NEW EDUCATION CAMPUS AT JINDABYNE

(New Primary and High School)
Aviation Safeguarding Assessment

Prepared for:

NSW Department of Education - School Infrastructure

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with NSW Department of Education - School Infrastructure (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.30436-R02-v2.0	16 December 2021	Dr Peter Georgiou	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy
610.30436-R02-v1.1	20 July 2021	Dr Peter Georgiou	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy
610.30436-R02-v1.0	12 July 2021	Dr Peter Georgiou	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy

EXECUTIVE SUMMARY

SLR Consulting Australia Pty Ltd (SLR) has been engaged by NSW Department of Education – School Infrastructure to carry out an Aviation Safeguarding Assessment of the proposed New Education Campus at Jindabyne (New Primary and High School).

This Aviation Safeguarding Report accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) in support of an application for a State Significant Development (SSD No 15788005). The SSDA is for a new education campus at Jindabyne, comprising of a new primary and high school, located at the Jindabyne Sport and Recreation Centre (JSRC).

This report addresses the Secretary's Environmental Assessment Requirements (SEARs), notably:

21. Aviation

- Identify if the proposal would affect or be affected by aviation operations associated with nearby airports and affected flight paths of any existing on shore Helicopter Landing Site (HLS). Where required, report a report prepared by a suitably qualified person that assesses the potential impacts of the future development on the aviation operations in accordance with the relevant sections of the National Airports Safeguarding Framework (NASF)

Relevant Policies and Guidelines:

- National Airports Safeguarding Framework and associated guidelines.

The present Aviation Safeguarding report has found that the proposed development would satisfy all NASF Guidelines assessed when taking into account the various Project Commitments detailed in the main body of the report.

This covers:

- NASF-B: The risk of building generated windshear and turbulence at airports;
- NASF-C: The risk of wildlife strikes in the vicinity of airports;
- NASF-E: The risk of distractions to pilots from lighting in the vicinity of airports;
- NASF-F: The risk of intrusions into the protected operational airspace of airports;
- NASF-G The protection of on and off-airport Communication, Navigation and Surveillance equipment;
- NASF-H: The protection of strategically important helicopter landing sites; and
- NASF-I: The protection of public safety areas at the end of runways.

CONTENTS

CONTENTS

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by NSW Department of Education – School Infrastructure to carry out an Aviation Safeguarding Assessment of the proposed New Education Campus at Jindabyne (New Primary and High School).

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Relevant Policies and Guidelines:

- National Airports Safeguarding Framework and associated guidelines.

The remainder of this report comprises the following sections:

Section 2 ...	Describes the proposed New Education Campus	
Section 3 ...	Summarises operations and geographical context of nearby Jindabyne Airstrip	
Section 4 ...	Summarises the key NASF (National Airports Safeguarding Framework) requirements relevant to this assessment	
Section 5 ...	Assesses potential impacts in relation to NASF-B:	Windshear and Turbulence
Section 6 ...	Assesses potential impacts in relation to NASF-C:	Wildlife Strikes
Section 7 ...	Assesses potential impacts in relation to NASF-E:	Lighting
Section 8 ...	Assesses potential impacts in relation to NASF-F:	Obstacles
Section 9 ...	Assesses potential impacts in relation to NASF-G:	CNS Facilities
Section 10 ...	Assesses potential impacts in relation to NASF-H:	Helicopter Landing Sites
Section 11 ...	Assesses potential impacts in relation to NASF-I:	Public Safety Areas
Section 12 ...	Provides the conclusions to the study	

2 THE PROPOSAL

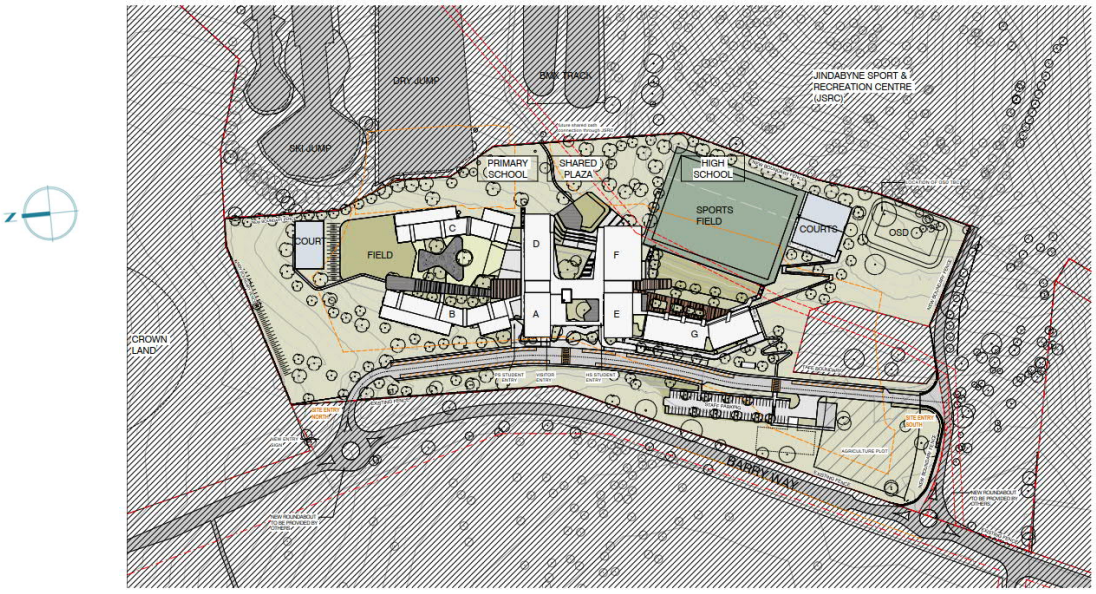
2.1 Description of Proposal

The proposed development is for the construction of the Jindabyne Education Campus comprising a new primary school and a new high school at Jindabyne (the proposal). The proposal is located within the JSRC located at 207 Barry Way (the site) and will accommodate approximately 925 students with the capacity for expansion in the future.

The proposed site plan is shown in Figure 1.

- The new primary school will be located generally in the northern portion of the site whilst the new high school will occupy the south part of the site.
- While the schools are inherently separate identities, with separate student entries, opportunities for integration are provided in a central shared plaza with co-located school administration facilities (refer Figure 1). This outdoor learning space is activated by the school canteen (shared) and separate core facilities including the primary school hall and library, and the high school gym and library, providing opportunities for shared community use.
- The new primary school will provide for a Core 21 school. This will comprise of 20 home base units and 2 support learning units, administration and staff facilities, covered outdoor learning area (COLA), hall, staff and student amenities, out of school care facilities, library and special programs. Landscaped areas include active and passive open space play areas, and a games court.
- The new high school will provide for a Stream 2 high school. This is to comprise of 20 general/specialised learning spaces and support learning units, administration and staff facilities, covered outdoor learning area (COLA), hall, staff and student amenities, library, and an agricultural learning unit. Landscaped areas include active and passive open space play areas, a sports field and multipurpose games courts.
- A new access driveway is proposed off Barry Way along the western boundary of the site and includes car parking, bus and private vehicle drop-off zones, and delivery zones.

Figure 1 Proposed Site Plan



2.2 Site Context

The site of the proposed new education campus at Jindabyne is located within the western extent of the existing JSRC at 207 Barry Way (101 DP1019527). The site is located within the Snowy Monaro Regional Council local government area and is approximately 2.2 km south of Jindabyne Town Centre. A site aerial is provided in Figure 2.

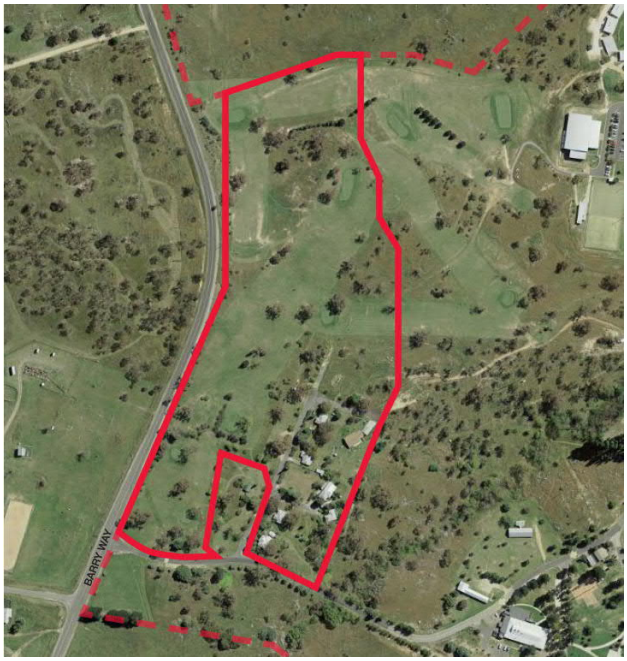
The site is approximately 9 ha in size, containing a former golf course and three existing workers cottages which were occupied during the construction of the Snowy Hydro Scheme. The majority of the site is undeveloped and contains maintained grasslands and scattered trees. Much of the surrounding land comprises remnant grassland, woodland and agricultural land.

As identified above, the site is within the existing JSRC which is a high performance and community sport centre located directly east of the site. The JSRC has a range of sporting facilities including a synthetic running track, cycling track, netball and tennis courts, fitness and indoor sports centres and sporting ovals, as well as other services and accommodation facilities. The newly constructed BMX track is located directly east of the site with the new ski jump currently under construction to the northeast.

TAFE NSW have recently lodged a development application for a Connected Learning Centre (CLC) and Mobile Training Unit (MTU) which is proposed to the south of the site. The CLC and MTU will utilise interactive, digitally enabled, flexible, and multipurposed learning environments to provide high-quality training and learning experiences accommodating a maximum of 20-25 students and 3 teachers.

The surrounding locality is generally rural in character with other land uses also including the Jindabyne Aero Club located to the west of the site on Tinworth Drive, an industrial area to the southwest and the Jindabyne Community Recycling Centre, located east of the JSRC.

Figure 2 Site Context Plan



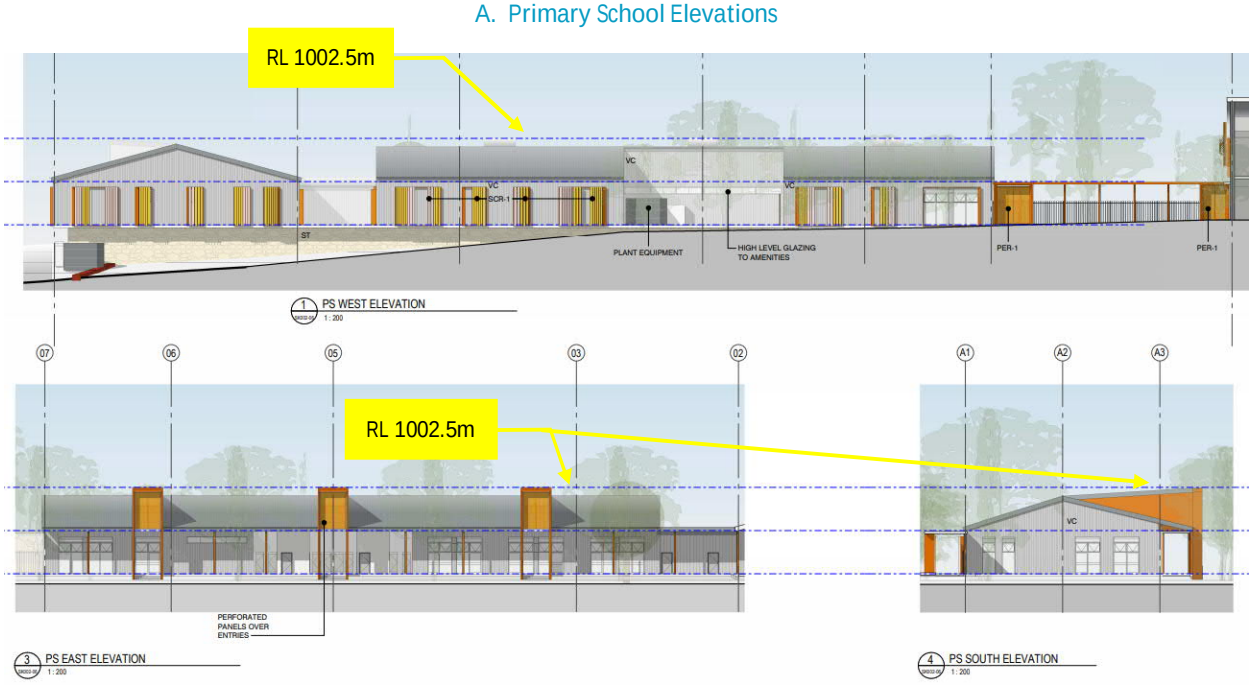
2.3 Description of Key Building Characteristics

Key characteristics of the proposal's buildings and other structures relevant to aviation safeguarding are shown in Figure 3.

- Fig.3A: The Primary School Roof RL lies at 1002.5m.
- Fig.3B: The High School Roof RL lies just below 1006.5m.
- Fig.3C: The campus staff parking lot lies at RL1004m.

Figure 3 Key Proposal Design Characteristics

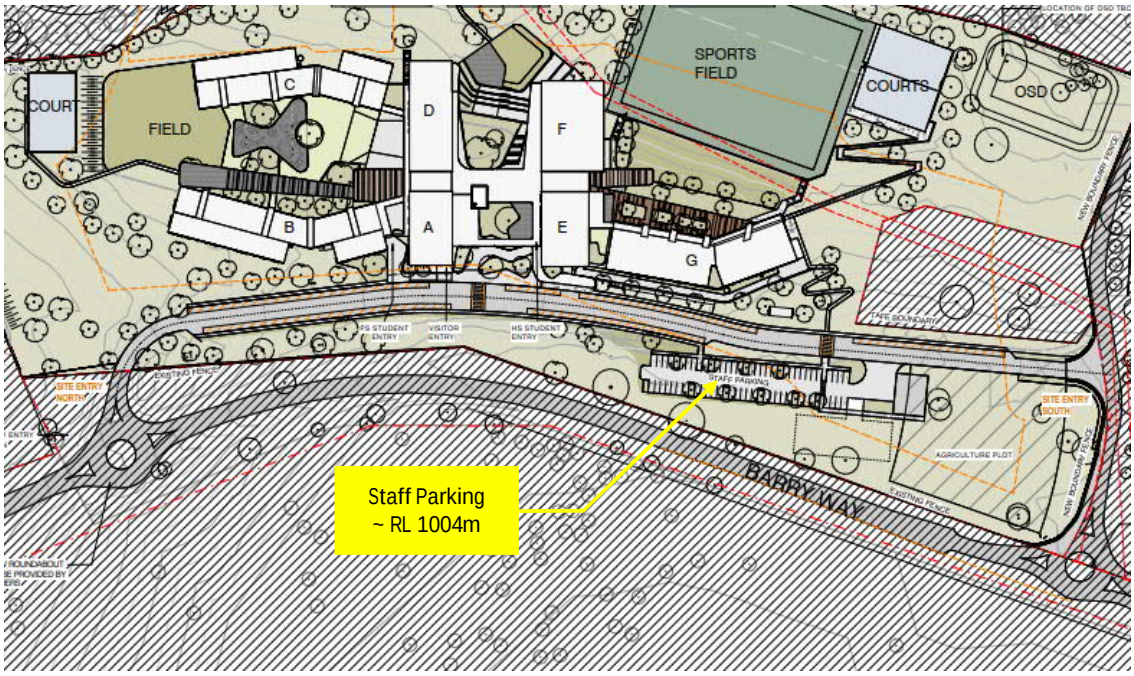
A. Primary School Elevations



B. High School Elevations

(Fig.3 cont'd)

C. Car Park



Additional Relevant Building and Construction Details

- It is assumed that the staff parking lot will have night-time (security) lighting. The luminaire design for this area has not yet been confirmed.
- Accordingly, standard height luminaires have been assumed in this study. 10 m height luminaires for example would therefore reach a maximum potential height of RL 1014m for the staff parking lot.
- Similarly, it is assumed that comparable security lighting will be provided throughout the site. Given that the elevation of the site falls away to the east, it is assumed that standard luminaires would reach a maximum RL lower than the car parking luminaires.
- The selection of construction crane for the project has not yet been made.
- Rather than assume a "typical" crane height for a development of this type, the study examines the limiting heights of cranes at various locations throughout the site that would comply with NASF-related "obstacle" limitations.

