VOLUME 4

Appendix O
Landscape character and visual

Western Sydney Airport EIS

Landscape character and visual impact assessment

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APPROVAL FOR ISSUE

Name	Signature	Date
Erin Williams		19/08/2016

RPS has prepared this report pursuant to the conditions in the Department of Infrastructure and Regional Development Deed of Standing Quotation (SON2030181), the Commonwealth RFQTS Number 2014/7540/001, the subsequent response accepted and referenced in the relevant Official Order; and the GHD Subconsultancy Agreement dated 11 May 2015 (collectively the "**Contract**"):

In particular, this report has been prepared by RPS for the Commonwealth (and to the extent expressly stated in the Contract (and for the purposes stated therein) the parties referred to in the Contract ("**Other Parties**") and may only be used and relied on by the Commonwealth and the Other Parties in accordance with the Contract for the purpose agreed between RPS, GHD and the Commonwealth as set out in the Contract.

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Glossary and abbreviations

Term	Definition
AHD	Australian Height Datum
ATCT	Airport Terminal Control Tower
BWSEA	Broader Western Sydney Employment Area
CASA MOS	Civil Aviation Safety Authority Manual of Standards
Cumulative Effects	Cumulative effects occur between projects, where the combination of effects created by multiple projects may be greater than the sum of the individual effects
1997-99 EIS	PPK 1997, Draft Environmental Impact Statement Second Sydney Airport Proposal, Commonwealth Department of Transport and Regional Development and PPK Environment and Infrastructure Pty Ltd 1999, Supplement to Environmental Impact Statement Second Sydney Airport Proposal, Volume 3 Supplement. Prepared on behalf of the Department of Transport and Regional Services
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Landform	The shape and form of the land surface which is the result of the action and interaction of natural and/or human factors. *
Landscape Character	A distinct recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse
Landscape Character Zone	An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately adjacent
LCVIA	Landscape Character and Visual Impact Assessment
LED	Light Emitting Diode
LIIEMA	Landscape Institute and Institute of Environmental Management and Assessment (UK)
Magnitude of Effect	A term that combines the judgements about the size and scale of the effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is short or long term in duration
OLS	Obstacle limitation surface – a series of surfaces that define the limits to which structures or objects may project into the airspace to ensure the safety of aircraft
Residual Impacts	Impacts that remain following the implementation of mitigation measures
RMS	Roads and Maritime Services (NSW)
Sensitivity	A term applied to visual receivers, combining judgements of the susceptibility of the receiver to the specific type of change or development proposed and the value related to that receptor
Skyglow	The brightening of the night sky above our towns, cities and countryside
SWGC	South West Growth Centre
Visual amenity	The overall pleasantness of the views people enjoy of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of the people living, working, recreating, visiting or travelling through an area. *
Visibility Envelope	A map, usually digitally produced, showing areas of land within which a development is theoretically visible.
VIA	Visual Impact Assessment
Visual receiver	Individuals and/or defined groups of people who have the potential to be affected by a proposal.
WSIP	Western Sydney Infrastructure Plan

Executive summary

The landscape in which the airport is proposed comprises a modified landscape occupying a rural and scenic area known for its undulating landform and open viewsheds within the Cumberland Plains of Western Sydney. There are scenic values associated with both the rural qualities of the area as well as the nearby Blue Mountains World Heritage Area which forms a backdrop to the airport site to the west.

The rural character that has existed for many decades in Western Sydney is changing due to the development of the South West Growth Centre (SWGC), the commitment by the Commonwealth Government for the Western Sydney Infrastructure Plan (WSIP) and the establishment of the Broader Western Sydney Employment Area (BWSEA). The proposed airport is being developed within the context of these broader projects.

Key Findings

1. The proposed airport development would involve substantial modification of the landscape and the existing rural visual quality in the area to a more urbanised and commercial landscape character.

2. The overall visual impacts of the proposed airport are reduced due to the local topography and by existing vegetation which limit the size of the visual catchment of the airport site.

3. Future surrounding urban development, as a part of government planning and implementation, will alter the existing rural character north, south and east of the airport thereby reducing visual sensitivity (and visual impacts) over time.

4. The Stage 1 airport construction and operation will likely have the most visual impacts on areas to the north such as Luddenham and Elizabeth Drive due to their relatively close proximity to the airport.

5. There will be some relatively minor construction activity in the southern portion of the site in Stage 1 to accommodate water retention basins and other ancillary infrastructure and longer term construction and airport operations in the southern portion of the airport site will increase visual impacts in the areas south of the airport such as Bringelly, Greendale and Bents Basin with the possibility of overflights or aircraft being seen in the sky. Distant views of airport construction and operation from surrounding rural residential areas at higher elevations, such as Mount Vernon, Silverdale and Rossmore, are only of a moderate to low visual impact. The impact would however be increased by either aircraft taking off and landing and/or overflights.

6. Visual assessments were undertaken at selected important cultural and recreational areas including three publicly accessible locations in the Blue Mountains and Bents Basin. The assessment concluded that visual impacts will range from moderate to high due to the high sensitivity ratings of the viewpoints and the effect of aircraft taking off and landing and/or overflights.

7. Retention of existing remnant vegetation will assist in diminishing the visual impacts of the airport facilities to the surrounding areas particularly along the perimeter at Badgerys Creek.

8. Operational lighting will have a relatively low visual impact on the surrounding areas. The 05/23 (northeast/southwest) runway alignment inherently limits the populated areas that could potentially be affected by the approach lighting and runway lighting and potential impacts would be further reduced if advances in lighting technology such as light emitting diode (LED) lights are incorporated in the airport design. The impact will also reduce over time as further planned urbanisation and lighting pollution occurs in nearby areas including the BWSEA and the SWGC.

Mitigation Measures

Retention of existing trees within areas of the airport site will help to mitigate the visual impact in the short term and longer term. If site planting is undertaken, it should incorporate the use of locally endemic species.

Opportunities to retain and potentially embellish important natural features within the landscape such as the riparian zone along Badgerys Creek should be investigated and incorporated wherever possible, noting that conflicts might arise as a result of other important airport considerations such as bushfire risk minimisation and site surveillance and security

Site perimeter fencing may result in a significant visual impact during construction and operation due to the extent required. Measures such as screen planting in key locations could help diminish its overall visual impact. Any decision to incorporate screen planting will need to consider the security requirements of the airport.

Requirements for creating large level areas within the airport through balanced cutting and filling should, wherever possible, try and minimise large grade transitions near the boundaries. This is particularly important in order to avoid unnatural visual transitions or barriers in more visible areas, such as near roads. Site flood control measures, if any are required, will also need to be taken into account in any decision making.

Low angle, cut-off fittings should be used to mitigate the impact of the high intensity approach lighting and runway lighting. Detailed consideration should be given to the adoption of full cut off LED apron and external building lighting, both for the Stage 1 and longer term airport development.

1 Introduction

1.1 Project overview

Planning investigations to identify a site for a second Sydney airport first commenced in 1946, with a number of comprehensive studies—including two previous environmental impact statements for a site at Badgerys Creek—having been completed over the last 30 years.

More recently, the Joint Study on Aviation Capacity in the Sydney Region (Department of Infrastructure and Transport, 2012) and A Study of Wilton and RAAF Base Richmond for civil aviation operations (Department of Infrastructure and Transport, 2013) led to the Australian Government announcement on 15 April 2014 that Badgerys Creek will be the site of a new airport for Western Sydney. The airport is proposed to be developed on approximately 1,780 hectares of land acquired by the Commonwealth in the 1980s and 1990s. Airport operations are expected to commence in the mid-2020s.

The proposed airport would provide both domestic and international services, with development staged in response to demand. The initial development of the proposed airport (referred to as the Stage 1 development) would include a single, 3,700 metre runway coupled with landside and airside facilities such as passenger terminals, cargo and maintenance areas, car parks and navigational instrumentation capable of facilitating the safe and efficient movement of approximately 10 million passengers per year as well as freight operations. To maximise the potential of the site, the airport is proposed to operate on a 24 hour basis. Consistent with the practice at all federally leased airports, non-aeronautical commercial uses could be permitted on the airport site subject to relevant approvals.

While the proposed Stage 1 development does not currently include a rail service, planning for the proposed airport preserves flexibility for several possible rail alignments including a potential express service. A joint scoping study is being undertaken with the NSW Government to determine rail needs for Western Sydney and the airport. A potential final rail alignment will be determined through the joint scoping study with the NSW Government, with any significant enabling work required during Stage 1 expected to be subject to a separate approval and environmental assessment process.

As demand increases, additional aviation infrastructure and aviation support precincts are expected to be developed until the first runway reaches capacity at around 37 million passenger movements. At this time, expected to be around 2050, a second parallel runway is expected to be required. In the longer term, approximately 40 years after operations commence, the airport development is expected to fully occupy the airport site, with additional passenger and transport facilities for around 82 million passenger movements per year.

On 23 December 2014, the Australian Government Minister for the Environment determined that the construction and operation of the airport would require assessment in accordance with the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act). Guidelines for the content of an environmental impact statement (EIS) were issued in January 2015.

Approval for the construction and operation of the proposed airport will be controlled by the Airports Act 1996 (Cth) (Airports Act). The Airports Act provides for the preparation of an Airport Plan, which will serve as the authorisation for the development of the proposed airport.

The Australian Government Department of Infrastructure and Regional Development is undertaking detailed planning and investigations for the proposed airport, including the development of an Airport Plan. A draft Airport Plan was exhibited for public comment with the draft EIS late in 2015.

Following receipt of public comments, a revised draft Airport Plan has been developed. The revised draft Airport Plan is the primary source of reference for, and companion document to, the EIS. The revised draft Airport Plan identifies a staged development of the proposed airport. It provides details of the initial

development being authorised, as well as a long-term vision of the airport's development over a number of stages. This enables preliminary consideration of the implications of longer term airport operations. Any airport development beyond Stage 1, including the construction of additional terminal areas or supporting infrastructure to expand the capacity of the airport using the first runway or construction of a second runway, would be managed in accordance with the existing process in the Airports Act. This includes a requirement that, for major airport developments (defined in the Airports Act), a major development plan be approved by the Australian Government Minister for Infrastructure and Regional Development following a referral under the EPBC Act.

The Airport Plan will be required to include any conditions notified by the Environment Minister following this EIS. Any subsequent approvals for future stages of the development will form part of the airport lessee company's responsibilities in accordance with the relevant legislation.

1.2 Purpose

This landscape character and visual impact assessment (VIA) has been prepared in support of the EIS for the proposed airport development at Badgerys Creek in Western Sydney. The objective of this report is to the meet the requirements of the EIS Guidelines and to assess the visual impacts of the airport development in accordance with the Significance of Impact Assessment Guidelines 1.1 (MNES) and 1.2 (Environment).

The purpose of this report is to identify potential landscape and visual impacts of the proposed airport. The report will inform appropriate, contextual mitigation measures that can be incorporated in both the design and management of the proposed airport development to help offset adverse impacts from the construction and operation of the airport wherever possible and to satisfy the requirements of relevant authorities.

1.3 Limitations of this report

RPS has prepared this report pursuant to the conditions in the Department of Infrastructure and Regional Development Deed of Standing Quotation (SON2030181), the Commonwealth RFQTS Number 2014/7540/001, the subsequent response accepted and referenced in the relevant Official Order (collectively the "Contract"). In particular, this report has been prepared by RPS for the Commonwealth and may only be used and relied on by the Commonwealth and the party or parties identified in the Contract (Other Parties) in accordance with the Contract for the purpose agreed between GHD, RPS and the Commonwealth as set out in the Contract.

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This assessment is intended to be an objective report based on professional analysis of the landscape and the design proposals. It seeks to establish the anticipated visual impacts of the proposal on a wide range of existing and future viewers of the landscape, most of whom cannot be specifically identified and whose perceptions it is not possible to solicit.

