Transport
for NSW

Elizabeth Drive – West Upgrade

Review of Environmental Factors

September 2023

NSW GOVERNMENT

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Acknowledgement of Country

Transport acknowledges the Dharug, the traditional custodians of the land on which the Elizabeth Drive West Upgrade is proposed.

We pay our respects to their Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas and their rich contribution to society.

Approval and authorisation

Title	Elizabeth Drive West Upgrade Review of Environmental Factors
Accepted on behalf of Transport by:	Mark Barrett Senior Project Development Manager, Infrastructure and Place
Signed	Mark Barrett
Date:	11/9/2023

Executive summary

The proposal

Transport for NSW ('Transport') proposes to upgrade about 3.6 kilometres of Elizabeth Drive between The Northern Road at Luddenham, to near Badgerys Creek Road at Badgerys Creek, where it would connect with the future M12 Motorway (the proposal).

The key features of the proposal include:

- Upgrade of Elizabeth Drive from a two-lane rural road, to a four-lane road (two lanes in each direction) with provision of a central median to allow for future upgrade to six lanes
- A new bridge over Cosgroves Creek to carry eastbound and westbound traffic
- Upgrades to two intersections along Elizabeth Drive: Luddenham Road and Adams Road
- Active transport provision along the full corridor with the inclusion of shared paths along both sides of Elizabeth Drive corridor
- Inclusion of public transport infrastructure with bus priority at intersection and bus stops facilities
- New stormwater drainage infrastructure
- Property acquisitions and adjustments on both sides of Elizabeth Drive and some side roads.
- Relocation/adjustment of existing utilities.

The proposal is one of two adjacent planned upgrades of Elizabeth Drive between The Northern Road, Luddenham and Duff Road, Cecil Hills (referred to collectively as the Elizabeth Drive upgrades):

- Elizabeth Drive West Upgrade (the proposal), which is the subject of this Review of Environmental Factors (REF)
- Elizabeth Drive East Upgrade which would include the upgrade of about 7.8 kilometres of Elizabeth Drive between Badgerys Creek Road near the future M12 Motorway and about 600 metres east of Duff Road at Cecil Hills. This proposal is the subject of a separate REF and does not form part of the proposal.

Need for the proposal

Elizabeth Drive is the main east-west road connection between Elizabeth Street, Liverpool (at its eastern extent) and The Northern Road, Luddenham. Currently, Elizabeth Drive provides vital east-west transport links for residents and enterprises, including freight between Luddenham and the surrounding suburbs with the nearest strategic centre in Liverpool.

Elizabeth Drive is located within the Western Parkland City, which is set to experience substantial growth in population and employment opportunities associated with the Western Sydney Airport (WSA) planned to commence operation in 2026) and the Western Sydney Aerotropolis. The Western Sydney Aerotropolis has been planned to become a thriving economic hub for the emerging Western Parkland City, delivering new jobs, homes, infrastructure and services for people in the region. Further, it is projected to prompt the expansion of industrial, residential and commercial precincts and planned land releases for employment and residential zones in the area.

The WSA and the transformational nature of planned development in the Western Sydney Aerotropolis precinct is expected to generate significant traffic volumes and place substantial pressure on the local and wider road network, including Elizabeth Drive. Elizabeth Drive is set to become an important thoroughfare in the Western Parkland City, connecting the WSA and the Western Sydney Aerotropolis with strategic centres identified in the Western City District Plan (Greater Sydney Commission, 2018a).

The proposal would support this planned development by easing anticipated capacity constraints and facilitating increased movement and connectivity to surrounding growth areas. Further, the proposal would play a crucial role in connecting people and freight movement between the nearest strategic centres in Western Sydney.

In combination with other road network upgrades being delivered by Transport, including the completed upgrade of The Northern Road, the M12 Motorway project (currently under construction), and the planned Elizabeth Drive East Upgrade, the proposal would provide critical infrastructure to support the planned economic centre in the Western Sydney Aerotropolis,

facilitating a jobs hub across aerospace and defence, manufacturing, healthcare, freight and logistics, agribusiness, education and research industries.

Improvements in road safety are also a key driver of the proposal. Between 2013 and 2017, Elizabeth Drive recorded a crash rate that was three times higher than that of a typical arterial road. Of relevance to the construction footprint, between January 2016 and December 2020, five crashes were recorded at the intersection of Elizabeth Drive and Luddenham Road, and nine crashes at the intersection of Elizabeth Drive and Badgerys Creek Road (Transport for NSW, 2020).

The proposal would include several safety measures to minimise the potential for harm, such as the removal of roadside hazards and implementation of safety barriers where required. The introduction of a central median as part of the proposal would reduce the risk of head on vehicle collisions. The provision of new shared walking and cycling paths along the full length of the proposal on both sides of Elizabeth Drive, would also improve safety for pedestrians and cyclists.

Proposal objectives

The objectives of the proposal are to:

- Provide a defined road corridor adequate to accommodate future growth
- Maintain the primary function of a movement corridor
- Support key north-south routes (eg The Northern Road and M12 Motorway)
- Improve road safety for all road users
- Provide active transport, bus priority and vehicle access to assist in key connections to:
  - WSA, business and technology park
  - Western Sydney Aerotropolis
  - Centres identified in the Western Parkland City and Western Sydney Parklands
- Provide an efficient, resilient freight network
- Contribute to the desired future character and connectivity of the Western Parkland City and Western Sydney Parklands.

Options considered

Two options were considered in response to the strategic need for the proposal – a 'do nothing' option and upgrading the existing Elizabeth Drive between The Northern Road and Badgerys Creek Road.

The 'do nothing' option would involve Elizabeth Drive continuing in its current state, with no upgrade. This would not meet the proposal objectives outlined above, and would not provide sufficient capacity to support ongoing growth of the region. Proceeding with upgrading Elizabeth Drive would support the new WSA and surrounding precincts, reduce congestion, improve travel times and increase safety for motorists. As such, upgrading Elizabeth Drive was selected as the preferred option and is the subject of this REF.

Several design options were also considered for the proposal, such as extending the existing road corridor to the north or south. These are detailed in Chapter 2 (Need and options considered).

Statutory and planning framework

The proposal is for the purpose of a road and road infrastructure facilities, and would be carried out by Transport for NSW (Transport), which is a public authority. In accordance with clause 2.109 of State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP), the proposal is permissible without development consent and subject to assessment under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This REF has examined and considered all matters affecting or likely to affect the environment by reason of the proposal.

This REF has been prepared to meet the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) strategic assessment approval for Transport Division 5.1 road activities. Appropriate significant impact assessments were carried out for threatened species and ecological communities either recorded or considered as having a moderate or higher likelihood of occurring within the construction footprint. The proposal construction would include direct impact to threatened species and ecological communities identified under the EPBC Act, including areas of River-flat eucalypt forest on

coastal floodplains of southern New South Wales and eastern Victoria (listed as critically endangered under the EPBC Act); Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and Southeast Queensland (endangered); disturbance of foraging habitat for the Grey-headed Flying-fox *Pteropus poliocephalu* (vulnerable); and removal of up to six *Pultenaea parviflora* individuals (vulnerable). These impacts, however, are not considered to result in a significant impact on the environment or matters of national environmental significance.

The proposal would also be located adjacent to Commonwealth land associated with the WSA; however, this is not anticipated to result in significant direct or indirect impacts to this land or its environment. The proposal is not likely to have a significant impact on other matters of national environmental significance within the meaning of the EPBC Act. Therefore, the proposal can be assessed under Division 5.1 of the EP&A Act and a referral under the EPBC Act is not necessary.

Community and stakeholder consultation

Transport has consulted with the community and stakeholders during the development of the proposal.

Community consultation was initially carried out in June 2019 to inform the community of the proposed access strategy for the proposal, invite feedback and gather local knowledge. Further consultation was carried out for the broader Elizabeth Drive upgrade in March and April 2020 to inform the community of the strategic design and alignment of the proposed upgrades.

Various government agencies and key stakeholders have been consulted about the proposal, including consultation with (but not limited to):

- Penrith City Council, Liverpool City Council and NSW State Emergency Services in accordance with the Transport and Infrastructure SEPP due to potential impacts on local roads and proposed work within flood liable land
- Aboriginal stakeholders in the preparation of the Aboriginal cultural heritage assessment for the proposal, including seeking feedback on the assessment methodology, cultural values, and results of the assessment in accordance with the Procedure for Cultural Heritage Consultation and Investigation (PACHCI) (Roads and Maritime Services, 2011) and the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW, 2010a)
- Other agencies and stakeholders including, WSA, Western Parkland City Authority, Department of Planning and Environment and Sydney Water Corporation.

The issues raised by the community, government agencies and key stakeholders were considered in the proposal design and/or addressed in the REF (refer to Chapter 5 (Consultation)). Transport will continue to seek feedback as the proposal progresses, including during detailed design and construction. Feedback received during REF display will be considered in a response to submissions report.

Environmental impacts

The key environmental impacts of the proposal are summarised in the following sections.

Noise and vibration

Several representative construction scenarios have been modelled to assess the potential construction noise impacts on nearby receivers. The vegetation clearing scenario is predicted to result in the greatest number of exceedances of the daytime construction noise management levels. During this scenario, about 50 receivers during work in standard construction hours may experience noise levels above the noise management levels. Noise levels are predicted to be 'moderately intrusive' (11-20 dB(A) above the noise management levels) at 13 receivers and 'highly intrusive' (>20 dB(A) above the noise management levels) at 10 receivers across the construction footprint during standard construction hours. The magnitude of these impacts is similar to other major work projects.

To minimise disruption to daily traffic and disturbance to surrounding landowners and businesses, it would be necessary to carry out some work outside of standard construction work hours. The 'site establishment and enabling work' scenario has been assessed for this period as it is considered to represent a reasonable worst-case assessment of the types of activities which are likely to take place outside of standard construction work hours. About 136 receivers are predicted to experience exceedances during work outside of standard construction hours for this scenario. Of these receivers, 58 receivers would experience exceedances ranging from six to 15 dB ('clearly audible'), to greater than 25 dB ('highly intrusive'). These receivers would require the implementation of night-time noise mitigation measures would be implemented. All 136 receivers would receive notification of the night-time work.

Noise management levels are predicted to exceed the sleep disturbance screening level at about 45 residential receivers during the site establishment and enabling work scenario. As the work is expected to be staged, the number of affected residential receivers at any one time would be limited. Safeguards and management measures have been developed to reduce the potential noise impacts from this construction phase work. In addition to these safeguards and management measures, Transport and its contractor would also comply with any relevant noise and vibration management measures specified in the environment protection licence (EPL), which would be sought for the project.

The above worst-case noise impacts represent times when noise intensive equipment is being used. There would also frequently be periods when construction noise levels are much lower than the worst-case levels predicted as well as times when no equipment is in use.

Where minimum working distances are complied with, no adverse impacts from vibration intensive work are likely in terms of human response or cosmetic damage. Should work be required within these minimum working distances, safeguards and management measures to control excessive vibration and to notify potential receivers would be implemented.

During operation, road traffic noise levels are predicted to exceed the Road Noise Policy (DECCW, 2011) L_{Aeq} noise criteria at a total of 60 residential receivers. Generally, these exceedances would occur at receivers directly adjacent to the Elizabeth Drive Road corridor. Seven residential receivers adjacent to Elizabeth Drive have been identified as experiencing road traffic noise at a level requiring specific reasonable and feasible noise mitigation measures in accordance with the Road Noise Policy. No exceedances of the criteria are predicted at non-residential land uses during operation.

Noise from audio-tactile push buttons installed at proposed signalised intersections would be compliant with the relevant noise criteria during the daytime, evening and night-time periods, for all volume settings.

Traffic, transport and access

During construction of the proposal, it is anticipated that peak traffic generation would include about 200 light vehicles and 70 heavy vehicles per day. Construction traffic would be distributed across the construction ancillary facilities and the proposal alignment, depending on the stage of construction and progression of activities. The additional 25 construction vehicle movements generated during the AM and PM peak hours would represent an increase to peak hourly traffic volumes along Elizabeth Drive of about one percent. These traffic volume increases are minor and expected to be manageable given that they are within the realm of daily traffic variations typically experienced across Sydney's road network including Elizabeth Drive.

Property access would be maintained as far as practicable during the construction period; however, temporary disruptions to private property access would be required to facilitate certain construction activities. Planned disruptions to property access would be subject to engagement with the affected property owner, with alternative access arrangements provided where possible.

Once operational, the Elizabeth Drive upgrades are expected to result in benefits to the road network and accommodate the majority of future traffic demands associated with the growth of the region. Without the Elizabeth Drive upgrades, in 2040 it is anticipated that 10.9 per cent of vehicles in the AM peak period and 10.3 per cent of vehicles in the PM peak period of the forecast demand would be unable to enter the road network on Elizabeth Drive. Once the Elizabeth Drive upgrades are operational, this percentage would substantially decrease to only 0.5 per cent of vehicles in the AM peak and 2.6 per cent of vehicles in the PM peak. It is anticipated that real time signal coordination and the ITS would further reduce the congestion on the road network when those systems are fully deployed.

Average travel speeds along Elizabeth Drive during peak periods would be improved by up to 17 per cent in 2030 and up to 18 per cent in 2040, compared to a scenario without the proposal, which suggests a reduction in congestion. In addition, the proposal would provide an important arterial function as it would be located in proximity to precincts in the Western Sydney Aerotropolis that are planned for enterprise, agri-business and light industrial uses.

The proposal would include new shared walking and cycling paths along the full length of the proposal on both sides of Elizabeth Drive, tying into the shared walking and cycling path at The Northern Road. The new paths would improve safety for cyclists and pedestrians, and facilitate connections to employment opportunities in the Western Sydney Aerotropolis.

Five crashes were reported at the intersection of Elizabeth Drive and Luddenham Road (within the construction footprint) with one incident recording a serious injury and two incidents recording moderate injuries. The provision of a central median as part of the proposal would reduce the risk of cross traffic collisions for motorists; however, this would result in the loss of direct access to properties along Elizabeth Drive from the opposite direction of travel. Property owners would need to use existing U-turn facilities, and proposed provisions for U-turn functions to access properties in the opposite direction of travel which would slightly increase travel time, or use the local road network to access properties where possible. It is estimated

there would be a maximum increase of 17 seconds for residents to access properties between The Northern Road and Luddenham Road in 2040 with the proposal.

Biodiversity

The proposal has sought to avoid and minimise impact to a range of biodiversity values where feasible. Residual impacts of the proposal on biodiversity values would include:

- Clearing of about 29.35 hectares of native vegetation in total, which includes the following areas:
  - About 22.11 hectares native vegetation which is not biodiversity certified (and, therefore, requires assessment under the Biodiversity Conservation Act 2016 (BC Act) in accordance with the Biodiversity Assessment Method (BAM; Department of Planning, Industry and Environment 2020))
  - About 7.24 hectares of native vegetation on biodiversity certified land, which is not subject to further assessment
  - Four TECs subject to assessment under the BC Act (6.28 hectares)
  - Two TECs subject to assessment under the EPBC Act (1.49 hectares)
- Clearing of about 0.22 hectares of non-native/exotic vegetation
- Removal of known habitat for threatened flora species, including 3.08 hectares of *Marsdenia viridiflora* subsp. *viridiflora* – endangered population; six *Pultenaea parviflora* individuals
- Removal of known and assumed habitat for threatened fauna species
- Removal of 32 hollow-bearing trees, 10 of which are not on biodiversity certified land, and meet the definition of hollow bearing trees in accordance with the BAM and may be used by smaller hollow-dependent fauna
- Indirect impacts to flora and fauna within 25 metres of the construction footprint, such as reduced viability of adjacent habitat due to edge effects, noise, dust or light spill; transport of weeds and pathogens from the site to adjacent vegetation; and loss of breeding habitats, through the removal of hollow-bearing trees.

Significant impact assessments were carried out for threatened species and ecological communities identified as occurring within the construction footprint. These assessments concluded that the proposal is unlikely to have a significant impact on any nationally listed entity. Through the application of specific and measurable safeguards and managed measures proven effective on similar proposals, it is anticipated that the level of impact to threatened fauna and flora would be minimise and appropriately managed. Transport would also seek biodiversity offsets to offset residual impacts, which have been calculated in accordance with the BAM calculator.

Non-Aboriginal heritage

The proposal would result in direct impacts to the Luddenham Road Alignment (a listed local heritage item which intersects with Elizabeth Drive) and potential temporary indirect visual impacts to McGarvie Smith Farm (a listed local heritage item).

The proposal would require the widening of the Luddenham Road Alignment to about 60 metres, for a length of about 100 metres, before tapering into the existing alignment to suit the new signalised intersection. However, the proposal would not alter the overall alignment, and the item would continue to fulfil its historical purpose as an essential link between St Marys and Luddenham.

During the construction of the proposal, construction ancillary facility 3 would be located within part of the heritage curtilage of the McGarvie Smith Farm; however, heritage significant buildings and structures would be located outside of the construction footprint. Construction ancillary facility 3 would be located entirely on land that is currently being used to support construction of the M12 Motorway. The establishment and use of the construction ancillary facility for this proposal may result in temporary indirect (visual) impacts to the landscape character of this item. Although work would take place within the heritage curtilage of the item, there would be no direct impacts to the heritage values of the McGarvie Smith Farm.

While construction activities would be likely to occur within the heritage curtilage of the McGarvie Smith Farm, there would only be the potential for temporary indirect visual impacts, given that heritage significant buildings on the site would be located about 115 to 160 metres away and separated from the proposal by an access track (ie are beyond a distance in which direct impacts may occur). A small portion of the proposed widened road corridor would also be located within the heritage curtilage of the McGarvie Smith Farm; however, this would be located along the boundary of the curtilage, over 450 metres away from heritage significant buildings on the site. As such the operation of proposal is not anticipated to have an impact on the significance of McGarvie Smith Farm.

Aboriginal cultural heritage

Construction work for the proposal (such as earthworks) is anticipated to directly impact one previously recorded Aboriginal site. This would result in a partial loss of value for one surface and subsurface artefact (Elizabeth Drive/Adams Road AFT 1). The impacted Aboriginal site is considered to display moderate significance based on consideration of the research potential, representativeness, intactness and rarity of the site. Archaeological salvage excavation would be carried out to manage the impact of the proposal and offer an opportunity to better understand the activities which were undertaken at impacted sites.

The proposal is not expected to impact on any items of Aboriginal heritage or cultural values when it is operational, as earthworks and disturbance would be restricted to the construction phase.

Hydrology and flooding

Some construction work would be carried out in flood affected areas, within the vicinity of creeks which traverse the construction footprint, including Cosgroves Creek and Oaky Creek. If inundated during a flood, material, fuel, chemicals and equipment stored in stockpile and compound sites could wash away. This could impact the surrounding environment, particularly adjacent waterbodies. Construction work and potential impacts would be temporary in nature. Compounds and stockpiles could also affect flood flow paths, if inappropriately located. Appropriate safeguards and management measures would be implemented to manage these potential impacts.

The proposal would be designed to a flood immunity of a one per cent annual exceedance probability event (AEP) for the main road alignment. Flood modelling carried out for the proposal for flood events up to and including the one per cent AEP show that:

- Elizabeth Drive would not be overtopped by flooding during the one per cent AEP flood event
- Afflux of greater than 100 millimetres would generally be contained to isolated areas within the road corridor, with the exception of one privately owned land parcel located immediately south-west of the Elizabeth Drive and Adams Road intersection (Lot 106 / DP 846962). This property has the potential to experience a maximum afflux of 130 millimetres. This increase would generally be contained within Cosgroves Creek on land zoned as ENZ – Environment and Recreation. No buildings have been identified in the affected area based on a review of aerial imagery
- Flow velocities on the floodplain would not significantly increase. The maximum velocities during the one per cent AEP flood event would not exceed 2.5 metres per second, consistent with the future base case
- There would be no material increases in flood hazard categorisation outside of the construction footprint. Modelling results indicate that potential increases in flood hazard would be generally contained within creeks and design drains located in land zoned as ENZ – Environment and Recreation, while other areas are also estimated to result in reductions in flood hazard.

A building impact assessment was carried out of the Cosgroves Creek model catchment. One building is predicted to experience above floor flood impacts in both the future base case (without the proposal) and the design case (with the proposal), assuming that floor levels are about 300 millimetres above ground level. The depth of above floor flooding at this building is not anticipated to increase due to construction of the proposal.

Further design refinement would be carried out during detailed design to minimise potential increases in flood depths, where possible.

Socio-economic

During construction, the proposal would stimulate broader economic benefits through job generation and construction multipliers such as expenditure on services and supplies. Residents, social infrastructure users, businesses and landowners would experience a degree of disruption and other temporary negative impacts. In particular, changes to traffic conditions and noise and vibration from construction work would result in moderate impacts on local amenity for receivers surrounding the proposal.

Once operational, the proposal would support economic activity within region, which would have positive flow on effects for business activity and employment. The increase in accessibility and decrease in traffic congestion enabled by the proposal would result in moderate positive socio-economic impacts. The proposal would provide active transport facilities and infrastructure to enable the provision of public transport. This would contribute to a number of direct and indirect social and health benefits such as community cohesion and connectivity. This could potentially improve the wellbeing of residents and the physical health of those in the social locality, due to the utilisation of available and safe infrastructure.

There is potential, however, for some adverse impacts as a result of the proposal. Amenity impacts would be experienced generally at properties closest to the widened road corridor, such as increases in operational traffic noise and changes in the landscape and visual environment, which may adversely affect people's daily activities.

Partial acquisition of 18 privately owned properties would be required for the proposal. These properties accommodate a mix of land uses, including residential, commercial (including agricultural), and vacant or unknown land uses, which has the potential to result in stress for landowners and permanent changes to existing land uses in acquired areas. At the majority of properties, partial acquisition is anticipated to directly impact parts of driveways, internal tracks, or sheds, rather than dwellings. One property has been identified which potentially includes a residential dwelling within the area proposed to be partially acquired.

Property adjustments at the properties identified for partial acquisition would also be required and include adjustments to fencing, farm dams, sheds, driveways and letterboxes, and a loss of vegetation and grassed areas. This has the potential to affect communities by placing additional pressure and stress on residents due to loss of land used for various uses (for example, existing sheds or buildings). Transport would consult with landowners subject to property acquisition and adjustments throughout detailed design.

All property acquisition would be carried out in accordance with the Land Acquisition Information Guide (Transport for NSW, 2014) and the *Land Acquisition (Just Terms Compensation) Act 1991*.

Transport would implement safeguards and management measures to avoid or minimise potential impacts as a result of the proposal, including community and stakeholder consultation. Ongoing design development would also consider opportunities to minimise potential socio-economic impacts.

Landscape and visual amenity

Construction activities located within the road corridor and ancillary facilities would be seen by a low number of residents and motorists living or working in surrounding properties, and by a high number of visual receivers travelling along Elizabeth Drive and connecting roads (including the Northern Road, Adams Road and Luddenham Road). High to moderate (adverse) temporary impacts are predicted to be experienced by these receivers.

During operation, the most visually prominent changes would include the upgrade of Elizabeth Drive, with the addition of a vegetated central median strip separating carriageways with two lanes travelling in either direction, and shared paths on both sides of the road. Elizabeth Drive would change from a rural road to an upgraded transport corridor with formalised kerb and gutters and a shared path for walking and cycle. This would result in an overall moderate (neutral) visual impact, and a low (neutral) effect on the overall landscape character of the area. These changes would be appropriate given the ongoing development of the surrounding landscape in response to the construction of the WSA and Western Sydney Aerotropolis. Notwithstanding, detailed design of the proposal would include consideration of opportunities to minimise landscape and visual impacts.

Other impacts

Other notable impacts of the proposal include:

- Property impacts due to the partial acquisition of 18 lots, and adjustments to existing properties (subject to detailed design)
- Potential for construction work to increase surface water runoff and impacts to surface water quality of receiving waterways (Cosgroves Creek, Oaky Creek, Badgerys Creek and South Creek) with the mobilisation of sediments and contaminant laden stormwater
- Potential for existing contamination present within soils in the construction footprint to be exposed or disturbed during construction activities, such as excavation and earthworks. The Phase 1 Contamination assessment carried out for the proposal identified that contaminants of potential concern may be present within the construction footprint, associated with uncharacterised fill, fly tipped waste and areas of former and current agricultural land. A Phase 2 Contamination Assessment (detailed site investigation) would be carried out to confirm the presence of potential contaminants and risks
- Air quality impacts from dust generated during construction, which would present a low unmitigated risk for dust soiling, human health and ecological receptors.

Safeguards and management measures would be implemented to avoid, minimise and/or manage the potential impacts of the proposal.

Justification and conclusion

The Elizabeth Drive West Upgrade has been driven by the need to support future planned growth of the Western Parkland City, address potential future capacity constraints on the surrounding road network and improve safety for all road users. The proposal is also aligned with several strategic policies and government strategies, such as Future Transport Strategy 2056 (Transport for NSW, 2022) and the Greater Sydney Region Plan – A Metropolis of Three Cities (Greater Sydney Commission, 2018).

Environmental impacts from the proposal have been avoided or minimised during design refinement, where possible, for example through review of the design to minimise the need for vegetation removal. However, the proposal is likely to result in some permanent impacts on biodiversity, Aboriginal heritage, operational road traffic noise, as well as some temporary construction related impacts relating to traffic, noise and vibration, socio-economic matters and water quality. Environmental safeguards and management measures as detailed in this REF would minimise these potential impacts.

Overall, the proposal is justified on the basis that it results in long-term benefits on road safety and movement along Elizabeth Drive, and supports the planned growth of the Western Parkland City, WSA and Western Sydney Aerotropolis, which is considered to outweigh the potential adverse impacts.

Display of the review of environmental factors

This REF will be on display for comment until 31 October 2023. The documents can be accessed in the following ways.

Internet

The documents are available as pdf files on the Transport for NSW website at https://nswroads.work/elizabethdrive

Copies by request

Printed and electronic copies are available by emailing elizabethdrive@transport.nsw.gov.au, noting that there may be a charge for hard copies or USB.

Staffed displays

Date: Wednesday 11 October 2023 (Face-to-Face)
Location: Hubertus Club, 205 Adams Road, Luddenham
Time: 5–7pm

Date: Tuesday 17 October (Online session)
Location: MS Teams - Register for this session by sending us an email at elizabethdrive@transport.nsw.gov.au
Time: 12 noon – 1pm

Date: Saturday 21 October 2023 (Face-to-Face)
Location: Bringelly Community Centre, 5 Greendale Road, Bringelly
Time: 10am–12 noon

How can I make a submission?

