Albion Park Rail bypass

Environmental impact statement
Technical Paper 2 – Aviation

October 2015

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GLOSSARY AND ACRONYMS

Aerodrome	A defined area on land or water (including any buildings, installations, and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft
AHD	Australian Height Datum
Airport	A general term covering aerodrome and ancillary infrastructure such as terminals, hangars and other associated development
CASA	Civil Aviation Safety Authority
CL	Centreline
Displaced threshold	A threshold not located at the extremity of a runway
Elevation	The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from the mean sea level
Instrument approach procedures	The procedures to be followed by aircraft in letting down from cruising level and landing at an aerodrome. (A series of predetermined manoeuvres by reference to flight instruments for the orderly transfer of an aircraft from the beginning of the initial approach to a landing, or to a point from which a landing may be made.)
Instrument runway	A runway intended for the operation of aircraft using instrument approach procedures
Method of Working Plan	A document which sets out arrangements for the safe conduct of works which affect aerodrome operations
NASF	National Airports Safeguarding Framework
Non-instrument runway	A runway intended for the operation of aircraft using visual approach procedures.
Non-precision approach runway	An instrument runway served by visual aids and a non-visual aid providing at least directional guidance adequate for a straight-in approach.
NOTAM	Notice to Airmen A standardised way of communicating changes in operating conditions to pilots and aircraft operators
OAS	Obstacle assessment surface
OLS	Obstacle Limitation Surface(s)
PANS-OPS	Procedures for Air Navigation Systems – Aircraft Operations Defines the criteria for ensuring minimum aircraft to object separations are maintained when aircraft are following instrument flight procedures
PAPI	Precision Approach Path Indicator
Primary runway(s)	Runway(s) used in preference to others whenever conditions permit.
RWY	Runway
Threshold	The beginning of that portion of the runway usable for landing

GLOSSARY AND ACRONYMS

Runway	A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.
Approach surface	The component of the OLS designed to protect approaching aircraft from collision with objects
Take-off climb surface	The component of the OLS designed to minimise the operational restrictions on aircraft taking off due to obstacles
Inner horizontal surface	The component of the OLS designed to protect aircraft undertaking standard circuit manoeuvres from collision with objects
Visual segment surface	Part of the PANS-OPS surfaces required to be kept clear of obstacles to protect aircraft during the final, visual, segment of an instrument approach procedure

EXECUTIVE SUMMARY

Roads and Maritime Services is planning for a 9.8 kilometre extension of the Princes Motorway between Yallah and Oak Flats to bypass Albion Park Rail. The alignment passes close to the Illawarra Regional Airport. A review of the interaction between the proposed motorway and the airport has been prepared to inform the motorway design and assess its impacts.

The assessment is summarised in the following table.

Issue	Summary of assessment
Airspace protection	Existing obstacle limitation surfaces Vehicles and street light poles would not infringe the existing obstacle limitation surfaces, PANS-OPS surfaces or the obstacle assessment surfaces for the precision approach path indicator (PAPI) system. Aspirational future obstacle limitation surfaces Some existing local roads already intrude into the aspirational future obstacle limitation surface for the airport. In these locations, the project will not result in a greater penetration than currently occurs. The project will extend into the aspirational obstacle limitation surface in two instances: ▪ A short section of the proposed motorway approximately 100 metres south of Macquarie Rivulet for a length of 80 metres, where the alignment is constrained by flood protection requirements ▪ On Yallah Road, associated with street light poles. In two other locations, street light poles may come close to, but are unlikely to penetrate, the aspirational obstacle limitation surface. Consideration of street light pole height will be made during detailed design.
Communication, navigation and surveillance infrastructure	The project would have no impact on the existing or expected future communication, navigation and surveillance infrastructure
Lighting distraction and glare to pilots	Street lighting would need to be designed to ensure it meets the requirements for the applicable light control zones under the Civil Aviation Regulations. Provided this occurs, no negative impacts of the project are identified.
Road structure generated windshear and turbulence	A preliminary assessment indicates the risk presented by road structure generated windshear and turbulence in relation to aircraft operations at Illawarra Regional Airport is anticipated to be low. For the bridge over the motorway for the southbound exit ramp at Albion Park, this aspect should be reviewed following detailed design of the road structure.

Issue	Summary of assessment
Wildlife hazards	The proposed bypass and local roads are not land uses which are identified as presenting a risk of wildlife attraction which may result in wildlife strikes to aircraft. Croom Reserve and the Croom Regional Sporting Complex represents a moderate risk in relation to wildlife strike. This risk would not be altered following the proposed changes to the Croom Regional Sporting Complex and Croom Reserve. Planned site landscaping would be complementary to the existing environment and would avoid the use of trees and shrubs that attract birds and bats that would alter the wildlife regime in the vicinity of the airport. Any impacts to wildlife behaviour should be monitored in accordance with the requirements of NASF Guideline C.
Possible impacts of aircraft operations on road users	The project is consistent with the current and expected future approaches to public safety zones at similar airports. Jet blast effect at wind velocities over 50 kilometres per hour would not reach the proposed road alignment

Construction activities associated with the proposed motorway have been assessed in relation to the intrusion of airspace by construction plant and equipment.

Mitigation measures have been identified to successfully manage impacts on aircraft operations during construction.

1 INTRODUCTION

1.1 PROPOSED PROJECT AND PROJECT OBJECTIVES

Roads and Maritime Services is planning for a 9.8 kilometre extension of the Princes Motorway between Yallah and Oak Flats to Bypass Albion Park Rail (Figure 1-1).

The purpose of the project is to complete the missing link for a high standard road between Sydney and Bomaderry. The project aims to address short and long term transport needs.

The project objectives are listed and described in Table 1-1.

Table 1-1 Project objectives

Project Objectives	Description
Provide a motorway standard bypass of Albion Park Rail.	Motorway standard refers to a dual carriageway and a design speed of at least 100 kilometres per hour.
Provide a minimum of one in 20 year flood immunity.	The project is to ensure that the highway can remain open in a flood event with an average recurrence level of at least one in 20 years.
Provide access for A-double vehicles.	A-double vehicles incorporate two trailers that can each carry a full-length shipping container. While these vehicles are not currently used, it is intended that the project be designed to accommodate such vehicles to provide maximum flexibility into the future.
Provide east-west connectivity for current and future land use.	It is important that efficient motor vehicle, cycle and pedestrian movements are catered for across the project.

The key features of the project include:

Feature	Description
Lanes	There would be a motorway with two lanes in each direction divided by a median (with capacity to upgrade to three lanes in each direction in future).
Route	The route is shown in Figure 1-1.
Interchanges	Three interchanges provided at Yallah, Albion Park and Oak Flats would connect the local road network with the motorway.
Bridges	The following bridges would be provided: ▪ Bridges to carry the motorway over Duck Creek, Macquarie Rivulet and Frazers Creek ▪ Bridges to carry the motorway over the Princes Highway and Tongarra Road ▪ A bridge to carry the motorway over the South Coast Railway Line ▪ Bridges to carry local roads, and ramps over the motorway ▪ Bridges to provide floodwater conveyance and flood relief.
Local road changes or upgrades	An upgrade to Yallah Road, between Larkins Lane and the Princes Highway at Yallah, would be undertaken as part of this project. Other changes and upgrades to the local road network would include minor realignments and creation of cul-de-sacs.