3 JINDABYNE AIRSTRIP

Jindabyne Airstrip (ICAO: YJIN) is owned and operated by the Jindabyne Aero Club.

- It is characterised as an "ALA" (aircraft landing area).
- The airstrip is non-instrumented, hence visual flight operations only.
- The airstrip does not currently comprise runway lighting and markings to enable night-time flights.

Jindabyne Airstrip has TWO runways:

MAIN Runway 12/30

- 990 m long and 45 m wide.
- The centre improved section (838 m x 15 m) is smooth compacted granite gravel. The grass at either end of the gravel is rough but usable for larger aircraft.
- The runway has a variable gradient. The western and eastern thresholds of the runway lie at RL 1035 and RL 1017 respectively, ie runway elevations drop west to east.

Secondary Runway 09/27

- 760 m long and 30 m wide, all grass.
- The runway also has a variable gradient. The western and eastern thresholds of the runway lie at RL 1037 and RL 1018 respectively, ie runway elevations also drop west to east.

The YJIN eNOTAMS (latest update 20/06/2021) notes the following:

- 30/03/2016 - Permanent - New lighted communications tower approximately 150 ft AGL on the southern side of the field (approximately 350 ft above runways). All circuits to the North.
- 29/04/2014 - Permanent - Animal Hazard - Emus, Kangaroos, Eagles, Deer and other wildlife.

The Jindabyne Aero Club website (www.jindabyneaeroclub.org.au) notes the following regarding "Airmanship":

- Be aware of the significant slope on the runways and use it to your advantage.
- Be very aware of the TWO large wind socks on the strip.
- Consider carefully the impact of the runway slope, the wind, terrain effects, density altitude and windshear on your aircraft performance.

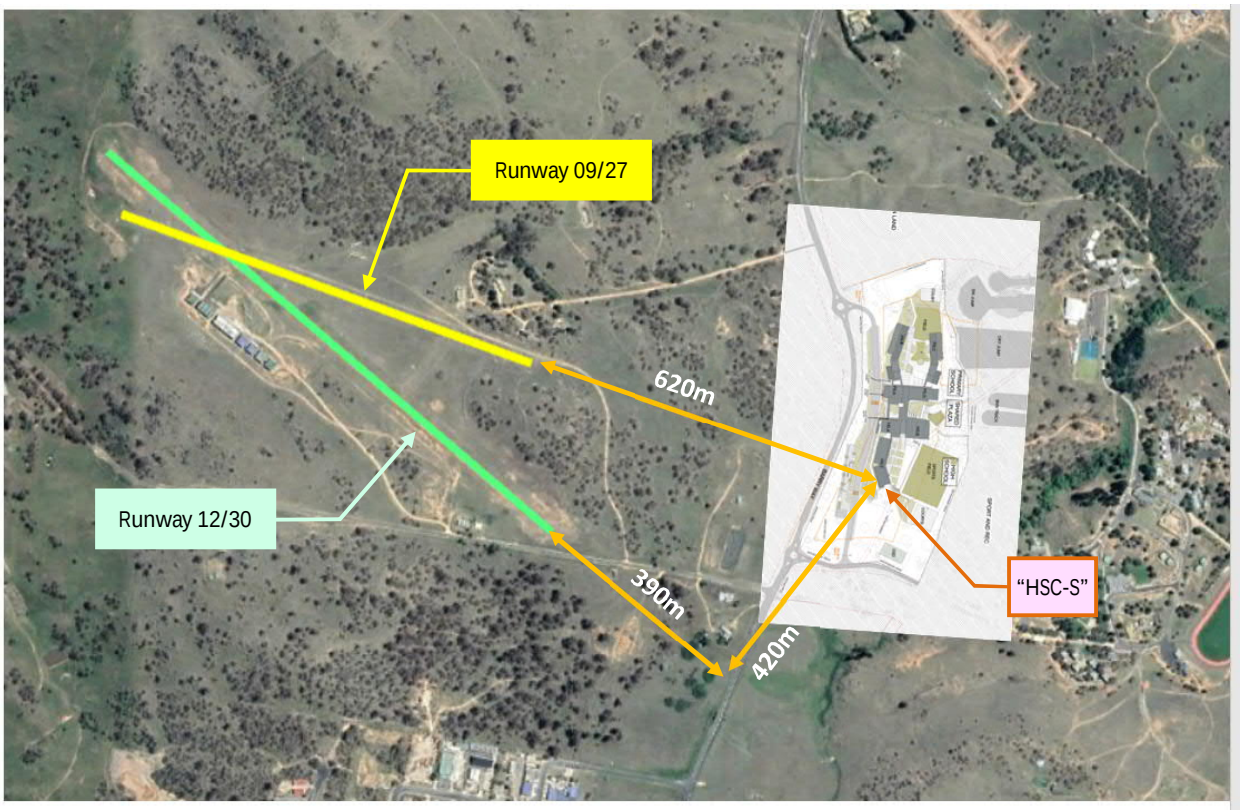
AIP Australia ERSA (08/11/2018) notes the following:

- Animal hazard exists.
- Caution: high ground to W (west).
- Caution: TWR (tower) southern side of airfield.
- Caution: Model ACFT do operate from the airfield; while they are operating, they will be monitoring CTAF 126.7.
- Severe TURB (turbulence) in W (west) wind conditions.

Figure 4 shows an aerial view of Jindabyne Airstrip, the surrounds and the proposal site.

- The southern end of the proposed High School Building HS-C (denoted "HSC-S" in Figure 4) is the closest building within the proposed campus to both runways.
- "HSC-S" lies along the centreline extension of Runway 09, approximately 620 m from the end of the runway.
- "HSC-S" lies at a point which is 390 m along the centreline extension of Runway 12, offset in a perpendicular direction approximately 420 m.

Figure 4 Context of Jindabyne Airstrip and Proposal



Aerial: courtesy GoogleEarth

3.1 Consultation with Jindabyne Aero Club

Contact was made with Jindabyne Aero Club to obtain additional information regarding operations at the airstrip. Contac was via verbal communication given Covid-related travel restrictions. The following information was provided by the club's Secretary, Mr Martin Hughes.

Runway Usage

- Usage at the airstrip is heavily weighted towards Runway 12/30 compared to Runway 09/27: 97% compared to 3%.
- Runway 09/27 is generally only used as a "last" alternative to Runway 12/30 under adverse cross-wind conditions. It also serves (infrequently) as a training runway for grass landing and "go-around" practice.
- In terms of Runway 12 and Runway 30 landings/take-offs, the split is roughly 50:50.
- The above usage reflects not only the regional distribution of winds in terms of prevailing wind direction but the significant topographical effects of the high ground to the west of the airstrip.
- As noted in the eNOTAMS, all circuits are towards the north.

Helicopter Operations

- The airstrip is used routinely by helicopters: users include the National Parks & Wildlife Service, the Rural Fire Service (fire-fighting) and operators of tourist charter flights.
- Helicopters generally make use of the western end of Runway 09/27.
- It is noted that helicopters are not constrained by prevailing wind directions in the same way that aircraft are, ie landings and take-offs generally into the wind. Helicopters have much greater flexibility in terms of landing glide paths and take-off routes.

Wildlife Strikes

- The airstrip site is currently not fenced, hence the potential for hazards involving emus, kangaroos, etc.
- In relation to bird strike, eagles are not seen as the highest risk to the airstrip, as they are generally found at higher altitudes and smaller in number. Moreover, nesting grounds for eagles are found generally in the high country surrounding the area.
- The highest risk associated with bird strike at the airstrip appears to be associated with parrots and galahs, who tend to flock in larger numbers and are found closer to the ground as they forage for seed, etc.

Future Plans for the Airstrip

- The Jindabyne Aero Club is planning a hoped-for future expansion at the airstrip.
- The proposals for this expansion are only in Draft Form at the present time.
- In relation to aspects of relevance to this study, it is understood that the only element of future expansion involving the airstrip's runways involves a potential extension to Runway 30, ie towards the northwest. This is the only feasible terrain and topography option to extend either of the airstrip's two runways.
- There are no plans to alter operations on the infrequently-used Runway 09/27.

Perceived Risks at the Airstrip

- It has been noted that the airstrip is subject to a number of key risk factors.
- These include: the slope (west to east) of the two runways, high ground to the west of the airstrip, the topographical changes in windflow patterns at the airstrip induced by the high ground to the west, wildlife strike, obstacles (such as the 150 ft NBN Tower on the south side of the airstrip), etc.
- There is a nature strip (open paddocks) past the end of Runway 12 which provides an additional "safety" element in case of landing/take-off over-shoots on this runway. No such "safety" factor exists for Runway 30.
- Finally, it is noted again that operations are heavily weighted at the airstrip towards Runway 12/30 compared to Runway 09/27.
- Accordingly, of the four runway modes available at the airport, the one with the greatest perceived risk is Runway 30, ie landings from the southwest, take-offs to the northwest.

History of Incidents at the Airstrip

- It is understood that there has been one documented fatal crash at the airstrip. It involved an autogyro incident where the aircraft ran out of fuel.
- In addition, it is reported that there have been a number of "incidents" associated with the risk factors noted above.
- The JAC's Secretary noted that users at the airstrip are generally well aware of the risk factors noted above and exercise appropriate caution accordingly.

4 NASF GUIDELINES

Australia is a signatory to international civil aviation agreements that require all developments in the vicinity of airports to meet internationally agreed criteria for protecting low level airspace from tall buildings and other structures, smoke and plumes. These requirements are currently implemented by the following:

- Commonwealth Airports (Protection of Airspace) Regulations 1996 (Airspace Protection Regulations);
- Civil Aviation Safety Regulations 1998;
- Civil Aviation (Building Control) Regulations 1988; and
- Civil Aviation Safety Authority's Manual of Standards Part 139.

There is a need to ensure the coordination of on-airport and off-airport planning for all airports. Regardless of who owns and operates an airport, planning on or in the vicinity of an airport needs to be conducted in a manner that is cognisant of all parties.

- For airports covered by the Airports Act 1996, there are regulatory provisions requiring this coordination.
- For other airports, such as Jindabyne Airstrip, this coordination may not be mandated, but should be considered as part of the development of a "good neighbour" relationship.

To support the above, the National Airports Safeguarding Framework (NASF, endorsed in May 2012 by the National Airports Safeguarding Advisory Group) has developed information to guide State, Territory and Local Governments in regulating and managing:

- Intrusion by aircraft noise;
- The risk of building generated windshear and turbulence at airports;
- The risk of wildlife strikes in the vicinity of airports;
- The risk of wind turbine farms as physical obstacles to air navigation;
- The risk of distractions to pilots from lighting in the vicinity of airports;
- The risk of intrusions into the protected operational airspace of airports;
- The protection of on and off-airport Communication, Navigation and Surveillance equipment;
- The protection of strategically important helicopter landing sites; and
- The protection of public safety areas at the end of runways.

The following Principles guide the implementation of NASF Guideline:

- Principle 1. The safety, efficiency and operational integrity of airports should be protected by all governments, recognising their economic, defence and social significance.
- Principle 2. Airports, governments and local communities should share responsibility to ensure that airport planning is integrated with local and regional planning.
- Principle 3. Governments at all levels should align land use planning and building requirements in the vicinity of airports.
- Principle 4. Land use planning processes should balance and protect both airport/aviation operations and community safety and amenity expectations.

- Principle 5. Governments will protect operational airspace around airports in the interests of both aviation and community safety.
- Principle 6. Strategic and statutory planning frameworks should address aircraft noise by applying a comprehensive suite of noise measures.
- Principle 7. Airports should work with governments to provide comprehensive and understandable information to local communities on their operational requirements and potential impacts.

The proposed New Education Campus is committed
to meeting the expectations set out in the above Principles.

All NASF Guidelines are listed in Table 1, which also includes the reference Section where the relevant impact assessment is contained in this study.

Table 1 NASF Guideline Summary

Guideline	Description	Report Reference
NASF-A	Measures for Managing Impacts of Aircraft Noise	note 1
NASF-B	Managing the Risk of Building Generated Windshear and Turbulence at Airports	Section 5
NASF-C	Managing the Risk of Wildlife Strikes in the Vicinity of Airports	Section 6
NASF-D	Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation	note 2
NASF-E	Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports	Section 7
NASF-F	Managing the Risk of Intrusions into the Protected Airspace of Airports	Section 8
NASF-G	Protecting Aviation Facilities – Communication, Navigation and Surveillance (CNS)	Section 9
NASF-H	Protecting Strategically Important Helicopter Landing Sites (HLS)	Section 10
NASF-I	Managing the Risk of Public Safety Areas at the Ends of Runways	Section 11

Note 1 Aircraft Noise has been covered separately in a stand-alone report

Note 2 NOT RELEVANT: no wind turbines are planned as part of the proposal

5 PROPOSAL IMPACTS RE NASF-B (2018)

5.1 Background and Objective of NASF-B

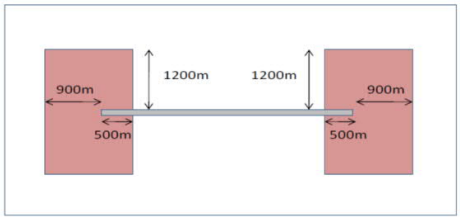
NASF-B (2018): Managing the Risk of Building Generated Windshear and Turbulence at Airports

NASF-B (2018) contains benchmark assessment trigger points for a new building development or building expansion.

Which buildings should be assessed ?

The "Assessment Trigger Area" (ATA):

Buildings do NOT need to be assessed under NASF-B (2018) if they lie OUTSIDE the so-called ATA, as shown to the right in NASF-B (2018) Figure 1.



If a building lies within the so-called "Assessment Trigger Area", apply the "1:35" Rule

- "1:35 Rule" – If the distance from the nearest runway centreline to the closest point of the new building is more than 35 times the height (above runway level) of the building, no further assessment is required as far as NASF-B (2018) is concerned;

If a building does not satisfy the "1:35" rule, assess the following criteria:

1. "7-knot alongwind criterion" – the variation in mean wind speed due to wind disturbing structures must remain below 7 kt (3.6 m/s) along the aircraft trajectory at heights below 200 ft. The speed deficit change of 7 kt must take place over a distance of at least 100 m;
2. "6-knot crosswind criterion" – the variation in mean wind speed due to wind disturbing structures must remain below 6 kt (3.1 m/s) across the aircraft trajectory at heights below 200 ft. The speed deficit change of 6 kt must take place over a distance of at least 100 m.
3. "4-knot turbulence criterion" – the standard deviation of wind speed must remain below 4 kt (2.06 m/s) at heights below 200 ft.

To satisfy the above alongwind, crosswind and turbulence criteria, the following is noted:

- In the absence of a simple (ie qualitative, expert opinion) safety case option, NASF-B requires a qualified wind engineer or other suitably qualified wind professional to assess the proposed development using Wind Tunnel Testing or Computational Fluid Dynamics (CFD) Simulation Modelling in order to satisfy the approval authority/decision maker (and CASA if their advice is sought) that the structure is acceptable.
- The Wind Tunnel Testing or CFD Simulation Modelling is to be used to assess when and in what circumstances the 6 kt (3.1 m/s) and 7 kt (3.6 m/s) wind speed deficit criteria and 4 kt (2.1 m/s) wake turbulence criterion (refer above) are likely to be exceeded. NASF-B (2018) Clause 34 states: "The assessment report should provide enough information (eg whether the criteria will be exceeded, what wind strength and direction would cause each criteria to be exceeded, how often this can be expected to happen) to allow planners to decide whether the proposed structure is acceptable, whether the risks can be mitigated through operational procedures at the airport, or whether the proposed structure should be refused."

5.2 Relationship of the Proposal to NASF-B (2018) Guideline "Triggers"

Runway 12/30

As can be seen in Figure 4, the proposal would lie within the 1,400 m x 2,400 m NASF-B (2018) "Assessment Trigger Area" at the southeast end of Runway 12/30.