The assessment has been undertaken based on conceptual level information and therefore is generally broad in its approach. As such, it has not included a detailed review of the individual ancillary airport components such as the fuel farm weather station, signage, maintenance and other airport support facilities or infrastructure upgrades in the surrounding area such as roads.

Scope of this Report

This report assesses those impacts associated with the construction and operation of the proposed airport and comprises the following sections.

- description of the context of the site in terms of the visual environment;
- description of the main visual components of the proposed airport for both Stage 1 and the longer term development;
- qualitative assessment of the potential visual impact of the changes to the visual amenity and views from key representative viewpoints for both the construction and operation phases;
- assessment of visual impact using a grading matrix;
- provision of mitigation measures where possible to address key identified visual impacts; and
- assessment of cumulative and residual effects.

In order to address the night time visual impact assessment, this report provides an update of the operational lighting impact assessment prepared by O'Hanlon Design (Commonwealth Department of Transport and Regional Services, 1999) with consideration given to current lighting standards and requirements for airports.

2 Approach and methodology

2.1 Assessment process

This report uses a well-utilised approach to visual quality assessment that is systematic, consistent and based on professional, value judgement of commonly accepted and adopted criteria within the industry.

There is currently no standard guidance on the assessment of landscape and visual impact within Australia. Methods used in this VIA are from the NSW Roads and Maritime Services (2013) *Environmental Impact Assessment Practice Note - Guideline for Landscape Character* and the *Visual Impact Assessment* and *Guidelines for Landscape Visual Impact Assessment Third edition* (2013). The methodology has been adapted and designed to address the specific issues of this project.

This assessment focuses on two main types of visual impact:

- effect on visual amenity; and
- effect on surrounding viewpoints.

An assessment of those two effects (or impacts) depends on the combination of two main factors.

1. visual sensitivity (of the visual amenity or viewpoints).
2. the magnitude of the visual change.

Using the grading matrix in Table 1 below, consideration of both of these factors is required to arrive at an overall level of effect or impact.

The assessment therefore determines the potential level of impact to the visual amenity of the site and its surrounds in general terms, as well as more specific impacts to key surrounding viewpoints such as from roads, residential and recreational locations.

2.2 Visual sensitivity

An assessment of the landscape character was undertaken to develop an understanding of the context and the sensitivity of the area's landscape character.

Visual sensitivity refers to the character of a setting, the quality of the view, and how sensitive it is to the proposed change (RMS, 2013). An assessment of visual sensitivity refers to the qualities of an area, the type and number of receivers and how sensitive the existing character is to the proposed change. Combined with magnitude, sensitivity provides a measure of impact.

Visual sensitivity is related to the direction of view, the composition of the view and may include more than one character zone. A landscape character zone refers to an "area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately adjacent." (RMS, 2013).

2.3 Magnitude of effect

The magnitude of a visual effect is the degree of change the visual landscape undergoes as a result of the proposed development. It is the measurement of the overall scale, form and character of a development proposal when compared to the existing condition (RMS, 2013). Magnitude also takes into consideration the distance between the viewer(s) and the proposal.

2.4 Visual impact grading matrix

Once a visual sensitivity level and magnitude are determined, they are combined into a visual impact grading matrix to identify an overall level of impact on key viewpoints.

Table 1 below is used to provide a general understanding of the level of impact and is utilised in the assessment of predicted visual impacts in section 4.0 of this report.

		Magnitude					
Sensitivity	**Impact Rating**	**High**	**High-Moderate**	**Moderate**	**Moderate-Low**	**Low**	**Negligible**
	High	High Impact	High Impact	Moderate-High	Moderate-High	Moderate	Negligible
	High-Moderate	High Impact	Moderate-High	Moderate-High	Moderate	Moderate	Negligible
	Moderate	Moderate-High	Moderate-High	Moderate	Moderate	Moderate-Low	Negligible
	Moderate-Low	Moderate-High	Moderate	Moderate	Moderate-Low	Moderate-Low	Negligible
	Low	Moderate	Moderate	Moderate-Low	Moderate-Low	Low Impact	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Table 1 Landscape character and visual impact grading matrix (RMS 2013)

3 Existing environment

An understanding of the visual character of the existing landscape and the type and extent of potential views acts as a baseline for the visual impact assessment. For example, a description of the visual character of the landscape would identify areas of visual enclosure where existing structures, topography and vegetation limit views, as opposed to visually open landscapes where widespread inter-visibility between communities and visual features exist.

Landscape character is generally defined as the recognisable pattern of elements that occurs in a particular landscape. Variations in geology, soils, vegetation, land use, settlement patterns, landform and building types are the physical elements that create different landscapes with distinctive characteristics and create a unique sense of place. The landscape character of the airport site was assessed in order to determine the degree of change that would occur from the result of the proposed airport in both Stage 1 and the longer term.

The landscape character provides a picture or sense of the landscape and is defined by the area of visually distinct common features. Defining the landscape character and its values aids in determining the capacity for the landscape to accommodate any changes from the introduction of development.

3.1 Site context

The proposed airport development site is approximately 1,700 hectares in area within the Cumberland Plain region of Western Sydney. The Cumberland Plain is a broad geographical region in the Sydney metropolitan area stretching from Windsor in the north to Picton in the south, from the Hawkesbury Nepean in the west to Sydney's inner western suburbs in the east.

The site and surrounding areas include ridgelines and rolling hills within the visual context of the Greater Blue Mountains to the west which provides a backdrop to views from the east. The existing landscape is of a rural character and part of the greater South Creek Valley.

The overall landscape character surrounding the airport is open and rural with expansive views possible from surrounding hill tops and higher elevations to the west. The area's character is also defined by cleared pastureland, large lot residences (both single or double storey) set back from the road and punctuated with exotic planting. Patches of remnant vegetation exists within the airport site, particularly along creek lines, road edges and near farm dams.

The area north of Elizabeth Drive is rural pasture land with scattered remnant vegetation, farm dams and open views of the landscape. Immediately north of the site are farm buildings generally set well back from Elizabeth Drive and do not have a strong visual connection with the road. Northeast of the airport site is a landfill which is setback and screened from Elizabeth Drive and therefore has only a minor visual presence. Badgerys Creek runs south-north forming the eastern and part of the southern site boundary. The remnant vegetation along its edges provides a natural character which contrasts with the overall open rural character of the rest of the site. It also provides visual screening of views to the eastern areas of the airport site from further east.

East of the airport site there is more regular patterning of lots, homes and farm buildings with smaller lot sizes aligned perpendicular to the streets. Roads in the area have undefined edges and contribute to the overall rural character. A good example can be seen in Plate 1.

Plate 1 View south from Lawson Road

South of the site near Badgerys Creek Road, the area is characterised by large, rural residential lots and farms on undulating topography. Homes are generally setback from the road and characterised by a mix of remnant vegetation, exotic planting, farm dams and open lawn. Examples of this can be seen in Plates 2 and 3.

Plate 2 View south from Badgerys Creek Road

Plate 3 View west from Badgerys Creek Road

The Bringelly and Greendale areas south and southwest of the proposed airport site are characterised by large lot rural houses within a mix of remnant native vegetation and exotic tree plantings and mown grass areas as shown in Plate 4. The landscape opens up in areas with views west in the direction of the Blue Mountains as shown in Plates 5 and 6.

Plate 4 View north from Dwyer Road, Bringelly

Plate 5 View west from Dwyer Road, Bringelly toward the Blue Mountains

Plate 6 View northeast from Greendale Road, Wallacia

Luddenham is the most urbanised area near the proposed airport. It consists of a commercial area accessed from The Northern Road and a residential area just to the east. Dwellings in this area are closer together and set close to the road, as shown in Plate 7. The area appears to have grown minimally within the last few years with the addition of 4-5 homes on Ethan Close. Despite a more urban character at Luddenham, the area immediately surrounding is rural with open views of the landscape to the south and east as shown in Plate 8.

Plate 7 View from Adams Road looking north west along Jamison Street, Luddenham

Plate 8 View from Adams Road looking south west, Luddenham

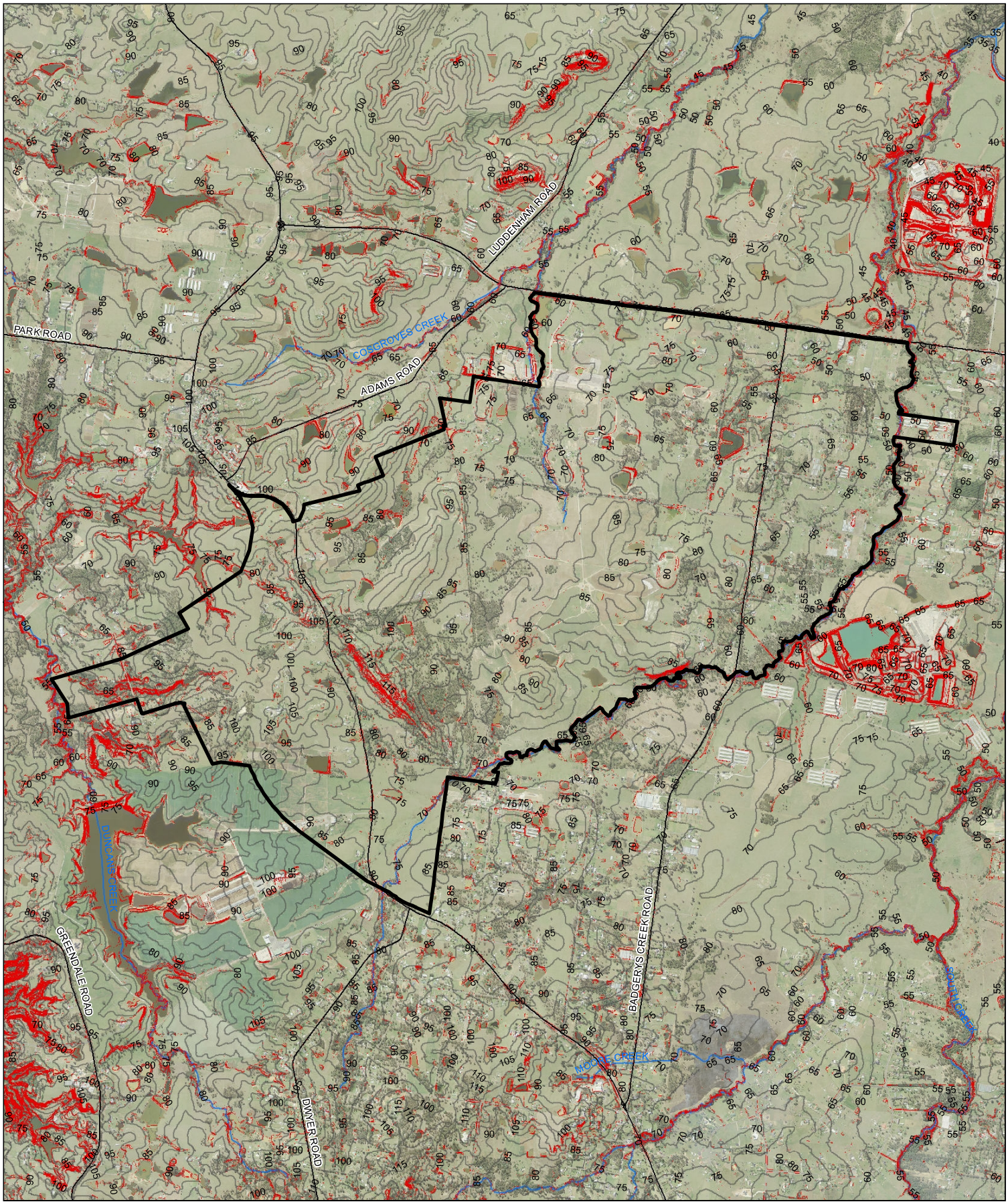
Mount Vernon is a sparsely populated rural suburb approximately five kilometres north east of the proposed airport. Much of the suburb consists of undulating topography and some rural-residential properties have views over the wider area including to the west toward the proposed airport site and the Blue Mountains.

