

# Draft Aerotropolis Precinct Plan

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Technical Report Summaries

November 2020



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# Acknowledgement of Country

Planning for the Western Sydney Aerotropolis acknowledges more than 60,000 years of continuous Aboriginal connection to the land that makes up NSW.

This Precinct Plan recognises that, as part of the world's oldest living culture, the Traditional Aboriginal and Torres Strait Islander Owners and Custodians of the Australian continent and adjacent islands share a unique bond to Country — a bond forged through thousands of years of travelling across lands and waterways for ceremony, religion, trading and seasonal migration.

Aboriginal people maintain a strong belief that if we care for Country, it will care for us. The Aerotropolis area is custodially cared for by three Aboriginal groups: the Darug, Dharawal and Gundungurra. Others, such as the Eora, Darkinjung, Wiradjuri and Yuin maintain trade or other obligatory care relationships with the area. The Deerubbin, Gandangara and Tharawal Local Aboriginal Land Councils also have local land holdings and responsibilities towards Aboriginal people living in the area.

This significant connection to Country has helped to shape this Precinct Plan.

Country takes in everything within the physical, cultural and spiritual landscape - landforms, water, air, trees, rocks, plants, animals, foods, medicines, minerals, stories and special places. It includes cultural practice, kinship, knowledge, songs, stories and art, as well as spiritual beings and people: past, present and future.

The 11,200 hectare of the Aerotropolis forms part of Country - the interconnected and complex system of water, landscape, geology, sky and culture important to Traditional Owners and Custodians. Country is emerging as an integral concept to urban design. It extends from the mountains, across the plains and rolling hills to the sea and beyond.

Artwork by Nikita Ridgeway







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# Summary of technical supporting studies

This Appendix provides a summary of each of the technical studies that have been prepared to support the Precinct Plan. The technical studies include:

- Aboriginal and non-Aboriginal heritage
- Aboriginal engagement outcomes
- Air quality and odour
- Biodiversity
- Bushfire risk
- Economic and market feasibility
- Land capability and contamination
- Social infrastructure
- Stormwater, water cycle management and management of riparian lands
- Sustainability and heat
- Transport
- Utilities audit
- Wildlife management and wildlife strike.

Each section of this Appendix describes the study and its scope of investigation and details the key findings and recommendations.



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# 1 Aboriginal and non-Aboriginal heritage

## 1.1 Description of study

Extent Heritage have been commissioned to prepare an Aboriginal and Non-Aboriginal Cultural Heritage Assessment for the Initial Precincts. The assessment is an initial high-level analysis designed to guide the precinct planning and highlight key heritage issues and areas of sensitivity.

The assessment outlines the heritage significance of the Initial Precincts and their surrounds through the identification of Aboriginal and non-Aboriginal heritage sites, potential heritage sites and areas of archaeological significance. In addition, the assessment provides Aboriginal heritage sensitivity mapping and the identification of Aboriginal cultural heritage values.

In response to known heritage significance, the assessment identifies potential risks which should be managed as part of precinct planning and development and identifies areas which will require further detailed analysis. Recommendations for heritage enhancement opportunities and long-term conservation outcomes are provided throughout the precincts, as well as considerations for site specific mitigation.

## 1.2 Assessment and findings

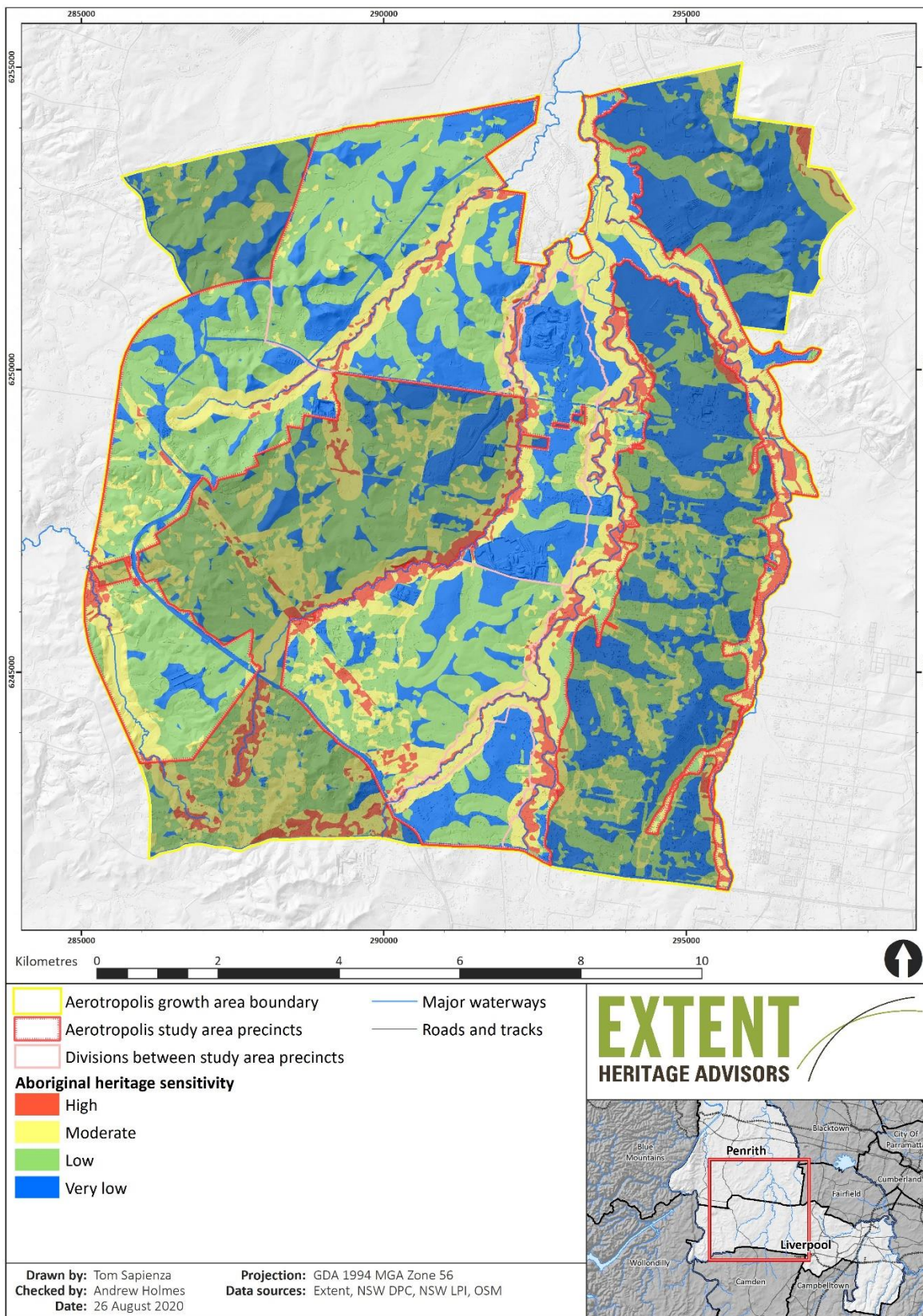
### Aboriginal heritage

The assessment identified 138 known Aboriginal heritage sites including objects, places, and declared Aboriginal Places. Among the 138 identified sites, the majority (115) are identified as 'artefact' sites comprising artefact scatters and isolated finds. The remaining sites largely comprise potential archaeological deposits (PADs) (19), most of which (15) were found in association with artefacts. Other site types that have been identified within the five precincts include three culturally-modified trees (carved or scarred) and one grinding groove site. The identified sites have been identified across the landscape and concentrated within areas where relatively low amount of land disturbances have occurred. Culturally modified trees are located in areas where remnant vegetation remains extant (e.g. along creek lines and away from urban areas), whereas grinding groove sites are located close to creek lines due to the need for water in the grinding process. The known PADs occur most often on lower elevations and along or between creek lines, and few are known in areas of high elevations such as hills or ridgelines. In addition to the identification of known sites, the assessment mapped the Aboriginal heritage sensitivity across the initial precincts (see **Figure 1** below).

*Note: Whilst the specific locations of known Aboriginal heritage sites and AHIMS data have been identified and considered in the precinct planning work, a map showing these sites have not been included within this report due to sensitivity reasons.*



**Figure 1 Aboriginal heritage sensitivity within the Aerotropolis**



### Consultation with Aboriginal stakeholders and identification of cultural values

The assessment also undertook consultation with Registered Aboriginal parties (RAPs) and organised an initial Aboriginal cultural values mapping workshop with a focus group of Elders and knowledge holders comprising the primary traditional owner representatives of Darug and Dharawal descendants as well as the Local Aboriginal

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Land Councils (LALCs) whose land includes portions of the Aerotropolis. The aim of the workshop was to start the process of learning about the Aboriginal cultural values, in order that these values can be conveyed to planners and designers. The intention is that Aboriginal cultural values can be incorporated into the design of the Aerotropolis from the beginning of the design process. Key findings included:

- » Every stakeholder emphasised the paramount importance of ensuring development works will not impact grinding grooves, modified trees and art sites.
- » Stakeholders highlighted the importance of preserving all creek corridors within the study area and keeping them as open space.
- » Concern was expressed about the cumulative impact of development. When the stakeholders were asked what they would most like to see if they were to return to the Initial Precincts in 50 years, the consensus answer was a large conserved portion of the Cumberland Plain. The consensus was also that this conservation area would not just include conserved creek corridors, but also a representative range of remnant terrain. The stakeholders expressed a strong preference for natural vegetation patterns.
- » Unusual and well-preserved landforms such as exposed sandstone outcrops, areas of remnant old growth vegetation and well-preserved creek corridors should be protected where possible.
- » The workshop participants emphasised the Cumberland Plain is imbued with stories of dispossession and disconnection of Aboriginal people from their traditional lands and their families after European occupation. Any interpretation and story-telling needs to be led by Aboriginal people.
- » It is critical that the traditional owners and LALCs play a key role in future consultation and are given the opportunity to participate in further studies. The stakeholders stated that it is offensive when Aboriginal groups with no connection to Country are engaged to do archaeological work.
- » Further work and detailed archaeological investigations are needed moving forward to comment with certainty on cultural values. Traditional owners and LALC access to walk Country will be needed for subsequent stages of investigation.

## Non-Aboriginal heritage

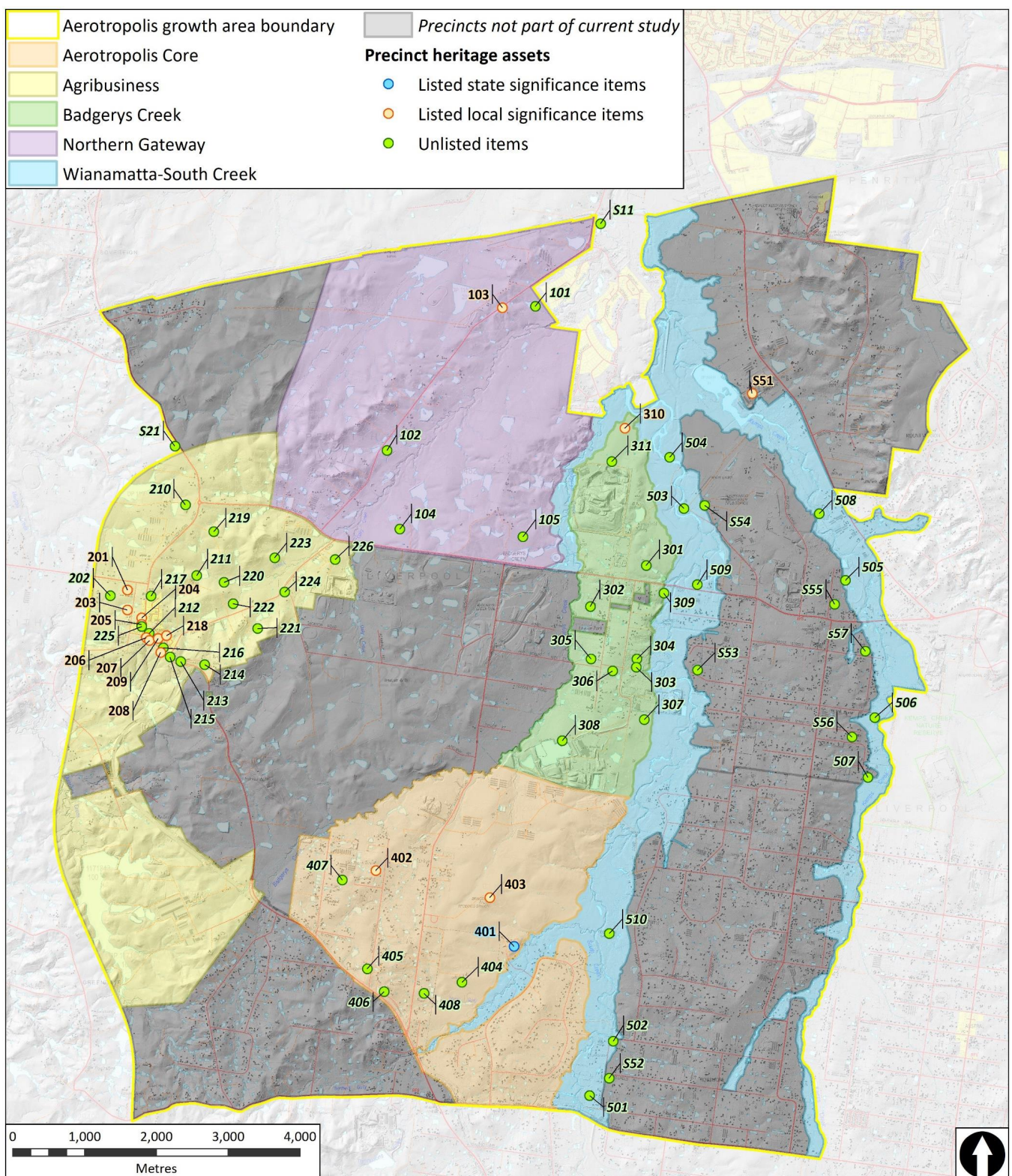
Non-Aboriginal heritage assets have been assessed for all precincts and a 200m buffer around each precinct. The buffer is designed to identify heritage assets that may be indirectly impacted by actions undertaken within the precincts, such as view lines. The analysis is based on a review of statutory and non-statutory heritage registers including:

- » The National Heritage Database
- » State Heritage Register
- » State Heritage Inventory
- » Schedule 5 of Local Environmental Plans (LEP) for Penrith and Liverpool
- » National Trust of Australia (NSW) Register.

During the initial phase of investigation approximately 130 potential heritage assets were identified. This has been reduced to 61 sites (listed and potential) within the precincts and 10 sites within the buffer (shown in **Figure 2** below).



**Figure 2 Locations of all identified non-Aboriginal heritage places and sites**



A breakdown of heritage assets within the Initial Precincts and within the Aerotropolis buffer is provided below.

**Table 1 Heritage assets in Initial Precincts**

Type of Item	Items within the initial precincts	Items within the buffer area	Controls
<b>Within the Aerotropolis initial precincts</b>			
SHR listed sites	1	0	Subject to strict statutory controls
SEPP/LEP/s170 listed sites	16	2	Subject to SEPP/local/agency controls
Unlisted sites and previously unidentified sites	44	8	May be subject to the 'relics' provisions of the NSW Heritage Act

A following table provides a breakdown of listed heritage items across the Initial Precincts.

**Table 2 Listed heritage items**

Precinct	Sites within Initial Precincts	Sites within buffer area
<b>Northern Gateway</b>	5	1
<b>Agribusiness</b>	27	2
<b>Aerotropolis Core</b>	11	0
<b>Badgerys Creek</b>	8	0
<b>Wianamatta-South Creek</b>	10	7

Approximately 70% of the identified sites are located immediately adjacent to the main roads that pass through, or define the precinct boundaries (Luddenham Rd, Elizabeth Drive, The Northern Road, Badgerys Creek Road and Bringelly Road). There are large portions of some precincts in which no heritage items have been identified. A noticeable cluster of sites is located within the Agribusiness Precinct, particularly in the vicinity of the village of Luddenham village. A site listed on the State Heritage Register, 'Kelvin', is located within the Aerotropolis Core Precinct.

There are also several items identified that occupy large tracts of land, these include Fleurs Aerodrome and Fleurs Radio Telescope Site (Badgerys Creek Precinct) the McMaster Field Station (Northern Gateway Precinct), and the Former OTC site (Aerotropolis Core Precinct).

## 1.3 Recommendations

### Aboriginal heritage

- » A section of remnant Cumberland Plain Woodland running from hill crest down slope to creek should be identified and placed into conservation – views and curtilage are important considerations in this too.
- » Broadly, development should be avoided in areas of high Aboriginal heritage sensitivity, minimised in areas of moderate sensitivity, and focused in areas of low and very low sensitivity (see above in **Figure 1**).
- » Development should be avoided in and around specific Aboriginal heritage site types, such as modified trees (carved or scarred) and grinding grooves.
- » The stakeholders stated that it is too early to comment with certainty on cultural values because the archaeological investigations have not taken place, and large parts of the landscape have not been



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extensively investigated during prior studies. Whilst some key cultural values were identified, continued consultation, on-Country walks and ground truthing of archaeological sites is required at the master planning and development stages in order to gain more of an understanding of cultural values, stories and places.

- » The need for further and ongoing in-depth consultation with the Aboriginal community stakeholders and knowledge holders was highlighted.
- » The stakeholders present at the Cultural Values Workshop said that it is critical that the traditional owners and LALCs play a key role in future consultation and are given the opportunity to participate in further studies.
- » Any interpretation and story-telling needs to be undertaken in consultation with the traditional owners and LALCs to ensure it is culturally appropriate.
- » There are some family connections to this Country and nearby, and those should be recognised through acknowledgment in the studies completed of the area as well as further interpretation through consultation with the traditional owners and LALCs.

## Non-Aboriginal heritage

Most of the known and potential historical archaeological sites date to the period after 1860 and are primarily related to small dwellings on rural lots or residential sites within the village of Luddenham or with tenant farms scattered through the Luddenham Estate.

- » Archaeological evidence associated with early land grants may survive at Kelvin Grove, within the Fleurs Estate and within Badgery's Exeter Farm. Such sites, depending on their integrity and type, have the potential to be State significant and additional investigations may be required to confirm their heritage listing.
- » Development in the vicinity of heritage items should be designed and sited to protect the heritage significance of the item and its setting. Development of land or a building in the vicinity of a heritage item should be undertaken in a manner that complements the heritage significance of the site or area.
- » Lots containing potential items can be managed in several ways. If they are to be impacted, then they should be subject to detailed assessment to determine the level of archaeological intervention required.
- » There are also several large tracts of land that may contain discrete areas of archaeological potential. Such areas should be subject to detailed assessment to determine how the potential archaeological resources are to be managed rather than placing the whole area under an archaeological management procedure.
- » Extant local heritage items such as buildings, structures and places are significant pieces of evidence in the historic record of the development of this area from pastoral estates to rural village settlements. With that in mind, in many cases the significance of a place extends beyond the physical evidence and includes the views and settings that contribute to the site's character and former uses.
- » Further investigation is needed to determine the heritage significance of potential heritage items and potential areas of archaeological significance which are to be retained and conserved, where possible.
- » Ultimately, successful heritage management in the face of new development aims to keep heritage relevant and sustainable. To do this, the development of, and around, heritage items needs to accommodate retention and adaptive reuse of the historic features as well as support appropriate new developments, public and private and commercial.

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## 2 Aboriginal engagement outcomes

### 2.1 Description of study

GHD, in partnership with Zion Engagement and Planning (Zion), were commissioned to engage with Aboriginal communities and stakeholders to inform precinct planning for the Initial Precincts.

Aboriginal communities and stakeholders living in the Western Parkland City were invited to participate in the engagement program during June and July 2020. GHD/Zion worked with Aboriginal representatives from local government to identify stakeholders and organisations to be contacted and invited to participate. In total, 132 people participated in 27 engagement activities.

### 2.2 Assessment and findings

#### Principles

Several overarching themes emerged from discussions with stakeholders during the engagement process:

- » **Reconciliation:** as a traditional movement corridor and a place close to Country boundaries, the site of the Aerotropolis has always been a place where different mobs have come together. The Precinct Plan should honour this by creating a place where Aboriginal culture and community are respected, and in the spirit of reconciliation, all Aboriginal and non-Aboriginal communities feel welcome and acknowledged.
- » **Protecting Country:** Country can be protected (in part) through respecting its natural form (such as ridgelines, waterways etc) and maintaining the connection between places. Ideally plants and greenery should be clearly visible throughout the Aerotropolis, and re-vegetation and planting should honour the original landscape of the Cumberland Plain.
- » **Cultural Safety:** the Aerotropolis can be a place where Aboriginal communities feel culturally safe and included, through embedding Aboriginal cultural values in the built form.
- » **Storytelling:** in Aboriginal communities, knowledge is not written, it is spoken and often done so through storytelling. This concept can be embedded through creating places that honour the stories of Traditional custodians and reflect Aboriginal culture and history.
- » **Holistic Service Provision:** Aboriginal culture views the person in a holistic way. The Aerotropolis can help to foster cultural sensitivity when designing or planning for Aboriginal communities by creating places that provide a 'one-stop-shop' to service delivery.