- Accordingly, further assessment is required as far as NASF-B (2018) is concerned.

The NASF-B (2018) "1:35 Rule" states that:

- If the distance from the nearest runway centreline to the closest point of the new building is more than 35 times the height (above runway level) of the building, no further assessment is required as far as NASF-B is concerned.

The nearest (and tallest) proposal building (refer "HSC-S" in Figure 4) would lie 420 m from the nearest perpendicular point of Runway 12/30 and its southeast projection.

To satisfy the 1:35 rule, and hence avoid the necessity for further NASF-B (2018) analysis:

- The "HSC-S" Building would need to have a maximum height of no greater than 12 m above the ground elevation of the southeast end of Runway 12/30.

As noted in Section 2 and Section 3:

- The southeast end of Runway 12/30 lies at RL 1017m.
- The allowable maximum height of building at the closest "HSC-S" location would therefore be RL 1029m.
- The High School Roof lies just below RL 1006.5m.

On this basis, the proposal satisfies NASF-B (2018) with respect to the "1:35" rule
and NO further assessment is required for acceptance of the proposal
(in relation to all NASF-B considerations) for Runway 12/30.

Runway 09/27

Again, as per Figure 4, the proposal would lie within the 1,400 m x 2,400 m NASF-B (2018) "Assessment Trigger Area" at the southeast end of Runway 09/27. In fact, the closest relevant building (refer "HSC-S" in Figure 4) lies under the runway centreline projection of Runway 09/27.

- Accordingly, further assessment is required as far as NASF-B (2018) is concerned.

The NASF-B (2018) "1:35 Rule" states that:

- If the distance from the nearest runway centreline to the closest point of the new building is more than 35 times the height (above runway level) of the building, no further assessment is required as far as NASF-B is concerned.

The nearest (and tallest) proposal building (refer "HSC-S" in Figure 4) lies directly under the southeast projection of Runway 09/27.

In principle, to satisfy the 1:35 rule, and hence avoid the necessity for further NASF-B (2018) analysis:

- The "HSC-S" Building would need to have to have a maximum height no greater than 0 m above the ground elevation of the southeast end of Runway 12/30.

As noted in Section 2 and Section 3:

- The southeast end of Runway 12/30 lies at RL 1018m.
- The allowable maximum height of building at the closest "HSC-S" location would therefore be RL 1018m.
- The High School Roof lies just below RL 1006.5m.

On this basis, the proposal satisfies NASF-B (2018) with respect to the "1:35" rule
and NO further assessment is required for acceptance of the proposal
(in relation to all NASF-B considerations) for Runway 09/27.

The above interpretation of the "1:35" Rule to a building which lies directly below the centreline projection of a runway is in principle appropriate.

Some further commentary provides further support for the associated conclusion.

Wake Flow Behind Square and Rectangular Buildings

Ref: Peterka & Cermak (1983), "Turbulence in Building Wakes"

In Peterka & Cermak (1983), the mean velocity and turbulence characteristics of building wakes were measured via model scale testing in a boundary layer wind tunnel. The study investigated the mean velocity deficit and the increase in turbulence (or turbulence "excess") relative to the undisturbed flow upstream.

- Eight buildings were tested, of either square or rectangular cross-section and with height-to-width aspect ratios ranging from less than 1:1 (ie building height less than the building width) to 4:1.

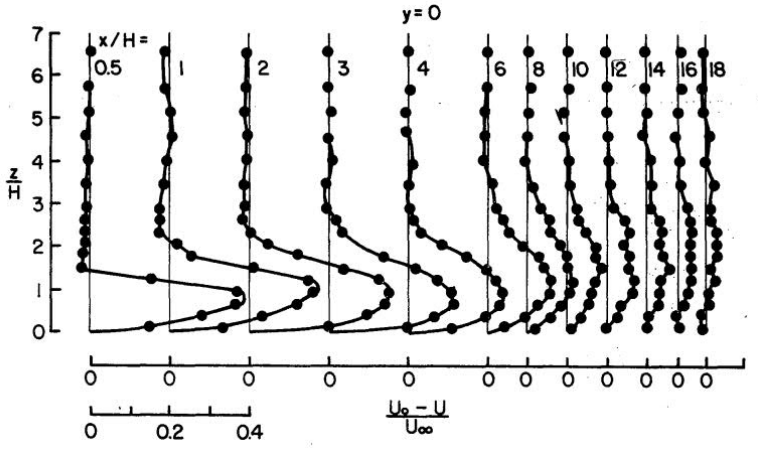
Interestingly, the introduction in this paper cited the need to quantify the potential impact of building developments in close proximity to airports (especially inner urban airports) as one of the reasons for carrying out the study. The study recognised a number of building-induced wake characteristics:

- Firstly, it was recognised that the extent of the wake and flow behaviour within the wake were highly dependent on width to depth ratios and width to height ratios of the buildings and shape details (eg rounded corners, projections, etc) as well as upstream flow conditions (open country terrain flow, suburban terrain flow, etc).
- Secondly, the study recognised that the wake was not a simple region which accounted for all building-induced flow impacts. Rather, the extent of the wake had to be defined in terms of the particular parameter of interest. Thus, some flow characteristics, eg discrete edge vortices transported to the wake, were seen to persist in the flow at distances well beyond the point where other flow parameters such as the mean wind speed had essentially been restored to their upwind (undisturbed) value.

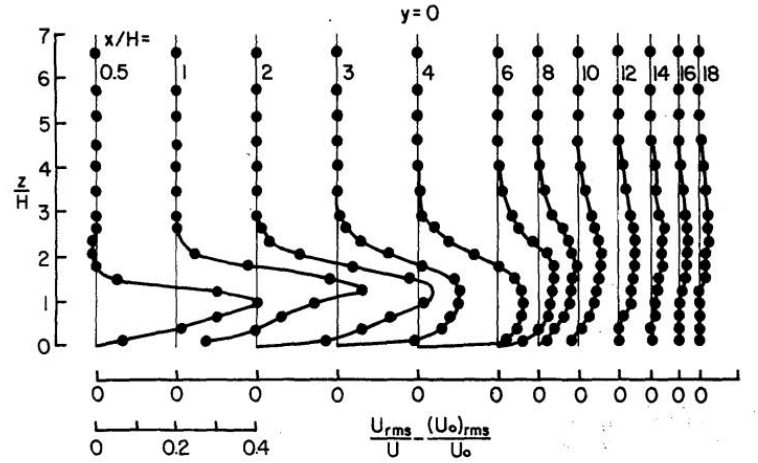
A typical example of the results is shown in Figure 5 for a building with dimensions of building width equal to 2.5 times building depth and building width equal to 3.2 times building height (the "width" is the dimension perpendicular to the oncoming flow direction).

Figure 5 Vertical Profiles of Wake Impact of a Rectangular Building (W/H=2.5, W/D=3.2)

Mean Wind Speed Deficit



Turbulence Excess



Mean Wind Speed

Figure 5 shows the changes to mean wind speed (mean wind speed deficit) at different building height distances (up to x/H=18) downstream of the building. Of interest to this study:

- The vertical extent of the mean flow disturbance increases from 1.5 times the building height close to the building itself to around 3 times the building height further downstream.

Turbulence

Figure 5 also shows the corresponding changes to the turbulence behind the same building, expressed in terms of the change in turbulence intensity. Since the turbulence intensity increases in the wake, the change is labelled the turbulence "excess". Again, in relation to this study:

- The vertical extent of the disturbance to turbulence increases from just over 2 times the building height close to the building itself up to 4 times the building height further downstream.

These results and other building/terrain category combinations examined in this study suggest the following:

- For a building height of 9 m (which is the maximum height of the school buildings within the proposal), disturbances to MEAN wind speeds would be negligible at a height above ground level of 27 m and disturbances to TURBULENCE would be negligible at a height above ground level of 36 m.

For the critical "HSC-S" building (Roof Level at RL 1006.5m):

- Disturbances to MEAN wind speeds would be negligible above say RL 1025m and disturbances to TURBULENCE would be negligible above say RL 1034m.

The southeast end of Runway 09/27 is at RL 1018 and the "HSC-S" building is approximately 620 m distant.

- Assuming a 3° glide path slope, an aircraft on approach to Runway 27 (flying over the proposal site) would be just above RL 1050m.

The above confirms that any potential disturbance to winds by the proposal building at the location "HSC-S" location would not extend to the Runway 09/27 glide path extending to the southeast.

Again, it is concluded that NO further assessment is required for acceptance of the proposal (in relation to all NASF-B considerations) for Runway 09/27.

6 PROPOSAL IMPACTS RE NASF-C (2014)

6.1 Background and Objective of NASF-C (2014)

NASF-C (2014): Managing the Risk of Wildlife Strikes in the Vicinity of Airports

Wildlife strikes and/or avoidance can cause major damage to aircraft and/or reduction of safety. Most wildlife strikes occur on or in the vicinity of airports, where aircraft fly at lower elevations. 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 existing land use is managed in the vicinity of airports can significantly influence the risk of wildlife hazards. The number of wildlife strikes and the attendant risk of fatalities, injuries, aircraft damage and operational delays can be reduced by managing land use around airports to minimise the potential for wildlife to be in conflict with aircraft operations.

In response to the above, NASF-C (2014) was developed to provide guidance in relation to the management of risk of collisions between wildlife and aircraft at or near airports where that risk may be increased by the presence of wildlife-attracting land uses. For example, NASF-C contains guidance in relation to the risk of waste foodstuffs being dumped near airports that may pose a risk to aviation safety by attracting wildlife.

6.2 Key considerations for managing risk of wild life strikes in the vicinity of airports

Key aspects of the assessment of new developments in relation to NASF-C rest on two scenarios:

- Scenario A: Whether wildlife will be attracted to a proposed development close to an airport, which can then migrate onto the airport or across flight paths, increasing the risk of strikes;

  OR

- Scenario B: Whether the existing wildlife in an area planned to be developed, is then displaced and subsequently moves closer to or even onto airport sites, again increasing the risk of strikes.

An example of Scenario “A” is the development of facilities involved in food garbage disposal, sewage treatment and disposal, abattoirs and freezing works, fish processing plants, etc.

An example of Scenario “B” is the development of a facility which would completely destroy the breeding and feeding grounds of the local wildlife, who would then necessarily seek new areas for their survival, which may be closer to an airport site.

NASF-C (2014) Action Areas Related to Wildlife Strike

NASF-C (2014), which is in general compliance with ICAO “Airport Services Manual- Bird Control and Reduction”, includes an Attachment 1 which provides guidance in relation to new land uses in terms of distances from aerodromes and the need or otherwise for active measures to mitigate the risk of wildlife strike. The distance benchmarks are split into 3 km, 8 km and 13 km from the aerodrome reference point.

The proposed New Education Campus development includes the following usages found in NASF-C (2014) Attachment 1:

- Sports Facility (eg tennis, bowls, etc)
- Parks / Playground
- Car Park

Table 2 lists the NASF-C (2014) recommended actions for the above land uses.

Table 2 NASF-C (2014) Attachment 1 – Wildlife Strike Mitigation Recommendations

Land Use	Risk Level	Recommended Action for a New Development		
		Within 3 km Radius	Within 8 km Radius	Within 13 km Radius
Sports Facility	Moderate	Mitigate	Mitigate	Monitor
Parks / Playground	Moderate	Mitigate	Mitigate	Monitor
Car Park	Very Low	Monitor	No Action	No Action

NASF-C (2014) suggests the following actions in relation to wildlife strike mitigation:

- Airport operators are expected to play a role in the planning process by providing comments on how any proposed changes to land use in the vicinity of an airport (refer Table 2) might increase the risk of wildlife strike. For example, airport operators should be in a position to provide assistance or advice to relevant stakeholders on bird and wildlife mitigation measures, drawing on knowledge obtained in managing this issue on the airport site covering such issues as the status of individual bird attractants sites, existing/potential flyways (regular bird flight paths) between separate bird attractant sites, etc.
- Airport operators are encouraged to provide input to land use planning authorities and land owners if required on agreed action plans for monitoring and, where necessary, reducing wildlife attraction to areas in the vicinity of airports. These could include: monitoring surveys, wildlife hazard assessments by qualified ornithologists or biologists, wildlife awareness and management training for relevant staff, establishment of bird population triggers, implementation of activities to reduce hazardous bird populations; and adoption of wildlife deterrent technologies to reduce hazardous bird populations.

6.3 Relevant Supporting Studies

To support the SSDA for the proposal, the following detailed studies relevant to NASF-C (2014) have been undertaken:

- ECOLOGICAL 21CAN-18872, "Monaro Cluster – Jindabyne Site Arboricultural Impact Assessment" (May 2021).
- WSP PS125302-ECO-REP-001, Rev.A, "Jindabyne Education Campus – Biodiversity Development Assessment Report" (June 2021).

ECOLOGICAL Arboricultural Report

The following summarises key aspects of the arborist report supporting the proposal SSDA relevant to NASF-C (2014):

- A total of 210 trees were assessed and tagged in October 2020 and April 2021.
- A total of 75 trees will be highly affected (>20 % TPZ encroachment) by the proposed development based on the current site plan and would need to be removed.
- Of these 75, a total of 23 high retention value trees will be subject to high impact. These trees are considered important and should be prioritised for retention and protection.
- A further total of 29 medium retention value trees will be subject to high impact. These trees are moderately important for retention.
- A further total of 23 low retention value trees will be subject to high impact. These trees are not considered important for retention, nor require special works or design modification to be implemented for their retention.
- Any loss of trees should be offset with replacement planting in accordance with the relevant offset policy.
- A total of 103 trees will be subject to no impact from the proposed development. These trees can be retained as there is no foreseeable encroachment within the trees' Tree Protection Zones.
- A total of 12 trees will be subject to medium impact and have the potential to be retained subject to further investigation (i.e. root mapping) and mitigation measures.
- Many trees, including some high retention value trees, have attained considerable size, and features include decay, termite activity, hollows, and large dead branches. These features can often be considered defects and hazards when the use of the area around the tree changes. When this occurs, the risk of harm to people and property from falling trees and branches can also change. However, trees with these features can also be valued for history, visual amenity, fauna habitat, environmental education and carbon sequestration.
- Therefore, it is recommended that remnant high retention value trees (Eucalyptus sp.) with notable defects are incorporated in lower occupancy parts of the proposed school. It is also recommended that that tree management measures are implemented to manage the risk. In areas where occupancy is expected to be high, a level 3 assessment of the canopy is recommended to assess for decay. It is recommended that the deadwood and dead branches be trimmed out by a qualified level 3 arborist where these trees are to be retained.

Relevance to NASF-C

One of the identified risk elements (in relation to NASF-C) and the proposal is an assessment of the potential for wildlife habitats located in the current proposal site to be demolished and the impacted wildlife to be displaced, potentially close to Jindabyne Airstrip.

The ECOLOGICAL Arboricultural Reports demonstrates the following:

- A comprehensive study of ALL trees on the proposal site has been undertaken and a detailed analysis has been undertaken classifying each and every tree's "retention value" with the objective of retaining the maximum possible number of trees on the site.

- Any remaining loss of trees will be offset with replacement planting in accordance with the relevant offset policy.

The above suggests that the proposal should not result in any noticeable displacement of wildlife whose arboreal habitat currently lies within the site. Furthermore, the ECOLOGICAL Arboricultural Report includes:

- A Tree Protection Plan: with supporting tree protection measures (refer Arboricultural Report Table 4); and
- A recommended Tree Protection Monitoring Program covering all stages of the proposal: Pre-Construction, Construction and Post-Construction (Operational).

The above measures should be able to identify any significant shift in wildlife populations, which have the potential to increase relevant wildlife strike risk at Jindabyne Airstrip.