Plate 9 View south from Mount Vernon Road, Mount Vernon

3.2 Landform

The topography of the airport site and surrounding area is typical of the Cumberland Plains, consisting of gently rolling foot hills with local relief of 10-30 metres. Slopes are generally less than 5 percent but sometimes to 10 percent and very occasionally up to 10 to 20 percent. Crests and ridges are broad (200-600 metres) and rounded with convex upper slopes grading into concave lower slopes (Bannerman and Hazelton, 1990).

A ridge line with a high point of 118 metres AHD occurs in the western portion of the site near The Northern Road. It offers views over the immediate area and the much wider landscape. Areas in the western half of the airport site are generally at a higher elevation whereas they are lower and flatter along Badgerys Creek with the lowest point being 43 metres in the north east corner of the site near Elizabeth Drive. Elevations more typically range between 60 and 90 metres throughout the central areas of the airport site, refer Figure 1.



LEGEND

- Airport site
- Existing contours

Slope (percent)

- 0 - 20
- Above 20

Paper Size A3

0 250 500 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Job Number 21-24265
Revision A
Date 30 Aug 2016

Site topography

Figure 1

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Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data Source: Please refer to "Digital Data Sources" on the second page of the EIS

3.3 Vegetation

The airport site contains gently undulating, low hills on shale and broad flats on alluvium on the Cumberland Plain. The vegetation comprises remnant patches of grassy woodland and narrow corridors of riparian forest within extensive areas of grassland, cropland and cleared, developed land. The main land uses are agriculture and low density rural-residential development.

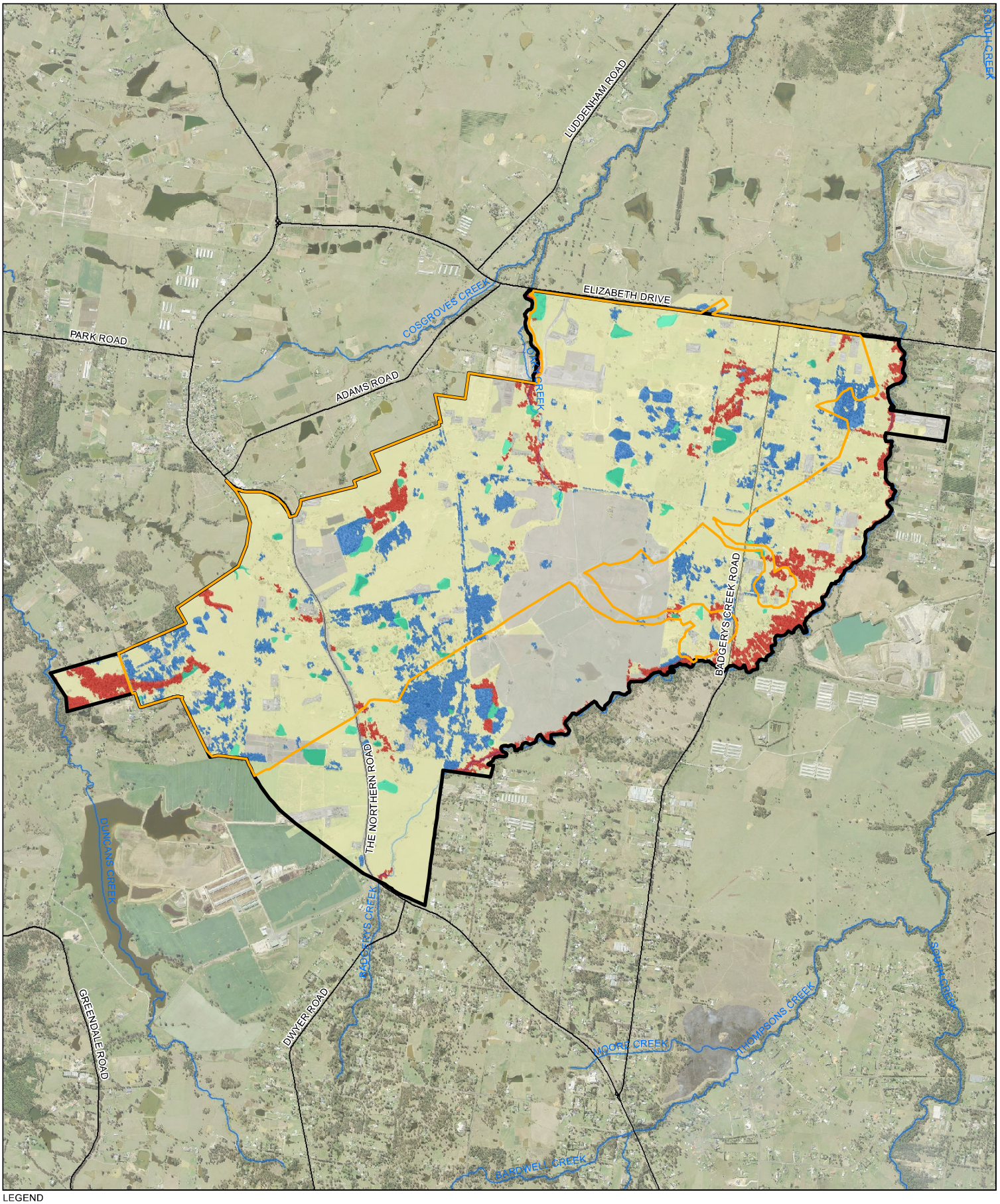
The majority of the airport site contains exotic grassland with pasture species such as Kikuyu (*Pennisetum clandestinum*) and Paspalum (*Paspalum dilatatum*) along with some native species such as Kangaroo Grass (*Themeda australis*). There are occasional isolated paddock trees that are remnants of adjoining native woodland and forest.

The most extensive native vegetation type is Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*Eucalyptus moluccana*) woodland with a grassy understorey and occasional dense patches of the shrub species Native Blackthorn (*Bursaria spinosa spinosa*). This vegetation generally occurs in small, remnant patches surrounded by grassland.

The riparian corridors of Badgerys Creek and other drainage lines through the airport site contain denser forest of Forest Red Gum, Grey Box and Cabbage Gum (*Eucalyptus amplifolia*) along with Swamp Oak (*Casuarina glauca*), Broad-leaved Apple (*Angophora subvelutina*) and paperbarks (*Melaleuca* spp.). Understorey vegetation is similar to the grassy woodland on higher ground but also contains moisture loving species such as rushes and sedges.

There are a large number of dams and flooded depressions throughout the airport site formed by the construction of barriers across small drainage lines. These water bodies contain a moderate diversity and abundance of native wetland plants such as Cumbungi (*Typha orientalis*) and Spike Rush (*Eleaocharis sphacelata*).

The condition of native vegetation varies across the airport site as a result of previous land uses and grazing intensity. Areas that have been historically cleared and/or heavily grazed now contain regrowth vegetation in poorer condition. There is moderate to severe weed infestation throughout, with linear remnants along roads and isolated patches in agricultural land the most severely affected. Notwithstanding the generally moderate to poor condition of vegetation at the airport site, it has high conservation significance as a result of the presence of threatened species and ecological communities and the generally limited extent and quality of similar vegetation in the Western Sydney region.



LEGEND

- Airport site
- Stage 1 construction area

Habitat type

- Cleared land
- Grassland
- Riparian forest
- Wetland
- Woodland

Paper Size A3

0 250 500 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Job Number	21-24265
Revision	A
Date	30 Aug 2016

Vegetation zones

Figure 2

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Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data Source: Please refer to "Digital Data Sources" on the second page of the EIS

3.4 Lane use

Pastoral and horticultural land uses remain the primary land uses in the area. Large blocks of agricultural land are found to the north and west, while rural residential and agricultural properties are generally concentrated to the east and south.

Figure 3 shows the various types of land uses immediately surrounding the site. This includes the following large, land uses:

- Elizabeth Drive Landfill containing non-putrescible and industrial waste and located approximately one kilometre north of the airport site;
- Twin Creeks Golf & Country Club, a 200 lot residential estate and golf course approximately five kilometres north of the airport site;
- Boral Brickworks brick pit and production facility located approximately one kilometre east of the airport site;
- Inghams Multiplication Farm - a large commercial agricultural use located approximately one kilometre east of the airport site;
- Royal Australian Air force Telecommunications, Bringelly – This is a military base located approximately two kilometres southeast of the airport site;
- The University of Sydney - a rural farm located approximately four kilometres south west of the airport site; and
- Bents Basin State Conservation Area – a recreation area located approximately 5 kilometres south west of the airport site.

The following broad character zone map depicts adjacent land uses (Figure 3).

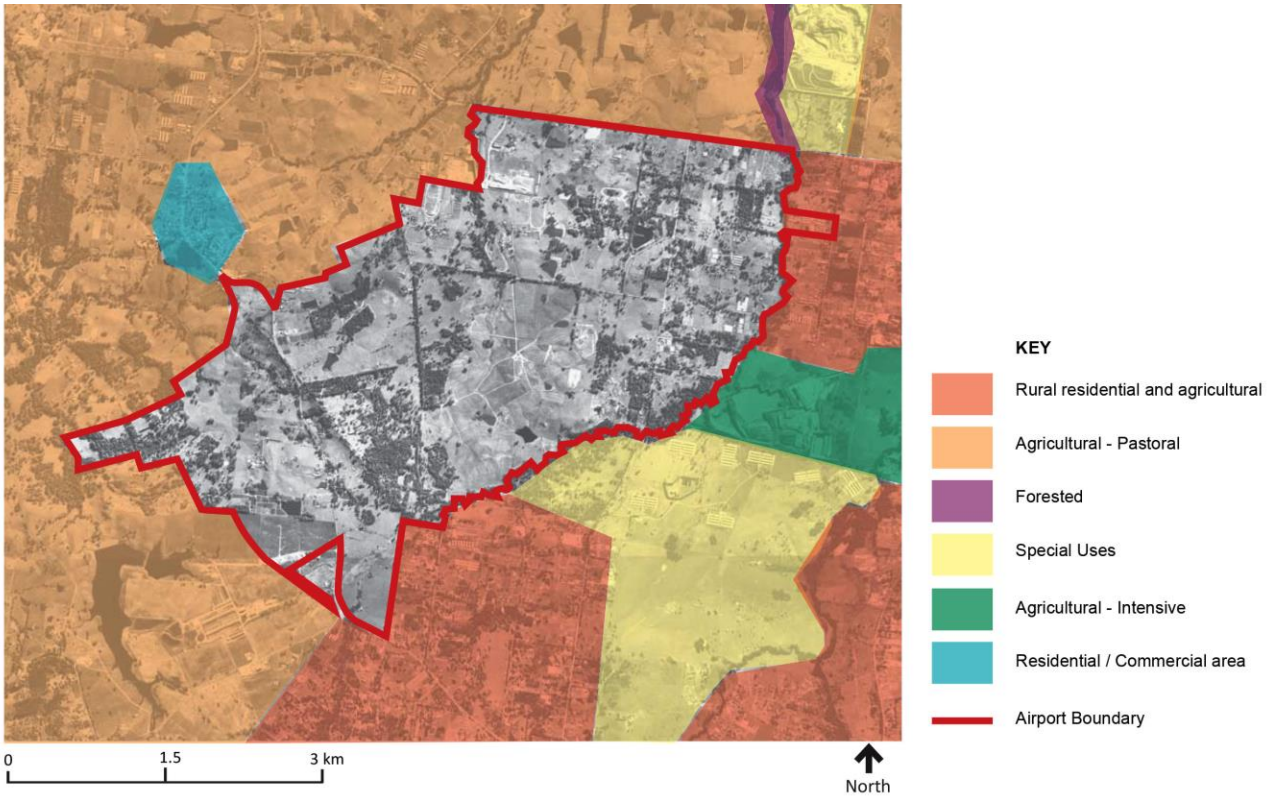


Figure 3 Surrounding land uses

3.5 Heritage items

An understanding of the area's historic landscape is considered important in a landscape character assessment as it looks at the material remains of the past in order to help understand the present-day landscape and inform the overall landscape character.

