covering open water sources; using plants in landscaping that are low wildlife attractants, and; designing infrastructure in a way that reduces perching and potential nest platforms.

3. The bioreactors, the facility's largest structures, can be left uncovered. The aeration action in the bioreactors will likely deter wildlife from accessing the water, therefore we don't believe these assets require permanent covers if aeration is continuous. However, ongoing monitoring is recommended to identify any emerging issues.

4. Sydney Water are demonstrating a commendable and proactive approach to safeguarding WSA.

# 2. Background

## 2.1. Wildlife Strikes and Land Use Around Airports

In civil aviation around 93% of strikes occur at below 3500' AGL (Dolbeer 2011), with 96% of flying-fox strikes recorded at or below 1000' AGL (Parsons et al 2008). Consequently, management focusses largely on terminal airspace and management responsibility has typically resided with aerodrome operators. However, aircrew and air traffic controllers should be engaged in strike risk and mitigation processes, and high-risk operations consider predicted or observed wildlife movement patterns. It is also critical that external stakeholders, including wildlife authorities, local planning authorities and land users, are engaged to monitor and mitigate wildlife hazards, and that both on- and off-aerodrome hazards are critically assessed.

### 2.1.1. Case Studies

#### 2.1.1.1. CASE STUDY: Canberra Airport and the Healthy Waterways Project

The ACT Healthy Waterways Project aimed to protect and improve long-term water quality in the ACT by reducing the level of nutrients, sediment and pollutants entering waterways. It involved the construction of ponds, wetlands, rain gardens and swales, along with creek restoration and channel reconnection. There were a number of considerations to select sites, including safeguarding Canberra Airport against wildlife strikes. Proposed sites in the vicinity of the airport were evaluated to determine their potential contribution to the airport's strike risk. The sites were chosen based on the National Airports Safeguarding Framework (NASF) requirement to assess wildlife hazards at wetlands within 8 km of airports. A risk assessment for each site was based on the wildlife species that present a strike risk at Canberra Airport (and associated habitat requirements and behavioural characteristics); aircraft movements (including flight paths and aircraft types); the proximity and juxtaposition of the sites; and the overall design and construction plan for the individual sites. The assessment was further informed by the wildlife surveys conducted at each site.

Some sites did not go ahead due to the high risk, but others proceeded with mitigation. The types of mitigation applied included:

- Installing interpretive signage and enforcement to prevent feeding of wildlife.
- Modifying wetlands to remove islands and perching structures.

- Removing rock clumps and felled trees from waterlines.
- Increasing batter of wall and bank gradients in waterways.
- Increasing water levels to greater than 1m.
- Using rock gabions to increase water depth and eliminate shallow verges.
- Modifying landscaping to remove plant species that attract hazardous wildlife.
- Eliminating open water sections of wetlands to minimise the attraction for landing waterbirds.

**Key outcome:** Overall objective of the project achieved with modifications to safeguard the airport.

#### 2.1.1.2. CASE STUDY: Water retention close to an airport

*The following case study has been anonymised due to ongoing and outstanding actions.*

A site, situated close to an airport less than 350 m from the runway centreline, was modified in the 1980s to create a stormwater retention system, but sedimentation has since filled the old basin. The local council plans to modify the creek system, including the retention basin, to facilitate drainage, mitigate flood risks, and restore effective stormwater detention basin. This will involve excavating and dredging in the existing catchment and remove natural sediment deposition onto on-site treatment pads. The excavation will create a 200,000$m^3$ stormwater detention basin and remove 16,400$m^2$ of vegetation. The project site was identified as potentially attractive to birds and other wildlife, which would contribute to the airport's wildlife strike risk. Council planners noted the potential hazard in the development application:

*"Editor's note: A development proposal in the vicinity of a strategic airport that may increase risk of wildlife strike should be referred to the airport manager for assessment. A development proposal in the vicinity of a defence or joint-user airfield that may increase risk of wildlife strike should be referred to DoD for assessment".*

*"Where local government seek to approve land uses which may increase the risk of wildlife strike near existing airports, steps should be taken to mitigate risk in consultation with the airport manager and qualified bird and wildlife management experts".*

In response the airport commissioned a wildlife management expert to assess the potential for the project to increase the wildlife strike risk. The assessment identified the following:

- Without modifications to the design of the project, the council should consider if alternative locations are available to meet its stormwater management requirements.

- Regulations and guidance are clear that waterbodies in proximity to airfields should be prevented or eliminated.

- Increased aircraft movements at the airport (particularly of faster and larger aircraft) increases the probability of strikes even if the number of birds at retention basin remains stable.

- The majority of birds previously recorded at the retention basin are waders and waterbirds which present a significant strike risk because of their large body mass and tendency to move in flocks.

- The airport has a limited strike history with large and/or flocking species. In the event of an increase in strikes with these species, the development at the retention basin will likely be implicated.

- Construction will likely attract hazardous species for at least 12 weeks.

- Once completed, the site will likely attract hazardous bird species. The preferred water depth for hazardous bird species is nearly evenly split between deep and shallow water options.

- Modifications to the project design will reduce the attractiveness of the site; however, unless the basin is inaccessible to birds, the site will attract hazardous species and they will likely transit critical aircraft flight paths.

- If council modify this environment, and the modifications increase the strike risk, it is likely that the council will be held responsible in the event of a significant wildlife strike.

**Key outcome:** pending.

#### 2.1.1.3. CASE STUDY: Gold Coast Airport and the Desalination Plant

Located on the boundary of Gold Coast Airport, the Gold Coast Desalination Plant liaised with the airport regarding their proposed facility prior to construction in 2006 over concerns about how the facility may contribute to the airports strike risk. This was before the implementation of the NASF Guideline C but was considered under Queensland's State Planning Policy relating to wildlife hazards in the vicinity of airports. The previous wastewater treatment plant

had established populations of hazardous species on site, such as Australian White Ibis, and there were also concerns over how these populations would respond to the construction and whether they would be displaced onto the airfield.

The desalination plant operator completed a study to identify potential hazards, recommend mitigation actions, provide an on-going monitoring program, and deliver wildlife hazard management training to plant staff. The key areas that required attention during the construction included excavation and earthworks, topsoil management, construction crew food waste, wastewater drainage, landscaping designs and building design. Following the initial review, to mitigate the potential risk to Gold Coast Airport, daily wildlife dispersal was done at the construction site, directing wildlife away from the site and the airport.

**Key outcome:** The Desalination Plant was constructed on the designated site with a management plan and procedures in place to monitor, detect and manage wildlife hazards. Key to the success of the program is the relationship with the airport which includes communicating wildlife activity and changes to plant operations to the Aerodrome Reporting Officers, and involvement in the airport's quarterly Runway Safety Committee.

**Figure 1.** Construction of the Gold Coast Desalination Plant.

**Figure 2.** The completed desalination facility.

### 2.1.1.4. CASE STUDY: Christchurch Airport and Wetlands

The Christchurch District Council's Christchurch District Plan identifies a range of Permitted Activities in the Birdstrike Management Area including for the creation new water bodies and stormwater basins with the following activity specific standards:

**Permitted activity:**

Creation of a new: stormwater basin; or water body (including wastewater oxidation pond) which exceeds 500m² in area (does not apply to any area of a water body covered by an aviary).

**Specific standards:**

a. The combined area of all stormwater basins and/or water bodies, that are wholly or partly within 0.5km of the proposed water body or stormwater basin's edge, shall not exceed 1000m².

b. Any stormwater basin has been designed by a suitably qualified person, with experience in stormwater management systems, to the following standards:

   i. Stormwater infiltration basins shall be designed to fully drain within 48 hours of the cessation of a 2% AEP storm event;

   ii. Sufficient rapid soakage overflow capacity shall be provided to minimise any ponding of stormwater outside the infiltration area(s); and

   iii. Plant species used shall be limited to those listed in Appendix 6.11.9.

c. Any water body has been designed by a suitably qualified person, with experience in stormwater management systems, to the following standards:

   i. Side slopes shall be at least as steep as 4V:1H except for:

      A. any side slope treated with rock armouring; or

      B. any area required for vehicle access, provided that such access has a gradient of at least 1V:8H:

   ii. No permanent island features shall be included, that could provide perching sites for birds; and

   iii. Plant species used shall be limited to those listed in Appendix 6.11.9.

These provisions give effect to:

- **6.7.2.1.2 Policy – Avoidance or mitigation of navigational or operational impediments**:

  a. Avoid or mitigate the potential effects of activities that could interfere with the safe navigation and control of aircraft, including activities that could interfere with visibility or increase the possibility of birdstrike.

- **3.3.12 Objective – Infrastructure**:

  b. Strategic infrastructure, including its role and function, is protected from incompatible development and activities by avoiding adverse effects from them, including reverse sensitivity effects. This includes:

    iv. managing the risk of birdstrike to aircraft using Christchurch International Airport.

**Key outcome:** Formal obligation for wetland and stormwater basin management embedded in local government planning framework in order to contribute to airport safeguarding at Christchurch Airport.

## 2.2. Wildlife Strikes and Western Sydney Airport

WSA engaged Avisure in January 2018 to assess the wildlife hazard, identify potential strike risks and to present strike risk mitigation options for consideration during design and construction stages of the airport. A risk assessment based on airport survey data collected identified numerous high and moderate risk species, Table 1 (Avisure 2019).

**Table 1.** WSA wildlife species risk assessment, 2018.

| Rank | Common Name | Risk |
|---|---|---|
| 1 | Eastern Grey Kangaroo (*Macropus giganteus*) | Very High |
| 2 | Spotted Deer (*Axis axis*) | High |
| 3 | Wood Duck (*Chenonetta jubata*) | High |
| 4 | Black Swan (*Cygnus atratus*) | Moderate |
| 5 | Domestic Dog (*Canis lupus familiaris*) | Moderate |
| 6 | Straw-necked Ibis (*Threskiornis spinicollis*) | Moderate |
| 7 | Unidentified Duck (Family: *Anatidae*) | Moderate |
| 8 | Pacific Black Duck (*Anas superciliosa*) | Moderate |
| 9 | Feral Goat (*Capra aegagrus hircus*) | Moderate |
| 10 | Hardhead (*Aythya australis*) | Moderate |
| 11 | Australian Pelican (*Pelecanus conspicillatus*) | Moderate |
| 12 | Australian Raven (*Corvus coronoides*) | Moderate |
| 13 | Eurasian Coot (*Fulica atra*) | Moderate |
| 14 | Cattle Egret (*Bubulcus ibis*) | Moderate |
| 15 | Wedge-tailed Eagle (*Aquila audax*) | Moderate |
| 16 | Masked Lapwing (*Vanellus miles*) | Moderate |
| 17 | Grey Teal (*Anas gracilis*) | Moderate |
| 18 | Little Black Cormorant (*Phalacrocorax sulcirostris*) | Moderate |

| Rank | Common Name | Risk |
|---|---|---|
| 19 | Little Pied Cormorant (*Microcarbo melanoleucos*) | Moderate |
| 20 | Purple Swamphen (*Porphyrio porphyrio*) | Moderate |
| 21 | Galah (*Eolophus roseicapilla*) | Moderate |
| 22 | Common Starling (*Sturnus vulgaris*) | Moderate |
| 23 | Swamp Wallaby (*Wallabia bicolor*) | Moderate |
| 24 | Pied Currawong (*Strepera graculina*) | Moderate |
| 25 | Magpie Lark (*Grallina cyanoleuca*) | Moderate |

In addition, Avisure identified sixty-six sites within 13 km of WSA that attract wildlife and, in their current use, may contribute to the airport's strike risk once operational if left unmanaged.

At the time of this risk assessment in 2018, the airport site and immediate surrounds hosted a complex network of farm dams and ponds that supported large populations of these water birds (e.g. duck, teal, swan, cormorant, pelican). Construction of the airport and changes to land use in the vicinity will remove many of these water sources. However, the construction of additional permanent water sources, along with the revitalisation of natural water courses, may continue to support large populations of these birds. Careful planning regarding the location of these water sources relative to airport is required and regular surveys will monitor their redistribution. The redistribution of water birds, who make up 44% of the risk species, will depend on the availability of water sources.

The species and off-airport risks are dynamic, are not accurate predictors of future risks, and will change in response to landscape changes during airport construction and operation, as well as changing land use activity close to the airport. WSA intend to continue regular monitoring on the airfield site during and after construction, along with regular assessments to determine species risks. How wildlife uses the landscape, and how they will respond to changes in that landscape during airport construction and operation, is complex. The only way to develop targeted and effective wildlife management is by understanding how they use this changing landscape, and the only way to understand this is through ongoing and standardised monitoring, including the use of radar, and regular risk assessments.

The risk associated with large terrestrial mammals (e.g. kangaroo, deer, dog, goat and wallaby) will be minimal once the airport is contained by a secure perimeter fence. The airport will be responsible for maintaining fence integrity by identifying and resolving any breach issues.

# 3. Wildlife Hazard Assessment Method

Avisure reviewed the following literature and data:

- Australian Transport Safety Bureau (ATSB) aviation occurrence database.
- WSA Initial Wildlife Hazard Assessment Final Report 2019.
- Civil Aviation Safety Authority (CASA) Advisory Circular 139-26(0) Wildlife Hazard Management at Aerodromes.
- CASA Part 139 Aerodromes Manual of Standards (MOS).
- National Airports Safeguarding Framework (NASF) Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports.
- International Birdstrike Committee (IBSC) Recommended Practices No. 1 Standards for Aerodrome Bird/Wildlife Control.
- International Civil Aviation Organization (ICAO) Doc 9137 Airport Services Manual. Part 3: Wildlife Control and Reduction.
- ICAO Doc 9184 Airport Planning Manual. Part 2: Land Use and Environmental Control.
- ICAO Annex 14 to the Convention on International Civil Aviation: Aerodromes, Volume 1 Aerodrome Design and Operation.
- Greater Sydney Commission Our Greater Sydney 2056 Western City District Plan – Connecting Communities.
- NSW Government 2017 Metropolitan Water Plan.
- Western Sydney Planning Partnership (WSPP) Western Sydney Aerotropolis Discussion Paper on the Proposed State Environmental Planning Policy.
- WSPP Western Sydney Aerotropolis Summary of Key Planning Documents.
- WSPP Western Sydney Aerotropolis Plan. Draft for Public Comment.
- WSPP Western Sydney Aerotropolis Development Control Plan – Phase 1. Draft for Public Comment.

- Federal Aviation Administration (FAA) Advisory Circular 150/5200-33B - Hazardous Wildlife Attractants on or Near Airports.

A workshop with Avisure and Sydney Water representatives on Tuesday February 18th, 2020:

- Consolidated information about the water treatment facility.
- Discussed the concept of wildlife strikes at airports and how land use activity in the vicinity of airports can contribute.
- Discussed the proposed water treatment facility design features.
- Presented possible mitigation options for Sydney Water consideration.

Following the workshop, Avisure:

- Consolidated all information.
- Completed a series of risk assessments to determine the site's risk level based on open and closed water facilities, and the inclusion of landscaping on the site.
- Evaluated the level of risk from the risk assessment against the proposed facility design and its specific assets.
- Identified recommendations to mitigate potential risks.
- Compiled the *Sydney Water Wildlife Hazard Assessment* report (this report).

An online meeting with Avisure and Sydney Water representatives on Friday August 21st, 2020 (as part of the project extension commissioned in August 2020):

- Presented more information regarding proposed stormwater management facilities and designs.
- Discussed the proposed changes to the treatment facility's infrastructure.
- Discussed aviation safeguarding principles and options for Sydney Water to mitigate wildlife strike risks.

# 4. Regulations, Standards and Guidance

There are a number of national and international requirements and guidance documents that indicate land use in the vicinity of an airport can contribute significantly to the wildlife hazard levels and safety of aircraft operations. Tables 2 and 3 summarises these requirements, Appendix A provides more detail.