Submissions can be made through the following methods:

Phone: Call our toll free project line at 1800 865 303

Email: Email us at our project email address at elizabethdrive@transport.nsw.gov.au

Submissions will be managed in accordance with the *Transport for NSW Privacy Statement*. A copy can be made available upon request.

What happens next?

Transport will collate and consider the submissions received during public display of the REF.

After this consideration, Transport will determine whether or not the proposal should proceed as proposed and will inform the community and stakeholders of this decision.

If the proposal is determined to proceed, Transport will continue to consult with the community and stakeholders prior to and during construction.

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Appendix K – Urban Design, Landscape Character and Visual Impact Assessment

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Appendix M – Phase 1 Contamination Assessment Report

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Figures

1. Introduction

This chapter introduces the proposal and provides the context of the environmental assessment.

1.1 Proposal identification

Transport proposes to upgrade about 3.6 kilometres of Elizabeth Drive between The Northern Road at Luddenham, to near Badgerys Creek Road at Badgerys Creek (the proposal), where it would connect with the future M12 Motorway. The proposal is one of two planned upgrades of Elizabeth Drive, between The Northern Road, Luddenham and Duff Road, Cecil Hills. This includes the following proposals (referred to collectively as the Elizabeth Drive upgrades):

- Elizabeth Drive West Upgrade (the proposal), which is the subject of this review of environmental factors (REF)
- Elizabeth Drive East Upgrade which includes the upgrade of about 7.8 kilometres of Elizabeth Drive between Badgerys Creek Road near the future M12 Motorway, and about 600 metres east of Duff Road at Cecil Hills. This proposal is the subject of a separate REF and does not form part of the proposal.

The proposal would be carried out within the Penrith Local Government Area (LGA) and the Liverpool LGA. Figure 1-1 shows the construction footprint and the operational footprint for the proposal.

A detailed description of the proposal is provided in Chapter 3 (Description of the proposal).

FIGURE 1-1:
LOCATION OF THE PROPOSAL

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Imagery © Nearmap 2021.

1.2 Purpose of the report

This REF has been prepared by AECOM on behalf of Transport. For the purposes of these works, Transport is the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail the safeguards and management measures to be implemented.

The description of the proposed work and assessment of associated environmental impacts has been carried out in the context of Section 171 of the Environmental Planning and Assessment Regulation 2021, the factors in Guidelines for Division 5.1 assessments (Department of Planning and Environment (DPE), 2022), Roads and Related Facilities EIS Guideline (DUAP, 1996), the *Biodiversity Conservation Act 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act), and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of:

- Section 5.5 of the EP&A Act, including that Transport examines and takes into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity
- The strategic assessment approval granted by the Federal Government under the EPBC Act in September 2015, with respect to the impacts of Transport's road activities on nationally-listed threatened species, ecological communities and migratory species.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and, therefore, the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and, therefore, the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- The significance of any impact on nationally-listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and if offsets are required and able to be secured
- The potential for the proposal to significantly impact any other matters of national environmental significance or Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Department of Climate Change, Energy, the Environment and Water, for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

1.3 Structure and content of the report

The structure and content of the REF is outlined in Table 1-1.

Table 1-1 Structure and content of the REF

Chapter	Description
REF Chapters	
Chapter 1 – Introduction (this chapter)	Outlines the background to the proposal, and the purpose and structure of the REF
Chapter 2 – Need and options considered	Outlines the need for the proposal and provides an overview of the options considered during the development of the proposal
Chapter 3 – Description of the proposal	Provides a detailed description of the proposal, including the elements of the proposal, construction, and operation
Chapter 4 – Statutory and planning framework	Provides an outline of the statutory approvals framework including applicable legislation and planning policies

Chapter	Description
Chapter 5 – Consultation	Provides an overview of the consultation which has been carried out to date, and consultation which would be carried out to support the REF exhibition and construction phase
Chapter 6 – Environmental assessment	Provides an assessment of the potential environmental impacts associated with the construction and operation of the proposal
Chapter 7 – Environmental management	Outlines the proposed environmental management systems to be implemented and provides the safeguards and management measures to be implemented during the construction and operation of the proposal, to manage the impacts identified in the REF
Chapter 8 – Conclusion	Provides the justification for the proposal and an outline of the key conclusions of this report
Appendices	
Appendix A	Consideration of Section 171 factors and matters of national environmental significance and Commonwealth land
Appendix B	Statutory consultation checklists
Appendix C	Property acquisition
Appendix D	State Environmental Planning Policy (Biodiversity and Conservation) 2021, Chapter 6 considerations
Appendix E	Noise and Vibration Assessment Report
Appendix F	Traffic and Transport Assessment Report
Appendix G	Biodiversity Development Assessment Report
Appendix H	Non-Aboriginal Heritage Impact Assessment
Appendix I	Stage 3 PACHCI – Aboriginal Cultural Heritage Assessment Report
Appendix J	Socio-economic Impact Assessment
Appendix K	Urban Design, Landscape Character and Visual Impact Assessment
Appendix L	Surface Water and Groundwater Assessment Report
Appendix M	Phase 1 Contamination Assessment Report
Appendix N	Air Quality Impact Assessment Report

2. Need and options considered

This chapter describes the need for the proposal in terms of its strategic setting and operational need. It identifies the various options considered and the selection of the preferred option for the proposal.

2.1 Strategic need for the proposal

2.1.1 Overview of strategic context and need for the proposal

Elizabeth Drive is a major State road and is the main east-west road connection between Elizabeth Street, Liverpool (at its eastern extent) and The Northern Road, Luddenham (at its western extent). Within the construction footprint, Elizabeth Drive is a two-lane undivided road (one lane in each direction). There are currently two unsignalised intersections along Elizabeth Drive within the construction footprint, which includes Luddenham Road and Adams Road. The current posted speed limit is 80 kilometres per hour along Elizabeth Drive and Luddenham Road. Other local roads in the construction footprint have a posted speed limit of 60 kilometres per hour.

Currently Elizabeth Drive provides vital east-west transport links for residents and enterprises, including freight between the nearest strategic centres in Liverpool and Luddenham and the surrounding suburbs.

The Western Sydney International (Nancy-Bird Walton) Airport (Western Sydney Airport; WSA) and Western Sydney Aerotropolis, are expected to generate significant traffic volumes and place pressure on the local road network. WSA is planned to commence operation in 2026 and would comprise a single runway, a terminal and other relevant facilities, to accommodate around 10 million passengers annually as well as air freight traffic (Australian Government, 2019a).

The Western Sydney Aerotropolis has been planned to become a thriving economic hub for the emerging Western Parkland City, delivering new jobs, homes, infrastructure and services for people in the region. The Western Sydney Aerotropolis Plan (Western Sydney Planning Partnership, 2020) estimates that up to 200,000 new jobs could be created in the Western Parkland City, as the WSA becomes a catalyst for significant growth in the Western Parkland City. The Western Parkland City covers the eight local government areas of the Blue Mountains, Camden, Campbelltown, Fairfield, Hawkesbury, Liverpool, Penrith and Wollondilly councils, and the sheer scale and rapid rate of change necessitates clear direction to deliver the vision for the City as discussed in the Western Parkland Blueprint (Western Parkland City Authority, 2021a) (refer to Section 2.1.5).

Transport is committed to supporting the delivery of the WSA and the Western Parkland City. The proposal would support the projected and planned development in the region and play a crucial role in connecting people and moving freight between the nearest strategic centres in Western Sydney and the Greater Sydney region.

The proposal would form part of the planned Western Parkland City road corridor upgrades, and would tie into the new M12 Motorway at the intersection of Badgerys Creek Road, which would provide motorway access to the WSA and Western Sydney Aerotropolis. Once connected and operational, there would be an anticipated increase in traffic volume on and off Elizabeth Drive. Future traffic volumes are discussed in Section 2.1.4.

In addition to supporting planned development in the area, the proposal would also alleviate existing flooding issues along the road corridor as Elizabeth Drive is subject to relatively shallow depth of flood inundation. During a one per cent Annual Exceedance Probability (AEP) storm event, some overtopping occurs where it crosses the floodplain at Cosgroves Creek and Oaky Creek and occasionally over Luddenham Road. The proposal would remove and replace existing drainage infrastructure and include the provision of new drainage infrastructure, thus improving current conditions.

2.1.2 Network performance

The Western Parkland City is projected to grow from a population of 740,000 in 2016 to over 1.5 million by 2056. Further, it is projected that the Western Sydney Aerotropolis would prompt the expansion of industrial, residential and commercial precincts and planned land releases for employment and residential zones in the area. As part of the artery of the Western Parkland City, Elizabeth Drive is set to become an important thoroughfare in Sydney, connecting the WSA and the Western Sydney Aerotropolis with the Western Sydney strategic centres and the Greater Sydney region. This development is expected to transform Elizabeth Drive from a rural road to a heavily trafficked urban corridor, with an estimation of between 24,000 and 55,000 vehicles per day.

Currently, to the west of the M7 Motorway, Elizabeth Drive experiences frequent congestion during peak times. Traffic modelling carried out for the proposal (discussed in Section 6.2), indicates that without the proposal, the network would operate at a maximum capacity by 2030. This would result in unsatisfactory congestion levels and increased travel time for motorists.

Intersections within the construction footprint currently operate at a level of service (LoS) of B (good operation with acceptable delays and spare capacity) or A (good operation). Existing average delays at the Badgerys Creek Road intersection range between 21 seconds at the AM peak to 24 seconds during the PM peak, and at the Luddenham Road intersection between 13 seconds in the AM peak to eight seconds in the PM peak.

The new proposed signalised intersections located at Luddenham Road, M12 Motorway / WSA Connection and Badgerys Creek Road would be expected to work satisfactorily (LoS D or better) in the 'do nothing' scenarios in 2030 and 2040 (described further in Section 6.2). This is with the exception of Elizabeth Drive and Badgerys Creek Road which is expected to operate at a LoS F in the 2040 AM peak scenario. This indicates that the projected traffic demands would exceed available capacity.

The traffic modelling found that with the Elizabeth Drive upgrades, network performance and travel times along Elizabeth Drive would improve in the 2030 and 2040 future scenarios (described further in Section 6.2). Further, the introduction of a central median is expected to improve overall network performance and would reduce the likelihood of rear-end and head-on crashes between vehicles attempting to cross Elizabeth Drive for property access. The proposal is, therefore, expected to reduce delays, increase the average speed across the network and improve safety conditions.

2.1.3 Road safety

Between 2013 to 2017, the crash rate along Elizabeth Drive from The Northern Road to the M7 Motorway was three times higher than the typical rate for an arterial road, with a total of 92 crashes reported. This included one fatal crash. A review of crash types suggest that the majority are associated with acceleration/deacceleration (eg rear-end crashes) and turning movements associated with uncontrolled intersections and access points along Elizabeth Drive (Transport for NSW, 2020).

For the construction footprint specifically, a summary of the number, severity and types of crashes along Elizabeth Drive is provided in Table 2-1 and Table 2-2, based on historical crash data collected in the five years between January 2016 and December 2020. The location and severity of crashes within the construction footprint, is shown on Figure 2-1.

Five crashes were reported at the intersection of Elizabeth Drive and Luddenham Road (within the construction footprint) with one incident recording a serious injury and two incidents recording moderate injuries. These crashes involved vehicles travelling from the opposite direction.

The proposal is anticipated to provide improvements to safety with the installation of traffic lights at the intersection of Elizabeth Drive with Luddenham Road. Without traffic lights, drivers are increasingly taking risks by not waiting for suitable gaps in traffic, often resulting in cross traffic collisions.

Outside of the construction footprint, nine crashes were reported at the intersection of Elizabeth Drive and Badgerys Creek Road. These resulted in two incidents of serious injuries, three incidents of moderate injuries and three incidents of minor injuries. Eight out of the nine crashes involved vehicles travelling from the opposite direction.

By providing a central median, the proposal would reduce the likelihood of rear-end and cross traffic collisions between vehicles attempting to cross Elizabeth Drive for road and property access, and the oncoming traffic in the opposite direction.

Table 2-1 Severity of crashes within the construction footprint (2016 – 2020)

Fatality	Serious injury	Moderate injury	Minor/other injury	Non causality / Tow away	Total
0	4	9	3	5	21

Table 2-2 Type of crashes within the construction footprint (2016 – 2020)

Cross traffic	Right through	Left through	Opposite head on	Rear end	Off to the left	Other
1	2	1	1	2	7	7

The proposal has also been designed in accordance with Guide to Road Safety Part 1 and 2 (Austroads 2021) (Austroad guidelines) through harm minimisation on high-speed roads as demonstrated in the design considerations below:

- Clear zones: Safety barriers are proposed where non-frangible road hazards could not be placed outside the "clear zone"
- Delineation: Line markings, guide posts and warning signs would be provided to enable a reliable level of road delineation and assist in reducing the risk of vehicles losing control and running off the road
- Road design elements: The geometric design of the road is a principal factor influencing a vehicle's ability to traverse and remain on a road. The proposal design of the critical road elements such as lane widths, road shoulders, horizontal and vertical elements, road surface, sight distance and drainage were completed in accordance with the Austroads guidelines
- Hazards: There are different types of road hazards that may be encountered on roadsides such as trees, utility poles, culvert end-walls, embankments, open drains, bodies of water and kerbs. The proposal would remove roadside hazards or position hazards such as utility poles behind the verge where it is less likely to be struck
- Safety barriers: Safety barriers are proposed along Elizabeth Drive within the construction footprint, in locations where roadside hazards cannot be made safe, removed or relocated.

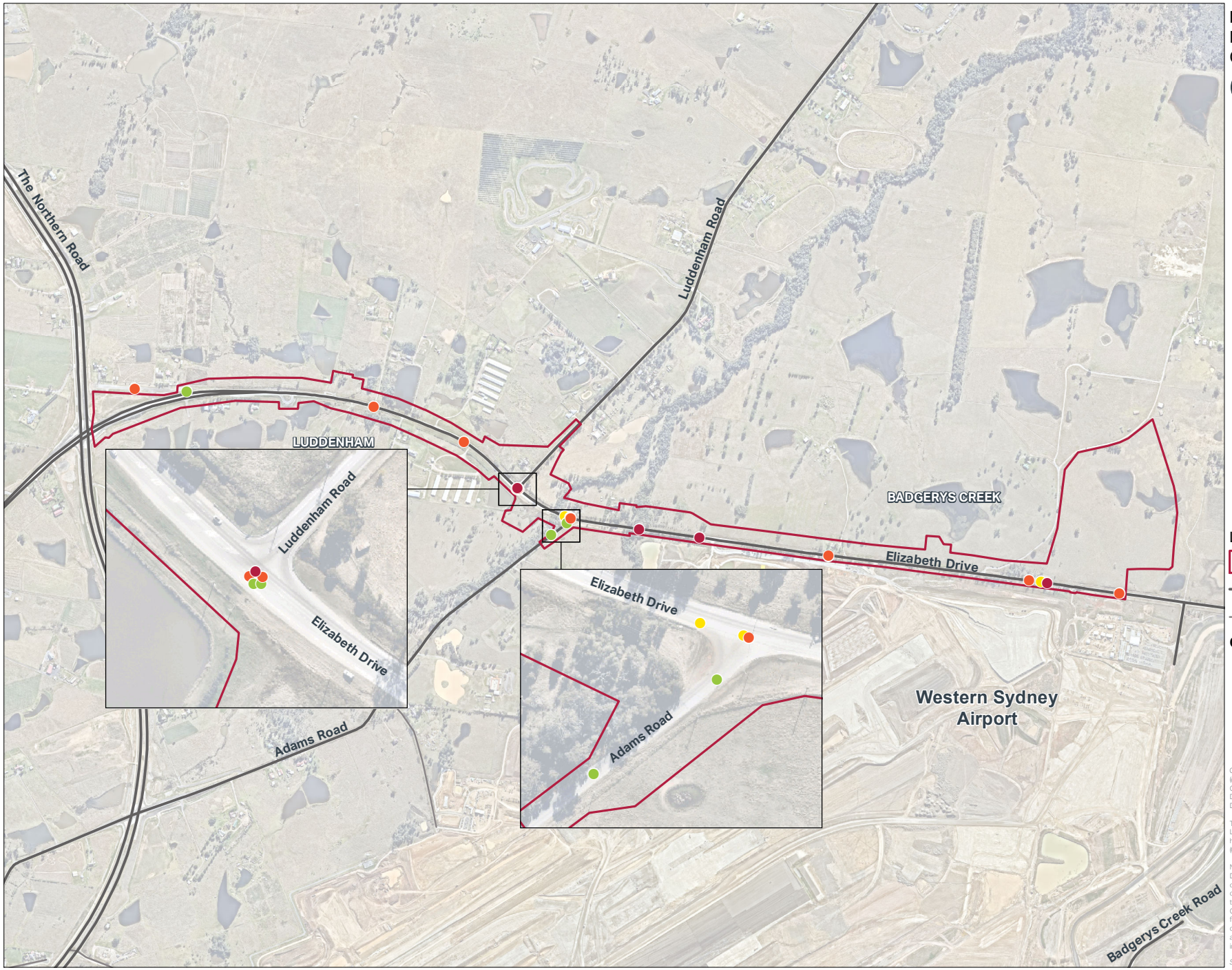


FIGURE 2-1:
LOCATION AND SEVERITY OF CRASHES (2016 TO 2020)

2.1.4 Future traffic volumes and capacity requirements

WSA and the transformational nature of development in the Aerotropolis precinct would place significant pressure on the local and wider road network.

Traffic modelling carried out for the M12 Motorway Environmental Impact Statement (Transport for NSW, 2020a) shows that in the absence of an upgrade to Elizabeth Drive, the average network speed deteriorates significantly and travel time for light vehicles more than doubles from 2026 to 2036. This level of deterioration is indicative of high growth in traffic demand and development of congestion as road capacity is saturated.

The M12 Motorway would provide east-west access to the WSA and would connect to Sydney's Motorway network. However, while the M12 Motorway is anticipated to provide an additional travel option to Elizabeth Drive, traffic volumes on Elizabeth Drive are still anticipated to exceed capacity (discussed in Section 2.1.2). This is due to the scale of planned development around Elizabeth Drive, with existing rural agricultural land anticipated to be replaced by intensive industrial and business developments.

The proposal would support future planned growth and address potential future capacity constraints on the surrounding road network. Specifically, the proposal would increase the capacity of Elizabeth Drive by providing additional traffic lanes, upgrading the intersections at Luddenham Road and Adams Road, and limiting access from properties on Elizabeth Drive to left in / left out (ie precluding right turns through the introduction of the central median).

In combination with The Northern Road and the M12 Motorway, the proposal would provide critical infrastructure to support the planned economic centre in Western Sydney, facilitating a job hub across aerospace and defence, manufacturing, healthcare, freight and logistics, agribusiness, education and research industries as envisaged in the Western Sydney Aerotropolis Plan (Western Sydney Planning Partnership, 2020).

2.1.5 Strategic planning and policy framework

This section describes the compatibility of the proposal with strategic planning policy documents.

Future Transport Strategy: Our vision for Transport in NSW

The Future Transport Strategy: Our vision for transport in NSW (Transport for NSW, 2022) sets the strategic direction for Transport to achieve world-leading mobility for customers, communities and businesses. It provides the framework that informs network plans, service plans and policy decisions to achieve the following three outcomes:

- Connecting our customer's whole lives
- Successful places for communities
- Enabling economic activity.

The proposal would support a number of these strategic directions under each outcome, including:

- Connecting our customer's whole lives: the proposal would
  - Improve east-west connectivity and play an important role in connecting people and freight between the nearest strategic centres in Western Sydney and the wider Sydney Region
  - Provide a shared walking and cycling path, bus priority features, as well as urban design measures to improve amenity
  - Improve active transport and enable faster commutes to employment to support a healthy lifestyle
  - Include new bus bays along Elizabeth Drive that are compliant with accessibility requirements
- Successful places for communities:
  - Provision for improved public transport infrastructure
  - Improve road safety along Elizabeth Drive for all road users
  - Avoid and minimise environmental impacts where possible, as outlined in this REF
- Enabling economic activity:
  - Increase the capacity of Elizabeth Drive to support the nearby developments and planned economic growth within the area, including improvement of freight travel times

- Optimise existing infrastructure by upgrading the current Elizabeth Drive road corridor
- Improve connectivity with the wider Sydney region, supporting visitor access across NSW.

State Infrastructure Strategy 2018 – 2038: Building Momentum

The State Infrastructure Strategy 2018 – 2038: Building Momentum (Infrastructure NSW, 2018) (the strategy) is a 20-year infrastructure plan for the NSW Government. The strategy assesses the infrastructure problems faced by the state and investigates solutions. Using the outcomes of these assessments, it provides recommendations to best grow the State's economy, enhance productivity and improve living standards for the NSW community.

The strategy highlights six strategic directions, which along with associated recommendations provide the framework within which the proposal has been developed:

- Integrating land use and infrastructure planning
- Infrastructure planning, prioritisation and delivery
- Asset management – assurance and utilisation
- Resilience
- Digital connectivity and technology
- Innovative service delivery models.

The strategy recognises that different regions of NSW face different opportunities and needs, and sets geographic directions for infrastructure planning, investment and policy. In the Greater Sydney and outer metropolitan area, it identifies the Western Parkland City (as identified in The Greater Sydney Region Plan – A Metropolis of Three Cities described below) as a key economic district, realising the growth potential of the WSA and Aerotropolis. The infrastructure response identified for the Western Parkland City includes the following priorities which would be supported by the proposal:

- Prioritise intercity road connections to support access from all directions
- Prioritise sustainable transport connections, particularly walking and cycling infrastructure within the city
- Deliver a freight network to support a growing city, and the next tranche of container imports into Sydney.

The strategy also highlights the need to ensure that the transport sector can cater for the growing needs of Greater Sydney. The recommendations in the strategy were guided by the Future Transport 2056 (Transport for NSW, 2020) and The Greater Sydney Region Plan (Greater Sydney Commission, 2018) discussed below. The proposal would support several of these recommendations, including:

- Integrate transport with land use
  - Investment in infrastructure that provides high frequency and high volume access and connectivity between the three cities, while enhancing local amenity
  - Support regional hubs by enhancing the connectivity via north-south and east-west links
- Unlock capacity in existing assets
  - Remove network bottlenecks and upgrade operational infrastructure
- Improve regional and metropolitan freight productivity.

The strategy recognises the need for an improved road network with enhanced east-west connections to the surrounding road network, facilitating better access to growth centres and employment areas. The proposal would support this by providing critical infrastructure to facilitate the growing needs of Greater Sydney, and its east-west connections.

NSW Freight and Ports Plan 2018-2023

The NSW Freight and Ports Plan 2018-2023 (Transport, 2018a) is a supporting plan to the Future Transport Strategy 2056. It provides industry with the continuity and certainty it needs to make long-term investments benefiting businesses and the wider State. The plan identifies five key objectives and associated goals to be met by 2023 and includes over 70 initiatives to achieve these. The proposal would support the following objectives and related goals:

- Objective 3 – Capacity:
  - Goal 2: Deliver new infrastructure to increase road freight capacity and improve safety
- Objective 4 – Safety:
  - Goal 1: Safer networks, transport, speeds, and people.

- The proposal would support these goals by providing an additional travel lane in each direction on a section of Elizabeth Drive projected to experience increased traffic over time, thereby increasing its capacity. The proposal would also assist the safe and efficient freight movements along a freight route which provides for 25-26 metre B-double heavy vehicles.

Active Transport Strategy

This Active Transport Strategy (Transport for NSW, 2022a) draws on the Future Transport Strategy and its vision for walking, bike riding and personal mobility. The strategy provides a plan to guide planning, investment and priority actions for active transport across NSW. To deliver upon the vision to double active transport trips in NSW in 20 years, the Active Transport Strategy focuses on five areas:

- Enable 15-minute neighbourhoods
- Deliver continuous and connected cycling networks
- Provide safer and better precincts and main streets
- Promote walking and cycling and encourage behaviour change
- Support our partners and accelerate change.

The proposal would directly support the focus area of delivering continuous and connected cycling networks. The proposal would provide a new shared walking and cycling path to allow for bi-directional movements between cyclists and pedestrians along Elizabeth Drive on both sides. This new shared walking and cycling path would connect with the M12 Motorway's shared path at the western extent of the proposal. Treatments at intersections with Elizabeth Drive upgraded by the proposal may also include connections to the shared walking and cycling paths.

The Greater Sydney Region Plan – A Metropolis of Three Cities

The Greater Sydney Region Plan – A Metropolis of Three Cities (Greater Sydney Commission, 2018) sets out a vision for three, integrated and connected cities. The three cities identified are the Western Parkland City, the Central River City and the Eastern Harbour City, each with supporting metropolitan and strategic centres, which would enable workers to locate closer to knowledge-intensive jobs, city-scale infrastructure and services, entertainment and cultural facilities.

As described in the plan, the population of Greater Sydney is projected to grow to eight million people by 2058, with almost half of that population residing west of Parramatta. Re-balancing economic and social opportunities across Greater Sydney would leverage that growth and deliver the benefits more equally and equitably.

The proposal would be located within the Western Parkland City, which is planned to include expansive industrial and urban services to the north and east of the WSA and, coupled with planned neighbourhoods, would result in significant population growth and employment opportunities in this area.

The proposal aligns with several directions and associated objectives described in the plan, including:

- 'A city supported by infrastructure', which includes:
  - Objective 1: Infrastructure supports the three cities: The objective recognises that connections to existing infrastructure in all of the three cities need to be improved, and that transport corridors and locations for new centres need to be safeguarded for future infrastructure investments. The proposal would support this objective by improving existing infrastructure and connection to the M12 Motorway, WSA and Western Sydney Aerotropolis.
  - Objective 2: Infrastructure aligns with forecast growth – growth infrastructure compact: The proposal would support this objective by providing increased capacity for the projected traffic volumes on Elizabeth Drive associated with growth in the surrounding area of the Western Parkland City.
  - Objective 3: Infrastructure adapts to meet future needs: Upgrading Elizabeth Drive would deliver enhanced capacity to meet the projected traffic needs. The proposal has also been designed so as not to preclude further adaptation in the future such as adding a third lane in each direction if required.
  - Objective 4 – Infrastructure use is optimised: The proposal would support this objective by upgrading the existing Elizabeth Drive to optimise its use as a key connecting road corridor in the area.
- 'A city for people', which includes:
  - Objective 6: Services and infrastructure meet communities' changing needs: The proposal would support the projected growth of the area and assist in providing a better connection to surrounding suburbs. The shared walking and cycling path with verge planting would enhance user experience and landscaping adapted to the local context would improve the urban design of the road corridor.