Based on a review of the findings of the European and other heritage technical report (RPS 2015), there is one item of State heritage significance located near the airport site. Other items of European heritage which are locally listed on either the Liverpool or Penrith LEPs in the suburbs of Luddenham and Badgerys Creek are shown in Table 2.

Table 2 Heritage items near the airport

Item No.	Name and location	Heritage significance	Type of impact
SA1	Former Overseas Telecommunications Commission site group Badgerys Creek Road, Bringelly	Local	Indirect: Visual impact.
SA2	Kelvin 30 The Retreat, Bringelly	State	Indirect: Visual impact, impact to ambience of site.
SA3	Two RAAF water tanks Badgerys Creek Road, Bringelly	Local	Indirect: Visual impact.
SA4	Mount Pleasant homestead 3 Shannon Road, Bringelly	Local	Indirect: Visual impact, impact to ambience of site.

Item No.	Name and location	Heritage significance	Type of impact
SA5	Bringelly Public School group 1205 The Northern Road, Bringelly	Local	None
SA6	Wilmington Reserve 17 Jamison Street, Luddenham	Local	Indirect: Visual impact, impact to ambience of site
SA7	Luddenham Public School The Northern Road, Luddenham	Local	Indirect: Visual impact, impact to ambience of site.
SA8	Lawson's Inn Lot 2 DP 623457, Luddenham	Local	Indirect: Visual impact, impact to ambience of site.
SA9	McGarvie Smith University Farm 124 Elizabeth Drive, Badgerys Creek	Local	Indirect: Visual impact, impact to ambience of site.
SA10	Brick cottage 21-55 Campbell Street, Luddenham	Local	Indirect: Visual impact, impact to ambience of site.
SA11	Luddenham Road alignment	Local	Indirect, direct: Visual impact, impact to southern alignment of Luddenham Road following Elizabeth Drive realignment
SA12	Weatherboard cottage 3065-3067 The Northern Road, Luddenham	Local	Indirect: Visual impact, impact to ambience of site.
SA13	Weatherboard cottage 3075 The Northern Road, Luddenham	Local	Indirect: Visual impact, impact to ambience of site.
SA14	Luddenham Progress Hall 3091-3095 The Northern Road, Luddenham	Local	Indirect: Visual impact, impact to ambience of site.
SA15	Luddenham Uniting Church and cemetery 3097-3099 The Northern Road, Luddenham	Local	Indirect: Visual impact, impact to ambience of site.
SA16	St James Anglican Church and cemetery 3101-3125 The Northern Road, Luddenham	Local	Indirect: Visual impact, impact to ambience of site.
SA17	Showground 428-452 Park Road, Luddenham	Local	Indirect: Visual impact, impact to ambience of site

Item No.	Name and location	Heritage significance	Type of impact
SA18	Shadforth Monument Greendale Road, Greendale	Local	None
SA19	Private dwelling (former St Marks) Greendale Road, Greendale	Local	None
SA20	Greendale Roman Catholic Cemetery Greendale Road, Greendale	Local	None
SA21	Vertical slab dairy Lot 10, Adams Road, Badgerys Creek	Local	Indirect: Visual impact, impact to ambience of site.
SA22	Evergreen homestead Off Derwent Road, Bringelly	Local	Indirect: Visual impact, impact to ambience of site.

Aboriginal cultural heritage values also contribute to the visual context of the airport site and more broadly to the local area. Badgerys Creek was a focus for past Aboriginal occupation and contains a relatively high predicted subsurface occurrence of stone artefacts and archaeological deposits. Two identified items on the site comprise a modified tree (site ID B40) and a sandstone outcrop with grinding grooves (site ID B120) which are both located in close proximity to Badgerys Creek. (Navin Officer Heritage Consultants, 2015). Other sites existing within the airport site and more broadly in the Western Sydney region are likely to continue to be displaced as a result of urbanisation

Management of the Aboriginal heritage items and values currently present at the airport site may assist in reducing the visual impacts of the airport development. Both can be effected through the maintenance and improvement of the natural vegetation structure in the riparian zone along Badgerys Creek and where possible, along other property boundaries and creek lines.

4 Visual impact assessment

The visual impact assessment of the proposed airport involves the identification of the visual catchment and key representative viewpoints, the sensitivity of the selected viewpoints and assessment of their visual impact.

Potential visual impacts were identified following review and consideration of the Airport Plan and the Draft Construction Planning Report (GHD, May 2015) for both the airport construction and operation. Indicative layouts for the Stage 1 and longer term development found in the Airport Plan provided information on the general arrangement and location of airport facilities.

Indicative information on maximum building heights for items such as the terminals and car parks was back calculated from the maximum permissible heights identified from the obstacle limitations surfaces for the airport which governs the protection of the airspace from protrusions. In lieu of specific information on building heights, the parameters used in this assessment are expected to be very conservative.

4.1 Visual catchment

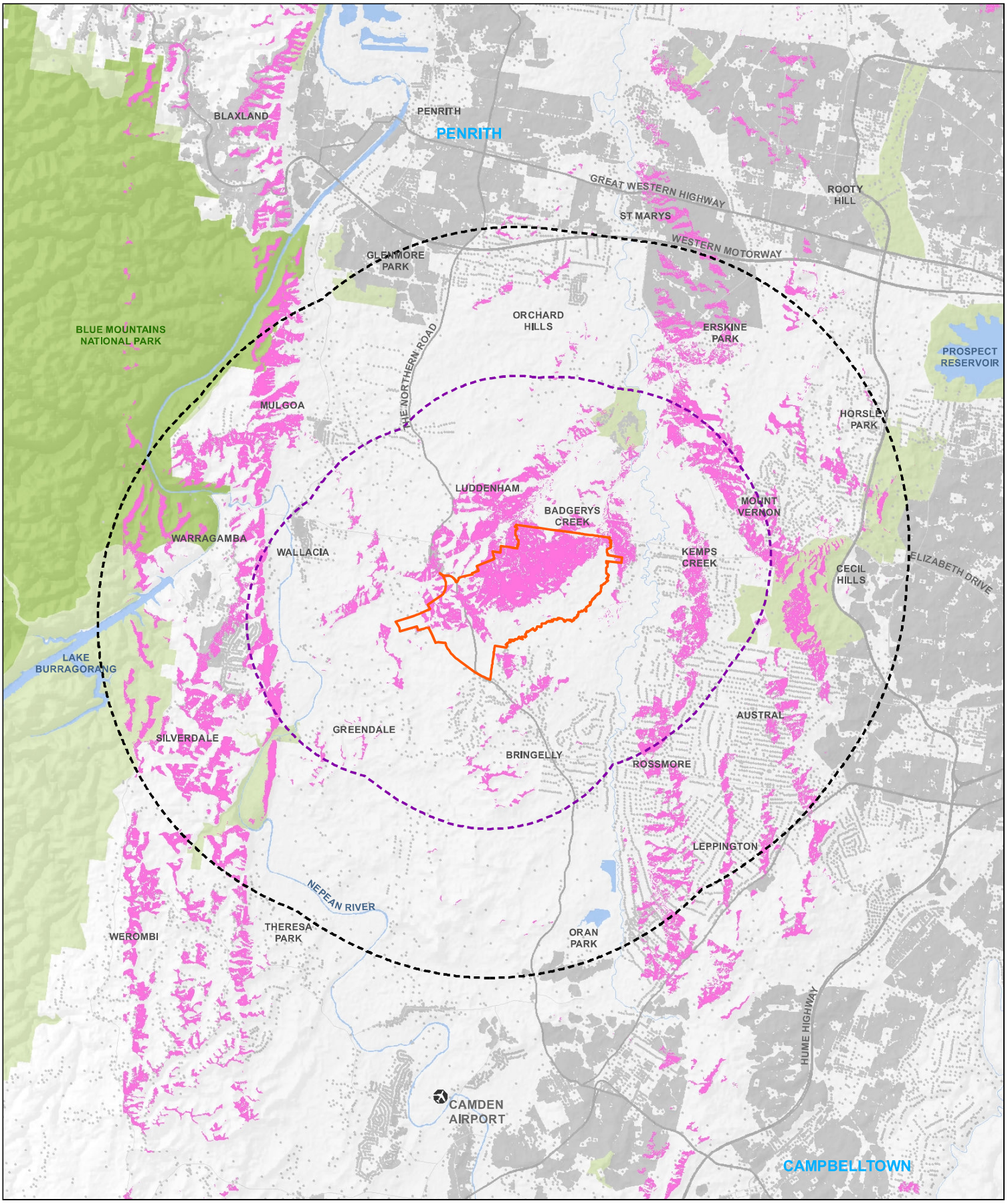
The visual catchment of a site is the extent of the landscape that can be viewed from the site and, by extension, the extent of locations from which the site can be seen. Landscape vegetation, land use and landform all play large roles in determining the visual catchment.

An initial desktop survey was undertaken to identify and consider possible representative viewing points from which the proposed airport may be visible. Field surveys were then conducted to 'ground truth' the desktop survey. Ground truth means to check and confirm decisions made in the desktop survey by visiting locations and confirming that the conclusions are generally as anticipated.

A Visibility Envelope is a map, usually digitally produced, showing areas of land within which a development is theoretically visible. For this study, two maps were generated for areas within a 10 kilometre radius of the airport based on the maximum allowable structure heights within the airport site as defined by the obstacle limitations surface (OLS) for both the Stage 1 area and the longer term development. The purpose was to get a better understanding of the potential visibility of the airport development from the surrounding areas and to inform selection of representative viewpoints for analysis. The OLS defines limits to which structures or objects may project into the airspace to ensure the safety of aircraft and includes both onsite and offsite elements.

Figures 4 and 5 provide indicative visibility envelope maps for the Stage 1 and longer term airport developments. They show the potential visual catchment based on existing topography and the maximum allowed building heights of key buildings and structures on the site such as the airport control tower, terminal buildings and other major structures based on the Stage 1 and the longer term master plans for airport development. Each visibility envelope map gives an indication of potential views in the short and longer term helping to inform the selection of representative viewpoints for assessment.

The visibility envelope is a guide of potential views only and does not take into consideration other factors such as existing structures in the surrounding areas, trees or vegetation such as in forested areas of the Blue Mountains that may block or prevent views of the airport.