#### Opportunities

The following opportunities for the future Aerotropolis were identified during engagement with Aboriginal stakeholders and community.

##### Cultural Celebration

Cultural celebration is a practical way to embed Country and culture to develop feelings of cultural safety and reconciliation. Opportunities for cultural celebration include:

- » Integrating Aboriginal place names throughout the Aerotropolis at Metro stations, streets and public places
- » Artwork, installations, murals, or presentation of key artefacts found during heritage assessments
- » Dedicating space for Aboriginal communities to gather and connect to Country such as native gardens or a yarning circle.



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## **Employment and Procurement**

Employment and procurement opportunities for Aboriginal workers and businesses was a key priority identified by Aboriginal communities during consultation. The following opportunities were identified to ensure such opportunities are accessible for Aboriginal residents of Western Sydney:

- » Diversify and increase employment opportunities available to Aboriginal communities
- » Introduce Aboriginal employment and procurement targets for businesses
- » Provide support for Aboriginal job seekers in overcoming barriers to accessing employment; i.e. through provision of appropriate training.

## **Infrastructure and Facilities**

Consultation identified current gaps in both hard and soft infrastructure that is targeted towards Aboriginal communities in Western Sydney. The Aerotropolis provides an opportunity to build on current infrastructure and services available to fill these gaps:

- » Facilities for cultural celebration, information and education (i.e. Aboriginal museum, keeping place, yarning cycle)
- » Centralised facilities to support job-seekers, Aboriginal businesses and employers
- » Prioritise public transport accessibility that caters for the Aboriginal workforce

## **Education**

Consultation identified a strong need for greater education pathways and to prepare students for the workforce; specific opportunities included:

- » Strengthening pathways between school and post-school qualifications and ensuring training is linked to actual job opportunities. This includes greater focus on work-readiness in schools.
- » Greater emphasis on Aboriginal culture and knowledge in schools, i.e. compulsory cultural awareness training to ensure culturally safe schools

## **Caring for Country**

Opportunities for caring for Country apply to planning, construction and operation of the Aerotropolis, and includes:

- » Land management incorporating traditional knowledge and practices as well as landscape planning informed by Aboriginal communities
- » Recognition of Aboriginal people as traditional custodians through employment of Aboriginal people in land care roles or rangers.

## **Health**

Addressing gaps in and changing approaches to current health service delivery were identified as potential opportunities. This includes addressing the barriers to accessing health care services for Aboriginal communities, delivering Aboriginal medical services, and ensuring non-Aboriginal medical services are culturally safe and inclusive.

## **Housing**

Consultation identified opportunities for the Aerotropolis to address housing challenges for Aboriginal communities in Western Sydney. This included increasing the provision of affordable and temporary housing in accessible locations as well as ensuring culturally appropriate housing that supports extended family living.

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## Cultural tourism

Aboriginal communities and stakeholders noted that tourists should not have to travel to other parts of Australia to experience living Aboriginal culture, and the Airport provides a unique opportunity to facilitate cultural tourism in the Aerotropolis.

## 2.3 Recommendations

Through engagement with Aboriginal communities and stakeholders the following recommendations are made for consideration in planning framework.

### Precinct planning

To inform precinct planning, it is essential that places of significance are mapped to ensure that the spatial layout and location of land uses and zones are responsive and sympathetic to cultural values. Moreover, the following design outcomes are recommended for precinct planning of the Aerotropolis:

- » Limiting development encroachment along creek lines and waterways
- » Preservation of remnant vegetation clusters to ensure caring for Country
- » Sympathetic built form to ensure vistas back to Country, creeks and sky are maintained and celebrated.
- » Inclusion of parks along ridgelines and high points of Country to ensure preservation and celebration of these important features

### State Environment Planning Policy (SEPP)

It is important that the SEPP incorporates a range of feedback from Aboriginal communities and stakeholders in relation to zones and uses throughout the Aerotropolis, including:

- » Objective within each of the proposed zones that responds to Country, community or culture
- » Affordable Rental Housing targets reflect the affordability needs of the community and consider a diverse housing typology
- » Caring for Country principles incorporated into biodiversity and riparian corridor planning

### Development Control Plan

A number of potential areas of the Development Control Plan should be aligned with consultation outcomes; these include:

- » Connection to Country – ensuring a strong approach to starting with Country and promoting the value of important sites
- » Design excellence – cultural design framework to be triggered through the design excellence process to ensure culture is embedded at key sites and through master planned developments
- » Public art – ensure cultural narratives are embedded through public art/installations
- » Wayfinding – embed language into signage and wayfinding
- » Native vegetation – reflective of the Cumberland plain landscape
- » Tree preservation – consideration of the connections to trees that are of significance
- » Cultural conservation and celebration – important to separate our culture and heritage to promote different thinking about cultural values being living and intangible
- » Cultural play spaces – opportunity to embed cultural learning into play spaces
- » Housing diversity – include reference to extended family living opportunities.
- » Ridgeline parks – include reference to connecting with Country and links to creek lines



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## Additional strategies

Engagement outcomes that are beyond the scope of precinct planning have informed additional recommended strategies which should be considered by relevant government agencies, including:

- » **Aboriginal art strategy:** to ensure culturally responsive and inclusive public art across the Aerotropolis
- » **Cultural design framework:** to provide a process for incorporating Country and Aboriginal culture in the built form and planning
- » **Aboriginal employment and procurement strategy:** to ensure Aboriginal communities and businesses are provided with opportunities for employment and procurement in the Aerotropolis
- » **Aboriginal infrastructure and service delivery:** to identify infrastructure or services required for Aboriginal communities to inform the Social Infrastructure Strategy
- » **Caring for Country strategy:** to integrate Aboriginal traditional knowledge and practices into land management throughout the Aerotropolis and ensure active involvement of Aboriginal communities.
- » **Aboriginal communities and stakeholder strategy:** to ensure engagement with Aboriginal communities and stakeholders about planning for Aerotropolis and Western Parkland City is culturally appropriate, respectful, meaningful and coordinated across government agencies.

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## 3 Air quality and odour

### 3.1 Description of study

Northstar have been commissioned by Aurecon to perform a baseline constraints and land capability analysis, with a focus on air quality and odour. The purpose of the study is to identify sources of air pollutants and odour, understand the potential for those sources to impact the development of land and provide management strategies in responding to potential constraints.

### 3.2 Assessment and findings

In this study, 'risk' has been evaluated as the product of scales applied to 'sensitivity' and to 'magnitude'. For air quality and odour studies, that approach is appropriate given the potential significance of impacts of air pollutants and odour may vary depending on the nature and 'sensitivity' of the receiving environment.

- » 'Sensitivity' has been defined on a simplified 4-point scale from 'low' to 'very high' using land use data derived from the relevant Local Environmental Plans and land use derived from the Western Sydney Aerotropolis Plan.
- » The potential 'magnitude' (predicted scale of potential impact to the air quality / odour environment) of emissions of air pollutants and odour has been defined on a simplified 4-point scale using published separation distance thresholds ("buffer distances") and NSW EPA Level 1 odour assessment procedures.
- » The resultant values for 'sensitivity' and 'magnitude' have been mapped within a Geographical Information System (GIS) and overlaid to generate a product evaluation of 'risk'.

The study has identified existing and approved uses, as well as any uses within a 500m radius of the Aerotropolis, that may produce air pollutants or odours. Such uses included:

- » Poultry farming operations
- » Waste management, including land fill and resource recovery facilities
- » Commercial and industrial activities such as Brickworks and Concrete Batching Plant in Bringelly.
- » Infrastructure, including roads and the proposed airport

#### Sensitivity

Land sensitivity is assessed on the basis of existing and approved land use classifications as well as those identified in draft precinct plans.

This assessment shows that based upon the State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 land use designations the distribution of sensitivity varies by precinct. The majority of land in the Agribusiness Precinct (45%) is of high sensitivity, the majority of land in the Northern Gateway Precinct and Aerotropolis Core Precinct (incorporating Badgerys Creek Precinct and Wianamatta-South Creek Precinct) is of medium sensitivity (47% and 78% respectively).

The following recommendations are made for the management of sensitivity:

- » Developing and refining land uses in the Precinct Plan.
- » Relocating sensitive land uses or restricting land uses to those less sensitive to changes in air quality and/or odour.
- » Staging of development so that sensitive land uses at elevated risk are managed.



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## Magnitude

This assessment shows that the majority (57% to 63%) of land is classified as 'very high' magnitude across all precincts. Magnitude is evaluated as aggregated across all sectors (agriculture, extractive industries, waste management, commercial and industrial and infrastructure). Of all sectors, agriculture represents the greatest magnitude.

In managing the magnitude of such activities, the following recommendations are made:

- » Reducing the magnitude of identified hazards through focused assessments on identified high magnitude activities.
- » Removing or relocating high magnitude activities by relocating the identified hazards to other locations to manage the resultant risks.
- » Staging of development so that high magnitude hazards are managed.

## Risk

This assessment shows that, based upon the assumed land uses and screening-level evaluations of magnitude, that the majority of land is assessed as being in 'medium risk'. The land assessed as medium risk at Northern Gateway Precinct is 94%, 68% at Agribusiness Precinct and 96% at Aerotropolis Core Precinct (incorporating Badgerys Creek Precinct and Wianamatta-South Creek Precinct).

High risk is assessed as 6% of land at Northern Gateway Precinct, 31% of land at Agribusiness Precinct and 2% of land at Aerotropolis Core Precinct (incorporating Badgerys Creek Precinct and Wianamatta-South Creek Precinct).

## 3.3 Recommendations

The following recommendations are made:

- » The air quality and odour study should be updated as the Precinct Plan is developed and refined to provide revised evaluations of sensitivity and subsequently risk
- » The air quality and odour baseline study should be updated as the land use in the Precinct Plan is developed.
- » The magnitude of impacts associated with the identified agricultural activities (poultry farming) are refined. The Level 1 assessment methodology is intended to provide a high-level screening assessment, and the study requires further refinement of that methodology as a Level 2/3 odour assessment. Of note, the magnitude of impacts from poultry farms numbers 13, 16, 17, 48, 49, 50, 57, 58 and 60 are recommended to be refined in Stage 2 studies.
- » The magnitude of impacts associated with a number of identified waste management facilities should be refined in Stage 2, notably SUEZ Kemps Creek Advanced Resource Recovery Technology Facility, SUEZ Kemps Creek Landfill and Australian Native Landscapes.

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## 4 Biodiversity

### 4.1 Description of study

Eco Logical Australia has been engaged to undertake a Biodiversity Assessment for precinct planning of part of the Aerotropolis subject to *State Environmental Planning Policy (Sydney Region Growth Centres) 2006*. The aim of this report is to identify key ecological constraints and opportunities to assist precinct planning as well as provide recommendations with respect to terrestrial ecosystem management. The assessment was undertaken in the Aerotropolis Core Precinct and part of the Badgerys Creek and Wianamatta-South Creek Precincts, south of Elizabeth Drive.

### 4.2 Assessment and findings

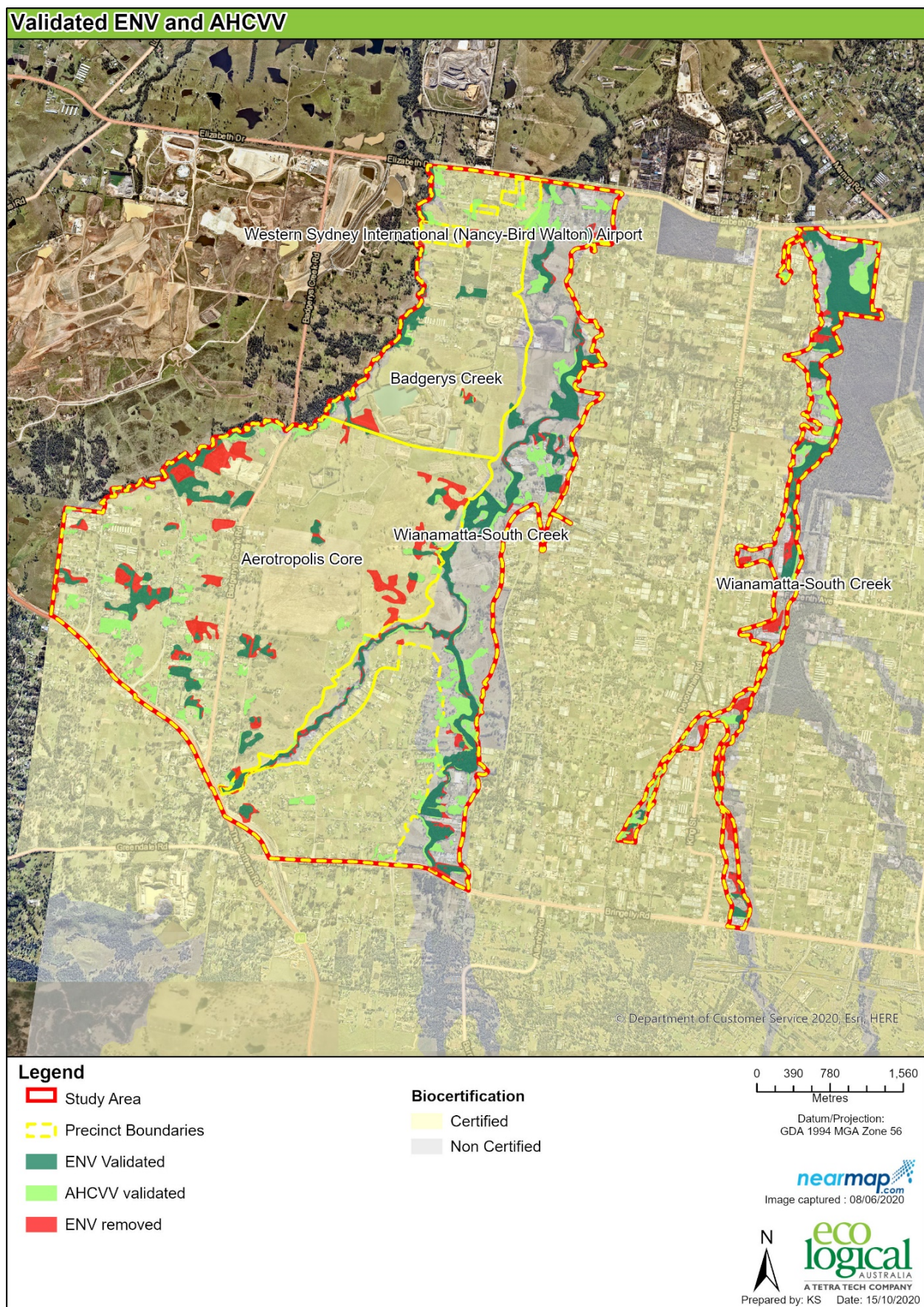
#### State Environmental Planning Policy (Sydney Region Growth Centres) 2006

The area to the south of Elizabeth Drive for the Badgerys Creek Precinct and Wianamatta-South Creek Corridor Precinct, together with the Aerotropolis Core Precinct is subject to precinct planning requirements of the *Order to confer biodiversity certification on the State Environmental Planning Policy (Sydney Region Growth Centres) 2006* (Growth Centres SEPP). The Growth Centres SEPP was the subject of a Biodiversity Certification under NSW legislation and a Strategic Assessment under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC).

A key aspect of the biodiversity study was the identification and validation of Existing Native Vegetation (ENV) to ensure that precinct planning is consistent with the Relevant Biodiversity Measures (RBMs) defined under *Order to Confer Biodiversity Certification on the SEPP (Sydney Region Growth Centres) 2006*. The RBMs include a requirement to protect 2,000ha of ENV in the overall Growth Centres. Based on the draft Growth Centres Conservation Plan (2007), this area is required to protect 227.18ha of ENV in the Aerotropolis. Validated ENV is shown in **Figure 3** below.



**Figure 3 Location of validated ENV**



Achieving 227.18ha is a critical element in meeting the broader 2,000ha ENV retention target that underpins the Biodiversity Certification that applies to the Growth Centres.



Currently 183.7ha of validated ENV is within land zoned Environment and Recreation under the Aerotropolis SEPP. A further 45.06ha of ENV can be retained within the Precinct's open space network, of which 44.2 ha is within certified lands and 0.86 ha is within non-certified lands. This can provide a total of 228.76 ha, which is 1.58-ha more than the minimum requirement of 227.18 ha ENV for the Aerotropolis.

There is also a total of 81.4ha of Additional High Conservation Value Vegetation (AHCVV) present within the Wianamatta-South Creek Precinct. Approximately, 23.3ha of this area has been field validated.

AHCVV is defined as meeting the same criteria as ENV (i.e. a 10% or greater canopy cover and a patch size of 0.5ha or more). The difference between AHCVV and ENV is that AHCVV was not mapped in the original Draft Conservation Plan 2007. These areas may not have been originally mapped due to mapping inaccuracies or changes to the condition and size of the vegetation since the production of the Draft Conservation Plan 2007 map. It is noted, if it is proposed to count the 23.3ha of field validated AHCVV towards the 2,000ha target, once the Biodiversity Certification Order is amended, it will also need to be rezoned to the Environment and Recreation Zone and mapped as AHCVV on the High Biodiversity Value map in the Aerotropolis SEPP.

## Landscape features

Parts of the subject site have been cleared for residential, commercial or industrial purposes. Remnant native vegetation was present in reserves and parts of rural lots.

## IBRA bioregion and subregion

The study area is located within the Sydney Basin IBRA Bioregion and the Cumberland Subregion.

## Native vegetation extent

The total extent of native vegetation within the subject site is 531.83ha, equating to approximately 21% of the total area.

## Habitat connectivity

Soils within the Cumberland Subregion are generally fertile compared to surrounding Hawkesbury Sandstone landscapes, which has resulted in extensive clearing of native vegetation for agriculture and more recently, urban development. Because of this, approximately 13% of the pre-1970 extent of native vegetation in the Cumberland Subregion remains intact and in good condition (DECCW, 2011). Remaining vegetation is generally highly fragmented, which larger patches restricted to reserves, riparian corridors and areas not suitable for agriculture. Within the study area, native vegetation is present along the riparian corridors of South Creek, Kemps Creek and Thompsons Creek and their tributaries, and within protected areas south of Elizabeth Drive.

## Vegetation communities

Four native vegetation communities were identified within the subject site through desktop assessment and field survey. Areas of exotic cover were also present; these areas were not consistent with any remnant native vegetation communities.

Descriptions of each vegetation community, including broad conditions states are identified in the table below.