**Table 2.** National and NSW requirements and recommendations for managing wildlife hazards in the vicinity of airports.

| Instrument | Summary |
|---|---|
| CASA Part 139 MOS | The Part 139 MOS prescribes the aerodrome requirements. Sections relevant to wildlife hazard management focus on: bird hazard information for the Aeronautical Information Package (AIP), drainage and drains in the runway strip, requirements for serviceability inspections, Notice to Airman (NOTAM) requirements for bird hazards, Reporting Officer responsibilities, animal hazard management requirements, and standing water on paved surfaces. |
| National Airport Safeguarding Framework | Guideline C of the NASF, *Managing the Risk of Wildlife Strikes in the Vicinity of Airports*, provides guidelines to land users and planners regarding the management of wildlife hazards. Adhering to the ICAO guidelines relating to radial distances from airports (3km, 8km and 13km), the NASF allocates risk categories to land uses from very low to high and recommends actions for both existing and proposed developments (i.e. incompatible, mitigate, monitor, no action). The NASF encourages a coordinated approach between airport operators and land use planning authorities to mitigate risks, and where risks are identified for new developments, the NASF recommends:<br>• developing a management program<br>• establishing management performance standards |

| Instrument | Summary |
|---|---|
| | • allowing for design changes and/or operating procedures where the land use is likely to increase the strike risk<br>• establishing appropriate habitat management<br>• creating performance bonds should obligations not be met<br>• monitoring by airport authorities<br>• reporting wildlife events as per ATSB requirements. |
| *NSW Environmental Planning and Assessment Act 1979* | The *Environment Planning and Assessment Act* institutes the state's planning system and describes the Ministerial Directions under Section 9.1. that relate to safeguarding aviation and the Western Sydney Aerotropolis. |
| *NSW Damage by Aircraft Act 1952* | The *Damage by Aircraft Act* describes 'unlimited liability' to aircraft operators in the event of property damage/destruction or personal injury/loss of life by an aircraft or part thereof. In worst case situations following a significant strike, aircraft operators will likely seek to clarify if aerodrome operators, and even land users in the vicinity of airports, showed adequate due diligence in their responsibility to safeguard operations against wildlife strikes. |
| *NSW Workplace Health and Safety Act 2011* | The *Work Health and Safety Act* requires appropriate duty of care to employees and contractors to maintain a safe working environment. Although not directly linked to aviation and wildlife strike management, the presence of wildlife in workplaces can create health issues for workers. Therefore, managing land use activities that are attracting wildlife, particularly where birds are nesting or roosting, not only contributes to airport safeguarding but maintains a safe work environment. |

**Table 3.** International standards and recommendations for managing wildlife hazards in the vicinity of airports.

| Instrument | Summary |
|---|---|
| International Civil Aviation Organization<br><br>ICAO Annex 14, Volume 1 (Aerodrome Design and Operation) | As a member state to the ICAO, Australia is required to adhere to the rules and regulations stipulated by ICAO, including those relating to wildlife hazard management on and around airports. There are also series of guidance documents and best practice standards airports can refer to assist with wildlife hazard management. ICAO Annex 14, Volume 1 (Aerodrome Design and Operation) establishes requirements for the management of wildlife strikes, including the requirement for authorities to take actions to reduce the number and types of wildlife-attracting sites in the vicinity of airports. |
| ICAO Airport Services Manual Doc. 9184: Part 2 Land Use and Environmental Control | Provides airport personnel with guidance on land use planning within the vicinity of aerodromes, and the need for good planning and control measures. It focusses on how the airport impacts on its surroundings, and vice versa, with regard to people, flora, fauna, the atmosphere, water courses, air quality, soil pollution, rural areas, and the environment in general. It frequently discusses the significance of how some land use in the vicinity of airports, such as landfills, can influence an airport's strike risk profile. Appendix 2, Land-use Guidelines for the Avoidance of Bird Hazards, is particularly useful however it does remind readers that "*Any land use that had the potential to attract birds in the airport vicinity should be subject of a study to determine the likelihood of bird strikes to aircraft using the airport*". |
| World Bird Strike Association | The World Birdstrike Association (International Bird Strike Committee (IBSC)) provides a series of standards relevant to all aspects of integrated wildlife hazard management programs. |

| Instrument | Summary |
| --- | --- |
| Federal Aviation Administration | The United States FAA has no jurisdiction over Australian aerodromes; however, they provide critical and useful guidance on water body management in AC 150/5200-33B, with particular reference to new storm water management facilities. |

# 5. Wildlife Hazard Assessment

## 5.1. Sydney Water Site

Sydney Water are charged with the responsibility to create and operate a water treatment facility in western Sydney that contributes to the long term goal of creating a 'liveable, growing and resilient Greater Sydney' (Metropolitan Water Plan 2017). Figure 3 highlights the location of this critical infrastructure relative to WSA and the wildlife buffers. Figure 4, which was updated since the Avisure's initial assessment in May 2020, describes the draft layout for the site. Sydney Water will also be responsible for constructing and managing major stormwater infrastructure in the western Sydney area.

At this time, the site of the facility is confirmed, however the specifics relating to on-site infrastructure design, landscaping, site values (i.e. beyond the provision of a water treatment facility) are still being finalised. The WHA aims to comment on the facility's water processing infrastructure and on-site landscaping. Recommendations based on these elements may also help inform future decision making in other aspects of the site. In the absence of detailed plans for stormwater management, the WHA also comments on stormwater management in general.

In accordance with the NASF, the facility is categorised as a moderate risk and Sydney Water are recommended to mitigate wildlife hazards (Table 3). The results of Avisure's risk assessment is detailed in section 5.2.

### 5.1.1. Infrastructure and potential wildlife attractants

The facility is located directly under the approach path for aircraft arriving on runway 23. At a distance of 4.5 km from the runway threshold, aircraft on approach will be at approximately 500-700ft AGL. Birds using the site may contribute directly and indirectly to WSA's strike risk profile. Raptors or other birds that aerially hunt or thermal may conflict directly with aircraft. Of greater concern is if the site provides access to food and water which then contributes to sustaining or growing local populations of wildlife who use various locations in the region, including the airfield. Elevated populations of birds interchangeably using different land uses close to airports can elevate strike risks.

Figure 3 shows the location of the Upper South Creek Advanced Water Recycling Centre relative to the Western Sydney Airport (shaded pink). The 3km, 8km and 13km wildlife buffers are determined by the NASF (explained Section 3). The red line depicts the designated approach/departure path for aircraft operating on WSA's first runway (RWY 05/23). The second runway will be orientated parallel to the first runway.

Figure 4 shows the Upper South Creek Advanced Water Recycling Centre draft layout plan, provided by Sydney Water


**Figure 3: Location of Upper South Creek Advanced Water Recycling Centre relative to Western Sydney Airport**

Sydney Water

Wildlife Hazard Assessment

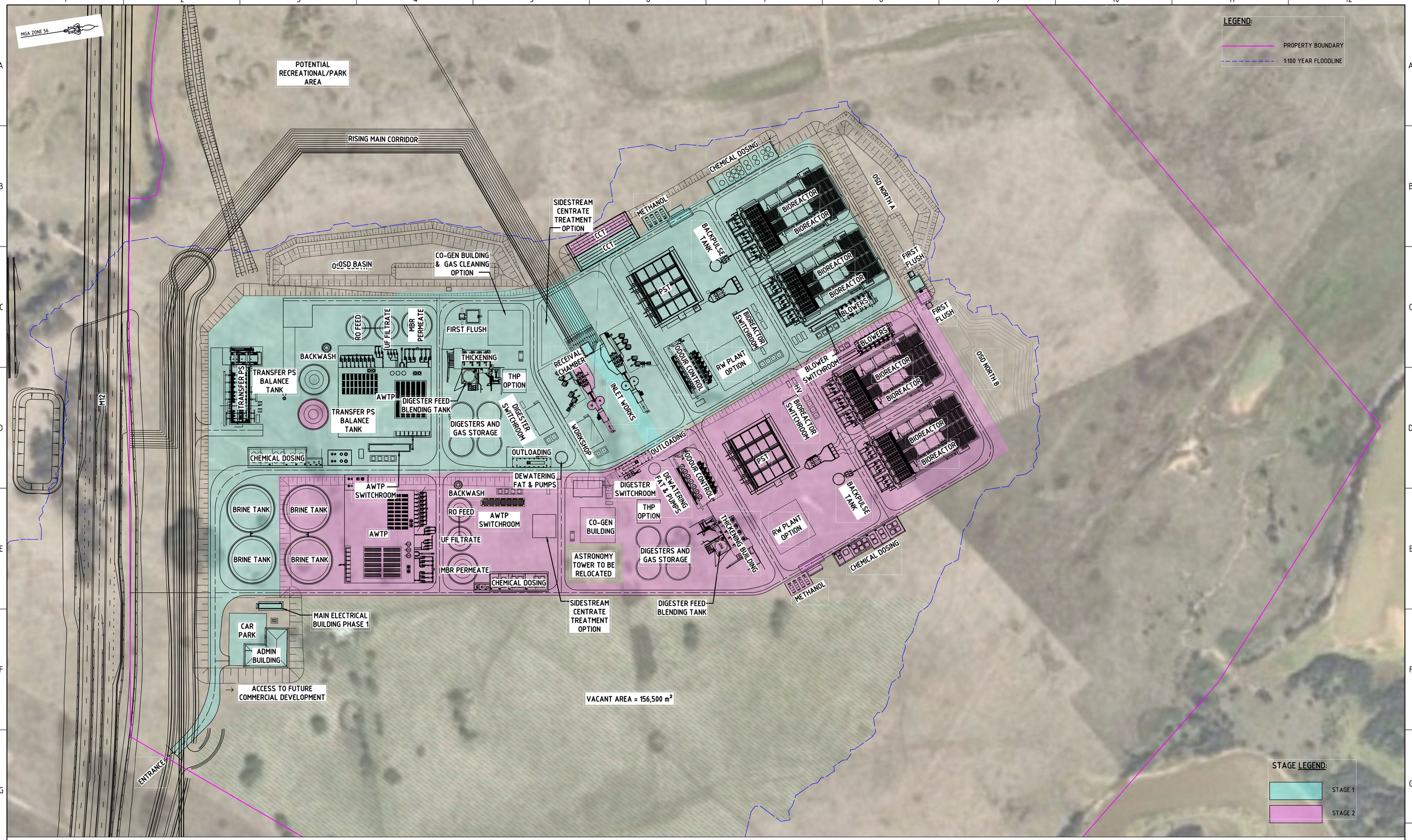
- Upper South Creek Advanced Water Recycling Centre
- Northern runway approach/departure paths
- Wildlife buffers
- Western Sydney Airport boundary

AVISURE safety | aviation | wildlife

Job number: PR5194
Revision: 1
Author: AJS
Date: 25/11/2020

0 1 2 4 6 8
Kilometers

GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter




# GENERAL LAYOUT

SCALE 1:1500

REFERENCE DESIGN ONLY

Figure 4: Water treatment facility draft layout Plan, provided by Sydney Water

10 0 10 20 30 40 50m
1:1500 FULL SIZE A1

| | | |
|---|---|---|
| DESIGNED | M. RUSH ISP DESIGN TEAM | 17.04.20 |
| DRAWN | G. WHALLEY ISP DESIGN TEAM | 17.04.20 |
| VERIFIED | C. HARE ISP DESIGN TEAM | 10.06.20 |
| APPROVED | N. VIVIAN ISP DESIGN TEAM | 10.06.20 |

| LETTER | DETAILS OF ISSUE | APP'D | DATE |
|---|---|---|---|
| 1 | ISSUED FOR DRAFT REFERENCE DESIGN | N.V | 10.06.20 |



Sydney WATER

RECOMMENDED
PROJECT ENGINEER SYDNEY WATER

ACCEPTED
PROJECT MANAGER SYDNEY WATER

ISP DESIGN TEAM DOCUMENT No. 20036007-RT0007-00-DRG-JJ-0004

UPPER SOUTH CREEK ADVANCED WATER RECYCLING CENTRE
GENERAL LAYOUT
STAGE 2

DRAWING No. —

DRAFT | SHEET No. 1

A1 | PROJ No. 20036007 | DRAWING STATUS: DRAFT REFERENCE DESIGN

SWA1-EXT AUG 2014
554
801
594
841

Table 4 comments on the proposed site infrastructure, the key Water Sensitive Urban Design (WSUD) (associated with proposal stormwater management infrastructure), and the potential wildlife attraction. Note - the changes to WRC's infrastructure provided to Avisure in August 2020 are unlikely to create any additional risks to those indicated in the initial report delivered in May 2020.

**Table 4.** Upper South Creek Advanced Water Recycling Centre infrastructure and Water Sensitive Urban Design for stormwater infrastructure and potential wildlife attraction.

| WRC Process Unit / WSUD Measure | Open Water | Comment | Is likely to attract wildlife? |
|---|---|---|---|
| WRC | | | |
| Incoming mains (slab) | No | N/A. Standardised monitoring protocols will identify any wildlife usage. | No |
| Flow receival chamber | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| Inlet works | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| Screenings handling | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| PSTs | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| Fine screens | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| MBR flow split | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| Sludge screens (provisional) | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| Bioreactor | Yes | Aeration action is likely to deter wildlife. Standardised monitoring protocols will identify any wildlife usage. | Unlikely due to aeration |
| Membrane Tanks (MBR) | Yes | Will be covered with trafficable removable covers. | Unlikely if covered |
| MBR Backwash Tank | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| AWTP Balance Tank | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| Odour Control | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |

| WRC Process Unit / WSUD Measure | Open Water | Comment | Is likely to attract wildlife? |
|---|---|---|---|
| Chemicals | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| Methanol | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| Blower Room | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| Switch room | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| FAT | Yes | Standardised monitoring protocols will identify any wildlife usage. | Unlikely |
| Thickening and poly | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| Digesters | Yes | Standardised monitoring protocols will identify any wildlife usage. | Unlikely |
| Gas holders | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| Outloading | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| AWTP (UF+RO) | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| AWTP intermediate tanks (UF+RO) | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| Brine storage | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| RO Backwash tank | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| Effluent Storage Tank | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| Transfer PS | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| CCT | Yes | Will not have permanent water. Standardised monitoring protocols will identify any wildlife usage. | No |
| Admin building | No | NA. Standardised monitoring protocols will identify any wildlife usage. | No |
| First Flush | Yes | Will be covered. Standardised monitoring protocols will identify any wildlife usage. | Unlikely if covered |
| On Site Detention / Retention Basins | Yes | Will not be covered, however if standardised monitoring identifies any wildlife hazards, netting (or similar) will be used to deter wildlife. | Unlikely if covered |

| WRC Process Unit / WSUD Measure | Open Water | Comment | Is likely to attract wildlife? |
|---|---|---|---|
| WSUD (stormwater) | | | |
| Detention basin and biofiltration | Yes | 2 basins (600 + 800 $m^2$) lined with vegetation (300mm to 600mm high)<br>Temporary water storage will fully drain within 24-48 hours.<br>Temporary water storage will be a low attractant and is not likely to encourage continuous use by wildlife.<br>Where the water level does not exceed the height of the vegetation, the vegetation will obscure the surface area and deter those bird groups who land on the surface (e.g. ducks, swans, pelicans) | Yes, if not covered |
| Biofiltration street trees | No | Mature trees that will not exceed 10m, established along all (suitable) facility roads.<br>Five or less trees planted in any one group, with 12.5m intervals between groups (low shrubs will be substituted where interval spacing is not possible). Trees may be staggered at 25m intervals between other tree groups.<br>Will temporarily hold water on the surface and fully drain within 24-48 hours.<br>May encourage wildlife to forage, depending on the plant species used.<br>Temporary surface water will be a low attractant and is not likely to encourage continuous use by wildlife | Depends on plant species selection |
| Wetlands | Yes | Semi-permanent water bodies, 0.3m to 1.18m deep, with a total water surface area of 5,000$m^2$. Bank slopes approaching the wetland will not exceed 4V:1H and vertical sandstone blocks (0.5m high) may be used to form the wetland edge (extend 0.5m into semi-permanent water).<br>Located in the floodplain adjacent to existing water bodies and farm dams in the riparian corridor – including the existing billabong that will be retained on site.<br>Water level may drop to expose normally submerged batter slopes during low rainfall periods.<br>Surface area will comprise 60% macrophytes and 40% open water. | Yes |