LEGEND

- Airport site
- 5km Site Buffer
- 10km Site Buffer
- Areas of no theoretical visibility
- Areas of theoretical visibility

Paper Size A3

0 1,000 2,000 4,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Visibilty Envelope
Stage 1 development

Job Number 21-24265
Revision A
Date 30 Aug 2016

Figure 4

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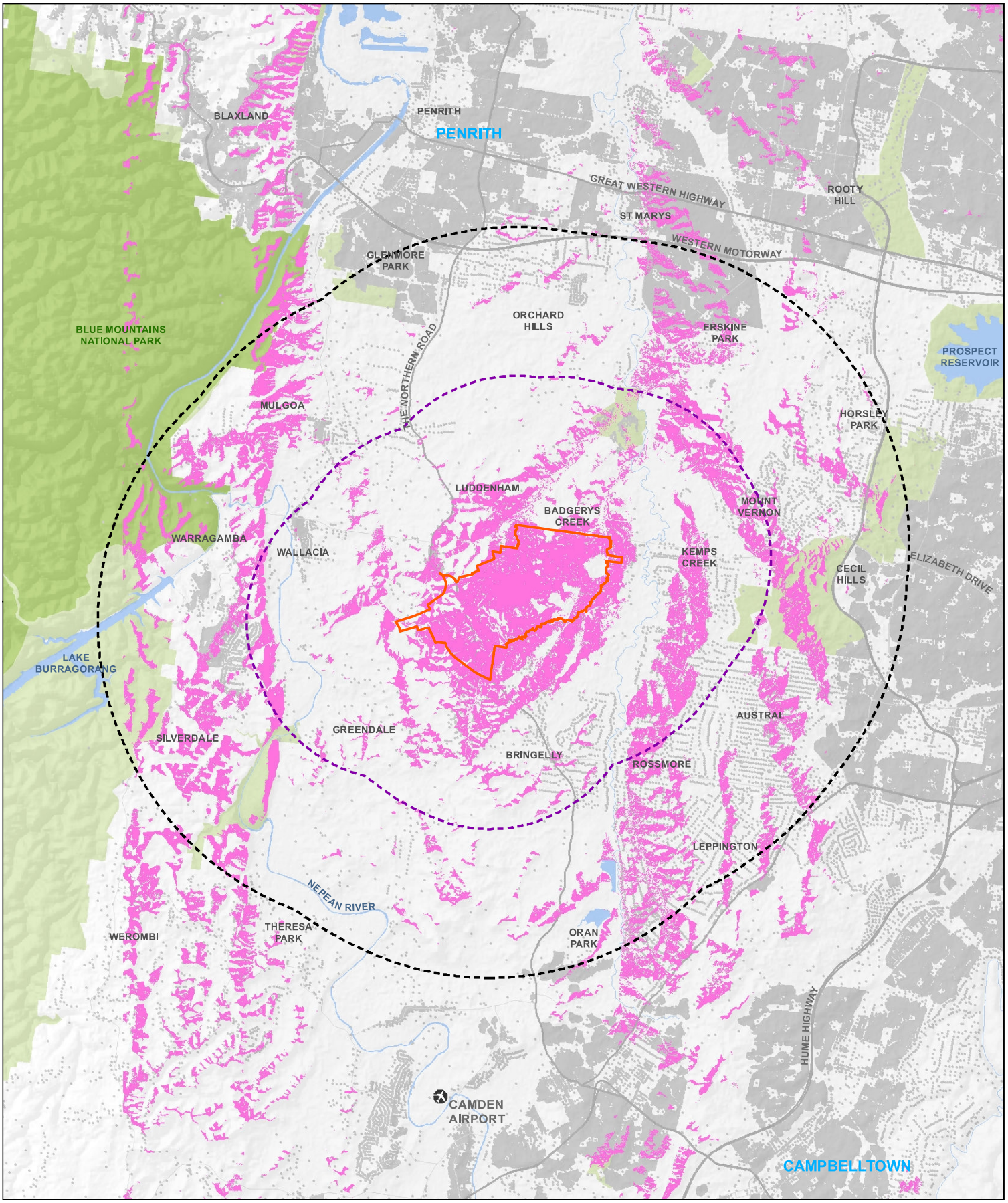
Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data Source: Please refer to "Digital Data Sources" on the second page of the EIS



LEGEND

- Airport site
- 5km Site Buffer
- 10km Site Buffer
- Areas of no theoretical visibility
- Areas of theoretical visibility

Paper Size A3

0 1,000 2,000 4,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Visibility Envelope
Long Term Development

Job Number 21-24265
Revision A
Date 30 Aug 2016

Figure 5

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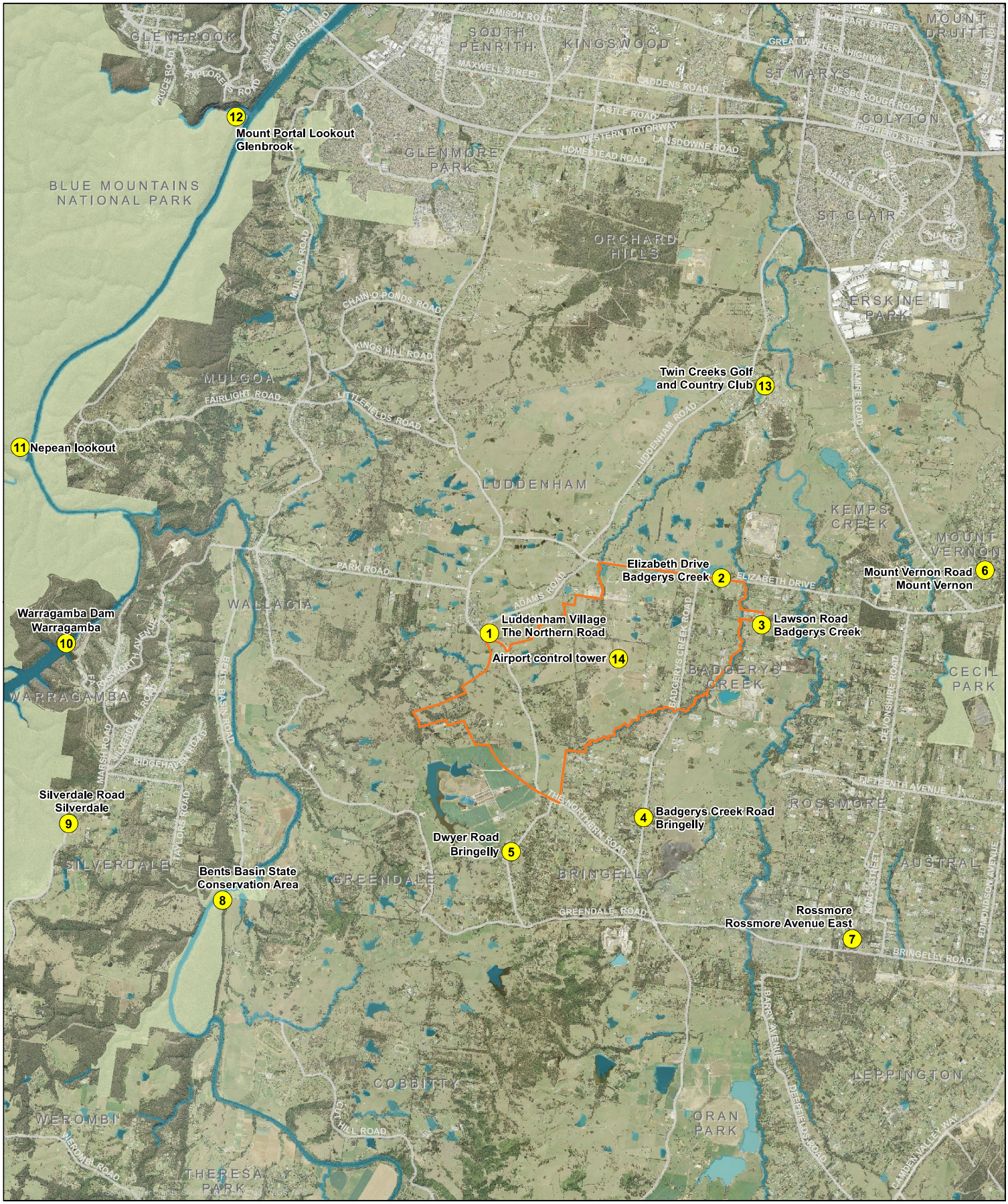
Level 15, 133 Castlereagh Street Sydney NSW 2000 T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data Source: Please refer to "Digital Data Sources" on the second page of the EIS

4.2 Selection of representative viewpoints

The viewpoints selected in this assessment are intended to represent a range of typical views found within the area. Figure 6 shows the location of the selected view points from which assessments of visual impacts are made in Section 4.3.

The selected viewpoints are considered to represent locations where a reduction in visual amenity would have some visual impact either because of: the duration of the view (such as views from residential areas), the importance of visual amenity to the experience of the location (such as recreational areas) or where there are large numbers of potential viewers (such as busy roads).



LEGEND

- Airport site
- Waterways
- Parks and reserves
- Roads
- Viewpoints

Paper Size A3

0 0.5 1 2

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Job Number	21-24265
Revision	A
Date	30 Aug 2016

Selected representative viewpoints

Figure 6

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data Source: Please refer to "Digital Data Sources" on the second page of the EIS

Table 3 summarises the location of selected representative viewpoints shown in Figure 6 and indicates the relative heights of the viewpoints and their distance to the airport control tower which is the tallest structure located near the centre of the airport.

Table 3 Relative heights and offsets of representative viewpoints from the Airport

View point no.	Location	Height (approx AHD)	Approx distance to the airport control tower	Area type
1	Luddenham Village, east of The Northern Road	100-105	3 kilometres	Commercial & residential area
2	Elizabeth Drive, Badgerys Creek	65-90	2 kilometres	Road
3	Lawson Road, Badgerys Creek	60-65	3 kilometres	Rural residential & agricultural area
4	Badgerys Creek Road, Bringelly	60-75	2 kilometres	Rural residential & agricultural area
5	Dwyer Road, Bringelly	105	5 kilometres	Rural residential
6	Mount Vernon Road, Mount Vernon	80	7 kilometres	Rural residential
7	Rossmore, Rossmore Avenue East	90	7 kilometres	Rural residential
8	Bents Basin State Conservation Area	45	10 kilometres	Recreational area
9	Silverdale Road, Silverdale	210	13 kilometres	Rural residential
10	Warragamba Dam, Warragamba	155	12 kilometres	Recreational area
11	Nepean lookout, Glenbrook	115	13 kilometres	Recreational area
12	Mount Portal Lookout, Glenbrook	150	14 kilometres	Recreational area
13	Twin Creeks Golf and Country Club	45-50	6 kilometres	Recreational and residential area

4.3 Assessment of selected viewpoints

The extent of visual impact of the airport is largely determined by the visual prominence of the elements proposed, the extent the proposal reduces pre-existing views, and number of visual receivers likely to be impacted by any change in the visual landscape character of the site post development.

In making a judgement about what is a significant or high impact, the following points were taken into consideration:

- The sensitivity to changes in views and visual amenity;
- The effects on visual receivers at recognised and important public viewpoints; and
- Large-scale changes which introduce new, non-characteristic, discordant or intrusive elements into a view.

There will be three general types of visual impacts created by the airport.

1. Temporary views of construction activity.
2. Permanent views of the airport site and associated infrastructure.

3. Ongoing views of aircraft taking off and/or landing.

The assessment also considers the visual impact coinciding with different stages of the proposed development including:

- Construction phase – Temporary construction activities associated with the Stage 1 development and indicative activities associated with construction of the longer term airport development;
- Stage 1 - Operational airport at opening with one runway, airport control tower, terminal and facilities; and
- Longer term development – Operational airport including two runways, airport control tower, and expanded terminal and facilities.

The assessment of permanent visual impacts associated with the Stage 1 development as well indicative impacts associated with the longer-term development on the representative viewpoints are summarised in Table 4 below. Due to the long term nature of the airport development, it was decided not to assign visual impact ratings for the longer term.

A separate assessment of the impacts of construction activities, aircraft operation and operational lighting can be found in section 4.5.