Feature	Description
Pedestrian and bicycle connections	Improved pedestrian and cycle connections are proposed as part of the project. Shared use path crossings are proposed in all locations where the motorway and local roads cross. Cyclists would be able to use the motorway shoulders in both directions, accessible via the motorway ramps. The motorway would have controlled access fencing to prevent pedestrians from accessing the road corridor.
Drainage	The following drainage elements would be provided: ▪ Network of gutters, channels, pipes and pits to collect and convey stormwater by gravity to the point of discharge into receiving waters ▪ Scuppers and carrier pipes to convey stormwater from bridged sections to the bridge supports ▪ Detention basins, vegetated swales, sediment traps, oil interceptors etc where required.
Emergency access and management facilities	Emergency stopping bays would be provided along the mainline at a spacing of one to two kilometres. Maintenance access would be provided to bridge abutments, basins, utilities and cut benches. Access tracks would generally originate from emergency stopping bays.
Detention Basins	Adjustments to the Green Meadows Detention Basin would ensure an appropriate level of flood storage would be maintained. An additional detention basin is proposed adjacent to Croome Road to mitigate flooding impacts in low level flood events.
Noise barriers	Noise barriers between the motorway and sensitive receivers would be required in some locations to reduce noise impacts.
Lighting	Lighting would be provided as required for safety reasons. Typically this would be limited to busy entry and exit ramps and the local road network.
Landscape and urban design	Landscape and urban design treatments would integrate the project with the surrounding environment.
Croom Regional Sporting Complex	Directly impacted sporting facilities at the Croom Regional Sporting Complex would be replaced, including sporting fields and associated amenities. Changes would be made to the southern access of the sporting complex. There would be new and reconfigured internal roads, pedestrian/cycle paths and parking provided.
Construction activities and temporary ancillary facilities	The key construction activities would include: ▪ Mobilisation and site establishment ▪ Clearing, grubbing and topsoil stripping, including clearing all areas within the site boundary (except within the nominated environmental protection areas), temporary work areas and local work areas ▪ Demolition of existing roads and buildings ▪ Bulk earthwork and haulage of materials ▪ Construction of the road pavement ▪ Construction of drainage structures

Feature	Description
	▪ Construction of bridges (this would likely include heavy vehicle deliveries of over-size loads) ▪ Relocation and construction of sporting facilities ▪ Changes to property access ▪ Signposting ▪ Installation of lighting and roadside furniture ▪ Landscaping, waste disposal and rehabilitation of disturbed areas with no future use. Temporary ancillary facilities would be provided to enable the above construction activities for the project. A total of 13 temporary ancillary facility sites have been identified for the project.

Figure 1-1 The proposed Albion Park Rail bypass Project

1.2 STUDY OBJECTIVES

A review of the interaction between the project and the Illawarra Regional Airport as part of the Environmental Impact Statement for the project has been completed.

This technical paper has been prepared to inform the design of the project, and enable an accurate assessment of the impacts that can be expected to result.

The technical paper has been prepared to meet the following objectives:

- Clearly document the existing environment with respect to the Illawarra Regional Airport within the project area
- Clearly document the impacts that can be expected to result from the proposal on the airport facilities and operations
- Provide technical information to inform the project design and enable impacts of the project to be minimised through design
- To fully address all elements of the Secretary's Environmental Assessment Requirements (SEARs) which are relevant to the aviation impacts of the project.

1.3 STRUCTURE OF THIS TECHNICAL ASSESSMENT

The structure of this technical paper is shown in Table 1-2.

Table 1-2 Structure of this Technical Paper

Section Reference	Section Heading	Description
Executive Summary	Executive Summary	Concise summary of this technical paper, and the key findings.
Section 1	Introduction	This section
Section 2	Assessment Requirements	Identifies the Secretary's Environmental Assessment Requirements, other legislative requirements and guidelines relevant to aviation operations
Section 3	Existing Environment	Description of the Illawarra Regional Airport features and the interaction with the surrounding environment
Section 4	Impacts of the Project	Comprehensive assessment of the completed project with respect to its interaction with the Illawarra Regional Airport
Section 5	Assessment of Construction Impacts	Describes the main impacts of construction on airport operations and how these would be mitigated

2 ASSESSMENT REQUIREMENTS

2.1 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Table 2-1 identifies the Secretary's Environmental Assessment Requirement (SEARs) which are relevant to this chapter.

Table 2-1 Secretary's Environmental Assessment Requirements relevant to this chapter

Secretary's Environmental Assessment Requirement relevant to this technical paper	Where addressed in this technical paper
An assessment of aviation issues associated with the Illawarra Regional Airport (during construction and operation, including proposed future operations), including impact on:	
▪ communications/navigation/surveillance infrastructure,	Section 4.2
▪ the Obstacle Limitation Surface (OLS)	Section 4.1.1 and Section 5.1
▪ Precision Approach Path Indicator (PAPI) Obstacle Assessment Surfaces (OAS)	Section 4.1.3 and Section 5.1
▪ the Procedures for Air Navigational Services — Aircraft Operations Surface (PANS-OPS)	Section 4.1.2 and Section 5.1
▪ road structure generated windshear and turbulence	Section 4.4.1
▪ lighting distractions and glare to pilots	Section 4.3

2.2 OTHER LEGISLATIVE REQUIREMENTS

Operations at civilian airports in Australia are governed by a range of legislation, including:

- *The Civil Aviation Act 1988*
- The Civil Aviation Regulations 1988 (and supporting Civil Aviation Orders)
- The Civil Aviation Safety Regulations 1998.

All pilots and aircraft operators must comply with this legislation which defines standards for airworthiness, licensing requirements, rules for the operation of aircraft and maintenance.

In addition, aerodromes may be registered or certified by CASA under Part 139 of the Civil Aviation Safety Regulations 1998. Registered and certified aerodromes must comply with the applicable Part 139 requirements. Aerodromes with published instrument flight procedures must also comply with certain requirements under Part 173 of these regulations.

The Civil Aviation Safety Authority (CASA) regulates the industry for adherence to the various regulations, as well as providing a range of guidance to operators as to how this may be achieved.

2.3 RELEVANT GUIDELINES

2.3.1 ICAO STANDARDS AND RECOMMENDED PRACTICES

As a signatory state to the *International Convention on Civil Aviation* (the 'Chicago Convention') and member of the International Civil Aviation Organisation (ICAO), Australia is obliged to implement Standards and Recommended Practices set out by ICAO. Those applicable to aerodromes are promulgated in *Annex 14 Volume I – Aerodromes* to the convention.

The PANS-OPS surfaces are intended to safeguard an aircraft from collision with obstacles when the pilot is flying solely by reference to instruments. Protection of these surfaces is critical, as pilots may be navigating without any visual reference outside the aircraft. ICAO provides the relevant criteria for aircraft instrument procedure design. Airspace associated with aircraft instrument procedures is defined by the Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) protection surfaces for an aerodrome. These surfaces are ascertained in accordance with the criteria in the ICAO *Procedures for Air Navigation Services - Aircraft Operations* (Doc 8168, PANS-OPS).

2.3.2 CASA MANUAL OF STANDARDS

CASA publishes a Manual of Standards in relation to Part 139 of the Civil Aviation Safety Regulations 1998. The CASA *Manual of Standards Part 139 – Aerodromes*, (CASA MOS Part 139) sets out the ICAO standards and recommended practices applicable to Australian aerodromes, incorporating any differences between national and international standards which have been agreed between Australia and ICAO.

CASA MOS Part 139 forms the primary reference document for aerodrome operators and CASA aerodrome inspectors to identify whether airport facilities are in accordance with the Civil Aviation Safety Regulations Part 139.

2.3.3 NATIONAL AIRPORTS SAFEGUARDING FRAMEWORK

The National Airports Safeguarding Framework (NASF) is a national land use planning framework that aims to:

- Improve community amenity by minimising aircraft noise-sensitive developments near airports including through the use of additional noise metrics and improved noise-disclosure mechanisms; and
- Improve safety outcomes by ensuring aviation safety requirements are recognised in land use planning decisions through guidelines being adopted by jurisdictions on various safety-related issues.

The NASF was developed by the National Airports Safeguarding Advisory Group, comprising of Commonwealth, State and Territory Government planning and transport officials, the Australian Government Department of Defence, the Civil Aviation Safety Authority (CASA), Airservices Australia and the Australian Local Government Association.

The NASF was agreed to by Commonwealth, State and Territory Ministers at the Standing Council on Transport and Infrastructure meeting on 18 May 2012. The agreement represents a collective commitment from governments to ensure that an appropriate balance is maintained between the social, economic and environmental needs of the community and the effective use of airport sites. NASF applies to all airports in Australia.

NASF currently consists of a set of seven principles and six guidelines. The full NASF principles and guidelines can be found on the Department of Infrastructure and Regional Development's website at: **www.infrastructure.gov.au/aviation/environmental/airport_safeguarding/nasf.**

Of the NASF guidelines, four in particular are relevant to this assessment.

- Guideline B: *Managing the Risk of Building Generated Windshear and Turbulence at Airports*
- Guideline C: *Managing the Risk of Wildlife Strikes in the Vicinity of Airports*
- Guideline E: *Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports*
- Guideline F: *Managing the Risk of Intrusions into the Protected Airspace of Airports.*

3 EXISTING ENVIRONMENT

3.1 ILLAWARRA REGIONAL AIRPORT

Illawarra Regional Airport (Wollongong Aerodrome) is a security controlled, Registered Aerodrome under Part 139 of the *Civil Aviation Safety Regulations 1998.* The airport is owned and operated by Shellharbour City Council. It is the base for a growing Light Aeronautics Industry, which provides maintenance and engineering services for aircraft ranging from ultralight to medium size turboprop and jet aircraft. The Historical Aircraft Restoration Society (HARS) museum and workshop are located at the airport.