WSP BDAR Report

The following summarises key aspects of the BDAR supporting the proposal SSDA relevant to NASF-C (2014):

- WSP's PMST search identified three threatened ecological communities in the general vicinity of the proposal. None of these was found to be present within the proposal site boundary.
- A conclusion was reached that the grassland within the proposal site boundary is "derived" or "secondary" grassland. As such, the grassland areas of the proposal site are considered to be derived from PCT 1191 (Snow Gum / Candle Bark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion) and NOT part of the EPBC Act listed TEC (Threatened Ecological Communities).
- Biodiversity surveys were undertaken by WSP in June 2021. These were used to assess the likelihood of threatened species of animal within the proposal site.
- Of specific interest to NASF-C (2014), the proposal site does contain large hollow-bearing trees which may be suitable for use as breeding habitat by Gang-gang Cockatoos, Barking Owl or Powerful Owl.
- The proposal site does not appear to contain any large stick nests that would be appropriate for use by raptors. A single Little Eagle nest was located approximately 220 m northwest of the proposal site.
- At this stage, there are no species present within the proposal site on the basis of being identified on an important habitat map for species and similarly, there are no threatened fauna species SAII (Serious and Irreversible Impact) entities that would be affected by the proposal.

Relevance to NASF-C

The WSP BDAR observations are in line with the history of the proposal site. The proposal is located in a previously disturbed area. A substantial portion of the subject land was formerly a golf course (it is understood that the fairways and greens can be seen in historical aerial photos). Parts of the subject land formerly contained buildings which have been demolished. Similarly, parts of the subject land contain houses that are currently occupied by Sports and Recreation Staff. Most importantly, the proposal is not located in an area of undisturbed or intact habitat.

Again, it is concluded that the proposal is unlikely to result in any noticeable displacement of wildlife whose arboreal habitat currently lies within the site.

6.4 Impact of the Proposed Development

On the basis of the Arboricultural and BDAR Reports recently carried out in support of the proposal SSDA:

- The proposal appears highly unlikely to result in any noticeable displacement of wildlife from the site and closer to Jindabyne Airstrip.

Accordingly, there would be no impact from the proposed development in relation to NASF-C with respect to wildlife displacement issues.

With regard to wildlife attraction issues:

- The proposal does not contain facilities involved in activities that would be likely to attract wildlife from further afield and potentially closer to Jindabyne Airstrip, eg food garbage disposal, sewage treatment and disposal, abattoirs and freezing works, fish processing plants, etc.
- It is assumed that the proposal's Waste Management Plan will also assist in ensuring that wildlife populations are not inadvertently attracted to the site and hence closer to Jindabyne Airstrip operations.

Project Commitment:

- Commitments have already been made within the SSDA Arboricultural and BDAR studies in relation to monitoring that would confirm the absence of any noticeable and large-scale displacement of wildlife closer to Jindabyne Airstrip.

7 PROPOSAL IMPACTS RE NASF-E (2014)

7.1 Background and Objective of NASF-E (2014)

NASF-E (2014): Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports

Pilots rely on specific patterns of aeronautical ground lights during inclement weather and outside daylight hours. These 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. Importantly, they also enable the pilot to land the aircraft at the appropriate part of the runway.

- It is therefore important that lighting in the vicinity of airports is not configured or is of such a pattern that pilots could either be distracted or mistake such lighting as being ground lighting from the airport.

NASF-E has therefore been developed to provide guidance in addressing the risk of distractions to pilots of aircraft from lighting and light fixtures near airports.

Key Proposal Elements Relevant to NASF-E

In relation to the proposal, the following elements are noted being relevant to NASF-E (2014):

- Security/night-time lighting throughout the site, including the two proposal car parks;
- Potential flood lighting for the proposal Sports Field; and
- Construction lighting, in particular associated with construction cranes.

NASF-E (2014) Lighting Guidance

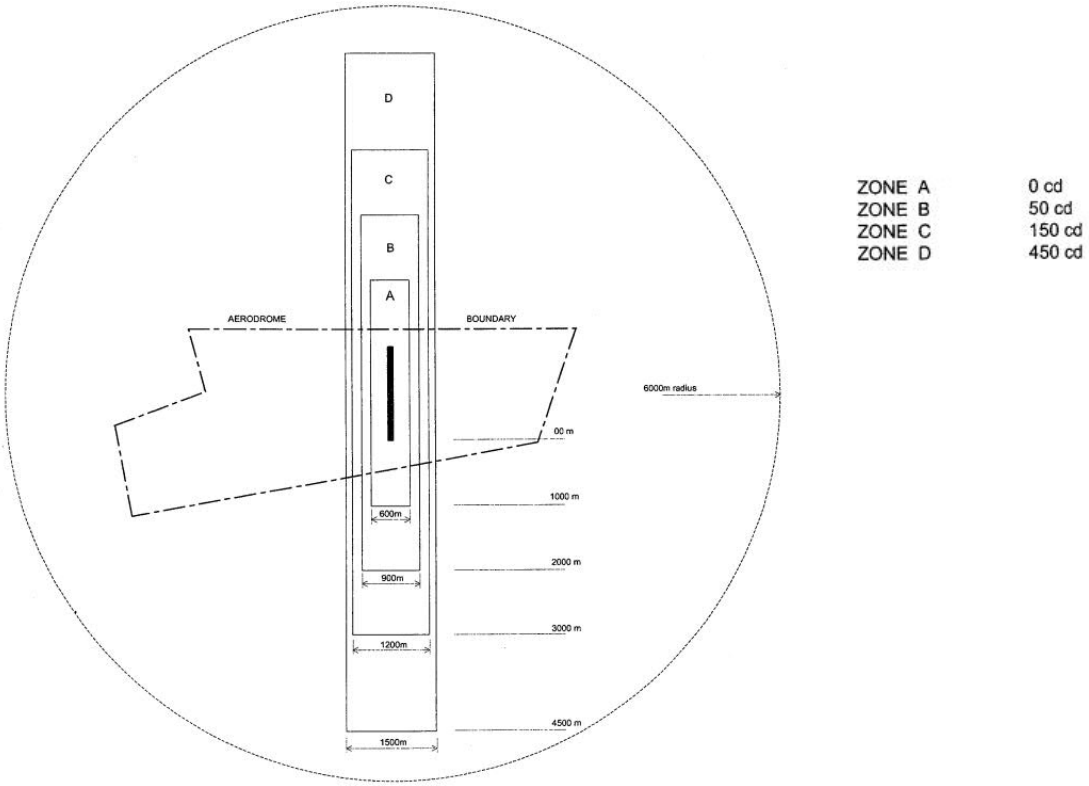
NASF-E (2014) provides guidance for situations where lights are to be installed within a 6 km radius of a known aerodrome. Within this large area there exists a primary area which is divided into four light control zones: A, B, C and D. These zones reflect the degree of interference ground lights can cause as a pilot approaches to land.

The primary area and associated ones “A” to “D’ are shown in Figure 6, which includes the intensity of light emission above which interference is likely.

NASF-E (2014) notes the following:

- The fact that a certain type of light fitting already exists in an area is not necessarily an indication that more lights of the same type can be added to the same area.
- Light fittings chosen for an installation should have their iso-candela diagram examined to ensure the fitting will satisfy the zone requirements, in particular whether the polar diagrams published by manufacturers show sufficient detail in the sector near the horizontal.
- For installations where light fittings are selected because their graded light emission above horizontal conform to the zone requirement, no further modification is required.
- If a light fitting does not meet the zone requirements, a screen should be fitted to limit the light emission to zero above the horizontal. This also addresses issues associated with luminaire movement in high wind conditions.

Figure 6 NASF-E Recommended Maximum Intensity of Light Sources (measured 3° above Horizon)



Coloured Lighting

- Coloured lights are likely to cause conflict irrespective of their intensity as coloured lights are used to identify different aerodrome facilities. Proposals for coloured lights should be referred to CASA for detailed guidance.

Glare

- The potential for glare caused by reflected sunlight from structures such as buildings has been considered as a potential source of distraction to pilots.
- CASA advises that glare from buildings tends to be momentary and therefore unlikely to be a source of risk. Moreover, the potential for risk from building glare is further attenuated by the use of sunglasses which pilots normally wear in bright daylight.

7.2 Impact of the Proposed Development

According to the feedback received from the Jindabyne Aero Club (interview with Secretary, Mr Martin Hughes):

- Jindabyne Airstrip currently has NO runway lighting that would enable night-time operations

On this basis, there would be no impact from the proposed development in relation to NASF-E (2014).

However, the following it also noted:

- Communication with Jindabyne Aero Club (interview with Secretary, Mr Martin Hughes) has revealed potential masterplanning activities leading to airstrip operation expansions. It is not known if this would entail night-time operations.
- The airstrip is currently used for emergency purposes by helicopter operations (eg Rural Fire Service for fire-fighting and rescue flights).

In light of the above, it is considered prudent to assess the Lighting Design of the proposed development once detailed design commences to ensure that NASF-E (2014) lighting recommendations can be made IF it is confirmed with the Jindabyne Aero Club that expansion of the airstrip will be sought AND that this will involve night-time operations.

Project Commitment:

- It is recommended that communication with JAC be continued in relation to any future airstrip masterplanning to ensure that the objectives of NASF-E (2014) are addressed IF relevant.

8 PROPOSAL IMPACTS RE NASF-F (2012)

8.1 Background and Objective of NASF-F (2012)

NASF-F (2012): Managing the Risk of Intrusions into the Protected Operational Airspace of Airports

The navigation airspace of airports is the airspace above a set of imaginary surfaces, the design of which is determined by criteria established by the International Civil Aviation Organisation (ICAO). These surfaces, known as the OLS (Obstacle Limitation Surfaces), are established with the aim of protecting aircraft from obstacles or activities that could be a potential threat to safety.

The OLS also help to protect aerodromes from becoming unusable in the future through the growth of obstacles around the aerodromes. If obstacles penetrating the OLS are not regulated, the relevant airspace safety regulator may have to mitigate the accompanying risks by placing restrictions on operations at the affected aerodrome.

8.2 Obstacle Limitation Surfaces (OLS)

As noted above, critical to the protection of airspace navigation are the "OLS", Obstacles Limitation Surfaces. The criteria for determining the OLS for a specific airport runway have been established by the ICAO.

OLS take the form of a set of (ICAO-defined) 3-dimensional surfaces, which extend upwards and outwards from an airport's runway(s) encompassing the critical airspace in which key air traffic and flight procedures associated with the aerodrome are conducted.

Table 3 lists the constituent elements of the OLS for Non-Precision and Precision Runways. In the present instance, the elements of interest are those for a Non-Precision Runway.

Table 3 Constituent OLS Surface Elements for Non-Precision and Precision Runways [1]

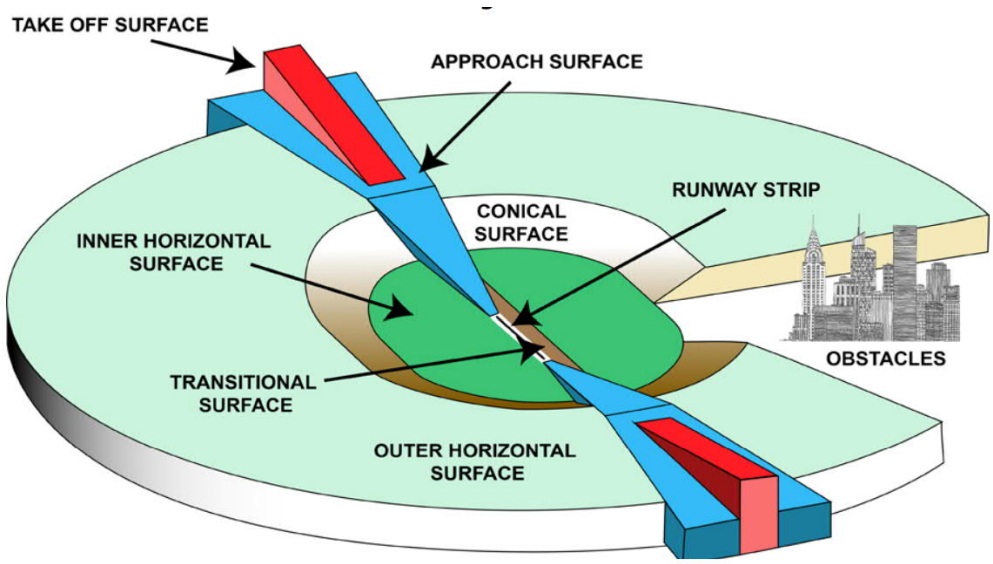
OLS Elements for NON-Precision Runways	OLS Elements for Precision Runways
(a) conical surface; (b) inner horizontal surface; (c) approach surface; (d) transitional surface; and (e) take-off climb surface.	(a) outer horizontal surface; (b) conical surface; (c) inner horizontal surface; (d) approach surface; (e) inner approach surface; (f) transitional surface; (g) inner transitional surface; (h) baulked landing surface; and (i) take-off climb surface.

Note 1 Source: Manual of Standards Part 139 – Aerodromes: Chapter 7 Obstacle Restriction and Limitation

Figure 7 provides an illustrative view of the OLS and its constituent elements. The OLS can be thought of as two intersection set of surfaces:

- The surfaces that extend outwards from the runway along its centreline extension relevant to aircraft landings and take-offs; and
- The surfaces that surrounding the runway in a broadly oval shape which cover all remaining areas.

Figure 7 ICAO-Compliant / MOS 139-Defined OLS Geometry



Appendix A provides the detailed dimensions of heights and slopes of the various surfaces that constitute the OLS.

Appendix A shows that the dimensions and gradient slopes for the various surfaces are a function of the Aerodrome Reference Code Number.

ICAO Code Number definitions are provided in Appendix B.

For the present study:

- Runway 09/27 is a “Code 1” runway
- Runway 12/30 is a “Code 2” runway

8.3 Relationship of Proposal to Jindabyne's Runways and Respective OLSs

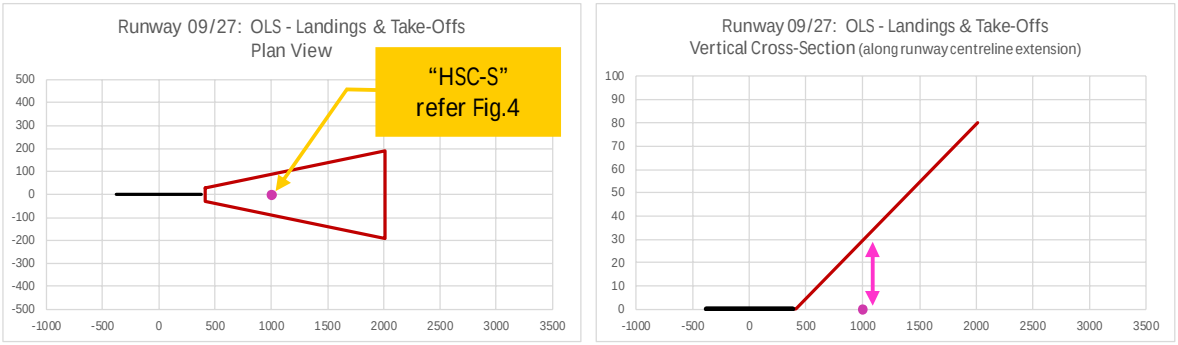
OLS for Landings & Take-Offs

Figure 8 shows the location of the nearest building of the proposed New Education Campus (denoted "HSC-S" in Figure 4) to the relevant OLS constituent surfaces of Jindabyne Airstrip Runway 09/27 and Runway 12/30 relevant to Landings and Take-Offs.