| WRC Process Unit / WSUD Measure | Open Water | Comment | Is likely to attract wildlife? |
|---|---|---|---|
| | | Will attract wildlife to forage, shelter, and breed, including species of concern within the wildlife strike risk context (e.g. ducks, swans, pelicans, cormorants, raptors).<br>Semi-permanent water may encourage breeding or roosting colonies to establish. This will also depend on the infrastructure offered by surrounding vegetation.<br>Macrophyte coverage of the surface area may deter some larger birds from landing on the water but may also encourage populations of aquatic vertebrates (e.g. frogs) and invertebrates which in turn may attract birds. How the macrophytes are distributed may also influence bird activity (e.g. if concentrated around the edged, the exposed water surface area in the middle of the wetland may be large enough for birds to land on).<br>Slopes less than 4V:1H may encourage wildlife to use the banks to loaf or access the wetlands when water or waterlogged soils are available | |
| Irrigated park lands, grassed lined detention basins and misting for urban cooling | Yes (detention basin) | Stormwater and recycled water used to irrigate landscape areas and (potentially) redirected to rooves for urban cooling.<br>Grassed slopes for landscape zones, earthworks, detention areas and stormwater drains will not exceed 4V:1H to facilitate mowing.<br>Includes 24 ha of irrigated surface area of grassed parkland or rooves for misting/cooling.<br>Irrigation, in general, can encourage invertebrate activity which can attract larger wildlife. Healthy and productive grasses and vegetation are also more attractive for birds and other wildlife.<br>Misting for urban cooling may offer wildlife temporary refuge during hot periods, however the extent of this is unknown and may depend on a combination of factors such as adjacent vegetation or structure for wildlife to perch or shelter, and activity at the facility (i.e. general people/vehicle activity and operating machinery which may discourage wildlife).<br>Slopes less than 4V:1H may encourage wildlife to use the banks to loaf or access basins when water or waterlogged soils are available | Possible |

| WRC Process Unit / WSUD Measure | Open Water | Comment | Is likely to attract wildlife? |
|---|---|---|---|
| Discharge channels | Yes (temporary) | 160m long x 12m wide that only flows when there is an increase flow to treatment or prolonged rain (effluent or storm water).<br>Grassed bank slopes will not exceed 4V:1H to facilitate mowing.<br>Steeper channels (1V:3H) will be densely planted with native sedges and grasses.<br>Intermittent water flow will be a low attractant and is not likely to encourage continuous use by wildlife providing the channels fully discharge after each event.<br>Slopes less than 4V:1H may encourage wildlife to use the banks to loaf or access the channels when water or waterlogged soils are available | Yes, when water is present. |
| Storm water harvesting | No | 1 ML of underground tank storage or equivalent as above ground rainwater tanks distributed across the site to supply stormwater for irrigation of irrigated lands and grassed lined basins outlined above.<br>Underground water storage, or above ground covered tanks, are unlikely to attract wildlife. | No |
| Green Rooves | No | Considered on a case by case basis for new buildings but is not part of the core stormwater management infrastructure.<br>Avisure have not previously evaluated the level of wildlife attraction to green rooves. It is likely that invertebrate populations, once established, will attract some level of foraging wildlife. This wildlife activity will be influenced but the vegetation installed on the rooves.<br>Various studies from Europe[1] suggests that green rooves can provide a food source and breeding site for some bird species, including lapwings and plovers[2]. Infrastructure on green rooves may further encourage bird usage. | Possible |

[1] Brenneisen 2003; Fernandez-Canero & Gonzalez-Redondo 2010; Partidge & Clark 2018; Baumann & Kasten 2009.

[2] Baumann (2006).

## 5.2. Risk Assessment

Avisure has developed a model for determining an off-airport land use's contribution to the wildlife strike risk (Appendix B summarises the method). It involves probability based on survey data and desktop assessments to derive values for the wildlife attracted (or potentially attracted) to a site and to derive values for the inherent wildlife attractiveness of a location. It also includes strike consequence information based on the wildlife species and the location of the site relative to an airport. In addition, the risk assessment includes the connectivity of wildlife attractive (or potentially attractive) sites to determine the potential for wildlife to transit through critical airspace.

We applied this assessment for four different scenarios[3]:

1. No open water, no landscaping, no grassed areas (Note - we assessed non-mitigated for a baseline measure; however it is noted that Sydney Water intend to mitigate).
2. Open water, no landscaping, no grassed areas.
3. No open water, landscaping, grassed areas.
4. Open water, landscaping, grassed areas.

**Overall result:** *Very high risk* in all four scenarios assessed. Surrounding land uses, airport species risks, and the position of the WRC relative to the aircraft approach path, made significant contributions to this risk result.

Our recommendation for sites assessed as *very high risk* is to *mitigate*. This aligns with the recommendation from the NASF Guideline C.

Mitigation options are detailed in Section 6.

Table 5 summarises the results of each scenario assessed.

3 The risk model is not sensitive to minor on-site variables (e.g. covering one open water tank compared to covering two open water tanks), so a broader approach was required.

**Table 5.** Summary of risk assessment results, Sydney Water, March 2020. Wildlife Risk accounts for wildlife observed (or with the potential to occur on-site) and is based on avian fauna recorded on the airport site between January to December 2018. Wildlife Risk also accounts for strikes involving these species. In the absence of WSA strike data, strikes reported to the ATSB throughout Australia and only in NSW were included. The Site Risk considers crude site attractants (e.g. presence or absence of open water, putrescible waste etc), and aircraft movement data, flight paths, and aircraft type/height. In the absence of actual aircraft movement data for WSA, projected numbers were extrapolated. The Airspace Risk is the accumulation of the Wildlife Risk and Site Risk, which then determines the overall Risk Rank.

| Scenario | | Wildlife Risk | Site Risk | Airspace Risk | **Risk Rank** |
|---|---|---|---|---|---|
| Open water: | ☐ | 689.4 | 108 | 797.4 | Very High |
| Landscaping: | ☐ | | | | |
| Grassed areas: | ☐ | | | | |
| Open water: | ☒ | 689.4 | 144 | 833.4 | Very High |
| Landscaping: | ☐ | | | | |
| Grassed areas: | ☐ | | | | |
| Open water: | ☐ | 689.4 | 126 | 815.4 | Very High |
| Landscaping: | ☒ | | | | |
| Grassed areas: | ☒ | | | | |
| Open water: | ☒ | 689.4 | 153 | 842.4 | Very High |
| Landscaping: | ☒ | | | | |
| Grassed areas: | ☒ | | | | |

### 5.2.1. Key points

1. The very high-risk rank is linked to a number of factors:

    - In the absence of bird survey data from the WRC site, data from WSA was used which included a significant number and type of species. The existing farm dams and ponds on the WSA site that support large populations of water birds results in high wildlife risk scores which contribute to the site's elevated risk.

- As per Section 1.2.2 (Limitations and Assumptions), without long-term site-specific monitoring data the risk assessment is not sensitive enough to account for minor variations in habitat or resources.

- There are significant land uses within 13km of WSA that were factored into the risk assessment. The risk assessment accounted for these sites based on the monitoring completed for WSA between January and December 2018. It is likely that land use activity has already changed since then and will continue to change as the region develops.

2. The aeration of the bioreactors and membranes will probably deter wildlife usage regardless of the available open water. However, the installation of gantries over these structures may provide perching or nesting opportunities.

3. Any other water storage facility on site may attract wildlife, particularly if structures over the water (e.g. gantries) provide a perching opportunity.

4. Despite the risk assessment results, landscaping and grassed areas at the site are not necessarily considered inappropriate. In our opinion, these can be included so long as the vegetation species used are not significant wildlife attractants.

5. The risk assessment did not consider stormwater management and storage infrastructure throughout western Sydney region; however we have provided some guidance and mitigation options for consideration.

6. Monitoring programs at WSA and in its vicinity to date have not provided the opportunity to collect sufficient and robust data about the temporal and spatial distribution of flying-foxes in the western Sydney area. We have identified flying-foxes as a potential significant risk and our landscaping recommendations take a conservative approach in order to minimise the number of flying-fox attractants. This is because:

    - There are seven known active flying-fox colonies in the Western Sydney area.

    - Although six of these colonies lie outside of the 13 km wildlife buffer, they can travel 100 kilometres in a single night with a foraging radius of up to 50 kilometres from their camp (McConkey et al. 2012) and have been recorded travelling over 500 kilometres in two days between camps (Roberts et al. 2012).

    - Flying-foxes present a significant wildlife strike risk for WSA due to their strike history at Australian airports.

- In general, airports that have significant flying-fox populations close to the airport, or that have large areas of suitable foraging habitat, experience an additional strike peak during dusk and post-dusk periods as flying-foxes depart their roosts and begin their nightly foraging.

7. Other wildlife of particular concern are large species, such as raptors, ibis and pelicans, and flocking species such as ducks and galahs.

# 6. Wildlife Hazard Mitigation

Managing hazards that attract wildlife generally focus on exclusion. This can mean physical barriers such as nets over water but can also account for a variety of design options that, if incorporated well, can provide effective long-term options for deterring wildlife.

## 6.1. Wildlife attraction principles

Permanent water can act as artificial wetlands and can attract wildlife, particularly where the water is easily accessible (i.e. from the banks or on the surface area of the water) and where adjacent vegetation offers safety and refuge.

Wastewater treatment facilities can be highly attractive to wildlife if open water sources are accessible (e.g. The Western Treatment Plant in Cocoroc, Victoria, which is listed as an Important Bird Area by BirdLife International because of the numbers and types of birds it supports (Melbourne Water, 2020)) (Figure 5). Treated sewage can contain high nutrient levels which can enhance the attraction to foraging birds. Apart from this, treatment facilities offer a relatively predator free environment and it's not uncommon for wildlife populations to establish permanent territories at these facilities given the opportunity. Landscaping and the built environment at these facilities can supplement the attraction.

**Figure 5.** Melbourne Water's Western Treatment Plant supports significant numbers of birds (source: Melbourne Water[4]).

4 https://www.melbournewater.com.au/community-and-education/recreation/birdwatching

The built environment can provide a range of perching, roosting and nesting opportunities for wildlife. For example; building eaves provide nesting platforms for Fairy Martins (Figure 6); light structures provide platforms for raptor nests; poor management of rubbish bins and skips can attract opportunistic foragers like Australian White Ibis.

**Figure 6.** More than 100 Fairy Martin nests established at a water treatment plant in south-east Queensland.

Vegetation used in landscaping can be particularly attractive to wildlife because they offer feeding, sheltering, roosting, and nesting opportunities. Shrubs and trees that produce nectar, berries, fruit or seeds will attract birds and flying-foxes. Landscaping in the vicinity of an airport should consider the how proposed planting schedules (species and structure) may attract wildlife.

Of particular concern are plants that attract flying-foxes (*Pteropus* species), flocking birds such as cockatoos corellas and galahs and large species such as ibis, who may establish large communal roosts and foraging territories. Critical to an airport's strike risk is the interchangeable use of on- and off-airport wildlife attractants. These complex movements on and around airports are difficult to predict, however proactive measures to mitigate potential risks, such as excluding or minimising known plant attractants from landscaping schedules, can make significant contributions to reducing an airports strike rate.

Grass, when maintained at short lengths provide wildlife with the opportunity to forage, loaf, and establish breeding territories. Some of Australia's highest strike risk wildlife show a preference for short grass, including Masked Lapwing, Little Corella, Galah, Australian Magpie, Australian White and Straw-necked Ibis, and Feral Pigeon. As a food source, some grasses are more attractive than others, particularly when seeding. Conversely, grasslands that are maintained at heights beyond 400 mm, can attract a suite of other hazards by providing refuge for rodents, small mammals and reptiles, which can attract raptors such as Nankeen Kestrels, Black Kites and Wedge-tailed Eagles.

Table 6 summarises the mitigation and monitoring options.

## 6.2. Wildlife hazard management recommendations

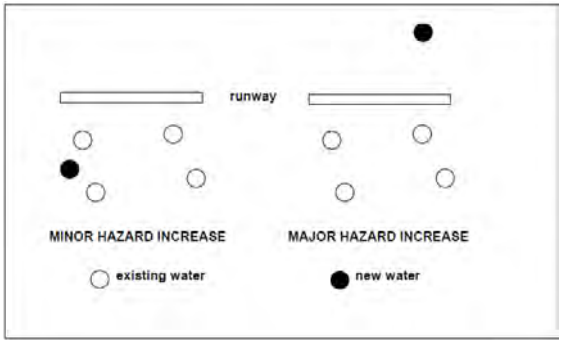
**Table 6.** Recommendations and mitigation options for Sydney Water to manage wildlife hazards at the western Upper South Creek Advanced Water Recycling Centre and associated stormwater management infrastructure.

| Area of Mitigation | Recommendation / mitigation option |
|---|---|
| Bioreactor and MBR tanks | The aeration action, if continuous, will probably deter wildlife use. Therefore covers are not considered necessary.<br>However, gantries and other support structures that provide perching or nesting platforms should be minimised or fitted with anti-perching devices (which can be retro-fitted if monitoring identifies ongoing issues with perching or nesting wildlife).<br>   |

| Area of Mitigation | Recommendation / mitigation option | |
|---|---|---|
| Built environment | Where perching, roosting or nesting activity is detected on structures, install exclusionary devices such as netting or anti-perching spikes. Carefully evaluate any retrospective installation of exclusionary devices to ensure they are effective. |  |
| | At the design stage, assess and evaluate building and infrastructure design to identify ways to proactively reduce the wildlife attraction (e.g. reduce eave size or remove altogether, if possible, to reduce nesting opportunity). Can minimises any retrospective efforts required to reduce the attraction by installing exclusionary devices or retrofitting structures. | |
| Prioritising risks | All mitigation applied should target moderate to high risk species. This includes large species, such as raptors, ibis and pelicans, and flocking species such as ducks and galahs. Ongoing monitoring and regular risk assessments will help identify high and moderate risk species. | |
| Waste management | Enclose waste receptacle areas.<br>Provides an extra barrier to prevent bird access. |  5 |

5 Source: www.urbanshed.ca

| Area of Mitigation | Recommendation / mitigation option |
|---|---|
| | Ensure all waste bins are lidded and kept closed.<br>Restricts access to opportunistic urban forages such as Feral Pigeon and Australian White Ibis. |
| | Ensure waste collection is at a suitable frequency to ensure bins do not overflow.<br>Restricts access to opportunistic urban forages such as Feral Pigeon and Australian White Ibis.  |
| Landscaping | Refer Appendix C<br>*Note - aligns with the same landscaping principles recommended to the WSPP for inclusion in their Aerotropolis planning framework. However, this a guide and Sydney Water should review all proposed site-specific landscaping schedules and species selection at the design stage.* |

| Area of Mitigation | Recommendation / mitigation option | |
|---|---|---|
| Stormwater management facilities (includes drains and detention/retention areas) | Consider the impacts of potentially conflicting airspace between birds and aircraft considering the introduction of a new waterbody in relation to the runway (see image. Source: UK, CAA CAP 680). |  |
| | Evaluate all proposed stormwater facilities as per the WSPP evaluation and assessment process to determine the potential wildlife hazard level. | |
| | Detention areas should fully drain within 24-48 hours. | |
| | Ponding should not exceed 100m$^2$ of open water, for more than a continuous 48-hour period. Wildlife hazard assessments should consider this within the context of distance from the airport and location relative to other off-airport hazards. | |
| | The continuous water surface area of detention and retention basins should not exceed 100m$^2$. Wildlife hazard assessments should consider this within the context of distance from the airport and location relative to other off-airport hazards. | |

<table>
<tr><th>Area of Mitigation</th><th>Recommendation / mitigation option</th></tr>
<tr><td rowspan="3"></td><td>Net detention and retention basins (or other permanent water) if surface area exceeds 100m$^2$. Wildlife hazard assessments should consider this within the context of distance from the airport and location relative to other off-airport hazards.<br><br>Consider replacing open water areas with underground storage or rain gardens.</td><td>  </td></tr>
<tr><td colspan="2">Cover retention basins and other permanent water sources with exclusion devices.</td></tr>
<tr><td>  <br>  <br>8</td><td>  <br>6</td><td>  <br>7</td></tr>
</table>

6 Photo source: Andy Baxter.

7 Shade balls (source: https://commons.wikimedia.org/wiki/User:Junkyardsparkle).

8 Floating/permeable cover (source: www.ieccovers.com).

| Area of Mitigation | Recommendation / mitigation option |
|---|---|
| | Water depth between 0.5m and 1.18m is less likely to attract hazardous flocking bird such as pelicans, swans, and cormorants; or upending ducks such as Pacific Black Ducks; or wading birds such as ibis and egrets. Wildlife hazard assessments should consider this within the context of distance from the airport and location relative to other off-airport hazards. |
| | Bank slopes for retention and detention areas and stormwater drains should not exceed 4V:1H. Narrow-sided retention and detention ponds are very effective at deterring birds from accessing water from the banks. Use of gabion or other edging treatment (see images below) can assist with maintaining steep banks and minimising erosion. |
| |   |
| | *Note - in areas where public safety may be compromised with the use of steep-sided banks, consider installing walkways or platforms over the banks.* |
| |  [9]  |