Since 2008 there have been no Regular Public Transport services at the airport, although Shellharbour City Council does not rule out that opportunity in the future.

The airport facilities currently allow aircraft up to 25 tonnes to category 2C standards to operate. This includes all light general aviation aeroplanes, turboprop types such up to Dash 8-300 (50-seat) and several small private jet types such as Cessna Citation. Shellharbour City Council is seeking to upgrade the facility progressively to meet the standards applicable for larger category 3C aeroplanes to operate.

3.2 RUNWAYS

There are two operational runways at the airport.

Runway 16/34 is the primary runway, aligned in a north-south orientation. The runway is 1,819 metres long, 30 metres wide and is provided with lighting to allow night time operations. A precision approach path indicator (PAPI) system is provided to both ends of this runway to assist pilots in following an accurate approach gradient when landing. In general, the primary runway meets the code 3C requirements, subject to correction of vertical grading at the northern end and widening of the runway strip within which the runway is located. However the existing obstacle limitation surfaces currently do not meet code 3 standards.

Runway 08/26 is a secondary runway aligned east-west, 931 metres long and 30 metres wide. This runway is used when wind conditions dictate the crosswind component for operations on Runway 16/34 exceeds the maximum allowable. Due to its length, it is only used by smaller aircraft. There are no night time operations on Runway 08/26.

3.3 INSTRUMENT APPROACH PROCEDURES

The following instrument approach procedures are currently published for use at Illawarra Regional Airport:

- RNAV-Z(GNSS) runway aligned approach to Runway 16
- RNAV-Z(GNSS) runway aligned approach to Runway 34
- An NDB-A circling approach
- A GNSS circling approach.

It is considered likely that these procedures will be maintained in the future. However, it is considered unlikely that any significant modifications to these procedures, or any new procedures, would be implemented given the constraints imposed by the surrounding environment (discussed below) and the nature of operations at the airport.

3.4 SURROUNDING ENVIRONMENT

The existing A1 Princes Highway passes adjacent to the northern boundary of the airport. The roundabout intersection with the A48 Illawarra Highway is some 260 metres north of the Runway 16 threshold.

To the east of the airport is relatively dense, low-rise development. To the south is a regional sporting facility and reserve, and to the west land is more rural, but with some built up areas.

The terrain surrounding the airport is undulating, with significant hills approximately three kilometres south-south-east and four kilometres south-south-west. The Illawarra Escarpment is approximately 10 kilometres north.

As a result of these terrain features, the Runway 34 approach is offset five degrees to the west. The approach gradients for both Runway 16 and Runway 34 have also been raised from the standard 3-degrees, in order to avoid surrounding terrain.

Council has prepared ‘aspirational’ obstacle limitation surfaces which meet code 3 standards. However in some areas the existing terrain would infringe the ‘aspirational’ OLS.

3.5 AIRSPACE PROTECTION

In order to complete the assessment of impacts on the airport’s operational airspace, confirmation of the obstacle limitation surfaces which apply is necessary.

The airport operator, Shellharbour City Council, has provided to Roads and Maritime a copy of the obstacle limitation surfaces which it seeks to protect from development. Based on this, discussions with Council’s appointed technical consultants for airport matters, and reference to published information, the relevant parts of the existing and aspirational OLS have been constructed for use in this assessment.

The key parameters on which these were prepared are set out in Table 3-1 for the existing OLS currently applicable to the airport, and in Table 3-2 for the aspirational OLS which the design seeks to accommodate.

Table 3-1 Existing OLS – Key parameters

Parameter	RWY 08 RWY 26	RWY 16	RWY 34
Runway classification	Code 2 Non-instrument	Code 2 Instrument non-precision	Code 2 Instrument non-precision
Approach surfaces:			
Threshold coordinates (MGA94)	E 296484.71 N 6173261.68	E 296795.82 N 6174463.15	E 297136.40 N 6172855.80
Length of inner edge	90m	150m	150m
Distance from threshold (m)	60m	60m	60m
Divergence each side	10%	15%	15%
Inner edge elevation (AHD)	9.22m	6.72m	8.61m
Slope	4%	3.33%	3.33%
Offset from Runway CL	Nil	Nil	5° W
Transitional surfaces:			
Slope	1 : 5	1 : 7	1 : 7
Inner horizontal surface			
Elevation (AHD)	52.0m		
Take-off climb surfaces:			
Runway end coordinates (MGA94)	E 296484.71 N 6173261.68	E 297172.74 N 6172684.29	E 296795.82 N 6174463.15
Length of inner edge	80m	90m	90m
Distance from runway end	60m	60m	60m
Divergence each side	10%	10%	10%
Slope	4%	4%	4%
Offset from Runway CL	Nil	5° W	Nil

Table 3-2 Aspirational OLS – Key parameters

Parameter	RWY 08 RWY 26	RWY 16	RWY 34
Runway classification	Code 2 Non-instrument	Code 3 Instrument non-precision	Code 3 Instrument non-precision
Approach surfaces:			
Threshold coordinates (MGA94)	E 296484.71 N 6173261.68	E 296795.82 N 6174463.15	E 297136.40 N 6172855.80
Length of inner edge	90m	150m	150m
Distance from threshold (m)	60m	60m	60m
Divergence each side	10%	15%	15%
Inner edge elevation (AHD)	9.22m	6.72m	8.61m
Slope	4%	3.33%	3.33%
Offset from Runway CL	Nil	Nil	5° W
Transitional surfaces:			
Slope	1 : 5	1 : 7	1 : 7
Inner horizontal surface			
Elevation (AHD)	52.0m		
Take-off climb surfaces:			
Runway end coordinates (MGA94)	E 296484.71 N 6173261.68	E 297172.74 N 6172684.29	E 296795.82 N 6174463.15
Length of inner edge	80m	180m	180mm
Distance from runway end	60m	60m	60m
Divergence each side	10%	12.5%	12.5%
Slope	4%	2%	2%
Offset from Runway CL	Nil	5° W	Nil

4 IMPACTS OF THE PROJECT

The motorway has been assessed to determine the potential impacts on current and future aviation operations of the Illawarra Regional Airport with respect to the following matters;

- The protection of the airport's operational airspace
- Communication, navigation and surveillance infrastructure
- Lighting distraction and glare to pilots
- Road structure generated windshear and turbulence
- Wildlife hazards
- The possible impact of aircraft operations on road users.

The impacts in relation to each aspect is described under the following subsections.

4.1 AIRSPACE PROTECTION

Three separate elements of airspace around Illawarra Regional Airport require protection from the intrusion of obstacles, which could affect the ability of aircraft to operate safely at the airport in accordance with aviation standards. These are

- The obstacle limitation surfaces (OLS)
- The PANS-OPS surfaces
- The Precision Approach Path Indicator Obstacle Assessment Surface.

To avoid unnecessary impacts on the airport, therefore, the motorway, local road upgrades and associated structures should remain clear of these components of airspace.

No permanent penetration of the PANS-OPS protection surfaces is permitted. Temporary penetrations of PANS-OPS protection surfaces, and either permanent or temporary penetrations of the OLS may be permitted subject to assessment by CASA that the penetrations do not constitute a hazard to aircraft operations.

4.1.1 OBSTACLE LIMITATION SURFACES

The Obstacle Limitation Surfaces (commonly abbreviated to OLS) are a set of imaginary surfaces associated with an aerodrome. They define the volume of airspace that should ideally be kept free from obstacles in order to minimise the danger to aircraft during an entirely visual approach. These surfaces are of a permanent nature and comprise the reference datum which defines an obstacle. Anything above the vertical limits of the OLS is regarded as an obstacle.

CASA MOS Part 139 defines the OLS for registered aerodromes such as Illawarra Regional Airport. The characteristics of the OLS are determined with reference to a series of parameters which relate to the physical features and operational capability of the runways at the aerodrome.

Existing and aspirational Illawarra Regional Airport OLS

The existing Illawarra Regional Airport OLS is based on the standards that apply to Code 2 aeroplanes. This is primarily due to the surrounding obstacle environment, which prevents the standards for larger Code 3 aeroplanes being achieved.