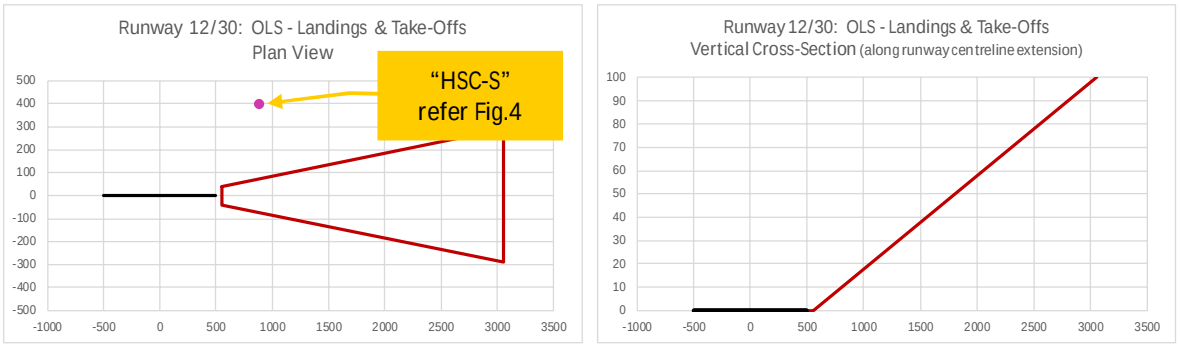
- The proposal's southern-most High School Building HS-C lies WITHIN the Landing/Take-Off OLS for Runway 09/27. In terms of compliance, it would need to be a maximum height of 30 m relative to the ground elevation at the southeast end of the runway.
- The proposal's southern-most High School building does NOT lie within the Landing/Take-Off OLS for Runway 12/30. There is therefore no compliance height in this instance in relation to landings and take-offs.

Figure 8 Jindabyne Airstrip OLS Relevant to Aircraft Landings and Take-Offs

Runway 09/27



Runway 09/27



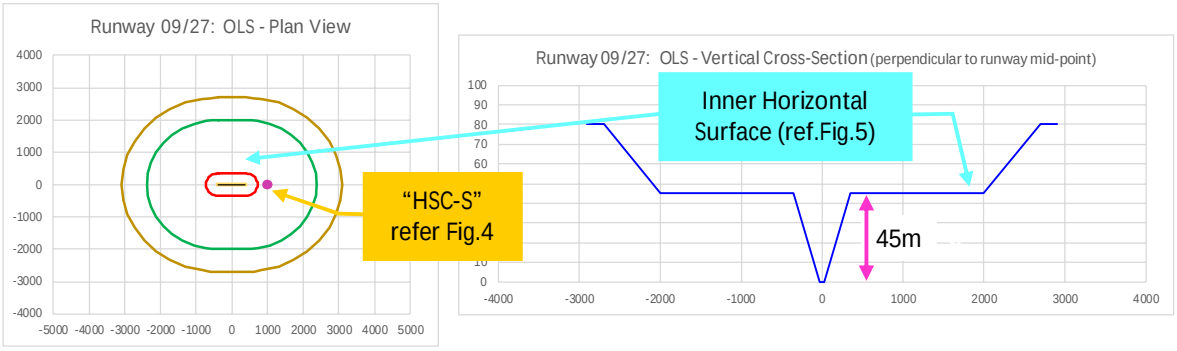
OLS for All Other OLS Areas (ie other than for Landings & Take-Offs)

Figure 9 shows the location of the nearest building of the proposed New Education Campus (denoted "HSC-S" in Figure 4) to the relevant OLS constituent surfaces of Jindabyne Airstrip Runway 09/27 and Runway 12/30 relevant to all other areas (ie other than for landings and take-offs).

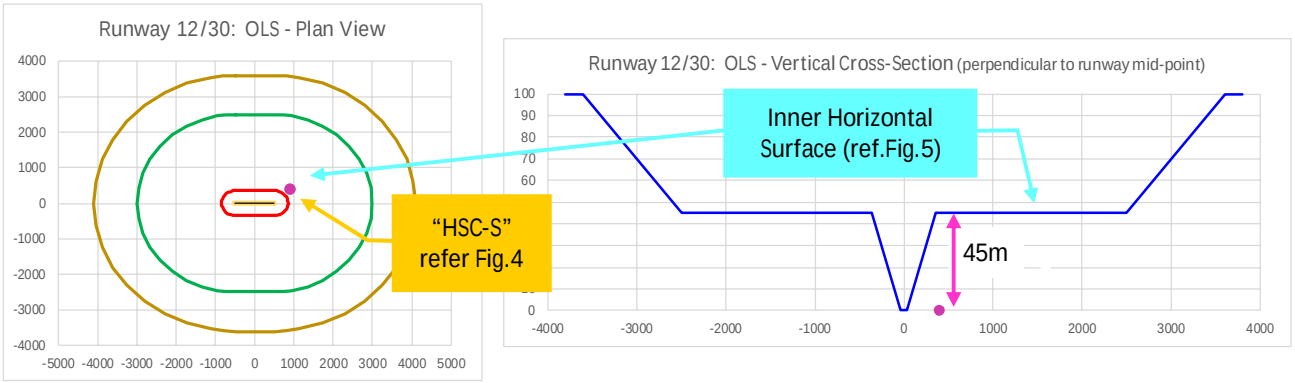
- The proposal's southern-most High School Building HS-C lies within the OLS Inner Horizontal Surface for Runway 09/27. In terms of compliance, it would need to be a maximum height of 45 m relative to the ground elevation at the southeast end of the runway. This is greater than the 30 m compliance height in terms of the Landing/Take-Off OLS, hence the 30 m compliance requirement governs.
- The proposal's southern-most High School Building HS-C also lies within the OLS Inner Horizontal Surface for Runway 12/30. In terms of compliance, it would need to be a maximum height of 45 m relative to the ground elevation at the southeast end of the runway. Since there is NO compliance height in terms of the Landing/Take-Off OLS for this runway, the 45 m compliance requirement governs.

Figure 9 Jindabyne Airstrip OLS Relevant to Aircraft Landings and Take-Offs

Runway 09/27



Runway 12/30



8.4 Compliance in Relation to the Proposal and Jindabyne Airstrip OLS

From Figure 8 and Figure 9, it can be deduced that compliance with Jindabyne Airstrip's OLS would require that:

- The height of the proposal's buildings would need to less than 30 m above the ground elevation of the southeast end of Runway 09/27, which is at RL 1018m (refer Section 3)

AND

- The height of the proposal's buildings would need to less than 45 m above the ground elevation of the southeast end of Runway 12/30, which is at RL 1017m (refer Section 3).

In Section 2, it was shown that:

- The maximum height of the proposal's High School buildings is RL 1006.5.

Accordingly, no building element of the proposal would penetrate Jindabyne Airstrip's OLS.

Other Potential "Obstacles"

No information is currently available regarding detailed dimensions for the other two potential "obstacles" associated with the proposal:

- Lighting towers to be used throughout the proposal, especially those located at the staff car park (refer Figure 3-C) which would be the closest to Jindabyne Airstrip and the proposal's Sports Field; and
- Cranes that will be used during the construction phase of the proposal.

Lighting Towers

The lighting towers to be used throughout the proposal will likely fall into two categories:

- Standard luminaires used for night-time/security lighting around all buildings and car parks; and
- Non-standard luminaries that could potentially be used for the proposal's Sports Field, located in the central eastern portion of the site, if the field is to be used for night-time activities.

In relation to the standard luminaires to be deployed through the site:

- The closest luminaires to Jindabyne Airstrip will be those servicing the staff car park – refer Figure 3-C. The ground elevation at the car park is RL 1004m.
- A review of the OLS surfaces in Figure 8 and Figure 9 shows that the maximum "obstacle" height for objects in the car park areas would be 25 m above the ground elevation of the southeast end of Runway 09/27, which is at RL 1018m. The maximum allowable obstacle height would therefore be approximately RL 1043m.
- This implies that obstacles (such as lighting towers) located within the car parks could be as high as 25 m above ground level and still comply with the Jindabyne Airstrip OLS.
- The standard lighting luminaires likely to be used for the two proposal car parks will almost certainly be less than 25 m in height.

In relation to the luminaires that may be deployed around the proposal Sports Field:

- The closest luminaires to Jindabyne Airstrip around the perimeter of the proposal's Sports Field would be located at ground elevations of roughly RL 1000m.
- A review of the OLS surfaces in Figure 8 and Figure 9 shows that the maximum "obstacle" height for objects in the car park areas would be 32 m above the ground elevation of the southeast end of Runway 09/27, which is at RL 1018m. The maximum allowable obstacle height would therefore be approximately RL 1050m.
- This implies that obstacles (such as lighting towers) located around the Sports Field could be as high as 50 m above ground level and still comply with the Jindabyne Airstrip OLS.
- The luminaires likely to be used for the two proposal Sports Field are unlikely to be taller than 50 m in height.

Accordingly,
assuming that lighting towers used for the proposal Sports Field are less than 50 m in height,
no lighting towers associated with the proposal would penetrate Jindabyne Airstrip's OLS.

Construction Cranes

The construction cranes to be used throughout the proposal will likely be located close to the proposal's buildings and materials storage locations:

- A conservative assumption for the local ground elevations at any construction crane position would be RL 1005m, the highest elevation point throughout the site.
- A review of the OLS surfaces in Figure 8 and Figure 9 shows that the maximum "obstacle" height for objects in any area would be 25 m above the ground elevation of the southeast end of Runway 09/27, which is at RL 1018m. The maximum allowable obstacle height would therefore be approximately RL 1043m.
- This implies that obstacles such as construction cranes located anywhere within the site could be as high as 38 m above ground level and still comply with the Jindabyne Airstrip OLS.
- At this stage, the maximum height of the cranes likely to be used during the proposal construction phase is not known.

It is important to note that, in so far as NASF-F (2012) is concerned, the OLS does not prohibit all intrusions.

- The aim is to ensure that all objects that intrude into the OLS can be identified and assessed for their potential impact on aircraft operations.
- The assessment will enable a determination on whether the intrusion is permissible, and if so, a determination on whether any risk mitigation requirements should be imposed.

Accordingly,
the following actions are recommended in relation to the proposal's construction cranes.

Construction Crane Height Determined:

- As soon as practicable, the maximum height of cranes to be used for the proposal should be determined.

Scenario 1: Maximum Crane Height is less than or equal to 38 m.

- In this instance, the proposal's construction cranes will not penetrate the Jindabyne Airstrip's OLS and no further action is mandated.

Scenario 2: Maximum Crane Height is greater than 38 m.

- The proponent should inform both the Jindabyne Airstrip Operator and the relevant planning authority that there is potential for a proposed construction crane to infringe the airstrip's OLS.
- If it is confirmed that the proposed structure (ie crane) is likely to infringe the OLS, the planning authority will seek advice from the aerodrome operator. The aerodrome operator will also refer any proposed structure to CASA if it becomes aware that it is likely to infringe the OLS surface.
- A determination will then need to be made as to any conditions that should be imposed on the proposed development to reduce the risk from the proposed structure to acceptable levels, without affecting the regularity or efficiency of airstrip operations.
- Such conditions almost always result in advice on marking and/or lighting of the proposed structure, ie the construction cranes.
- In the present instance, given that Jindabyne Airstrip is not used for night-time operations, conditions would cover crane marking, ie distinctive colouring to make any tall cranes visible to surrounding aircraft.
- In light of the above potential scenario, a planning authority should consider approving the proposal with conditions, on the assumption that, although the structure may constitute a hazardous object, the risk can be mitigated, without affecting aerodrome operations in any way, by imposing conditions such as requirements for lighting and/or marking.
- It is also open to planning authorities to approve proposals if it is able to establish through a safety study that the hazard from a proposal can be mitigated such that the safety and operating efficiency of the aerodrome is not affected. If that proves to be the case, then the mitigation measures identified should be conditions of the proposal's approval.

Obstruction Lighting – for "Scenario 2"

Australia's Manual of Standards Part 139 – Aerodromes: Chapter 9 Visual Aids Provided by Aerodrome Lighting contains the following (ICAO-compliant) requirement:

- Low intensity obstacle lights are steady red lights and are to be used on non-extensive objects whose height above the surrounding ground is less than 45 m, where such objects constitute "obstacles" relative to the aerodrome OLS.
- Medium intensity obstacle lights are to be used either alone or in combination with low intensity lights where the top of the object is 45 m or more above the surrounding ground, where the object of concern constitute an "obstacle" relative to the aerodrome OLS.

It has been noted that the maximum potential height of construction cranes and the proposal's Sports Field night-time lighting are currently unknown.

In the event that (a) the proposal's Sports Field night-time lighting is higher than 50 m, and/or (b) construction cranes are higher than 38 m, the above "obstacle" lighting will need to be incorporated into the design.

Crane Lighting

- Cranes that impinge upon the Jindabyne Airstrip OLS should be provided with Medium-Intensity Steady-Red Lights (minimum luminous intensity of 2,000 Candelas). The lighting configuration should make the cranes visible at night-time from a full range of angles.
- Night-time is defined as half-hour after sunset and half-hour before sunrise.
- Examples of crane lighting are shown in Figure 10. Xenon-based lamps are typically used (thanks to their brightness), although LED lighting is increasingly being adopted because of its associated reduced power consumption and longer operating life.

Figure 10 Crane Aviation Warning Lighting Examples

- Consultation should be undertaken with relevant stakeholders (namely Jindabyne Aero Club) as to whether any proposal cranes that impinge on the airstrip's OLS should also be supplied with daytime (white) lighting (medium intensity Type A, high intensity Types A/B).
- Daytime lighting can however have unintended and significant third-party impacts, e.g. nuisance glare impact on surrounding residences, potential consequences on local avian populations, etc.
- Key factors influencing the addition of daytime aviation warning lights (flashing white lights) are (i) the proximity of the subject obstacle to the runway centreline extension of concern, (ii) the height of the obstacle in absolute terms and relative to any other surrounding tall obstacles, and (iii) any distinctive markings that can be substituted for lighting in terms of a warning system.
- On balance, given the very low frequency of use for Runway 09/27 and the potential for daytime nuisance glare on surrounding receivers, consideration should be given to avoiding the daytime lighting recommendation.

- For example, any proposed cranes which impinge the Jindabyne Airstrip OLS could be made conspicuous by their colour, e.g. employing a colouring pattern with alternating contrasting bands. The typical protocol for such "markings" is for the bands to be perpendicular to the longest dimension of the obstacle and have at least 5 m in width. Previous studies have concluded that the use of a yellow and black (or dark blue) pattern provides the best contrast with the background from the air.

All of the above applies to any OLS-protruding Sports Field lighting (ie night-time lights greater than 50 m in height), involving either a single medium intensity, steady red light at the top of the luminaire or possible two such obstacle lights if the lighting is taller than 60 m above local ground level.

Comment

In light of Jindabyne's CURRENT daytime-only "normal" operations, the above NASF-F (2012) related recommendations are conservative.

They do however allow for the possibility of future airstrip expansion involving night-time operations and for any current emergency helicopter-related flights occurring at night-time, eg round-the-clock fire-fighting and rescue.

9 PROPOSAL IMPACTS RE NASF-G (2016)

9.1 Background and Objective of NASF-G (2016)

NASF-G (2016): Protecting Aviation Facilities - Communication, Navigation and Surveillance (CNS)

Military and civilian CNS infrastructure and facilities enable:

- pilots to navigate while enroute between airports;
- pilots to utilise navigation aids to conduct instrument approach procedures;
- dialogue between pilots and air traffic control; and
- air traffic control to monitor and confirm an aircraft location.

CNS facilities are therefore crucial to the safety of "instrumented" aviation. If not properly assessed and managed, inappropriate development located in the vicinity of CNS facilities can compromise their effectiveness.

NASF-G therefore provides land use planning guidance to better protect CNS facilities and hence support the systems and processes to safely manage the flow of aircraft into, out of and across Australian airspace.

Building Restricted Area

In HASF.G, a Building Restricted Area (BRA) is defined as a space where development has the potential to cause unacceptable interference to CNS facilities.

- The purpose of BRAs is to trigger an assessment of potential impacts on CNS facilities from proposed developments. They are not intended to prohibit development, except where it would lead to an adverse impact on a CNS facility.

The extent of a BRA depends on the type of CNS facility – BRAs normally take the form illustrated in Figure 11.