Table 4 Assessment of selected viewpoints

Viewpoint 1 – Luddenham village	
Stage 1	**SENSITIVITY = High-Moderate** The viewpoint is representative of views from the Luddenham commercial and residential area. Views to the south and west will be dominated by the airport development and boundary fence in the foreground. There is assumed cultural value placed on the existing rural landscape by local residents where visual amenity is important and where residents and workers will be subject to long duration views. **MAGNITUDE = High-Moderate** The existing ridge line south of the Luddenham residential area will assist in restricting views directly south from residents however airport development along the western boundary will likely be partially or directly visible by residents and workers. Viewing distance is approximately one kilometre from the western end of the runway and there will be views of aircraft taking off or landing. Furthermore, there is little visual capacity of the surrounding rural landscape to absorb the airport development. **VISUAL IMPACT** The likely visual impact from this location is Moderate-High due to there being a noticeable reduction in the amenity of existing views from airport development and aircraft.
Longer term (indicative)	**SENSITIVITY** It is expected that the character of the broader area is expected to change from rural to more urbanised with the development of the Western Sydney Employment Areas particularly to the north and east of Luddenham, the upgrade of The Northern Road and Elizabeth Drive and future implementation of the M12 motorway. In this context, the sensitivity of viewers will decrease over time. **MAGNITUDE** There will be an increased visual prominence through the expansion of the airport terminal complex, the additional second runway, maintenance, cargo, commercial and car parking facilities. There will likely also be an increased amount of aircraft taking off and landing from the second runway and overall increase in air traffic in general.

Viewpoint 2 – Elizabeth Drive, Badgerys Creek	
Stage 1	**SENSITIVITY = Moderate** The viewpoint is representative of views from drivers and passengers of vehicles using Elizabeth Drive. Views are brief however are at relatively close distance to the northern areas of the airport and runway. **MAGNITUDE = High** The existing landscape character within the airport site will be highly modified with landform changes and removal of the existing vegetation. The scale and nature of the airport site development during operation will be noticeable to visual receivers with views of airport features and boundary fence in the foreground. Aircraft will be similarly prominent as flights are directed over Elizabeth Drive from the eastern end of the airport runway based on current flight path information. **VISUAL IMPACT** The likely visual impact from this section of Elizabeth Drive is regarded as Moderate-High due to there being a noticeable reduction in the amenity of the surrounding views from the airport development and aircraft.
Longer term (indicative)	**SENSITIVITY** Minimal increases to sensitivity could be expected to occur with higher road traffic levels over time. **MAGNITUDE** The context of the view will change over time with areas north of Elizabeth Drive expected to be developed as part of the WSEA development and future implementation of the M12 motorway, however it is likely the aircraft will become more prominent due to expected increases in aircraft movements over Elizabeth Drive.
Viewpoint 3 – Lawson Road, Badgerys Creek	
Stage 1	**SENSITIVITY = High** The viewpoint is representative of views from rural residences and farms approximately five hundred meters east of the airport boundary. Views to the west of the airport features may be possible from some properties and be dominated by the airport boundary fence in the foreground. There is assumed cultural value placed on the existing rural landscape and the landscape along Badgerys Creek by local residents where visual amenity is important and where residents and workers will be subject to long duration views. **MAGNITUDE = Moderate** The clearance of vegetation and overall extent of change in topography for the operation of the airport is likely to be visible from some properties in this area however it will not be prominent due to the intervening vegetation along Badgerys Creek obscuring much of the airport site. Aircraft movements will be directed to the north over Elizabeth Drive and to the south based on current flight path information. **VISUAL IMPACT** The likely visual impact from this location is Moderate-High due to the proximity of viewers to airport development leading to a reduction in the amenity of existing views.
Longer term (indicative)	**SENSITIVITY** It is expected that the character of the broader area will change from rural to more urbanised with the development of the industrial precincts and employment areas as part of the planned South West Growth Centre and the upgrade of key roads such as Lawson Road and Elizabeth Drive. In this context, it could be expected that the Sensitivity of viewers will decrease over time. **MAGNITUDE** There will be a significant increase in the visual prominence of the airport through the expansion of the terminal complex, maintenance, cargo, commercial and long term employee car park and the second airport runway one and a half to two kilometres to the west. Aircraft will be prominent with aircraft movements over Lawson Road and an increased amount of aircraft taking off from the second runway.

Viewpoint 4 – Badgerys Creek Road, Bringelly	
Stage 1	**SENSITIVITY = High-Moderate** The viewpoint is representative of views from rural residences and farms one to two kilometres south of the airport boundary. Views to the north of the airport features may be possible from some properties. There is assumed cultural value placed on the existing rural landscape by local residents where visual amenity is important and where residents and farm workers will be subject to long duration views. **MAGNITUDE = Moderate-Low** The clearance of vegetation and overall extent of change in topography for the operation of the airport is likely to be visible from some properties in this area however it will not be prominent due to the intervening vegetation obscuring much of the airport site. Aircraft will be visible as flights are directed in a north-south direction approximately one kilometre to the east of Badgerys Creek Road based on current flight path information. **VISUAL IMPACT** The likely visual impact from this location is Moderate due to there being a reduction in the visual amenity of the view.
Longer term (indicative)	**SENSITIVITY** It is expected that the character of the broader area will change from rural to more urbanised with the development of the industrial precincts and employment areas as part of the planned South West Growth Centre and the upgrade of key roads such as Bringelly and The Northern Road identified in the Western Sydney Infrastructure Plan. In this context, the sensitivity of viewers would be expected to decrease over time. **MAGNITUDE** There will be a significant increase in the visual prominence of the airport through the expansion of the terminal complex, maintenance, cargo, commercial and other airport facilities as well as a second airport runway. There will likely also be an increased amount of aircraft taking off and landing from the opening of the second runway and overall increase in visible aircraft with the aircraft movements over Badgerys Creek Road on an east-west flight path orientation.
Viewpoint 5 – Dwyer Road, Bringelly	
Stage 1	**SENSITIVITY = High-Moderate** The viewpoint is representative of views from rural residences approximately two kilometres south of the airport boundary. There is assumed cultural value placed on the existing rural landscape by local residents where visual amenity is important and where residents will be subject to long duration views. **MAGNITUDE = Moderate-Low** Views to the north of airport features during its operation are unlikely due to existing vegetation and topography. Aircraft will be visible both day and night as aircraft movements are directed in a north-south direction approximately two kilometres to the east of Dwyer Road based on current flight path information. **VISUAL IMPACT** The likely visual impact is Moderate due to there being a general reduction in the visual amenity from aircraft.
Longer term (indicative)	**SENSITIVITY** The sensitivity of this view would be expected to increase as a result of increases in the overall number of visual receivers over time. **MAGNITUDE** Increased development south of the airport as part of the planned South West Growth Centre and the upgrade of key roads such as Bringelly Road and The Northern Road as identified in the Western Sydney Infrastructure Plan will further reduce the relative prominence of the airport.

Viewpoint 6 – Mount Vernon Road, Mount Vernon	
Stage 1	**SENSITIVITY= High-Moderate** The viewpoint is representative of views from rural properties at elevations higher than Badgerys Creek approximately five kilometres from the airport boundary. Some properties have broad views of areas to the west and possibly of the Blue Mountains beyond. Sensitivity is derived from the assumed cultural value placed on the existing rural landscape by local residents where visual amenity is important and where residents will be subject to long duration views. **MAGNITUDE = Moderate** Airport features such as the control tower as well as aircraft taking and landing will likely be visible. Views of some areas within the airport site however may be partially screened by vegetation and topography depending on the elevation and aspect of individual residences. The overall landscape has some capacity to absorb views of the development given the views consist of an existing modified landscape character. Aircraft may be seen but at a distance of over four kilometres based on current flight path information. **VISUAL IMPACT** The likely visual impact is Moderate-High due to there being a noticeable reduction in the amenity of the view from the airport development and aircraft.
Longer term (indicative)	**SENSITIVITY** It is expected that the character of the broader area is expected to change from rural to more urbanised with the development of the Western Sydney Employment Areas particularly to the north of the airport and the upgrade of Elizabeth Drive and future implementation of the M12 motorway. In this context, the sensitivity of viewers will decrease over time. **MAGNITUDE** There will be an increased visual prominence of the airport through the expansion of the terminal complex, the additional second runway, maintenance, cargo, commercial development and car parking facilities. There will likely also be an increased amount of aircraft taking off and landing from the second runway and overall increase in air traffic with the flight paths from the second runway orientated in a northwest direction over the Mount Vernon Area.
Viewpoint 7- Rossmore Avenue East, Rossmore	
Stage 1	**SENSITIVITY = Moderate** The viewpoint is representative of views from rural residential and agricultural properties approximately seven kilometres to the airport boundary. Properties in this area of Rossmore are at elevations higher than Badgerys Creek with some having broad views toward the west and northwest. The visual sensitivity of this location is derived from it being a residential and agricultural area, where visual amenity is important and where residents and workers are subject to long duration views. **MAGNITUDE = Low** Changes to the landscape including vegetation clearance, earthworks and new structures such as the control tower and terminal will result in a noticeable change in the view and a reduction in visual amenity. The view however is filtered by local vegetation. Aircraft movement will be visible in the sky at a distance of over five kilometres based on current flight path information. **VISUAL IMPACT** The likely visual impact on this view is regarded as Moderate-Low due to there being a minor reduction in the amenity of the view from the airport development.

Longer term (indicative)	**SENSITIVITY** It is expected that the character of the broader area will change from rural to more urbanised with the development of the industrial precincts and employment areas as part of the planned South West Growth Centre and the upgrade of key roads such as Bringelly Road identified in the Western Sydney Infrastructure Plan. In this context, the sensitivity of viewers would be expected to decrease over time. **MAGNITUDE** There will be an increased visual prominence of the airport through the expansion of the terminal complex, the additional second runway, maintenance, and cargo, facilities in the southern half of the airport site. There will likely also be an increased amount of aircraft taking off and landing from the second runway and overall increase in air traffic with the flight paths from the second runway orientated in a northwest direction over Bringelly Road, Rossmore based on current flight path information.
Viewpoint 8 – Bents Basin State Conservation Area	
Stage 1	SENSITIVITY = Moderate Some visual sensitivity is derived at this location from the importance of visual amenity due to its use as a State Recreation Area by visitors and staff. Visitor numbers will fluctuate seasonally and are only temporary. At night the location will have a higher degree of sensitivity due to the nature of use as an overnight recreation use. MAGNITUDE = Low There are no direct views of the airport features however visual receivers are able to see aircraft in the sky from a distance of approximately two kilometres based on current flight path information. VISUAL IMPACT The likely visual impact is Moderate-Low due to there being only a minimal perceivable reduction in visual amenity from aircraft.
Longer term (indicative)	SENSITIVITY The location is expected to remain a State Recreation Area and it is assumed that there is significant value placed on the natural landscape by visitors. Additional recreation activity could be expected in the future. In this context, an increase of sensitivity is expected. MAGNITUDE There would be no direct views of the airport features however aircraft will be more prominent with the location of a flightpath over the recreation area and an expected increase in air traffic having a greater degree of visual impact.
Viewpoint 9 – Silverdale Road, Silverdale	
Stage 1	**SENSITIVITY = Moderate** The visual sensitivity of this location is derived from it being an elevated, rural residential area with broad expansive views over surrounding areas, where visual amenity is important and where residents are subject to long duration views. Residences are located approximately 10 kilometres from the airport boundary. **MAGNITUDE = Low** Vegetation clearance for the airport will result in a change in the view and a reduction in visual amenity in the vicinity of this view, particularly from houses that have may have an unobstructed view of the Badgerys Creek landscape. The new runway and airport features will be visible from some residences however limited in others depending on the aspect, topography and vegetation. Visual impacts from aircraft are possible due to the southwest-northeast alignment of the flight path approximately two to three kilometres to the south based on current flight path information. **VISUAL IMPACT** The likely visual impact is Moderate-Low due to there being a noticeable reduction in the amenity of views to residences.