- 'A well-connected city', which includes:
  - Objective 15: The Eastern, Greater Paramatta and Olympic Peninsula, and Western Economic Corridors are better connected and more competitive: The proposal would provide a east-west transport link in the 'Western Economic corridor', and would connect to centres serviced by the future Sydney Metro Western Sydney Airport.
  - Objective 16: Freight and logistics network is competitive and efficient: The proposal would support this objective by improving the efficiency of Elizabeth Drive and its key intersections for freight and logistics.

By supporting these directions and objectives, the proposal would support the development of the Western Parkland City.

Western City District Plan

The Western City District Plan (Greater Sydney Commission, 2018a) (the plan) recognises planning priorities and actions for improving the quality of life for residents as the Western City District grows and changes. The plan is a guide for implementing the Greater Sydney Region Plan: A Metropolis of Three Cities, at a district level and is a bridge between regional and local planning. The Western City District covers the Blue Mountains, Camden, Campbelltown, Fairfield, Hawkesbury, Liverpool, Penrith and Wollondilly LGAs.

The 20-year plan aims to manage economic, social and environmental growth. The plan highlights Liverpool and Penrith as key areas of growth in the Western City District. It leverages the transformative and economic stimulus provided by the WSA and considers the transport, infrastructure, services, affordable housing, and open spaces that will be required as the population grows.

The vision for the Western Parkland City is one of a 30-minute city providing residents with more jobs and services within a 30-minute journey of where they live. Some 200,000 jobs are planned within the Aerotropolis and the Western City District Plan, meaning it is integral to achieving this vision. Furthermore, the Western Sydney Aerotropolis aims to enable a resilient 24-hour economy, with a transport network that supports the safe and efficient movement of people and goods.

To satisfy the commitment to providing jobs close to home, the Western City District Plan identifies the need to enhance and create east-west and north-south transport links, including Elizabeth Drive, which is identified as a major east-west transport link servicing the WSA and Aerotropolis and directly connecting them to Liverpool and Penrith city centres.

The proposal aligns with the following planning priorities described in the plan:

- W1 – Planning for a city supported by infrastructure:
  - The proposal would improve a key piece of road infrastructure aligned to projected future growth in the area and linking the road to other key transport corridors
- W7 – Establishing the land use and transport structure to deliver a liveable, productive, and sustainable Western Parkland City:
  - The proposal would improve a key east-west transport route, enhancing connectivity and access to major transport infrastructure, employment areas and services including The Northern Road, M12 Motorway, M7 Motorway, WSA and Western Sydney Aerotropolis
  - The proposal would improve a part of the freight and logistics network with access to the WSA
- W8 Leveraging industry opportunities from WSA and Wester Sydney Aerotropolis:
  - The proposal would support this planning priority by enhancing the transport connection to the WSA and Western Sydney Aerotropolis.

Greater Sydney Services and Infrastructure Plan

The Greater Sydney Services and Infrastructure Plan 2018 is a transport blueprint designed to facilitate the growth of Greater Sydney over the next 40 years.

The Greater Sydney Services and Infrastructure Plan supports the whole-of-government approach to Greater Sydney becoming a metropolis of three cities. The Greater Sydney Services and Infrastructure Plan aims for people to have access to jobs and services in their nearest metropolitan centre and strategic centre within 30-minutes by public transport, seven days a week.

There are two components to the 30-minute city concept within Greater Sydney:

- Connecting people in each city to their nearest metropolitan centre or cluster; Harbour CBD, Greater Parramatta, Airport-Aerotropolis, Greater Penrith, Liverpool and Campbelltown-Macarthur

- Connecting residents in each of the five districts to one of their Strategic Centres by public and active transport, giving people 30-minute access to local jobs, goods and services.

The 30-minute city aligns with the customer outcomes of Future Transport Strategy: Our vision for transport in NSW. To support the vision for Greater Sydney, the NSW Government has developed a vision for the transport system to enable people and goods to move around the city efficiently and reliably adhering to the 30-minute city concept through the use of three types of transport corridors:

- City-shaping corridors – major trunk road and rail public transport corridors providing higher speed and capacity linkages
- City-serving corridors – higher density corridors concentrated within about ten kilometres of metropolitan centres providing high frequency access with more frequent stopping patterns
- Centre-serving corridors – corridors that support local trips to connect people with their nearest centre and transport node.

The city-shaping corridor includes higher speed and volume linkages between metropolitan centres and metropolitan clusters / strategic centres. The corridor is expected to enable people living in any of the three cities to access their nearest metropolitan centre within 30-minutes and to be able to travel efficiently between the metropolitan centres.

As Greater Sydney transitions to a metropolis of three cities, the city-shaping corridor would expand to provide improved access to and between each metropolitan centre / metropolitan cluster, particularly Greater Parramatta and centres in the Western Parkland City. Figure 2-2 presents the Greater Sydney strategic transport corridors.

The proposal is aligned with the objectives of the Greater Sydney Services and Infrastructure Plan as it would connect people in the Western Parkland City to the nearest metropolitan centre in Liverpool. With the proposed upgrades, Elizabeth Drive would have the characteristics of a city-serving corridor and align with the 30-minute city concept.

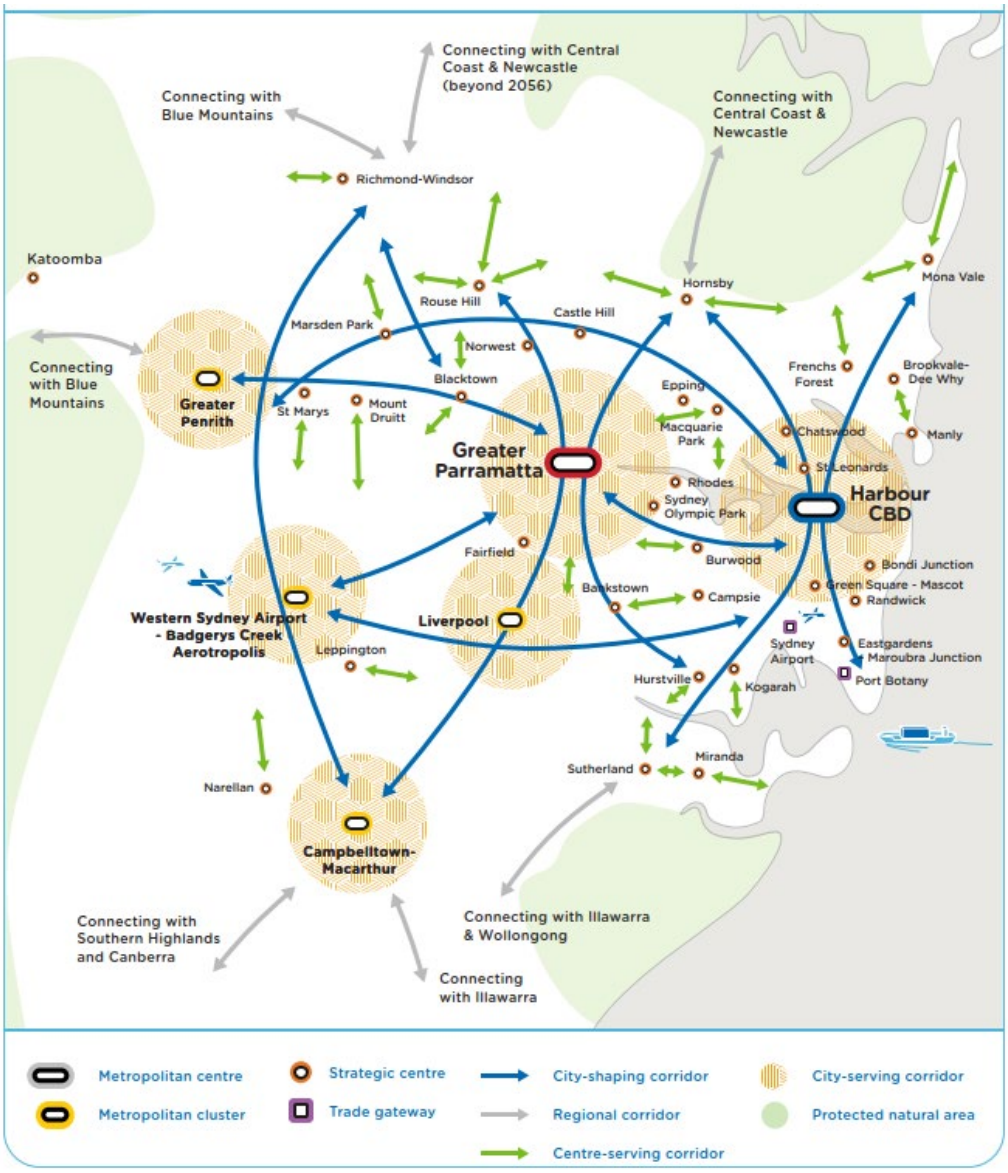


Figure 2-2 Greater Sydney strategic transport corridors (Source: Greater Sydney Services and Infrastructure Plan (2018))

Western Sydney City Deal – Smart Cities Plan

The Western Sydney City Deal – Smart Cities Plan (Western Sydney City Deal Delivery Office, 2018) (the City Deal) is a three-tiered government collaborative approach, setting a plan for investment for the Western Parkland City. The City Deal would build on the significant investment in WSA, which is a catalyst for economic activity within the region, creating jobs for the local community. The six key commitments that are provided in the City deal include:

- Connectivity
- Jobs for the future
- Skills and education
- Liveability and environment
- Planning and housing
- Implementation and governance.

The City Deal is enabled by the Future Transport Strategy 2056 and the Greater Sydney Region Plan which jointly define the future of Sydney, from both a land use and transport perspective, as a highly connected city of three cities.

With an increased investment in infrastructure, Western Sydney would become more connected to Greater Sydney. The proposal would provide a crucial piece of infrastructure allowing increased movement and connectivity to growth areas with employment lands.

Western Sydney Aerotropolis Plan

The Western Sydney Aerotropolis Plan (Western Sydney Planning Partnership, 2020) (the plan) is a planning framework for the Western Sydney Aerotropolis, which was previously known as the Western Sydney Airport Growth Area. The Western Sydney Aerotropolis would establish a new high-skill jobs hub for aerospace and defence, manufacturing, healthcare, freight and logistics, agribusiness, education and research industries all centred around the WSA. The plan defines how the Western Sydney Aerotropolis would be created, and how its precincts would integrate with growth areas and be consistent with the Greater Sydney Region Plan. The plan gives effect to four themes, 11 objectives and 50 principles. The relevant themes and objectives the proposal would support in this plan include:

- Theme – Productivity, Objective 1: an accessible and well-connected Western Sydney Aerotropolis
- Theme – Infrastructure and collaboration, Objective 7: Infrastructure that connects and services the Western Parkland City as it grows.

The Western Sydney Aerotropolis is located within the Liverpool and Penrith LGAs and would eventually contain ten precincts including the Aerotropolis Core, Agribusiness, Badgerys Creek, Dwyer Road, Kemps Creek, Mamre Road, North Luddenham, Northern Gateway, Rossmore and Wianamatta-South Creek.

The precincts would comprise a mix of land uses including employment and business, airport related industries, mixed use, residential/urban land use and significant open space corridors along the primary drainage corridors, notably South Creek.

Transport infrastructure within the Western Sydney Aerotropolis would be carefully staged to support land use as it develops while enabling efficient transport connectivity to and from WSA from 2026. No timeframe is put on the evolution of each stage, with the market to determine when each stage would be required.

However, six precincts have been identified in the Western Sydney Aerotropolis Plan which would be subject to accelerated planning through the precinct planning process. The Northern Gateway and Agribusiness precincts bordering Elizabeth Drive are expected to generate significant job opportunities, noting that job prospects in these precincts would attract people not only from the surrounding area but from Greater Sydney.

Elizabeth Drive also forms part of the planned road corridor upgrades (key network upgrade) and would provide supporting road access to the Northern Gateway and Agribusiness precincts playing a crucial role in connecting people travelling to the Western Sydney Aerotropolis and surrounding precincts. The Western Sydney Aerotropolis Plan also identifies Elizabeth Drive as a rapid bus corridor. The proposal aligns with the plan by providing bus jump-start facilities at each signalised intersection on both directions of Elizabeth Drive.

Land use zoning and other provisions relating to development in the Western Parkland City are governed by State Environmental Planning Policy (Precincts – Western Parkland City) 2021 (refer Section 4.1.1).

The proposal sits within the three kilometre wildlife buffer zone identified in the plan as an area where birds and other wildlife can impact aircraft, particularly during take-off and landing. Landscape species considered in the urban design vision for the proposal have been selected to manage the risk of wildlife strike with aircraft (refer to Appendix K (Urban Design, Landscape Character and Visual Impact Assessment)).

Western Sydney Aerotropolis Precinct Plan

The Western Sydney Aerotropolis Precinct Plan (DPE, 2023) (precinct plan) provides place-based objectives, performance criteria and structure planning for five precincts within the Western Sydney Aerotropolis as shown in Figure 2-3 including:

- Aerotropolis Core
- Badgerys Creek
- Wianamatta-South Creek
- Northern Gateway
- Agribusiness (excluding Luddenham Village).

Planning for the remaining precincts would be carried out at a later stage, and the provisions of other planning instruments continue to apply to those areas.

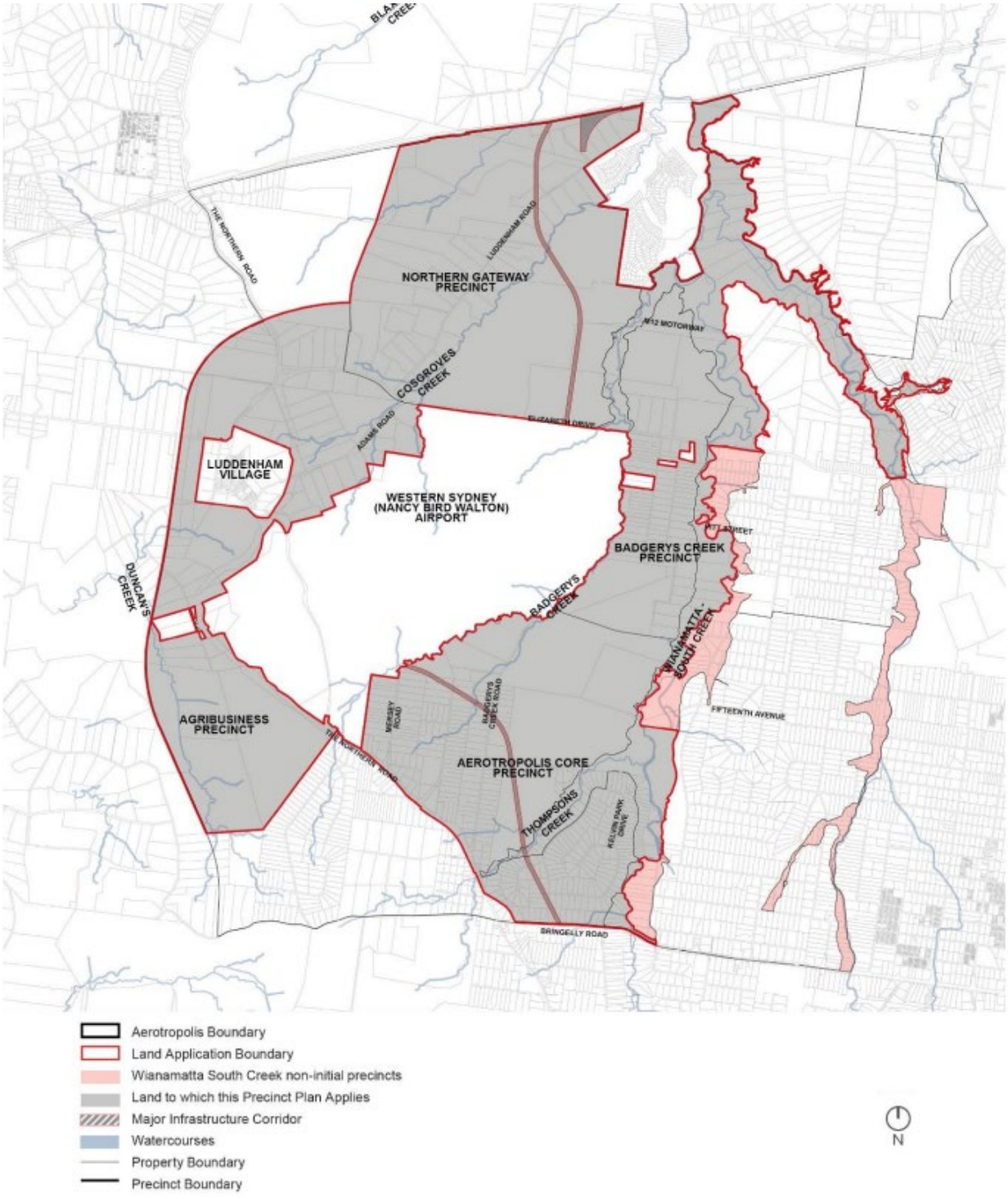


Figure 2-3 Western Sydney Aerotropolis precincts (Source: Western Sydney Aerotropolis Precinct Plan, 2022)

The precinct plan outlines a movement framework and related transport objectives for the development of the above five precincts. One of the objectives of the movement framework is to 'create a road network for private vehicles and freight which can provide efficient links and integration to the broader regional network while also supporting local accessibility in centres and between places.'

In this precinct plan, Elizabeth Drive is designated as a primary arterial road, with signalised intersections to other primary and sub-arterial roads that traverse each of the precincts. One of the requirements of the precinct plan is that the roads and streets are to be designed in accordance with the Western Sydney Street Design Guidelines (Western Sydney Planning Partnership, 2020). In the Western Sydney Street Design Guidelines arterial roads function as primary freight and through traffic routes, while also supporting future rapid bus routes at key locations. Arterial roads are generally two to three lanes in each direction.

The Northern Gateway and Agribusiness precincts both adjoin the proposal with direct access from the road to both precincts. Elizabeth Drive would provide indirect access to the other three precincts.

The vision and objectives for each precinct are discussed below.

Northern Gateway Precinct

The Northern Gateway Precinct would be a major interface for the WSA and a specialised centre linking the Airport with the metropolitan cluster. It would be an employment precinct that can be easily accessed, with supporting residential areas where land is not severely affected by aircraft noise. It would provide skilled employment and business opportunities north of the Airport in areas such as freight and logistics, warehousing, technology, commercial enterprise, offices, industry, creative industry, fresh food markets, education, civic, health, visitor accommodation, recreation and entertainment. The Precinct would have synergies with the adjacent WSA Business Park, south of Elizabeth Drive. Access to the precinct from the wider region and medium and higher density residential areas located close to Luddenham Metro Station, would be via Luddenham Road, Elizabeth Drive and the Agribusiness Precinct.

The precinct objective of relevance to the proposal (Objective 02) relates to facilitating 'the development of a high technology employment precinct'.

Agribusiness Precinct

The Agribusiness Precinct offers key access to WSA, allowing the development of agribusiness uses with ready access to export markets and employment opportunities in innovative industries and services. The location of the precinct enables rapid distribution connections to the broader road freight supply chain in Greater Sydney. The Precinct would also provide opportunities for education and tourism.

The precinct objective of relevance to the proposal (Objective 01) relates to enabling 'fresh and value-added food production with access to local and global markets, and support Australia's value-added agribusiness export industries'. The proposal would enable transport of goods to and from the precinct.

Infrastructure and Development Staging

Within each precinct, areas are categorised or sequenced into first, second and third priority areas. The first priority areas align with the first stages of transport and utilities infrastructure delivery and are intended to be the initial stages of development, working towards achieving the employment and population targets of the Western Sydney Aerotropolis Precinct Plan.

Objective DS03 seeks to align the sequencing of development within the Western Sydney Aerotropolis with the following criteria of relevance to the proposal: proximity to, and the timing of delivery of the M12 Motorway, The Northern Road and the proposal; access to the WSA for freight and passengers; and job creation potential and demand for land for new development.

The Northern Gateway Precinct bordering Elizabeth Drive to the north and sections of the Agribusiness Precinct along the western extent of Elizabeth Drive are identified as first priority areas for development, as they align with the first stages of transport and utilities infrastructure delivery (refer to Figure 2-4).

Objective MF03 seeks to provide 'efficient links and integration to the broader regional network while also supporting local accessibility in centres and between places,' while Objective MF06 requires the network to contribute to the achievement of modal split targets for active transport, public transport and private vehicle by 2026, 2036 and 2056.

Further discussion of the transport network and modes of transport is in Section 6.2.

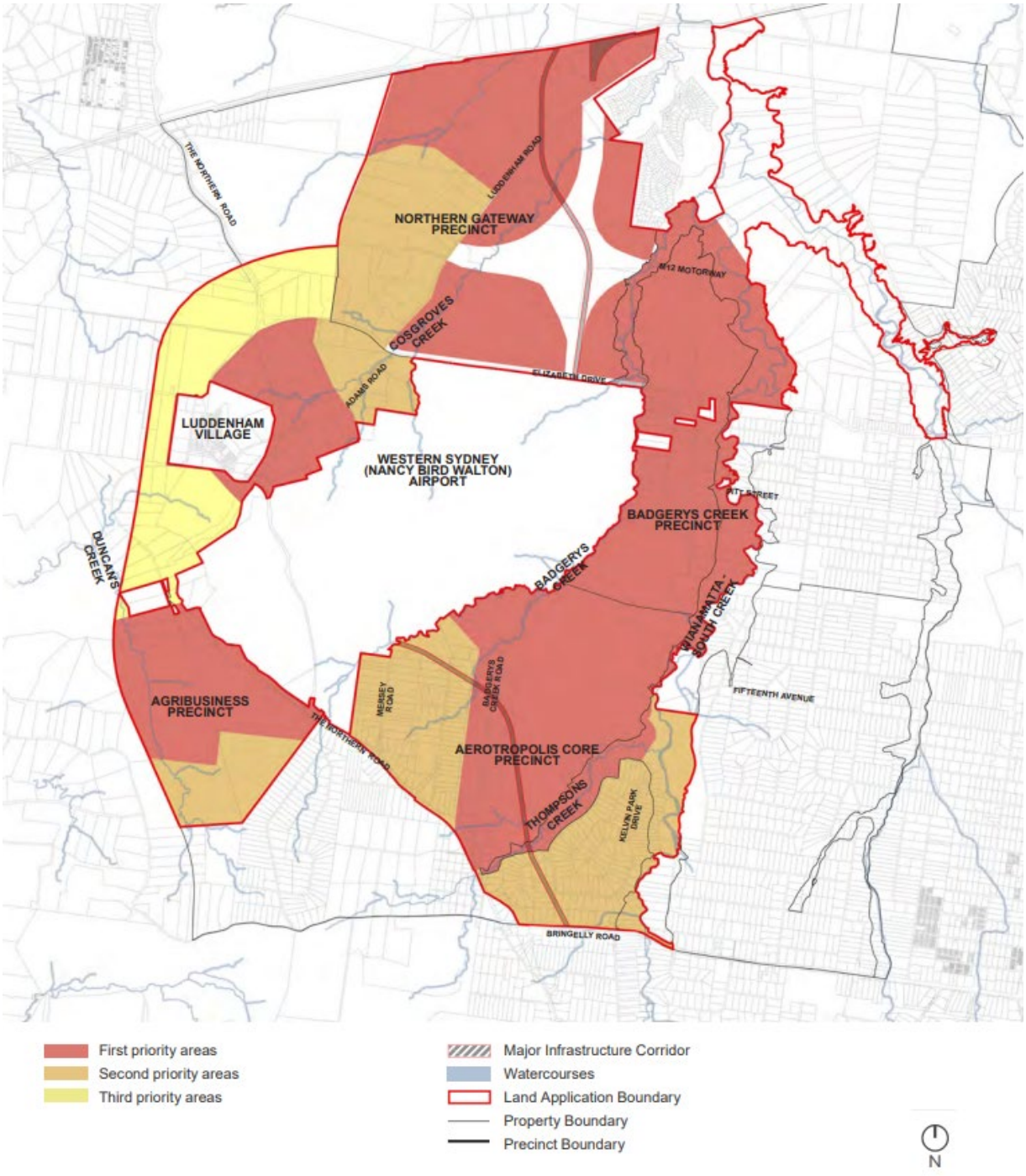


Figure 2-4 Western Sydney Aerotropolis development sequencing (Source, Western Sydney Aerotropolis Precinct Plan)

The five initial Western Sydney Aerotropolis precincts comprise about 6,600 hectares (or 59 per cent) of the overall Aerotropolis land area of about 11,200 hectares.

Together, the five initial Western Sydney Aerotropolis precincts are projected to accommodate about 102,000 new jobs and about 34,000 new residents by 2056. This equates to a job density of 16 jobs per hectare and a population density of five residents per hectare.

These projections indicate the five initial Western Sydney Aerotropolis precincts would have a job to resident ratio of 3:1, meaning the dominant task is to transport people into the five initial Western Sydney Aerotropolis precincts from across Greater Sydney. The Northern Gateway precinct would also house about 10,000 residents placing further demands on the surrounding road network.

Table 2-3 outlines the future employment and population projections for the five initial Western Sydney Aerotropolis precincts.

Table 2-3 Future employment and population projections for the five initial precincts (Source: Western Sydney Aerotropolis Transport Planning and Modelling, AECOM 2021)

Precinct	Area (hectares)	Jobs	Job density (jobs per hectare)	Residents	Population density (residents per hectare)
Aerotropolis Core	1,382	60,000	43	24,000	17
Northern Gateway	1,616	21,000	13	10,000	6
Agribusiness	1,572	10,000	16	Minimal	0
Badgerys Creek	612	11,000	18	No additional	0
Wianamatta – South Creek	1,392	0	0	0	0
Total	6,574	102,000	-	34,000	-

The Draft Economic Development Roadmap – Phase 1 and The Western Parkland Blueprint

The Western Parkland City Authority is tasked with guiding growth and investment for the Western Parkland City. The *Draft Economic Development Roadmap – Phase 1* (Western Parkland City Authority, 2021b) (the roadmap) provides an overarching strategy for delivery of economic growth opportunities for the Parkland City. It outlines three directions for the Western Parkland City to optimise opportunities for economic growth and development, each with a set of priorities: foster innovation and build global competitiveness; leverage city strengths; and develop 22nd century workforce skills.

The *Western Parkland Blueprint* (Western Parkland City Authority, 2021a) (the Blueprint) has been prepared in conjunction with the roadmap. It identifies a series of directions to achieve the vison for the Parkland City (a green, connected and advanced Parkland City), first established in the *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018).