Figure 11 NASF-G (2016) BRA Zones: A, A/B and Area of Interest (2D Representation of 3D Zones)

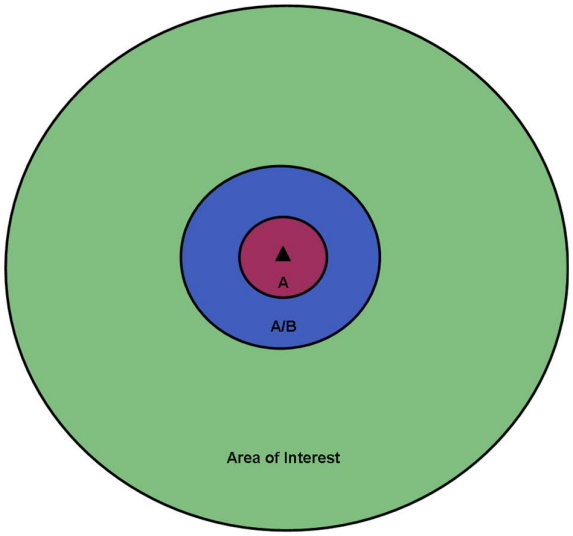


Table 4 details the radial distances for the three BRA "zones" for each type of CNS facility typically found both on and off-airport land. In relation to the action required by zone:

- Zone "A": All applications must be referred to Airservices Australia for assessment
- Zones "A/B" and "Area of Interest: Usually No requirement, unless the development in question constitutes a potential large "obstacle", eg for satellite ground stations, any development greater than 10 m in height and located within 30 m to 150 m of the station.

Table 4 BRA Summary for Various CNS Facilities (Distances Shown are Radius in Metres)

Facility Type	Zone A	Zone A/B	Area of Interest
High Frequency (HF)	0 – 100	100 – 6,000	6,000 – 10,000
Very High Frequency (VHF)	0 – 100	100 – 600	100 – 2,000
Satellite Ground Station (SGS)	0 - 30	30 - 150	n/a
Non-Directional Beacon (NDB)	0 – 60	60 – 300	n/a
Distance Measuring Equipment (DME)	0 – 100	100 – 1,500	n/a
VHF Omni-Directional Range (VOR)	0 – 100	100 – 1,500	n/a
Conventional VHF Omni-Directional Range (CVOR)	0 – 200	200 – 1,500	n/a
Doppler VHF Omni-Directional Range (DVOR) - Elevated	0 – 100	150 – 1,500	n/a
Doppler VHF Omni-Directional Range (DVOR) – Ground Mounted	0 – 150	150 – 1,500	n/a
Middle and Outer Marker	0 – 5	5 – 50	n/a
Glide path	n/a	n/a	n/a
Localiser	n/a	n/a	n/a
Automatic Dependent Surveillance Broadcast (ADS-B)	0 – 100	100 – 1,500	n/a
Wide Area Multilateration (WAM)	0 - 100	100 – 1,500	n/a
Primary Surveillance Radar (PSR)	0 – 500	500 – 4,000	4,000 – 15,000
Secondary Surveillance Radar (SSR)	0 – 500	500 – 4,000	4,000 – 15,000
Ground Based Augmentation System (GBAS) - RSMU	0-155	155 - 3,000	n/a
GBAS - VDB	0-200	200 - 3,000	n/a
Link Dishes	30m		
Radar Site Monitor - Type A	30m	0 – 500	n/a
Radar Site Monitor – Type B	70m	0 – 500	n/a

9.2 Impact of the Proposed Development

According to the feedback received from the Jindabyne Aero Club (interview with Secretary, Mr Martin Hughes):

- Jindabyne Airstrip currently has NO CNS (Communication, Navigation & Surveillance) facilities.

Accordingly, there would be no impact from the proposed development in relation to NASF-G.

Project Commitment:

- It is recommended that communication with JAC be continued in relation to any future airstrip masterplanning to ensure that the objectives of NASF-G (2016) continue to be addressed.

In relation to the above, it is noted that the proposal's buildings are located at least 600 m from the nearest runway threshold at the airstrip – refer Figure 4.

- This exceeds all Zone "A" radial dimensions summarised in Table 4.

10 PROPOSAL IMPACTS RE NASF-H (2018)

10.1 Background and Objective of NASF-H (2018)

NASF-H (2018): Protecting Strategically Important Helicopter Landing Sites (HLSs)

NASF-H (2018) notes that the helicopter industry is one of the fastest growing and diverse segments of the aviation industry. The safety, viability and efficient operation of aircraft at an HLS can be compromised by development including permanent buildings and temporary structures (including cranes), gaseous plumes, telecommunication towers, overhead wires and power lines as well as landscape features (such as trees).

Despite the importance of maintaining unimpeded flight paths to strategically important HLSs, HLSs do not typically require formal land use planning approval and/or are considered ancillary to existing uses. In Australia, HLSs are not licensed, certified or regulated in the way that aerodromes are under Part 139 of the Civil Aviation Safety Regulations 1998 (CASR). The Airports Act 1996 makes no specific reference to the use of HLSs.

If intrusions into HLS flight paths, and the associated risks, are not assessed, ongoing helicopter operations at strategically important sites may be compromised, and in the extreme, may potentially result in the decommissioning of the HLS.

NASF-H (2018) pays particular attention to "strategically important" HLSs, "SHLSs", which include:

- an HLS associated with a hospital; or
- an elevated (eg on top of a building) HLS, located within a populated area; or
- an HLS subject to instrument flight procedures; or
- any other facility identified as strategic by State/Territory or Commonwealth government/authorities.

NASF-H (2018) provides guidance to planning authorities regarding SHLSs to ensure:

- the ongoing operation of those SHLS;
- the use of those SHLS are not compromised by any proposed development encroaching into flight paths;
- new development (and associated activities) do not present a hazard to helicopters arriving or departing from those SHLS; and
- any new SHLS are appropriately located.

The helicopter operations at Jindabyne Airstrip are considered to constitute an SHLS, given the operations of the local Rural Fire Service at the airstrip.

Key Considerations

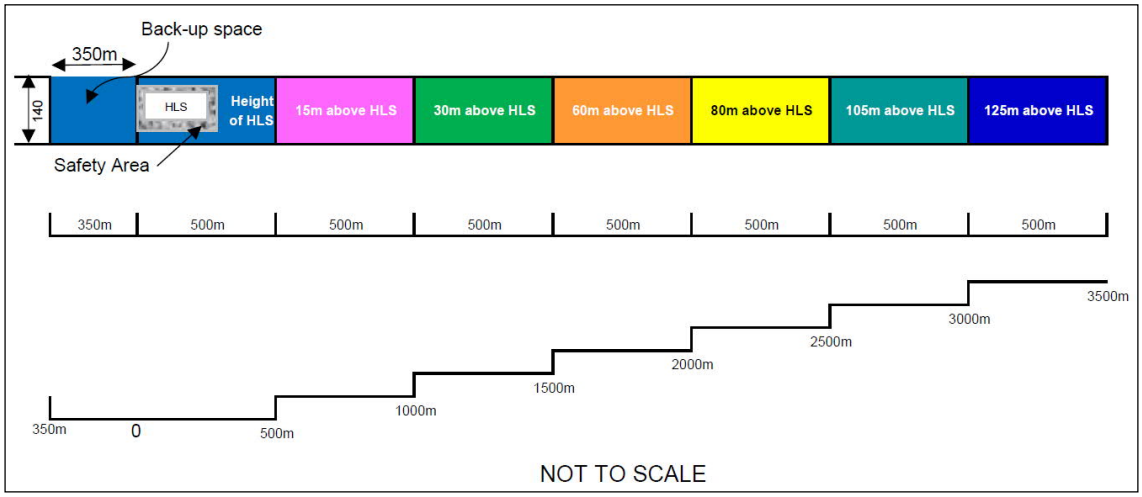
In relation to the proposed New Education Campus, the key consideration relevant to this report concerns the maximum heights of buildings and other obstacles within the site (including cranes) and whether these protrude into any flight path for Jindabyne Airstrip's helicopter operations.

Obstacle Limitation Surfaces (OLS) for Jindabyne Airstrip Helicopter Operations

There is currently no formal requirement for an HLS to have a declared Obstacle Limitation Surface (OLS), however a recommended OLS is defined in CAAP 92-2(2) Guidelines for the Establishment and Operation of Onshore Helicopter Landing Sites.

If a survey of existing helicopter flight paths is not available, the area to be identified for determining the trigger for land use planning referrals to the SHLS asset owner should be in accordance with Figure 12. No development should be permitted to exceed the height limits within Figure 12 without the prior approval of the SHLS asset owner.

Figure 12 Referral Trigger for an SHLS (where HLS flight paths have not been surveyed)



NASF-H (2018) states that any development that exceeds the heights shown in Figure 12, which is consistent with the highest level of HLS classification (Performance Class 1), must be referred to the asset owner and CASA.

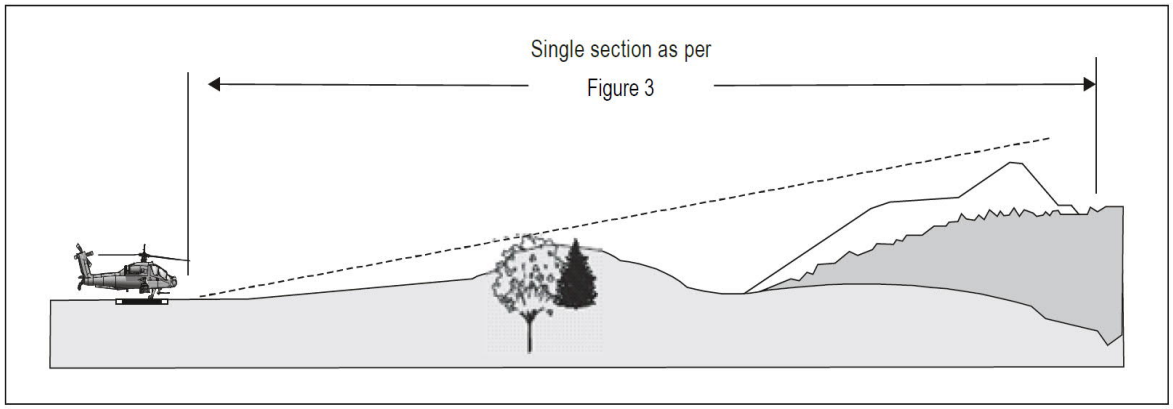
CASA Guidance re HLS OLS

Civil Aviation Safety Authority (CASA,2014), CAAP 92-2(2) "Guidelines for the establishment and operation of onshore Helicopter Landing Sites" provides the following guidance in relation to HLS OLS geometry:

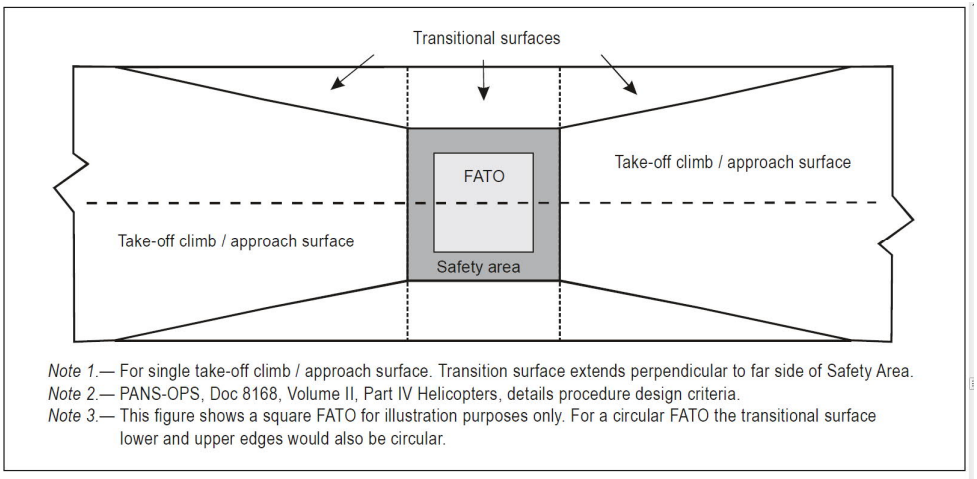
- the glide slope shown in Figure 13 ranges from 4.5% to 12.5%, depending on "condition" category.
- the length of glide slope is also dependent on "condition" category and ranges from 1,220 m to 3,386 m.

Figure 13 HLS Approach and Take-Off Surfaces

Elevation View



Plan View



Note 1.— For single take-off climb / approach surface. Transition surface extends perpendicular to far side of Safety Area.
Note 2.— PANS-OPS, Doc 8168, Volume II, Part IV Helicopters, details procedure design criteria.
Note 3.— This figure shows a square FATO for illustration purposes only. For a circular FATO the transitional surface lower and upper edges would also be circular.

Considerations Related to Cranes

NASF-H (2018) states that any development proposal located within/beneath the flight path to an HLS must be required to indicate:

- whether a crane is to be erected during the construction of that development;
- the maximum height of the crane;
- the height and swing radius of the crane with the jib stowed when not in operation; and
- the period in which the crane is anticipated to remain on site.

Lighting

Although night-time operations are not currently occurring at Jindabyne Airstrip, it is presumed that emergency helicopter operations can occur, given the potential for night-time emergency fire-fighting and rescue.

Where an SHLS is to be used in association with night time operations, all lighting is to comply with CAAP 92-2 (2) Guidelines for the Establishment and Operation of Onshore Helicopter Landing Sites, except where certified by a suitably qualified and experienced aviation professional.

- Lighting erected onto any obstruction (eg building, crane) within the flight path or above 110 m in height (whether it is located within a flight path or not), must be able to be detected by Night Vision Goggles (or equivalent).
- It is understood that lighting that is red in colour and low intensity steady light is preferable.
- Additionally, any buildings, cranes, etc above 110 m in height (regardless of their location) should be referred to CASA as part of the assessment process.

At night, and in periods of poor visibility during the day pilots rely on the particular pattern of the aeronautical ground lighting to assist in aligning themselves with the correct touchdown point. It is therefore important that lighting in the vicinity of an HLS is not configured or is of such a pattern that pilots could either be distracted or mistake such lighting as being ground lighting from the HLS.

Accordingly, where planning applications involve significant lighting in proximity to an HLS, an assessment of potential impacts should be made.

Other Considerations

NASF-H (2018) also address the following matters:

- mitigating noise relating to helicopter operations;
- wildlife/bird strikes;
- Remotely Piloted Aircraft Systems (RPAS) “drones” operation/strikes; and
- Building-induced windshear or air turbulence, where this could affect the normal flight of helicopters operating from these SHLS.

In the present report, the above considerations are addressed within the relevant NASF Guideline sections, eg NASF-B (2018) for windshear and turbulence.

10.2 Impact of the Proposed Development

According to the feedback received from the Jindabyne Aero Club (interview with Secretary, Mr Martin Hughes):

- Helicopter operations at Jindabyne Airstrip overwhelmingly involve landings and take-offs close to the WESTERN end of Runway 09/27.

It has also been noted that:

- Helicopters are not constrained by prevailing wind directions in the same way that aircraft are, ie landings and take-offs generally into the wind.
- Helicopters have much greater flexibility in terms of landing glide paths and take-off routes.

- Helicopter landings and take-offs are able to utilise flight paths which would not be located anywhere close to the site of the proposed New Education Campus.

Accordingly, it is considered that any conceivable helicopter-related OLS at Jindabyne Airstrip (refer Figure 12 and Figure 13) would NOT be co-located (in plan view) with the proposal site and hence intrusion into the helicopter OLS at Jindabyne can be completely avoided.

Accordingly, there should be no impact from the proposed development in relation to NASF-H.

Project Commitment:

- As suggested in NASF-H (2018), it is recommended that communication with JAC be made in relation to the siting and maximum height of the construction cranes to be used for the proposal, once these details are known.

11 PROPOSAL IMPACTS RE NASF-I (2018)

11.1 Background and Objective of NASF-I (2018)

NASF-I (2018): Managing the Risk in Public Safety Areas at the Ends of Runways

NASF-I (2018) notes that, while Australia has an excellent aviation safety record, there will always be an inherent risk associated with flying and the operation of aircraft at or around airports.

The notion of Public Safety Areas (PSAs) in land-use planning can further reduce the already low risk of an air transport accident affecting people who live, work or travel in close proximity to airports.

While air crashes are rare events, historically, the majority occur in the vicinity of airports during take-off or landing of aircraft, typically when aircraft are below 1,000 ft elevation and aligned with the runway. The way land use is managed at the end of runways, including beyond airport boundaries, can contribute to mitigating the risk of on-ground fatalities from aircraft incidents.