**Table 3 Vegetation communities within the subject site**

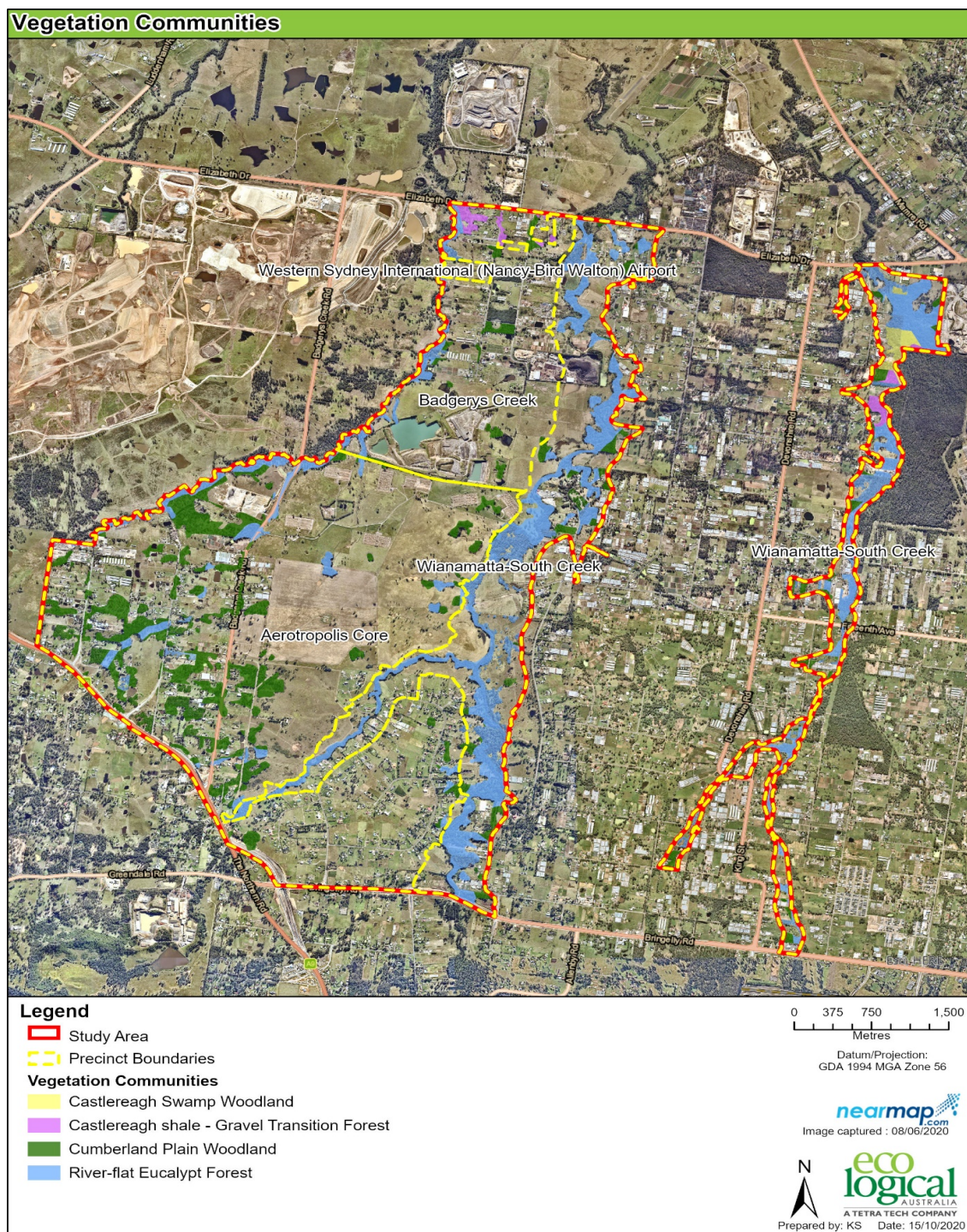
Vegetation Community	Plant Community Type	Area (ha)	BC Status	EPBC Status
Cumberland Plain Woodland	<b>849:</b> Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	194.52	CE	CE
	<b>850:</b> Grey Box - Forest Red Gum grassy woodland on shale of the southern			

Vegetation Community	Plant Community Type	Area (ha)	BC Status	EPBC Status
	Cumberland Plain, Sydney Basin Bioregion			
River-Flat Eucalypt Forest*	<b>835:</b> Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	312.33	E	-*
Castlereagh Woodland	Swamp <b>1067:</b> Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	10.87	E	-
Castlereagh Transition Forest	Shale-Gravel <b>724:</b> Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	14.11	E	CE
<b>TOTAL (ha)</b>		<b>531.83</b>		

\* In 2016, River-Flat Eucalypt Forest was nominated for listing as a threatened ecological community under commonwealth legislation (EPBC Act) as coastal floodplain eucalypt forest of Eastern Australia. Conservation advice for this ecological community has been drafted, public consultation closed in August 2019, and the nomination is currently being assessed.

\*CE = Critically Endangered and E = Endangered

**Figure 4 Vegetation communities**



## Threatened species habitat

No threatened flora species were identified opportunistically or during targeted survey. However, threatened flora species associated with native vegetation identified within the subject site and recorded within 10km of the subject site were identified as having the potential to occur within the subject site.

A total of 9 threatened flora species are identified as having the potential to occur in the subject site.

A total of 24 threatened fauna species are identified as having the potential to occur in the subject site.



## Validated existing native vegetation and identification of additional high conservation value vegetation

Desktop aerial photo analysis and field survey was undertaken to validate the extent of the mapped 'Existing Native Vegetation' (ENV) to confirm whether it still existed. This process resulted in the following classifications:

- » ENV originally mapped within Draft Growth Centres Conservation Plan 2007
- » Validated ENV
- » Additional High Conservation Value Vegetation.

Approximately 227.18ha of vegetation in the Aerotropolis was identified in the Draft Growth Centres Conservation Plan 2007 within non-biodiversity certified lands and will therefore require protection. Most of these lands are within the Wianamatta-South Creek Corridor Precinct. Desktop assessment and field survey validated 183.7ha of previously identified ENV within non-biodiversity certified lands, resulting in a shortfall of 43.48ha of ENV. This is outlined in **Table 4** below. To maintain parity with the Biodiversity Certification Order, the shortfall will need to be made up by protecting other patches of ENV in the subject site.

**Table 4 Certified and non-certified land**

	Certified Land (ha)	Non-Certified Land (ha)	Total (ha)
Mapped ENV in Draft Conservation Plan	130.98	227.18	358.17
Validated ENV (desktop analysis and field validated)	62.59	181.92	244.51
AHCVV (ELA field validated)	10.47	23.96	34.43
AHCVV (desktop study)	35.43	65.09	102.54

## Recovery potential

Recovery potential relates to the ability of the land to be managed for an improvement in the condition of the remnant vegetation and to increase linkages (wildlife corridor) between extant stands of vegetation. Identifying areas of recovery potential is consistent with the aims of the BC Act; to protect and encourage the recovery of threatened species, populations and communities listed under the EPBC Act.

With appropriate management actions, areas identified as having a moderate recovery potential would improve the condition of threatened species habitat and ecosystem connectivity within the precinct. Management actions would need to be on-going and facilitate the natural regeneration of the overstorey and/or regeneration of native species (grasses, herbs and forbs) in the seed bank.

Four classes of recovery potential have been identified within the subject site which has been informed by the assessments (desktop and field) conducted in this report. The four classes are as follows:

- » **High Recovery Potential:** Native vegetation mapped as areas that meet the definition of ENV or AHCVV which generally have native canopy cover of greater than 10% and contained native species in each structural layer
- » **Moderate Recovery Potential:** Other areas of native vegetation with some canopy, less structural complexity and a higher level of weed infestation or ongoing disturbance
- » **Low Recovery Potential:** Areas which show some potential for natural regeneration. Some native species present in some structural layers, very high level of weed infestations, not all structural layers present
- » **Very Low Recovery Potential:** All other areas including cleared and heavily cultivated and/or pasture improved areas.

Area calculations of each recovery potential class within the subject site is present in the table below.

**Table 5 Recovery potential class**

Recovery Potential Class	Area (ha)
High	489.21
Moderate	63.79
Low	3.29
Very Low	1,986.93

## Ecological constraints assessment

An ecological constraint ranking was derived applying an amended methodology that combines size, condition, connectivity and recovery potential into a single ecological constraint value. Most of the vegetation within the study area is ranked as having high biodiversity value by virtue of it being an Endangered or Critically Endangered Ecological Community. This was based on ecological values and do not take account of the Biodiversity Certification Order which shows that the study area is partially biodiversity certified under the BC Act.

Broadly the rankings are as follows:

- » **High constraint:** High ecological value, relatively large areas of good quality, well connected vegetation
- » **Moderate constraint:** Moderate ecological value, smaller areas of good quality vegetation or large areas of poorer quality vegetation
- » **Low constraint:** Low ecological value, areas infested with weeds and exotics, with a low recovery potential or completely cleared or developed.

**Table 6 Ecological constraint rankings**

Ecological Constraint	Area (ha)
High	489.91
Moderate	66.39
Low	1,986.93

## 4.3 Recommendations

### State Environmental Planning Policies

It is recommended to amend the Aerotropolis SEPP at the time the that Precinct Plan is made to ensure that 227.18ha of protected ENV is zoned Environment and Recreation and development controls prohibit the clearing of ENV, including:

- » Retain 183.7ha of ENV within land zoned Environment and Recreation under the Aerotropolis SEPP.
- » Protect the ENV via clause 27 in the Aerotropolis SEPP, with such vegetation being identified on the Aerotropolis SEPP High Biodiversity Values map.
- » Amend Clause 27 of the Aerotropolis SEPP to ensure consistency with Appendix 8, Clause 6.3 within the Growth Centres SEPP, regarding development controls for ENV.
- » Retain 45.06ha of ENV within the open space network, of which 44.2ha is within certified lands and 0.86ha is within non-certified lands.
- » Amend land zoned Environment and Recreation under the Aerotropolis SEPP to include areas of ENV within the open space network.

- » Include the retained ENV within the open space network within the Aerotropolis SEPP High Biodiversity Values map.

## Native vegetation rehabilitation

### Wianamatta-South Creek Precinct

Wianamatta–South Creek Corridor is the longest freshwater stream in Greater Sydney and a defining element of the Western Parkland City and the Aerotropolis. As the Aerotropolis transforms, the catchment will be renewed and improved using a risk-based approach to manage the cumulative effects of development on the health of catchments, as defined the Western City District Plan. The Wianamatta–South Creek Precinct is approximately 757.65ha in size (south of Elizabeth Drive) and will require active management across the whole area to restore the Precinct into a healthy, resilient ecological spine of the Aerotropolis.

The rehabilitation works for this Precinct should be focused on weed control, assisted regeneration and revegetation. Based on the recovery potential and existing native vegetation within this precinct, the study recommends the Precinct be separated into 3 management zones, each with differing objectives and management strategies, as described in the table below.

**Table 7 Management zones for the Wianamatta-South Creek Precinct**

Management Zone	Objectives and Priorities
Weed Control and Rehabilitation	<p>Management Zone One consists of native vegetation communities with high recovery potentially, which contain diagnostic species in most strata. This Zone will have the capability to regenerate with proper weed management. The main priorities recommended are:</p> <ul style="list-style-type: none"> <li>» Target removal of priority and environmental weeds</li> <li>» Control of exotic grasses and other exotic species</li> <li>» Monitor native vegetation and weed densities.</li> </ul>
Weed Control and Minor Revegetation	<p>Management Zone Two consists of native vegetation communities with moderate recovery potentially, which contain diagnostic species in the canopy and mid-storey strata. The groundcover is generally characterised by exotic grasses and/or environmental weeds, which may require minor revegetation works to 'fill in gaps'. The main priorities recommended are:</p> <ul style="list-style-type: none"> <li>» Target removal of priority and environmental weeds</li> <li>» Control of exotic grasses and other exotic species</li> <li>» Minor revegetation works, including groundcover species</li> <li>» Monitor native vegetation and weed densities.</li> </ul>
Weed Control and Revegetation	<p>Management Zone Three consists of exotic vegetation or degraded native vegetation with very low recovery potential. This Zone will require extensive revegetation to rehabilitate back to the ecological communities that were once present. The main priorities recommended are:</p> <ul style="list-style-type: none"> <li>» Target removal of priority and environmental weeds</li> <li>» Control of exotic grasses and other exotic species</li> <li>» Tubestock planting following weed control in all areas of low resilience</li> <li>» Monitor native vegetation and weed densities.</li> </ul>

### Rehabilitation and revegetation constraints

Revegetation and rehabilitation of conservation areas will be required to consider the Wildlife Management Assessment Report (Avisure, 2020) to ensure the risk of wildlife strike from operating aircraft at Western Sydney



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Airport is mitigated, once the airport is operational. A summary of some of the landscaping recommendations are provided below.

- » Site specific Vegetation Management Plans will be required to identify planting lists and densities that restore natural bushland as much as possible, whilst not increasing aviation risk.
- » Select landscape plants that minimise the attraction of birds and flying foxes.
- » Do not plant trees and shrubs which bear edible berries, fruits, seeds or nuts, or flower profusely.
- » Avoid species from the Proteaceae family. The nectar produced by these species can attract flying-foxes and various nectivorous birds.
- » Avoid species from the Myrtaceae family. Many species in this family produce large volumes of nectar that can be highly attractive to flying foxes and various nectivorous birds.
- » Avoid species from the Moraceae family due to their decorative and aesthetic appeal.
- » Avoid palm species. These extend across a range of families and should only be used when a strict documented regime of regular fruit/flower cluster removal occurs.
- » Avoid clumps of trees and shrubs because they provide more shelter and more concentrated feeding areas than individual or small groups of plants.
- » Apply the following conditions when planting trees along access and other roads to the airport:
  - > Maximum mature height of any tree: 10m.
  - > No more than 5 trees planted in any one group.
  - > Average interval between tree groups not less than 200m.
  - > Minimum interval between tree groups is 100m.
  - > Single trees are planted >50m to any other single tree or tree groups.
  - > Trees constitute no more than 5% of total tree/shrub plantings.
- » Apply the following conditions to shrub plantings:
  - > Shrubs do not exceed 5m mature height.
  - > Shrubs which produce nectar, fruits or seed (e.g. Banksia, Grevillea, Hakea) are not planted in groups of more than 5 per group and such groups are not be planted <50m to specimens of the same species or groups of any species which may similarly attract birds or flying-fox at the same time of the year.
- » Use low prostrate ground cover plants, avoiding profusely fruiting or seeding species. Use ground cover species rather than grasses to reduce the wildlife attraction and minimise ongoing maintenance costs.
- » Avoid grasses that produce a lot of seed for rough grass or soil stabilisation.

## Climate change

Climate change may become a significant threat to biodiversity in the near future and impact on the success of future rehabilitation and revegetation strategies for the Aerotropolis through the following means (DECCW, 2010):

- » A reduction in the geographic range of certain species.
- » Changes in population dynamics and survival.
- » Increased opportunity for range expansion of invasive species.
- » Increased likelihood of extreme weather events and fire.

As part of the draft CPCP, Macquarie University undertook a quantitative evaluation that modelled how climate change will affect the suitability of habitat for numerous Cumberland subregion species (Biosis, 2020). Although there still remains a high level of uncertainty on how climate change will impact on specific biodiversity values,

the evaluation concluded that it will have a significant impact on the availability of suitable habitat within the Cumberland subregion for the vast majority of species assessed.

To facilitate adaptation of biodiversity to climate change, the study recommended four main principles to implement (Biosis, 2020). Such principles are outlined in the table below as well as how the Precinct Plan will ensure consistency.

**Table 8 Principles for implementation**

<b>Principles (Biosis, 2020)</b>	<b>Consistency</b>
<b>Protect the largest and most viable patches</b>	The size of a patch of native vegetation is known to positively correlate with many ecological functions such as species richness, genetic diversity and adaptation or natural disturbance. Therefore, ensuring protection of large, good condition native vegetation will aid in managing biodiversity under climate change. The draft Precinct Plan will ensure that large intact areas of native vegetation within the Wianamatta-South Creek corridor will be protected in the future, with opportunities to further enhance such patches through revegetation.
<b>Maintain and improve habitat connectivity</b>	Ensuring habitat connectivity will aid in species dispersal which in turn, will aid in adaptation to differing climate change scenarios. The draft Precinct Plan will ensure habitat connectivity is maintained within the Wianamatta-South Creek corridor, with opportunities to further enhance such patches through revegetation. Furthermore, the creation of the open space network will also create east to west habitat corridors allowing for further habitat connectivity beyond the Precinct boundary.
<b>Reduce the impacts of other threats</b>	Reducing key existing threats will also aid in facilitating adaptation to climate change through enhancing resilience. This can be done through managing connectivity of fragmented ecosystems, effective invasive species management and appropriate controls of disturbance regimes. It is envisaged that appropriate management regimes over the Wianamatta-South Creek Precinct will be implemented in the future. Not only will this include rehabilitation works and revegetation, however, also include appropriate weed and potentially pest management.
<b>Manage uncertainty through adaptive management</b>	Future rehabilitation strategies for the Wianamatta-South Creek Precinct will ensure adaptive implementation of any management regimes. When choosing appropriate species for revegetation within the Precinct, revegetation plans should consider incorporating 'climate ready' provenances of 'diagnostic' and priority species, where available and appropriate. Where climate ready provenances are not available, revegetation strategies should aim to maximise genetic diversity to support climate change adaptation and increase the likelihood of long-term health and persistence of biodiversity.

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# 5 Bushfire risk assessment and management plans

## 5.1 Description of study

Two components of work in relation to bushfire were prepared by Eco Logical Australia. The first was a bushfire risk assessment focusing on the Aerotropolis as a whole, to provide an assessment of the landscape bushfire risk and the residual risk for development following the provision of bushfire protection measures. It included an assessment of the Aerotropolis against the considerations of the Rural Fire Services (RFS) *Planning for Bushfire Protection 2019* (PBP).

The second component of work prepared was a suite of bushfire management plans for the Initial Precincts of Aerotropolis Core, Badgerys Creek, Wianamatta-South Creek, Northern Gateway and Agribusiness. These bushfire management plans address the staging of development within each of the initial precincts and provide recommendations on how development within these precincts should respond to any identified bushfire risk.

## 5.2 Assessment and findings

### Bushfire risk assessment

Land within the Aerotropolis is classified as bushfire prone land and is located within a broader landscape of bushfire prone land as well as within the Cumberland and Macarthur Bush Fire Risk Management Zones. The landscape is comprised predominantly of grassland and narrow corridors of wetland vegetation in the north west and less vegetated areas to the south east where the extent of development is greater. The north west area presents the greatest bushfire risk across vast agricultural and grassland lots interconnected by heavily vegetated riparian corridors.

The bushfire risk assessment considered land within the Aerotropolis as acceptable for the proposed development and adequate in accommodating the required bushfire protection measures prescribed under PBP for the following reasons:

- » The development site is very large, providing an area of 11,200ha within which bushfire resilience can be incorporated. There is ample area to locate Asset Protection Zones, Special Fire Protection Purpose Development and other bushfire protection measures to meet the prescribed acceptable solutions
- » Capacity exists to enhance the bushfire protection measures throughout the staged implementation of development
- » Landscape design controls across the development will further reduces the bushfire attack potential
- » Over 75% of future development will be located within Bushfire Attach Level LOW
- » The perimeter to area ratio of the development is low compared to most development proposed on bushfire prone land in NSW. A low perimeter to area ratio reduces bushfire risk and helps increase community resilience
- » No unusual cumulative risks have been identified. Complementary and consistent risk management through land and building design, and community programs are also feasible.

Further details about the bushfire risk of each precinct are demonstrated in the table below.



**Table 9 Bushfire risk of each precinct**

Precinct/s	Bushfire Risk
<b>Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek</b>	<ul style="list-style-type: none"> <li>» The bushfire hazard in the Aerotropolis Core and Badgerys Creek Precincts is continuous primarily as grassland hazard and forested wetland along the eastern and western perimeters of the precincts to converge and surround the northern aspects of Badgerys Creek Precinct. A significant network of connected riparian corridors and retained vegetation dissect the Aerotropolis Core and potentially exposes the precinct to multiple bushfire fronts.</li> <li>» The largest potential fire hazard is the riparian corridors within the Wianamatta-South Creek Precinct that surrounds the Aerotropolis Core and Badgerys Creek Precincts.</li> <li>» Based on the fire history, landscape fire advantages, minimal residential use and the proposed larger allotment size enabling appropriate bushfire protection measures, it is not considered that the Aerotropolis Core and Badgerys Precincts would be within an unacceptable bushfire landscape.</li> </ul>
<b>Agribusiness</b>	<ul style="list-style-type: none"> <li>» The bushfire hazard in the Agribusiness Precinct is extensive and continuous to the west of the precinct, within the broader landscape of managed medium density residential and agricultural areas. A significant network of connected riparian corridors and retained vegetation from the south-west through to the north-west potentially exposes the precinct to larger sized bushfires.</li> <li>» The largest potential fire hazard is the vast agricultural and grassland lots throughout the precinct, along with riparian corridors and woodland vegetation.</li> <li>» Based on the fire history, landscape fire advantages, minimal residential use and the proposed larger allotment size enabling appropriate bushfire protection measures, it is not considered that the Agribusiness Precinct would be within an unacceptable bushfire landscape.</li> </ul>
<b>Northern Gateway and Wianamatta-South Creek</b>	<ul style="list-style-type: none"> <li>» The bushfire hazard in the Northern Gateway Precinct is continuous primarily as grassland hazard and woodland along the north-eastern and northern perimeters of the Precinct. A significant network of connected riparian corridors and retained vegetation north-east to south-west potentially exposes the Precinct to multiple bushfire fronts.</li> <li>» The largest potential fire hazard is the grassland to the north and east, and riparian corridors within the precincts.</li> <li>» Based on the fire history, landscape fire advantages, minimal residential use and the proposed larger allotment size enabling appropriate bushfire protection measures, it is not considered that the Northern Gateway Precinct would be within an unacceptable bushfire landscape.</li> </ul>

## Bushfire management plans

The bushfire management plans were prepared to inform and assist with the preparation of the *Urban Design and Landscape Reports* for the Initial Precincts. Each management plan provides an assessment of the landscape bushfire risk and the residual risk for development following the provision of bushfire protection methods.

Application of bushfire protection measures will minimise the risks from bushfire. Asset protection zones and multi-access points are essential protection measures that have informed precinct design. Several strategies in the form of planning controls were provided to reduce the bushfire risk to an appropriate level within the Precincts.