However, Runway 16/34 at the airport already meets or is capable of being upgraded to meet, the physical requirements for Code 3 aeroplanes in several other respects. Therefore, Shellharbour City Council, the aerodrome operator for Illawarra Regional Airport, seeks to ensure that new structures remain outside of the OLS which would apply in these upgraded

circumstances. This is termed the aspirational OLS, in recognition of the fact that it does not yet apply.

Clearance to vehicles

The vertical alignment of the motorway and local access roads has been heavily influenced by the aspirational OLS for the Illawarra Regional Airport. Generally the motorway design maintains a minimum of 4.6 metre clearance from the road surface clearance to the lowest part of the aspirational OLS. This clearance ensures that standard Roads and Maritime articulated vehicles, which may be up to 4.6 metre high, would not be considered as an obstacle with reference to the aspirational OLS.

However this clearance is not possible in the following locations:

- On Yallah Road approximately 120 metres to the east of the Larkins Lane intersection, the new road alignment for Yallah Road joins the existing road level which is only 3 metres below the aspirational OLS Runway 34 take-off climb surface. The project design does not produce a greater intrusion than the existing situation
- Approximately 100 metres south of Macquarie Rivulet for 80 metres, the motorway design allows a minimum of 4.1 metre clearance to the aspirational OLS *take-off climb surface* at the outside edge of the proposed shoulder. This is due to the competing constraint to keep the motorway edge line above the 100 year ARI flood levels. A 4.6 metre clearance to the aspirational OLS *approach surface* is maintained on the motorway travel lanes
- The new Croome Road joining into the existing road, to the south east of the Croom Regional Sporting Complex stadium. The project design does not produce a greater intrusion than the existing situation.

These reduced clearances will have no impact on the current operation of the airport and will not affect the safety of future aspirational operations. There may be some restrictions on take-off to the north by larger aircraft. The overall impact on future aircraft operations, compared to the existing situation (without the motorway), is minimal.

Clearance to light poles

The conceptual street lighting design has been reviewed against the obstacle limitation surfaces, on the basis of a 9.0 metre mounting height in line with the design for lights located within the extents of the OLS. The street lighting poles remain well below the aspirational OLS except for the locations identified below.

In the following locations, light poles in the motorway design have been assessed as not penetrating the OLS, however they would come close to it and as such will be monitored and controlled in detailed design to ensure no penetration occurs:

- At the Yallah Road intersection with the A1 Princes Highway, street lighting poles would come close to the aspirational OLS Runway 34 take-off climb surface
- At the Croome Road roundabout, street lighting poles may come close to the existing and aspirational inner horizontal surface
- At the Croom Regional Sporting Complex, changes to sporting field with lighting as part of the project works are limited to relocation of the three existing Junior Rugby League lights about 30-40 metres south of their existing positions.

In the following location, light poles would penetrate the aspirational OLS:

- On Yallah Road, at the intersection with the local access to the TransGrid substation, two (2) light poles would penetrate the aspirational OLS Runway 34 take-off climb surface by an estimated 2-3 metres.

4.1.2 PANS-OPS SURFACES

Illawarra Regional Airport has PANS-OPS surfaces associated with the existing published instrument approach procedures to Runway 16 and Runway 34. Each procedure has several surfaces associated with it.

The lowest PANS-OPS surfaces within the project area are termed the visual slope segment (VSS) surfaces. These surfaces protect the pilot from collision with obstacles during the final, visual, segment of an instrument approach.

The visual slope segment surface for Runway 34 RNAV (GNSS) approach is a trapezoidal shape with an inner edge (closest to the runway threshold) 90 metre wide and sides which diverge from the extended runway centreline at a specified rate. The rate of divergence is 15 per cent on the eastern side and 23.75 per cent on the western side. The slope of the surface, which may not be exceeded by any obstacles, is 3.981 per cent, which corresponds to a 3.4 degree approach slope to Runway 34.

The visual slope segment surface for Runway 16 has an inner edge 90 metres wide and sides which diverge equally at 15 per cent. The slope of the surface is 4.506 per cent, which corresponds to a 3.7 degree approach slope to Runway 16.

In relation to a future Code 3 non-precision instrument approaches to Runway 34, the visual slope segment surface would be of a similar geometry, but with an inner edge 300 metres wide. As the slope of the visual slope segment is determined by the published approach gradient, the slope of the surface would not be expected to change.

The motorway design does not impact the existing or potential future visual slope segment surfaces.

4.1.3 PAPI OBSTACLE ASSESSMENT SURFACES

In accordance with CASA MOS Part 139, Paragraph 9.9.2.1, an obstacle assessment surface associated with a precision approach path indicator (PAPI) system must be surveyed and assessed for obstacles for each end of the runway where a PAPI is to be provided.

The obstacle assessment surface has a baseline width of 150 metres, coincident with the existing baseline for the approach surface, and sides which splay outwards at 7.5 degrees commencing from the ends of the baseline. The surface extends to nine kilometres from the baseline.

The slope of the obstacle assessment surface for a standard 3-degree approach gradient is 1.9 degrees. However, the PAPIs at Illawarra Regional Airport are set for an approach gradient of 3.7 degrees to Runway 16 and 3.4 degrees to Runway 34. The corresponding obstacle assessment surface gradients, in accordance with CASA MOS Part 139 paragraph 9.9.2.4, are 2.6 degrees and 2.3 degrees respectively.

As the PAPI for Runway 16 is offset, so too would be the applicable obstacle assessment surface.

The PAPI obstacle assessment surface is contained within the lateral limits of, and has the same slope as, the future PANS-OPS visual slope segment surface for the approach. Therefore, objects which do not penetrate the PANS-OPS will not obstruct the PAPI obstacle assessment surface.

4.2 COMMUNICATION, NAVIGATION AND SURVEILLANCE INFRASTRUCTURE

Illawarra Regional Airport has a non-directional beacon. This navigation aid is owned by Airservices.

The Civil Aviation Safety Authority has mandated the use of satellite-based navigation technology for all aircraft operating under instrument flight rules in the Australian Flight Information Region by 4 February 2016.

This allows Airservices to decommission almost half of the existing ground-based navigation aid network. The remaining network of conventional navigation aids, currently being replaced and upgraded by Airservices, will form the Backup Navigation Aid Network to support satellite-based operations.

The non-directional beacon at Illawarra Regional Airport will form part of the Backup Navigation Aid Network.

Clearance requirements for non-directional beacons are set out in siting guidelines provided by Airservices, and also in CASA MOS Part 139 Section 11.1.3. No component of the project would infringe the clearances set out in those documents.

4.3 LIGHTING DISTRACTION AND GLARE TO PILOTS

Light control zones

Ground lights may cause confusion or distraction to pilots as a result of their colour, position, pattern or intensity of light emission above the horizontal plane. CASA has the power, through Regulation 94 of the Civil Aviation Regulations 1988 (CAR 1988), to require lights which may cause confusion, distraction or glare to pilots in the air, to be extinguished or modified.

Section 9.21 of CASA MOS Part 139 provides advice with regard to the design and provision of lighting systems for use at or in the vicinity of an aerodrome, with the intention of minimising the potential hazard to aircraft operations from the lighting. Anyone proposing to install a lighting system within the vicinity of the aerodrome should be made aware of the requirements by the airport operator.

The advice provided by CASA is applicable to lighting installations within a six kilometre radius of the airport. With respect to this project this would include street lights, sports field lighting and any temporary lighting required during construction or operation. The lights within this radius fall into a category most likely to be subjected to the provisions of Regulation 94 of CAR 1988. Within the six kilometre radius, a primary area exists which is divided into four light control zones designated A. B, C and D. These zones reflect the degree of interference ground lights can cause as a pilot approaches to land. Each zone has specified limits on the intensity of light emissions (at three degrees above the horizontal plane) which should be maintained. Figure 4-1 is extracted from CASA MOS Part 139 and shows these light control zones.