The consideration of public safety risks is not unique to airports. Such risks are also considered for developments and emergency management in the vicinity of a range of existing or proposed industrial sites that can give rise to adverse public safety outcomes.

NASF-I (2018) therefore has been developed to provide guidance in relation to the potential increases in risk associated with new developments located in areas near the end of an airport runway, specifically through the specification of so-called Public Safety Areas (PSAs).

What is a PSA?

In NASF-I (2018), a PSA is a designated area of land at the end of an airport runway within which development may be restricted in order to control the number of people on the ground at risk of injury or death in the event of an aircraft accident on take-off or landing.

PSAs can be determined via two approaches:

Risk-Based PSA Methodology

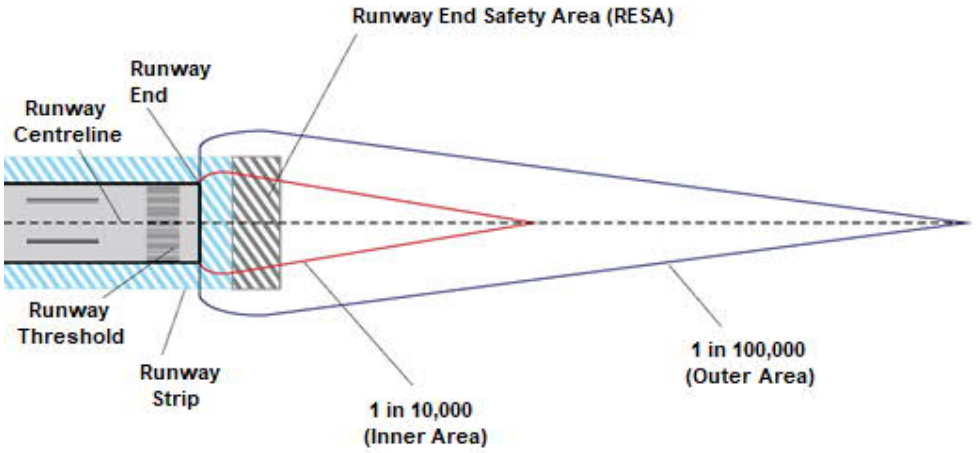
A logical approach to determine a PSA would be to determine the statistical chance of an accident occurring at a particular location. Factors to be taken into account include:

- overall number and frequency of aircraft movements, type of aircraft, distance of the location from the critical take-off and landing points, historical incidents, likelihood of unusual weather occurrences, etc.

Risk-based statistical analyses typically result in PSAs that appear as the shown in Figure 14, involving the following key “zones”:

- Outer area = 1 in 100,000 (1×10^{-5}) risk level per year (in this area, any person living or working for a period of a year, has approximately a 1 in 100,000 chance per year of being killed as a result of an aircraft incident).
- Inner area = 1 in 10,000 (1×10^{-4}) risk level per year (in this area immediately adjoining the end of the runway, any person living or working for a period of a year, has approximately a 1 in 10,000 chance per year of being killed as a result of an aircraft incident.

Figure 14 Typical Risk-Based PSA Geometry

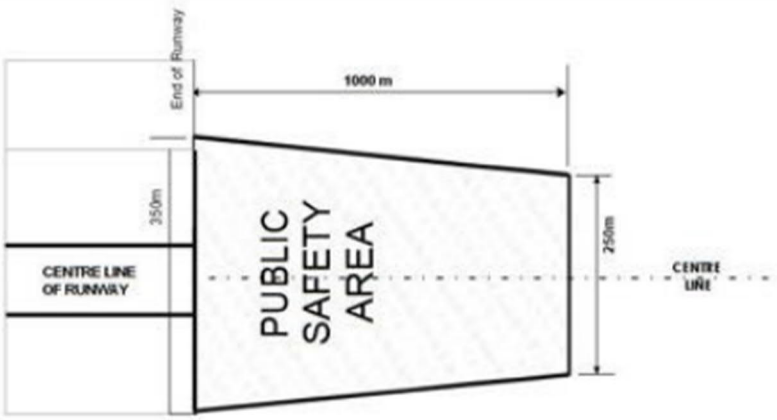


Proscriptive PSA Methodologies

Within Australia, Queensland has in place their July 2017 State Planning Policy (SPP) – State Interest Guidance Material Strategic Airports and Aviation Facilities, which addresses public safety risks. This is a guidance document with a focus on certified aerodromes.

Figure 15 shows the proscriptive QLD SPP geometry for a runway PSA, extending out 1,000 m from the end of runway, starting off 350 m in width and narrowing to 250 m in width.

Figure 15 QLD SPP Proscriptive PSA Geometry



Considerations in Relation to NASF-I (2018)

NASF-I (2018) was developed with the objective of ensuring that there is no increase in public safety risk from new development. This objective needs to be balanced with broader public interest issue, eg the need to support regional economic growth. The assumed risk from an aviation incident is therefore just one element of an overall public safety risk assessment that may be considered as part of the planning process for a new development.

When considering public safety risk, the 'As Low As Reasonably Practicable' (ALARP) approach is commonly used.

- The NSW Department of Planning has previously adopted the ALARP method of addressing societal concerns when there is a risk of multiple fatalities occurring in one event as detailed in the document Hazardous Industry Planning Advisory Paper No.4 Risk Criteria for Land Use Safety Planning (January 2011).

The ALARP approach balances risk and societal benefit.

- Above a certain level, a risk is regarded as intolerable and is forbidden irrespective of the potential benefit of a given project.
- The middle region is called the ALARP or Tolerability region, where risk is accepted if a benefit from continuing activities at that risk level exists.
- The bottom region exists where there is no need for detailed work to demonstrate ALARP, as it is the broadly acceptable region of negligible risk.

No single agreed tolerable risk level is defined in Australia or indeed internationally:

- Risk in the range of 1 in a million to 1 in 10,000 are routinely adopted by various jurisdictions dependent on a range of circumstances.
- At around the 1 in a million mark, the levels of individual risk begin to merge into the background risks from everyday life.
- Therefore, the range from 1 in a million to 1 in 10,000 per year is generally termed the ALARP region, within which risks should be 'as low as reasonably practicable'.

No single best practice model for estimating risk contours has been identified in Australia or internationally. Different models have their own strengths and weaknesses.

Which airports will have PSAs ?

- All leased federal airports will be expected to consider public safety risk on airports.
- It is up to each state/territory and local government to decide how best to implement the NASF-I into their planning schemes.
- A PSA will not necessarily be introduced at all airports.

To SLR's knowledge, application of the relatively new NASF-I (2018) Guideline to Jindabyne Airstrip has not formally been undertaken in relation to any surrounding developments.

11.2 Impact Assessment in Relation to NASF-I (2018)

The following factors have been identified in relation to the proposed New Education Campus and the relevance of NASF-I (2018):

- The proposal lies under the extended centreline extension of Runway 09/27, with the nearest building approximately 620 m from the end of runway.
- The proposal involves a new education facility, implying a large increase of people (students, teachers, etc) located beneath the Runway 27 approach flight path.
- While the application of NASF-I (2018) to "ALAs" (aircraft landing areas) is not an automatic (mandatory) requirement, the issue of the potential population at risk suggests it should at least be considered.
- Usage of Runway 09/27 is minimal – refer Section 3.
- The ratio of aircraft movements on Runway 09/27 versus Runway 12/30 for example has been estimated at 3% compared to 97%.
- The nearest proposal building to the site (refer "HSC-S" in Figure 4) is approximately 620 m from the southeast end of Runway 09/27.
- There is no history of an aircraft-related fatality at the airstrip, although "incidents" have been reported.
- There is a well-publicised and well-understood risk profile at the airstrip – refer Section 3 for various risk advisories through eNOTAMS, ERSA notice, JAC's website, etc.
- Circuits for ALL runways at the airstrip are TO THE NORTH. Take-offs on Runway 09 therefore should have little difficulty in avoiding passing directly over the proposal site.
- Potential risk levels associated with the proposal would reflect the daily routine of school timetables, with higher potential relative exposure during standard school hours and working week days, ie Monday to Friday. Risk levels outside of these days/hours would be reduced, eg the potential risk level for say early morning and late afternoon on a Sunday would be significantly lower. Any potential risk during school vacation periods would similarly be significantly reduced.
- In terms of potential FUTURE operations, the only increase to operations envisaged at the airstrip is to Runway 30, where no public safety risk to the proposal exists.

Taking all of the above into account, an ALARP approach involving collaboration between the proposal proponent and the airstrip Operator is deemed the appropriate response to achieving compliance with NASF-I (2018). This approach is outlined below.

Project Commitment:

It is recommended that communication with JAC be made to ensure that the objectives of NASF-I (2018) can be addressed. This would include consideration of airstrip operational management options regarding the use of Runway 09/27. For example, the current (minimalist) usage of Runway 09/27 for grass landing and "go around" training could be scheduled during "low" risk periods, eg school vacation periods, early morning or late afternoon Sundays, etc.

12 CONCLUSIONS

SLR Consulting Australia Pty Ltd (SLR) has been engaged by NSW Department of Education – School Infrastructure to carry out an Aviation Safeguarding Assessment of the proposed New Education Campus at Jindabyne (New Primary and High School).

This Aviation Safeguarding Report accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) in support of an application for a State Significant Development (SSD No 15788005). The SSDA is for a new education campus at Jindabyne, comprising of a new primary and high school, located at the Jindabyne Sport and Recreation Centre (JSRC).

This report addresses the Secretary's Environmental Assessment Requirements (SEARs), notably:

21. Aviation

- Identify if the proposal would affect or be affected by aviation operations associated with nearby airports and affected flight paths of any existing on shore Helicopter Landing Site (HLS). Where required, report a report prepared by a suitably qualified person that assesses the potential impacts of the future development on the aviation operations in accordance with the relevant sections of the National Airports Safeguarding Framework (NASF)

Relevant Policies and Guidelines:

- National Airports Safeguarding Framework and associated guidelines.

NASF Guideline Framework

The National Airports Safeguarding Framework (NASF), endorsed in May 2012 by the National Airports Safeguarding Advisory Group, has developed information to guide State, Territory and Local Governments in regulating and managing:

- Intrusion by aircraft noise;
- The risk of building generated windshear and turbulence at airports;
- The risk of wildlife strikes in the vicinity of airports;
- The risk of wind turbine farms as physical obstacles to air navigation;
- The risk of distractions to pilots from lighting in the vicinity of airports;
- The risk of intrusions into the protected operational airspace of airports;
- The protection of on and off-airport Communication, Navigation and Surveillance equipment;
- The protection of strategically important helicopter landing sites; and
- The protection of public safety areas at the end of runways.

This report addresses all of the above with the exception of aircraft noise (addressed in a separate stand-alone noise intrusion report) and wind turbine risk (there are no wind turbines associated with the New Education Campus proposal.

NASF-B (2018): Managing the Risk of Building Generated Windshear and Turbulence at Airports

Runway 12/30

- On the basis of the NASF-B (2018) "1:35" rule, the present assessment has shown that the proposal satisfies NASF-B (2018) and NO further assessment is required for acceptance of the proposal (in relation to all NASF-B considerations) for Runway 12/30.

Runway 09/27

- Similarly, on this basis of the NASF-B (2018) "1:35" rule, the present assessment has shown that the proposal satisfies NASF-B (2018) and NO further assessment is required for acceptance of the proposal (in relation to all NASF-B considerations) for Runway 09/27.

Wind Tunnel Testing studies were reviewed to provide further support for the above, given that position of the development's High School precinct Building HS-C relative to the centreline projection of Runway 09/27.

This review confirms that any potential disturbance to winds by the development would not extend to the Runway 09/27 glide path extending to the southeast.

NASF-C (2014): Managing the Risk of Wildlife Strikes in the Vicinity of Airports

The present assessment has reviewed the following detailed studies relevant to NASF-C (2014) which have been undertaken to support the SSDA for the proposal:

- ECOLOGICAL 21CAN-18872, "Monaro Cluster – Jindabyne Site Arboricultural Impact Assessment" (May 2021).
- WSP PS125302-ECO-REP-001, Rev.A, "Jindabyne Education Campus – Biodiversity Development Assessment Report" (June 2021).

On the basis of the Arboricultural and BDAR Reports:

- The proposal appears highly unlikely to result in any noticeable displacement of wildlife from the site and closer to Jindabyne Airstrip.

Accordingly, there would be no impact from the proposed development in relation to NASF-C with respect to wildlife displacement issues.

With regard to wildlife attraction issues:

- The proposal does not contain facilities involved in activities that would be likely to attract wildlife from further afield and potentially closer to Jindabyne Airstrip, eg food garbage disposal, sewage treatment and disposal, abattoirs and freezing works, fish processing plants, etc.
- It is assumed that the proposal's Waste Management Plan will also assist in ensuring that wildlife populations are not inadvertently attracted to the site and hence closer to Jindabyne Airstrip operations.

The WSP BDAR observations are in line with the history of the proposal site. The proposal is located in a previously disturbed area. A substantial portion of the subject land was formerly a golf course (it is understood that the fairways and greens can be seen in historical aerial photos). Parts of the subject land formerly contained buildings which have been demolished. Similarly, parts of the subject land contain houses that are currently occupied by Sports and Recreation Staff. Most importantly, the proposal is not located in an area of undisturbed or intact habitat.

Project Commitment:

- Commitments have already been made within the SSDA Arboricultural and BDAR studies in relation to monitoring that would confirm the absence of any noticeable and large-scale displacement of wildlife closer to Jindabyne Airstrip.

NASF-E (2014): Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports

In relation to the proposal, the following elements are noted being relevant to NASF-E (2014):

- Security/night-time lighting throughout the site, including the proposal's staff car park;
- Potential flood lighting for the proposal Sports Field; and
- Construction lighting, in particular associated with construction cranes.

According to the feedback received from the Jindabyne Aero Club (interview with Secretary, Mr Martin Hughes):

- Jindabyne Airstrip currently has NO runway lighting that would enable night-time operations

On this basis, there would be no impact from the proposed development in relation to NASF-E (2014). However, the present assessment has noted the following:

- Communication with Jindabyne Aero Club (interview with Secretary, Mr Martin Hughes) has revealed potential masterplanning activities leading to airstrip operation expansions. It is not known if this would entail night-time operations.
- The airstrip is currently used for emergency purposes by helicopter operations (eg Rural Fire Service for fire-fighting and rescue flights).

In light of the above, it is considered prudent to assess the Lighting Design of the proposed development once detailed design commences to ensure that NASF-E (2014) lighting recommendations can be made IF it is confirmed with the Jindabyne Aero Club that expansion of the airstrip will be sought and this will involve night-time operations.

Project Commitment:

- It is recommended that communication with JAC be continued in relation to any future airstrip masterplanning to ensure that the objectives of NASF-E (2014) are addressed IF relevant.

NASF-F (2012): Managing the Risk of Intrusions into the Protected Operational Airspace of Airports

The navigation airspace of airports is the airspace above a set of imaginary surfaces, the design of which is determined by criteria established by the International Civil Aviation Organisation (ICAO). These surfaces, known as the OLS (Obstacle Limitation Surfaces), are established with the aim of protecting aircraft from obstacles or activities that could be a potential threat to safety.

The OLS also help to protect aerodromes from becoming unusable in the future through the growth of obstacles around the aerodromes. If obstacles penetrating the OLS are not regulated, the relevant airspace safety regulator may have to mitigate the accompanying risks by placing restrictions on operations at the affected aerodrome.

The present assessment has assessed the OLS for the Jindabyne Airstrip (including both runways).

Proposal Buildings

- No building element of the proposal would penetrate Jindabyne Airstrip's OLS.

Lighting Towers

The lighting towers to be used throughout the proposal will likely fall into two categories:

- Standard luminaires used for night-time/security lighting around all buildings and staff car park; and
- Non-standard luminaries that could potentially be used for the proposal's Sports Field, located in the central eastern portion of the site, if the field is to be used for night-time activities.

The standard lighting luminaires likely to be used for the proposal staff car park will almost certainly be less than 25 m in height and would hence comply with NASF-F (2012).

Scenario 1: Sports Field flood lighting is less than or equal to 50 m.