Given that the Western Parkland City would account for a quarter of NSW population growth by 2036, the extent of change in the intervening period necessitates clear directions and critical priorities to steer and manage growth articulated in the Blueprint.

One such direction is to 'deliver a connected city' – a 30-minute city where residents live close to jobs, services and amenities.

In delivering the vision of a connected city, connectivity directions relate to improved transport links, delivery of active transport connections and the expansion of freight networks to allow for the more efficient movement of goods within the city. A critical priority is to prepare a Western Parkland City structure plan increasing north-south and east-west links across the city (C1 Priority). Another critical priority is to deliver road activation packages in the Western Sydney Aerotropolis, South West, greater Macarthur and Wilton growth areas and support delivery of rapid, frequent and local bus connections (C7 priority). To do this, key connections and upgrades are required to support the movement of people and goods, increase accessibility and improve network safety across the Western Parkland City. Critical roads (funded and unfunded) identified include Elizabeth Drive.

Maintaining and enhancing transport linkages and services across the Western Parkland City is critical to leveraging its existing advantages and also achieving its aspiration to be a 30-minute city with increased access to public transport. The upgrade of Elizabeth Drive has been identified in the Blueprint as a key intra-city transport node in the Western Sydney Aerotropolis and nearby growth areas enabling enhanced public transport linkages to the WSA and Western Sydney Aerotropolis.

The development of WSA within the Western Parkland City would allow for new economic opportunities by improving supply chains for export orientated business including agribusiness and increasing regional spend in the tourism sector. Specifically, the advanced city A12 critical priority refers to 'targeting transport infrastructure to support and expand global and national trade gateways' acknowledging the potential for the freight and logistics sector to take advantage of WSA and support export-oriented businesses and growth in e-retail and imports. This relies on investment in transport infrastructure in the local and wider area including Elizabeth Drive.

Western Sydney Airport – Airport Plan

The *Western Sydney Airport – Airport Plan* (Commonwealth of Australia, 2021) sets out the plan for development and operation of the WSA. The plan outlines the concept design for WSA and the details of the specific airport-related developments authorised by the plan, including conditions for these developments. This plan is primarily concerned with the Stage 1 Development of WSA, which is intended to establish the WSA with a single 3,700 metre runway located in the north-western portion of the airport site, a terminal and other support facilities.

The WSA will be a major catalyst for investment, jobs and growth in Western Sydney. The WSA is bounded by Elizabeth Drive to the north and The Northern Road to the west. With a world class airport being constructed, it is necessary that adjacent roads are upgraded to address the demands the WSA would have on local infrastructure.

National Road Safety Strategy 2021-2030

The *National Road Safety Strategy 2021-2030* (Commonwealth of Australia, 2021) identifies initiatives to improve the safety of Australia's roads targeting a reduction in the annual number of road crash fatalities and serious road crash injuries by at least 50 per cent by the end of 2030. The proposal would provide the opportunity to reduce crashes, as it would increase capacity for traffic through additional lanes, introduce a central median, a signalised intersection, and walking and cycling facilities including a shared path. By improving road safety, the proposal would directly support the aims of this strategy.

2026 Road Safety Action Plan

The *2026 Road Safety Action Plan: Toward zero trauma on NSW roads* (Transport for NSW, 2022) sets the direction for road safety in NSW. The NSW Government has set a vision to achieve zero fatalities and serious injuries by 2050. Targets have also been established to halve fatalities on NSW roads, and reduce serious injuries by 30 per cent, by 2030.

The proposal supports the priorities set out in this plan as it would provide a better standard of road and road safety improvements. These include:

- Separation of carriageways through the provision of a central median
- Widening and sealing road shoulders
- Providing a new road surface
- Formalising walking and cycling facilities
- Provision of a new signalised intersection of Elizabeth Drive and Luddenham Road.

Sydney's Green Grid

As part of the Greater Sydney Region and District Plans, the Sydney Green Grid (Office of the Government Architect, 2017) provides a spatial framework to underpin Greener Places, the draft green infrastructure policy (Office of the Government Architect, 2017). The Sydney Green Grid proposes the creation and consolidation of a 'network of high quality green areas that connect town centres, public transport networks and major residential areas,' enhancing open space throughout Greater Sydney.

Elizabeth Drive has been identified as a potential focus area as it is an important cross connection into surrounding neighbourhoods and adjacent to Green Grid project opportunities, in particular South Creek and Ropes Creek.

2.1.6 Local government policy context

Connected Liverpool 2040

Connected Liverpool 2040 (Liverpool City Council, 2020) is Liverpool City Council's Local Strategic Planning Statement (LSPS), which includes a 20-year strategic planning vision to shape Liverpool's future, guiding the development of public transport, active transport, housing, jobs and services as well as parks, open spaces and the natural environment. The strategy would be supported by the proposal, which would include active transport facilities and support the road connections in the area.

Liverpool City Council Community Strategic Plan 2022-2032

Liverpool City Council's Community Strategic Plan 2022-2032 (Liverpool City Council, 2022) is a ten-year plan that identifies the community's long-term vision, aspirations and main priorities for its LGA. The plan has four strategic directions which focus on social (healthy, inclusive, engaging), environmental (liveable, sustainable, resilient), economic (evolving, prosperous, innovative) and civic leadership (visionary, leading, responsible) outcomes. The plan also recognises that forecast growth in the Liverpool LGA is set to put pressure on already congested roads and ageing transport connections.

Through the delivery of an upgraded Elizabeth Drive to support the growth of the region, and new shared walking and cycling paths, the proposal would support several of the strategies identified in the plan, including:

- Environmental: promote and advocate for an integrated transport network with improved transport options and connectivity
- Economic: continue to invest in improving and maintaining Liverpool's road networks and infrastructure.

Penrith Local Strategic Planning Statement: Planning for a Brighter Future

Penrith City Council's LSPS – *Planning for a Brighter Future* (Penrith City Council, 2020) sets out the 20-year vision for land use in Penrith LGA. The planning statement recognises the special characteristics which contribute to Penrith's local identity and how growth and change will be managed in the future. There are 21 planning priorities outlined in this plan. The proposal aligns with the following planning priorities in particular:

- Planning Priority 1: Align development, growth and infrastructure
- Planning Priority 10: Provide a safe, connected and efficient local network supported by frequent public transport options
- Planning Priority 11: Support the planning of the Western Sydney Aerotropolis.

Penrith City Strategy

The *Penrith City Strategy* (Penrith City Council, 2013) addresses the long-term issues facing the Penrith LGA and provides directions for the LGA's future, incorporating a range of planning strategies and action plans. The strategy addresses seven themes including housing, jobs and economy, transport and access, infrastructure delivery, community well-being and the environment and places.

The proposal supports the transport and access goals set in this plan including:

- An efficient and integrated public transport network that links the city and the region
- An integrated shared pathway network that links the city
- Cycling and walking are readily available transport choices
- A better integrated, well-connected and more sustainable road network in the city and the region
- Improved road network efficiency and safety.

Penrith 2036+

Penrith 2036+ (Penrith City Council, 2017) (the plan) is Penrith City Council's community strategic plan, which outlines the community's vision, aspirations and values. The plan identifies a vision for a regional city that is inclusive and prosperous and offers the best in urban living and a sustainable rural environment. Five community outcomes are identified in this plan.

The proposal would support Outcome 4 'we manage and improve our built environment', and its associated strategy to 'plan and manage sustainable transport infrastructure and networks to meet current and future community needs.' The proposal would support this community outcome, as an upgraded Elizabeth Drive would support the growth of the region, and new shared walking and cycling paths which would satisfy the community need for sustainable transport infrastructure.

Penrith Green Grid Strategy

The *Penrith Green Grid Strategy* (Penrith City Council, 2021) outlines a plan to support the creation of cool and green neighbourhoods across Penrith and encourage walking and cycling by connecting schools, public transport and town centres with green infrastructure such as green spaces, parks, waterways and bushland. The strategy identifies Green Grid Project opportunities within the Penrith LGA including locations intersecting with Elizabeth Drive. The intersecting locations include The Northern Road, Cosgroves Creek and Badgerys Creek near the proposal. The proposal aligns with this strategy as it would provide dedicated walking and cycling facilities which could connect to Green Grid Project opportunity locations.

2.2 Limitations of existing infrastructure

Elizabeth Drive in the construction footprint is the main east-west road connection in the area, travelling through suburbs of Luddenham and Badgerys Creek within the Penrith and Liverpool LGAs. The existing road configuration is a two-lane road (one lane in each direction) which suffers from congestion during peak times (discussed further in Section 6.2).

Table 2-4 describes the existing road design and infrastructure on Elizabeth Drive within the construction footprint.

Table 2-4 Existing road design and infrastructure on Elizabeth Drive within the construction footprint

Existing road design / infrastructure	Elizabeth Drive within construction footprint
Connections	Elizabeth Drive is a state road which forms part of a major east-west route between The Northern Road and the M7 Motorway. Elizabeth Drive ties in to an intersection with The Northern Road, a state road, via a signalised intersection. There are no other connections to state roads within the construction footprint. Local and regional road connections within the construction footprint include the following (all unsignalised): • Luddenham Road – unsignalised • Adams Road – unsignalised
Culvert at Cosgrove Creek	One lane in each direction crossing Cosgroves Creek
Road configuration	One lane in each direction, with no median
Posted speed limit	80 kilometres per hour
Traffic volumes	• Eastbound: Average of 4,700 vehicles per day • Westbound: Average of 4,700 vehicles per day
Dedicated pedestrian facilities	None
Dedicated cyclist facilities	None
Parking	There are no existing designated parking facilities along Elizabeth Drive and parking is prohibited in wider sealed shoulders in a number of locations
Public transport facilities	None

2.3 Proposal objectives and development criteria

The objectives and development criteria relevant to the proposal are described below.

2.3.1 Proposal objectives

The objectives of the proposal are as follows:

- Provide a defined road corridor adequate to accommodate future growth and maintenance needs
- Maintain primary function of a movement corridor east-west
- Support key north-south routes (eg The Northern Road, M12 Motorway and future road network connections in the Western Sydney Aerotropolis area)
- Improve road safety for all road users
- Provide active transport, bus priority and vehicle access to assist in key connections to:
  - WSA, business and technology park
  - Western Sydney Aerotropolis
  - Centres identified in the Western Parkland City and Western Sydney Parklands
- Provide an efficient, resilient freight network
- Contribute to the desired future character and connectivity of the Western Parkland City and Western Sydney Parklands.

The proposal would contribute to these objectives as part of the overall program of work.

2.3.2 Urban design objectives

The urban design objectives for the proposal are largely derived from the nine urban design principles in Urban Design Policy – Beyond the Pavement (Transport for NSW, 2020) and are outlined below. In addition, Objective 10 of the Western Sydney Aerotropolis Precinct Plan is incorporated into the proposal objectives, relevant to the proposal's provision of a new shared cyclist and pedestrian pathway. This plan has been discussed earlier in Section 2.1.5.

Urban design objectives for the proposal include:

- To develop and present an integrated engineering and urban design outcome that:
  - Fits sensitively into the built, natural and community environments through which it passes, is well designed and contributes to the character and functioning of the area
  - Contributes to the accessibility and connectivity of people within regions and communities
  - Contributes to the overall quality of the public domain for the community and all road users.
- To carry out a succinct landscape character and visual impact assessment, the results of which are iteratively fed into the concept development process and environmental assessment (refer Section 6.8)
- To provide landscaped, safe, activated, interesting and healthy streets that prioritise pedestrian, cycle and public transport movements.

2.3.3 Sustainability objectives

The Transport Sustainability Plan 2021 (Transport for NSW, 2021) (the sustainability plan) outlines the agency's vision for sustainability – that every journey is people and planet positive. To achieve this vision, Transport has identified eight focus areas, which address the most important sustainability aspects associated with Transport's activities. Each sustainability focus area is supported by sustainability goals, which are aligned with the United Nations Sustainable Development Goals as part of best practice sustainability approaches.

The proposal would be developed and delivered in accordance with the sustainability plan by aligning with the sustainability focus areas and sustainability goals listed in Table 2-5.

Table 2-5 Transport's sustainability focus areas and goals

Sustainability focus area	Sustainability goals
Respond to climate change	• Net zero emissions by 2050 • Consider climate change risks in all decisions
Protect and enhance biodiversity	• No net loss of biodiversity
Improve environmental outcomes	• Develop a circular economy for transport by designing waste and pollution out and keeping products and materials in use • Reduce environmental impacts of projects and operations
Procure responsibility	• All suppliers meet the standards in the Transport Supplier Sustainability Charter • Social and environmental outcomes included in all procurement decisions • Go beyond minimum compliance targets in Transport's Aboriginal Procurement Policy
Partner with communities	• Always leave a positive legacy for communities as a result of projects • Uphold, apply and report on community engagement

Sustainability focus area	Sustainability goals
Respect heritage and culture	• Aboriginal culture is integrated and preserved • Acknowledging and incorporating culture through stories, examples, and best practice
Align spend and impact	• All decisions consider value created from sustainability alongside financial analysis • Reduce whole of life costs for the transport network
Empower customers to make sustainable choices	• Use customer journeys to inform, engage and inspire more sustainable practices and demonstrate Transport's progress

2.3.4 Development criteria

The development criteria for the broader Elizabeth Drive program of work include:

- Provide additional traffic capacity along Elizabeth Drive within the construction footprint, and improve intersection and network performance
- Minimise constructability issues
- Minimise impacts on utilities
- Minimise land use and community impacts
- Minimise environmental impact.

The development criteria guided the development of the proposal design, along with the specific design criteria which are provided in Section 3.2.1.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of alternatives

Transport carried out investigations into options to upgrade Elizabeth Drive, to support the Western Parkland City, and improve access to the WSA and Western Sydney Aerotropolis. A 'do nothing' option was also considered, to identify potential consequences of not proceeding with the upgrade.

As part of early planning, this also included the preparation of an access strategy, which outlined how motorists and road users would be able to move around and travel on an upgraded Elizabeth Drive. This access strategy was displayed at a community consultation session, carried out on Wednesday 19 and Saturday of 22 June 2019 at Kemps Creek Public School. Feedback received from the community during this session was considered, and used to refine and prepare the strategic design and environmental assessment of the proposal (refer further to Section 5.3.1).

2.4.2 Alternatives considered

Two alternatives were considered in response to the strategic need for the proposal (described in Section 2.1):

- Alternative One: 'Do-nothing' – This would involve Elizabeth Drive continuing in its current state, with no upgrade
- Alternative Two: Upgrade the existing Elizabeth Drive – This would involve proceeding with upgrading Elizabeth Drive.

2.4.3 Analysis of Alternative One: Do nothing

The 'do nothing' alternative would involve Elizabeth Drive continuing to function in its current state, and not proceeding with upgrading Elizabeth Drive. There would be no improvement of traffic flow, travel times and safety along Elizabeth Drive. This alternative would not meet any of the proposal objectives as summarised in Table 2-6.

There are some advantages of the 'do nothing' option, including no costs incurred or funding required and there would be no construction traffic disruption or noise impacts. Considering the anticipated land use, development and population growth associated with growth of the Western Sydney Aerotropolis precincts and wider Western Parkland City, the existing road

capacity and design would be inadequate to service future traffic demand. If the existing road infrastructure is not upgraded, it is likely the existing Elizabeth Drive would not have the capacity to accommodate future traffic growth.

Table 2-6 Performance of Alternative One against proposal objectives

Proposal objectives	Meets objective
Provide a defined road corridor adequate to accommodate future growth	Elizabeth Drive currently experiences frequent congestion during peak times (refer to Section 2.1.2). Traffic modelling shows that Elizabeth Drive would operate at its maximum capacity by 2030. As such, Elizabeth Drive would not have sufficient capacity to support future growth
Maintain primary function of a movement corridor east-west	Elizabeth Drive in its current form would not provide a suitable east-west movement corridor nor would it support key north-south routes. The WSA and proposed development across the Western Sydney Aerotropolis, are expected to generate significant traffic volumes and place pressure on the local road network. Elizabeth Drive would not connect with the M12 Motorway, and would thus limit access to the WSA and Western Sydney Aerotropolis. It would, therefore, not provide key linkages to other precincts within the Western Parkland City or adequate connectivity to the Western Sydney Parklands
Support key north-south routes (eg The Northern Road, M12 Motorway and future road network connections in the Aerotropolis area)	
Contribute to the desired future character and connectivity of the Western Parkland City and Western Sydney Parklands	
Improve road safety for all road users	With the projected increase in future traffic demands, and without improving the existing conditions, the potential for vehicle crashes is likely to increase, and there are no safe facilities for walking and cycling along the existing corridor
Provide active transport, bus priority and vehicle access to assist in key connections to: • WSA, business and technology park • Western Sydney Aerotropolis • Centres identified in the Western Parkland City and Western Sydney Parklands.	There are limited dedicated walking, cycling and bus facilities along Elizabeth Drive. Shoulders and verges are the only available means for pedestrians to travel along Elizabeth Drive exposing them to live traffic
Provide an efficient, resilient freight network	An efficient and resilient freight network would not be achieved as Elizabeth Drive in its current state, would not provide sufficient future road network capacity to support the movement of freight, which is required to support the future development of the region

2.4.4 Analysis of Alternative Two: Upgrade the existing Elizabeth Drive (the proposal)

Alternative Two would involve upgrading the existing Elizabeth Drive from The Northern Road at Luddenham to near Badgerys Creek Road at Badgerys Creek. Upgrading the existing Elizabeth Drive would support the NSW Government strategies as outlined in Section 2.1.5.

The Elizabeth Drive Upgrade would meet the proposal objectives outlined in Table 2-7 and substantially improve traffic efficiency and safety. Elizabeth Drive would provide a key piece of connecting infrastructure to other transport corridors such as The Northern Road and the M12 Motorway, providing an integrated road network. Upgrading the existing Elizabeth Drive would facilitate projected growth of WSA and Western Sydney Aerotropolis and other planned developments in the area.

Table 2-7 Performance of Alternative Two against proposal objectives

Proposal objectives	Meets objective
Provide a defined road corridor adequate to accommodate future growth	The proposal would improve network performance and travel times. The network would also have sufficient capacity to accommodate future traffic demands (refer to Section 6.2)
Maintain primary function of a movement corridor east-west	The proposal would form part of the planned Western Parkland City road corridor upgrades, and would tie into the new M12 Motorway, which would provide motorway access to the WSA and Western Sydney Aerotropolis. The proposal would connect people and move freight between the nearest strategic centres in Western Sydney and the wider Sydney region and support land use change as part of the Western Parkland City.
Support key north-south routes (eg The Northern Road, M12 Motorway and future road connections in the Aerotropolis area)	
Contribute to the desired future character and connectivity of the Western Parkland City and Western Sydney Parklands.	
Improve road safety for all road users	The proposal would improve current road safety by providing additional lanes, a central median and intersection upgrades, and include facilities that support safe public transport use, walking and cycling
Provide active transport, bus priority and vehicle access to assist in key connections to: • WSA, business and technology park • Western Sydney Aerotropolis • Centres identified in the Western Parkland City and Western Sydney Parklands	The proposal would include a shared walking and cycling path on both sides of Elizabeth Drive, with cycling crossing facilities enabling active transport connections to precincts, neighbourhoods and parkland with the Western Parkland City. Bus priority infrastructure would also be provided
Provide an efficient, resilient freight network	The proposal would deliver an improved, efficient and resilient freight network, connecting Elizbeth Drive with The Northern Road and M12 Motorway which are also approved B-double routes. The proposal would also provide efficient access to the Western Sydney Aerotropolis precinct road network, fulfilling its role as a primary arterial road (including for freight) as set out in the Western Sydney Aerotropolis Precinct Plan (Department of Planning and Environment, 2022)

2.4.5 Summary of alternative selection

- Alternative One: Do-nothing
  - Would not meet the proposal objectives
  - Would not meet the strategic need (related to current and future traffic congestion and safety issues, and need to support surrounding significant developments)
  - Has the potential to impede the socio-economic growth of the region
- Alternative Two: Upgrade the existing Elizabeth Drive (the proposal)
  - Provides the opportunity to meet all proposal objectives
  - Provides the most opportunity to address the strategic need
  - Enables economic growth and development for industry to capitalise on the WSA and land use change supporting this.

Alternative Two was chosen as the preferred alternative, as it would have the most potential to address the strategic need described in Section 2.1.

2.4.6 Methodology for selection of preferred design option

An options assessment for the proposal was carried out as part of the broader Elizabeth Drive upgrade along the 14-kilometre stretch between The Northern Road and M7 Motorway. The options assessment split the stretch of Elizabeth Drive into five sections, described from west to east as the following:

- Section One – The Northern Road to Oaky Creek
- Section Two – WSA from Oaky Creek to Badgerys Creek
- Section Three – Badgerys Creek Road to Western Road
- Section Four – Western Road to Mamre Road
- Section Five – Mamre Road to the M7 Motorway.

The relevant sections relating to the proposal include Sections One and Two. Design options for each section were identified and analysed to determine a 'preferred option'.

2.4.7 Options considered and analysis

The following options were identified for Section One and Section Two.

Options for Section One – The Northern Road to Oaky Creek

Widening options

Section One comprises a 2.4 kilometre stretch of Elizabeth Drive between The Northern Road and Oaky Creek and include the intersections of Adams Road and Luddenham Road with Elizabeth Drive. The options short-listed for this section, and an analysis of each option, are presented in Table 2-8.

Table 2-8 Options assessment for Section One (The Northern Road to Oaky Creek)

Section One options	Option features	Analysis
Option One: Do nothing	The existing configuration for Elizabeth Drive would remain in its current state	The 'do nothing' option is not considered suitable to provide the critical road infrastructure needed to service WSA and Western Sydney Aerotropolis
Option Two: Widen mainly to the south, with transition to the north toward WSA	Widening would occur to the south of the existing road corridor, with a transition to widening to the north at the eastern extent of the section toward WSA and Luddenham Road	This option would provide a road geometry that enables tie in to the completed upgrade of The Northern Road (at the western end of this section), and tie in to Luddenham Road (in the east of this section). Widening to the north of the road carriageway at the eastern end of the section would avoid encroachment into the WSA site to the south of Elizabeth Drive. The option has also sought to minimise property impacts where possible.

Options for Section Two – Western Sydney Airport from Oaky Creek to Badgerys Creek

Section Two comprises a three-kilometre stretch of Elizabeth Drive from Oaky Creek to Badgerys Creek. The options short-listed for this section, and an analysis of each option, are presented in Table 2-9.

Table 2-9 Options assessment for Section 2 (Western Sydney Airport from Oaky Creek to Badgerys Creek)

Section Two options	Option features	Analysis
Option One: Do nothing	The existing configuration for Elizabeth Drive would remain in its current state	The 'do nothing' option is not considered suitable to provide the critical road infrastructure needed to service WSA and Western Sydney Aerotropolis

Section Two options	Option features	Analysis
Option Two: Widen to the north	Widening would occur on the northern side of the existing Elizabeth Drive carriageway	Widening on the northern side of Elizabeth Drive was selected as the preferred option for this section as it would avoid encroachment into the WSA site located to the south. Widening to the south was not considered as it would impact the WSA design and operations

2.4.8 Summary of preferred options for sections

A summary of the preferred design option for Section One and Two is provided below.

Section One – Oaky Creek to The Northern Road

The option to widen mainly to the south, with transition to the north toward WSA, was selected as the preferred option as it provided an alignment which would enable tie in to The Northern Road and Luddenham Road, and would avoid encroachment into WSA.

Section Two – Western Sydney Airport from Badgerys Creek Road to Oaky Creek

The option of widening to the north was selected as the preferred option to avoid impact to WSA located to the south.

2.5 Design refinements

A summary of key design refinements that have occurred during concept design development have been outlined in Table 2-10.

Table 2-10 Design refinements

Proposal element	Design refinement	Reasoning
Shared walking and cycling path	Extension of the shared path along the southern verge of Elizabeth Drive at the western extent of the construction footprint, to transition to a shared path that ties in with the shared path constructed as part of the completed upgrade of The Northern Road	To provide improved connectivity for pedestrians and cyclists by connecting two active transport (walking and cycling) corridors
Southern leg of Luddenham Road	An earlier revision of the design included an extension of Luddenham Road to the south to connect to Adams Road. The proposed southern extension of Luddenham Road was replaced with a provision for a U-turn function and realigned with a shift to the east	To reduce impacts to an existing farm dam to the south-west of the proposed intersection. The refinement would allow for a potential future extension of Luddenham Road to the south, to connect into the existing Adams Road
Adams Road access	Re-configuration of the Adams Road intersection to be left-in only access from Elizabeth Drive (with no access from Adams Road onto Elizabeth Drive); and addition of provision for a U-turn function on Adams Road for northbound vehicles	• Intersection re-configuration: to allow for road design requirements and safety considerations associated with the close proximity to the proposed Luddenham Road signalised intersection and new bridge over Cosgroves Creek • Provision for a U-turn function: to allow northbound vehicles on Adams Road to turn around, as existing entry onto Elizabeth Drive would be removed

Proposal element	Design refinement	Reasoning
Drainage infrastructure adjustment	Addition of drainage channels along the northern side of Elizabeth Drive, which also increased the overall size of the construction footprint	To prevent stormwater runoff from entering the road corridor, and avoid the need for a proposed bioretention basin to treat the runoff from the external catchment area
Removal of construction ancillary facility area	Removal of a temporary construction ancillary facility area located to the south of Elizabeth Drive and in between Luddenham Road and Adams Road	The option for an ancillary facility in this area was discounted due to environmental constraints associated with its close proximity to Cosgroves Creek. Construction ancillary facilities for the proposal are described in Section 3.3
Extent of operational footprint	Utilisation of the existing Elizabeth Drive road corridor and selection of cleared and/or disturbed areas where widening outside of this area was required	To minimise impacts to biodiversity and property impacts to landowners
Extent of construction footprint	Refinement of construction footprint, including minimisation of encroachment into 'avoided' land mapped under the Cumberland Plain Conservation Plan (CPCP) (DPE, 2022). This included reducing the extent of construction ancillary 2 (described in Section 3.3) to avoid an area of 'avoided' land	To minimise impacts to biodiversity (including 'avoided land' mapped under the CPCP), landowners, and an existing farm dam
Construction ancillary facilities	Siting of construction ancillary facilities within cleared/and or disturbed areas. This included locating ancillary facility three within the compound used by the M12 Motorway project	To minimise impacts to biodiversity (including 'avoided land' mapped under the CPCP) and landowners
Avoidance of commonwealth land and WSA	Refinement of operational footprint to avoid commonwealth land and the WSA	To avoid encroachment and potential impacts to commonwealth land
Design of construction traffic route	Design of construction traffic routes to maximise the use of classified State and regional roads	To minimise the impact to the local community (such as traffic and road safety impacts) as much as possible
Urban design and landscaping	Urban and landscaping design development and refinement to provide appropriate buffer to the community, and selection of appropriate landscaping species	To provide appropriate buffering and minimise potential visual impacts to the community. Selection of appropriate landscaping species also sought to minimise potential of bird strike due to WSA operations

In addition to the design refinements in Table 2-10, Transport has considered options in design development to minimise impacts to biodiversity values. Review of biodiversity constraints during identified that two threatened plant species were identified within the construction footprint, east of Luddenham Road, to the south of the existing Elizabeth Drive, and would be impacted by the proposed southern verge of Elizabeth Drive. These species include *Marsdenia viridiflora subsp. viridiflora* (Native Pear), listed as Endangered under the BC Act, and *Pultanaea parviflora* (Sydney Bush Pea), listed as Endangered under the BC Act and Vulnerable under the EPBC Act.