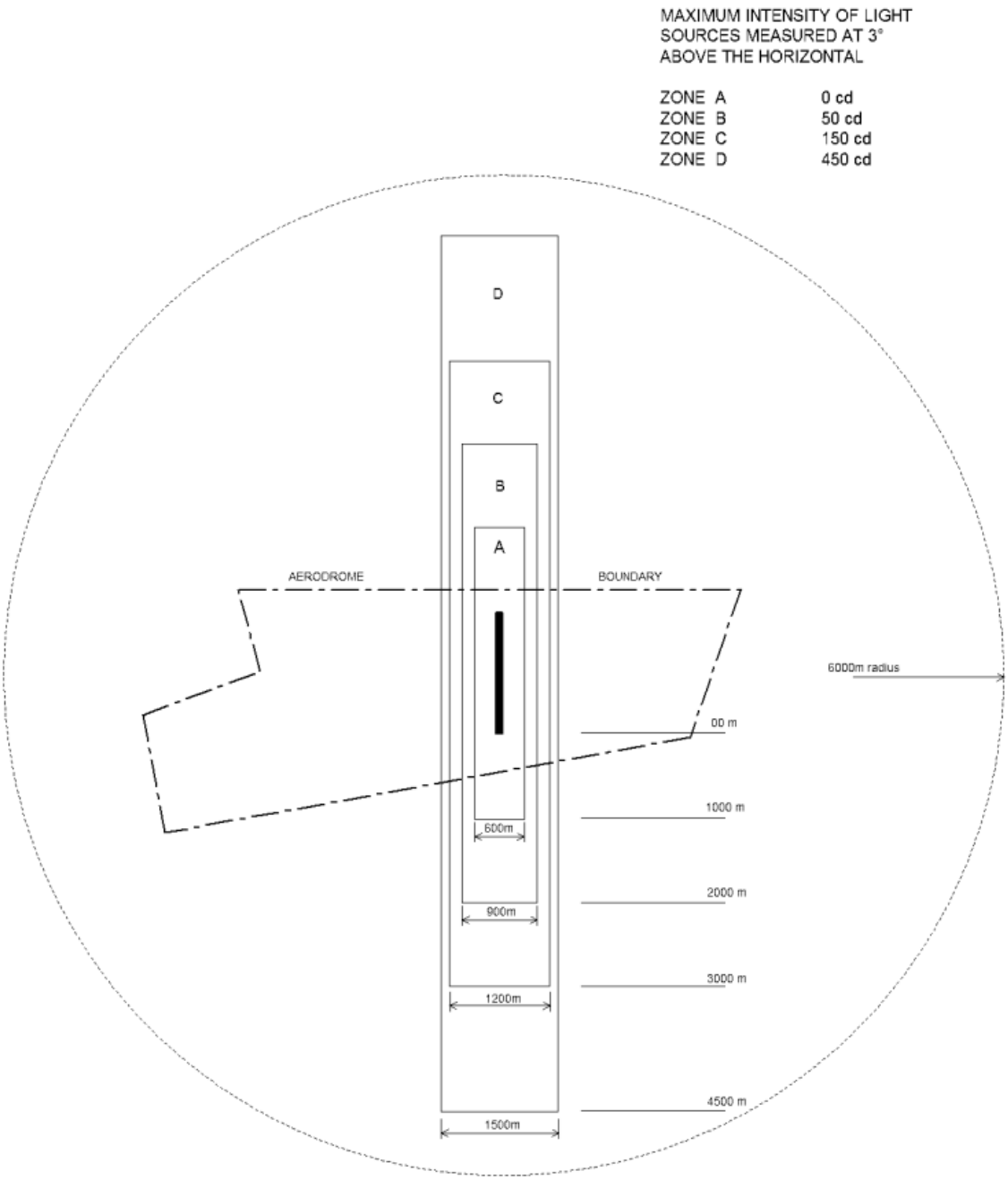

Figure 4-1 Light Control Zones
(From CASA MOS Part 139)

Figure 4-2 indicates how these light control zones would apply to Runway 16/34 and Runway 08/26 at Illawarra Regional Airport. Portions of the motorway would fall within the primary area and any street lighting within these areas would need to be designed to meet the restrictions applicable to the respective light control zone. The most effective manner of meeting these restrictions should be considered during the detailed design with reference to CASA.

NASF Guideline E also contains information to assist development proponents and planning authorities to ensure that lighting in the vicinity of the airport does not compromise aviation safety. It is important that the guideline is consulted or CASA advice sought when new sources of significant lighting are being planned in the vicinity of airports. Examples of such developments include: motorway lighting; container yards; refinery flare plumes; stadium flood lighting; and construction lighting.

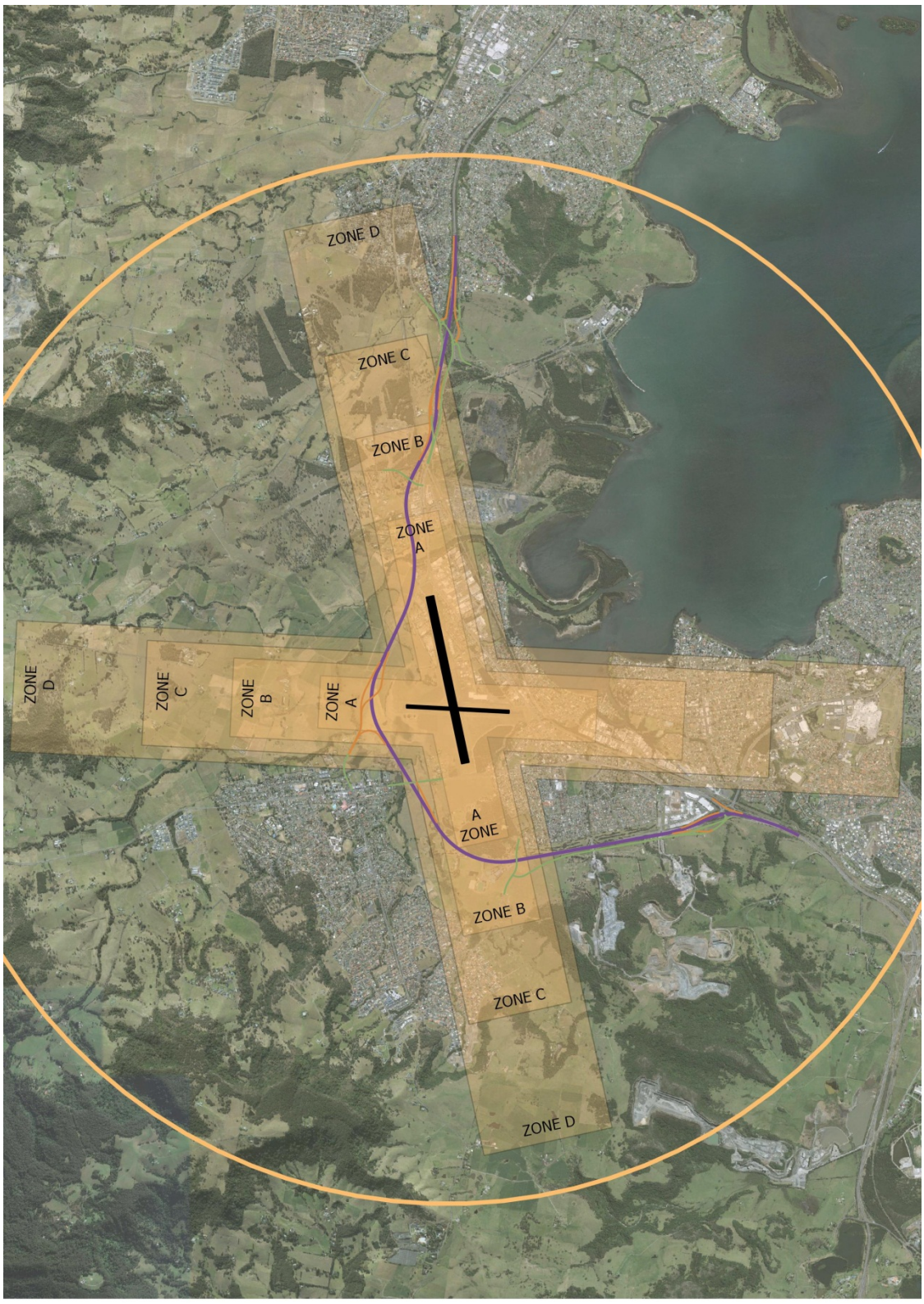

Figure 4-2 Illawarra Regional Airport light control zones (Runway 16/34)

Vehicle headlights

The light control zones described above are not applicable to vehicle headlights. The power of vehicle headlights is unlikely to be sufficiently high to be dazzling to pilots at distances of several hundred metres to several kilometres where these would normally be visible.