**Table 10 Bushfire management plan for the Initial Precincts**

Precinct/s	Bushfire Management Plan
<b>Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek</b>	<ul style="list-style-type: none"> <li>» The most likely bushfire attack scenarios are smaller, lower intensity fires starting either within or outside the Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek Precincts.</li> <li>» Should a rapid-fire response be applied and/or they occur under lower Forest Fire Danger Index conditions, then the chance of containment is much higher and the potential consequence lower.</li> </ul>
<b>Agribusiness</b>	<ul style="list-style-type: none"> <li>» The most likely bushfire attack scenarios are smaller, lower intensity fires starting either within or outside the Agribusiness Precinct.</li> <li>» Further, there are landscape fire advantages, minimal residential use and the proposed larger allotment size enabling appropriate bushfire protection measures, it is not considered that development in the Agribusiness Precinct would be within an unacceptable bushfire landscape.</li> </ul>
<b>Northern Gateway and Wianamatta-South Creek</b>	<ul style="list-style-type: none"> <li>» The most likely bushfire attack scenarios are smaller, lower intensity fires starting either within or outside the Northern Gateway and Wianamatta-South Creek Precincts.</li> <li>» Should a rapid-fire response be applied and/or they occur under lower Forest Fire Danger Index conditions, then the chance of containment is much higher, and the potential consequence is lower.</li> </ul>

## 5.3 Recommendations

More detailed bushfire risk assessment and recommendations to accurately prescribe setbacks, road and landscaping is required at a precinct level.

To ensure the requirements of *Planning for Bushfire Protection 2019* are met, recommendations were made around the following aspects to ensure appropriate bushfire protection measures within the precincts. In addition, bushfire protection measures recommended for inclusion in the DCP are below.

**Table 11 Recommendations for inclusion in the Development Control Plan**

Recommendations to meet requirements of <i>Planning for Bushfire Protection 2019</i>	Recommendations for bushfire protection measures in the DCP
<ul style="list-style-type: none"> <li>» Asset protection zones</li> <li>» Compliant water supplies</li> <li>» Underground electricity and gas services</li> <li>» Multiple-access road corridors for emergency services and others</li> <li>» Neighbourhood safer places</li> <li>» Landscape management and garden design principles</li> </ul>	<ul style="list-style-type: none"> <li>» Where a site is identified as being bushfire prone, development is undertaken in accordance with Rural Fires Act 1997, <i>Planning for Bushfire Protection 2019</i>.</li> <li>» Ensure appropriate fire management regimes and hazard reduction techniques for native vegetation areas, waterways and riparian zones. APZs are to be located wholly within land zoned for urban purposes and not within land zoned Environment and Recreation, E1, E2 or managed as a reserve.</li> <li>» Landscaping in bushfire prone areas will be designed in accordance with Appendix 4 of <i>Planning for Bush Fire Protection 2019</i>.</li> </ul>

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# 6 Economic and market feasibility – part 1

## 6.1 Description of study

Atlas Urban Economics have been engaged to provide economic and market feasibility advice to inform precinct planning for the Initial Precincts (Aerotropolis Core/Badgerys Creek/Wianamatta-South Creek, Northern Gateway and Agribusiness).

Part 1 carries out property market and land use research in the Aerotropolis and broader Western City to understand the opportunity for the study area to accommodate various land uses. Part 2 is discussed in the following section.

## 6.2 Assessment and findings

### Population

The Western City District is projected to increase by some 822,00 residents over the coming decades to 2041, reaching a total population of just over 1,870,000. This will see the District remain the largest population hub within the five defined districts of Greater Sydney; and accounting for 34% of the total Greater Sydney population growth over this period.

The Western City District is expected to require around 704,000 dwellings over the coming decades to 2041.

### The local economy

The Western City District covers an area of vast geography and is comprised of multiple local economies and sectoral systems. An overall catchment area is defined as the Western City District local government areas (LGAs). This Catchment Area is then split into Primary and Secondary Catchments based on their proximity to the Western Sydney Airport. The Primary Catchment is defined as the Liverpool, Penrith, Fairfield, Camden and Campbelltown LGAs, with the Secondary Catchment defined as Blue Mountains, Hawkesbury and Wollondilly LGAs.

In the primary growth catchment Gross Regional Product (GRP) grew by an average of 4.1% per annum since 2014; outstripping the average population growth of 2.4% per annum over the past five years.

The following observations are made on the nature and composition of employment in the Catchment Area:

- » There is significant manufacturing presence across a broad range of industry sub-sectors in both catchments
- » There is a modest but important agricultural sector
- » There is a notable tourism industry with established markets in areas such as the Blue Mountains
- » Despite strong population-serving and industrial sectors of employment; industries such as health care and social assistance, administrative and support services, and real estate services experienced declining employment
- » Approximately 50% of residents in the primary catchment and 80% in the secondary catchment area commute outside of their respective catchment for employment.

Within the primary catchment, the largest importing and exporting sectors include basic metal manufacturers inputs, construction services, ownership of dwellings, wholesale and retail trade. The Secondary Catchment trades significant amounts of coal to and from the region associated with mining operations at Tahmoor and Appin, while construction services, defence, and ownership of dwellings also feature strongly in both imports and exports. Other agriculture is a notable exporting sector from the Secondary Catchment.



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## Trajectory

The strong economic growth of the Catchment Area is currently being challenged by the COVID-19 Pandemic. Social distancing initiatives aimed at slowing the spread of COVID-19 have included suspending international tourism and significant travel restrictions between Australia's states.

Many businesses across key sectors such as hospitality, sports and recreation, and transportation have been forced to either close or significantly alter their operating models. The extensive international impacts means that economic activity is likely to remain impacted for some time.

However, despite the current challenges, the outlook for the Catchment Area's economy remains strong. The impending development of the Aerotropolis will provide numerous opportunities to drive employment and industry growth.

## Implications for study area

### Population/growth

The broader Western City District is the most populated area within Greater Sydney. Population growth over the recent past has been steady and sustained, with much greater growth projected over the next two decades.

Looking forward, the Western City is expected to remain a major destination for young families. By 2041 the District is projected to comprise the largest proportion of young residents in Greater Sydney with more than 26% aged under 20 years.

A corollary of population growth is a need for dwellings, employment opportunities, business services and infrastructure. The local economy of the Western City has been strong, with GRP outpacing population growth over the past three years to 2019.

Notwithstanding the unprecedented level of government investment in infrastructure, the creation of employment opportunities has lagged with more than 50% of working residents in the Primary Catchment travelling outside for employment. An even greater proportion of residents (some 80%) in the Secondary Catchment commute outside for work.

The pace of housing delivery has also lagged, with average annual dwelling completions falling below the annual number of dwellings required to accommodate population growth. This has implications for the achievement of the growth aspirations of the Western City District.

### Land use/local economy

Existing land uses and development activity provide a useful indication of what the Study Area could resemble in the coming decades with the Western Sydney Airport and Aerotropolis.

A significant manufacturing presence is observed across a broad range of industry sub-sectors which has grown off the back of proximity to Sydney markets. An important agricultural sector contributes to Sydney's food bowl, comprising an economic value equivalent to 25% of the Greater Sydney region. Industrial-type activity is observed to operate alongside to support and complement the rural production and agricultural activities in the region.

It is not uncommon for rural and peri-urban lands at the edge of the urban footprint of cities to experience land use tensions and conflicts with urban uses. Over the last decade as precinct planning has resulted in rezoning of these lands for urban uses, some businesses have continued to operate while others have been displaced by divestment of lands to developers.

## Findings

- » It is important to recognise that until the Aerotropolis reaches a critical mass of residents, the Study Area will only be viable for certain land uses. Industrial uses, principally freight and logistics, can be expected to be early movers from Day 1 given the deepening demand for industrial land across Greater Sydney and the natural synergies between industrial uses, the Aerotropolis and the orbital road network.

- 
- » In the early years there will likely be resistance by businesses to locating within the Study Area. Businesses may locate production operations in the Study Area while maintaining head office operations elsewhere. As the region establishes a critical mass of residents from which businesses can draw upon for all skill levels, the Study Area will grow in attractiveness as a business destination.
  - » The facilitation of agribusiness uses will require a notable level of curation and support. The greatest challenge for the establishment of the Agribusiness precinct is conceivably the lack of direct Government control/ ownership of landholdings.
  - » The establishment of a resident population base within the Aerotropolis and its surrounds will be critical to the success of not only the Precinct's centres but also to attract business investment.

## Challenges

Several distinct challenges to achieving the vision of the Aerotropolis are identified through market research and stakeholder engagement. These are summarized below in order of significance:

- » Distance from labour pool (skilled, unskilled and executives) is acknowledged by industry and stakeholders as arguably the greatest challenge facing the viability of non-industrial employment uses in the Aerotropolis.
- » Businesses need access to all skill levels - from unskilled and skilled workers to executive positions. Ensuring both strong public transport linkages and soft linkages between industry, government and the university sector will be critical in this regard.
- » Lack of population critical mass is identified as a key challenge for service businesses and population-serving sectors, including retail, non-retail and urban services.
- » Transport and logistics businesses will likely be first movers into the Aerotropolis is recognised by industry and stakeholders. Whilst this will be the crucial first step in facilitating initial investment into the Study Area, it will be important that these uses do not define the market profile of the Aerotropolis.

## 6.3 Recommendations

Recommendations of the Market and Economic Feasibility Assessment are provided in Section 6: Market and Economic Feasibility – part 2.

# 7 Market and economic feasibility – part 2

## 7.1 Description of study

Atlas Urban Economics have been engaged to provide economic and market feasibility advice to inform precinct planning for the Initial Precincts (Aerotropolis Core/Badgerys Creek/Wianamatta-South Creek, Northern Gateway and Agribusiness).

Part 2 of their report builds upon the baseline research undertaken in Part 1 and examines the feasibility of different land uses across the Aerotropolis to understand their density requirements and tolerance to infrastructure contributions. The objective of the report is to consider the market viability of different land uses and development typologies in the Aerotropolis and how their take-up may occur over time as the Aerotropolis grows.

## 7.2 Assessment and findings

In undertaking a feasibility analysis, Atlas Urban Economics have considered the precinct-specific projections prepared by the Western Sydney Planning Partnership (known as common planning assumptions) as well as undertaking a take-up analysis which approximates delivery of development typologies based on their investment requirements, commercial considerations and the Aerotropolis's competitive position to comparable areas/precincts.

### Common planning assumptions

#### Common planning assumptions and equivalent densities

The Western Sydney Planning Partnership have prepared precinct-specific projections (known as common planning assumptions) which outline the expected number of jobs, residents and dwelling to be accommodated over the coming decades. The projections in the Common Planning Assumptions (CPA) form the basis of planning aspirations and precinct planning. The CPA are overlayed against the developable area of each precinct to enable an appreciation of the equivalent employment and population densities projected by precinct (see Table below). These are calculated based on the quantum of development capable land after deducting land that is constrained by physical and environmental factors.

**Table 12 Projected employment and population densities**

Precinct	Developable Area (ha)*	2036 Projections			2056 Projections			Equivalent Density	
		Jobs	Population	Dwellings	Jobs	Population	Dwellings	2036	2056
Aerotropolis Core	872	12,600	10,433	1,873	51,000	24,000	8,373	14 jobs/ha 12 pp/ha	58 jobs/ha 27pp/ha
Badgerys Creek	452	2,174	53	18	10,092	26	6	5 jobs/ha	22 jobs/ha



Northern Gateway	705	14,872	10,322	1,655	19,273	116,438	5,905	21 jobs/ha 15pp/ha	27 jobs/ha 23pp/ha
Agribusiness	737	5,405	3,319	1,288	13,844	3,800	1,476	7 jobs/ha 5pp/ha	20 jobs/ha 5pp/ha

\* Developable area in this Study is defined as the land available for development but excludes public open space

## Case study benchmarking of equivalent densities

To gauge the development scale and typologies required to accommodate the employment and population projected in the common planning assumptions, case study benchmarking of centres and employment areas in Greater Sydney was undertaken. This included:

- » Commercial precincts across the Western and Central City
- » Industrial precincts across the Western City
- » Residential Areas zoned for a mix of densities across the Western and Central City.

The following broad observations were made:

- » Business park precincts such as Macquarie Park and Norwest typically accommodate a mix of 4-5 storey office buildings in addition to 2-3 storey commercial buildings with a ground floor showroom/warehousing component.
- » Suburban Centres (i.e. Blacktown, Bankstown, Fairfield) comprise a wide variety of building typologies, ranging from large enclosed shopping centres, 4-8 storey office buildings and strip retail (single or double storey).
- » City Centres such as Parramatta and Liverpool comprise a similar mix of uses as suburban centres though with denser forms of commercial development with office buildings of >20 storeys.
- » Industrial precincts are often homogenous, though large-scale logistic precincts are distinct given the scale of the buildings that accommodate warehousing and distribution centres. General industrial and light/service industrial precincts commonly comprise a mix of freestanding warehouses and complexes with strata-titled industrial units.
- » Residential precincts are diverse with built form typically reflecting the maximum density permitted under planning controls. Only medium and high density residential typologies are considered given the permissibility of residential uses proposed in the draft SEPP.

## Equivalent development typologies

Based on benchmarking of centres and employment areas in Great Sydney, the following range of development typologies and corresponding densities are identified that could accommodate the employment and population densities projected under the common planning assumptions.

**Table 13 Potential development typologies**

Land Use	Potential Development Typologies	Indicative Densities	
		FSR (Lot Size)	HOB
Commercial Uses			
Business Park	4-5 storey office buildings, ground floor retail 2-3 storey commercial building with ground floor warehousing Retail showrooms	1.0 to 1-2:1	22m to 37m
Suburban Centre	4-8 storey office building, ground floor retail Enclosed shopping centres Two-storey strip retail	1.5:1 to 4:1	30m to 65m
City Centre	Office buildings (3-20 storeys and >20 storeys) Enclosed shopping centres Two-storey strip retail	>2.5:1	12m to 120m
Industrial Uses			
Large scale logistics	High clearance warehouses and distribution centres with ancillary office component	0.5:1	-
General industrial	High clearance warehouses Manufacturing facilities Stata-titled industrial suites	0.5:1 to 0.6:1	9.5m to 21m
Light/Service industrial	Strata-titled industrial suites Freestanding workshops Small warehouses	(Equivalent to 0.8:1 to 1:1)	12m
Residential Uses			
Medium-density residential	2 storey townhouses 2-3 storey 'walk-up' unit blocks	(Equivalent to 0.8:1 to 1:1)	6m to 15m
High-density residential	3-8 storey RFBs 2-3 storey 'walk-up' unit blocks 8-12 storey mixed use development	0.8:1 to 2.5:1	11m to 45m

## Development feasibility and likely commencing delivery horizon

In greenfield environment such as the Aerotropolis, the issue of development feasibility is more a question of 'when' than 'if'. When development will be feasible, and the pace of development will depend on the following pre-requisites:

- » There is market demand for the proposed land use and development typology.
- » There is market willingness to pay an economic price for the completed floorspace.
- » The site can be economically acquired/consolidated to enable a commercial return on investment.

Even though the above pre-requisites may be present, the following factors are also required to trigger when development is delivered:

- » Transport infrastructure (and hard infrastructure) investment and level of accessibility available.

- » Access to services and soft infrastructure.
- » Sufficient depth of market demand.

The table below demonstrates the delivery horizon timeframes from opening year in 2026 as well as key triggers for delivery of the potential development typologies.

**Table 14 Potential development typologies and their delivery horizon**

Land Use	Potential Development Typologies	Delivery Horizon	Key Triggers for Delivery
<b>Commercial Uses</b>			
Low Rise	Low-rise commercial/warehouses	0-5 years	Metro and transport infrastructure investment, provision of retail and urban amenity including local business services
Low to Mid Rise	Low-rise commercial buildings		
	Mid-rise commercial buildings	5-10 years	
High Rise	High-rise office buildings	15 years+	Attractive value proposition against Liverpool and Parramatta (i.e. rents, urban and retail amenity and diversity of local labour pool)
<b>Industrial Uses</b>			
Transport and Logistics	High clearance warehouses and distribution centres	0-5 years	Continued population growth in Greater Sydney
General Industrial	High clearance warehouses Manufacturing facilities	0-5 years	Synergies for certain occupiers to being located proximate the Aerotropolis
Light/Service industrial	Freestanding workshops Strata-titled industrial suites	5-10 years	Resident population critical mass in Aerotropolis and surrounds
<b>Residential Uses</b>			
Medium-density residential	'Walk up' multi dwellings	0-5 years	Metro and transport infrastructure investment, retail and urban amenity including local business services
High-density residential	Residential flat buildings Mixed use development	5-15 years	Attractive value proposition against competing high density residential centres (e.g. Liverpool, Parramatta, Blacktown)
<b>Retail and Hospitality</b>			



Supermarket and specialty retail	Strip retail Shopping centres	5-15 years	Resident and worker population critical mass in Aerotropolis and surrounds
Hotels, pubs, serviced apartments	Mixed use commercial buildings	5-15 years	Airport passenger throughput and visitation to the Aerotropolis
<b>Institutional and Special Use</b>			
Education and health facilities	Standalone buildings Mixed use commercial buildings	5-15 years	Resident and worker population critical mass in Aerotropolis and surrounds
Arts and cultural centres	Standalone buildings Mixed use commercial buildings	5-15 years	

## Potential take up of development

This section estimates potential take-up of development assuming the indicative typologies. The take-up analysis has regard to the Study Area's competitive position against investment opportunities in comparable areas/precincts. The estimate of potential development take-up considers the requirements of early movers, followers and incubators in approximating when development typologies may be feasible to deliver.

The estimates of potential take-up by development is therefore different to the Common Planning Assumptions; the latter encapsulates planning aspirations while the former approximates delivery of different typologies based on their investment requirements and commercial considerations.

The estimates of development take-up in the table below make assumptions on potential development typologies that could be accommodated in the precincts. These assumptions will be subject to refinement as precinct planning progresses.

**Table 15 Potential development typology and their timing**

Precinct	2016	2036	2056	Potential Development Typology	Comments
<b>Dwellings</b>					
Aerotropolis Core	373	1,873	8,373	Shop-top housing (5-12 storeys) Residential flat buildings (5-12 storeys) Multi-dwelling housing (3 storeys)	Medium density housing is expected to be taken-up first in the first 5 years, with shop top housing and higher density formats expected to commence delivery from Year 5.  This results in a gradual start to dwellings take-up, which is expected to accelerate from Year 10 as higher density formats become viable to develop.
Badgerys Creek	72	18	6	Not Applicable	Reduction in dwellings due to demolition and new development.
Northern Gateway	80	1,655	5,905	Shop-top housing (9-15 storeys) Residential flat buildings (9-15 storeys)	Medium density housing is expected to be taken-up first in the first 5 years, with shop top housing and higher density formats expected to commence delivery from Year 5.

				Multi-dwelling housing (3 storeys)	This results in a gradual start to dwellings take-up, which is expected to accelerate from Year 10 as higher density formats become viable to develop.
Agribusiness	607	1,288	1,476	Not Applicable	Rural workers accommodation is permitted in Proposed SEPP.
Population					
Aerotropolis Core	1,278	5,064	22,917	Based on Common Planning Assumptions household occupancy sizes	Persons per household: 2016: 3.42 2036: 2.7 2056: 2.74
Badgerys Creek	200	53	26		Persons per household: 2016: 2.76 2036: 2.95 2056: 4.46
Northern Gateway	246	4,423	16,183		Persons per household: 2016: 3.09 2036: 2.67 2056: 2.74
Agribusiness	1,722	3,319	3,800		Persons per household: 2016: 2.84 2036: 2.58 2056: 2.57
Employment					
Aerotropolis Core	604	10,604	47,604	High Rise office towers (8-18 storeys) Mid-rise office buildings (4-8 storeys) Shop-top housing (5-12 storeys) Strip retail (1-2-storeys) Warehousing (1-storey) Industrial park (1-2 storeys) Business park (2-4 storeys)	Low-rise and medium density formats are expected to be viable from Year 1, with higher density formats (towers) becoming viable to develop in the longer term.  This is because the higher cost of construction associated with taller buildings is unlikely to be offset by corresponding market rents in the early years.  Employment is therefore expected to be accommodated within lower density formats in the early years before taller buildings become feasible to deliver. This is expected to coincide with the establishment of critical mass and associated retail and local services. The exhaustion of development opportunities in Parramatta and Liverpool is also expected to occur by then.  This results in a steady rise to employment take-up, which is expected to accelerate from Year 15 as towers become viable to develop.