To review options to avoid or reduce impact on these individuals, alternative design approaches to the concept design for the southern verge (including the shared walking and cycling paths) and road carriageways were reviewed. This took into account a range of considerations, including:

- The opportunity to retain of threatened flora species
- Avoidance of additional property acquisition
- Avoidance of impacts to utilities

- Urban design outcomes, including maintaining visual consistency with the road corridor and landscaping
- Active transport connectivity, including the ability to maintain walking and cycling path provisions on both sides of Elizabeth Drive
- Road alignment geometry, including a preference to provide an alignment to the standard of the rest of the Elizabeth Drive corridor for visual and driver consistency
- Ability to provide a median width which safeguards for a future third lane in each direction if required
- Financial considerations.

Design approaches considered included the following:

- Different configurations of the road verge and walking and cycling paths to minimise impact to the cluster of Sydney Bush Pea and Native Pear individuals including removing a section of the paths, reducing their width, or deviating them around the cluster
- Different alignments of the road carriageway to entirely avoid the threatened Sydney Bush Pea and Native Pear individuals, including shifting only the westbound carriageway (by reducing the central median) or shifting both carriageways to the north
- Proceeding with the proposed concept design (as described in Chapter 3 (Description of the proposal), from which the southern verge and associated elements (eg paths, utility corridor, batters) would require removal of several Sydney Bush Pea and Native Pear individuals.

Different configurations of the walking and cycling paths would retain part of the cluster Sydney Bush Pea and Native Pear individuals; however, would still require removal of some individuals. Alternative configurations to the proposed concept design options would have adverse impact to active transport connectivity (through impact to the route and amenity of the shared walking and cycling path) and urban design outcomes, as well as impacts upon utilities. Changes to the road carriageway configuration could entirely avoid the cluster of individuals; however, moving both carriageways to the north would result in the in the requirement for additional property acquisition of northern properties. Relocation of the westbound carriageway would reduce the central median width and would not safeguard the future expansion of Elizabeth Drive to three lanes in each direction if required.

Proceeding with the concept design would not provide the opportunity to avoid the removal of the Sydney Bush Pea and Native Pear individuals; however, this option performed the best against the factors considered, relative to other design options. For example, the concept design would minimise adverse property acquisition, utility and active transport impacts, relative to other to the other design options considered. As such, proceeding with the concept design was selected as the preferred approach.

The biodiversity impacts of the concept design have been assessed in Section 6.3 and Appendix G (Biodiversity Development Assessment Report). Safeguards and management measures are also proposed in these sections to manage potential impacts to biodiversity, including threatened flora species.

3. Description of the proposal

This chapter describes the proposal, including the design parameters and major design features, the construction method and associated infrastructure and activities.

This REF was prepared based on the concept design for the proposal as described in this chapter. If approved, the proposal would be carried out generally in accordance with the description in this REF (and any changes proposed in response to submissions received during the public display of the REF) and in accordance with the safeguards and management measures identified in Chapter 7 (Environmental management).

The proposal is subject to detailed design and, if the proposal is approved, the proposal's design and construction methodology would be refined by the construction contractor in conjunction with Transport before work begins.

3.1 The proposal

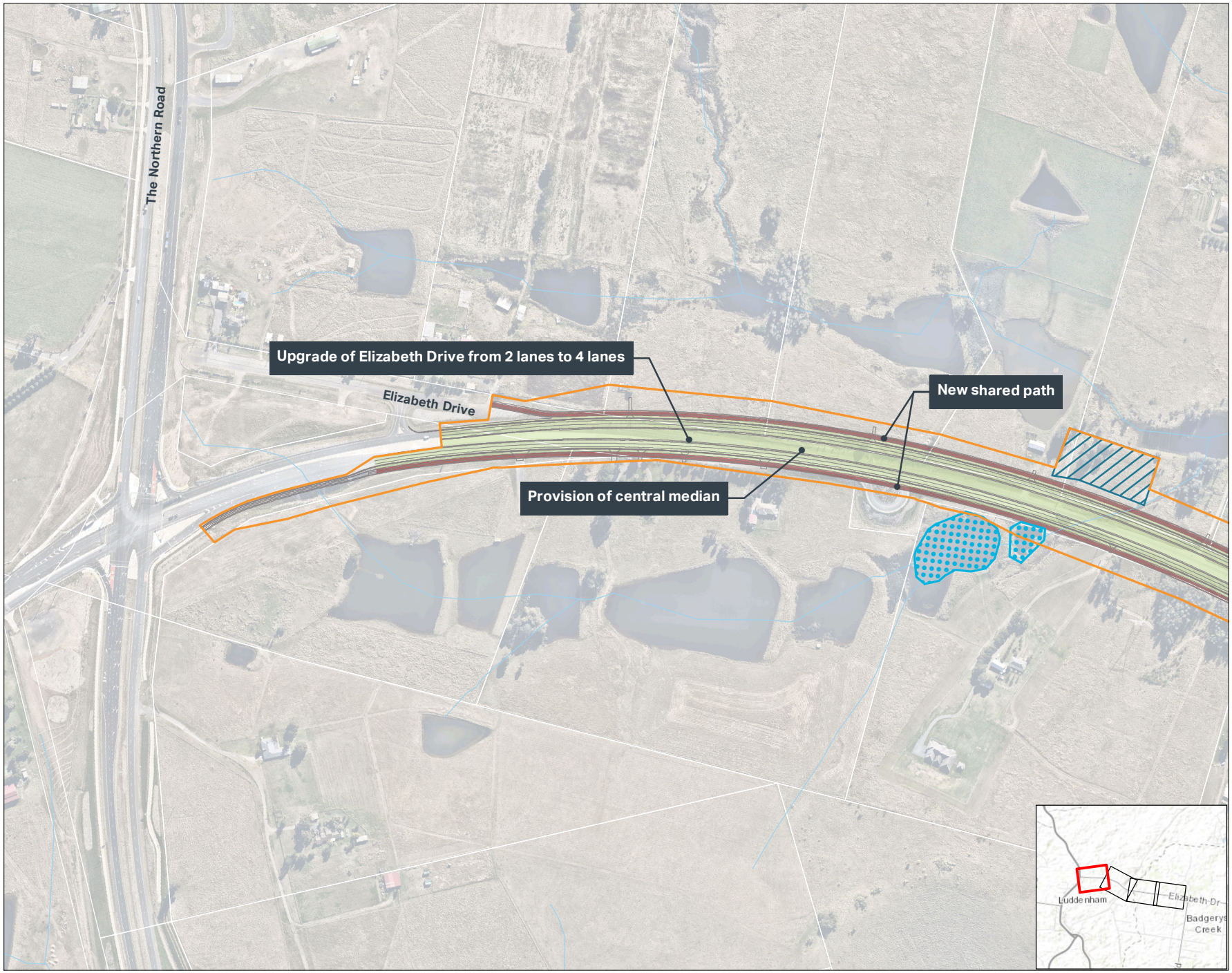
Transport proposes to upgrade about 3.6 kilometres of Elizabeth Drive between The Northern Road at Luddenham to near Badgerys Creek Road at Badgerys Creek where it would connect with the future M12 Motorway (the proposal). The proposal is one of two planned upgrades of Elizabeth Drive between The Northern Road, Luddenham and Duff Road, Cecil Hills (referred to collectively as the Elizabeth Drive upgrades):

- Elizabeth Drive East Upgrade which would include the upgrade of about 7.8 kilometres of Elizabeth Drive between Badgerys Creek Road near the future M12 Motorway and about 600 metres east of Duff Road at Cecil Hills. This proposal is the subject of a separate REF and does not form part of the proposal.
- Elizabeth Drive West Upgrade (the proposal), which is the subject of this REF

The proposal would be carried out within the Penrith Local Government Area (LGA) and the Liverpool LGA.

Figure 1-1 shows the construction footprint and operational footprint for the proposal. Figure 3-1 through to Figure 3-4 show the key features of the proposal, which would include (subject to detailed design):

- Upgrade of Elizabeth Drive from a two-lane rural road, to a four-lane road (two lanes in each direction) with provision of a central median to allow for future upgrade to six lanes
- A new bridge over Cosgroves Creek to carry eastbound and westbound traffic
- Upgrades to two intersections along Elizabeth Drive: Luddenham Road and Adams Road
- Active transport provision along the full corridor with the inclusion of shared paths along both sides of Elizabeth Drive corridor
- Inclusion of public transport infrastructure with bus priority at intersection and bus stops facilities
- New stormwater drainage infrastructure
- Property acquisitions and adjustments on both sides of Elizabeth Drive and some side roads
- Relocation/adjustment of existing utilities.



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0 50 100 m

FIGURE 3-1:
KEY FEATURES OF THE PROPOSAL (SHEET 1 OF 4):

WESTERN EXTENT

Legend

- Operational footprint
- Farm dam
- Road design
- Drainage line

Key Features

- New shared path
- Road upgrade
- Basin

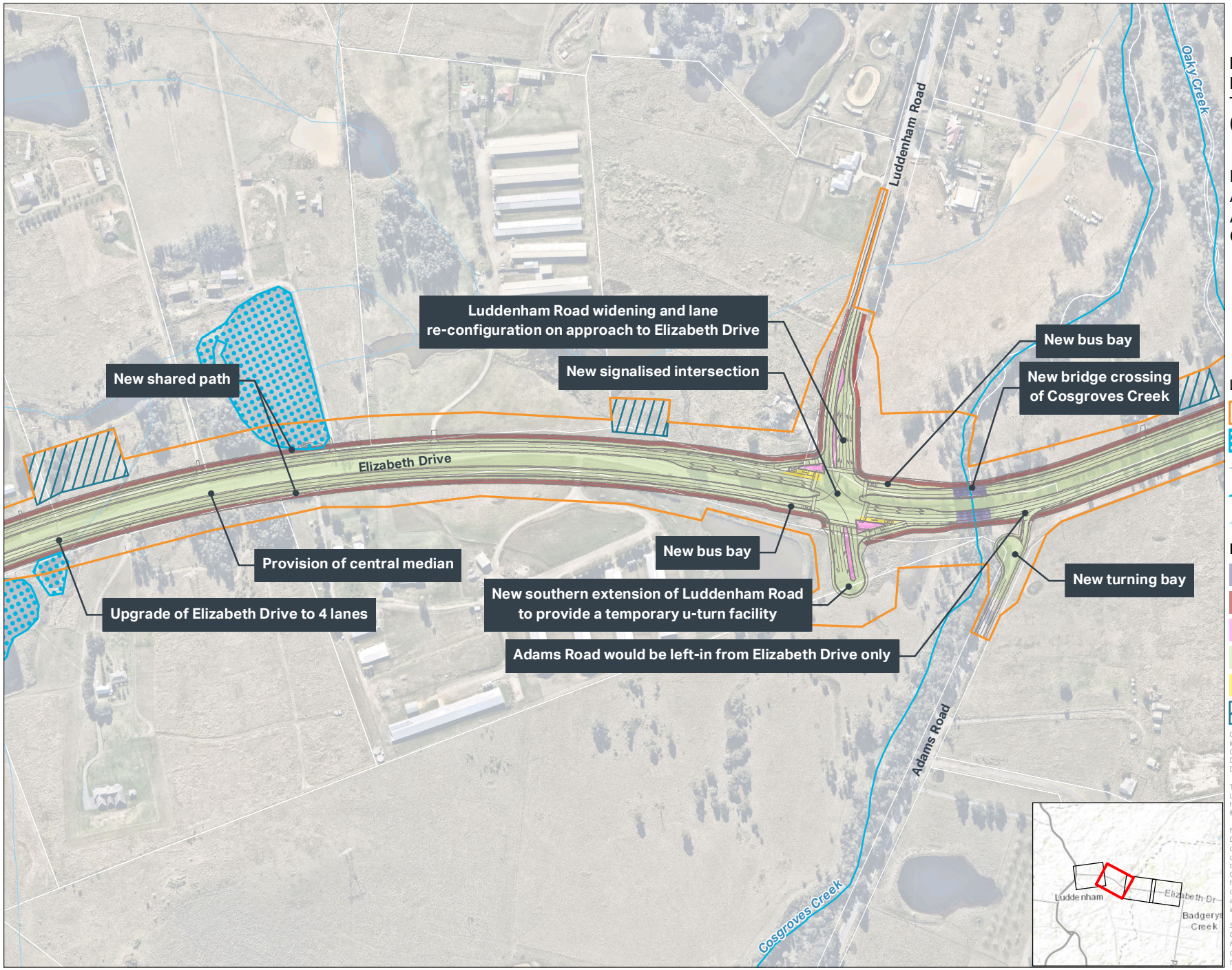

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FIGURE 3-2:
KEY FEATURES OF THE PROPOSAL (SHEET 2 OF 4):

LUDDENHAM ROAD AND ADAMS ROAD INTERSECTIONS AND BRIDGE OVER COSGROVES CREEK

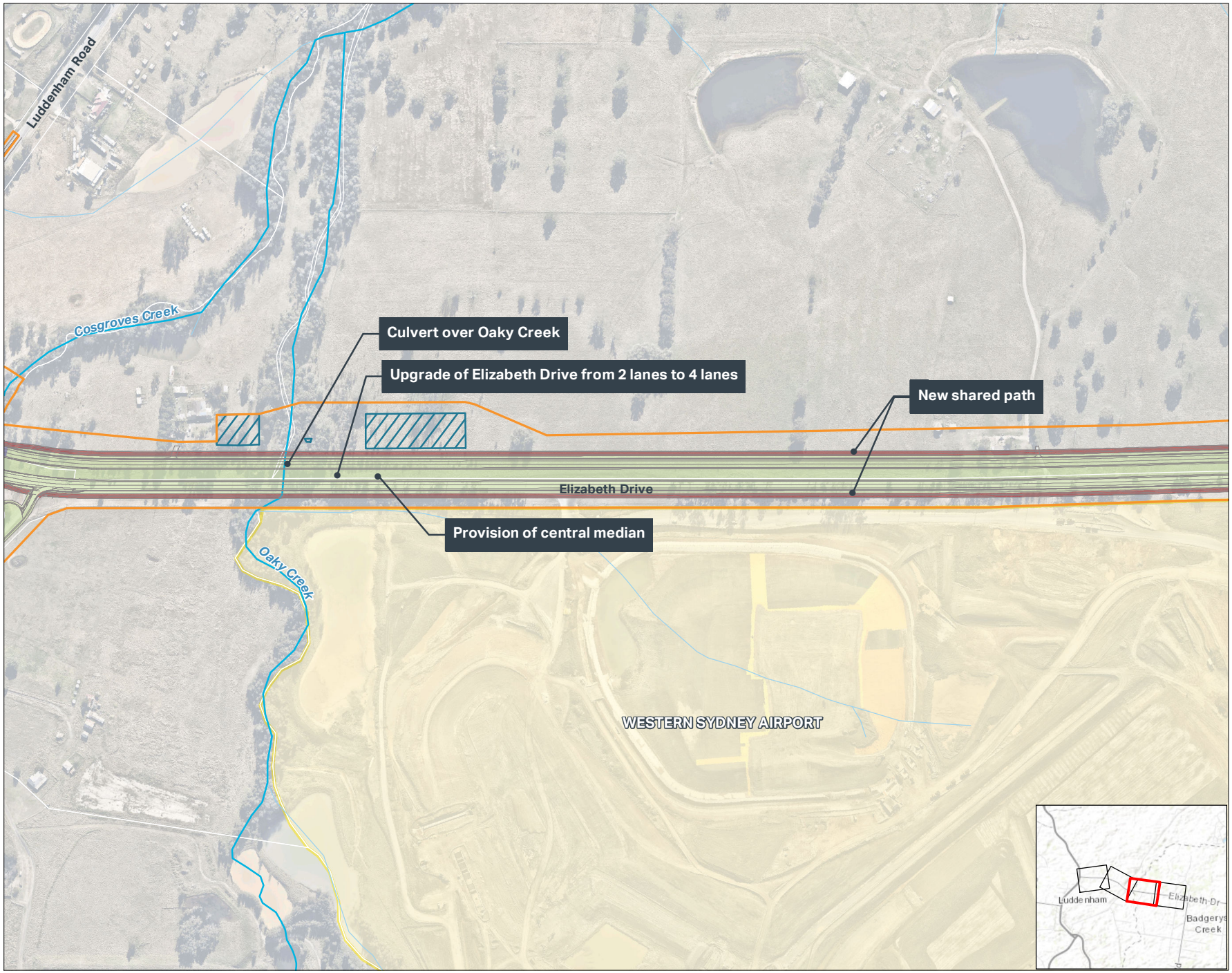
Legend

- Operational footprint
- Farm dam
- Road design
- Watercourse
- Drainage line

Key Features

- New bridge crossing
- New shared path
- Raised median
- Road upgrade
- Queue jump bus lane
- Basin

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Imagery © Nearmap 2021.



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0 50 100 m

FIGURE 3-3:
KEY FEATURES OF THE PROPOSAL (SHEET 3 OF 4):

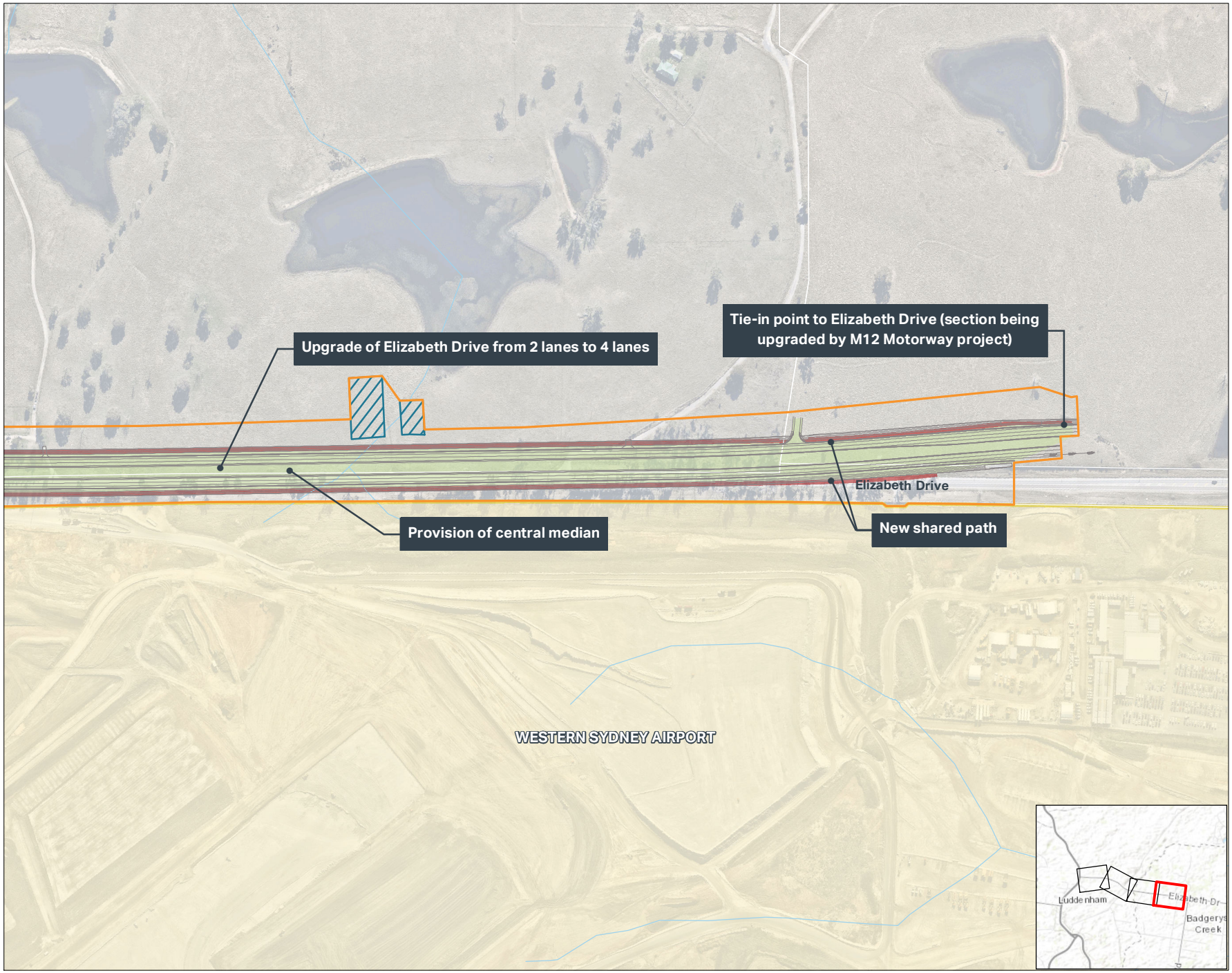
NORTH OF WESTERN SYDNEY AIRPORT

Legend

- Operational footprint
- Western Sydney Airport
- Road design
- Watercourse
- Drainage line

Key Features

- New bridge crossing
- New shared path
- Road upgrade
- Basin



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0 50 100 m

FIGURE 3-4:
KEY FEATURES OF THE PROPOSAL (SHEET 4 OF 4):

EASTERN EXTENT

Legend

- Operational footprint
- Western Sydney Airport
- Road design
- Drainage line

Key Features

- New shared path
- Road upgrade
- Basin

3.2 Proposal design

This section describes the key features of the proposal in more detail. The proposal would be subject to ongoing design development and would continue to be refined during subsequent design stages.

3.2.1 Design criteria

The design of the proposal has been developed to include the key design elements and associated design criteria summarised in Table 3-1. The proposal has been designed to take into account engineering, road safety, environmental and transport planning standards developed by Transport, Austroads and Standards Australia. These standards describe the criteria that should be adopted for specific road classifications and conditions. The criteria have been developed to ensure all roads are designed to be safe, effective, well-planned and easily maintained. The proposal has also been designed with regard to Transport's urban design guidelines, particularly *Beyond the Pavement 2020* (Transport, 2020).

Given the proximity to the WSA, detailed design of the proposal would also be carried out in accordance with the guidelines of the National Airports Safeguarding Framework (NASF) (Australian Government, 2018). The NASF is a national land use planning framework that was established with the aim of ensuring that development adjacent to airports is carefully planned, managed and compatible with airport operations.

Table 3-1 Key design elements and associated design criteria

Design element	Design criteria
Road formation	• Two traffic lanes in each direction with a central median of sufficient width to permit potential future widening to three lanes in each direction if required • Typical traffic lane width of about 3.5 metres (note that lane widths differ, such as kerbside and slip lanes) • Typical bus lane width of about 4.5 metres
Posted traffic speed	• Elizabeth Drive – proposed posted speed of 80 kilometres per hour (design speed 90 kilometres per hour) • Luddenham Road – proposed posted speed of 80 kilometres per hour (design speed 90 kilometres per hour) • Adams Road – proposed posted speed of 60 kilometres per hour (design speed 70 kilometres per hour).
Elizabeth Drive carriageway width	Total carriageway width ranging from about 49.5 metres to 54.2 metres
Shoulder widths	• Nearside (left hand side in direction of travel) – typically about 2.5 metres • Offside (right hand side in direction of travel) – typically about 0.5 metres, and one metre at bridge crossings
Median width	Typically about 13.5 metres
Design vehicles	• Elizabeth Drive carriageways and connection between Elizabeth Drive and The Northern Road to facilitate up to and including a 26-metre B-Double vehicle • Connections between Elizabeth Drive and Luddenham Road to facilitate up to and including a 26-metre B-Double vehicle • Connections between Elizabeth Drive and Adams Road to facilitate up to and including a 19-metre semi-trailer
Batter slopes	• Typically 4:1 (horizontal: vertical) ratio on the northern side of the road with some exceptions to limit the construction footprint • Typically 3:1 (horizontal: vertical) ratio on the southern side of the road with some exceptions to limit the construction footprint • Exceptions would include localised areas to a maximum of 2:1 (horizontal: vertical) ratio to limit the construction footprint

Design element	Design criteria
Nature strip width	About 3 metres (between the Elizabeth Drive kerb and the shared walking and cycling path)
Walking and cycling path width	Typically about 4.5 metres wide, transitioning to about three metres to tie into an existing shared path at The Northern Road and at the M12 Motorway Project
Verge	About 0.5 metres (between the path and the batter)
Flood immunity	• 100-year average recurrence interval (ARI) for main road alignment • 1-year ARI for shared walking and cycling path

3.2.2 Engineering constraints

The design of the proposal has been developed to take into account the following key engineering constraints:

- Avoiding encroachment into the WSA
- Protecting airspace around WSA (described further in Section 3.2.4)
- Minimising the need for and extent of property acquisitions and adjustments
- Coordinating with the design and construction of the M12 Motorway
- Minimising disturbance of existing utilities and coordinating relocation or realignment with utility providers
- Minimising changes to the existing flooding regime, including potential for inundation of the proposal and surrounding land
- Minimising impacts to existing farm dams around the proposal
- Optimising the practical and efficient construction of the proposal
- Optimising the practical and efficient operation, maintenance and management of the proposal
- Providing high quality urban design, landscape and visual amenity outcomes
- Minimising disruptions to local and through traffic and property access along the length of the proposal
- Minimising disruptions to landowners and impacts on native vegetation by utilising the Elizabeth Drive road corridor where possible.