Provided that street lights are in accordance with the light control zones, there is limited potential for pilots to confuse the motorway with the runway at night. Runway lights are spaced in regular patterns at specific distances. This is especially to avoid confusion with other light sources, such as moving vehicle headlights which have more irregular and dynamic patterns.

Pilots would ordinarily establish focus on the runway at least six kilometres from touchdown. Once the aircraft is stabilised in the approach, pilot attention ensures that surrounding features, such as the motorway, would be unlikely to attract their attention.

Reflective glare from buildings

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

4.4 WINDSHEAR AND TURBULENCE

4.4.1 ROAD STRUCTURE GENERATED WINDSHEAR AND TURBULENCE

Background

Buildings of a certain size and dimensions, when sited near to runway ends, can sometimes generate windshear and turbulence effects which can pose a safety risk to aircraft.

NASF Guideline B *Managing the Risk of Building Generated Windshear and Turbulence at Airports*, sets out guidelines for the assessment of proposed building developments in the vicinity of runways with respect to their potential to cause hazards to aircraft safety as a result of turbulent airflows. These guidelines are designed to assist land use planners and airport operators in their planning and development processes to reduce the risk of building generated windshear and turbulence at airports near runways. The Australian Government considers that these guidelines are important to better inform the siting and construction of on-airport buildings and in the immediate vicinity of airports to mitigate the risk of building-generated windshear and turbulence.

It should be noted that NASF Guideline B is written specifically with reference to buildings (such as offices, warehouse type buildings and hangars) which present a regular geometric shape and can be assessed on the basis of their length/width/height ratios. It is not intended to address irregularly shaped structures, such as road cuttings, bridges and embankments, which have non-vertical faces, are porous to wind and are not essentially rectangular in shape. The guidance does not provide an assessment method for these types of structures, nor does it imply that the presence of these in proximity to runways, which occurs frequently around the world, presents any kind of risk to aircraft operations.

Nonetheless, to gain an understanding of the likely level of risk as a result of windshear and turbulence generated by the proposed road structures, a preliminary assessment in line with the approach given in NASF Guideline B has been undertaken in relation to the motorway design. The purpose of the preliminary assessment is to identify any areas where further work may be required in subsequent design stages.

Preliminary assessment

NASF Guideline B provides a multi-stage process for the assessment of buildings and obstacles near airports with regards to building generated windshear and turbulence. Firstly, envelopes are defined within which building generated windshear and turbulence should be assessed.

These are based on distances from the extended runway centreline and runway ends. Buildings and obstacles outside this envelope applied to each runway of concern are considered not to pose a safety risk in terms of windshear and turbulence.

The assessment envelopes for building generated windshear and turbulence associated with NASF Guideline B cover an area 1,200 metres or closer perpendicular to the runway centreline and extend 900 metres along the extended centreline of the runway prior to the runway threshold and 500 metres along the runway. The assessment envelopes as applied to the runways at Illawarra Regional Airport and the project are indicated in Figure 4-3.

The following structures are located within the lateral extents of the assessment envelopes as defined above:

- BR06 Twin Bridges on the motorway over Macquarie Rivulet at 18.9 kilometres south of Wollongong
- BR07 Twin bridges on the motorway over Frazers Creek North of Albion Park at 19.9 kilometres south of Wollongong
- BR08 Bridge over the motorway for the southbound exit ramp at Albion Park at 20.7 kilometres south of Wollongong
- BR09 Twin bridges on the motorway over Frazers Creek at Croom at 21.3 kilometres south of Wollongong
- BR11 Twin bridges on the motorway over Frazers Creek and Croom Regional Sporting Complex access road 22.3 kilometres south of Wollongong.

For buildings which fall within the assessment envelopes, NASF Guideline B sets out a three stage assessment process. The first stage is to review each against a nominal 1:35 slope from the runway centreline.

For single buildings or obstacles which fall within the assessment envelopes, NASF Guideline B defines a Height Multiplier known as the '1:35' rule. The 1:35 rule is based on a similar rule developed in the Netherlands and proposes that buildings with a perpendicular distance to a runway centreline that is less than 35 times the height of the building should be further assessed and aerodynamic modelling may be required. The rule is noted as very conservative and any building that passes the 1:35 rule test is considered not to create unsafe wind effects.

For buildings that do not pass the 1:35 rule, NASF Guideline B provides a Mean Wind Speed Deficit methodology. An approach based on the results of empirical testing is provided in the guideline. This approach is however not applicable to structures which do not have well-defined length, width and height dimensions, such as road structures. In these situations, NASF Guideline B suggests undertaking a quantitative assessment using computational fluid dynamics or wind tunnel testing to determine any exceedance of the mean wind speed deficit acceptance criterion.

Road structures of the type proposed for this project already display a number of mitigation measures recommended by NASF Guideline B:

- Wake disruption through surrounding roughness (as a result of vegetation)
- Natural contours including rounded or tapered edges (of embankments, cuttings and abutments etc)
- Flow relief through openings in structures.

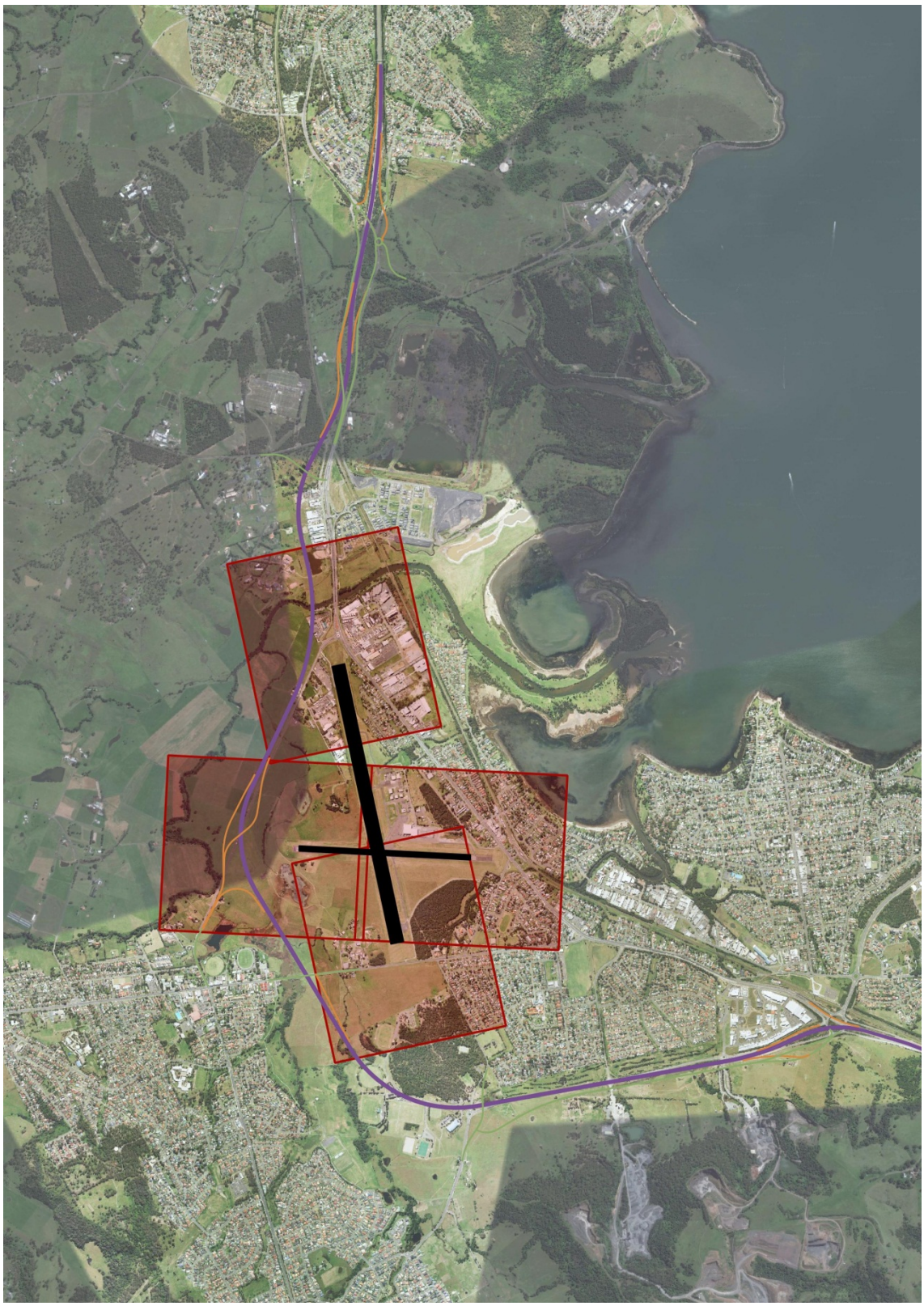

Figure 4-3 Illawarra Regional Airport windshear assessment envelopes

Table 4-3 Road structure generated windshear and turbulence potential – Preliminary assessment