Badgerys Creek	154	2,154	9,154	Warehousing (1-storey) Industrial park (1-2 storeys) Business park (2-4 storeys)	These typologies are expected to accommodate 'early movers' with steady and sustained take-up of development opportunities expected.  Take-up estimates an average of 40ha per annum in the first 10 years, increasing to 80ha per annum thereafter.
Northern Gateway	221	9,221	19,221	High-rise office towers (8-18 storeys) Mid-rise office buildings (4-8 storeys) Shop-top housing (9-15 storeys) Strip retail (1-2 storeys) Warehousing (1-storey) Industrial park (1-2 storeys)	Low-rise and medium density formats are expected to be viable from Year 1, with higher density formats (towers) becoming viable to develop in the longer term.  This is because the higher cost of construction associated with taller buildings is unlikely to be offset by corresponding market rents in the early years.  Employment is therefore expected to be accommodated within lower density formats in the early years before taller buildings become feasible to deliver. This is expected to coincide with the establishment of critical mass and associated retail and local services. The exhaustion of development opportunities in Parramatta and Liverpool is also expected to occur by then.  This results in a steady rise to employment take-up, which is expected to accelerate from Year 15 as towers become viable to develop.
Agribusiness	330	1,830	13,830	Warehousing (1-storey) Industrial park (1-2 storeys)	Non-agricultural typologies are expected to accommodate 'early movers' with steady and sustained take-up of development opportunities expected.

## 7.3 Recommendations

The following recommendations are made for precinct planning in the Aerotropolis based on Part 1 and 2 of the Market Feasibility and Economic Study:

### Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek Precinct

The Aerotropolis Core Precinct is the largest initial precinct and is envisaged to accommodate the greatest number of new dwellings and jobs. A mix of Enterprise and Mixed Use land zonings are proposed across the precinct.

- » Establishment of a new residential community will be important to catalyse the location of local services.
- » Precinct planning within the Mixed Use Zone should be prioritised given the importance of establishing a critical mass of residents within the precinct in attracting centre-based uses and broader employment activity.
- » Opportunities for tourism and visitation uses will be important to the vitality and vibrancy of the Precinct.



- 
- » Masterplanning by Western City & Aerotropolis Authority (WCAA) and Sydney Metro around the Aerotropolis Core Metro Station will play an important role to unlock key development opportunities that will contribute to building investment momentum.
  - » In the early years, strategically located Government-owned sites could be key to catalysing development activity.
  - » To ensure industrial development within the Enterprise zone does not result in foregone development opportunities for commercial office uses in the future, a 'ring fence' or staged approach could be considered until higher order employment uses are viable.

## Northern Gateway Precinct

The Northern Gateway Precinct is anchored by the future Sydney Science Park which has already been rezoned. The remainder of the Precinct is to be zoned Enterprise.

- » The expeditious delivery of the Sydney Science Park will be critical in establishing the first resident catchment within the Aerotropolis. Masterplanning by Sydney Metro around the proposed Luddenham Metro Station will be important to coordinate and build upon the momentum generated by the Sydney Science Park.
- » Subject to environmental and land capacity, the proposed Enterprise Zone across the remainder of the precinct will likely attract strong demand for large scale logistics and warehousing operations. These users would typically require warehouse facilities of >10,000sqm and will typically have a site coverage of less than 50% given heavy vehicle reticulation and car parking requirements, though smaller
- » While large floorplate industrial and transport-based uses will require accommodation, smaller industrial uses are equally important. Over time and as residential and business communities establish in the Aerotropolis and broader region, there will be demand for small scale industrial and urban services floorspace. These users have smaller again floorspace requirements and can occupy areas <1,000sqm. Users could be accommodated with floorplates from 3,000sqm to 5,000sqm.

## Agribusiness Precinct

The Agribusiness Precinct is intended to be entirely zoned Agribusiness. The various industrial and agricultural land uses permitted under this zone present some difficulty in ensuring the intended vision for the Precinct can be realised.

- » Direct engagement between NSW Government (WSPP, WCAA) and existing landowners in the precinct is essential. Partnership arrangements or land acquisitions may need to be considered in order to achieve certain land use outcomes.
- » Higher value land uses (e.g. industrial) could potentially 'crowd out' agribusiness and lower intensity uses. Development controls in the planning framework could consider specifying the types of uses permitted in parts of the precinct.
- » Additional objectives could be inserted into the draft Objectives of the Agribusiness Zone to ensure that traditional industrial uses permitted within the zone are complementary and support agribusiness uses.

# 8 Land capability and contamination

## 8.1 Description of study

A land capability assessment for the proposed development has been undertaken by Aurecon to:

- » Identify existing soil and water conditions and land capability with respect to future urban development and precinct planning
- » Identify constraints and opportunities specifically for groundwater, salinity, contamination and land capability
- » Identify potential limiting factors on land use including environmentally sensitive lands and flooding.

## 8.2 Assessment and findings

### Salinity

The majority of the study area is characterised as having a moderate salinity potential. Limited areas of known salinity and high salinity potential are also present; however, these are localised to low-lying gullies, drain lines and foot slopes along creek lines.

Soil landscape maps have been prepared by the NSW Office of Environment and Heritage (OEH) to inform planning authorities and the public about the nature and limitations of soils in NSW.

The following soil landscapes are present in the study area:

**Table 16 Existing soil landscapes**

Soil Type	Soil Description
Berkshire Park (bp)	<b>Alluvial:</b> alluvial soils consisting of heavy clays and clayey sands, often mottled. Large boulders occur in sand/clay matrix. Occur on dissected, gently undulating low rises on Tertiary river terraces. Soils generally have increasing clay content with depth although erosion and deposition cycles may have caused the occasional reversal of this trend.
Blacktown (bt)	<b>Residual:</b> shallow to moderately deep (>100 cm) hard setting mottled texture contrast soils. Brown loam over mottled brown light clay to grey plastic heavy clay.
Luddenham (lu)	<b>Erosional:</b> brown loam to clay loam over light to medium clay. Slopes 5-20%. Shallow on crests (<100 cm) to moderately deep (<150 cm) on lower slopes and drainage lines.
South Creek (sc)	<b>Alluvial:</b> very deep layered sediments over bedrock or relict soils. Brown sandy loam to clay loam over brown light to medium clay. Typically present along major drainage lines.
Disturbed Terrain	<b>Disturbed:</b> the original soil has been removed, greatly disturbed or buried. Landfill includes soil, rock, building and waste material.

- » The Blacktown landscape is the primary landscape throughout the Initial Precincts, including the Agribusiness, Aerotropolis Core, Northern Gateway, and Badgerys Creek Precincts; with small isolated areas within the Wianamatta-South Creek Precinct. This landscape has a high capability for urban development
- » The Berkshire Park landscape is present as a minor area within Badgerys Creek Precinct. This landscape generally has a high urban capability with localised areas not suitable for urban development
- » The Luddenham landscape is present within the Agribusiness and Northern Gateway Precincts. This landscape has a generally low to moderate capability for urban development

- 
- » The South Creek landscape is present throughout the Wianamatta-South Creek Precinct and small areas of other precincts. This landscape is generally considered not suitable for urban development.

Where salinity is likely to occur in areas of urban development, the following overarching principles should apply:

- » Land managers should clearly demonstrate what measures will be employed to ensure the salinity hazard does not increase (both on site and on adjoining land) as a result of a development
- » Identify and manage sensitive soils (e.g. sodic soils, reactive soils, type of salts, salt loads)
- » Consider the impacts that changing recharge and water quality regimes will have on groundwater and other water dependent ecosystems
- » New houses, buildings or infrastructure (including roads, pathways and retaining walls) in current or potentially salt affected areas may need to be built to withstand the effects of salinity (including the establishment of good drainage prior to construction)
- » Drainage pits and some WSUD actions are not appropriate for high salt store or sensitive landscape positions
- » Leaky pipes in older delivery and stormwater systems will impact on the water balance and salt movement within a catchment and must be considered as part of the overall salinity management strategy
- » Employ deficit irrigation principles to prevent over-irrigation of sports grounds, golf courses, parks, private gardens and lawns, and limit the application of extra salt through water recycling programs or irrigation of saline groundwater
- » Implement a monitoring program (where deemed necessary) including a clear identification of responsibilities.

### **Acid sulphate soils**

Acid Sulfate Soils (ASS) refer to soils containing sulfides. When the sulfides contained in ASS are exposed to oxygen, such as from groundwater drawdown and/or excavation, sulfuric acid can be generated, which may result in a number of detrimental effects on groundwater dependant ecosystems, underground structures and receiving water bodies, including:

- » Implement a monitoring program (where deemed necessary) including a clear identification of responsibilities
- » Increasing the concentration of heavy metals in the groundwater to potentially toxic levels
- » Reduced durability of underground structures, such as steel and concrete, through corrosion
- » Degradation of soil quality in affected areas, preventing vegetation growth.

A search of the Department of Planning Industry and Environment ASS risk map indicates there is no mapped presence of ASS within the Aerotropolis precincts.

### **Soil permeability**

The hydrologic groups present within the Aerotropolis include Group C and Group D soils (slow and very slow infiltration rates when thoroughly wetted) soils. These are typically poorly draining soils and as such will present limitations to urban and agricultural land development within the Aerotropolis.

## **Groundwater levels**

Groundwater quality, expressed as groundwater salinity, describes the electrical conductivity of groundwater.

All landscapes within the Aerotropolis are classified as moderate constraint, with groundwater levels typically between 2m and 8m below ground level. The groundwater quality expressed as salinity in the Aerotropolis is generally moderately saline to very saline conditions.

Agricultural land use can lead to both increases and decreases in groundwater levels depending on the nature of groundwater management and land use activity. Deep and intensive land drainage and over extraction of



groundwater can lead to a decline in groundwater levels, whilst over-irrigation and removal of deep-rooted vegetation can lead to a rise in groundwater levels.

In relation to urban development constraints, where groundwater is shallow, urban development may result in increased risks from flooding, salinization, contamination, stability of structures and viability of production wells.

Rising groundwater levels as a result of increased urban development in the Aerotropolis may cause significant salinity impacts to sensitive receiving environments and groundwater dependent ecosystems.

## Contamination

### Contaminated sites

Under Section 60 of the *Contaminated Land Management Act 1997* (CLM Act), a person whose activities has contaminated land, or a landowner whose land has been contaminated, is required to notify the NSW Environmental Protection Agency (EPA) when they become aware of the contamination.

A search of the EPA's public register has revealed the following sites within the Aerotropolis:

**Table 17 Contaminated sites**

Site ID / Address	Site Name	Precinct
3103/Lot 4 The Northern Road, Luddenham	Elura Liquid Waste Disposal Site	Agribusiness
770/1163 Mamre Road, Kemps Creek	Caltex-Branded Service Station	Wianamatta-South
897/3019-3035 The Northern Road, Luddenham	Caltex Service Station	Agribusiness

Other potentially contaminating sites within the project footprint are identified below

**Table 18 Potentially contaminated sites**

Address	Site Name	Precinct
Lot 90 Elizabeth Drive, Kemps Creek	Brandown Quarry, Waste and Recycling Services	500m from Wianamatta-South Creek Precinct
1725 Elizabeth Drive, Kemps Creek	SUEZ Kemps Creek Resource Recovery Park	Badgerys Creek

### Per-and poly-fluoroalkyl substances (PFAS)

The environmental and potential human impacts from exposure to PFAS are of increasing concern worldwide. The EPA is currently undertaking state-wide PFAS investigation program to identify the use and impacts of PFAS. One PFAS investigation site was identified within a 10 km radius of the project area. The site is the Kemps Creek Rural Fire Service training site, located at 245 Devonshire Road, Kemps Creek (outside the study area).

The investigation verified the presence of PFAS at and around the facility, and attempted to determine the extent of PFAS migration, and inform management actions for the site (NSW EPA), <https://www.epa.nsw.gov.au/yourenvironment/contaminatedland/pfas-investigation-program/pfas-investigation-sites/kempscreek-rfs-training-site>) The EPA and NSW PFAS Taskforce has recommended that specific residents near the depot do not use surface water for drinking, cooking or watering produce.

The SUEZ Resource Recovery Park and Brandown Quarry both have the potential for PFAS to migrate off site into surrounding precincts.

A small airfield, St Mary's / Kennets Airfield, is located in the north of the Northern Gateway precinct. PFAS is known to of been historically used at airfields; the risk is however considered to be low as PFAS was likely only used at large airports for firefighting training.

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## Constrained development areas due to contamination risks

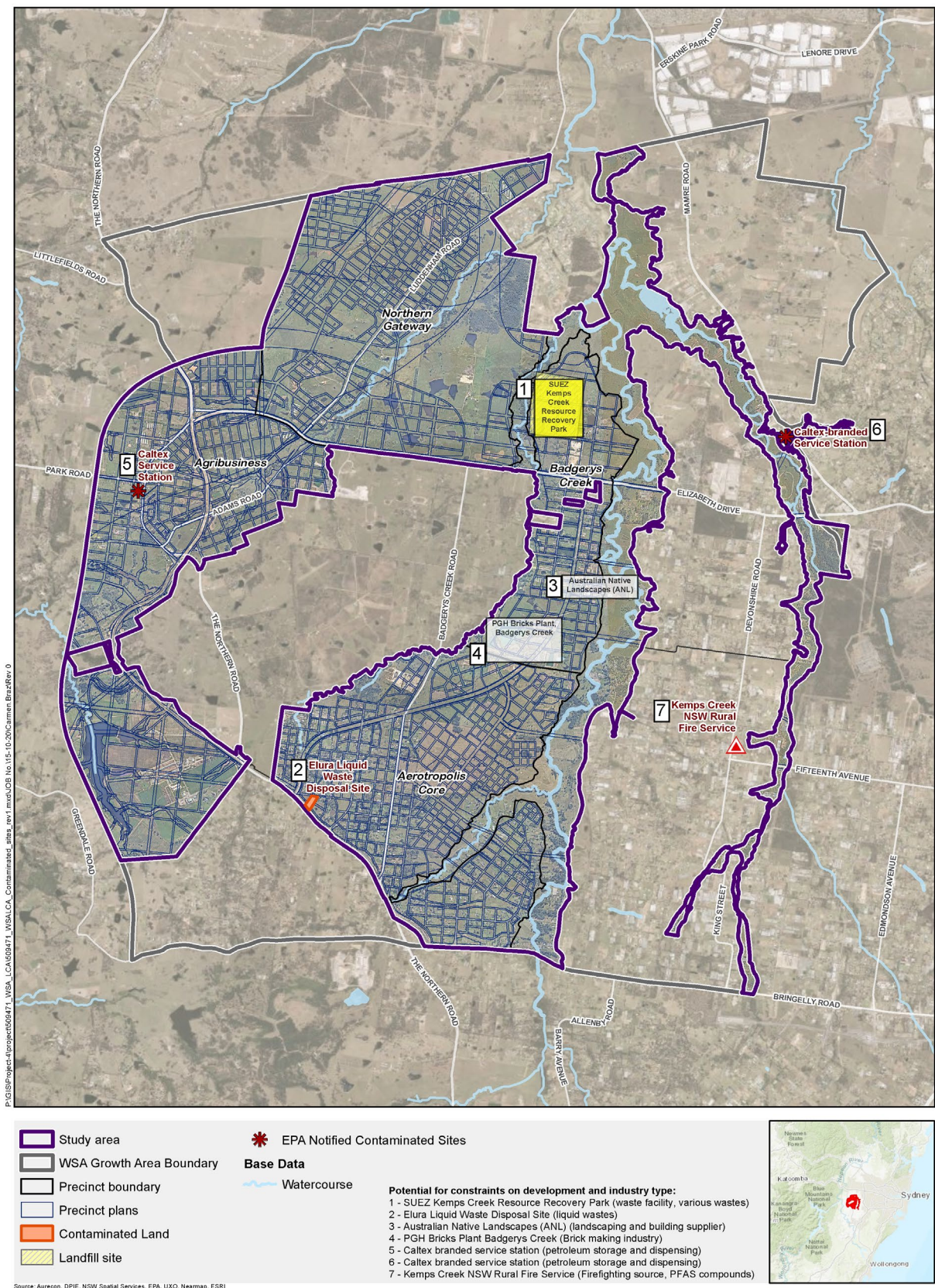
The following sites are likely to have constraints associated with potential contamination relating to soil, groundwater, surface water, landfill gas and vapour:

- » **Aerotropolis Core, Badgerys Creek Precincts:**
  - > SUEZ Kemps Creek Resource Recovery Park, 1725 Elizabeth Drive, Kemps Cree
  - > Elura Liquid Waste Disposal Site, 3103 / Lot 4 The Northern Road Luddenham
  - > Australian Native Landscapes (ANL), 210 Martin Rd, Badgerys Creek
  - > PGH Bricks Plant Badgerys Creek, 235 Martin Rd, Badgerys Creek
- » **Northern Gateway Precinct:**
  - > No major constraints identified
- » **Agribusiness Precinct:**
  - > Caltex Branded Service Station, 897/3019-3035 The Northern Road, Luddenham
- » **Wianamatta-South Creek Precinct:**
  - > Caltex Branded Service Station, 770/1163 Mamre Road, Kemps Creek
  - > Kemps Creek Rural Fire Service training site, 245 Devonshire Road, Kemps Creek

The Figure below illustrates these sites, numbered from 1 to 7



**Figure 5 Constrained development areas due to contamination risks**



Source: Aurecon (2020)

## Limiting factors on land use

### Wetlands

A number of wetland sites have been mapped, including local reservoirs and freshwater lakes, by the NSW Wetlands mapping. Wetlands are identified in the Northern Gateway, Agribusiness and Badgerys Creek precincts.

### Environmentally sensitive land

A number of environmentally sensitive areas have been identified in Aerotropolis Core, Badgerys Creek and Agribusiness Precincts, many occurring along existing watercourses.

### Scenic protection land

Scenic protection land is identified in the northern portions of the Agribusiness and Badgerys Creek Precincts. In the Northern Gateway Precinct, scenic protection land dissects the site in a south west to north east direction and also occurs along the southern boundary.

### Flood prone land

Flood prone land, as identified by the 1 in 100-year flood event has been included as a limiting factor on agricultural and urban land use due to the associated risks with developing within a flood zone. Flood prone land is concentrated mainly on land adjacent to existing watercourses; however outside precinct boundaries. A number of smaller areas in the Northern Gateway and Agribusiness Precincts are identified as flood prone.

### Major infrastructure corridors

Major infrastructure corridors are also identified as limiting factors on land use. Key future transport corridors including the Outer Sydney Orbital, M12 Corridor and the North South Rail Line are identified as limiting factors particularly in the Aerotropolis Core and Northern Gateway Precincts.

## 8.3 Recommendations

The table below provides a baseline summary of management measures that can be used to manage land capability aspects in the Aerotropolis.