9 Source: WSAP 2019.

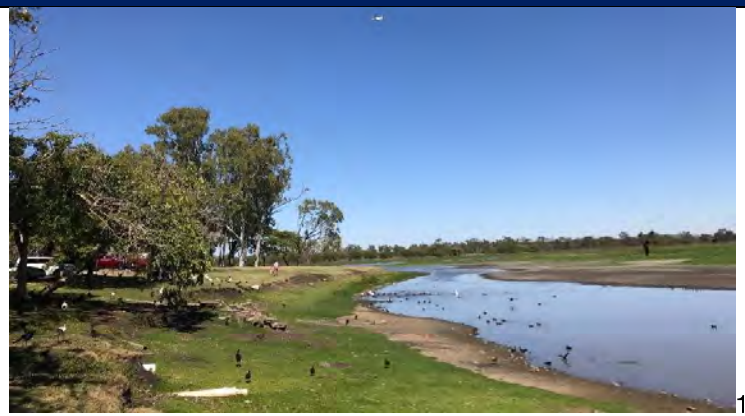
| Area of Mitigation | Recommendation / mitigation option |
|---|---|
| | Breaking up large areas of surface water can help deter some water birds from landing on them (e.g. ducks, swans, pelicans). Islands, however, should be avoided. |
| | Drains and culverts can provide an ideal nesting habitat for species such as Fairy Martins and Welcome Swallows. Drains should be completely circular, free of 90° angles, including at the central join. This will prevent stable foundations for nest building. To limit access by birds drains, including circular drains, can be fitted with exclusion devices to prevent access for birds and vertebrate pests. |
| | Use underground drains and water storage where possible to reduce the availability of water to wildlife. |
| Management Plan | Prepare and implement a Wildlife Management Plan that includes:<br>• regular monitoring surveys<br>• wildlife hazard assessments by qualified ornithologists or biologists<br>• wildlife awareness and management training for relevant staff<br>• establishment of bird population triggers<br>• implementation of activities to reduce hazardous bird populations; and<br>• adoption of wildlife deterrent technologies to reduce hazardous bird populations<br>• establish performance indicators to evaluate implementation and compliance to consent conditions<br>• include a review process to regularly assess implementation against performance indicators, identify gaps, and ensure currency<br>• allocate roles and responsibilities for plan implementation and review. |
| Monitoring | Establish a regular and standardised monitoring regime that:<br>• determines the actual level of wildlife attraction<br>• identifies temporal variation of wildlife activity (i.e. how wildlife uses the site at different times of the day, year or climatic phase) |

| Area of Mitigation | Recommendation / mitigation option |
|---|---|
| | • identifies emerging risks<br>• monitors the presence and behaviour of wildlife<br>• monitors for evidence of wildlife shelter/nesting provided by infrastructure (e.g. buildings, equipment) and/or vegetation<br>• identifies attractants (e.g. water, food)<br>• validates plant species choice and landscaping structure, or other mitigation applied. |
| | Monitoring frequency should be congruent with the level of risk, however for the first 12 months of operation, we recommend monthly monitoring. |
| | Monitoring procedures should:<br>• Establish a standard survey route around the designated site. This does not have to include every single structure/location but should include key ones.<br>• Designate stopping points where areas are scanned for wildlife.<br>• Record wildlife data on a standardised form (electronic or paper) that has been created to capture at least the following data:<br>o Date<br>o Time<br>o Observer<br>o Weather<br>o Wildlife name<br>o Wildlife number<br>o Wildlife behaviour (e.g. perching, foraging, transiting, etc.)<br>o Wildlife habitat usage (e.g. grass, building, drain, tank, etc.) |

| Area of Mitigation | Recommendation / mitigation option |
|---|---|
| | • Monitoring should also note any nesting activity, unusual bird activity, effectiveness of mitigation devices. |
| Active Management | Where monitoring identifies an unacceptable level of wildlife activity, prepare procedures/plans and resources to apply active control such as wildlife dispersal, roost disturbance, breeding disruption (e.g. egg and nest removal), trapping and relocation, or lethal control.<br><br>Breeding disruption, trapping and lethal control can only occur under a Licence to Harm Protected Animal under the *NSW Biodiversity Conservation Act 2016* issued by the Department of Planning, Industry and Environment (Environment, Energy and Science)., unless the target species is categorised as introduced. |
| Nest Removal | Establish protocols to detect and remove bird nests under a Licence to Harm Protected Animal under the *NSW Biodiversity Conservation Act 2016* issued by the Department of Planning, Industry and Environment (Environment, Energy and Science). Protocols should consider the health and safety of personnel completing the works. |
| Construction Activity[10] | Include wildlife hazard management as part of Construction Environment Management Plans (CEMP). This will assist with identifying potential wildlife attractions and identify ways to mitigate any risks. It can also help deter any wildlife becoming attracted, and habituated, to the site who may create hazardous conditions once the airport is operational. The CEMP can include options for managing wildlife hazards associated with:<br>• earthworks<br>• soil and other material stockpiles<br>• temporary infrastructure<br>• water retention area. |

10 Applicable only when WSA is operational.

| Area of Mitigation | Recommendation / mitigation option |
|---|---|
| Detention basin and biofiltration | Vegetation selection should consider species that are less attractive to wildlife as a food source (see Appendix C).<br>Steepening the sides of the basins will further deter wildlife (see general Stormwater Management recommendations).<br>Establish a regular and standardised monitoring regime (see Monitoring recommendation). |
| Biofiltration street trees | Vegetation selection should consider species that are less attractive to wildlife as a food source (see Appendix C).<br>Establish a regular and standardised monitoring regime (see Monitoring recommendation). |
| Wetlands | Future monitoring and assessments will be required to determine if the distance of the wetland relative to WSA diminishes the contribution to the strike risk (e.g. unless significant numbers of wildlife are regularly infringing aircraft airspace to access the wetlands [i.e. when they transit to and from other sites, particularly if those sites are located on the opposite side of WSA], the site's contribution to the airport's strike risk may not be unacceptable).<br>Establish slopes at 4V:1H (see general Stormwater Management recommendations).<br>Arrange macrophyte coverage to minimise areas of open water.<br>Establish a regular and standardised monitoring regime (see Monitoring recommendation). |

| Area of Mitigation | Recommendation / mitigation option |
|---|---|
| |   |
| Irrigated park lands, grassed lined detention basins and misting for urban cooling | Maintain grassed areas at heights of 200-300mm to reduce the attraction to grassland foragers (Appendix C).<br>Establish slopes at 4V:1H (see general Stormwater Management recommendations).<br>Establish a regular and standardised monitoring regime (see Monitoring recommendation). |
| Discharge channels | Grass and sedge selection should consider species that are less attractive to wildlife as a food source (Appendix B), particularly for flocking bird groups such as ducks and parrots.<br>Establish slopes at 4V:1H (see general Stormwater Management recommendations).<br>Establish a regular and standardised monitoring regime (see Monitoring recommendation). |
| Green rooves (optional) | Grass/groundcover rooftops can reduce the wildlife attraction by applying the same grassland principles used at ground level (e.g. appropriate species selection, grass height management, etc., refer Appendix C). |

11 Source: Avisure. Birds at Murray Lagoon, a permanent wetland located next to Rockhampton Airport

| Area of Mitigation | Recommendation / mitigation option |
|---|---|
| | Other vegetation types used (e.g. shrubs) should consider species that are less attractive to wildlife as a food source (Appendix C).<br><br>Establish a regular and standardised monitoring regime (see Monitoring recommendation). |
| |  <br>12  <br>13 |

12 Source: https://lindasblogs.wordpress.com/2017/08/30/greenery-atop-a-renowned-nyc-structure/

13 Source: https://www.cbsnews.com/news/new-york-city-javits-convention-center-green-roof-renovation/

# 7. Conclusion

Evaluating how a land use activity, which does not yet exist, contributes to a non-existent airport's strike risk can limit the power of the assessment. Despite this, much information can be extrapolated from existing information sources that can adequately inform the assessment. The WRC's assessment was well-informed by recent wildlife surveys at WSA, national and regional wildlife strike data available from the ATSB, the NASF, Avisure's risk assessment, recent/ongoing work with the WSPP regarding planning principles for western Sydney, and clear objectives and basic infrastructure requirements for the treatment facility. This information when combined and evaluated showed the WRC would likely present a very high risk given the availability of open water, the composition of wildlife species likely to use the site, its proximity to WSA, and the projected aircraft movement rates.

To help safeguard WSA against the wildlife strike risk, Sydney Water can apply a range of mitigation options. It is not considered necessary to cover the bioreactors because the aeration process will likely deter wildlife activity, however managing other water sources on site is recommended. Off-site, Sydney Water will need to consider the potential wildlife attraction associated with stormwater management facilities and how to best manage wildlife hazards. This will vary depending on nature of the stormwater infrastructure and its location relative to WSA.

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# Appendices

A. Regulations, standards and guidance.

B. Risk assessment method.

C. Guidelines for plant species use in Sydney Water landscaping.

# Appendix A: Regulations, Standards and Guidance

There are a number of national and international requirements and guidance documents that indicate land use in the vicinity of an airport can contribute significantly to the wildlife hazard levels and safety of aircraft operations.

## National Requirements

### Civil Aviation Safety Authority - Part 139 Manual of Standards (MOS) (2019)

**Table A1.** Part 139 MOS (2019) requirements for wildlife management around airports.

| Section | Detail |
|---|---|
| Part 139 MOS 11.08 (1) | *Information that must be included in the Aerodrome Manual*<br>The wildlife hazard management procedures must be included or referenced in the aerodrome manual to deal with the hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the aerodrome, including details of the arrangements for the following: *Information that must be included in the Aerodrome Manual.*<br>The wildlife hazard management procedures must be included or referenced in the aerodrome manual to deal with the hazards to aircraft operations caused by the presence of wildlife on or in the vicinity of the aerodrome, including details of the arrangements for the following:<br>(e) for proposed or actual sources of wildlife attraction outside the aerodrome boundary — liaising with the relevant planning authorities or proponents to facilitate wildlife hazard mitigation. |
| Part 139 MOS 17.01 (2) | The aerodrome operator, in consultation with the local planning authority, must attempt to monitor sites within 13 km of the aerodrome reference point that attract wildlife. |
| Part 139 MOS 17.04 (2) | The wildlife hazard management plan must at least:<br>(d) specify the liaison arrangements for local planning authorities within a radius of at least 13 km from the aerodrome reference point; and |

Civil Aviation Safety Authority - Advisory Circular (AC) 139-29(0) (2011).

**Table A2.** AC requirements for wildlife management around airports.

| Section | Detail |
|---|---|
| AC 6.4 | Operators of Certified Aerodromes are required to monitor and record the presence of wildlife on or in the vicinity of the aerodrome. Where this monitoring confirms the existence of a wildlife hazard, the aerodrome operator must develop a Wildlife Hazard Management Plan (WHMP). |
| AC 6.11 | For wildlife hazards in the aerodrome vicinity which contribute to the risk but are outside the control of the aerodrome operator (i.e. on land located outside the aerodrome boundary), it is expected that the aerodrome operator will:<br>• advise the relevant landowner(s) or controlling authority of both the nature of the wildlife hazard and the resultant impact on the aerodrome; and<br>• work with the relevant landowner(s) or controlling authority to manage the wildlife hazard. |
| AC 7.3.1 | Operators of Certified Aerodromes are required to monitor and record on a regular basis the presence of wildlife on the aerodrome. This requirement also extends to the aerodrome vicinity where wildlife hazards outside the aerodrome boundary are found to impact on the safe operation of the aerodrome. |
| AC 9.2 | Wildlife monitoring must involve wildlife activity in the vicinity of the aerodrome. |
| AC 9.4.1 | The monitoring of wildlife in the vicinity of the aerodrome should cover any obvious concentrations of wildlife and/or sources of wildlife attraction (i.e. habitat, migratory routes, feeding and breeding areas etc.) which contribute to the risk at the aerodrome. |
| AC 9.4.4 | The outcome of the wildlife monitoring must be recorded. These records should be maintained in order to provide a detailed history of wildlife populations and behaviour over time. |
| AC 9.4.5 | Once monitoring has identified a wildlife hazard, it should then be assessed. |

# National Airport Safeguarding Framework

**Table A3.** National Airports Safeguarding Framework Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports.

| Land Use | Wildlife Attraction Risk | Actions for Existing Developments | | | Actions for Proposed Developments/ Changes to Existing Developments | | |
|---|---|---|---|---|---|---|---|
| | | 3 km radius (Area A) | 8 km radius (Area B) | 13 km radius (Area C) | 3 km radius (Area A) | 8 km radius (Area B) | 13 km radius (Area C) |
| **Agriculture** | | | | | | | |
| Turf farm | High | Mitigate | Mitigate | Monitor | Incompatible | Mitigate | Monitor |
| Piggery | High | Mitigate | Mitigate | Monitor | Incompatible | Mitigate | Monitor |
| Fruit tree farm | High | Mitigate | Mitigate | Monitor | Incompatible | Mitigate | Monitor |
| Fish processing /packing plant | High | Mitigate | Mitigate | Monitor | Incompatible | Mitigate | Monitor |
| Cattle /dairy farm | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| Poultry farm | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| Forestry | Low | Monitor | Monitor | No Action | Monitor | Monitor | No Action |
| Plant nursery | Low | Monitor | Monitor | No Action | Monitor | Monitor | No Action |
| **Conservation** | | | | | | | |
| Wildlife sanctuary / conservation area - wetland | High | Mitigate | Mitigate | Monitor | Incompatible | Mitigate | Monitor |
| Wildlife sanctuary / conservation area - dryland | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| **Recreation** | | | | | | | |
| Showground | High | Mitigate | Mitigate | Monitor | Incompatible | Mitigate | Monitor |
| Racetrack / horse riding school | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| Golf course | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| Sports facility (tennis, bowls, etc) | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| Park / Playground | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| Picnic / camping ground | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| **Commercial** | | | | | | | |
| Food processing plant | High | Mitigate | Mitigate | Monitor | Incompatible | Mitigate | Monitor |
| Warehouse (food storage) | Low | Monitor | Monitor | No Action | Monitor | Monitor | No Action |
| Fast food / drive-in / outdoor restaurant | Low | Monitor | Monitor | No Action | Monitor | Monitor | No Action |
| Shopping centre | Low | Monitor | Monitor | No Action | Monitor | Monitor | No Action |
| Office building | Very Low | Monitor | No Action | No Action | Monitor | No Action | No Action |
| Hotel / motel | Very Low | Monitor | No Action | No Action | Monitor | No Action | No Action |
| Car park | Very Low | Monitor | No Action | No Action | Monitor | No Action | No Action |
| Cinemas | Very Low | Monitor | No Action | No Action | Monitor | No Action | No Action |
| Warehouse (non-food storage) | Very Low | Monitor | No Action | No Action | Monitor | No Action | No Action |
| Petrol station | Very Low | Monitor | No Action | No Action | Monitor | No Action | No Action |
| **Utilities** | | | | | | | |
| Food / organic waste facility | High | Mitigate | Mitigate | Monitor | Incompatible | Mitigate | Monitor |
| Putrescible waste facility - landfill | High | Mitigate | Mitigate | Monitor | Incompatible | Mitigate | Monitor |
| Putrescible waste facility - transfer station | High | Mitigate | Mitigate | Monitor | Incompatible | Mitigate | Monitor |
| Non-putrescible waste facility - landfill | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| Non-putrescible waste facility - transfer station | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| Sewage / wastewater treatment facility | Moderate | Mitigate | Monitor | Monitor | Mitigate | Mitigate | Monitor |
| Potable water treatment facility | Low | Monitor | Monitor | No Action | Monitor | Monitor | No Action |

**Table A4.** National Airports Safeguarding Framework Guideline C: recommendations for land use planning around airports.

| Section | Detail |
|---|---|
| 18 | The guidelines can also be used when considering the establishment of new airports. When a greenfield site is being considered for a new airport, selection agencies can consider the degree of incompatible land usage, including wildlife attracting land usage, in the vicinity of potential sites. |
| 20 | There are many existing locations where there would be advantages in mitigating existing risk. It is also essential that new land uses and changes to land zoning within 13 km of the airport property are regularly monitored and action plans created to mitigate any unacceptable increase in the risk of bird strike. For example, the ICAO document 'Airport Services Manual- Bird Control and Reduction' suggests that dumps should be not be sited within 13km of airport property There are many existing locations where there would be advantages in mitigating existing risk. It is also essential that new land uses and changes to land zoning within 13 km of the airport property are regularly monitored and action plans created to mitigate any unacceptable increase in the risk of bird strike. For example, the ICAO document 'Airport Services Manual- Bird Control and Reduction' suggests that dumps should be not be sited within 13km of airport property. |
| 21 | Land use planning authorities should ensure that airport operators are given adequate opportunity to formally comment on planning applications for new or revised land uses that fall within the guidance provided in Attachment 1 (of the NASF). Airport operators will be expected to respond with comments on how the proposed changes to land use might increase the risk of wildlife strike and on any regulatory actions that could increase the risk of wildlife strike, such as permits related to land uses of concern. |
| 22 | Airport operators should negotiate with land use planning authorities and landowners if required on agreed action plans for monitoring and, where necessary, reducing wildlife attraction to areas in the vicinity of airports. These plans could include:<br>• regular monitoring surveys<br>• wildlife hazard assessments by qualified ornithologists or biologists<br>• wildlife awareness and management training for relevant staff<br>• establishment of bird population triggers; implementation of activities to reduce hazardous bird populations<br>• adoption of wildlife deterrent technologies to reduce hazardous bird populations. |

| Section | Detail |
|---|---|
| 24 | Where local authorities seek to establish land uses which may increase the risk of wildlife strike near existing airports, steps should be taken to mitigate risk in consultation with the airport operator and qualified bird and wildlife management experts. Risk mitigation measures that should be considered in such cases include:<br>• a requirement for a Wildlife Management Program<br>• the establishment of wildlife management performance standards<br>• allowance for changes to design and/or operating procedures at places/plants where land use has been identified as increasing the risk of wildlife strike to aircraft<br>• establishment of appropriate habitat management at incompatible land use<br>• creation of performance bonds to ensure clean–up and compensation should obligations not be met<br>• authority for airport operators to inspect and monitor properties close to airports where wildlife hazards have been identified<br>• consistent and effective reporting of wildlife events in line with ATSB guidelines. |
| 27 | There would be safety benefits if airport operators and land use planning authorities follow a common, coordinated approach to managing existing wildlife hazards at, and within the vicinity of, airports. Managing wildlife attractants is a key strategy in discouraging wildlife on and around airports. |

Compared to other airport safeguarding documents, the NASF is of a high standard. It succeeds in meeting the objectives of ICAO reference documents[14] and provides enough detail to develop risk-based land use plans in the vicinity of aerodromes.