Structure	Within Assessment Envelope for	Height of top of structure (m AHD)	Height of RWY CL (m AHD) (approx.)	Distance to RWY CL (m)	1:35 Rule (Pass / Fail)	Comments
BR06 (N abutment)	RWY 16	8.2	6.7+	50	Fail	Marginally within 1:35 envelope from runway. Structure is 380 m along extended runway centreline and elevation of aspirational OLS take-off climb surface at this point is 14.3 m AHD. Structure is unlikely to be influential.
BR06 (S abutment)	RWY 16	7.5	6.7+	80	PASS	
BR07 (N abutment)	RWY 16	10.0	7.0	460	PASS	
BR08 (W abutment)	RWY 08	17.5	9.2+	50	Fail	Structure is 340 m along extended runway centreline and elevation of aspirational OLS take-off climb surface at this point is 22.8 m. Structure is unlikely to be influential.
BR08 (E abutment)	RWY 08	16.5	9.2+	100	Fail	Structure is 290 m along extended runway centreline and elevation of aspirational OLS take-off climb surface at this point is 20.8m Structure is unlikely to be influential.
BR09	RWY 08	10.5	9.2	450	PASS	
BR11	RWY 16	14.3	8.5+	450	PASS	

When considered in relation to the results of the preliminary assessment summarised in Table 4-3, the risk presented by road structure generated windshear and turbulence in relation to aircraft operations at Illawarra Regional Airport is anticipated to be low.

Of the proposed road structures, all but three pass the preliminary assessment as defined in NASF Guideline B. The three structures which do not pass this assessment are considered unlikely to generate influential windshear or turbulence effects.

The need for further investigation of these three structures should be reviewed more closely at the detailed design stage, once the structural form and geometry are more clearly defined. However on the basis of the preliminary assessment, further work is not expected to be warranted.

4.4.2 CONVECTIVE TURBULENCE AND RADIANT HEAT

Aviation authorities have established that an exhaust plume with a vertical gust in excess of 4.3 metres per second may cause airframe damage or upset an aircraft flying at low level. However, standards in regard to convective turbulence caused by radiant heat emitted from building roofs, road pavements, hardstands or other surface treatments have not been promulgated.

The risk of an upset and loss of control caused by radiant heat emitted from such surfaces is however considered to be low, because thermal energy in the column of air is unlikely to be sufficient to generate the critical velocity of 4.3 metres per second.

Aircraft approaching to land at similar airports regularly overfly buildings and paved surfaces that consistently fail to produce intolerable thermal effects. An encounter with a thermal column generated by heat radiated from the pavement surface should be well within the capability of a proficient pilot to manage because of the expected low circulation velocity within the thermal.

4.5 WILDLIFE HAZARDS

Wildlife strikes and/or their avoidance can cause major damage to aircraft and a reduction in safety. The majority of aircraft collisions with wildlife occur near the airfield during take-off, landing and associated phases. They may cause damage that may impact on the pilot's ability to manoeuvre the aircraft and are a leading cause of aircraft crashes

The risk of a strike on or in the vicinity of an airport relates to the level and form of wildlife activity both within the boundary of an airport and in surrounding areas.

Airports actively reduce wildlife populations and manage the risk of strikes on airport land. Such on-airport activities are underpinned by current aviation safety regulations. Australia's international aviation safety obligations as a contracting state to the Convention on Civil Aviation include responsibilities to take action to manage the risk from wildlife hazards. Aviation safety regulations do not address the risk of wildlife strikes occurring outside the boundary of airports in the same way as they address on-airport risk. The risk of a strike off-airport relates mostly to wildlife activity in areas surrounding the airport. Wildlife attracted to land uses around airports can migrate onto the airport or across flight paths, increasing the risk of strikes.

Land use planning decisions and the way in which existing land use is managed in the vicinity of airports can, therefore, significantly influence the risk of wildlife hazards. Minimising the risk of wildlife strike requires careful consideration from a planning perspective to identify potential land uses that may attract birds or other wildlife.

NASF Guideline C identifies land uses that have the potential to increase wildlife strike potential and provides guidance on buffer zones within which certain activities around airports should be controlled. Within these buffers it is recommended that some activities are excluded whilst others have monitoring and control measures.

The motorway and associated local road upgrades are not land uses which Attachment 1 to NASF Guideline C indicates pose a risk in attracting birds. However the most similar use identified in the Guideline, car parks, is indicated as 'Very Low' wildlife attraction risk. Actions for proposed developments within three kilometres are to monitor any impacts to wildlife behaviour as a result of the development.

Planned site landscaping should nonetheless avoid the use of trees and shrubs that are attractive to birds and bats, which may alter the wildlife regime in the vicinity of the airport.

Sports facilities are indicated as a 'Moderate' wildlife attraction risk within Attachment 1 to NASF Guideline C. The Croom Regional Sporting Complex is immediately south of the airport and it is proposed that the motorway will travel through the facility. Sporting fields are proposed to be relocated as a result of this action. Croom Reserve is not being impacted by the project, and wildlife attraction risks would not change as a result of the project.

4.6 POTENTIAL IMPACTS OF AIRCRAFT OPERATIONS ON ROAD USERS

4.6.1 PUBLIC SAFETY AND AIRCRAFT CRASH RISK

Public safety zones

Public safety zones are intended to limit the risks to third-parties as a result of potential aircraft crashes in the vicinity of airports, rather than to ensure levels of safety to aircraft occupants which is addressed through the civil aviation regulatory framework. Currently in Australia there is no clearly-defined national policy with regard to public safety zones at airports. Although the National Airports Safeguarding Advisory Group is currently considering the issue, the NASF does not currently include guidance on the protection of public safety zones at runway ends.

In the absence of a finalised national approach to public safety around airports, planning authorities should consider existing approaches to public safety zones, associated safety principles and how these might be applied in taking a precautionary approach to the treatment of development and public risk around airport sites.

Existing approaches to public safety

Queensland is currently the only state which has adopted a policy which defines Public Safety Areas (PSAs) which are applicable to certain aerodromes considered to be of state significance.

The Queensland Government has released planning guidelines for land uses at runway ends in its July 2014 *State Planning Policy: State interest – strategic airports and aviation facilities.* The Queensland SPP identifies 'Public Safety Areas' (PSAs) within which development should be restricted in order to protect the safety of both aircraft and passengers, and property and people on the ground in the event of an aircraft accident during landing or take-off.

Under the Queensland policy, a PSA is required at the end of a runway where:

- Regular Public Transport (RPT) jet aircraft services are provided; or
- Greater than 10,000 aircraft movements occur per year (excluding light aircraft movements[1]).

These criteria do not apply to either of the runways at Illawarra Regional Airport.

[1] Light aircraft are generally defined as those with a maximum take-off weight (MTOW) of less than 5,700kg.

Future public safety policy and possible implications

It is considered likely that any future guidance in relation to public safety zones which may apply at Illawarra Regional Airport would be based on one of the following approaches:

- Application of a 'standard' public safety zone, similar to that currently adopted for Public Safety Areas in Queensland.
- Calculation of the individual risk contours in accordance with the methodology developed and applied in the UK.

Any future policy on the appropriate definition of public safety zone extents and acceptable land uses within such zones would need to balance the risks to public safety with the economic impacts of restricting certain development. In the absence of such a policy, reference is made to the existing Queensland policy which intends that development within a strategic airport's public safety area does not involve:

- A significant increase in the number of people living, working or congregating in the area
- The manufacture, use or storage of flammable, explosive, hazardous or noxious materials.

The project does not constitute such development and therefore would not be expected to be assessed as inconsistent with the intent of public safety zones.

4.6.2 JET BLAST

Jet operations at Illawarra Regional Airport are relatively rare and only occur on Runway 16/34, due to the runway length required.