3.2.3 Urban design objectives and principles

Urban design objectives were prepared for the proposal so that a 'whole of corridor' design would be developed that would integrate into the surrounding context. The urban design objectives are as follows:

- Embrace the importance of water in the landscape by retaining the north-south ecological corridors and ephemeral creek systems
- Contribute to the urban structure and streetscape of the Western Sydney Aerotropolis
- The built form responds to landmarks and natural topography/landform
- Maximise the benefit of and connectivity to the Western Sydney Parklands
- Starting with Country.

The urban design objectives have been integrated into the concept design and would be considered further in the detailed design phase of the proposal. Urban design is considered further as part of the landscape character and visual impact assessment provided in Section 6.8 and Appendix K (Urban Design, Landscape Character and Visual Impact Assessment).

3.2.4 Protection of airspace around WSA

The airspace surrounding the WSA is protected to maintain a safe operating environment for aircraft. The airspace is protected by the obstacle limitation surface (OLS), which is a series of mapped surfaces that set limits for development

around airports in terms of height, lighting, emissions and other factors. Criteria for safe airspace along with flying procedures are also established by the Procedure for Air Navigation Services – Operations (PANS-OPS) for the WSA.

The proposal is located wholly within the OLS for the WSA. Intrusion into the WSA OLS (and PANS-OPS) may be a controlled activity and require approval under Part 12 of the *Airports Act 1996*, unless an exemption applies. This exemption could relate to maximum heights introduced, whether the intrusion would be temporary, and the timing of the activity in relation to the development of the WSA. Transport would consult with WSA in relation to potential impacts on airport operations during construction of the proposal, to determine if a permit is required under the *Airport Act 1996*.

3.2.5 National Airports Safeguarding Framework

The NASF provides guidance to State, Territory and local governments on the management and regulation of safety risks and amenity issues near airports and strategic helicopter landing sites. The NASF includes a set of guidelines with the aim to provide for a best practice land use planning focus across several key considerations. Detailed analysis of compliance with these guidelines would be carried out during detailed design. A summary of the NASF guidelines is provided below with commentary on the key considerations for the proposal:

- Guideline C – Managing the Risk of Wildlife Strikes in the Vicinity of Airports: requires that work in the vicinity of airports consider management of wildlife to prevent bird strike. The proposal has considered WSA requirements, including the selection of tree species from an approved species list, designed to minimise the risk of bird strike. The drainage and swales design would also aim to avoid pavement surfaces ponding with water which may attract birds, thus preventing bird strike
- Guideline E – Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports: consideration to be given to the type of light fittings and the intensity of lighting installed within a six-kilometre radius of the WSA. Lighting proposed for use during construction would be selected in accordance with this guideline and in consultation with WSA
- Guideline F – Managing the Risk of intrusions into the Protected Airspace of Airports: provides guidance on the process, roles and responsibilities for achieving compliance with the requirements of the OLS and PANS-OPS. As described above and in Section 4.3.2 this would be considered further during detailed design, in consultation with WSA
- Guideline I – Public Safety Areas: public safety areas are areas of land at the ends of runways, within which development may be restricted to control the number of people on the ground at risk of injury or death in the event of an aircraft accident on take-off or landing. The *Western Sydney Airport – Airport Plan* (Commonwealth of Australia, 2021) identified a nominal 1000 metre trapezoid-shaped public safety area off the end of each runway, which a section of the proposal (including the existing Elizabeth Drive) traverses, near its connection to the M12 Motorway. Guideline I recognises that opportunities exist to review the trapezoid model and other models for public safety areas to determine which model is most appropriate for WSA. It is yet to be determined which model is to be applied to land use planning decisions around WSA, and Transport would continue to consult with WSA during detailed design to ensure that the relevant guidelines from the NASF are considered appropriately as the design is refined and developed further. The associated risk within this area would be assessed in consultation with WSA to minimise potential for stationary traffic for prolonged periods of time and safety risks to the public.

3.2.6 Major design features

The major design features of the proposal are shown in Figure 3-1 to Figure 3-4, and described in further detail in the following sections. These features include:

- Upgrade of Elizabeth Drive from its existing two-lane configuration to a four-lane configuration, and the addition of a central median
- A new twin bridge over Cosgroves Creek
- Reconfiguration of intersections with connecting roads, including Luddenham Road and Adams Road
- Connections to the M12 Motorway and WSA
- New shared walking and cycling paths
- Bus priority infrastructure
- Ancillary infrastructure and activities

Addition of traffic lanes and a central median

Elizabeth Drive would be upgraded from its existing two lane configuration to a four lane configuration, providing two 3.5 metre-wide lanes in each direction. A central median would also be provided to allow for Elizabeth Drive to be expanded to a six lane road in the future. The upgrade would extend from about 300 metres east of the Elizabeth Drive intersection with The Northern Road, continuing east for a distance of about 3.6 kilometres, to about 300 metres west of Badgerys Creek Road where it would tie into a section of Elizabeth Drive that is being upgraded as part of the M12 Motorway project. The tie in with the M12 Motorway would be further refined during detailed design, and an overlap in construction activities is not anticipated.

The addition of traffic lanes and a central median would involve widening and realignment of Elizabeth Drive as follows:

- Between The Northern Road and Luddenham Road – realigned and widened to both the north and south of the existing Elizabeth Drive
- At Luddenham Road – to the north of the existing Elizabeth Drive
- Between Luddenham Road and the M12 Motorway – to the north of the existing Elizabeth Drive alignment
- At the tie in to the M12 Motorway – northward divergence from the existing Elizabeth Drive.

Typical cross section designs for the proposal are shown in Figure 3-5, Figure 3-6 and Figure 3-7.

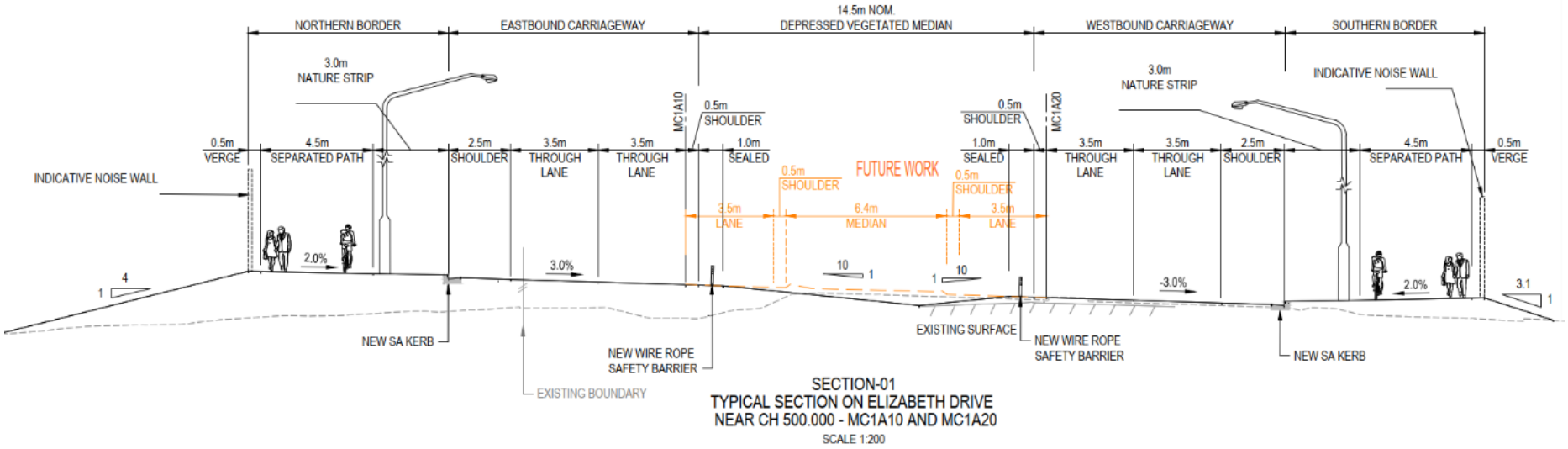


Figure 3-5 Typical cross section of the proposal on Elizabeth Drive at the western extent

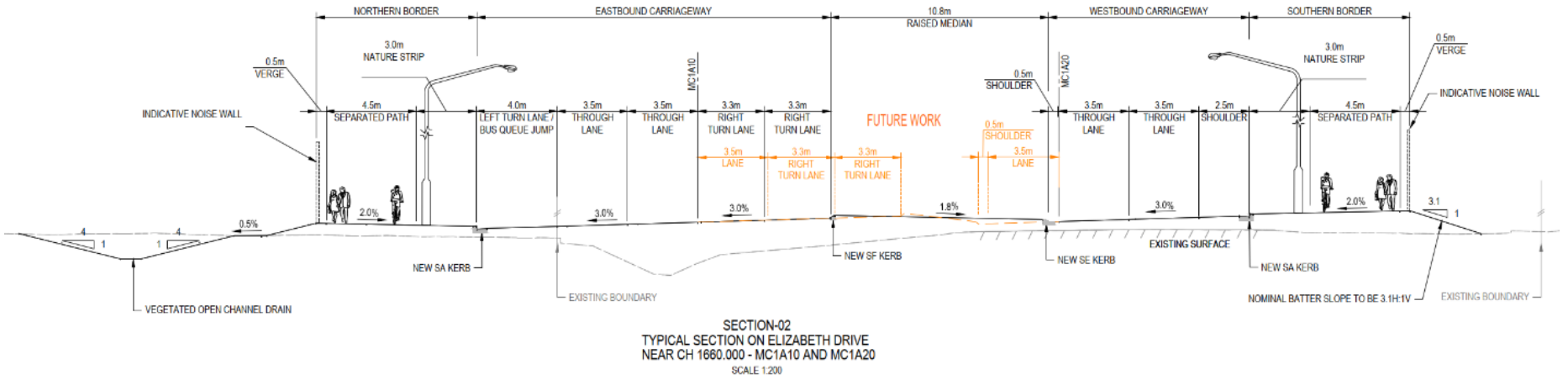


Figure 3-6 Typical cross section of the proposal on Elizabeth Drive near Luddenham Road

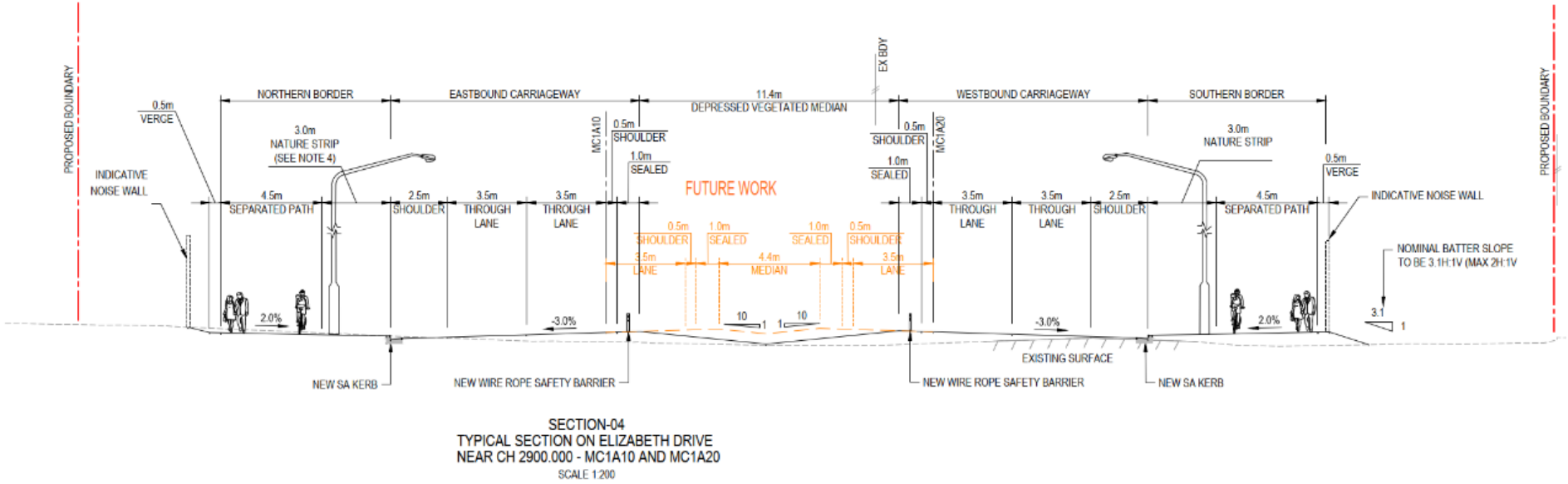


Figure 3-7 Typical cross section of the proposal along Elizabeth Drive (about 950 metres east of Adams Road and Elizabeth Drive intersection)

Twin bridge over Cosgroves Creek

A new twin bridge would be constructed over Cosgroves Creek to carry eastbound and westbound traffic, and the existing culvert at this location would be removed. The new bridge would be a single span industry standard 'super-T' girder structure, about 23 metres in length with a minimum clearance of 1.5 metres. Abutments would be supported on four cast-in-place piles, which would be located in the high bank of Cosgroves Creek. The indicative configuration of the bridge is shown in Figure 3-8 below.

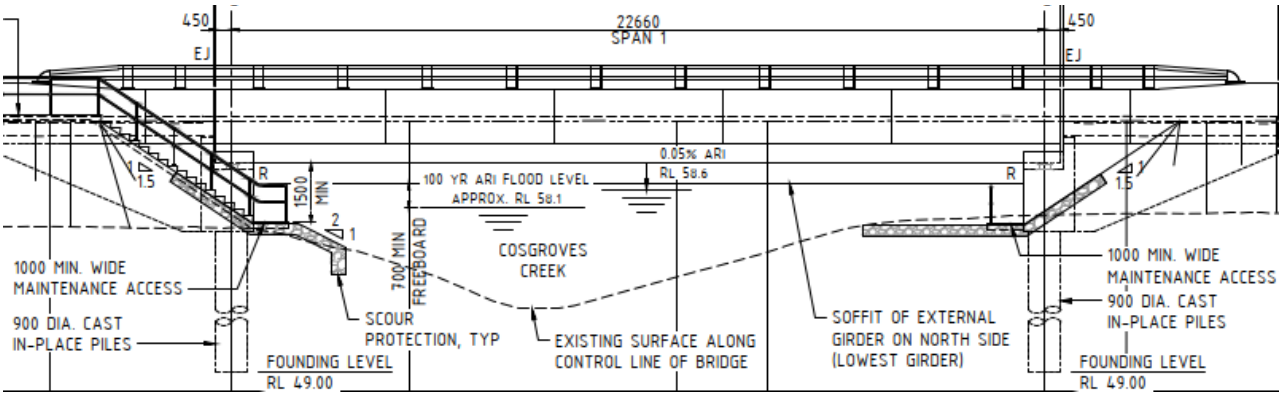


Figure 3-8 Cross-section of the proposed Cosgroves Creek bridge

Reconfiguration of intersections with connecting roads

The proposal would include reconfiguration of intersections with Luddenham Road and Adams Road. The intersections of Elizabeth Drive with Taylors Road and Badgerys Creek Road are being closed and adjusted as part of the M12 Motorway project.

The proposed Elizabeth Drive and Luddenham Road intersection is shown on Figure 3-9. The intersection would become signalised and would be configured to accommodate bus services. This would include a 'jump-start' bus lane, and new bus bays on Elizabeth Drive on the eastbound and westbound departure sides of the intersection. The intersection would also include the following design features:

- Tie in work with the existing alignment of Luddenham Road, north of Elizabeth Drive
- Two new transverse culvert crossings under Luddenham Road, both north and south of Elizabeth Drive, connected to Cosgroves Creek
- An extension of Luddenham Road to the south of Elizabeth Drive for a distance of about 80 metres to include provision for a U-turn function. Luddenham Road may be extended further south to connect with Adams Road in the future.

Turning movements and traffic lane configuration for the Elizabeth Drive and Luddenham Road intersection are summarised in Table 3-2.

Table 3-2 Turning movements and traffic lane configuration for the new Elizabeth Drive and Luddenham Road intersection

Leg of intersection	Lane configuration entering intersection	Lane configuration leaving intersection
Elizabeth Drive eastern leg	• Left slip lane into Luddenham Road southbound • A queue jump-start bus lane • Two through traffic lanes • Two right turn lanes into Luddenham Road northbound	• Two through traffic lanes • A bus bay (provisioning for a future bus stop)
Elizabeth Drive western leg	• Left slip lane to Luddenham Road northbound • A queue jump-start bus lane • Two through traffic lanes • Two right turn lanes into Luddenham Road southbound	• Two through traffic lanes • A bus bay (provisioning for a future bus stop)
Luddenham Road northern leg	• Two left turn lanes into Elizabeth Drive westbound • One through traffic lane • Two right turn lanes into Elizabeth Drive eastbound	• Two through lanes which would merge into one lane about 150 metres north of the intersection
Luddenham Road southern leg	• One left turn lane into Elizabeth Drive westbound • Two through lanes • One right turn lane into Elizabeth Drive eastbound	• Two through lanes leading to a provision for U-turn function about 80 metres south of the intersection (as Luddenham Road south of Elizabeth Drive would be a no through road)

The Elizabeth Drive and Adams Road intersection would be realigned slightly eastward from its existing location as shown in Figure 3-9. The realigned intersection would remove left-out turns from Adams Road onto Elizabeth Drive (westbound), and would instead only allow left-in turns into Adams Road southbound from Elizabeth Drive (westbound). The central median proposed along Elizabeth Drive would prevent right turn movements from Elizabeth Drive eastbound into Adams Road southbound, and from Adams Road northbound into Elizabeth Drive eastbound. A new turning bay would be provided on Adams Road on approach to Elizabeth Drive, to provide motorists travelling northbound the opportunity to turn around upon reaching the one-way segment of Adams Road.

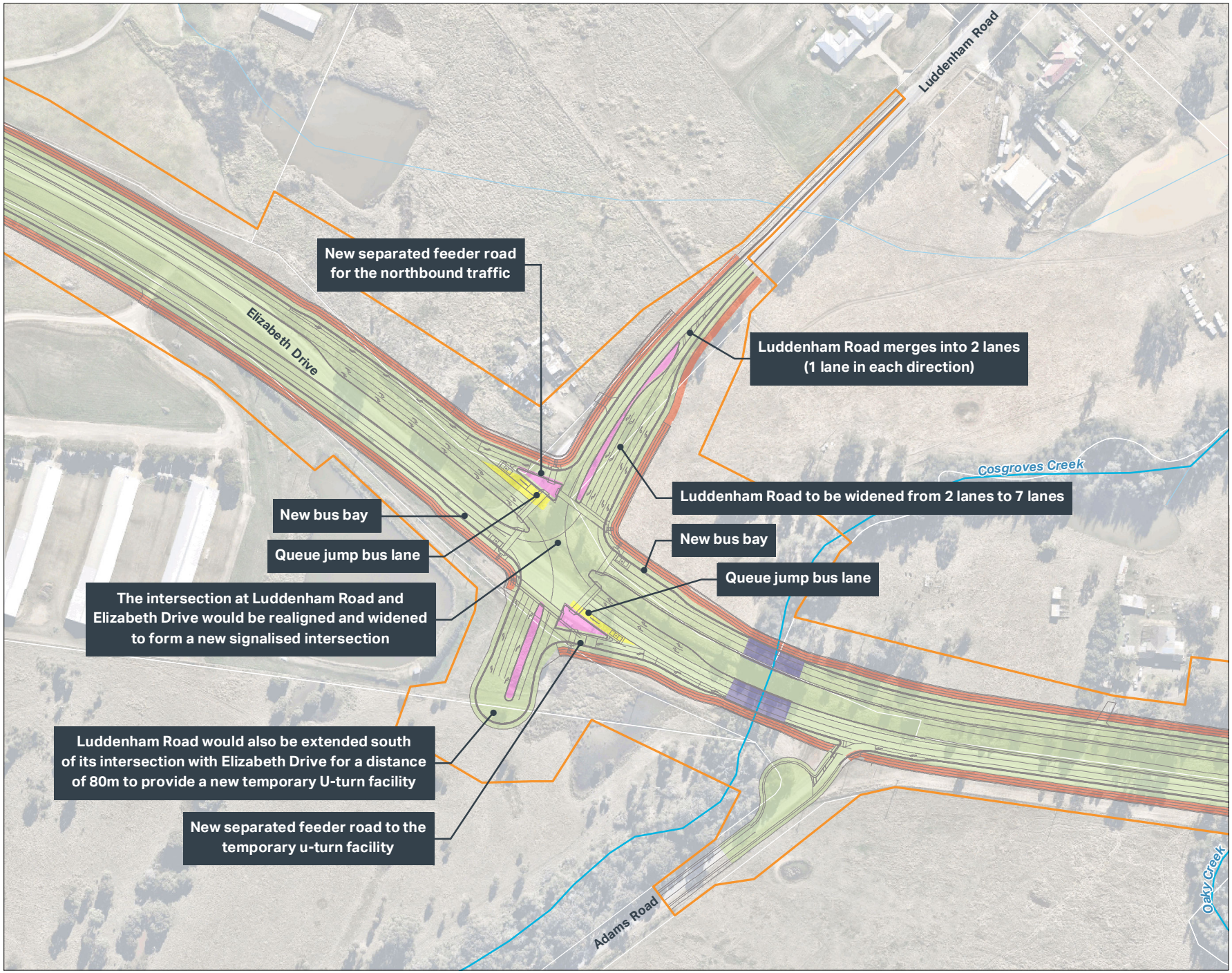


FIGURE 3-9:

INTERSECTION UPGRADE AT LUDDENHAM ROAD AND ELIZABETH DRIVE

N

0 25 50 m

Legend

- Operational footprint
- Road design
- Watercourse
- Drainage line

Key Features

- New bridge crossing
- New separated walking and cycle path
- Queue jump bus lane
- Raised median
- Road upgrade

Connections to the M12 Motorway and WSA

The proposal would connect into new intersections constructed as part of the M12 Motorway project and enable access to WSA. The eastern end of the proposal would tie into a section of Elizabeth Drive that is being upgraded at part of the M12 Motorway project. East of the proposal, Elizabeth Drive would carry traffic above the new Sydney Metro Western Sydney Airport line, interchanging with the M12's connection into WSA.

At its western end, the proposal would tie into The Northern Road, which also interchanges with the M12 Motorway.

Public transport infrastructure

The intersection of Elizabeth Drive and Luddenham Road would include the following bus priority infrastructure, to support future bus services:

- 'Queue jump-start' bus lanes eastbound and westbound on Elizabeth Drive, on approach to the intersection with Luddenham Road
- Two new bus bays eastbound and westbound on Elizabeth Drive, on the departure side of the intersection with Luddenham Road, each including provision for a new bus stop in each location.

The bus stop layout and associated furniture such as bus shelters, 'b' poles and signs would be designed and implemented by Transport's bus planning team in conjunction with the local council, separate to this proposal.

New paths for walking and cycling

The following improvements to encourage walking and cycling are proposed, as summarised in Table 3-3.

Table 3-3 New walking and cycling infrastructure

Location	New walking and cycling infrastructure
Elizabeth Drive westbound and eastbound	A shared walking and cycling path along both sides of Elizabeth Drive within the construction footprint, typically about 4.5 metres wide, transitioning to three metres to tie into an existing shared path at The Northern Road and at the M12 Motorway project. The shared walking and cycling path would typically be separated from the Elizabeth Drive carriageways by landscaped nature strip of about three metres in width
Cosgroves Creek bridge	A shared walking and cycling path, about 4.5 metres wide, in each direction, on the outer edge of the bridge over Cosgroves Creek. The path would be separated from the Elizabeth Drive carriageways by concrete bridge barriers and a cycle fence
Intersection with Luddenham Road	Dedicated signalised walking and cycling crossing points, with refuge islands provided within the central median
Intersection with Adams Road	A dedicated walking and cycling crossing point across Adams Road intersection (unsignalised)

Ancillary infrastructure and activities

The proposal would include ancillary infrastructure and activities, as summarised in Table 3-4.

Table 3-4 Ancillary infrastructure and activities

Component	Ancillary infrastructure and activities
Drainage infrastructure	• Existing open channel drains along Elizabeth Drive would be removed and replaced with new drainage infrastructure • Culverts would be installed under Elizabeth Drive where it crosses Oaky Creek (instead of a bridge structure), and under Luddenham Road which would direct flow to Cosgrove Creek • Drainage infrastructure would be designed and installed to meet the requirements of R0200 Stormwater Drainage Series drawings (Transport for NSW, 2017) • The configuration of drainage infrastructure would be subject to detailed design, and is likely to include the following: • Stormwater drainage pits and concrete pipes with the kerb along the full length of the proposal – Open channels along the northern and southern road embankments to intercept and redirect surface water runoff from the new road catchment area, while avoiding runoff discharging towards private property
Utilities	• Existing public utilities would be protected, adjusted or relocated as identified in preliminary investigations. This would be confirmed during subsequent design development through ongoing consultation between Transport and the following utility providers: – Communication – Telstra and NBN – Electrical – Ausgrid, TransGrid and Endeavour Energy – Gas services – Jemena – Sewer services – Sydney Water – Water services – Sydney Water – ITS – Transport • Utility trenches would be installed within the upgraded road verge, and under the new shared walking and cycling paths. These trenches would accommodate new utilities (which may be installed by external providers), as well as street lighting and ITS equipment power cables, and communication connections required for the proposal • Utilities (except for ITS) would be underbored under Cosgroves Creek as part of the bridge work
Safety barriers	• A combination of steel and wire rope safety barriers, and concrete bridge barriers, would be installed along the length of the proposal to separate live traffic lanes from roadside hazards
Intelligent Transport Systems (ITS)	• ITS equipment would be installed at the intersections of Elizabeth Drive with Luddenham Road and Adams Road. ITS equipment would include traffic detection/counting equipment (SCATS), closed circuit television (CCTV) cameras and VMS. • ITS equipment would be operated by Transport Management Centre (TMC) operators through the Motorway Management System (MMS). TMC operators would monitor the corridor 24 hours/seven days a week using the CCTV cameras along Elizabeth Drive within the operational footprint
Signage, line marking and street lighting	• Appropriate signage, line marking, and street lighting would be provided along Elizabeth Drive within the operational footprint • Lighting would be designed and installed in accordance with relevant guidelines and standards, including NASF Guidelines and WSA requirements

Component	Ancillary infrastructure and activities
Landscaping	• Landscaping would be carried out along the length of Elizabeth Drive within the operational footprint, within the central median and the nature strip separating traffic lanes from shared walking and cycling paths. This would be subject to detailed design, consideration of WSA requirements and would aim to maximise the use of locally endemic native species and minimise risk of bird strike
Property acquisition	• Partial property acquisition of 18 properties would be required as part of the proposal (refer to Section 3.4)
Property adjustments	• Property adjustments would also be required, and may include the relocation of existing fencing, driveways and gates. This would be minimised where possible and confirmed during detailed design in consultation with relevant landowners
Adjustments to farm dams	• Three farm dams would be reconfigured as part of the proposal where they intersect with the construction or operational footprint. This may involve de-watering and full or partial in-filling of each dam. This would be confirmed during detailed design and carried out in consultation with relevant landowners • No permanent adjustments to creeks would be required
Noise mitigation	• Noise mitigation would be provided where measures are required to address noise impacts associated with operation of the proposal. The need for, type and location of potential mitigation measures would be reviewed and confirmed as part of detailed design • The implementation of mitigation measures would be carried out in accordance with the relevant Transport guidelines and may include low-noise pavements or at-property treatments, subject to detailed design. Noise and vibration impacts and mitigation are discussed further in Section 6.1

Adjustments to property access

To improve road safety along Elizabeth Drive, a central median would be installed along Elizabeth Drive. This median would prevent vehicles from turning right across Elizabeth Drive to access private property and some businesses (vehicles can currently make this turning movement on the existing Elizabeth Drive by crossing over the double unbroken lines). As part of the proposal, access to property from Elizabeth Drive would be restricted to left-in / left-out only.