Longer term (indicative)	**SENSITIVITY** The sensitivity of this view would be expected to be similar as the number of viewers and the duration of the views is unlikely to change. **MAGNITUDE** Further development of the areas both north and south of the airport will alter the existing visual landscape as currently seen from this area from rural/semi-rural to increasingly urbanised. This change to a more urban environment will likely result in a decrease in the sensitivity of visual receivers in this area. The overall landscape will have greater capacity to absorb views with the expected urbanisation of areas north and south of the airport. After the opening of the second runway, views of aircraft will be more prevalent and closer to viewers based on current flight path alignment thus having a greater degree of visual impact.
Viewpoint 10 – Warragamba Dam and Recreation Area	
Stage 1	**SENSITIVITY = High** Visual sensitivity is derived at this location from the importance of visual amenity due to its use as a recreation, educational and historic area. It is assumed that there is significant value placed on both the natural and cultural landscape by visitors and staff. As an operational facility, workers will be subject to long duration views, visitors however are only temporary. **MAGNITUDE = Negligible** There are no direct views of the airport features and aircraft will not be prominent at a distance of approximately five kilometres from the recreation areas and visitors centre. **VISUAL IMPACT** The likely visual impact is Negligible due to there being little or no perceivable reduction in visual amenity.
Longer term (indicative)	**SENSITIVITY** Increased recreational visitors over time will increase the visual sensitivity. It is unlikely that its use or function will change or that development will occur in the immediate surrounding area. **MAGNITUDE** There are no direct views of the airport features and aircraft however there will be increased aircraft at a distance of approximately three kilometres to the north and five kilometres to the south from the recreation areas and visitors centre based on current flight path information.
Viewpoint 11 – Glenbrook Nepean Lookout	
Stage 1	**SENSITIVITY = High-Moderate** Visual sensitivity is derived from this location being one of the closest elevated positions to the west of the airport site at approximately eleven kilometres and within the Blue Mountains area. It is assumed that there is significant recreational and cultural value placed on the natural landscape and bush setting by park users. Viewer times may be of a long or short duration and tend to fluctuate seasonally. **MAGNITUDE = Low** Direct views of airport features are prevented by topography and vegetation and views of aircraft may be possible at a distance of over three kilometres based on current flight path information. **VISUAL IMPACT** The likely visual impact is Moderate due to there being perceived reduction in visual amenity from the visibility of aircraft in a natural landscape.

Longer term (indicative)	**SENSITIVITY** The value placed on the visual qualities of the natural landscape at this location would be expected to remain or possibly increase over time. Visitors to the lookout would also be expected to increase thereby slightly increasing the level of sensitivity. **MAGNITUDE** There are no direct views of the airport features however due to the realignment of the flight paths, aircraft will be seen directly overhead based on current flight path information therefore in this context thereby increasing the magnitude rating.
Viewpoint 12 – Mount Portal Lookout	
Stage 1	**SENSITIVITY – High-Moderate** This is an elevated lookout 12 kilometres northwest of the airport site within the Blue Mountains offering broad regionally significant views over western Sydney on a clear day to the south and west. Visitors may stay for short or long durations and fluctuate seasonally. It is assumed that there is significant recreational and cultural value placed on the landscape by visual receivers. **MAGNITUDE = Negligible** Landform and vegetation in the foreground will largely prevent views of the airport features to the south. There is capacity of the landscape to absorb views of the airport development due to broad landscape views of the existing developed areas to the south and east. Views of aircraft are possible at a distance of more than ten kilometres. **VISUAL IMPACT** The likely visual impact is Negligible due to there being little or no perceived reduction in visual amenity.
Longer term (indicative)	**SENSITIVITY** Increased population and visitation of the lookout would be expected to increase use and therefore visual sensitivity, however it is also expected that the character of the areas within the broader views will change from rural to more urbanised with the development of the Western Sydney Employment Areas particularly to the north between the airport and lookout. **MAGNITUDE** The visibility of airport features is unlikely to change however, based on current flight path information, the alignment of flight paths will bring aircraft at a closer distance to the lookout and an increase in aircraft that will create a greater visual impact and reduce visual amenity.
Viewpoint 13 – Twin Creeks Golf and Country Club	
Stage 1	**SENSITIVITY = High-Moderate** Twin Creeks is located approximately six kilometres to the northeast of the airport boundary. The sensitivity of this view relates to its use as a country club and recreational and social hub with a presumed high level of use as well as a residential estate. Many views therefore would be of a long duration. **MAGNITUDE = Moderate-Low** Existing vegetation and landform prevent direct views of airport features however aircraft movements are prominent both day and night with the flight path positioned over the golf club and oriented on a north-south alignment. **VISUAL IMPACT** The likely visual impact is Moderate due to there being a general reduction in the visual amenity from aircraft.

Longer term (indicative)	**SENSITIVITY** The Twin Creeks Golf and Country Club is likely to perform a similar role however development of the residential estate is expected to continue thereby increasing visual sensitivity. **MAGNITUDE** There are no direct views likely of the airport features however visual receivers will be affected by an increased number of aircraft with more visual effect due to increased air traffic with flight paths positioned over the golf club and oriented on a north-south alignment based on current flight path information.

4.4 Flight paths

Preliminary flight paths indicate that aircraft may be directed over a range of sensitive areas including residential and rural-residential areas, recreational areas and national parks creating visual impacts beyond the airport site. Aircraft will be visible as they fly overhead as well as when they pass through views towards the site. Both views of aircraft however are temporary and will be at varying distances and heights and will therefore have different effects on the receiver.

It can generally be assumed that arriving and departing aircraft, the further an aircraft is from the airport, the higher it will be and therefore less visually prominent. Furthermore, airport operational patterns, although generally consistent, will vary depending on wind conditions and other operational factors.

Many aircraft approaching and departing Sydney (Kingsford Smith) Airport currently fly over the Blue Mountains. Aircraft arriving and departing from the proposed airport would add to the existing density of flights over the Blue Mountains and be at lower altitudes, compared to aircraft using Sydney (Kingsford Smith) Airport. Consequently, aircraft approaching and departing the proposed airport would be more visible and audible to residents and visitors.

The impact of aircraft overflights on the World Heritage and other values of the Greater Blue Mountains is considered separately in the draft EIS.

4.5 Construction

Construction of the Western Sydney Airport will result in substantial changes to the landscape primarily through major earthworks and removal of existing vegetation. The presence of construction plant, equipment, stockpiling areas and storage areas will also have a temporary visual effect.

Construction activities are generally divided between site preparation and aviation infrastructure. Major construction activities consist of the early development work such as security fencing, topsoil stripping and stockpiling, construction of access roads and services and establishing temporary site facilities.

A summary of the likely visual impacts during construction of the Stage 1 development follows in Table 5.

Table 5 Summary of constructive impacts from selected viewpoints

Viewpoint	Analysis
1. Luddenham Village	Views of the construction of the airport in the northern areas of Stage 1 are likely from some areas in Luddenham and could include fencing, earthworks, plant and equipment therefore a perceived loss of visual amenity is expected. In the longer term, construction activities will be concentrated in the southern portion of the site and further away from viewers therefore visual impacts would be expected to be less.
2. Elizabeth Drive, Badgerys Creek	Views of the Stage 1 construction of the airport in the northern areas of Stage 1 are possible at close distance as well as views of construction vehicles accessing the site from Elizabeth Drive therefore a perceived loss of visual amenity is expected. In the longer term, construction areas in the southern portion of the site are further away from the viewer however there may be commercial development near Elizabeth Drive therefore similar or potentially slightly lower visual impacts could be expected.
3. Lawson Road, Badgerys Creek	In Stage 1, views of the construction of the airport in the northern areas including fencing, earthworks, plant and equipment may be possible however could be filtered by existing vegetation. Views of construction areas in the longer term around the eastern and southern edges of the site will likely be possible from some properties meaning the anticipated visual impacts would likely remain at a similar level as Stage 1.
4. Badgerys Creek Road, Bringelly	Views of the construction of the airport such as fencing and earthworks in Stage 1 may be possible but are likely filtered or blocked by vegetation and/or topography. When longer term development occurs, construction areas will be in the southern portion of the airport site and closer to the viewer therefore a greater impact is possible.
5. Dwyer Road, Bringelly	Views of the construction of the airport In Stage 1, may be possible but are likely filtered or blocked by vegetation and/or topography. When longer term development occurs in the southern airport areas, construction activity will be closer to visual receivers and therefore expected to have a greater visual impact.
6. Mount Vernon Road, Mount Vernon	Broad views of the construction of the airport in the northern areas of Stage 1 are likely from some areas in Mount Vernon and could include earthworks, plant and equipment therefore some loss of visual amenity is expected. Views of the construction of the airport in the southern areas in the longer term are at a greater distance but would likely be of a similar extent as Stage 1 due to the extent of views of the overall airport area.
7. Rossmore Avenue East, Rossmore	Broad views of the construction of the airport in the northern areas of Stage 1 are possible and could include earthworks, plant and equipment therefore some loss of visual amenity is expected. Longer term views of the construction of the airport in the southern areas would likely be of a similar extent as Stage 1 due to the extent of views of the overall airport area.
8. Bents Basin State Conservation Area	Views of the construction of the airport in either the Stage 1 or longer term are prevented by existing topography and vegetation.
9. Silverdale Road, Silverdale	Broad views of the construction of the airport in the northern areas of Stage 1 are possible but from a distance of approximately 10 kilometres therefore some loss of visual amenity is expected. Longer term views of the construction of the airport in the southern areas would likely be of a similar extent as Stage 1 due to the extent of views of the overall airport area.

Viewpoint	Analysis
10. Warragamba Dam and Recreation Area GBMWHA	Views of the construction of the airport in either the Stage 1 or longer term are prevented by existing topography and vegetation.
11. Glenbrook Nepean Lookout	Views of the construction of the airport in either the Stage 1 or longer term are prevented by existing topography and vegetation.
12. Mount Portal Lookout	Views of the construction of the airport in either the Stage 1 or longer term are prevented by existing topography and vegetation.
13. Twin Creeks Golf and Country Club	Views of the construction of the airport in either the Stage 1 or longer term are unlikely as they may be inhibited by existing topography and/or vegetation.

4.6 Lighting and skyglow effects

Lighting impacts

A review of lighting impacts from the proposed airport was conducted by a specialist consultant (Lighting, Art and Science 2015). The Airport Plan provides an indicative concept design of how an airport may be developed. The actual details of the design will only become known once an airport lessee company is in place and they submit building control approvals under the *Airports Act 1996.* As such, a preliminary assessment of lighting impacts has been based on information from the Civil Aviation Safety Authority (CASA) Manual of Standards (MOS) and the Australian Standard AS4280: *Control of the obtrusive effects from outdoor lighting* provides a likely performance specification for any lighting which is likely to be implemented. These have been used alongside the Airport Plan and the previous Operational Lighting Impacts Assessment (O'Hanlon Design Pty Ltd, 1998) to inform this preliminary assessment. It is noted that there are some limitations in applying AS4280 to this application and for the purpose of the visual impact assessment.

The CASA MOS Part 139 provides guidance regarding the design of airfield lighting including cyclic or flashing lighting and also the approach and runway lighting at the airfield. The CASA MOS regulates the light above the horizontal plane for lights within proximity of the runways to limit confusing lighting and glare for the pilots. The MOS does not however address the obtrusive effects of the lighting, however as the majority of the lighting is aimed into the sky, the obtrusive effects are likely to be minimal but the contribution to skyglow thus needs to be considered. Skyglow is the brightening of the night sky above our towns, cities and countryside.

There are two main lighting categories that need to be considered: airfield lighting and infrastructure lighting. Regarding airfield lighting, consideration in this assessment has included the effect of runway and approach lighting, the aerodrome beacon light and taxiway lighting. Taxiway lighting will have low intensity and will therefore have a negligible effect beyond the airport boundary.

The runway and approach lighting are assumed to comprise high intensity flashing lights which have a controlled beam width in both the horizontal and vertical planes and direct their peak intensity towards the sky. To be affected by these lights, a sensitive receiver would need to be in a location within a horizontal angle of 15 degrees of the axis of the runway, at the end of the runway and in an elevated position. To protect the airspace around the airport, and particularly in line with the approach and departure routes, building close to the end of the runway and along its axis will not be allowed. Based on the site inspection and the topography of the area, it is not considered that there are any locations where the beam of the approach lighting would be visible.