## NSW Environmental Planning and Assessment Act 1979

**Table A5.** Ministerial Directions in the *NSW Environment Planning and Assessment Act 1979.*

| Direction |
|---|
| **3.5 Development Near Regulated Airports and Defence Airfields**<br>Not allow development types that are incompatible with the current and future operation of that airport. |

14 Primarily ICAO DOC 9184 - Airport Planning Manual Part 2 - Land Use and Environmental Control.

| Direction |
|---|
| **7.8 Implementation of Western Sydney Aerotropolis Interim Land Use and Infrastructure Implementation Plan**<br>**Objective**<br>(1) The objective of this direction is to ensure development within the Western Sydney Aerotropolis is consistent with Stage 1 Western Sydney Aerotropolis Land Use and Infrastructure Plan dated August 2018 (the Stage 1 Land Use and Implementation Plan).<br>**Where this direction applies**<br>(2) The direction applies to Liverpool City Council, Penrith City Council, Blue Mountains City Council, Blacktown City Council, Camden Council, Campbelltown City Council, Fairfield City Council and Wollondilly Shire Council.<br>**When this direction applies**<br>(3) This direction applies when a relevant planning authority prepares a planning proposal for land within the Western Sydney Aerotropolis and land affected by the obstacle limitation surface and ANEF contours for Western Sydney Airport. |

## NSW Damage by Aircraft Act 1952

**Table A6.** Relevant sections of the *NSW Damage by Aircraft Act 1952*.

| Section | Detail |
|---|---|
| 10 | • Imposes strict and unlimited liability.<br>• Applies if a person or property on land or water suffers personal injury, loss of life, material loss, damage or destruction caused by:<br>o Impact with aircraft in flight<br>o Impact with aircraft that damaged or destroyed while in flight<br>o Impact with persons, animal or thing that dropped or fell from aircraft in flight<br>o Something that is a result of (1), (2) or (3)<br>o If the act is applied, the owner or operator of the aircraft are jointly and severally liable.<br>Damages are recoverable under the Damage by Aircraft Act without proof of intention or negligence. |

### NSW Workplace Health and Safety Act 2011

**Table A7.** Relevant sections of the *NSW Work Health and Safety Act 2011*.

| Section | Detail |
|---|---|
| 19 | Primary Duty of Care:<br>(2) A person conducting a business or undertaking must ensure, so far as is reasonably practicable, that the health and safety of other persons is not put at risk from work carried out as part of the conduct of the business or undertaking. |

## International Requirements and Standards

### International Civil Aviation Organization

**Table A8.** ICAO Annex 14 requirements for wildlife hazard management on and around airports.

| Section | Detail |
|---|---|
| 9.4 | **Wildlife strike hazard reduction**<br>*Note. — The presence of wildlife (birds and animals) on and in the aerodrome, vicinity poses a serious threat to aircraft operational safety.*<br>The wildlife strike hazard on, or near, an aerodrome shall be assessed through:<br>a) the establishment of a national procedure for recording and reporting wildlife strikes to aircraft;<br>b) the collection of information from aircraft operators, aerodrome personnel and other sources on the presence of wildlife on or around the aerodrome constituting a potential hazard to aircraft operations; and<br>c) an ongoing evaluation of the wildlife hazard by competent personnel. |
| 9.4.3 | Action shall be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.<br>*Note. — Guidance on effective measures for establishing whether or not wildlife, on or near an aerodrome, constitute a potential hazard to aircraft operations, and on methods for discouraging their presence, is given in the* Airport Services Manual *(Doc 9137), Part 3.* |

| Section | Detail |
|---|---|
| 9.4.4 | The appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem. Where the elimination of existing sites is not possible, the appropriate authority shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable. |
| 9.4.5 | **Recommendation. —** *States should give due consideration to aviation safety concerns related to land developments in the vicinity of the aerodrome that may attract wildlife.* |

## World Bird Strike Association

**Table A9.** IBSC Standards for Aerodrome Bird/Wildlife Control.

| Reference | Recommendation |
|---|---|
| Standard 9 | Airports should conduct an inventory of bird attracting sites within the ICAO defined 13 km bird circle, paying particular attention to sites close to the airfield and the approach and departure corridors. A basic risk assessment should be carried out to determine whether the movement patterns of birds/wildlife attracted to these sites means that they cause, or may cause, a risk to air traffic. If this is the case, options for bird management at the site(s) concerned should be developed and a more detailed risk assessment performed to determine if it is possible and/or cost effective to implement management processes at the site(s) concerned. This process should be repeated annually to identify new sites or changes in the risk levels produced by existing sites. Where national laws permit, airports, or airport authorities, should seek to have an input into planning decisions and land use practices within the 13km bird circle for any development that may attract significant numbers of hazardous birds/wildlife. Such developments should be subjected to a similar risk assessment process as described above and changes sought, or the proposal opposed, if a significant increase in bird strike risk is likely to result. |

## Federal Aviation Administration - AC150/5200-33B[15]

The FAA strongly recommends that off-airport storm water management systems be designed and operated so as not to create above-ground standing water if they are located within 10,000 feet (3km) or 5 miles (8km) if the attractant could cause hazardous wildlife movement across the approach or departure airspace.

Stormwater detention ponds should be designed, engineered, constructed, and maintained for a maximum 48–hour detention period after the design storm and remain completely dry between storms.

To facilitate the control of hazardous wildlife, the FAA recommends the use of steep-sided, riprap lined, narrow and linearly shaped water detention basins.

When it is not possible to place these ponds away from an airport's Air Operations Area, airport operators should use physical barriers, such as bird balls, wires grids, pillows, or netting, to prevent access of hazardous wildlife to open water and minimize aircraft-wildlife interactions.

When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue.

All vegetation in or around detention basins that provide food or cover for hazardous wildlife should be eliminated.

If soil conditions and other requirements allow, the FAA encourages the use of underground storm water infiltration systems, such as French drains or buried rock fields, because they are less attractive to wildlife.

15 Although the FAA has no jurisdiction in Australia, their comprehensive recommendations can be useful to guide approaches to managing storm water facilities close to airports.

# Appendix B: Risk Assessment Method

Management of bird and other wildlife hazards at airports requires an understanding of wildlife populations, their behaviour, and the risk management process. The process outlined in Australian Standard 31000:2018 Risk Management has been followed for this assessment:

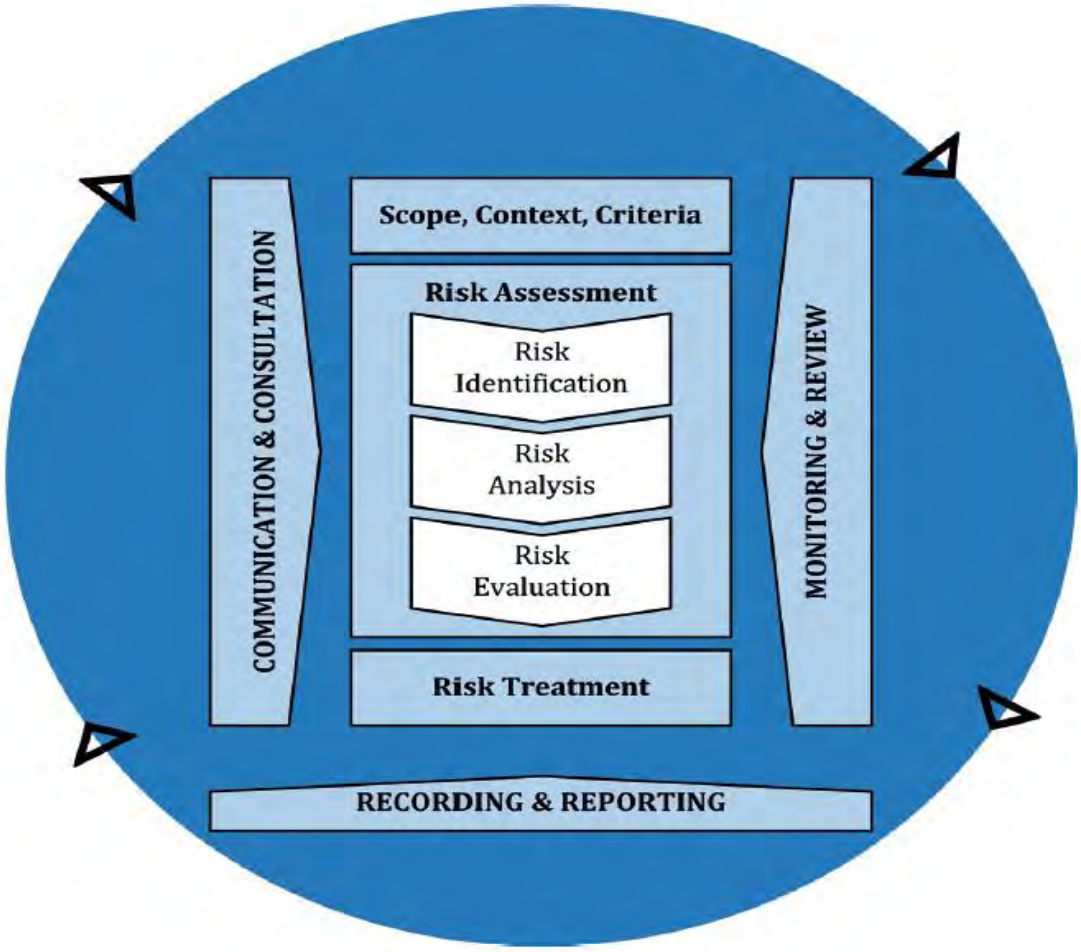



**Figure B1.** The risk management process (Source: AS 31000:2018 Risk Management).

## Off-airport Risk Assessment

Avisure has developed a model for determining an off-airport location's contribution to wildlife strike risk. It involves likelihood based on survey data and desktop assessments to derive values for the wildlife attracted (or potentially attracted) to a site and to derive values for the inherent wildlife attractiveness of a location. It also includes strike consequence information based on the wildlife species and the location of the site relative to an airport. In addition, the

risk assessment includes the connectivity of wildlife attractive (or potentially attractive) sites to determine the potential for wildlife to transit through critical airspace.

The model was developed in 2016 using long-term data sets for seven Australian airports which included comparison of on-airport survey data, off-airport survey data and strike rates for species to identify variables that contribute to changes in populations at each site and influence the observed strike rate or survey risk at the airport. National data for wildlife strikes was also reviewed and compared to observed strike and damage rates at these ports to refine likelihood and consequence assessment and species susceptibility to aircraft strikes.

Explanatory notes:

1. This process intends to provide a logical and systematic approach to the identification of site related risks and their contribution to aircraft hazards in the vicinity of an airport.
2. The Site Risk considers site attractants including connectivity between food resources, and roosting habitat, aircraft movement data, flight paths, and aircraft type/height at potential transects points. The Airspace Risk is the accumulation of the Wildlife Risk and Site Risk, which then determines the overall Risk Ranking for each site.
3. The model doesn't take into account actions undertaken by airports or other stakeholders to manage risks, however this is accounted for by incorporating strike data, effective controls on species risks would result in reduction in strike rates at an airport.
4. In the absence of strike data from WSA we used strike data from the ATSB's national incident occurrence database and filtered for species known to occur in the western Sydney area.
5. In the absence of monitoring data from the WRC, we extrapolated species recorded on the WSA site during a 12 month species monitoring program.
6. We excluded terrestrial mammals.

## Wildlife Risk

Wildlife Risk is scored based on likelihood (abundance, species behaviour and ability to avoid aircraft, and the number of strikes over the past five years) and consequence factors (group scores, mass and strike consequence rating) to give an individual risk score (Refer to Table B3 below).

**Table B3**. Wildlife Risk factors incorporated into the wildlife risk component.

| Risk Characteristic | Details | % Contribution to output |
|---|---|---|
| Abundance | No surveys (species type only used) | 18.2% |
| Wildlife avoidance | Derived from assessment of wildlife strike data compared with population data at several airports with long term datasets to identify susceptibility of species to strikes relative to population on airport | |
| Strike history | Based on comparison of strike events at the airport and at other airports thought the country | 81.8% |
| Strike consequence | Consequence rating based on previous strike history and mass of species | |
| Group score | Score based on tendency of species to flock | |

## Site Risk

The Site Risk assessment is designed to identify key hazardous species resources in the vicinity of the airport. In this case, the off-airport risk assessment is limited to a review of mapping data and previous reports to identify site attributes such as foraging resources, trees suitable for roosting and water on-site.

Site Risk factors (proximity to runways and flight paths, aircraft movement rates and type of aircraft operations and flight paths are combined with site attribute scores) are applied to the model to give a risk ranking at each site (Refer to table B4 below).

**Table B4**. Site Risk factors incorporated into the site risk component.

| Risk Characteristic | Details | % Contribution to output |
|---|---|---|
| Aircraft movements | Annual aircraft movement rates at WSA (projected) | 10.1% |
| Distance from runway | Site distance from the nearest runway end | 19.2% |
| Distance from flight path | Site distance from the nearest flight path, measured perpendicular to the extended centreline | |
| Site resources | Based on presence/absence of particular resources on site. Includes things such as foraging resources, trees suitable for roosting and water onsite | |
| Connectivity | Measure of connectivity to other relevant sites using the number of segments between sites and other resources which cross establish aircraft flight paths | |
| Height of aircraft | Aircraft height at nearest flight path point or runway adjacent to site (projected) | 37.7% |
| Type of aircraft | Proportion of large aircraft movements (projected) | 33% |

# Airspace Risk

Site Risk and Wildlife Risk scores were combined and assessed against the Airspace Risk ratings to classify each site's risk, Table B5.

**Table B5**. Airspace Risk ratings

| Risk Score | Rating |
|---|---|
| >500 | Very High |
| 250 to 500 | High |
| 120 to 250 | Moderate |
| 60 to 120 | Low |
| 0 to 60 | Very Low |

# Appendix C: Guidelines for plant species use in Sydney Water landscaping

Table C1 describes Avisure's planting and landscaping guidelines developed to reduce the wildlife attraction on and in the vicinity of airports to help minimise the wildlife strike risk. It is recognised that elements of these guidelines contradict the landscaping objectives and principles developed for the Western Parkland City, which includes the WRC. In response, we recommend they are applied wherever possible. Where landscape structure (i.e. the number of trees) cannot be compromised, species selection should be prioritised (i.e. select species that are consider low wildlife attractants).