**Table 19 Baseline management measures**

Constraint	Management Actions
Soil Salinity	<ul style="list-style-type: none"><li>» Scraping – remove salts that have accumulated on soil</li><li>» Flushing – wash away salts by flushing water over the surface</li><li>» Leaching – ponding freshwater to leach salts from soil</li><li>» Select suitable irrigation measures to manage soil salinity</li><li>» Select suitable irrigation water quality to manage soil salinity</li></ul>
Landscape Salinity (groundwater associated salinity)	<ul style="list-style-type: none"><li>» Buffer the salt store – keep it dry and still</li><li>» Intercept shallow lateral flows and shallow groundwater</li><li>» Stop discrete landscape recharge</li><li>» Discharge rehabilitation and management</li><li>» Increase agricultural production to dry out the landscape and reduce recharge</li><li>» Dry out the landscape with diffuse actions over most of the landscape</li><li>» Access and use groundwater to change water balance</li><li>» Maximise recharge to dilute water tables with engineering actions</li></ul>

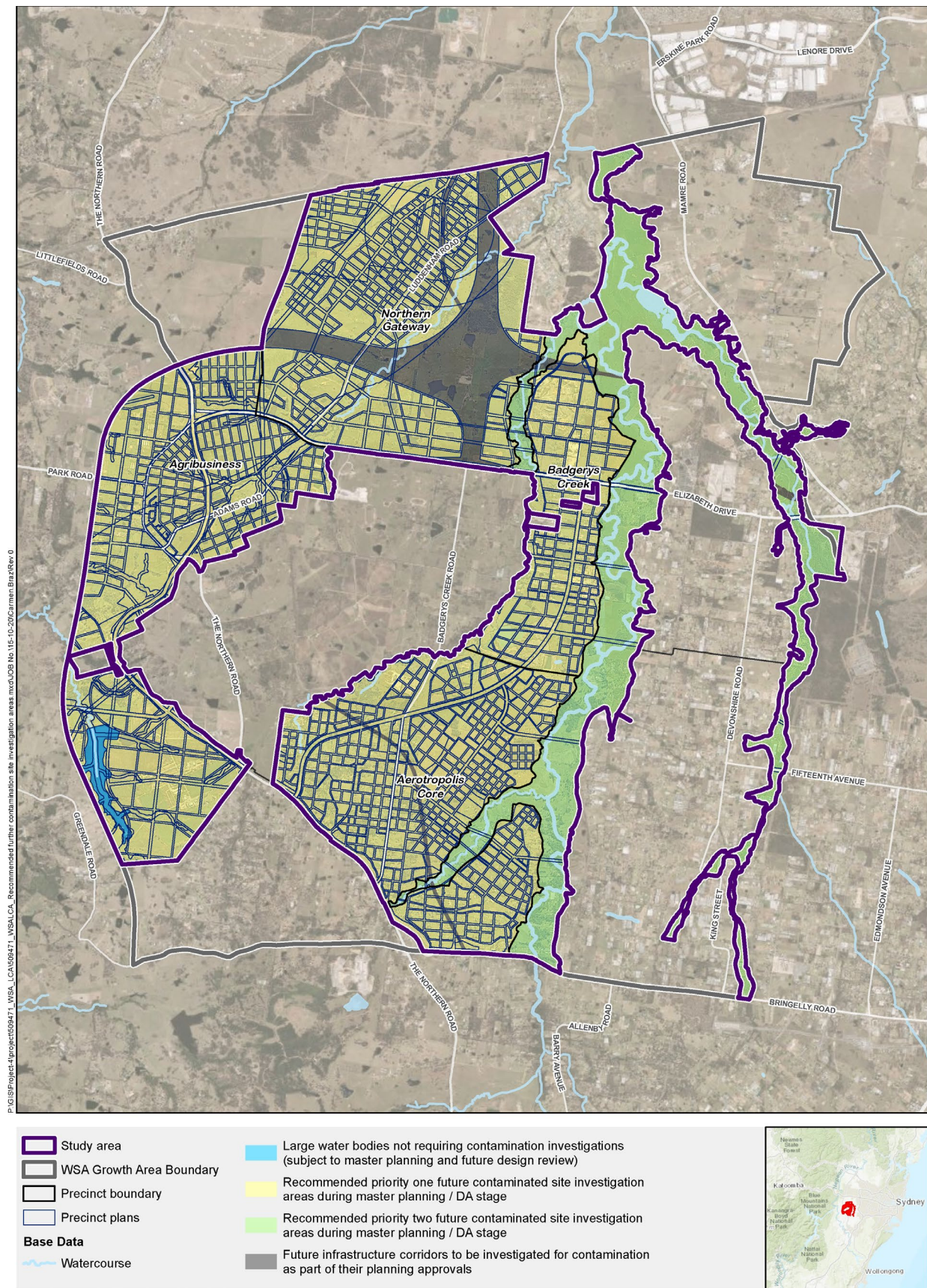


	<ul style="list-style-type: none"> <li>» Minimise recharge with engineering actions</li> <li>» Maintain and maximize runoff</li> <li>» Manage and avoid acid sulfate soil</li> </ul>
Soil Sodidity	<ul style="list-style-type: none"> <li>» Avoid disturbance and compaction</li> <li>» Alternative land use options</li> <li>» Planting tolerant species</li> <li>» Chemical amelioration</li> <li>» Deep ripping</li> <li>» Sand blocks and sand barriers</li> <li>» Topsoil / burial and revegetation</li> <li>» Increase organic matter</li> <li>» Deep ripping</li> <li>» Raised beds or deepened seedbeds</li> <li>» Improve drainage to reduce waterlogging</li> </ul>
Soil Erosion	<ul style="list-style-type: none"> <li>» Use land according to capability</li> <li>» Cover soils to avoid soil loss</li> <li>» Control runoff to retard erosive forces</li> <li>» Utilise contouring to control energy gradients</li> <li>» Minimize soil disturbance</li> <li>» Restrict vehicle access to unpaved areas</li> <li>» Create sealed access where necessary with appropriate drainage</li> <li>» Consider planting deep-rooted vegetation</li> </ul>
Water Quality (surface water and groundwater)	<ul style="list-style-type: none"> <li>» Minimize soil erosion</li> <li>» Identify and protect sensitive surface water and groundwater sources</li> <li>» Establish suitable land management practices</li> <li>» Establish Water Sensitive Urban Design measures to manage urban and agricultural water in the landscape.</li> </ul>
Groundwater Yield	<ul style="list-style-type: none"> <li>» Avoid over extraction of groundwater through allocation licences</li> <li>» Test permeability to establish safe sustainable yield</li> </ul>

## Recommended further contamination investigation priorities

Further contamination investigations across the Aerotropolis should be undertaken during master planning and development approval for proposed development. This would include undertaking a preliminary site investigation (PSI) and where required followed by a detailed site investigation (DSI) inclusive of intrusive site investigations, sampling and laboratory analysis and recommendation for land suitability for the proposed development or remedial or management actions to make the land suitable. This would be in accordance with the development control plan (DCP) at the time and any other NSW planning approvals such as State Environmental Planning Policy No. 55 and requirements of the *Contaminated Land Management Act 1997*. The figure below provides an overview of priority urban development future contamination investigation areas separated into precinct urban development (priority one), Wianamatta-South Creek and riparian areas (priority two), future transport corridors and large water bodies.

**Figure 6 Recommended further Contamination Site Investigation Areas**



Source: Aurecon (2020)



## 9 Social infrastructure

### 9.1 Description of study

A Social Infrastructure Needs Assessment has been prepared by GHD Australia to understand the future community and the needs of different users including workers, visitors, tourists and residents within the Initial Precincts.

### 9.2 Assessment and findings

The Needs Assessment considers four indicators to determine recommendations for the provision of social infrastructure that will service the future Aerotropolis population. The indicators are as follows:

- » **Existing need:** existing facilities that could service the precinct
- » **Demographic need:** projecting the future resident and worker population through development of a future demographic profile
- » **Comparative need:** assessing requirements against a rate of provision or benchmark. This was undertaken through a review of the Greater Sydney Commission's Place Infrastructure Compact (PIC) data and supporting policies.
- » **Identified need:** engagement with stakeholders was undertaken to understand from their perspective the opportunities for social infrastructure.

#### Existing social infrastructure

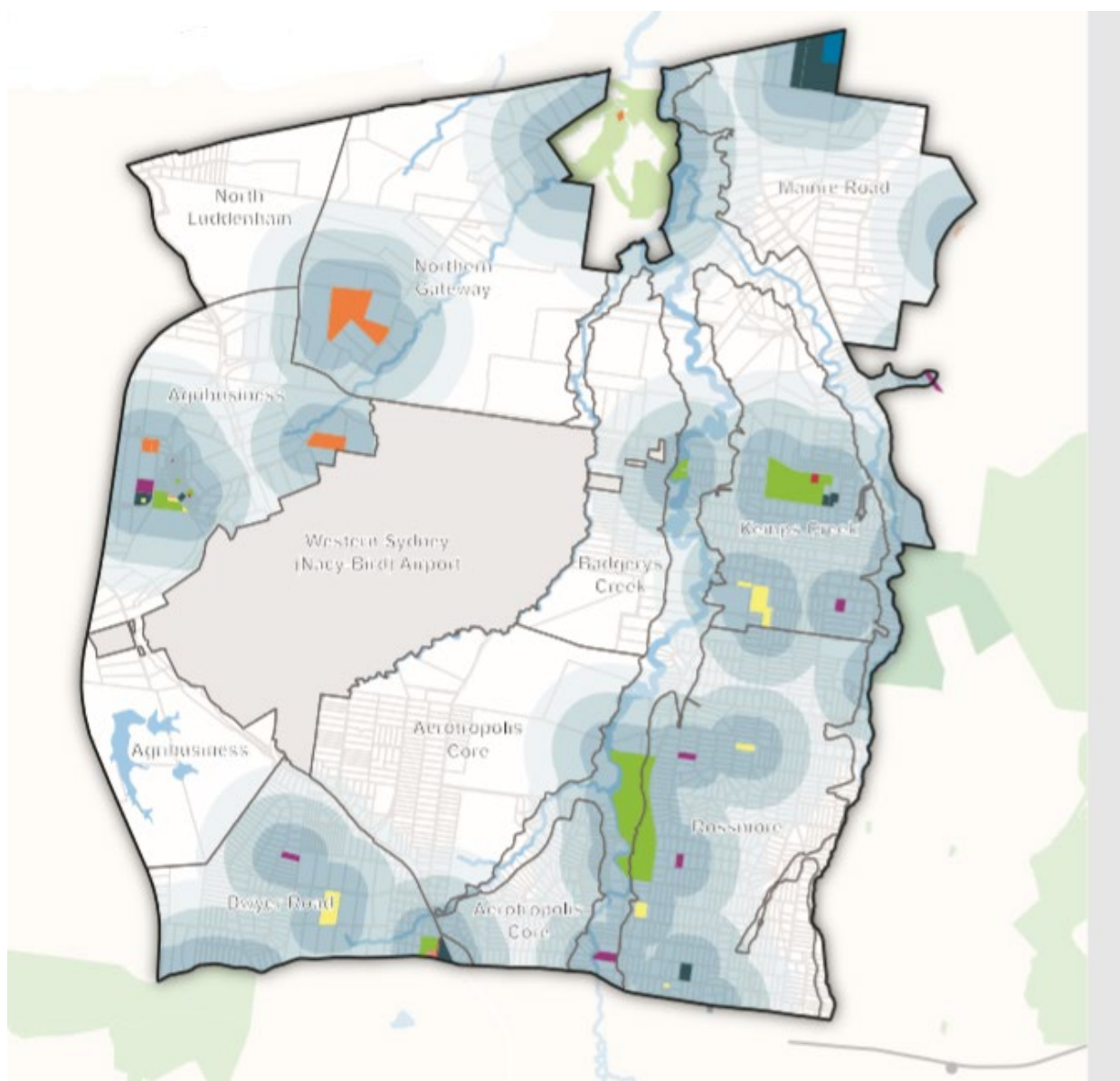
There is a low level of provision of social infrastructure currently within the Aerotropolis. The table and figure below demonstrate the existing social infrastructure located in the Aerotropolis, and the walkability catchments for each facility, which includes 400 metres (average 5 minute walk), 800 metres (average 10 minute walk) and 1200 metres (average 15 minute walk). Of note, there are currently no health facilities within the area.

**Table 20 Existing social infrastructure**

Social Infrastructure	Facility Type	Number of Facilities
Education	Government Primary School	3
	Non-Government Primary School	3
	Non-Government Combined School	2
	Non- Government High School	1
Emergency Services	Rural Fire Service	3
Community Facilities	Community Centre	1
	Community Hall	1
Childcare	Long Day Care	6
	OOSH Care	1
	Preschool	1
Aged Care	Nursing Home	1

<b>Cultural and Art Facilities</b>	Cultural Centre	1
<b>Religious Facilities</b>	Place of Worship	7
	Cemetery	2
<b>Sports and Recreation</b>	Showground	1
	Sports Club	1
	Sports Complex	1
	Parks	8

**Figure 7 Existing social infrastructure**







## Education

The Aerotropolis currently intersects five enrolment areas for government primary school and four local enrolment areas for government high schools. In addition, within a 15 kilometre catchment, there are 20 non-government primary schools, 18 non-government combined schools and 10 non-government high schools. There are also three tertiary education facilities and three university campuses.

## Health facilities

The Aerotropolis is located within two local health districts (LHD) including South Western Sydney LHD and Nepean Blue Mountains LHD, with Western Sydney LHD intersecting the 15 kilometre catchment of the Aerotropolis. There are currently no community health facilities located within the Aerotropolis. However, there are nine community health centres, one early childhood health centres and one disability services located within a 15 kilometre catchment.

There are two public hospitals and three private hospitals, including Fairfield and Nepean Hospital.

## Emergency facilities

There are currently four police stations, three ambulance stations, seven fire and rescue stations, 15 rural fire services and one state of emergency services (SES) located within a 15 kilometre catchment of the Aerotropolis. Of these facilities only three rural fire service facilities are located within the Aerotropolis.

## Community facilities

Generally, local government is responsible for the provision and management of community facilities including community/neighbourhood centres, senior citizens centres, youth centres, community halls and libraries however, the private sector does play a role. The Aerotropolis intersects two local government areas (LGAs) being Liverpool LGA and Penrith LGA.

Currently there are two community facilities located within the Aerotropolis – Bringelly community centre located in the Dwyer Road Precinct and Luddenham Progress Hall located in the town of Luddenham in the Agribusiness Precinct.

## Child Care facilities

Currently there are a number of existing child care facilities within the Aerotropolis including one pre-school, seven long day care centres and one out of school hours care (OOSHC). Additionally, there are 16 pre-schools, 21 long day care centres and 10 OOSHC with a 15 kilometre catchment of the Aerotropolis.

## Aged Care facilities

Currently there are only two aged care facilities within Aerotropolis located in the Mamre Road Precinct, which are Catholic Healthcare Emmaus Nursing Home and Retirement Village. Other aged care facilities located closest to the Aerotropolis include two other nursing homes and two other retirement villages. Additionally, there are 15 nursing homes and four retirement villages within a 15 kilometre catchment of the Aerotropolis.

## Cultural and arts facilities

There are no local and district public arts facilities within a 15 kilometre catchment of the Aerotropolis. However, there are a number of cultural clubs including the Czechoslovakian Country Club located in the Rossmore Precinct.

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These cultural clubs are generally privately owned and managed and are associated with a particular cultural group. However, they usually host a range of cultural events and have a range of facilities that are open to the wider public including restaurants, sports fields and halls that are available for hire.

The closest arts facilities to the Aerotropolis are Joan Sutherland Performing Arts Centre and EVAN Theatre which are both located just beyond a 15 kilometre catchment in Penrith.

### **Cemetery and place of worship**

There are nine cemeteries within a 15 kilometre catchment of the Aerotropolis, seven of which are operational including two cemeteries located within the Aerotropolis being Kemps Creek Cemetery and Crematorium and Luddenham Uniting Church Cemetery. Additionally, there are eight places of worship located within the Aerotropolis and a further 93 located within a 15 kilometre catchment.

### **Sport and recreation facilities**

There are currently three local and district sport and recreational facilities located within the Aerotropolis; being Luddenham Raceway, Workers Hubertus Country Club and Luddenham Showgrounds.

Additionally, there are three aquatic centres, three leisure centres, two showgrounds, two skate parks, seven sports centres, 10 sports complexes, 24 sports clubs, 12 sports courts and 50 sports fields located within a 15 kilometre catchment of the Aerotropolis.

### **Parks and open space**

There are currently 12 parks and open spaces located within the Aerotropolis.

## **Future social infrastructure**

### **Education**

The Western Sydney Aerotropolis Plan outlines the aspiration for the Aerotropolis to become an internationally significant and competitive area for research/ innovation, science, training and education (including tertiary and vocation education training institutions and secondary school level), particularly in the Aerotropolis Core Precinct. This will be achieved through planning strategic centres with integrated education facilities with other social infrastructure, such as health and community facilities and open space to attract and retain students, staff and talent.

### **Health**

The Aerotropolis is located in the South Western Sydney Local Health District (SWSLHD). SWSLHD's Integrated Primary and Community Care (IPCC) Development Plans for the South West Growth Centre details the different types of primary health care services to be provided in the South West Growth Centre which have been used in combination with the PIC data to inform the social infrastructure audit.

A review of NSW Health's PIC workbook and consultation with the SWSLHD confirmed that existing health hospitals with planned upgrades in the suburbs surrounding the Aerotropolis had sufficient capacity to support the future population up to 2036 and did not warrant a separate public hospital facility in the Aerotropolis.

### **Emergency facilities**

Consultation with Fire Rescue NSW (FRNSW) confirmed that the NSW Rural Fire Service (as at August 2020) are responsible for all fire services in the Aerotropolis. Rural Fire Service NSW are expected to transfer the area to the responsibility of FRNSW as the area becomes developed and increasingly urbanised. Boundary determination regarding service provision is discussed between FRNSW and RFS, both agencies should therefore be regularly consulted as the area becomes more developed.

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## Community facilities

The provision of appropriate community facilities can assist communities, and particularly vulnerable groups, to address social isolation and exclusion and improve overall social cohesion, health and wellbeing. Depending on the size of the population that is being served, and the amount of space/land available, multipurpose facilities can be provided as either a community space or a standalone centre. A multipurpose space could be integrated into another council facility such as a library, tourism centre or cultural facility. Facilities should accommodate for particular services and activities for specific target groups such as young peoples, older peoples, and people from culturally and linguistically diverse backgrounds.

### Childcare

Urban Economics (2018) prepared the Occupancy and Performance Appraisal: Early Childhood Education and Care Sector to analyse the factors influencing demand for, and supply of, Early Childhood Education and Care across Australia. The report found that childcare facilities close to a parent's place of work, along with other 'lifestyle' facilities including end-of-trip facilities and co-working spaces, are increasingly in demand by workers and business across CBDs and employment hubs.

The provision of childcare should be planned at the local level in close proximity to the population that it services. In areas of high employment, such as Aerotropolis Core Precinct or employment hubs, additional childcare places will be required to cater for workers.

### Aged Care and disability

While demand for residential aged care will largely be met by the private market, it is important for the precinct plans to consider this potential demand and allow for appropriate planning controls to enable the development of aged and disability care facilities within the Aerotropolis.

### Sports and recreation

All sport facilities should be multipurpose to cater for a range of sporting uses particularly as participation levels will change over time. Facilities should be adaptable and accommodate summer and winter sports and allow multiple uses within relatively short periods of time. When planning for new areas the Office of Sport NSW assess the need for sport and active recreation infrastructure using participation rate, forecast population, number of participants that can be assigned to a field per week and the number of existing facilities.

The Office of Sport NSW recommends that where land availability is constrained, existing local open space should be considered for active use on the proviso that it is large enough to accommodate both active and passive uses.

### Parks and open space

Parks and Open Space should be provided in a way that allows the space to be versatile, flexible, adaptable, and resilient. Community needs can change rapidly and the most effective parks can be reconfigured in design and function to accommodate changing participation, activities, trends, needs, and preferences.

## Social return on investment framework

The Social Return on Investment Framework is the third report of a series of reports that inform the Social Infrastructure Strategy. The Social Infrastructure Audit (report 1) and Social Infrastructure Needs Assessment (Report 2) have identified existing facilities and future facilities needed to service the anticipated resident, worker and visitor populations, while the Social Return on Investment Framework considers how to bring the social infrastructure recommendations to life by considering the programs and public activations that will support the use of the infrastructure and facilitate a night time economy.

Key to the success of this project is understanding the needs of the worker and visitor population within the precinct. For this reason, the Social Return on Investment Framework takes on a placemaking focus and employs a beyond 'business as usual' approach in order to align with the emerging innovative trend towards creating 'Loveable Cities'. While liveability refers to physical attributes of a place, lovability refers to the sentiment a place inspires, which is influenced by softer values such as behaviour and experience. This framework is the opportunity to provide infrastructure that will create an affinity to place. This will enable the Aerotropolis to become a 'loveable city' and a desirable place to live, work and visit.

## 9.3 Recommendations

Each of the Initial Precincts has its own character and identity that will contribute to achieving the vision of the Aerotropolis. Although precinct planning will investigate opportunities and appropriate planning controls for each individual precinct, planning for each precinct must take into consideration the broader goals and objectives of the Aerotropolis. Social infrastructure will play a critical role in creating the communities that will live, work and visit the Aerotropolis.

The following table demonstrates the social infrastructure requirements for each Aerotropolis precinct, to be delivered by 2056 which aligns with the Transport for NSW *Future Transport Strategy 2056*, and the Greater Sydney Commission *A Metropolis of Three Cities – Greater Sydney Region Plan*.

**Table 21 Social infrastructure requirements**

Precinct	Characteristics	Population	Recommend Social Infrastructure to 2056 (facility type)
Aerotropolis Core	Mix of employment uses 24-hour hub and thriving night time economy Entertainment and retail Arts and cultural experiences Health and education hub	Workers (estimated 50,000-60,000) Residents (estimated 20,000-24,000)	Education Health Emergency services Community facilities Childcare Aged care Cultural facilities Library Sports fields Local outdoor multipurpose sports courts District indoor sports facility Swimming facility Youth focused outdoor recreation Open space
Northern Gateway Precinct	Innovation hub on tourism, health, education and research Technology associated with food production & processing	Workers (estimated 19,000-21,000) Residents (estimated 8,000-10,000)	Education Health Emergency services Community facilities Childcare Aged care Cultural facilities Library Sports fields Local outdoor multipurpose sports courts District indoor sports facility Youth focused outdoor recreation Open space



Precinct	Characteristics	Population	Recommend Social Infrastructure to 2056 (facility type)
Wianamatta-South Creek	Central green spine and area of high biodiversity Connected open space network Outdoor recreation and outdoor amenity	Workers (minimal)	Emergency services Open space
Badgerys Creek	Airport/aviation related employment Industrial character	Workers (estimated 9,000-11,000)	Childcare Sports fields Open space
Agribusiness	Catalyst for agricultural operations Natural landscape character	Workers (estimated 8,000-21,000) Residents (minimal)	Education (Expand Bringelly Public School or Luddenham Public School) Childcare Aged care Library Sports fields Local outdoor multipurpose sports courts Open space

# 10 Stormwater, water cycle management and management of riparian lands

## 10.1 Description of study

An interim Stormwater and Water Cycle Management Study has been prepared to outline how stormwater, wastewater, recycled water as well as trunk drainage and riparian zones, should be managed in the Initial Precincts.