Vehicles wishing to turn right into property would need to continue to travel along Elizabeth Drive and use one of the following locations to perform a U-turn function:

- Willmington Road: An existing U-turn facility west of the intersection to facilitate travelling eastbound on Elizabeth Drive
- Luddenham Road: A proposed provision for a U-turn function as part of the proposal on the southern approach to facilitate travelling westbound on Elizabeth Drive.

This proposed change would increase the distance that some property owners would need to travel to access their property. Further details regarding travel time are further discussed in Section 6.2 and Section 5.2 of Appendix F (Traffic and Transport Assessment Report).

An existing U-turn facility on the southern side of Elizabeth Drive, about 700 metres east of the intersection with The Northern Road, would be decommissioned as part of the proposal to enable road widening to occur in this location. The Willmington Road and Luddenham Road locations described above are located within about a kilometre of this U-turn facility, and could be used as alternative locations to perform a U-turn function to enable property access.

3.3 Construction activities

Subject to detailed design and construction planning, construction of the proposal is anticipated to take around 48 months to complete. The construction footprint (ie area of land required for construction of the proposal), including locations of the three proposed construction ancillary facilities, is shown in Figure 3-10.

3.3.1 Overview of construction work

Construction of the proposal would involve the following general activities:

- Site establishment including set up of construction ancillary facilities and installation of environmental protection controls, including around creek areas
- Utility adjustments, relocations and replacements, where required
- Demolition of existing buildings/structures
- Property adjustments (eg adjustments to fencing)
- Vegetation removal
- Earthworks and drainage work
- Adjustments to existing farm dams within the construction footprint, including dewatering and re-shaping where required
- Bridge work over Cosgroves Creek, including installation of temporary diversion (if required) and temporary creek crossing, construction of new bridge and demolition/removal of the existing culvert
- Elizabeth Drive upgrade roadwork, including intersections with local roads and walking and cycling infrastructure
- Landscaping and finishing work.

Further details of these construction activities are provided in the following sections. Construction workforce, hours and anticipated traffic generation are detailed in Section 3.3.12, plant and equipment are summarised in Section 3.3.19 and construction material requirements are outlined in Section 3.3.20.

3.3.2 Construction ancillary facilities

Three temporary ancillary facilities would be established to support construction of the proposal. These are show on Figure 3-10 and would be located at:

- The Northern Road (construction ancillary facility 1) – located at the north-eastern corner of the Elizabeth Drive and The Northern Road intersection
- Luddenham Road (construction ancillary facility 2) – located at the north-western corner of the Elizabeth Drive and Luddenham Road intersection
- M12 Motorway tie in (construction ancillary facility 3) – located west of Badgerys Creek Road on the northern side of Elizabeth Drive. Subject to detailed design and construction planning, it is anticipated that this construction ancillary facility would operate as the main site office during construction of the proposal.

Construction ancillary facilities 1 and 2 would be located on private land acquired or leased by Transport (refer further to Section 3.4 for indicative acquisition and leasing requirements for the proposal). Construction ancillary facility 3 would be entirely on land that is currently being used to support construction of the M12 Motorway. Construction of the proposal would commence after the completion of the M12 Motorway construction work which utilises this construction ancillary facility.

Each construction ancillary facility may include the following activities:

- Establishment of site office/s, amenities, and temporary infrastructure, such as fencing and car parking areas
- Laydown and storage areas, and delivery of plant, equipment and materials
- Secure and bunded storage areas for re-fuelling and chemical storage
- Concrete batching plant
- Material crushing
- Stockpiling areas and spoil management (topsoil, excavated natural material, contaminated material). Stockpile locations would be determined during subsequent design stages using the criteria set out in the *Stockpile Management Guideline* (RMS, 2015).

Each construction ancillary facility would be secured with temporary fencing, and signage would be erected advising the public of access restrictions. Upon completion of construction, the temporary construction ancillary facilities, including work areas and stockpiles, would be removed and the sites would be cleared of all rubbish and materials. The sites would then be reinstated or handed over in agreement with the landowner.

FIGURE 3-10:
CONSTRUCTION FOOTPRINT AND CONSTRUCTION ANCILLARY FACILITIES

3.3.3 Site establishment

Site establishment work would be carried out at the beginning of the construction period, and would include:

- Identification and marking out of sensitive areas / no-go areas
- Vegetation removal (refer to Section 3.3.6)
- Installation of temporary sediment and erosion controls
- Installation of temporary traffic management measures including traffic signs and barricades
- Installation of temporary construction site fencing, and property adjustment work including relocation of fences, access points and boundary features
- Minor roadwork and earthworks to establish temporary construction access roads and construction ancillary facilities, including establishment of temporary hardstand/gravel areas
- Establishment of construction ancillary facilities, including erecting demountable offices/sheds and amenities, establishing temporary parking and installation of signage
- Utility work including protection and/or adjustment of existing utilities, connections to temporary site facilities, removal of redundant utilities (refer to Section 3.3.4).

3.3.4 Utility adjustments, relocations and replacements

The construction footprint contains several existing utilities, including communications and electrical, gas, sewer and water infrastructure that would need to be adjusted, relocated or replaced as part of the proposal. This would be carried out in consultation with the relevant utility provider, and would be completed progressively in accordance with the construction program.

The nature of utility work would be in keeping with construction requirements and in consultation with affected utility providers. This may include:

- Relocation /adjustment of utilities, where required
- Excavation of trenches for new utility routes within the road corridor
- Installation of bedding material and new utilities within the trenches or on new poles
- Testing and cutover of utilities into new infrastructure
- Identification, decommissioning and removal of redundant utility infrastructure.

3.3.5 Demolition of existing buildings and structures

The proposal has been designed to minimise the need for land acquisition and the demolition/removal of existing buildings and structures. Despite this, some partial property acquisition (refer to Section 3.4) and subsequent demolition/removal of existing buildings and structures would be unavoidable.

Demolition/removal of existing culvert over Cosgroves Creek would also be required to allow for construction of new twin bridge structures. Appropriate controls would be implemented to manage potential impacts to creeks during this work (refer further to Section 3.3.8).

Demolition/removal of existing buildings and structures (including bridges) would be carried out progressively to suit the construction program and progression of construction activities. Demolition/removal activities would generally include:

- Disconnecting existing utilities where required
- Identification and removal of asbestos or other contaminated materials
- Removal of fittings and other reusable elements using hand tools
- Progressive demolition of the building and structures (including bridges)
- Sorting and temporary storage of demolition material into recyclable and waste components
- Loading and transporting recyclable and waste material to a licensed waste/recycling facility.

Property acquisition details are provided in Section 3.4.

3.3.6 Vegetation removal

Vegetation removal would be required for the proposal within the construction footprint, and would include about 29.35 hectares of native vegetation in total and 0.22 hectares of urban native/exotic vegetation. Further details of vegetation affected by the proposal and potential biodiversity impacts are provided in Section 6.3.

Vegetation removal would be carried out in accordance with Transport's *Biodiversity Guidelines* (RTA, 2011) and would include:

- Identification and marking out of clearing limits, including trees to be retained such as hollow-bearing trees
- Identification of weed species required to be removed
- Identification of suitable habitat nearby for release of fauna that may be encountered
- Checking for the presence of fauna species onsite and relocation if required by a suitably qualified and experienced fauna handler
- Clearing of vegetation including removal of tree stumps
- Re-use of vegetation or mulch for use in rehabilitation areas or as environmental controls
- Offsite disposal of excess mulch at a licenced facility or at a pre-approved site for lawful re-use.

Vegetation removal would be carried out progressively to suit the construction program. Disturbed land would be stabilised between vegetation removal and bulk earthworks (refer to Section 3.3.7) to minimise the potential for erosion, sedimentation and the generation of dust. Opportunities to minimise the extent of vegetation removal would be further explored during the detailed design and pre-construction phases.

3.3.7 Earthworks and drainage work

Following vegetation removal and demolition/removal of existing buildings/structures, bulk earthworks would be completed to achieve the required design levels along the length of the proposal. This would include the construction of raised embankments, retaining walls and sections of cutting. Based on construction planning conducted to date, it is anticipated that the proposal would have a negative cut/fill balance (ie requiring the importation of fill material), as indicatively summarised in Table 3-5. A more precise estimate of the cut/fill balance would be completed during detailed design.

Table 3-5 Indicative cut/fill balance and depth of cut/fill for the proposal

Earthworks	Indicative estimated volume
Cut	48,700 cubic metres
Fill	172,800 cubic metres
Balance	124,100 cubic metres (required to be imported as additional fill to construct the proposal)

Drainage infrastructure would be constructed in line with the earthworks activities for the proposal, including adjustment/extension of existing culverts, construction of drainage lines and sedimentation basins, and tie in work to connect with the existing drainage infrastructure network.

Earthworks and drainage infrastructure adjustment/construction work would involve:

- Stripping, stockpiling and management of topsoil, subsoil, and material unsuitable for re-use
- Excavation and filling to the road formation levels, including excavation for embankments and cuttings
- Disposal of unsuitable and surplus material to a licensed facility, and importation of fill as required to meet cut/fill requirements
- Installation of temporary drainage infrastructure for construction (eg temporary sediment basins, earth bunds, channels and protection of existing stormwater pits)
- Installation of permanent drainage infrastructure.

3.3.8 Bridge construction over Cosgroves Creek

The proposal would involve construction of a new twin bridge across Cosgroves Creek to carry eastbound and westbound traffic, and removal of the existing culvert.

Construction of the new Cosgroves Creek bridge would be staged to allow continued operation of Elizabeth Drive during the construction work. Indicative staging would involve:

- Construction of the eastbound bridge lane, while traffic would continue to use the existing Elizabeth Drive
- Switching of traffic onto the newly constructed eastbound bridge lane
- Demolition/removal of the existing culvert
- Construction of the westbound bridge lane, while traffic continues to use the newly constructed eastbound bridge lane
- Final traffic switch onto the new bridge.

Construction work for the bridge would be supported by use of construction ancillary facility 2. It is anticipated that bridge work would generally involve:

- Establishment of construction site access, including a temporary access track and access ramp to the southern/eastern embankment of Cosgroves Creek (the northern/western embankment would be accessed directly from the existing Elizabeth Drive)
- Stripping and stockpiling of topsoil, and management of material unsuitable for re-use
- Establishment of a crane pad near the creek bank to place pre-cast bridge structural components
- Installation of bridge pilings
- Temporary diversion of Cosgroves Creek channel if required, to allow construction work to be carried out within the existing creek channel. This may involve localised excavation, installation of temporary pipes/culverts and appropriate controls to minimise potential scour effects. Temporary diversion (if required) would be designed to minimise impacts to the natural creek bed and creek flows
- Construction of a temporary creek crossing including culvert and rock access platform within the existing creek channel, to provide access for bridge work as required. Temporary waterway crossings would be designed in accordance with the requirements of the Policy and Guidelines for Fish Habitat Conservation and Management (NSW Department of Primary Industries, 2013)
- Bridge construction, including placement of pre-cast segments lifted into place using a crane or gantry from either side of Cosgroves Creek
- Return of Cosgroves Creek to its original channel, removal of temporary construction work and rehabilitation of disturbed areas.

Construction of the new bridge and removal of the existing culvert would involve similar construction activities, plant and equipment. Upon completion, all temporary features would be removed and the area rehabilitated in line with the urban design and landscape plan for the proposal.

3.3.9 Farm dam de-watering and infilling

The proposal would impact three farm dams, which would require de-watering and full or partial infilling. This would be planned in consultation with the relevant landowner and would likely include the following:

- Relocation of aquatic fauna where required, supervised by a suitably qualified and experienced fauna handler
- Installation of bunds, and erosion and sediment controls where required
- Dewatering of farm dam water, and either irrigating overland, pumping into a nearby dam, or using as onsite dust suppression
- Full or partial infilling with suitable material.

Safeguards and management measures would be provided in the Fauna Management Plan and Soil and Water Management Plan, and implemented as part of the CEMP. Dewatering and release of water would be subject to water quality and approval conditions as outlined in Section 6.9.

3.3.10 Pavement work

Carriageway pavement would be constructed on the completed earthworks formation (refer to Section 3.3.7) and would follow a typical road construction process, including:

- Rolling and grading of road formation foundation
- Placement and compaction of bound gravel road pavement
- Installation of subsoil inter-pavement drainage with connections to existing and new drainage pits
- Placement of a bitumen material over the bound gravel road pavement
- Placement of an asphalt wearing course and compaction with a roller.

Construction of the road pavement would be staged and coordinated to allow continued traffic along Elizabeth Drive, with traffic switching carried out as required. A similar approach would be carried out at the Elizabeth Drive and Luddenham Road intersection, and at Adams Road to the south of Elizabeth Drive.

The shared walking and cycling paths would be constructed in coordination with the pavement work and would include:

- Clearing and grading
- Excavation and compaction
- Laying of base material and concrete path.

3.3.11 Landscaping and finishing work

Following the pavement work, landscaping and finishing work would be carried out. This would include the removal of construction ancillary facilities and rehabilitation of disturbed areas.

Landscaping and finishing work would include:

- Line marking and installation of raised reflective pavement markers
- Installation of street lights, road and street furniture including signage
- Rehabilitation of disturbed areas and landscaping in accordance with the urban design and landscape plan.

Prior to operation, construction traffic management signage and temporary erosion and sediment controls would be decommissioned. The construction ancillary facilities would be demobilised, and include the removal of all construction materials and facilities such as site offices, toilet blocks and fencing. Areas disturbed during construction would be reinstated as agreed with the relevant landholder.

3.3.12 Construction workforce

It is anticipated that a peak workforce of up to 240 workers per day would be required. These workers would potentially be sourced locally where appropriate skill sets are economically available.

3.3.13 Construction hours

Construction would largely be carried out during standard construction work hours in accordance with the Interim Construction Noise Guideline (DECC, 2009):

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sundays and public holidays: no work.

Construction activities that involve impulsive or tonal noise emissions would be limited to the following hours in accordance with the *Construction Noise and Vibration Guideline* (RMS, 2016):

- Monday to Friday: 8am to 5pm
- Saturday: 9am to 1pm
- Sundays and public holidays: no work.

To minimise disruption to daily traffic and disturbance to surrounding landowners and businesses, it would be necessary to carry out some work outside of standard construction work hours. The following activities are likely to take place outside standard construction work hours:

- Delivery of construction materials and equipment
- Delivery of large components such as precast bridge components/girders
- Intersection work and tie in activities with existing roads
- Switching of traffic, including traffic management work
- Installation and adjustment of barriers and construction signage
- Operation of construction ancillary facilities to support the above work.

3.3.14 Construction traffic generation

During construction, it is anticipated that peak traffic generation would include about 200 light vehicles and about 70 heavy vehicles per day. Construction traffic would be distributed across the construction ancillary facilities and along the proposal, depending on the stage of construction and progression of construction activities. It is anticipated that the majority of light vehicles would arrive and depart the construction footprint outside of standard peak AM and PM hours.

3.3.15 Construction access and parking

Initially, construction traffic would access construction ancillary facilities via the existing Elizabeth Drive alignment. Temporary haulage routes would be established along Elizabeth Drive early in the construction program to minimise impacts to existing road users. Areas for parking would be provided at all ancillary facilities. Emergency service access would be maintained at all times during construction.

3.3.16 Indicative haulage routes

Indicative haulage routes have been identified at The Northern Road, the M7 Motorway and M12 Motorway, and are shown in Figure 3-11, Figure 3-12 and Figure 3-13. These roads would be utilised during construction for transportation of materials and spoil between different locations within the construction footprint. The proposed haulage routes have been designed to minimise use of local roads where possible and are subject to detailed design and construction planning.

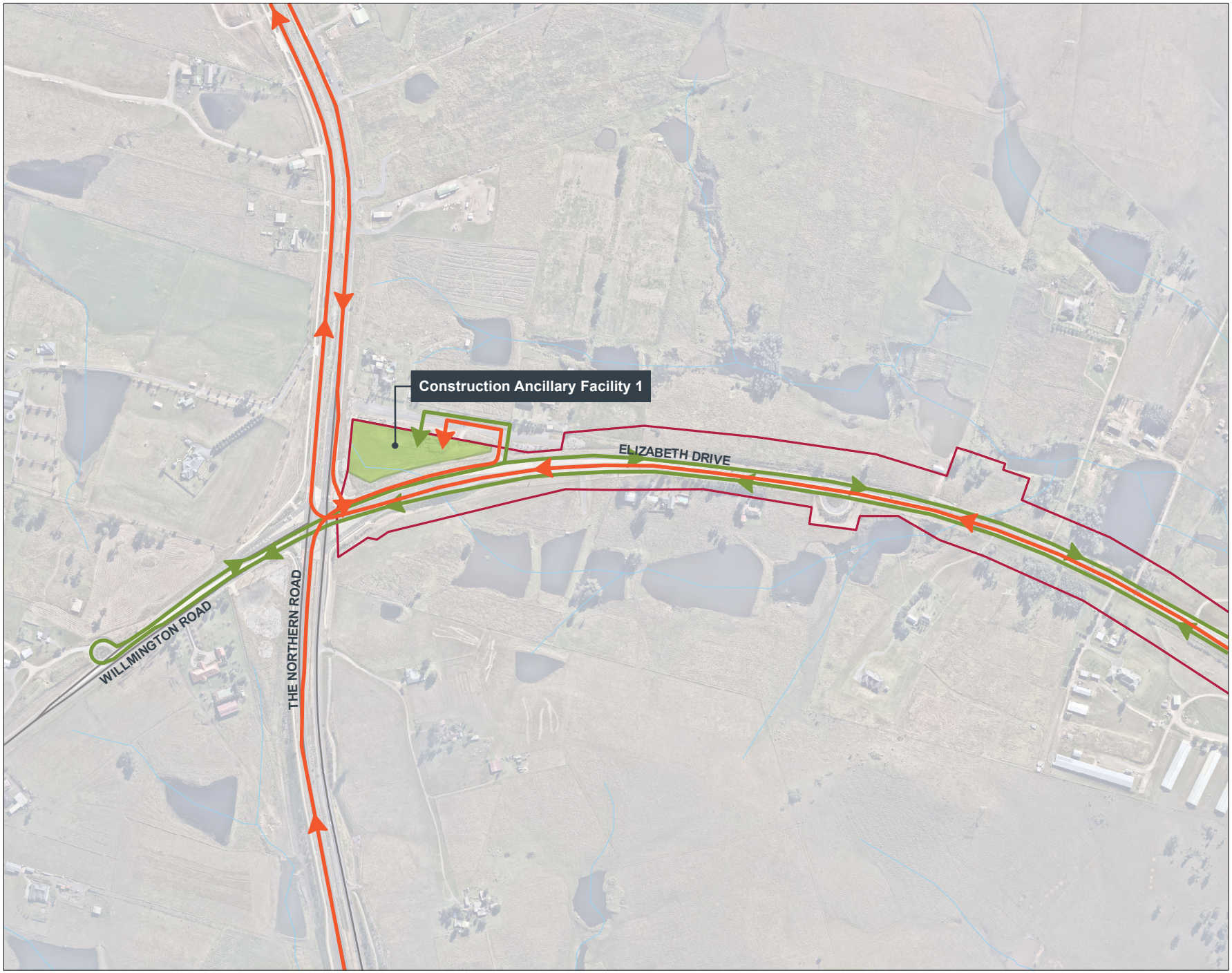
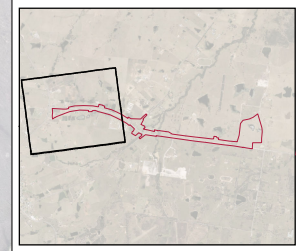


FIGURE 3-11:
INDICATIVE CONSTRUCTION HAULAGE ROUTE - ANCILLARY FACILITY 1

N

0 100 200 m



Legend

- Construction footprint
- Construction ancillary facility
- Drainage line

Haulage Route Options

- Site 1 - Option 1
- Site 1 - Option 2

Source: Imagery © Nearmap 2022.

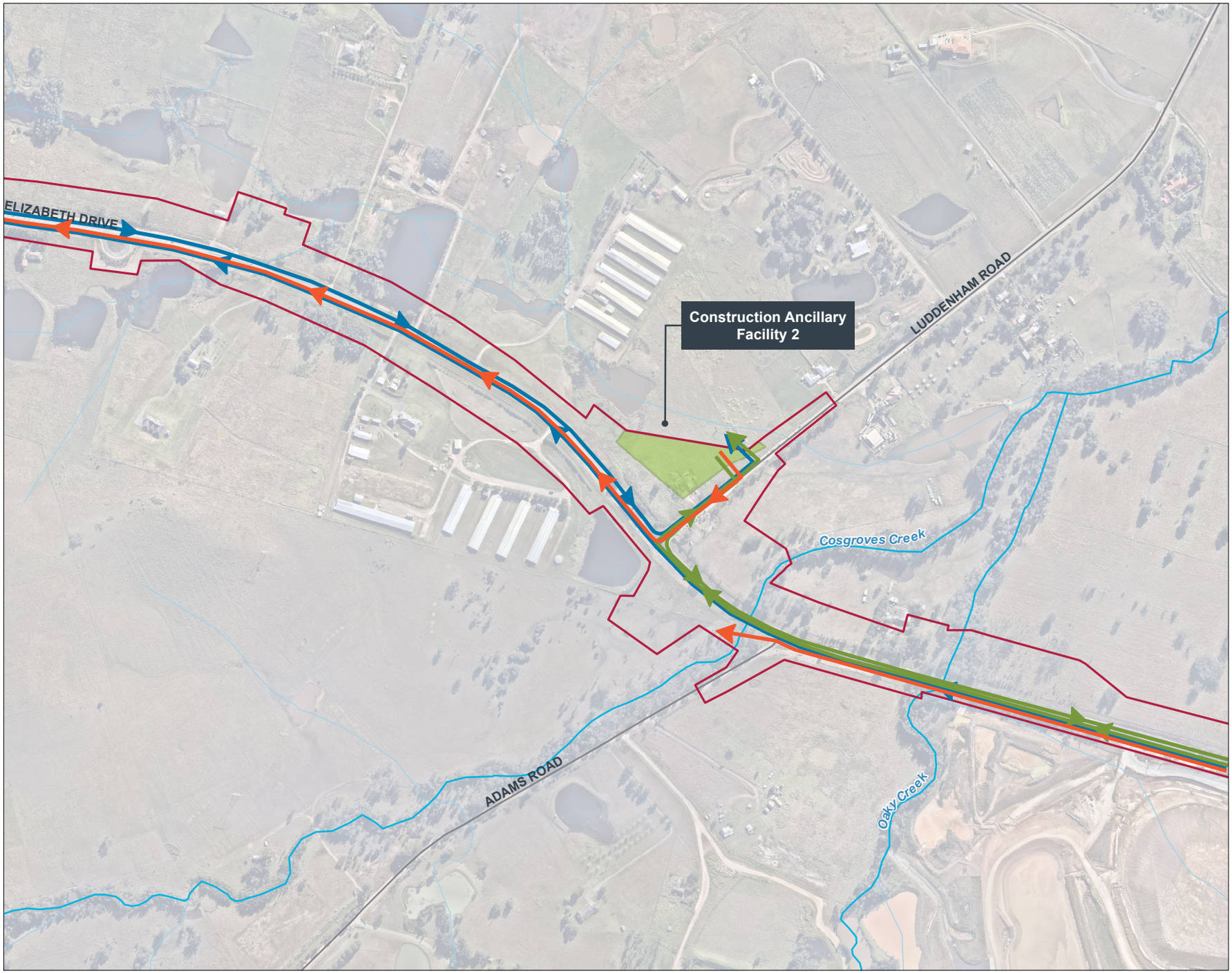


FIGURE 3-12:
INDICATIVE CONSTRUCTION HAULAGE ROUTE - ANCILLARY FACILITY 2

N

0 100 200 m

Legend

- Construction footprint
- Construction ancillary facility
- Watercourse
- Drainage line

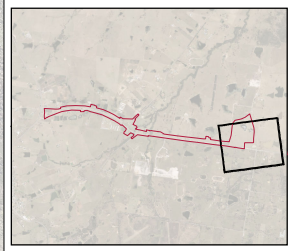
Haulage Route Options

- Site 2 - Option 1
- Site 2 - Option 2
- Site 2 - Option 3

FIGURE 3-13:
INDICATIVE CONSTRUCTION HAULAGE ROUTE - ANCILLARY FACILITY 3

N

0 60 120 m



Legend

- Construction footprint
- Construction ancillary facility
- Drainage line

Haulage Route Options

- Site 3 - Option 1

3.3.17 Construction traffic management

Traffic management measures would be implemented at various stages of the proposal in accordance with Traffic Control at Work Sites (Transport for NSW, 2022) and the measures described in Section 6.2. These measures would be specified in the Traffic Management Plan (TMP) for the construction of the proposal and could include:

- Modification of lane widths to facilitate the safe entry, exit and movement of plant and materials, and to allow for construction staging of work near existing roads
- Placement of separation barriers to protect road users and construction personnel
- Temporary reduced speed limits and lane closures on the existing Elizabeth Drive
- Temporary directional and advisory signs, along with VMS.

Traffic management measures would vary at each location and are indicative only. Final construction methods and sequencing would be refined by the construction contractor to minimise traffic and transport impacts. However, traffic impacts would be unavoidable during some construction activities, and may occur as a result of the following:

- Intersection and tie in activities of the main alignment to existing roads
- Pavement construction along Elizabeth Drive and connecting roads
- Construction of the bridge over Cosgroves Creek and culvert over Oaky Creek.