These are the principles recommended to the WSPP and will be further refined following landscape-focused workshops proposed with key landscape architects and designers.

**Table C1.** Planting guidelines and recommendations to reduce the wildlife attraction.

| Area | Recommendation | Comment for application in Sydney Water landscaping |
|---|---|---|
| Landscape and Vegetation Management Plan | Develop a plan that provides planting and species guidelines, identifies acceptable and unacceptable species, and provides guidance for landscaping to reduce the overall wildlife attraction. | Fully applicable. |
| Assessment and evaluation | For proposed landscaping works that do not meet approved guidelines, request an evaluation and assessment from a suitably qualified aviation ecologist. | Fully applicable. |
| Species selection | Select landscape plants that minimise the attraction of birds and flying-foxes. | Applicable and highly recommended.<br>Specific guidelines should be developed for species selection based on the wildlife buffers. |

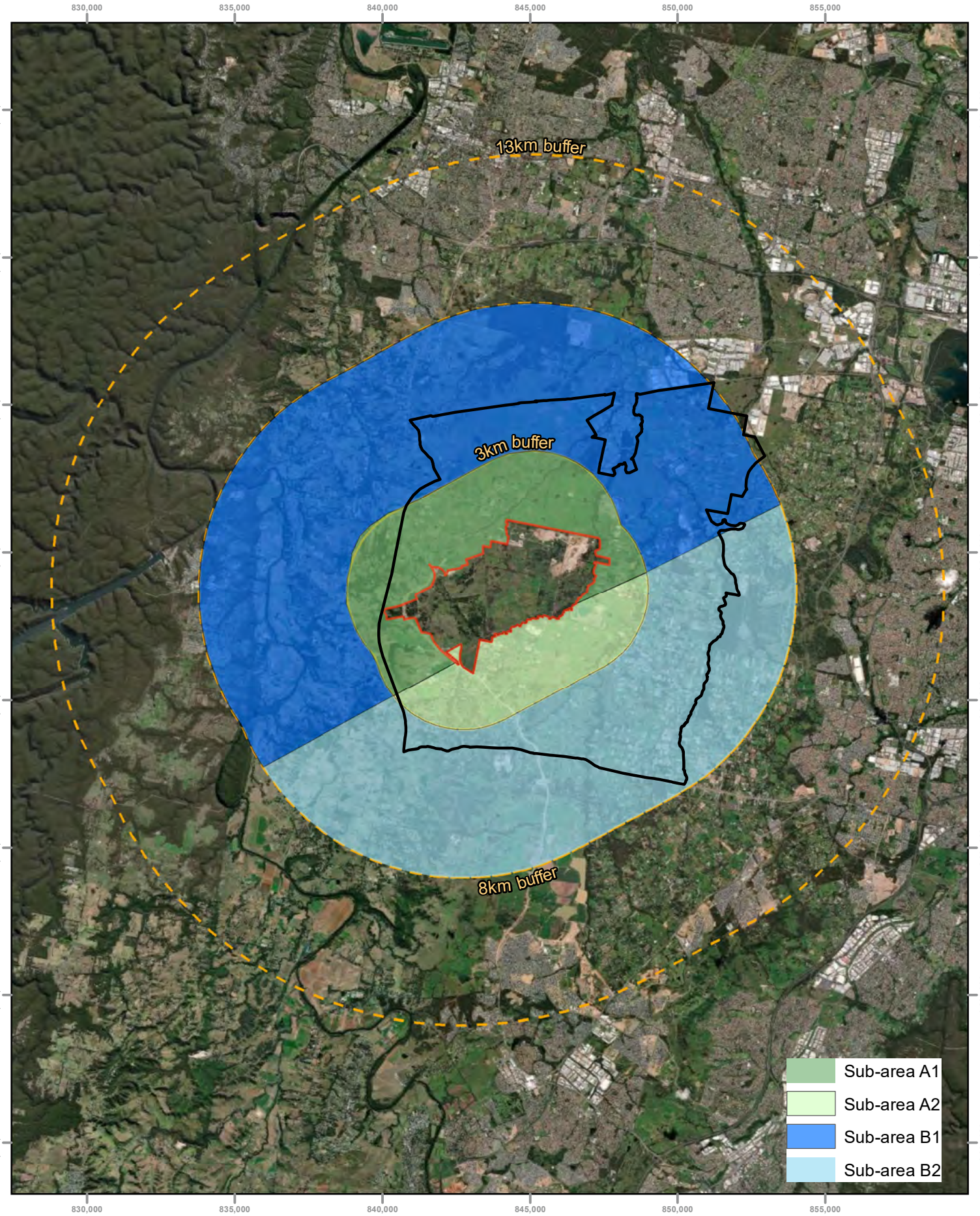
| Area | Recommendation | Comment for application in Sydney Water landscaping |
|---|---|---|
| | Do not plant trees and shrubs which bear edible berries, fruits, seeds or nuts, or flower profusely. | Applicable and highly recommended.<br>Whilst all plants bear berries, fruits, seeds, nuts or flowers, this principle suggests excluding or minimising those species identified as significantly attractive to wildlife. |
| | Avoid species from the Proteaceae family. Commonly used landscaping species include, *Banksia* spp, *Grevillea* spp, *Hakea* spp. The nectar produced by these species can attract flying-foxes and various nectar feeding (nectivorous) birds such as lorikeets. | Applicable and highly recommended.<br>This principle recommends replacing this group of plants with species that are less attractive. |
| | Avoid species from the Myrtaceae family. Commonly used landscaping species include *Callistemon* spp, *Corymbia*, *Eucalyptus* spp, *Lophostemon* spp, *Melaleuca* spp, *Syzygium* spp, *Xanthostemon* spp. Many species in this family produce large volumes of nectar that can be highly attractive to flying-foxes and various nectivorous birds. Studies at other airports have shown significant response to flowering Melaleuca by flying-foxes that have created severe strike risks. | Applicable and highly recommended.<br>This principle recommends replacing this group of plants with species that are less attractive. |
| | Avoid species from the Moraceae family. Commonly used landscaping species include *Ficus* spp (Figs) due to their decorative and aesthetic appeal. Fig fruits are highly attractive to flying-fox and other fruit eating (frugivorous) birds. | Applicable and highly recommended.<br>This principle recommends replacing this group of plants with species that are less attractive. |

| Area | Recommendation | Comment for application in Sydney Water landscaping |
|---|---|---|
| | Avoid palm species. These extend across a range of families and should only be used when a strict documented regime of regular fruit/flower cluster removal occurs. | Applicable and highly recommended.<br>This principle recommends replacing this group of plants with species that are less attractive. |
| | Where the aforementioned species already exist in landscaped areas, replace them with more suitable species. In some circumstances it may be possible to regularly remove clusters of fruits and flowers (depends on species). | Applicable and highly recommended if monitoring determines an unacceptable level of wildlife attraction relative to the airport. |
| Design recommendations<br>• Trees (mature height >5m)<br>• Shrubs (mature height 300mm-5m) | Avoid clumps of trees and shrubs because they provide more shelter and more concentrated feeding areas than individual or small groups of plants. | Applicable and highly recommended. |
| | Apply the following conditions when planting trees along access and other roads to the airport:<br>• Maximum mature height of any tree: 10m.<br>• No more than 5 trees planted in any one group.<br>• Average interval between tree groups not less than 200m.<br>• Minimum interval between tree groups is 100m.<br>• Single trees are planted >50m to any other single tree or tree groups.<br>• Trees constitute no more than 5% of total tree/shrub plantings. | Restricted.<br>It is recognised that this principle contradicts the Parkland vision relating to canopy cover, biodiversity objectives and urban heat management.<br>We recommend applying wherever possible close to the airfield.<br>For those areas where applying this principle is not possible, plant species should be carefully selected to reduce the wildlife attraction. |
| | Apply the following conditions to shrub plantings:<br>• Shrubs do not exceed 5m mature height.<br>• Shrubs which produce nectar, fruits or seed (e.g. Banksia, Grevillea, Hakea) are not planted in groups of more than 5 per group and such | Restricted.<br>It is recognised that this principle contradicts the Parkland vision relating to canopy cover, biodiversity objectives and urban heat management. |

| Area | Recommendation | Comment for application in Sydney Water landscaping |
|---|---|---|
| | groups are not be planted <50m to specimens of the same species or groups of any species which may similarly attract birds or flying-fox at the same time of the year. | For those areas where applying this principle is not possible, plant species should be carefully selected to reduce the wildlife attraction. |
| Ground Cover (mature height <300mm) | Use low prostrate ground cover plants, avoiding profusely fruiting or seeding species. Use ground cover species rather than grasses to reduce the wildlife attraction and minimise ongoing maintenance costs. | Applicable.<br>Should be applied where possible. |
| | Avoid grasses that produce a lot of seed for rough grass or soil stabilisation. | Applicable and highly recommended.<br>This principle recommends replacing this group of plants with species that are less attractive. |
| | Avoid grassed areas in gardens that require regular irrigation. Minimise the use of sprinklers and ensure taps do not drip. | Applicable if monitoring identifies significant wildlife hazards. |
| Maintenance | If necessary, remove trees and other plants and replaced with species that are more appropriate. Lopping and pruning to alter the structure of trees and shrubs can reduce food and perches and make the plants unsuitable for roosting or nesting. It can, however, be difficult if not impossible, to lop or prune some species of trees such as palms to the extent necessary to prevent birds from roosting or nesting. In such cases, the only effective way of removing the bird problem may be to remove the trees. Therefore, use palms sparingly, or not at all, in landscaping. | Applicable if monitoring identifies significant wildlife hazards. |

| Area | Recommendation | Comment for application in Sydney Water landscaping |
|---|---|---|
| | Regularly prune and lop trees and shrubs to improve their health and vigour and prevent the establishment of communal roosts and nesting colonies which, if allowed to establish, can be difficult to remove. | Applicable if monitoring identifies significant wildlife hazards. |
| Landscaping works when airport is operational | Tube stock planting, hydro mulching, or the establishment of other vegetation close to airports should be carefully monitored to determine any increase in wildlife activity. Management (e.g. wildlife dispersal) may be required if wildlife activity is elevating the strike risk at the airport. | Applicable if monitoring identifies significant wildlife hazards. |

Figure C1 shows the Western Sydney Airport wildlife buffers. Area shaded dark green (sub-area A1) in 3km buffer requires more scrutiny (above NASF recommendation) to minimise wildlife crossing the airport to access food/water sources. Aims to reduce wildlife crossing from south-east to north-west. Area shaded dark blue (sub-area B1) in 8km buffer requires more scrutiny (above NASF recommendation), but not as rigid as the 3km buffer zone, to minimise wildlife crossing the airport to access food/water sources.




## Western Sydney Airport wildlife and subarea buffers

NSW Department of Planning, Industry and Environment

Western Sydney Aerotropolis Wildlife Management Assessment

Aerotropolis precinct boundary

Western Sydney Airport

Wildlife buffers

AVISURE
safety | aviation | wildlife

Job number: PR4765
Revision: 4
Author: AJS
Date: 11/05/2020

0 0.5 1 2 3 4
Kilometers

GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter



PR4765_MPX_BufferMap_and_Suburb_Exclusions
A4

Table C2 evaluates the wildlife attraction of plant species known to occur in Western Sydney (sourced from Tozer, the WSA EIS, and proposed planting schedules for roadside landscaping) along with other species that may be considered acceptable for use in landscaping throughout the Aerotropolis. The table also recommends suitability for use in the WSA wildlife buffers. This table will be further refined following landscape-focused workshops scheduled with the Western Sydney Planning Partnership[16]. These workshops will also better inform the acceptable species palette.

**Table C2.** Species selection.

| Type | Botanical Name | Common Name | Bird attractant[17] | Flying-fox attractant[17] | Description | Recommended for use/inclusion in palette | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 3km (A1) | | 3km (A2) | | 8km (B1) | | 8km (B2) | |
| | | | | | | Yes | No | Yes | No | Yes | No | Yes | No |
| Tree | *Araucaria cunninghamii* | Hoop Pine | ☐ | ☐ | May be used for perching or roosting. Monitoring is required to determine if communal birds (e.g. lorikeets) use as roosts.<br>Avoid planting in rows/groups. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Tree | *Fraxinus 'Raywoodii'* | Claret Ash | ☐ | ☐ | May be used for perching or roosting. Monitoring is required to determine if communal birds (e.g. lorikeets) use as roosts.<br>Avoid planting in rows/groups. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Tree | *Acacia implexa* | Hickory Wattle | ☐ | ☐ | May be used for perching or roosting, some parrot (e.g. rosellas) and pigeon species may forage on the seed pods.<br>Monitoring required. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Tree | *Corymbia maculata* | Spotted Gum | ☒ | ☒ | Species from the Myrtaceae family are generally attractive to birds and flying-foxes. | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ |
| Tree | *Eucalyptus crebra* | Narrow-leaved Ironbark | ☒ | ☒ | Species from the Myrtaceae family are generally attractive to birds and flying-foxes. | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ |
| Tree | *Eucalyptus moluccana* | Grey Box | ☒ | ☒ | Species from the Myrtaceae family are generally attractive to birds and flying-foxes. | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ |
| Tree | *Eucalyptus tereticornis* | Forest Red Gum | ☒ | ☒ | Species from the Myrtaceae family are generally attractive to birds and flying-foxes. | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ |
| Tree | *Banksia oblongifolia* | Dwarf Banksia | ☒ | ☒ | Species from the Proteaceae family are generally attractive to birds and flying-foxes. | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ |
| Tree | *Banksia spinulosa* | Hairpin Banksia | ☒ | ☒ | Species from the Proteaceae family are generally attractive to birds and flying-foxes. | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ |
| Tree | *Callistemon viminalis* | Weeping Bottlebrush | ☒ | ☒ | Species from the Proteaceae family are generally attractive to birds and flying-foxes. | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ |
| Tree | *Leptospermum polygalifolium* | Tantoon | ☐ | ☐ | Insect attractant.<br>May attract small numbers of small birds.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Tree | *Melaleuca nodosa* | Prickly-leaved Paperbark | ☒ | ☒ | Species from the Myrtaceae family are generally attractive to birds and flying-foxes.<br>Low height may exclude flying-foxes. | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☒ | ☐ |
| Tree | *Acacia elata* | Cedar Wattle | ☐ | ☐ | May be inappropriate due to Obstacle Limitation Surface (OLS).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Tree | *Alphitonia excelsa* | Red Ash | ☐ | ☐ | May be inappropriate due to OLS.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Tree | *Brachychiton populneus* | Kurrajong | ☐ | ☐ | May be inappropriate due to OLS.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |

16 At the time of updating this report (Revision1, September 2020), the Western Sydney Planning Partnership had not yet finalised the acceptable species palette for landscaping the Western Sydney Aerotropolis.