CASA MOS Part 139 recommends maximum wind velocities which people, objects and buildings in the vicinity of an aeroplane may be subjected to jet blast. For public roads the maximum velocities are:

- 50 kilometres per hour where the vehicular speed may be 80 kilometres per hour or more
- 60 kilometres per hour where the vehicular speed is expected to be below 80 kilometres per hour.

Of the aircraft types typically operating, jet engine exhaust velocities of 50-60 kilometres per hour at take-off power settings would extend less than 200 metres from the aircraft but not outside the width of the runway strip.

The distance to the airside fence is more than 200 metres, and so jet blast impacts on the public would not be expected to extend beyond the perimeter fence.

Even in extreme circumstances, when larger and more powerful aircraft were operating, the motorway would not pass within the lateral zone in which exhaust velocities greater than 50 kilometres per hour would occur.

Any jet blast impacts from the airport would affect the existing Princes Highway more severely than the motorway.

4.7 MITIGATION

The following mitigation measures would occur, to minimise the risks presented to aircraft operations at Illawarra Regional Airport as a result of the project:

- The project would be designed in accordance with the requirements for Obstacle Limitation Surfaces as outlined in section 4.1.1 of this document.

- Street lighting would be designed to meet the restrictions applicable to the respective light control zone in accordance with Section 9.21 of the CASA *Manual of Standards Part 139* and NASF Guideline E *Managing the Risk of Distraction to Pilots from Lighting in the Vicinity of Airports* (as outlined in Section 4.3 of this document).
- The landscaping of the project would make use of non-wildlife attracting landscaping and would ensure other food sources for wildlife are minimised.

5 ASSESSMENT OF CONSTRUCTION IMPACTS

The potential impacts of the construction activities for the project on the Illawarra Regional Airport fall into two categories:

- Intrusion of airspace by construction plant and equipment
- Other hazards to aircraft operations as a result of construction activities.

The impacts in each group are described below along with mitigation measures for successfully managing the impacts of construction on aircraft operations

5.1 INTRUSION OF AIRSPACE BY CONSTRUCTION PLANT AND EQUIPMENT

Construction plant and equipment can frequently exceed the maximum clearance heights above ground level assumed for the finished project. Plant and equipment may also need to operate outside of the envelope of the running alignment of the motorway and associated local road upgrades.

There is a potential for intrusion of the operational airspace by construction plant. The potential for this to occur has been assessed to identify where issues are likely to require particular management during construction.

Due to the proximity to the airport, the complexity of the various airspace surfaces, the varying safety implications of penetrating these surfaces, and the varying existing ground levels, all construction work would need to be subject to a comprehensive management framework involving close liaison with the aerodrome operator, in order to ensure all impacts on the airspace are identified in advance and any necessary safety management measures are implemented.

5.1.1 GENERAL EARTHWORKS AND PAVEMENTS

Some earthworks and paving plant, particularly hydraulic excavators and tipper trucks used for loading and transport of materials can be up to 10m high when operating.

Preliminary assessment against the existing OLS and PANS-OPS suggests that minimum clearance of 10 metres would not be problematic for large sections of the works, including to the existing ground surface at the top of Yallah Hill, behind the commercial units at Yallah.

However some areas would require closer examination during construction planning. These include, in particular:

- The motorway including and south of Macquarie Rivulet for approximately 300 metres
- The motorway 1.6 kilometres south of Macquarie Rivulet for approximately 300 metres and construction of the southbound exit ramp
- The new Croome Road joining into the existing road, to the south east of the Croom Regional Sporting Complex stadium.

5.1.2 DRILLING

Drilling equipment, such as that used for geotechnical investigations, auger bores and drill holes in blasting operations often exceed 10 metres. Use of such equipment to build the motorway

adjacent to the Yallah industrial site at Yallah hill would need to be given specific consideration with respect to the operational airspace.

In cases where equipment height cannot be contained within the OLS, temporary displacement of the Runway 16 threshold may be necessary to safely accommodate this work.

5.1.3 STRUCTURES

Piling rigs, concrete pumps, cranes and similar equipment can significantly infringe the operational airspace surfaces. Their use would need to be subject to assessment on a case by case basis.

In most circumstances, infringements of the OLS inner horizontal surface, at 52 metres AHD, would not be a hazard to aircraft operations provided that they were adequately notified to pilots (and provided with obstacle lighting at night). However each possible infringement would need to be notified to the airport operator for assessment.

Intrusions into the take-off climb and approach surface extents would require operational restrictions on the use of the affected runways. The construction of the following structures would therefore require significant planning and management in order to avoid unacceptable impacts on the airport operations:

- Bridge BR05 over the motorway at Yallah Road at 18.1 kilometres south of Wollongong
- Twin bridges BR06 on the motorway over Macquarie Rivulet at 18.9 kilometres south of Wollongong
- Bridge BR08 over the motorway for the southbound exit ramp at Albion Park at 20.7 kilometres south of Wollongong
- Twin bridges BR11 on the motorway over Frazers Creek and Croom Regional Sporting Complex access road 22.3 kilometres south of Wollongong
- Bridge BR12 over the motorway at Croome Road at 23.4 kilometres south of Wollongong

5.2 OTHER CONSTRUCTION ISSUES

Other construction issues which could impact on the safety of aircraft operations at Illawarra Regional Airport are listed below. These issues would require addressing under the contractor's relevant construction safety and environmental management plans which would be prepared in the pre-construction phase. Although most issues would ordinarily be included within such plans, the potential for impacts on airport operations would need to be given special attention and the relevant aspects reviewed and agreed with the airport operator.

Lighting

Temporary fixed and portable lighting structures used in the construction of the works would need to meet the requirements for light control described in Section 4.3. This may require modification of standard equipment, or shielding, to ensure that maximum lighting intensities at three degrees above the horizontal are not exceeded.

Dust and debris

Construction activities can generate dust and debris which can reduce visibility, or which in extreme cases can be ingested into aircraft engines and systems causing failures in flight. To minimise these risks, airport operators employ stringent management measures and adopt a 'no tolerance' approach to 'foreign object debris'.

Works in close proximity to the airport boundary and final approach paths would need to apply a similar level of housekeeping and site management to ensure airborne dust and other matter is avoided. Lightweight materials which may become a hazard to aircraft must be secured to prevent them from coming loose. General lightweight rubbish needs to be kept in covered receptacles to prevent it becoming windblown.

Wildlife hazards

Changes to wildlife regimes can disrupt airport operator's management measures for wildlife strike risk. Construction of projects such as this can invoke differing habitats and provide sources of food which attract wildlife and change feeding, roosting and flocking behaviour in the vicinity of flight paths.

Open areas of topsoil, standing water, and changes to vegetation commonly affect wildlife behaviour. Whilst such effects are unavoidable during any construction work, for a project of this scale an ecological assessment of the potential impacts of proposed temporary construction activities and sequencing on wildlife behaviour, with a particular emphasis on any increase in the presence of birds and bats in proximity to aircraft, is recommended.

Any waste on the site that might offer a potential food source to birds or animals needs to be managed through storage in covered containers and frequently be removed from site.

5.3 MITIGATION

The following mitigation measures would occur, to minimise the risks presented to aircraft operations at Illawarra Regional Airport as a result of the construction of the project:

- Roads and Maritime would engage further with Shellharbour City Council during the detailed design and preparation of construction tender documentation, to agree suitable working restrictions for construction activities.
- Once a contractor is appointed, Roads and Maritime would require a Method of Working Plan, in accordance with the CASA Manual of Standards Part 139, to be prepared. The Method of Working Plan would set out the arrangements for carrying out all works which may impact on aviation safety, any necessary restrictions to aircraft operations, how these would be implemented, administered and managed to ensure safety. The Method of Working Plan will be agreed with the aerodrome operator (Shellharbour City Council) and subject to consultation with all stakeholders including regulatory agencies (CASA, Airservices Australia) and all aircraft operators at Illawarra Regional Airport prior to the commencement of works which may affect operations at the airport.
- Any restrictions on airport operations necessary to preserve the safety of aircraft movements whilst allowing the construction works to proceed would be communicated to all stakeholders through distribution of the Method of Working Plan and through publication of Notices to Airmen (NOTAM) through the relevant aeronautical information channels.
- Management of potential impacts on airport operation during construction of the project would be incorporated into any relevant construction environmental management documentation. Shellharbour City Council would be consulted on these management measures.
- Strict communication protocols, nominated points of contact and responsibilities for liaison between the contractor and airport operational personnel would be established, in relevant construction site management documentation.

6 REFERENCES

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