## 10.2 Assessment and findings

### Integrated water servicing

Water servicing for precincts are to feature total water cycle management that integrates and balances drinking water, wastewater, recycled wastewater and harvested stormwater. A final water balance will be provided that ensures water servicing will minimise demands on potable water supplies through alternative water sources. Recycled wastewater will be provided to the area. The final balance of recycled water and harvested stormwater will be calibrated to achieve waterway health outcomes.

The table below provides an overview of Sydney Water's drinking water and wastewater servicing strategy.

**Table 22 Potable and wastewater servicing strategy**

Timing	Measures
<b>Drinking Water</b>	
Existing	<p>Each of the initial precincts fall in Cecil Park Water Supply Zone within the Prospect South Delivery System and currently have limited to no water services available.</p> <p>Cecil Park Reservoirs are currently at capacity and cannot accommodate demands from new developments without the additional proposed amplification work to transfer flow from Liverpool and trunk infrastructure proposed within Cecil Park Water Supply Zone (WSZ).</p>
Interim	<p>Sydney Water is committed to provide services to early developments.</p> <p>Sydney Water are currently delivering the following trunk drinking water infrastructure to increase supply to the area:</p> <ul style="list-style-type: none"><li>» Rising Main (DN900) and pump WP0432 at Liverpool</li><li>» DN1200/DN1050 from Cecil Park reservoir up to Western Road, with offtakes at Range Road and Western Road connecting existing mains in Elizabeth Drive.</li></ul> <p>This work is in delivery and proposed to be operational in 2022.</p> <p>Sydney Water is also planning to deliver trunk infrastructure to support growth and major projects along Elizabeth Drive and Luddenham Road. Interim servicing may include offtakes from proposed mains in Elizabeth Drive to Badgerys Creek, Agribusiness and Northern Gateway precincts.</p> <p>Interim servicing for Aerotropolis Core precinct would be through proposed Oran Park Reservoir via Northern Road mains.</p>
Ultimate	<p>The current ultimate drinking water supply strategy for these precincts is to supply from Prospect South delivery system via the Cecil Park water supply zone and a</p>

Timing	Measures
	<p>proposed new water supply zone. A new reservoir (60ML) is proposed in the west at the end of Elizabeth Drive within the Agribusiness precinct.</p> <p>New drinking water reservoirs, pumping stations and trunk mains are required to fully service the precincts.</p> <p>Purified recycled water could also be introduced as a source for the drinking water supply however this would be a city-wide decision and has not been considered locally.</p>

Wastewater	
Existing	Each of the initial precincts currently have very limited wastewater servicing available, with most areas relying on septic tanks for wastewater disposal.
Interim	Sydney Water is committed to working with developers for interim servicing to early developments prior to 2025/26. Interim servicing may include decentralised wastewater treatment, tankering or interim pumped transfer. Interim servicing would be designed for transition to long term servicing with the timing of transition to be assessed on a case by case basis.
Ultimate	To fully service the region requires several wastewater pumping stations (WWPS) and deep gravity trunk mains. Several new pressure mains will transfer flows to the proposed Upper South Creek Advanced Water Recycling Centre (USC AWRC). The AWRC first stage completion is targeted for mid-2025. Trunk wastewater infrastructure is planned to be delivered in stages based on DPIE growth forecasts. The first stages are planned to be delivered in line with operation of the new AWRC.

## Recycled water servicing

Sydney Water has developed a proposed recycled water supply network from the Upper South Creek Advanced Water Recycling Centre at the Sub Regional planning level to service non-drinking uses across the Aerotropolis. In the proposed configuration, recycled water storages within the network would be provided and be topped-up from the drinking water network when recycled water supply cannot meet demand.

Sydney Water is also assessing alternate uses for highly purified recycled water such as environmental flows and augmentation of the drinking water supply.

## Stormwater harvesting and reuse

Stormwater generated within the precincts will be managed through a range of on-lot, street scape and end of pipe stormwater management elements.

## Stormwater system

A range of trunk drainage and preferred WSUD stormwater management elements have been developed through consultation with Penrith and Liverpool Councils. These WSUD elements work together to preserve the local waterways that cross the precincts as well as waterways in the lower catchment.

Achieving the stormwater management objectives will require a shift away from stormwater filtration to an approach that is more focussed on the retention of stormwater in the landscape through a combination of:

- » Rainwater tanks to supply non-potable and irrigation demands on private lands and in street verges
- » Maximising the retention and evaporative losses of stormwater through vegetated systems including passive irrigation, biofiltration street trees and wetlands
- » Exploiting opportunities for stormwater harvesting across the catchments where constraints permit.

A coordinated approach will be required to ensure that that land-take and maintenance efforts are minimised to a consolidated number of effective stormwater assets located strategically. A comparison of indicative life cycle

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costs of these WSUD elements and their effectiveness at achieving stormwater management objectives is provided in the study.

### Precinct scale water quantity management

The stormwater system also aims to manage peak flows for frequent events (e.g. 50% AEP) to minimise the risk of impacts to stream morphology as a result of increase in imperviousness due to development.

To manage local runoff and the impact that the Aerotropolis has on downstream areas, storm flows will need to be detained within the landscape. In consultation with stakeholders the study has shown that a combination of on-site detention (for industrial areas), on-line detention (on 1st and 2nd order creeks) through natural drainage design and stormwater assets can sufficiently manage precinct scale runoff and must be employed throughout the Aerotropolis.

### Riparian land management and waterway health

The protection, restoration and maintenance of waterways, riparian corridors, and water dependent ecosystems is essential in achieving the cultural, social and biodiversity aspirations as well as tree canopy targets of the Western Parkland City. Creeks within the initial precincts are being validated and mapped with associated vegetated riparian zones to support waterway health. Water dependant ecosystems and key fish habitat is also being identified and mapped. A riparian revegetation strategy will be developed once fieldwork is complete, recommending the areas and likely costs of riparian land that should be revegetated.

Preliminary mapping has been completed into the draft precinct plans as appropriate. Field work has been completed. Upon completion of field validated mapping, more accurate map sets will be produced to precisely detail top of bank and riparian vegetated buffers across the initial precincts along with final recommendations, precinct plans and development controls.

## 10.3 Recommendations

The report identified a number of specific recommendations, including:

#### **Water servicing:**

- » Water servicing for precincts are to feature total water cycle management that integrates and balances drinking water, wastewater, recycled wastewater and harvested stormwater in line with the finalised scenario.
- » All open spaces, areas of landscaping, parks and streets must be developed to include irrigation infrastructure to ensure demand and provide expected urban cooling benefits.
- » A final water balance will be provided to ensure water servicing will minimise demands on potable water supplies through alternative water sources, such as recycled water.
- » The final balance of recycled water and harvested stormwater will be calibrated to achieve waterway health outcomes.

#### **Waterway health:**

- » Development within the Aerotropolis is to ensure waterways, riparian corridors, selected farm dams, open water bodies and other water dependent ecosystems are protected, restored and maintained.
- » All development and public infrastructure must comply with, and contribute towards, the waterway health objectives development by the NSW Government under the Risk Based Framework for Considering Waterway Health Outcomes in Strategic Land Use Decisions.

#### **Stormwater and precinct scale stormwater quantity management:**

- » Trunk drainage is to be through natural creek lines or constructed natural drainage channels to help detain flows and contribute to biodiversity, public amenity and safety. The ongoing ownership and management of these assets must ensure adequate and sustainable funding for maintenance is available.



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- » Urban layouts, streets and drainage are to achieve effective perviousness and flow targets.
  - » Stormwater systems including on private lots, within the streetscape and trunk drainage must be designed to achieve the waterway health, urban cooling, tree canopy and open space outcomes through Water Sensitive Urban Design treatment trains.
  - » An allocation of enough, suitably located land area to allow for stormwater assets must be provided.
  - » Stormwater assets in the public realm should be designed as multifunctional also contributing to waterway health, biodiversity and public amenity
  - » Stormwater systems should manage peak flows for frequent events to minimise the risk of impacts to stream morphology.
  - » The ongoing ownership and management of these assets must ensure adequate access and sustainable funding for maintenance is available.

**Riparian land management:**

- » Vegetated riparian zones (VRZ) adjacent to creeks and other water bodies will be mapped and must be protected, restored and maintained.
- » Opportunities to revegetate beyond standard VRZs should be explored to maximize biodiversity outcomes and achieve urban canopy targets, particularly within the Wianamatta Precinct.

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# 11 Sustainability and heat

## 11.1 Description of study

A Sustainability and Heat Study has been prepared by Alluvium Consulting Australia in partnership with Mosaic Insights and the Institute for Sustainable Futures (UTS) to identify sustainability and heat mitigation measures as part of the Aerotropolis to help implement the vision of the Western Parkland City.

The study examined the resource demands for the Aerotropolis and its priority precincts across three scenarios for 2036:

- » Baseline – business as usual
- » Leading industry practice
- » Sustainable regenerative.

The study draws on research in the industry and identifies 17 case studies which are relevant to this project. These case studies demonstrate key examples from across Sydney, Australia and globally which have informed the Sustainability and Heat assessment for the Western Sydney Aerotropolis.

## 11.2 Assessment and findings

The study recommended the sustainability regenerative scenario as the model to achieve the Aerotropolis vision; and provides actions to ensure that any recommended sustainability measures are able to be implemented and supported by strong governance.

The sustainable regenerative scenario clearly delivers the best outcomes for the Aerotropolis from all aspects – water, waste, energy and heat – and it is strongly recommended that this approach is adopted as a priority. The evidence, from available predicted data, shows that adoption of a sustainable regenerative scenario will see, by 2036:

- » Up to a 30% reduction in the consumption of potable water
- » A 75% reduction in polluted stormwater entering South Creek
- » Elimination of waste to landfill
- » 100% recovery of organics for compost and energy generation
- » 100% local renewable energy generation
- » A more flexible and liveable built form that can respond to changes in needs through adoption of adaptable infrastructure and a share economy
- » A greener more resilient Western Sydney area with up to 7°C of cooling on extreme heat days provided by better design, greening and irrigation
- » A reduction in extreme and very strong heat stress days per summer from 47 to 19 days.

### Barriers to adoption of sustainable outcomes

The report identified a number of potential barriers to the delivery of a regenerative sustainable outcomes, which include those identified below:

- » Pressures for increased developable area and larger footprint structures, reducing the capacity to retain stormwater run-off, create cool buffers for urban cooling and climate adaption and protect and expand biodiversity.
- » Delay in provision of centralized infrastructure such as water recycling.

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- » Planning and coordination for the strategic positioning of businesses and servicing to support the circular economy.
  - » Inability to define adaptable infrastructure that is flexible and able to change over time as new services and resource management comes on line.
  - » Perceptions that sustainability and green infrastructure has a higher upfront capital cost than traditional approaches
  - » Land constraints such as flooding and salinity, impacting the target of increased infiltration and tree canopy.
  - » Potential for traditional land use definitions to impact delivery potential to circular economy, low carbon and water sensitive outcomes if not reviewed and updated over time.

## 11.3 Recommendations

### Aerotropolis future management

The following are actions recommended to ensure that any sustainability measures suggested for the Aerotropolis planning instruments are able to be implemented and supported by strong governance. These recommendations are identified over the short, medium and long term periods to enable transition to a sustainable regenerative future outcome at the Aerotropolis:

- » Develop the Phase 2 Development Control Plan Performance Outcomes and Benchmark Solutions in accordance with the findings in the report
- » Identify a coordinating body to provide the governance, integrated decision making, and management needed to bring various jurisdictions and systems together
- » Create partnerships to work towards co-governance of certain areas, utilities and infrastructure
- » Adoption of a sustainability / resilience framework aligned with sustainable regenerative development and resilience
- » Undertake a review of BASIX targets in the Aerotropolis
- » Establishment of ambitious targets that are as close to net zero as possible
- » Development of a strategies / guidelines, where relevant, to inform the delivery of sustainable outcomes
- » Ongoing review of permitted and prohibited land use categories to support development of sustainable regenerative Aerotropolis over time
- » Review of sustainability / regenerative principles over the long term development of the Aerotropolis
- » Review of resourcing and policy regulations in regards to maintenance and infrastructure integration
- » Clear and direct communication with developers on the vision of the Aerotropolis and the benefits of the sustainable regenerative model
- » Develop range of measures, including in relation to Circular Economy, canopy targets, the share economy and Salinity Management for the Aerotropolis.

### Sustainability principles

For the Aerotropolis to achieve its vision and objectives a range of principles are identified in the report as part of the recommendations. The principles have been outlined further below.

Example performance outcomes have also been drafted as examples of how the outlined principles could be delivered. Where relevant, these potential performance outcomes have been divided into those appropriate for the built environment and those suitable for the landscape – open space, public domain, parks.

**Table 23 Performance outcomes**

Principles	
<b>Water</b>	<ul style="list-style-type: none"> <li>» Fit for purpose water is supplied from within the catchment as a priority</li> <li>» Arrangements are in place to share water across property boundaries</li> <li>» Protection of natural soils, protecting and enhancing the existing areas of remanent native vegetation and biodiversity</li> <li>» Green infrastructure to provide water treatment, urban cooling, ecosystem service sand amenity is integrated into built, landscaped and natural environments</li> <li>» The Aerotropolis is designed to increase perviousness</li> <li>» Landscapes impacted by contaminated soils / salinity are actively managed and restored</li> <li>» Rainwater is captured at a range of scales</li> <li>» Vegetation is supported by soil volumes and passive irrigation</li> <li>» Tree canopy targets are met at the neighbourhood scale</li> <li>» Stormwater runoff targets are applied at scale</li> <li>» Flood management options are integrated</li> </ul>
<b>Waste</b>	<ul style="list-style-type: none"> <li>» Adopt principles of avoid, reduce, reuse and recycle in material choices / construction methods</li> <li>» Adopt a sustainability / resilience framework, as well as use planning controls to embed sustainable behaviours</li> <li>» Design out waste in supply chain and manufacturing and work to eliminate single use items</li> <li>» Establish Circular Economy Hubs for innovation and including Resources Recovery Processing infrastructure</li> <li>» Source separate for the circular economy</li> <li>» Design of the share economy</li> <li>» Adopt product stewardship approaches</li> <li>» Joint procurement for new commercial markets</li> </ul>
<b>Energy</b>	<ul style="list-style-type: none"> <li>» Plan for the Aerotropolis to be a net exporter of clean energy to the NSW grid</li> <li>» Include diversity of renewable energy supply</li> <li>» Provide decentralised local generation and supply</li> <li>» Develop integrated systems for energy generation</li> <li>» Develop multi modal transport systems in the 30 minute city</li> <li>» Promote the pedestrian and cycle network</li> <li>» Design and regulate for greening infrastructure for cooling, shade and amenity</li> <li>» Provide adaptable infrastructure for charging stations</li> <li>» Design roof space for energy generation, open space and amenity, gardens, food production, water harvesting and urban cooling</li> <li>» Provide space for local food production and distribution</li> <li>» Create equity of access to solar or renewables</li> <li>» Establish circular economy markets to reduce waste and transport emissions</li> <li>» Distributed and diverse shared economy facilities and libraries</li> </ul>
<b>Heat</b>	<p><b>Green Infrastructure:</b></p> <ul style="list-style-type: none"> <li>» Larger natural vegetation areas offer multiple benefits in terms of cooling.</li> </ul>



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- » Water providing (evaporative cooling through misting and irrigation breezes over water bodies, healthy vegetation, green roofs, walls, facades providing shade, insulation and evapotranspiration)
  - » Design of places providing air flow, green open space, and appropriate building morphology so that the cooling from green space can be harnessed and spread throughout the city

**Built Environment:**

- » High albedo building materials to reflect light and heat
- » Shade through eaves and overhangs, awnings
- » Permeable pavements
- » Make dips and concave spaces to trap water and reduce runoff
- » Passive irrigation of vegetation to increase evapotranspiration
- » Adequate vegetation around buildings
- » Natural ventilation

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# 12 Transport

## 12.1 Description of study

Aecom have been engaged to undertake transport planning services as part of planning for Initial Precincts. Aecom have prepared a Transport Infrastructure and Services Plan to outline the transport infrastructure and services required to support the land use proposed in the precinct plans for the initial precincts in the following three precinct groupings:

- » Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek
- » Agribusiness
- » Northern Gateway

The plan builds upon the work undertaken by Transport for NSW during the structure planning process which defined key strategic transport corridors that would be required to provide for all modes and journey types across walking and cycling, public transport, freight and private vehicle for access to, from and within the precinct groupings.

## 12.2 Assessment and findings

### Existing transport and land use context

Land within Aerotropolis is located within the Western Sydney Airport sub-precinct of Greater Sydney, which is made up of the following Travel Zones, as defined by NSW Transport Performance and Analytics:

- » Badgerys Creek
- » Bents Basin Greendale
- » Bringelly Mersey Road and Severn Road
- » Kemps Creek Emmanus Catholic College
- » Kemps Creek Shopping Centre
- » Luddenham
- » Luddenham Model Park SSME
- » Twin Creeks Golf Course
- » Wallacia

The travel zones within and adjacent to land within the Aerotropolis have a total residential population of 4,658 people.

#### Train

No railway lines currently operate within the study area. However, three train lines operate within 15km of the Aerotropolis.

#### Bus

Eight bus routes currently operate within the Aerotropolis, primarily connecting to the Metropolitan Clusters of Penrith and Liverpool.

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## Walking

Due to a lack of activated land use and scale of the Aerotropolis, walking as a mode of transport is primarily found within close proximity to residential areas for first and last mile access. Roads within the study area do not always cater for pedestrians with a lack of provision of footpaths.

## Cycling

No segments of the Principal Bicycle Network routes are located within the Aerotropolis. Cyclists are presented with 'high difficulty' rides along the Northern Road and part of Mamre Road and Elizabeth Drive.

## Road network

The following State roads are located within and adjacent to the Aerotropolis:

- |                     |                      |
|---------------------|----------------------|
| » Bringelly Road    | » M7 Motorway        |
| » Camden Valley Way | » Mamre Road         |
| » Cowpasture Road   | » Mulgoa Road        |
| » Elizabeth Drive   | » Park Road          |
| » Erksine Park Road | » The Northern Road. |
| » Lenore Drive      |                      |

## Existing travel patterns

The data used in this section is based on the 2016 Census and in this regard, it should be noted that the travel patterns since 2016 have substantially changed due to COVID-19 in 2020 and to a lesser extent the change in infrastructure around the study area.

Findings are as follows:

- » Private vehicles are the dominant transport mode for workers and residents, representing at least 70% or more of the transport mode share.
- » The most common journey to work destinations are concentrated in the Western Parkland City including industrial areas near the Aerotropolis as well as metropolitan clusters of Penrith and Liverpool.

## Committed transport infrastructure and services

The following transport infrastructure and services have been outlined in *Future Transport 2056*, *Greater Sydney Services* and *Infrastructure Plan* and the *Western Sydney City Deal* and have been committed through funding and the commencement of detailed planning or construction.

- » Sydney Metro Western Sydney Airport, including six new Metro stations
- » Rapid bus routes between Western Sydney International Airport and metropolitan centres of Penrith, Liverpool, Campbelltown, Parramatta and Blacktown
- » The M12 Motorway
- » Werrington Arterial Road
- » Bringelly Road upgrade
- » The Northern Road realignment and upgrade
- » Local Roads Package

## Transport infrastructure and services under investigation

The following transport infrastructure and services projects have been outlined as initiatives for investigation in *Future Transport 2056* and *Greater Sydney Services and Infrastructure Plan*. These initiatives are identified for future investigation and planning before they are committed by government and include:

- » Sydney Metro Western Sydney Airport Extensions to Schofields/Tallawong and Campbelltown-Macarthur via Narellan
- » South West Rail Link Extension, from Leppington to Western Sydney International Airport via the Aerotropolis
- » Aerotropolis to Parramatta Rail Link
- » Outer Sydney Orbital Motorway and Rail Freight Corridor
- » Western Sydney Freight Line
- » M5 Motorway Extension
- » Western Sydney Airport – Badgerys Creek Aerotropolis Inner and Outer Ring Roads
- » Infrastructure to support rapid bus connections and improved bus connections between Aerotropolis and Penrith, Liverpool, Blacktown, Parramatta and Campbelltown-Macarthur
- » Cycleway network within ten kilometres of strategic centres

## Transport infrastructure and services plan

### Future mode share targets

Both the Aerotropolis Core and the Northern Gateway will have the greater mix of land use in the future and are expected to have a higher mode share for walking and cycling.