17 Indicates an unacceptable level of attraction.

| Type | Botanical Name | Common Name | Bird attractant[17] | Flying-fox attractant[17] | Description | Recommended for use/inclusion in palette | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 3km (A1) | | 3km (A2) | | 8km (B1) | | 8km (B2) | |
| | | | | | | Yes | No | Yes | No | Yes | No | Yes | No |
| Tree | *Casuarina glauca* | Swamp Oak | ☐ | ☐ | May be inappropriate due to OLS.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Tree | *Jacksonia scoparia* | Dogwood | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub / small tree | *Persoonia linearis* | Narrow-leafed Geebung | ☐ | ☐ | Fruits may attract some terrestrial animals (macropods, possums) and some birds.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub / small tree | *Pittosporum revolutum* | Rough-fruited Pittosporum | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub / small tree | *Pomaderris lanigera* | Wooly Pomaderris | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Bursaria spinosa* | Native Blackthorn | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Callistemon citrinus 'White Anzac'* | White Anzac Bottlebrush | ☒ | ☒ | Species from the Myrtaceae family are generally attractive to birds and flying-foxes. | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ |
| Shrub | *Indigofera australis* | Australian Indigo | ☐ | ☐ | Insect attractant.<br>May attract small numbers of small birds.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Melaleuca thymifolia* | Thyme Honey Myrtle | ☐ | ☐ | Insect attractant.<br>May attract small numbers of small birds.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Daviesia ulicifolia* | Gorse Bitter Pea | ☐ | ☐ | Insect attractant.<br>May attract small numbers of small birds.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Dillwynia sieberi* | Prickly Parrot Pea | ☐ | ☐ | Insect attractant.<br>May attract small numbers of small birds.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Dodonaea viscosa subsp. cuneata* | Wedge Leaf Hop Bush | ☐ | ☐ | Insect attractant.<br>May attract small numbers of small birds.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Melaleuca decora* | Decorative Paperbark | ☒ | ☒ | Species from the Myrtaceae family are generally attractive to birds and flying-foxes. | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ |
| Shrub | *Boronia floribunda* | Boronia | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Hibbertia aspera* | Rough Guinea Flower | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Leucopogon juniperinus* | Prickly beard-heath | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Philotheca myoporoides* | Long-leaf Wax Flower | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |

| Type | Botanical Name | Common Name | Bird attractant[17] | Flying-fox attractant[17] | Description | Recommended for use/inclusion in palette | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 3km (A1) | | 3km (A2) | | 8km (B1) | | 8km (B2) | |
| | | | | | | Yes | No | Yes | No | Yes | No | Yes | No |
| Shrub | *Westringia fruticosa* | Coastal Rosemary | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Shrub | *Westringia longifolia* | Coastal Rosemary | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Imperata cylindrica* | Blady Grass | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Lomandra 'Katrinus'* | Mat Rush | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Lomandra 'Tanika'* | Mat Rush | ☐ | ☐ | Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Axonopus fissifolius* | Carpet Grass | ☒ | ☐ | Seed head removal required.<br>Attractive to ground foragers (e.g. lapwings, parrots, magpies, ducks) if height maintained <150mm.<br>Prevents weed eruptions (which may deter granivores such as parrots).<br>Monitoring required. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Cover | *Coolabah oats* | Oats | ☒ | ☐ | Likely to attract granivores. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Cover | *Cynodon dactylon* | Common Couch | ☐ | ☐ | Seed head removal required.<br>Attractive to ground foragers (e.g. lapwings, parrots, magpies, ducks) if height maintained <150mm.<br>Monitoring required. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Cover | *Echinochloa utilis* | Japanese Millet | ☒ | ☐ | Seeds attract ground foragers.<br>Pacific Black Duck – often involved in wildlife strikes. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Cover | *Secale cereale* | Rye Corn | ☒ | ☐ | Attracts granivores, small mammals and invertebrates. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Cover | *Trifolium pratense* | Red Clover | ☒ | ☐ | Attracts deer in the USA. May act as an attractant for Spotted Deer (high risk, see Table 1).<br>May attract small nectivorous and insectivorous birds. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Capillipedium spicigerum* | Scented Top Grass | ☒ | ☐ | Seeds may attract granivorous birds.<br>Seed removal may be required.<br>Monitoring required. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Cover | *Chloris truncata* | Windmill Grass | ☒ | ☐ | Seeds may attract granivorous birds.<br>Seed removal may be required.<br>Monitoring required. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Cover | *Cymbopogon refractus* | Barbed Wire Grass | ☒ | ☐ | Seeds may be eaten by rosellas.<br>Monitoring required. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Cover | *Dichanthium sericeum* | Queensland Bluegrass | ☒ | ☐ | Seeds eaten by finches, mannikins, galahs, cockatiels, corella and parrots. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Cover | *Lomandra longifolia* | Mat Rush | ☐ | ☐ | Dense plantings can create refuge for European Rabbit.<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Microlaena stipoides* | Weeping Grass | ☒ | ☐ | Seeds eaten by cockatoos, parrots, pigeons and finches. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |

| Type | Botanical Name | Common Name | Bird attractant[17] | Flying-fox attractant[17] | Description | Recommended for use/inclusion in palette | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 3km (A1) | | 3km (A2) | | 8km (B1) | | 8km (B2) | |
| | | | | | | Yes | No | Yes | No | Yes | No | Yes | No |
| Cover | *Themeda triandra* | Kangaroo Grass | ☒ | ☐ | Seeds eaten by cockatoos, parrots, pigeons and finches.<br>Food sources for kangaroos. | ☐ | ☒ | ☒ | ☐ | ☐ | ☒ | ☒ | ☐ |
| Cover | *Baumea rubiginosa* | Soft Twigrush | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Bolboschoenus caldwellii* | Club Sedge | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Bolboschoenus fluviatilis* | River Bulrush | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Carex appressa* | Tall Sedge | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Ficinia nodosa* | Knobby Club Rush | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Gahnia sieberiana* | Red-fruited Saw-sedge | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Juncus usitatus* | Common Rush | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Philydrum lanuginosum* | Frogmouth | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. Ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Schoenoplectiella mucronata* | Bog Bulrush | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. Ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Schoenoplectus validus* | Softstem Bulrush | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. Ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |
| Cover | *Gahnia sieberiana* | Red-fruited Saw-sedge | ☐ | ☐ | Can create refuge and habitat for some waterbirds (e.g. ducks, herons, swamphens).<br>Monitoring required. | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ | ☒ | ☐ |

## Revision History

| Rev. No. | Rev. Date | Details | Prepared by | Reviewed by | Approved by |
|---|---|---|---|---|---|
| 0 | 10/03/2020 | D**raft** Wildlife Hazard Assessment Report | Kylie Patrick Principal Consultant | Will Jamieson Regional Manager | Will Jamieson Regional Manager |
| 0 | 07/05/2020 | Final Wildlife Hazard Assessment Report | Kylie Patrick Principal Consultant | Will Jamieson Regional Manager | Will Jamieson Regional Manager |
| 1 | 02/09/2020 | Appendix C added<br>Updated Figure 4<br>Updated Case Studies | Kylie Patrick Principal Consultant | Will Jamieson Regional Manager | Will Jamieson Regional Manager |
| 2 | 27/11/2020 | Risk assessment method added.<br>Minor updates. | Kylie Patrick Principal Consultant | Will Jamieson Regional Manager | Will Jamieson Regional Manager |

## Distribution List

| Copy No. | Date | Format | Issued to | Name |
|---|---|---|---|---|
| 1 | 27/11/2020 | E-copy (PDF) | Sydney Water | Mark Rush |
| 2 | 27/11/2020 | E-copy (PDF) | Avisure | Administration |

contact@avisure.com | www.avisure.com

Cover photo: Silver Gulls at a wastewater treatment facility located on the NSW mid-north coast.

PR5194 Sydney Water-RE.Wildlife Hazard Assessment_Final.R2



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**ABN 26 131 545 054**

Australian Government
Civil Aviation Safety Authority

# Application for Operational Assessment of a Proposed Plume Rise

## Proponent Details

| | |
|---|---|
| Contact Name | Sam Corben |
| Company Name | Sydney Water |
| Address | 1 Smith Street, Parramatta, NSW Australia 2150 |
| Phone (BH) | 0412 913 905 |
| Email Address | sam.corben@sydneywater.com.au |
| Date Submitted | 27/07/2020 |
| File Reference: (CASA use only) | |

## Details of the Proposed Facility and Prior Consultation

| | |
|---|---|
| 1. Type of facility | Recycled water treatment |
| 2. Location of the nearest town (direction and distance) | Badgerys Creek, 2.5 km to the south-east of site |
| 3. Location of the facility in latitude and longitude (degrees, minutes, seconds) | Latitude: 33° 51' 26.3916" S<br>Longitude: 150° 46' 20.3592" E |
| 4. Proximity to any other existing or planned facility that generates a plume rise (if known) | Unknown |
| 5. Distance to the nearest aerodrome or landing area incl. helicopter landing sites | Approx. 4.3km, Western Sydney Airport |
| 6. Height of the stack or tallest structure at the site above ground level (AGL) | Tallest structures on site ~25m AGL |
| 7. Elevation of the location of the facility above mean sea level (AMSL) | 40.2m AMSL/AHD |
| 8. Date the facility will commence operation | Mid-2025 |
| 9 A. For single stacks:<br>▪ Stack exit velocity (metres per second)<br>▪ Stack exit temperature (degrees Celsius)<br>▪ Stack radius (metres)<br>▪ Stack height (metres above ground level) | Stack 1: Odour treatment discharge stack<br><br>Stack 1 exit velocity: 15 m/s<br>Stack 1 exit temperature: 20 C<br>Stack 1 radius: 1.5m<br>Stack 1 height: 15m AGL |

| | |
|---|---|
| 9 B. For multiple stacks please give median, mean and range for each parameter:<br>▪ Stack separation distance (metres)<br>▪ Stack exit velocity (metres per second)<br>▪ Stack exit temperature (degrees Celsius)<br>▪ Stack radius (metres)<br>▪ Stack height (metres above ground level) | Stack 2: Cogeneration engine exhaust stacks<br><br>Stack 1 and Stack 2 separation distance: approx. 165m<br>Stack 2 exit velocity: 12.3 m/s<br>Stack 2 exit temperature: ~426 C<br>Stack 2 radius: 0.4m<br>Stack 2 height: approx 6.0m AGL<br><br>There is likely to be at least 2 of these cogeneration engines located in close proximity to each other (~5m) |
| 9 C. For facilities with multiple configurations please give the parameters for the worst case scenario:<br>▪ Stack separation distance (metres)<br>▪ Stack exit velocity (metres per second)<br>▪ Stack exit temperature (degrees Celsius)<br>▪ Stack radius (metres)<br>▪ Stack height (metres above ground level) | Worst case assume all stacks located ~20m of each other.<br>Stack 3: Waste gas burner/flare (enclosed burner assumed)<br>Stack 2 and 3 sepation distance: 5m<br>Stack 3 exit velocity: unknown<br>Stack 3 radius: unknown<br>Stack 3 height: 6.0m-8.0m AGL (vendor dependent)<br>Heat radiation is minimised due to enclosed burner type. |
| 9 D. For facilities with multiple configurations please give the parameters for the normal operating scenario:<br>▪ Stack separation distance (metres)<br>▪ Stack exit velocity (metres per second)<br>▪ Stack exit temperature (degrees Celsius)<br>▪ Stack radius (metres)<br>▪ Stack height (metres above ground level) | Normal operating scenario is based on current reference design site layout.<br><br>~165m between Stacks 1 and 2/3. Stacks 2/3 will always be in very close proximity regardless.<br><br>Information on individual stacks provided in previous Q9 boxes. |
| 10. Details of any prior consultation with:<br>▪ CASA<br>▪ Dept of Defence<br>▪ Aerodrome Operator<br>▪ Other relevant party | Sydney Water has been in contact with WSA Co. through Chris Osborne<br><br>WSA Co. are aware that a wastewater treatment facility is being built in the vicinity of WSA, however no specific projects details are known. |

**Submitted By:**

| | | | |
|---|---|---|---|
| Name: Sam Corben | | Signature: Sam Corben | |
| Contact Phone: | 0412 913 905 | | |
| Email Address: | sam.corben@sydneywater.com.au | Date: | 27/07/2020 |

**From:** INFO OAR <oar@casa.gov.au>
**Sent:** Tuesday, 28 July 2020 9:58 AM
**To:** Airspace Protection
**Cc:** Sam Corben
**Subject:** FW: Application for Operational Plume Rise Assessment for Proposed Development - Recycled Water Treatment Facility [SEC=OFFICIAL]
**Attachments:** 20036007-CASAform1247_27072020.pdf

**OFFICIAL**

Good morning

Please see the attached and below.

Regards

Alex Dallwitz
Airspace Operations Coordinator
Office of Airspace Regulation
Air Navigation, Airspace and Aerodromes Branch
**CASA\Operations and Standards**
**p:** 02 6217 1364
16 Furzer Street, Phillip ACT 2606
www.casa.gov.au

---

**From:** Sam Corben <Samuel.Corben@aurecongroup.com>
**Sent:** Monday, 27 July 2020 4:02 PM
**To:** INFO OAR <oar@casa.gov.au>
**Cc:** Mark Rush <Mark.Rush@aurecongroup.com>; Stephanie Clarke <Stephanie.Clarke@aurecongroup.com>
**Subject:** Application for Operational Plume Rise Assessment for Proposed Development - Recycled Water Treatment Facility

Hi,

Please find attached a completed Form 1247 for an application for a plume rise assessment of the proposed development of a recycled water treatment facility. The project is a new recycled treatment facility in western Sydney, located approximately 4.3 km north-east of the new Western Sydney Airport.

If further information on the project is required for the assessment, please contact me via phone or email.

Kind regards,

**Sam Corben**
Process Engineer
Concept Design Team, Asset Lifecycle

Aurecon Arup
1 Smith Street, Parramatta NSW, 2150
m: +61 412 913 905
e: sam.corben@sydneywater.com.au; or
e: samuel.corben@aurecongroup.com

**NB. I am currently working from home and am emailing from my home organisation's account. You may reply to either Sydney Water email or the Aurecon account*

**From:** Alder, David <David.Alder@casa.gov.au>
**Sent:** Friday, 14 August 2020 3:42 PM
**To:** Sam Corben
**Cc:** Airspace Protection; planning@wsaco.com.au
**Subject:** RE: Application for Operational Plume Rise Assessment for Proposed Development - Recycled Water Treatment Facility [SEC=OFFICIAL]
**Attachments:** Plume Rise Recycled water treatment facility near Western Sydney Airport for Sydney Water odour treatment discharge and cogeneration engine exhaust stacks.pdf

**OFFICIAL**

Sam
Enclosed is an assessment which includes the proposed odour treatment discharge stack and the proposed cogeneration engine exhaust stacks.
If you would like us to analyse the 'worst case' scenario including the waste gas burner/flare; please advise the exit velocity, stack exit diameter and exit temperature to airspace.protection@casa.gov.au

Regards

David Alder

Aerodrome Engineer
Air Navigation, Airspace and Aerodromes Branch
**CASA Aviation Group**
**p:** 02 6217 **1342** **m:** 0455 051 611
16 Furzer Street, Phillip ACT 2606
GPO Box 2005, Canberra ACT 2601

**www.casa.gov.au**

---

**From:** Sam Corben <Samuel.Corben@aurecongroup.com>
**Sent:** Monday, 27 July 2020 4:02 PM
**To:** INFO OAR <oar@casa.gov.au>
**Cc:** Mark Rush <Mark.Rush@aurecongroup.com>; Stephanie Clarke <Stephanie.Clarke@aurecongroup.com>
**Subject:** Application for Operational Plume Rise Assessment for Proposed Development - Recycled Water Treatment Facility

Hi,

Please find attached a completed Form 1247 for an application for a plume rise assessment of the proposed development of a recycled water treatment facility. The project is a new recycled treatment facility in western Sydney, located approximately 4.3 km north-east of the new Western Sydney Airport.

If further information on the project is required for the assessment, please contact me via phone or email.

Kind regards,

**Sam Corben**
Process Engineer
Concept Design Team, Asset Lifecycle

Aurecon Arup
1 Smith Street, Parramatta NSW, 2150
m: +61 412 913 905

e: sam.corben@sydneywater.com.au; or

e: samuel.corben@aurecongroup.com

**NB. I am currently working from home and am emailing from my home organisation's account. You may reply to either Sydney Water email or the Aurecon account*

**Australian Government**

**Civil Aviation Safety Authority**

Air Navigation, Airspace and Aerodromes

*File Ref: F20/7118-1 in FO19/32*

10/08/2020

Sam Corben
Process Engineer
Aurecon
By Email:
samuel.corben@aurecongroup.com

Chris Osborne
WSA Co
By Email:
planning@wsaco.com.au

Dear Mr. Corben,

**PROPOSED PLUME RISE – RECYCLED WATER TREATMENT FACILITY, BADGERYS CREEK, NSW**

CASA has assessed the plumes from the proposed odour treatment discharge stack and the proposed cogeneration engine exhaust stacks for the Recycled Water Treatment Facility, Badgerys Creek, NSW.

Location:
Latitude: 33° 51' 26.3916" S
Longitude: 150° 46' 20.3592" E

Aviation Facilities in Vicinity (Future):

Western Sydney Aerodrome: Site is very approximately 0.1 km offset south east from runway 05L/23R projected centre line and very approximately 4 km north east of threshold 23R along the centre line.

Regarding the Obstacle Limitation Surfaces (OLS) at the site, the stack site is estimated to be under the Approach Surface for runway 23R, the Take off surface for runway 05L and the Conical Surface (or possibly Inner Horizontal Surface) for Western Sydney Aerodrome. (Could be confirmed with WSAco).

The Take Off surface is expected to be at a height of very approximately 155m above AHD. The Approach surface is expected to be at a height of very approximately 160m AHD. The Conical (or Inner Horizontal) Surface is expected to be very approximately at a height of 140m above AHD.

The helipads at Sydney Motorsport Park are at least 9 km away.