Similarly for runway lights, as the fittings are ground mounted, the lower angles will also be shielded by the topography of the ground and therefore it is not expected to be visible from surrounding residences with the exception of residences along the southern section of Badgerys Creek Road. There will be virtually no awareness of the lights unless there is fog.

The aerodrome beacon light is designed to produce the peak intensity between 2 and 8 degrees above the horizontal plane. In addition, there is no requirement for light below 1 degree above the vertical plane. There will therefore be a fall-off in intensity below 1 degree. As the position of the beacon is elevated, it will not have significant impact in the area immediately surrounding the airport. Due to the relatively flat terrain, there will be a low level of impact at ground level.

There is an Australian Standard for Obtrusive Light, AS4280: *Control of the obtrusive effects of outdoor lighting* which is not mandatory but is assumed to address the external infrastructure lighting of other airport infrastructure including roads, carparks and apron lighting. As the lighting impact from the airport is assessed at the receiver property boundary and the windows of habitable rooms, the distance from the airport lighting to the boundary should mean that any installations easily comply. Also, the majority of the airport infrastructure will be located between the two runways such that distances to the airport boundary will be substantial.

The impact of skyglow

There are three ways that sky glow will be generated from the airport development:

- Direct light into the sky from the airport lights.
  The main source of direct lighting would be the approach lighting and runway lighting that deliberately direct light into the sky as it is part of their function. Infrastructure lighting would be controlled through lighting design so that no light leaves the fitting above the horizontal plane.
- Light reflected off the ground.
  This is dependent on the illumination level and the reflectivity of the ground. The light levels would be an order of magnitude lower than those used in a sports stadium. A sports stadium generally directs some light above the horizontal to illuminate the ball in the air. The airport skyglow would therefore be much lower than skyglow emitted from a sports stadium.
- Light emitted from the windows of buildings.
  This is a common issue with all buildings. The design of the buildings is not yet known at this stage and this issue can be further considered once more information is made available.

An overall reduction in the potential for lighting impacts, including skyglow, would be achieved if LED apron lighting and external lighting is incorporated into the design. These lights offer high efficacy, low energy consumption and extended life. Their smaller size means that they can be optically controlled to achieve more accurately defined distributions. LEDs are already available in obstruction lights and taxiway lights and emit no light in the horizontal plane so that there would be no spill of light off the site.

4.7 Cumulative impacts

The proposed airport would likely be a catalyst for the development of future residential, commercial and industrial uses throughout Western Sydney and in particular services that support the proposed airport. Surrounding areas to the north and west of the airport site are designated as future employment areas as part of the BWSEA while areas to the east and south are currently earmarked for future industrial use as part of the SWGC. The proposed airport will accelerate industrial and urban development in these areas..

The BWSEA also indicates potential future primary and secondary roads, an orbital Multi Modal Corridor connection to the north and south and town centres to the south east. Future development of these areas will likely be led by or in response to the growth of Western Sydney generally and subsequent growth of the airport in response to changing demographics and economic opportunities.

Depending on the final design outcomes, these projects may increase the urban character of the area and will have a visual effect. These projects will also change the local rural character of the roads in the district. In particular, realignment of The Northern Road by the New South Wales Government as part of the WSIP may have a more significant visual impact depending on its final alignment and design. It is noted that this work is a New South Wales action outside the scope of this EIS.

Future development of surrounding area as supported by the BWSEA and the SWGC will lead to increased urbanisation over time. This will generally reduce the impact of the airport development, including night time lighting effects, as it becomes a part of the changing urban visual character of the area.

5 Mitigation and management measures

The following broad management measures are proposed to assist in managing the visual effects of the airport development. These measures take into account the urbanisation that is already underway in many surrounding areas.

5.1 Operation

Retention of existing vegetation

A key recommendation of this visual impact assessment is that existing vegetation along the perimeter and wherever possible elsewhere within the airport site should be retained for as long as possible. This would reduce visual impacts and screen views of key airport features. In the longer term it is expected that the entire site will need to be cleared for the airport development with the exception of the riparian zone along Badgerys Creek.

Furthermore, the surviving native vegetation on the airport site has acknowledged Aboriginal cultural value as a remnant of a past cultural landscape and the plant and animal resources it provided to local tribal groups (Navin Officer Heritage Consultants 2015). For this reason, any retention, rehabilitation or reinstatement of native vegetation (and associated habitat values) as part of visual impact management would also complement the maintenance of local cultural landscape values

Revegetation and planting

Opportunities for revegetation and planting programs along the Badgerys Creek riparian corridor would help to reduce the overall visual impact of the airport and its key infrastructure in both the short and longer term. Local planting strategies should also be considered that assist adjacent landholders to help buffer the impact of the airport development. However any proposed planting and vegetation strategies need to be cognisant of the hazards posed by potential regional bushfires and should therefore not materially add to existing risk levels of the airport development.

Revegetation within the Badgerys Creek riparian zone, and elsewhere where possible, should aim to re-establish vegetation communities that currently exist on the site or in the Cumberland Plain region. Landscape species could utilise native plant species identified as components of Cumberland Plain Woodland and River-Flat Forest, both of which are endangered ecological communities, and potentially other regionally significant species.

Aircraft overflights

As concluded in the 1997-1999 EIS visual impact assessment, there are very limited opportunities to mitigate the visual impacts of aircraft overflights on surrounding areas. The most effective solution would be to modify flight paths to avoid visually sensitive areas within close proximity to the airport. However it is acknowledged that such changes may have important operational, cost and safety implications.

Further, it is expected that the indicative flight paths which form the basis of this EIS would be progressively refined during a detailed design process, prior to the commencement of any airport operations. Any formal change to flight paths may be the subject of a future referral under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) once detailed design has occurred.

Landform

Where possible, future site levels should integrate with the surrounding terrain as much as possible to assist with the visual assimilation of the airport into the surrounding landscape. Significant and abrupt level changes along the airport perimeter should be avoided wherever possible.

Landscape features

The airport design should seek to integrate existing landscape features such as Badgerys Creek wherever possible. Badgerys Creek in particular is an important existing asset of both the site and surrounding catchment and there is an opportunity to rehabilitate the creek and thereby benefit an existing natural visual asset.

Perimeter fencing

Given the extent of construction and security fencing required around the airport site, mitigation measures should seek to diminish its visual impact from surrounding areas, subject to safety and security requirements. The layout of the fencing should also avoid long, straight continuous runs. The finish and colour of the fence should not be reflective or brightly coloured. Planting design can assist by providing a visual buffer such as providing setbacks (2 metres minimum) from the boundary to allow planting. Fencing locations should also aim to avoid sensitive areas such as along Badgerys Creek wherever possible.

Lighting

The indicative concept design in the Airport Plan locates the key airside infrastructure such as the main terminals, carparks and hangers in the middle of the site, south of the Stage 1 runway. It is expected that in the longer term a second runway would be developed on the southern portion of the site, resulting in buildings and facilities being located between the two runways. This enables the rest of the airport to act as a buffer to offsite areas from the impact of infrastructure lighting. There will still be some lighting that is emitted from within those buildings, however this could be limited as the buildings may be relatively low rise depending on their final design.

LED lighting is becoming widely used in external lighting and is gradually being introduced into all lighting applications. The small source size means that they can be optically controlled to achieve accurately defined distributions. Other international airports have recently begun relighting some of their aprons using LED lights. They effectively light the space with good colour rendering. Importantly, LED lights emit no light in the horizontal plane so that there would be no spill off the site significantly reduce stray light particularly in areas with major infrastructure.

Low angle cut-off fittings should also be considered for use to mitigate the impact of the high intensity approach lighting and runway lighting. These, and any future improvements, should also be considered in the longer term airport development.

5.2 Construction

The following management measures should be considered for implementation during construction of the airport to reduce offsite visual impacts:

- establish sterile cover crops over topsoil stockpiles, bund and surcharge areas;
- maintain the integrity of the surrounding landscape by integrating the levels of the airport earthworks with the surrounding perimeter levels and topography wherever possible to avoid large grade transitions through cutting and filling activities;
- provide adequate measures to maintain existing vegetation wherever possible, particularly along the site perimeter, to ensure vegetation remains healthy or promotes new growth;
- locate construction plant, machinery and vehicle parking areas away from public or sensitive viewing areas;
- locate any night lighting needed for construction away from public or sensitive viewing areas; and
- revegetate site areas no longer in use as soon as possible.

5.3 Residual effects

There is potential through the implementation of the mitigation and management measures to lessen the visual effects created by the proposed airport development, particularly those during the construction phase. Implementation of vegetation planting around the airport site in combination with the preservation of remnant vegetation will potentially reduce high impact ratings to moderate-high or possibly moderate depending on the extent and success of the planting implementation and the location of the receiver.

As outlined earlier, residual impacts could also be reduced by ensuring that key airside infrastructure such as the main terminals, carparks and hangers are located in the middle of the site where they could be surrounded by the two runways in the longer term, enabling the rest of the airport to act as a buffer from the impact of lighting.

6 Summary and conclusions

The visual impact assessment process has considered the existing landscape character coupled with an overlay of local community sensitivities and cultural associations at selected representative viewpoints. The proposed airport size, scale and character, along with other major infrastructure developments in the region over the next decade, will involve substantial modification of the landscape and the existing rural visual quality to a more urbanised and commercial landscape character.

The existing environment is rural with agricultural and rural-residential properties the most common land use in the vicinity of the airport site. Given these types of land uses, visual impacts for airport operations have been assessed as being moderate-high to high for some of the most proximate areas such as Luddenham and Bringelly.

Further from the airport, areas such as Mount Vernon, Bents Basin State Conservation Area, and the Twin Creeks Golf Club, although having limited or no views of the airport development, will be visually affected by aircraft overflights. They have been assessed as having moderate to moderate-high ratings as these areas are highly sensitive to urban development influences based on their cultural and recreational values.

Areas such as Warragamba Dam and the Glenbrook Nepean Lookout, although at a distance of over 10 kilometres from the proposed airport, are assessed as being a moderate to moderate-high visual impact due to their sensitivity ratings and visual impacts from overflights.

A review of potential lighting impacts concluded that due to the orientation of the runways, location of the key airside infrastructure between the two runways and the overall distance to the boundary, there is unlikely to be any significant lighting impacts on surrounding areas. Those areas which could potentially be exposed are relatively flat and will not have sufficient elevation to be impacted as these lights are generally directed upward towards the approaching aircraft. The 05/23 (north-east/south-west) runway alignment inherently limits the populated areas that could potentially be affected by the approach lighting and runway lighting. The Airport Plan locates key airside infrastructure such as the main terminals, carparks and hangers in the middle of the site. This means that in the longer term these buildings would likely be in between the parallel runways, enabling the rest of the airport to act as a buffer to offsite areas from the impact of infrastructure lighting. There will still be some lighting that is emitted from within those buildings, however this will be limited as the buildings will be relatively low rise. Both the potential lighting impacts and skyglow could be substantially reduced if LED lighting technology can be incorporated into the airfield design.

A number of mitigation and management measures have been recommended for consideration to reduce the visual impacts of the airport development during its construction, Stage 1 and the longer term development.

These mitigation measures generally consist of utilising locally endemic planting to screen and provide some visual continuity with the surrounding landscape both during construction and operation. Retention of as much of the existing remnant vegetation as possible will help to reduce visual impacts, particularly outside of the Stage 1 construction area, providing some screening of the airport primarily to the south and east. Any additional planting proposed would need to be cognisant of the potential hazards of regional bushfires and aim to not materially increase existing levels of risk at the site.

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