The Agribusiness and Badgerys Creek Precincts are expected to be primarily focused on warehouse and logistics, resulting in a significant freight task.

The table below outlines the adjusted number of trips and proportion of future travel for each of precincts. The overall future mode share targets for Aerotropolis differ between precincts due to different mode share characteristics including land use zoning, density and the provision of transport infrastructure and services.

**Table 24 Transport modes by Precinct**

Precinct	Trips						
	Active Transport		Public Transport		Car		Total
Aerotropolis Core	2,660	8%	16,090	45%	16,640	47%	35,390
Northern Gateway	650	6%	4,010	38%	5,960	56%	10,620
Agribusiness	110	2%	900	16%	4,590	82%	5,600
Badgerys Creek	120	2%	1,050	18%	4,720	80%	5,890
Total	3,540	6%	22,050	38%	31,910	56%	57,500

The analysis shows that there is additional public transport service capacity, which could potentially see even more substantial share of public transport as a mode. Although, based on the evidence presented in case studies and analysis, it is not reasonable to predict a higher public transport mode share, which can be reasonably validated based on a credible evidence base.

### Travel demand management strategy

To promote sustainable travel options and choices which can influence mobility to deliver sustainable outcomes in terms of mode of travel and volume of travel; a travel demand management (TDM) strategy has been developed



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for the Aerotropolis. The TDM strategy aims to limit private vehicle travel through providing a framework that encourages alternatives such as walking, cycling and public transport.

The TDM strategy is developed on the basis of the following principles:

- » **Parking:** the greater the restriction on private vehicle parking, the less likely people are to use private vehicles and more likely people are to opt for alternative, more sustainable modes of transport.
- » **Walking environment:** the TDM strategy recognises walking's place as an active and sustainable transport mode, and encourages people to walk for transport, especially for trips within two-kilometre catchments of origins and destinations. By encouraging more people to walk, and combining more walking with public transport trips, is an effective way to free up capacity on the transport system and reduce congestion in centres. The TDM strategy therefore encourages provision of a high-quality walking environment within the Aerotropolis.
- » **Cycling environment:** similarly, to walking, encouraging cycling will help to reduce the demand for other modes of transport. Well-placed cycling networks can also extend the catchment of the public transport system. The Strategy recommends provision of a high-quality cycling environment within ten kilometres of key destinations within the Aerotropolis.

## Development of the transport infrastructure and services plan

The proposed infrastructure and services for the Aerotropolis represent a beyond business-as-usual approach to transport planning in Western Sydney.

- » The integrated transport network is planned around centres, which priorities walking and cycling for short trips, and public transport to provide access both to/from and within the Aerotropolis precincts.
- » The provision of this active and public transport infrastructure and services will drive a sustainable transport mode share that, considering the size and density of the Aerotropolis, is not seen anywhere else in Western Sydney will be comparable to the Eastern and Central Cities. The Aerotropolis will be able to compete with some of the largest employment centres across the Greater Sydney Metropolitan Area.
- » Freight and vehicle needs are provided for on the primary freight network, which enables efficient movements of freight in what will be a 24/7 precinct centred around the Western Sydney International Airport.

**Walking and cycling:** walking and cycling will be prioritised for short, everyday trips to and within centres. In the Aerotropolis Core and Northern Gateway Precincts, the catchment around each Metro station in particular will be prioritised for active transport. Workers and residents will be able to walk or cycle to their nearest centre on separated infrastructure. On sub-arterial and arterials roads which connect centres, and connect the Aerotropolis to Greater Sydney, walking and cycling will be catered for with separated walking and cycling infrastructure on these corridors for longer trips.

**Sydney Metro Western Sydney Airport:** Sydney Metro Western Sydney Airport creates a backbone for public transport for Western Sydney. It includes new metro stations within the Northern Gateway Precinct, the Western Sydney International Airport business park and terminals, and the Aerotropolis Core Precinct. This Metro will provide fast, efficient, high capacity public transport services to, from and within the Aerotropolis. It will connect the Aerotropolis with Greater Sydney and, along with the feeder network of bus services, provide a genuine alternative to car travel.

**Western Parkland City Rapid Bus:** rapid bus services, in-line with the Western Sydney City Deal, are also proposed to connect five Western Sydney centres with the Western Sydney International Airport and Aerotropolis. The City Deal outlines the plan for Penrith, Liverpool and Campbelltown-Macarthur to be connected by fast and frequent rapid bus services that will provide additional connectivity to the airport and Aerotropolis from 2026. Transport for NSW is also planning two additional rapid bus routes to the Western Sydney International Airport, connecting Parramatta and Blacktown. Rapid bus services, which will be similar to the current B-Line product, will enable residents of Western Sydney to access the airport and Aerotropolis and drive a culture of public transport provision in the area from day one.

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**Other public transport services:** a network of frequent and local bus services will be implemented to provide connectivity both between and within precincts. Frequent bus will provide key links between centres that can connect businesses and residents to Metro services. Local bus services provide local connections within precincts to nearby centres, and ensure all businesses and residents are within walking distance of public transport.

## 12.3 Recommendations

In achieving the objectives of the TDM Strategy the following measures are recommended to be incorporated into the precinct planning framework, and Development Control Plan for the Aerotropolis:

- » Increased minimum bicycle requirements within commercial areas, educational facilities as well as community and residential facilities.
- » Removal of minimum parking requirements in the DCP to encourage early investors and developers in the study area to drive a lower parking provision.
- » Increased requirements for car share spaces in the DCP to encourage more people and businesses to reconsider ownership of vehicles and to utilise car share programs for trips which cannot be completed via a sustainable mode

Further measures suitable for businesses, educational facilities and communities to manage travel demand and promote sustainable travel in the Aerotropolis include:

- » Alternative or staggered work schedules
- » Training and guides to help people develop the skills and confidence to use active transport modes
- » Carpooling and ride share programs/initiatives
- » Travel behaviour campaigns to discourage dependence on private vehicles
- » Commuter financial incentives.

The TDM strategy needs to be supported by Transport Infrastructure and Services to create the planning and definition of a multi-modal transport network which considers the relationships between place and customers with the transport networks, the following measures are recommended to be incorporated into the precinct planning framework, and Development Control Plan for the WSA:

- » **A dedicated walking network** with pedestrian footpaths on all roads and streets. With consideration of a high amenity environment for walking throughout the precincts, which provide for priority access to, and within, centres and to key public transport nodes, as well as facilitating well-connected, high amenity green corridors.
- » **An extensive, dedicated bicycle network** with separated bicycle facilities built on all key roads and streets, to support the needs of all cyclists. The extensive coverage of the network, combined with the dedicated infrastructure is designed to make cycling an easy and comfortable travel choice for short, medium and long-distance journeys.
- » **The key public transport infrastructure and services** – built around a backbone of transit infrastructure and services through government commitments to the Sydney Metro Western Sydney Airport Line and the Western Sydney City Deal Rapid Bus Routes. These together will be integral to providing safe, convenient and efficient public transport travel options for those who live, work or visit the Aerotropolis.
- » **A highly efficient road network for private vehicles, freight, and all other modes.** There is a focus on accessibility at the local level, in centres and high value places, in areas where accessibility is critical to network function. Intermediate roads have a balanced focus of access, place and movement. Higher order roads which make up the strategic network (i.e. motorways, arterial roads) focus on movement, reliability of travel times and safe operations to support the efficient movement of people and goods for strategic travel. Together these two key enablers will support the delivery of the desired outcomes specified in the WSAP.

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## Staging and delivery

Staging and sequencing across the Aerotropolis has been indicatively identified in order to communicate priorities for infrastructure development and to align Government investment with achieving the targets established in the Western Sydney Aerotropolis Plan and to deliver mode share targets defined in this report, establishing sustainable patterns of travel behaviour from day one.

### **The first areas of priority are:**

- » Land around the committed Metro Stations at North Luddenham and Aerotropolis Core
- » Associated large landholdings where development can be relatively easily coordinated
- » The land adjacent and outside of the M12 corridor and interchange area that can support access to the Western Sydney Airport
- » Luddenham Village, where existing infrastructure can support development
- » Enabling access to the Western Sydney Airport from The Northern Road.

### **The areas of second priority are:**

- » Mixed use zoned land east of Thompsons Creek that can bolster employment and resident populations
- » Connecting developed areas between the Aerotropolis Core, Badgerys Creek and Northern Gateway Precincts.

### **The third areas of priority are:**

- » Land that is more difficult to develop owing to environmental and topographical constraints east of Badgerys Creek Road and east of The Northern Road.

### **Considerations informing these priorities are:**

- » High order transport nodes (Metro) and centres (ability to create a place)
- » Unfragmented land
- » Servicing (extending from existing infrastructure)
- » Environmental constraints.

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# 13 Utilities audit

## 13.1 Description of study

A Utilities Audit has been prepared by Aurecon to identify existing servicing infrastructure and review the capacity of existing utility services, to determine the implications for potential growth. The Audit transcends the individual precinct boundaries and aims to provide a holistic picture of utilities servicing in the region as servicing networks are more regional in nature.

## 13.2 Assessment and findings

Overall there is very limited existing utilities infrastructure across the Aerotropolis, which is consistent with the historical rural and agricultural land use in the region. All Agencies consulted were aware of the Aerotropolis and the limited existing servicing provision and are actively planning for future servicing.

### Potable water and recycled water

Sydney Water's existing water supply is serviced by regional reservoirs within four major water supply zones (Cecil Park, Warragamba, Leppington and Raby) and does not include water recycling treating facilities or the current use of recycled water. The majority of the precincts within the Aerotropolis are serviced by the Cecil Park system and future servicing can be supported by this system with augmentation.

Large portions of the Agribusiness Precinct currently have no servicing and are serviced by onsite water harvesting or water tanks. Any growth in these areas would require significant infrastructure to expand Sydney Water's network. There is limited capacity to accommodate future demand in the existing network. Sydney Water have planned for a staged development and upgrade of trunk water assets and new centralised reservoirs to accommodate growth in the Aerotropolis.

### Wastewater

There are no existing wastewater services / assets in the Aerotropolis Core, Northern Gateway, Badgerys Creek and Agribusiness Precincts. Sewer is currently treated via onsite disposal systems within each rural and agricultural landing holding. At a regional level, there is insufficient residual capacity to accommodate future growth and demand. Sydney Water's planned infrastructure solution includes the Advanced Water Recycling Centre in Upper South Creek and up to 11 separate sewer pumping stations to service the Aerotropolis. These works are expected to begin rollout from 2024/25 as the Airport is commissioned and development begins to take place.

New mains are proposed along South Creek and Cosgroves Creek to service initial development in the Northern Gateway Precinct, Aerotropolis Core Precinct, and northern portion of the Agribusiness Precinct.

### Gas/fuel

Gas is being supplied into Aerotropolis by two Jemena Trunk Regulating Stations located at Horsley Park and West Hoxton. The secondary and medium pressure mains are sparsely distributed around the Aerotropolis Core Precinct due to the existing low intensity land use which is unlikely to be sufficient to cater for the projected future growth in gas demand.

There is currently no fuel pipeline in the Aerotropolis but it is understood that long term planning for the Airport will consider the need for a fuel connection.



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## Electricity

Endeavour Energy and TransGrid have a network of bulk supply points, zone substation and transmission lines in the region to service the primary agriculture land use. There is some residual capacity in some zone substations such as the Kemps Creek, Bringelly and Luddenham Zone Substations but would only support very minor growth.

Long-term forecasts and planning strategies indicate that the existing capacity cannot support future growth without augmentation or additional infrastructure. The planned utilities include a new build supply point, several new zone substations and switching stations and feeders to support the additional 900MW growth expected in the WSPGA.

Relocation of existing electrical services within the Western Sydney International (Nancy-Bird Walton) Airport footprint and nearby is also underway as part of the Stage 1 Airport works.

## Telecommunications

A number of telecommunication towers exist around the Aerotropolis with recent towers upgraded by NBN Co for the Fixed Wireless rollout. This is currently providing partial fixed line and wireless NBN services to rural landholdings. 3G and 4G mobile coverage is present throughout the Aerotropolis with partial existing 5G mobile coverage. Rollout plans for the various service providers are staged to match the location and pace of development in the Aerotropolis.

## Stormwater

Liverpool City Council and Penrith City Council have provided data for the existing stormwater network within the Aerotropolis. Existing stormwater infrastructure is generally restricted to rural road culverts and occasional bridges. No additional trunk stormwater facilities are present and all dams are farms dams owned by the respective landowners.

Significant stormwater pit and pipe upgrades and development of water quality and quantity treatment measures are required to accommodate future development in addition to upgrading infrastructure to be climate change resilient. Landside water quality and detention basins are required to support growth in the future but it is understood that Sydney Water are presently undertaking a study to determine this requirement and land take.

## 13.3 Recommendations

The following recommendations are made based on results of the utilities audit:

- » A 330kV transmission line traverses the Agribusiness and Northern Gateway Precincts and has a 60m wide easement that is not likely to be relocated or undergrounded. As such, future land use planning should consider the implications of this easement on developable areas.
- » There is currently no fuel pipeline but it is understood that long term planning for the Airport will consider the need for a fuel connection.
- » Telecommunications: whilst the Aerotropolis is completely serviced, new growth would require infrastructure upgrades such as additional telecommunication towers to support the new industries and further optical fibre would likely to be rolled out. The rollout of telecommunications is not seen as a roadblock to delivery (or limiting to growth) however the rise of data centres and data intensive industries would need to be considered in the proposed servicing strategy.
- » Recycled water should be considered to offset potable water use and promote circular economies for the Aerotropolis should a viable source be created.

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# 14 Wildlife management and wildlife strike

## 14.1 Description of study

Avisure have been engaged to identify wildlife attraction issues associated with land use planning for the Aerotropolis and develop mechanisms to mitigate wildlife strike risks for aircraft operating at Western Sydney Airport once the airport is operational.

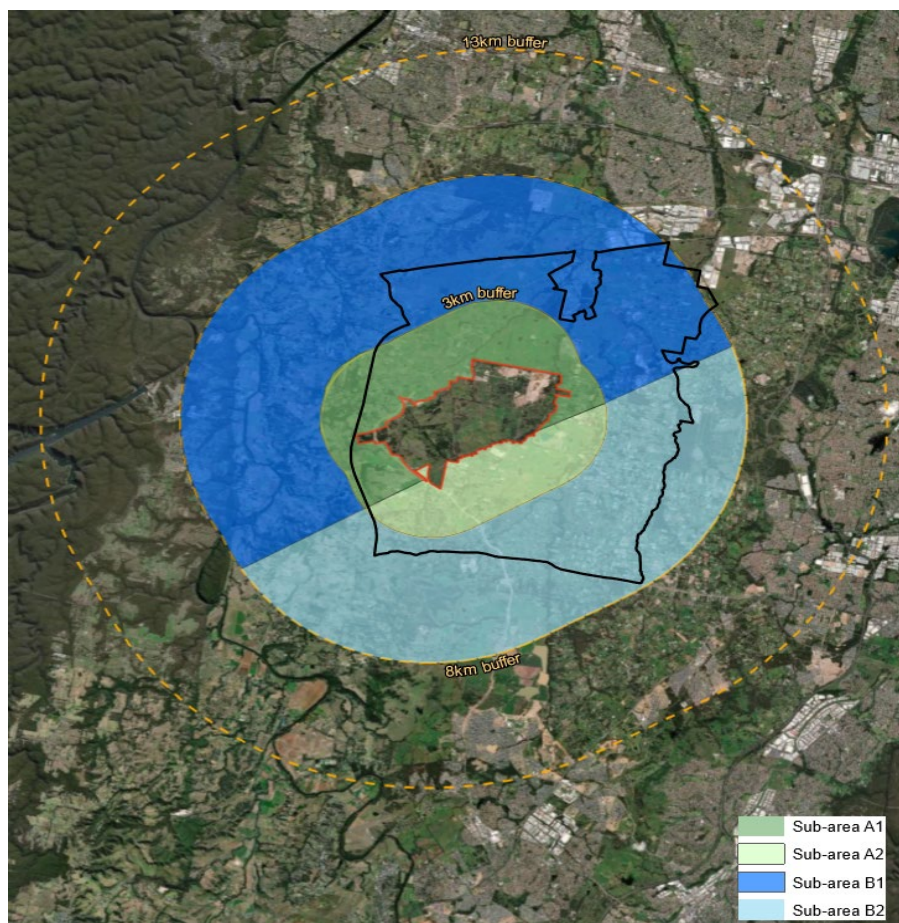
## 14.2 Assessment and findings

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

The Aerotropolis Aviation Wildlife Safeguarding Framework was adapted from the National Airports Safeguarding Framework (NASF) for use in the Aerotropolis planning framework and guidance material. This includes subdividing the National Airports Safeguarding Framework's wildlife buffers to reduce the number of wildlife infringing critical aircraft airspace by restricting land use activities on the north-west side of the airport. Restrictions in these areas does not necessarily mean refusing development applications but will require land users to apply more stringent mitigation. The rationale to subdivide the wildlife buffers aims to reduce the movement of birds across the airfield (i.e. north west to south east and vice versa).

**(Refer image below):** Area shaded dark green (sub-area A1) in 3km buffer requires a high level of scrutiny to minimise wildlife crossing the airport to access food/water sources. Aims to reduce wildlife crossing from south-east to north-west across the runways and main approach and departure axis. Area shaded dark blue (sub-area B1) in 8km buffer requires scrutiny, but not as rigid as the 3km buffer, to minimise wildlife crossing the airport to access food/water sources.

**Figure 8 Wildlife buffers**



## Landscaping

Avisure were also engaged to undertake a review of the proposed plant species list and guidelines for the Aerotropolis. The species list was found to contain some species that are attractive to wildlife (particularly flying-foxes) and in planted in the vicinity of Aerotropolis, are likely to create a risk to air traffic. The risk would escalate the closer to the airport such landscapes are developed and would escalate further as the landscapes mature, providing incrementally more nesting, roosting, perching and foraging sites in the years following planting.

There are no formal obligations on land users and regulatory authorities relating to landscaping in the vicinity of the Aerotropolis to minimise the wildlife attraction.

The Aerotropolis context is unique. Certain Australian bird species and especially flying-foxes present a risk that is not present in most other countries. No existing major Australian airport is surrounded by the number of flying fox camps that are present within 20km of Aerotropolis. From a risk management perspective, a precautionary approach to developing landscapes with plant species known to attract wildlife is recommended to help minimise future strike risks.

## 14.3 Recommendations

Safeguarding the Western Sydney Airport against wildlife strikes is seemingly at odds with the vision of the Aerotropolis that includes natural revitalization, water retention, enhancing biodiversity, establishing an extensive green and blue grid, and increasing tree canopy coverage. A balanced approach is recommended, with the National Airports Safeguarding Framework at its core, which affords the area amenity but minimizes the wildlife threats to aviation. This includes:

- » Applications for uses such as agriculture, recreation facility or waste management facility in proximity to wildlife buffers must be accompanied by a Wildlife Hazard Assessment and Management Plan

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- » Restrictions on the location, size and depth of retention basins and other water bodies, as well as undergrounding such infrastructure where possible
  - » Ensuring waste management practices restrict access to opportunistic urban forages. i.e. regular waste collection, enclosing waste receptacle areas
  - » Development of a suitable species palette and guidelines for landscaping in proximity to the airport
  - » Exclusionary devices on built form such as nets or anti-perching spikes
  - » Appropriate enclosures/safeguards for agricultural uses
  - » Establishing a regular and standardized monitoring regime to determine the actual level of wildlife attraction and identify any emerging risks.

## Landscaping

- » Trees planted in the vicinity of airports should be small to medium height to mitigate strike risk. A maximum height of 10m is considered best practice based on:
  - > The recommendation included in the Australian Airport Association's Airport Practice Note 9 – Wildlife Hazard Management at Airports (2016), page 43 (Passive Management: landscaping).
  - > It's inclusion in landscaping procedures and policies of Wildlife Hazard Management Plans for various Australian airports (including Sydney Airport, Mackay Airport, Avalon Airport, Karratha Airport, Coffs Harbour Airport, Ballina Airport, and several others).
- » Some trees, within 3km of Aerotropolis, will need to reach heights of up to 16m to help achieve the Parkland Vision. Mitigation can be considered where monitoring identifies wildlife activity associated with these tall trees is contributing, unacceptably, to the Aerotropolis strike risk. Any mitigation applied should be congruent with the circumstances (i.e. location, plant type, wildlife activity, level of risk) and may include branch trimming/removal, fruit/flower removal, replacement with alternative tree species, or wildlife dispersal/breeding restriction programs where roosts or breeding colonies have established.