- In this instance, the lighting will not penetrate the Jindabyne Airstrip's OLS and no further action is mandated under NASF-F (2012).

Scenario 2: Sports Field flood lighting is greater than 50 m.

Australia's Manual of Standards Part 139 – Aerodromes: Chapter 9 Visual Aids Provided by Aerodrome Lighting contains the following (ICAO-compliant) requirement which would apply:

- Medium intensity obstacle lights are to be used either alone or in combination with low intensity lights where the top of the object is 45 m or more above the surrounding ground, where the object of concern constitute an "obstacle" relative to the aerodrome OLS.

Construction Cranes

As soon as practicable, the maximum height of cranes to be used for the proposal should be determined.

Scenario 1: Maximum Crane Height is less than 38 m.

- In this instance, the proposal's construction cranes will not penetrate the Jindabyne Airstrip's OLS and no further action is mandated.

Scenario 2: Maximum Crane Height is greater than 38 m.

- The proponent should inform both the Jindabyne Airstrip Operator and the relevant planning authority that there is potential for a proposed construction crane to infringe the airstrip's OLS.
- If it is confirmed that the proposed structure (ie crane) is likely to infringe the OLS, the planning authority will seek advice from the aerodrome operator. The aerodrome operator will also refer any proposed structure to CASA if it becomes aware that it is likely to infringe the OLS surface.
- A determination will then need to be made as to any conditions that should be imposed on the proposed development to reduce the risk from the proposed structure to acceptable levels, without affecting the regularity or efficiency of airstrip operations.
- Such conditions almost always result in advice on marking and/or lighting of the proposed structure, ie the construction cranes.

- In the present instance, given that Jindabyne Airstrip is not used for night-time operations, conditions would cover crane marking, ie distinctive colouring to make any tall cranes visible to surrounding aircraft.
- In light of the above potential scenario, a planning authority should consider approving the proposal with conditions, on the assumption that, although the structure may constitute a hazardous object, the risk can be mitigated, without affecting aerodrome operations in any way, by imposing conditions such as requirements for lighting and/or marking.
- It is also open to planning authorities to approve proposals if it is able to establish through a safety study that the hazard from a proposal can be mitigated such that the safety and operating efficiency of the aerodrome is not affected. If that proves to be the case, then the mitigation measures identified should be conditions of the proposal's approval.

Under Scenario 2, Australia's Manual of Standards Part 139 – Aerodromes: Chapter 9 Visual Aids Provided by Aerodrome Lighting would apply with the following (ICAO-compliant) requirement:

- Low intensity obstacle lights are steady red lights and are to be used on non-extensive objects whose height above the surrounding ground is less than 45 m, where such objects constitute "obstacles" relative to the aerodrome OLS.
- Medium intensity obstacle lights are to be used either alone or in combination with low intensity lights where the top of the object is 45 m or more above the surrounding ground, where the object of concern constitute an "obstacle" relative to the aerodrome OLS.

In light of Jindabyne's CURRENT daytime-only "normal" operations, the above NASF-F (2012) related recommendations are conservative.

They do however allow for the possibility of future airstrip expansion involving night-time operations and for any current emergency helicopter-related flights occurring at night-time, eg round-the-clock fire-fighting and rescue.

Project Commitment:

- As soon as practicable, the maximum height of cranes to be used for the proposal and the maximum height of Sports Field flood lighting should be determined.
- Following consultation with Jindabyne Aero club regarding potential future operations at the airstrip, the above recommendations should be reviewed as to any potential obstacle marking and/or lighting requirements for the proposal construction cranes and Sports Field flood lighting.

NASF-G (2016): Protecting Aviation Facilities - Communication, Navigation and Surveillance (CNS)

According to the feedback received from the Jindabyne Aero Club (interview with Secretary, Mr Martin Hughes):

- Jindabyne Airstrip currently has NO CNS (Communication, Navigation & Surveillance) facilities.

Accordingly, there would be no impact from the proposed development in relation to NASF-G.

Project Commitment:

- It is recommended that communication with JAC be continued in relation to any future airstrip masterplanning to ensure that the objectives of NASF-G (2016) continue to be addressed.

NASF-H (2018): Protecting Strategically Important Helicopter Landing Sites (HLSs)

NASF-H (2018) pays particular attention to "strategically important" HLSs, "SHLSs", which include:

- an HLS associated with a hospital; or
- an elevated (eg on top of a building) HLS, located within a populated area; or
- an HLS subject to instrument flight procedures; or
- any other facility identified as strategic by State/Territory or Commonwealth government/authorities.

The helicopter operations at Jindabyne Airstrip are considered to constitute an SHLS, given the operations of the local Rural Fire Service at the airstrip.

Considerations Related to Cranes

NASF-H (2018) states that any development proposal located within/beneath the flight path to an HLS must be required to indicate:

- whether a crane is to be erected during the construction of that development;
- the maximum height of the crane;
- the height and swing radius of the crane with the jib stowed when not in operation; and
- the period in which the crane is anticipated to remain on site.

At night, and in periods of poor visibility during the day pilots rely on the particular pattern of the aeronautical ground lighting to assist in aligning themselves with the correct touchdown point. It is therefore important that lighting in the vicinity of an HLS is not configured or is of such a pattern that pilots could either be distracted or mistake such lighting as being ground lighting from the HLS.

According to the feedback received from the Jindabyne Aero Club (interview with Secretary, Mr Martin Hughes):

- Helicopter operations at Jindabyne Airstrip overwhelmingly involve landings and take-offs close to the WESTERN end of Runway 09/27.

The following has also been noted:

- Helicopters are not constrained by prevailing wind directions in the same way that aircraft are, ie landings and take-offs generally into the wind.
- Helicopters have much greater flexibility in terms of landing glide paths and take-off routes.
- Helicopter landings and take-offs are able to utilise flight paths which would not be located anywhere close to the site of the proposed New Education Campus.

Accordingly, it is considered that any conceivable helicopter-related OLS at Jindabyne Airstrip (refer Figure 10 and Figure 11) would NOT be co-located (in plan view) with the proposal site and hence intrusion into the helicopter OLS at Jindabyne can be completely avoided.

- Accordingly, there should be no impact from the proposed development in relation to NASF-H.

Project Commitment:

- As suggested in NASF-H (2018), it is recommended that communication with JAC be made in relation to the siting and maximum height of the construction cranes to be used for the proposal, once these details are known.

NASF-I (2018): Managing the Risk in Public Safety Areas at the Ends of Runways

NASF-I (2018) has been developed to provide guidance in relation to the potential increases in risk associated with new developments located in areas near the end of an airport runway, specifically through the specification of so-called Public Safety Areas (PSAs).

Considerations in Relation to NASF-I (2018)

NASF-I (2018) was developed with the objective of ensuring that there is no increase in public safety risk from new development. This objective needs to be balanced with broader public interest issue, eg the need to support regional economic growth. The assumed risk from an aviation incident is therefore just one element of an overall public safety risk assessment that may be considered as part of the planning process for a new development.

- All leased federal airports will be expected to consider public safety risk on airports.
- It is up to each state/territory and local government to decide how best to implement the NASF-I into their planning schemes.
- A PSA will not necessarily be introduced at all airports.

To SLR's knowledge, application of the relatively new NASF-I (2018) Guideline to Jindabyne Airstrip has not formally been undertaken in relation to any surrounding developments.

The following factors have been identified in relation to the proposed New Education Campus and the relevance of NASF-I (2018):

- The proposal lies under the extended centreline extension of Runway 09/27, with the nearest building approximately 620 m from the end of runway.
- The proposal involves a new education facility, implying a large increase of people (students, teachers, etc) located beneath the Runway 27 approach flight path.
- While the application of NASF-I (2018) to "ALAs" (aircraft landing areas) is not an automatic (mandatory) requirement, the issue of the potential population at risk suggests it should at least be considered.
- Usage of Runway 09/27 is minimal – the ratio of aircraft movements on Runway 09/27 versus Runway 12/30 for example has been estimated at 3% compared to 97%.
- The nearest proposal building to the site (refer "HSC-S" in Figure 4) is approximately 620 m from the southeast end of Runway 09/27.
- There is no history of an aircraft-related fatality at the airstrip, although "incidents" have been reported.
- There is a well-publicised and well-understood risk profile at the airstrip – refer Section 3 for various risk advisories through eNOTAMS, ERSA notice, JAC's website, etc.
- Circuits for ALL runways at the airstrip are TO THE NORTH. Take-offs on Runway 09 therefore should have little difficulty in avoiding passing directly over the proposal site.

- Potential risk levels associated with the proposal would reflect the daily routine of school timetables, with higher potential relative exposure during standard school hours and working week days, ie Monday to Friday. Risk levels outside of these days/hours would be reduced, eg the potential risk level for say early morning and late afternoon on a Sunday would be significantly lower. Any potential risk during school vacation periods would similarly be significantly reduced.
- In terms of potential FUTURE operations, the only increase to operations envisaged at the airstrip is to Runway 30, where no public safety risk to the proposal exists.

Taking all of the above into account, an ALARP approach involving collaboration between the proposal proponent and the airstrip Operator is deemed the appropriate response to achieving compliance with NASF-I (2018). This approach is outlined below.

Project Commitment:

- It is recommended that communication with JAC be made to ensure that the objectives of NASF-I (2018) can be addressed. This would include consideration of airstrip operational management options regarding the use of Runway 09/27. For example, the current (minimalist) usage of Runway 09/27 for grass landing and "go around" training could be scheduled during "low" risk periods, eg school vacation periods, early morning or late afternoon Sundays, etc.

OVERALL SUMMARY

The present Aviation Safeguarding report has found that the proposed development would satisfy all NASF Guidelines assessed when taking into account the various Project Commitments detailed above.

This covers:

- NASF-B: The risk of building generated windshear and turbulence at airports;
- NASF-C: The risk of wildlife strikes in the vicinity of airports;
- NASF-E: The risk of distractions to pilots from lighting in the vicinity of airports;
- NASF-F: The risk of intrusions into the protected operational airspace of airports;
- NASF-G The protection of on and off-airport Communication, Navigation and Surveillance equipment;
- NASF-H: The protection of strategically important helicopter landing sites; and
- NASF-I: The protection of public safety areas at the end of runways.

APPENDIX A

DIMENSIONS AND SLOPES OF OLS CONSTITUENT ELEMENTS

Source:

Manual of Standards Part 139 – Aerodromes
Chapter 7: Obstacle Restriction and Limitations

Approach Runways (refer MOS 139, Table 7.1-1)

OLS & Dimensions (in metres and percentages)	Runway Classification									
	Non-instrument				Instrument					
					Non-precision			Precision		
	Code No				Code No			I Code No		II & III Code No
	1*	2	3	4	1, 2	3	4	1, 2	3, 4	3, 4
OUTER HORIZONTAL										
Height (m)									150	150
Radius (m)									15000	15000
CONICAL										
Slope	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Height (m)	35	55	75	100	60	75	100	60	100	100
INNER HORIZONTAL										
Height (m)	45	45	45	45	45	45	45	45	45	45
Radius (m)	2000	2500	4000	4000	3500	4000	4000	3500	4000	4000
APPROACH										
Length of inner edge (m)	60	80	150[a]	150	90	150	300[b]	150	300	300
Distance from threshold (m)	30	60	60	60	60	60	60	60	60	60
Divergence each side	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%
First section length (m)	1600	2500	3000	3000	2500	3000	3000	3000	3000	3000
Slope	5%	4%	3.33%	2.5%	3.33%	3.33%	2%	2.5%	2%	2%
Second section length (m)	-	-	-	-	-	3600[c]	3600	12000	3600	3600
Slope	-	-	-	-	-	2.5%[c]	2.5%	3%	2.5%	2.5%
Horizontal section length (m)	-	-	-	-	-	8400[c]	8400	-	8400	8400
Total length (m)	1600	2500	3000	3000	2500	15000[d]	15000	15000	15000	15000
INNER APPROACH										
Width (m)								90	120	120
Distance from threshold (m)								60	60	60
Length (m)								900	900	900
Slope								2.5%	2%	2%
TRANSITIONAL										
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%
INNER TRANSITIONAL										
Slope								40%	33.3%	33.3%
BAULKED LANDING										
Length of inner edge (m)								90	120	120
Distance from threshold (m)								[e]	1800[f]	1800
Divergence each side								10%	10%	10%
Slope								4%	3.3%	3.3%

All distances are measured horizontally unless otherwise specified.

* Runways used for RPT operations at night by aircraft with maximum take-off mass not exceeding 5,700 kg are required to meet code 2 standards.

[a] 90 m where width of runway is 30 m.

[b] 150 m if only used by aeroplanes requiring 30 m wide runway.

[c] No actual ground survey required unless specifically required by procedure designer. Procedure designer will use topographical maps and tall structure databank to determine minimum altitudes.

[d] Approach area up to this distance needs to be monitored for new obstacles. Refer to procedure designer's advice on significant high ground or tall structure that needs monitoring.

[e] Distance to end of runway strip.

[f] Or to the end of the runway strip, whichever is less.

Runways Meant for Take-Off (refer MOS 139, Table 7.1-2)

Take-off climb surface – Dimensions (in metres and percentages)	Take-off Runways Code number		
	1*	2[a]	3 or 4
Length of inner edge	60	80	180 [b]
Minimum distance of inner edge from runway end [c]	30	60	60
Rate of divergence (each side)	10%	10%	12.5%
Final width	380	580	1800 [d]
Overall length	1600	2500	15000
Slope	5%	4%	2%[e]

All dimensions are measured horizontally unless otherwise specified.

* Runways used for RPT operations at night by aircraft with maximum take-off mass not exceeding 5,700 kg are required to meet code 2 standards.

[a] For aircraft above 5,700 kg the survey area does not cover full extent of obstacle clearance required as specified in CAO 20.7.1B.

[b] The length of the inner edge may be reduced to 90 m if the runway is intended to be used by aeroplanes having an mass less than 22,700 kg and operating in VMC by day. In this case the final width may be 600 m, unless the flight path may involve a change of heading in excess of 15°.

[c] The take-off climb starts from the end of clearway if a clearway is provided.

[d] The final width may be reduced to 1200 m if the runway is used only by aircraft with take-off procedure which does not include changes of heading greater than 15° for operations conducted in IMC or at night.

[e] The operational characteristics of aircraft for which the runway is intended should be examined to see if it is desirable to reduce the slope to cater for critical operating conditions as specified in CAO 20.7.1B. If the specified slope is reduced, corresponding adjustment in length for take-off climb is to be made so as to provide protection to a height of 300 m. If no object reaches the 2% take-off climb surface, new objects should be limited to preserve the existing obstacle free surface or a surface down to a slope of 1.6%.

APPENDIX B

AIRPORT REFERENCE CODE

Source:

ICAO Annex 14 Volume 1
Aerodrome Design and Operations
(7th Edition, 10 November 2016)

Aerodrome Reference Code (refer ICAO Annex 14 Vol.1, Table 1-1)

The ICAO's Aerodrome Reference Code provides a simple method for interrelating the numerous specifications concerning the characteristics of aerodromes so as to provide a series of aerodrome facilities that are suitable for the aeroplanes that are intended to operate at the aerodrome. The code is not intended to be used for determining runway length or pavement strength requirements. The code is composed of two elements which are related to the aeroplane performance characteristics and dimensions.

- Element 1 is a number based on the aeroplane reference field length.
- Element 2 is a letter based on the aeroplane wingspan and outer main gear wheel span.

Code element 1		Code element 2		
Code number (1)	Aeroplane reference field length (2)	Code letter (3)	Wingspan (4)	Outer main gear wheel span[a] (5)
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1 200 m	B	15 m up to but not including 24 m	4.5 m up to but not including 6 m
3	1 200 m up to but not including 1 800 m	C	24 m up to but not including 36 m	6 m up to but not including 9 m
4	1 800 m and over	D	36 m up to but not including 52 m	9 m up to but not including 14 m
		E	52 m up to but not including 65 m	9 m up to but not including 14 m
		F	65 m up to but not including 80 m	14 m up to but not including 16 m

a. Distance between the outside edges of the main gear wheels.

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