Plumes

Parameters for Stack 1 Odour treatment discharge stack:

Number of stacks 1
Exit velocity = 15 m/s
Stack diameter = 3m
Stack height = 15m AGL is approximately 55m above AHD
Temperature = 20°C (rounded up to 50°C)

Using the CASA screening tool with 50°C, the plume reduces to:

10.6 m/s at approximately 9m above the stack top or approximately 65m AHD
6.1 m/s at approximately 14m above the stack top or approximately 70m AHD
4.3 m/s at approximately 25m above the stack top or approximately 80m AHD

For calculation purposes the temperature was rounded up to 50°C... the minimum input temperature that the CASA software can process and will be conservative.

Stack 2: Cogeneration engine exhaust stacks

Number of stacks 1

Exit velocity = 12.3 m/s
Stack diameter = 0.8m
Stack height = 6m AGL is approximately 46m above AHD
Temperature = 426°C

Using the CASA screening tool, the plume reduces to:

6.1 m/s at approximately 6m above the stack top or approximately 52m AHD
4.3 m/s at approximately 10m above the stack top or approximately 56m AHD

Number of stacks 2
Stack Separation 5m
Exit velocity = 12.3 m/s
Stack diameter = 0.8m
Stack height = 6m AGL is approximately 46m above AHD

Temperature = 426°C

Using the CASA screening tool, the plume reduces to:

6.1 m/s at approximately 6m above the stack top or approximately 52m AHD
4.3 m/s at approximately 15m above the stack top or approximately 61m AHD

'Worst case' scenario including waste gas burner/flare

Number of stacks 3
Stack Separation 20m
Exit velocity stack = unknown

Stack diameter = unknown
Stack height = 8m AGL is approximately 48m above AHD
Temperature = minimised °C

CASA is not able to analyse the 'worst case' scenario including waste gas burner/flare due to insufficient input data provided.

Discussion

The site is under the approach and departure zones at Western Sydney Airport. Small aircraft would be in the minority and circling would not be expected to prevail in the location.

The methodology is conservative and aligned to a cool calm day and doesn't take the lateral dispersion and the 99.9$^{th}$ percentile case into account. As the site is a few kilometers from the runway, 6.1m/sec would be an appropriate critical velocity in this case. The CASA Advisory Circular AC 139-05v3.0 'Plume Rise Assessments'; freely available at:
https://www.casa.gov.au/sites/default/files/advisory-circular-ac-139-05-plume-rise-assessments.pdf
advises that the Manual of Aviation Meteorology (2003) defines the classifications of turbulence intensity as:
**Light.** (1.5 - 6.1 m/s) which can cause momentary changes in altitude and attitude.
**Moderate.** (> 6.1 - 10.6 m/s) which can cause appreciable changes in altitude and attitude.

Considering only the Odour Treatment Discharge stack and the Cogeneration Engine Exhaust stacks; the highest proposed plume dissipates to 6.1 m/sec at approximately 60 m above AHD which is under the OLS by very approximately 80 m.

Conclusion

The 'worst case' scenario has not been assessed due to insufficient input information.

Based on the information presented for the Odour Treatment Discharge stack and the Cogeneration Engine Exhaust stacks, there is no infringement of an OLS at 6.1m/sec or 4.3 m/sec, by a reasonable margin. CASA considers that there will be an Acceptable Level of Safety for these stacks. No mitigations for these stacks would be required.

If you would like CASA to analyse the 'worst case' scenario including the waste gas burner/flare; please advise the exit velocity, stack exit diameter and exit temperature.

Yours sincerely,

David Alder
Aerodrome Engineer

**From:** Alder, David <David.Alder@casa.gov.au>
**Sent:** Thursday, 8 October 2020 5:16 PM
**To:** Sam Corben
**Cc:** Airspace Protection; planning@wsaco.com.au
**Subject:** RE: Application for Operational Plume Rise Assessment for Proposed Development - Recycled Water Treatment Facility [SEC=OFFICIAL]

**OFFICIAL**

*F20/7118-1 in FO19/32*

Sam
Sorry for the delay. An IT upgrade obfuscated our software.
The following is in addition to the letter sent on 10 August.

Parameters for Waste Gas Flare:
Number of stacks 1 (or 3)
Exit velocity = 19 m/s
Stack diameter = .1m (rounded up to 0.5 m)
Stack height = 3.7m AGL is approximately 44m above AHD
Temperature = 750°C

Using the CASA screening tool with .5m diameter, the plume reduces to:
6.1 m/s at approximately 6m above the stack top or approximately 52m AHD (for 1 stack)
4.3 m/s at approximately 16m above the stack top or approximately 60m AHD (for 1 stack)
6.1 m/s at approximately 9m above the stack top or approximately 53m AHD (for 3 stacks)
4.3 m/s at approximately 24m above the stack top or approximately 68m AHD (for 3 stacks)

For calculation purposes the diameter was rounded up to 0.5 m … the minimum input diameter that the CASA software can process and will be conservative. (That is 25 times the actual area!)

Our Plume Screening software is for 'screening' – that is – to evaluate if it is worthwhile getting a detailed analysis by a specialist consultant. I can't accurately assess the Cogen operating simultaneously with the flare, for example. However, given the relatively low exit velocities (compared to power stations etc) and the margins under the OLS, it would appear that it is not worthwhile getting a detailed analysis by a specialist consultant.

Based on the information presented for the Waste Gas Flare, there is no infringement of an OLS at 6.1m/sec or 4.3 m/sec, by a significant margin. CASA considers that there will be an Acceptable Level of Safety for the flares. No mitigations for these flares would be required.

Regards

David Alder

Aerodrome Engineer
Air Navigation, Airspace and Aerodromes Branch
**CASA Aviation Group**
**p:** 02 6217 **1342** **m:** 0455 051 611
16 Furzer Street, Phillip ACT 2606
GPO Box 2005, Canberra ACT 2601

www.casa.gov.au

**From:** Sam Corben <Samuel.Corben@aurecongroup.com>
**Sent:** Tuesday, 25 August 2020 5:15 PM
**To:** Airspace Protection <Airspace.Protection@casa.gov.au>
**Cc:** Alder, David <David.Alder@casa.gov.au>
**Subject:** RE: Application for Operational Plume Rise Assessment for Proposed Development - Recycled Water Treatment Facility [SEC=OFFICIAL]

Hi,

Please see the following table for the data required on the waste gas flare as detailed in previous correspondence as required to assess the 'worst-case' configuration:

| | |
|---|---|
| **Stack Height** | 3.7m AGL |
| **Exit Temperature** | 750 degrees C |
| **Peak Exit Velocity** | 19 m/s |
| **Stack Tip Diameter** | 0.1m |

Please note the change in stack height from the original submission. Additionally, please let me know if any further information is required to assess this scenario for the proposed facility.

Regards,

**Sam Corben**
Process Engineer
Concept Design Team, Asset Lifecycle
Aurecon Arup
1 Smith Street, Parramatta NSW, 2150
m: +61 412 913 905
e: sam.corben@sydneywater.com.au; or
e: samuel.corben@aurecongroup.com

**NB. I am currently working from home and am emailing from my home organisation's account. You may reply to either Sydney Water email or the Aurecon account*

**From:** Alder, David <David.Alder@casa.gov.au>
**Sent:** Friday, 14 August 2020 3:42 PM
**To:** Sam Corben <Samuel.Corben@aurecongroup.com>
**Cc:** Airspace Protection <airspace.protection@casa.gov.au>; planning@wsaco.com.au

**Subject:** RE: Application for Operational Plume Rise Assessment for Proposed Development - Recycled Water Treatment Facility [SEC=OFFICIAL]

**OFFICIAL**

Sam
Enclosed is an assessment which includes the proposed odour treatment discharge stack and the proposed cogeneration engine exhaust stacks.
If you would like us to analyse the 'worst case' scenario including the waste gas burner/flare; please advise the exit velocity, stack exit diameter and exit temperature to airspace.protection@casa.gov.au

Regards

David Alder

Aerodrome Engineer
Air Navigation, Airspace and Aerodromes Branch
**CASA Aviation Group**
**p:** 02 6217 **1342** **m:** 0455 051 611
16 Furzer Street, Phillip ACT 2606
GPO Box 2005, Canberra ACT 2601

**www.casa.gov.au**

---

**From:** Sam Corben <Samuel.Corben@aurecongroup.com>
**Sent:** Monday, 27 July 2020 4:02 PM
**To:** INFO OAR <oar@casa.gov.au>
**Cc:** Mark Rush <Mark.Rush@aurecongroup.com>; Stephanie Clarke <Stephanie.Clarke@aurecongroup.com>
**Subject:** Application for Operational Plume Rise Assessment for Proposed Development - Recycled Water Treatment Facility

Hi,

Please find attached a completed Form 1247 for an application for a plume rise assessment of the proposed development of a recycled water treatment facility. The project is a new recycled treatment facility in western Sydney, located approximately 4.3 km north-east of the new Western Sydney Airport.

If further information on the project is required for the assessment, please contact me via phone or email.

Kind regards,

**Sam Corben**
Process Engineer
Concept Design Team, Asset Lifecycle
Aurecon Arup
1 Smith Street, Parramatta NSW, 2150
m: +61 412 913 905

e: sam.corben@sydneywater.com.au; or

e: samuel.corben@aurecongroup.com

**NB. I am currently working from home and am emailing from my home organisation's account. You may reply to either Sydney Water email or the Aurecon account*

## Melanie Zamudio

**From:** Airport Developments <Airport.Developments@AirservicesAustralia.com>
**Sent:** Tuesday, 2 March 2021 11:59 AM
**To:** Melanie Zamudio
**Cc:** Airspace Protection; planning@wsaco.com.au
**Subject:** YSSW-MA-006 - Upper South Creek Advanced Water Recycling Centre, Kemps Creek [SEC=OFFICIAL]

Hi Melanie,

Apologies for the delay. I refer to your request for an Airservices assessment of the Upper South Creek Advanced Water Recycling Centre, Kemps Creek.

This proposal will not adversely impact the performance of any existing Airservices Precision/Non-Precision Nav Aids, Anemometers, HF/VHF/UHF Comms, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links.

Future CNS facilities associated with Western Sydney Airport cannot currently be assessed against.

Thanks.

Kind regards,

**JOHN GRAHAM**
**AIRPORT DEVELOPMENT APPLICATIONS COORDINATOR**

**WORKING FROM HOME**
**Mobile** 0439 385 472
**Email** John.Graham@airservicesaustralia.com

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**From:** Melanie Zamudio <Melanie.Zamudio@aurecongroup.com>
**Sent:** Tuesday, 2 March 2021 8:07 AM
**To:** Airport Developments <Airport.Developments@AirservicesAustralia.com>
**Cc:** OLIVER, CRAIG <craig.oliver@sydneywater.com.au>
**Subject:** FW: [SEC=OFFICIAL] RE: Assessment of potential infringements into a Building Regulated Area - WSA [SEC=OFFICIAL]

Hi John

I have read the WSA response below. We have previously conducted the crane and height assessment with the OLS/ PansOps. This current request was purely to address Guideline I and any communication or navigation equipment that might be impacted.

If you could please provide a response as to when we can expect written confirmation from Airservices, I think we are nearing 6 weeks, and so I can brief Sydney Water on the status.

Any queries, please give me a call.

Thanks
Melanie

**Melanie Zamudio**
SA & Vic Planning Lead / Manager, Environment and Planning

0413 806 288
**Melanie.Zamudio@aurecongroup.com**
Aurecon Centre, Level 8, 850 Collins Street, Docklands, Melbourne VIC Australia 3008
PO Box 23061, Docklands, VIC 8012
**aurecongroup.com**




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**From:** Planning and Safeguarding <planning@wsaco.com.au>
**Sent:** Monday, 22 February 2021 5:56 PM
**To:** Melanie Zamudio <Melanie.Zamudio@aurecongroup.com>
**Cc:** OLIVER, CRAIG <craig.oliver@sydneywater.com.au>; Airport Developments <Airport.Developments@AirservicesAustralia.com>; Tim Smith <tsmith@wsaco.com.au>; Richard Longman <rlongman@wsaco.com.au>
**Subject:** [SEC=OFFICIAL] RE: Assessment of potential infringements into a Building Regulated Area - WSA [SEC=OFFICIAL]

**OFFICIAL**

Hi Melanie

I refer to your request below and submission to Airservices for Crane Approval. We note the crane is for construction purposes and is proposed to be used between 2022 and 2025. Details of crane usage for any operation purposes should be submitted to WSA once known.

Based on our site assessment below and on the information provided (a Ground RL of 40mAHD and maximum Crane Height of 65m AHD), the proposed crane to be used for construction purposes would not intrude into the Western Sydney International prescribed airspace and no further approval is required.

**Location Coordinates:** 150.772222, -33.86
**Address:** 885 MAMRE ROAD KEMPS CREEK NSW 2178
**Lot/Plan:** Lot 21/DP258414
**Ground Elevation (AHD):** 40.0 m
**OLS Elevation (AHD):** 132.3 m
**OLS Height Relative to Ground Level:** 92.3 m
**Local Government Area:** Penrith (C)

So that we can maintain a register of development activities in the area around the airport, please continue to advise of any changes to the proposed development even where initial assessment indicates no intrusion.

Development at this location may also infringe protected airspace associated with Bankstown Airport. Please contact Bankstown Airport for further information.

If you have any questions please call.

Regards

**Kirk Osborne**
Executive Manager, Land Use Planning and Approvals

+61 424 081 638
kosborne@wsaco.com.au
PO Box 397 Liverpool NSW 1871

Western Sydney Airport

**OFFICIAL**

**From:** Airport Developments <Airport.Developments@AirservicesAustralia.com>
**Sent:** Monday, 25 January 2021 2:54 PM
**To:** Planning and Safeguarding <planning@wsaco.com.au>
**Cc:** Melanie Zamudio <Melanie.Zamudio@aurecongroup.com>; craig.oliver@sydneywater.com.au
**Subject:** FW: Assessment of potential infringements into a Building Regulated Area - WSA [SEC=OFFICIAL]

Hi there,

Please see attachments and email trail below for a proposed Advanced Water Recycling Centre in proximity to WSA.

If appropriate, please request an assessment of the proposal by Airservices.

Thanks.

Kind regards,

**JOHN GRAHAM**
**AIRPORT DEVELOPMENT APPLICATIONS COORDINATOR**

**WORKING FROM HOME**
**Mobile** 0439 385 472
**Email** John.Graham@airservicesaustralia.com

airservices

**From:** Melanie Zamudio <Melanie.Zamudio@aurecongroup.com>
**Sent:** Friday, 22 January 2021 2:08 PM
**To:** Airport Developments <Airport.Developments@AirservicesAustralia.com>
**Cc:** OLIVER, CRAIG <craig.oliver@sydneywater.com.au>
**Subject:** RE: Assessment of potential infringements into a Building Regulated Area - WSA [SEC=OFFICIAL]

Hi John

Please find attached the completed Development Application Submission Form for the Upper South Creek Advanced Water Recycling Centre (Sydney Water) and associated site plan. For your information, we have also received approval from CASA, copy of the correspondence is attached.

Please advise if you require any further information or clarification of the detail provided.

I will be on leave from 27 January to 4 February, if you need any information during this time, please contact Craig (cc'd).

Kind regards
Melanie

**Melanie Zamudio**
Manager, Environment and Planning, Aurecon

**Melanie.Zamudio@aurecongroup.com**
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**aurecongroup.com**

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**From:** Airport Developments <Airport.Developments@AirservicesAustralia.com>
**Sent:** Friday, 15 January 2021 3:25 PM
**To:** Melanie Zamudio <Melanie.Zamudio@aurecongroup.com>
**Subject:** RE: Assessment of potential infringements into a Building Regulated Area - WSA [SEC=OFFICIAL]

Hi Melanie,

I have left a message on your phone, if you could please give me a call on 0439385472.

Airservices will assess the proposed Upper South Creek Advanced Water Recycling Centre.

Airservices requires a completed Development Application Submission Form (returned via email to Airport.Developments@AirservicesAustralia.com) and plans of the site. Please refer to the following link to our webpage that contains all of the information you will need to make your application: https://www.airservicesaustralia.com/industry-info/airport-development-assessments/

Please note the assessment process can take approximately **6 weeks** and will be forwarded to CASA.

Kind regards,

**JOHN GRAHAM**
**AIRPORT DEVELOPMENT APPLICATIONS COORDINATOR**

**WORKING FROM HOME**
**Mobile** 0439 385 472
**Email** John.Graham@airservicesaustralia.com




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