Further details of potential construction traffic impacts and proposed traffic management measures are provided in Section 6.2.

3.3.18 Property access

Property access would be maintained as far as practicable during the construction period; however, temporary disruptions to private property access would be required to facilitate certain construction activities. Any planned disruptions to property access would be subject to engagement with the affected property owner, with alternative access arrangements provided where possible. Construction of the proposal would not affect access to the WSA.

Property access points impacted from the opposite direction of travel by the proposed central median would be re-established as left-in / left-out access only during operation.

3.3.19 Construction plant and equipment

Construction plant and equipment required for the proposal would be confirmed during detailed design and construction planning. Indicative plant and equipment likely to be used for various construction activities is summarised in Table 3-6.

Table 3-6 Indicative construction plant and equipment

Construction activity	Indicative plant and equipment
Earthworks – clearing and grubbing	Graders, excavators, articulated dump trucks, bulldozers, watercarts, mulchers, chainsaws
Earthworks – strip topsoil	Elevating scrapers, graders, excavators, trucks, watercarts
Earthworks – bulk excavation	Bulldozers, front end loaders, off-road dump trucks, excavators (including hammers), graders, watercarts
Earthworks – levelling and material haulage	Graders, vibrating padfoot rollers, vibrating smooth drum rollers, excavators, dump trucks, truck and dogs, watercarts
Road pavement	Paving machines, rollers, truck and dogs
Bridges	Piling rigs, mobile cranes, excavators, telehandlers, concrete pumps and finishers, water pumps

3.3.20 Source and quantity of materials

Indicative quantities of materials required for the proposal are shown in Table 3-7.

Construction work would require (but not limited to) the materials listed in Table 3-7. The exact quantities of materials required would be confirmed during detailed design and construction planning. Where practicable, local suppliers who meet Transport's established pre-qualification requirements would be used to source construction materials.

In addition to construction materials, the following would be required:

- Importation of about 124,100 cubic metres of fill (refer to Section 3.3.7). Preference would be given to sourcing this fill from other local and regional construction projects with surplus fill meeting quality and geotechnical requirements
- Construction water, with total volume requirements dependent on final construction methodology and weather conditions during construction. Preference would be given to re-using site runoff, or sourcing water from the local water supply system.

Table 3-7 Indicative quantities of materials required for the proposal

Materials	Indicative quantity
Road base for the construction of a flexible road surface	4,100 cubic metres
Asphalt	4,000 tonnes
Precast concrete elements for drainage construction (culverts, pits and headwalls) and miscellaneous work	1,000 tonnes
Structural steel	1,700 tonnes
Conduits, pits, cables and pipes	28,800 metres
Bridge materials (concrete)	78,600 tonnes
Bridge materials (steel reinforcement)	6,200 tonnes
Line marking, raised reflective pavement markers and signs	Paint – for an area of about 8,900 square metres Reflective markers – about 3,300 markers Signs – about 150 signs
Safety barriers	Steel post/ rail – for a length of about 1,100 metres Wire rope – for a length of about 4,300 metres Concrete – for a length of about 4,000 metres
Steel for barrier railings and reinforcement in concrete	6,400 tonnes
Concrete for drainage construction, road surface construction, and miscellaneous work such as barrier kerbs, paving, kerbs and gutters and signpost footings	8,900 tonnes

3.4 Property acquisition and temporary leases

Based on the concept design and subject to negotiations, acquisition or temporary lease of lots would be carried out by Transport. This is indicatively expected to include partial acquisition of 18 properties. Of these 18 properties, three would also be subject to a temporary lease to accommodate a construction ancillary facility.

These properties are shown in Figure 3-14. A complete list of affected properties, including details of the proposed acquisition, is provided in Appendix C (Property acquisition).

All property acquisition would be undertaken in accordance with the following:

- *Land Acquisition (Just Terms Compensation) Act 1991* (the Just Terms Act)
- Land Acquisition Information Guide (Roads and Maritime Services, 2014)

- Property Acquisition Policy (Transport for NSW, 2021)
- Property acquisition standards developed by the NSW Government that focus on fairness, access to information and assistance, consistency and transparency
- Land acquisition reforms announced by the NSW Government in 2016
- Recommendations of the Auditor General's 2021 review of Transport's acquisition practices

These requirements ensure consistent and equitable dealings with all landowners whose lots are to be acquired. Information about acquisitions under the Just Terms Act can be viewed online at: Property acquisition in NSW. Information about Transport for NSW's approach to the acquisition process is provided at: Land acquisition information guide.

During the proposal, Transport may, at its absolute discretion, purchase residential properties that are not within the operational footprint, where landowners are able to demonstrate and meet the criteria for exceptional hardship, in accordance with the Exceptional Hardship Land Purchase Guideline (Roads and Maritime Services, 2016).

Transport's preference is to acquire land by negotiated agreement; however, a compulsory acquisition process may be required if agreement cannot be reached or is otherwise necessary.

Compensation payable pursuant to Section 55 of the Just Terms Act generally includes, among other things, provisions for market value, special value, severance, disturbance items (such as reasonable legal costs, valuation fees, relocation and removal expenses, and mortgage costs (i.e. fees associated with the discharge of mortgages and creation of a new mortgage where relocation is required)) and disadvantage resulting from relocation.

Depending on the individual circumstances of each lot and the potential impacts of the proposal, compensation may take the form of compensation or land/works, as agreed by the parties.

Property acquisition requirements would be further refined during detailed design, and consultation would be carried out with affected landowners regarding proposed changes to the property (including any adjustments and acquisition).

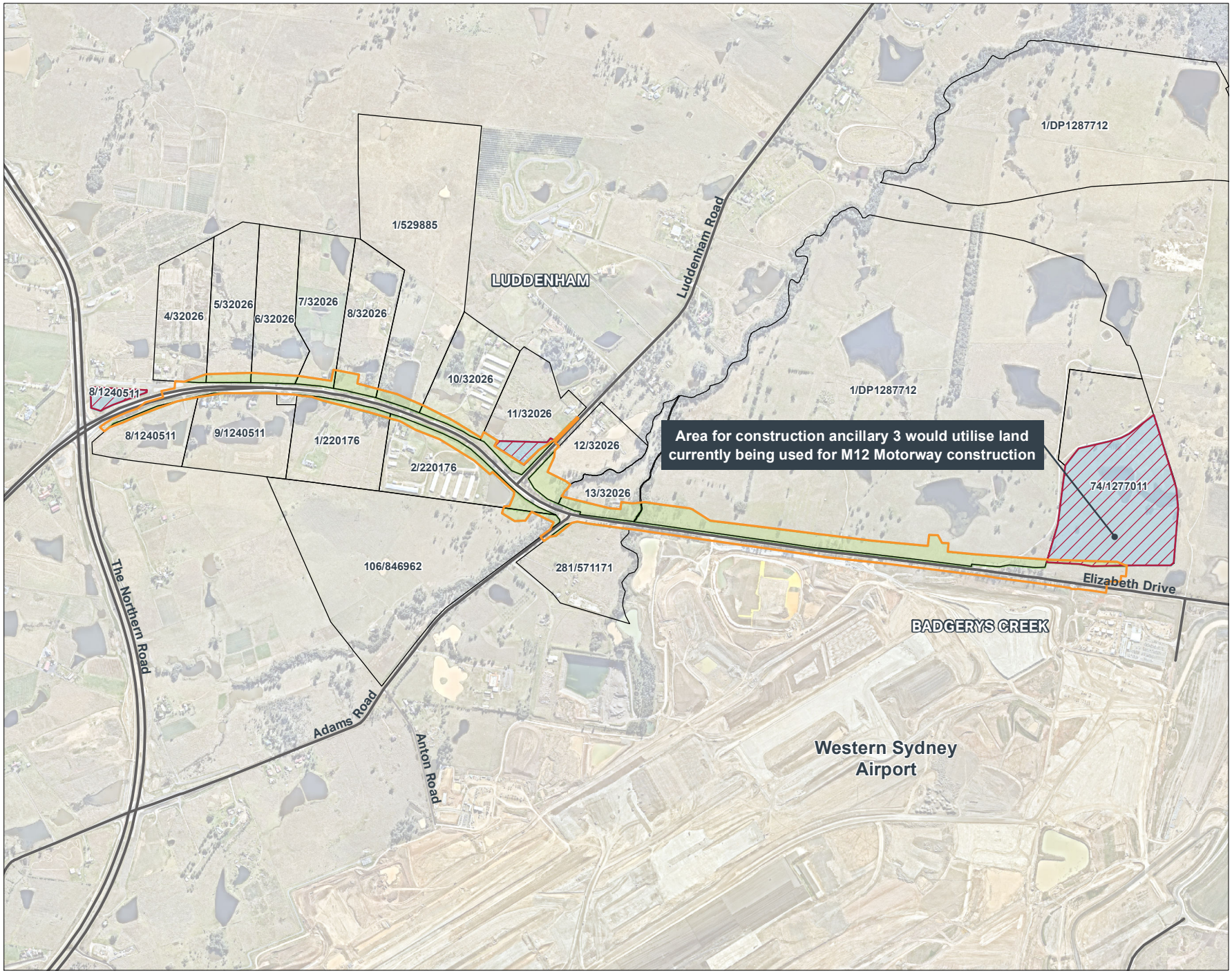


FIGURE 3-14:
PROPERTY ACQUISITION AND TEMPORARY LEASES FOR THE PROPOSAL

N

0 250 500 m

Legend

- Operational footprint
- Construction ancillary facility
- Property boundary
- Primary road
- Local road

Property Acquisition

- Partial Acquisition
- Lease

4. Statutory and planning framework

This chapter provides the statutory and planning framework for the proposal and considers the provisions of relevant state environmental planning policies, local environmental plans and other legislation.

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 2.109 of the Transport and Infrastructure SEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for road and road infrastructure facilities and is to be carried out by Transport as a public authority, it is permissible without development consent and can be assessed under Division 5.1 of the EP&A Act.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* (NPW Act) and does not require development consent or approval under State Environmental Planning Policy (Resilience and Hazards 2021) Chapter 2 Coastal management, State Environmental Planning Policy (Planning Systems) 2021 Chapter 2 State and regional development, State Environmental Planning Policy (Precincts – Regional) 2021 Chapter 2 State significant precincts.

Part 2.2 of Transport and Infrastructure SEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Chapter 5 (Consultation) of this REF outlines the consultation carried out in accordance with the requirements of the Transport and Infrastructure SEPP.

State Environmental Planning Policy (Precincts – Western Parkland City) 2021

The State Environmental Planning Policy (Precincts – Western Parkland City) 2021 (WPCSEPP) contains planning provisions for precincts which are located within the Western Parkland City. The WPCSEPP came into effect in March 2022 and consolidated several existing State Environmental Planning Policies for precincts within the Western Parkland City.

Chapter 4 (Western Sydney Aerotropolis) of the WPCSEPP sets out planning controls to enable land within the Western Sydney Aerotropolis to be developed for aviation services, and to facilitate development in the Western Sydney Aerotropolis in accordance with the Western Sydney Aerotropolis Plan.

The proposal is located entirely on land subject to WPCSEPP. Under clause 4.4 (2) of the WPCSEPP, the provisions of *Liverpool Local Environment Plan* (LEP) *2008* and *Penrith LEP 2010* do not apply to land affected by the proposal.

The Western Sydney Aerotropolis, as defined in the WPCSEPP, comprises nine precincts. The WPCSEPP establishes a number of precinct plans for the Western Parkland City, of which the proposal would traverse the Agribusiness Precinct and the Northern Gateway. These precincts would evolve from existing agricultural land uses to employment-oriented land uses as the Western Sydney Aerotropolis develops.

Land within these precincts is currently zoned as follows under the WPCSEPP (refer to Figure 4-1):

- ENZ – Environment and recreation
- ENT – Enterprise
- SP2 – Infrastructure
- AGB – Agribusiness.

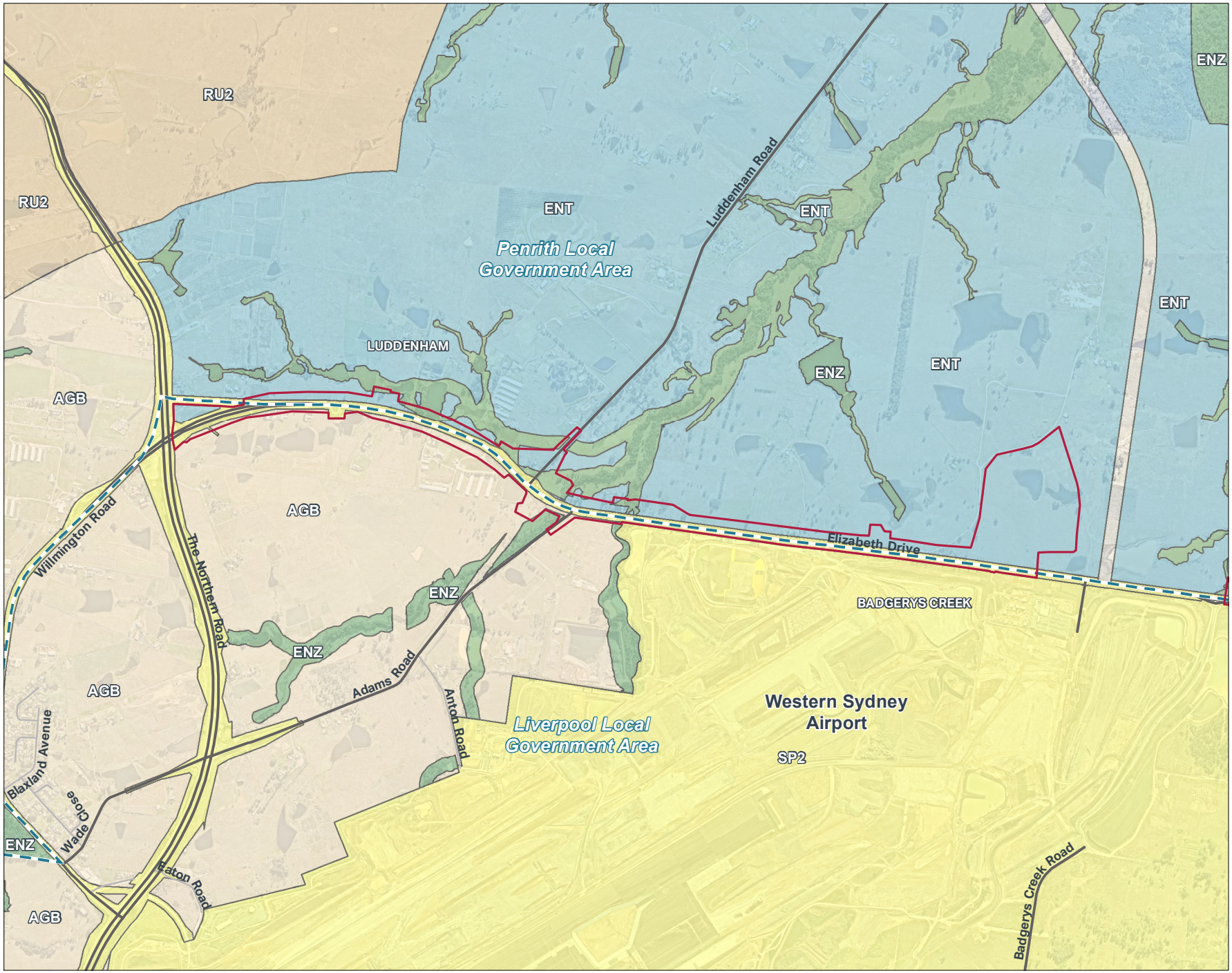


FIGURE 4-1:
LAND USE ZONES WITHIN AND AROUND THE PROPOSAL AREA

N

0 250 500 m

Legend

- Construction footprint
- LGA boundary
- Primary road
- Local road

SEPP (Precincts – Western Parkland City) 2021 – Chapter 4 Western Sydney Aerotropolis

- AGB Agribusiness
- ENZ Environment and Recreation
- ENT Enterprise
- SP2 Infrastructure

Penrith City Council LEP

- RU2 Rural Landscape

Table 4-1 identifies the objectives for each of the Western Sydney Aerotropolis land zones within the construction footprint and considers the consistency of the proposal with those objectives of each zone. The property and land use impacts of the proposal are discussed in Section 6.6.

Roads are permissible with development consent under all zones. However, as noted above, the Transport and Infrastructure SEPP operates to remove these consent requirements.

Table 4-1 Relevant WPCSEPP land use zone objectives

Land use zone	Land use zone objectives	Key proposal elements within land use zone	Comment
Chapter 4 – Western Sydney Aerotropolis			
ENZ: Environment and Recreation	• To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values • To protect the ecological, scenic and recreation values of waterways, including the Wianamatta-South Creek and its tributaries • To provide a range of recreational settings and activities and compatible land uses • To protect and conserve the environment, including threatened and other species of native fauna and flora and their habitats, areas of high biodiversity significance and ecological communities	Portions of the construction and operational footprint along the road alignment (including construction ancillary facility 2, and land for road widening, shared walking and cycling paths and drainage infrastructure)	The proposal would result in a permanent change to a small portion of this land use, to a transport infrastructure corridor. While this would remove the ability of the land to be developed as per the zone objectives, the proposal is permissible without consent under the Transport and Infrastructure SEPP. Further, the proposal has been designed to avoid environmental impacts where possible, and would also include safeguards so that impacts to ecological, scientific, cultural and aesthetic values within this land use zone are appropriately managed and mitigated where possible
ENT: Enterprise	• To encourage employment and businesses related to professional services, high technology, aviation, logistics, food production and processing, health, education and creative industries • To provide a range of employment uses (including aerospace and defence industries) that are compatible with future technology and work arrangements • To encourage development that promotes the efficient use of resources, through waste minimisation, recycling and re-use • To ensure an appropriate transition from non-urban land uses and environmental conservation areas in surrounding areas to employment uses in the zone • To prevent development that is not compatible with or that may detract from the future commercial uses of the land • To provide facilities and services to meet the needs of businesses and workers.	Portions of the construction and operation footprint along the road alignment and portions of the operational footprint (including construction ancillary facilities 1, 2 and 3; and land for road widening, shared walking and cycling paths, a new bridge over Cosgrove Creek, and drainage infrastructure)	The proposal would be consistent with these objectives, providing transport infrastructure to support development of a range of enterprises and providing access for workers from the local and wider area. Further, the proposal would complement the WSA being a 24-hour transport hub by providing an upgraded road corridor with improved connectivity

Land use zone	Land use zone objectives	Key proposal elements within land use zone	Comment
SP2: Infrastructure	• To provide for infrastructure and related uses • To prevent development that is not compatible with or that may detract from the provision of infrastructure • To facilitate development that is in keeping with the special characteristics of the site or its existing or intended use and that minimises adverse impacts on surrounding land	Most of the land within the construction footprint is zoned 'SP2: Infrastructure' for use as a classified road (Elizabeth Drive)	The proposal would be consistent with the land zone objectives, providing road and road infrastructure facilities and improved connectivity
AGB: Agribusiness	• To encourage diversity in agribusiness, including related supply chain industries and food production and processing that are appropriate for the area • To encourage sustainable and high technology agribusiness, including agricultural produce industries • To enable sustainable agritourism • To encourage development that is consistent with the character of Luddenham village • To maintain the rural landscape character and biodiversity of the area	A small portion of the construction and operational footprint to the south of Elizabeth Drive	The area of land for grazing would be decreased; however, this would be a small portion of the construction footprint. The proposal would support the transition to high intensity agribusiness land uses and facilitate freight movements of produce and goods to and from the WSA and wider Sydney

State Environmental Planning Policy (Resilience and Hazards) 2021

The *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP) aims to promote the remediation of contaminated land or reduce the risk of harm to human health or any other aspect of the environment. It also aims to promote an integrated and coordinated approach to land use planning in the coastal zone, consistent with the objects of the *Coastal Management Act 2016.*

The Resilience and Hazards SEPP establishes two categories of remediation work: Category 1 remediation work and Category 2 remediation work. In accordance with clause 4.13 (1), "a person who proposes to carry out a Category 2 remediation work on any land must give notice of the proposed work to the council for the local government area in which the land is situated" at least 30 days before the work.

A number of current and former land uses may have resulted in contamination of soils and groundwater, including the use of pesticides and fertilisers. Although no obvious signs of contamination were detected during the desktop review and site inspection, uncontrolled use of fill which is potentially contaminated is anticipated to have occurred in the construction footprint (eg during the construction of Elizabeth Drive, as well as for construction of farm dams and other activities). Uncontrolled fill may contain contaminants of potential concern such as asbestos, heavy metals, fly tipped waste or pesticides. Although there have been no obvious observations of gross contamination during the site inspection, this gap represents a moderate risk and would be confirmed via the preparation of a Detailed Site Investigation (Phase 2 Contamination Assessment). Further detail on potential contamination risk is provided in Section 6.11.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

Chapter 6 (Water catchments) of the *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (Biodiversity and Conservation SEPP) includes controls related to water catchments for the Georges River catchment, Hawkesbury-Nepean catchment, Sydney Harbour catchment and Sydney drinking water catchment. The Hawkesbury-Nepean catchment as defined in the SEPP applies to land within the Liverpool and Penrith LGAs including the construction footprint.

Chapter 6 (Water Catchments), Part 6.2, Division 2 of the Biodiversity and Conservation SEPP sets general controls for consideration by consent authorities assessing a development on land in a regulated catchment, including the Hawkesbury-

Nepean Catchment. Appendix D (State Environmental Planning Policy (Biodiversity and Conservation) 2021, Chapter 6 considerations) provides a summary of how these controls have been considered in the development of the proposal.

Chapter 6 (Water Catchments), Part 6.2, Division 3 of the Biodiversity and Conservation SEPP also includes controls for development in specific areas. Of relevance to the proposal, these areas include areas within 100 metres of a natural water body, and the Hawkesbury-Nepean conservation area sub-catchments. Appendix D (State Environmental Planning Policy (Biodiversity and Conservation) 2021, Chapter 6 considerations) provides a summary of how these controls have been considered in the development of the proposal.

The proposal is not located within the Foreshores and Waterways Area Boundary of the SEPP (Biodiversity and Conservation); therefore, the planning principles for the land within the Foreshores and Waterways Area, set out under Part 6.3 of the SEPP (Biodiversity and Conservation) do not apply to the proposal.

Chapter 13 (Strategic conservation planning) of the Biodiversity and Conservation SEPP is a key statutory mechanism to implement strategic conservation planning. The chapter outlines development controls to be considered in the development of the proposal. The development controls apply to land identified as 'Avoided land', 'Certified urban capable land' and 'Excluded land', as outlined in the CPCP. The applicability of the Biodiversity and Conservation SEPP to the proposal is further discussed in Section 4.1.3.

4.1.2 Western Sydney Aerotropolis Development Control Plan 2022

The Western Sydney Aerotropolis Development Control Plan (DCP) 2023 Phase Two (DPE, 2022) was finalised in November 2022. It supports the ongoing implementation of the Aerotropolis Precinct Plan by providing controls to guide development across the initial precincts for growth, namely the Aerotropolis Core, Badgerys Creek, Wianamatta-South Creek, Agribusiness and Northern Gateway Precincts.

While the proposal is partially situated within the application area of the DCP, the proposal would be assessed under Division 5.1 of the EP&A Act, and the DCP does not apply. However, the proposal would aim to support the provisions and objectives of the DCP where relevant and possible, which would be further considered during detailed design. Support and consideration of the DCP has been demonstrated through the selection of an indicative plant species list for the proposal (refer to Appendix K (Urban Design, Landscape Character and Visual Impact Assessment) and Section 6.8). These plant species have been selected due to their appropriateness for use within the region, including land inside the Western Sydney Parkland Commitment Areas, and beyond the three kilometre wildlife buffer to avoid the likelihood of bird strike (as outlined in the DCP).

4.1.3 Cumberland Plain Conservation Plan 2022

The CPCP identifies strategically important biodiversity areas within the Cumberland subregion to offset the biodiversity impacts of future urban development in the Western Parkland City.

The CPCP has been developed to meet requirements for strategic biodiversity certification under the BC Act and strategic assessment under the EPBC Act. At the time of this assessment the Commonwealth approval for the CPCP under Part 10 of the EPBC Act has not been granted. Part 2 of the Infrastructure Guidelines is not currently in effect and all impacts to avoided land must seek their own approvals under the EPBC Act if required.

The CPCP provides the biodiversity approvals required for new development in four nominated areas in Western Sydney and also supports the delivery of major transport infrastructure across the region. The construction footprint resides within the nominated area of the Western Sydney Aerotropolis.

The CPCP aims to achieve this through a conservation program that includes 26 commitments designed to improve ecological resilience and protect biodiversity. The commitments would be implemented over the life of the plan (to 2056) through a series of planned and managed actions.

The CPCP has identified land categories that would be certified for development under the BC Act, or where approval for development is to be sought under the EPBC Act. An overview of these land categories and the applicability to the proposal is provided below, and shown on Figure 4-2.

In accordance with Section 1.6 of the 'Cumberland Plain Conservation Plan: Guidelines for Infrastructure Development' (the infrastructure guidelines) (August 2022), the CPCP would apply to the proposal, however, would not be considered as 'essential infrastructure'.

Avoided land

This category identifies land with high biodiversity values that would be protected and is, therefore, not certified for future urban development. As the development is not considered 'essential infrastructure development' and would not be consistent

with Section 3.1 of the infrastructure guidelines, due to an encroachment of the construction footprint on a section of avoided land, it must be assessed against the BC Act, and approval sought under the EPBC Act if required.

The Environmental Protection and Assessment Regulation (EP&A Regulation) 2021, Section 201A requires notification to be provided to the Planning Secretary for activities impacting avoided land. This notification must conclude whether the project is consistent with the CPCP. The notification must be given within 30 days of determination. Transport will notify the Planning Secretary in accordance with these requirements.

The construction footprint intersects with the avoided land category within the riparian vegetation zones of Cosgroves Creek and Oaky Creek (refer to Figure 4-2), and as outlined above, is not considered 'essential infrastructure' and therefore, would be assessed against Section 3.1.2 of the infrastructure guidelines and relevant requirements of the BC Act, with approval sought under the EPBC Act, if required.

Table 4-2 provides a summary of the assessment of the proposal against Section 3.1.2 of the infrastructure guidelines. Further detail is provided in Section 5.5 of Appendix G (Biodiversity Assessment Report).

Table 4-2 Assessment against Section 3.1.2 of the CPCP infrastructure guidelines

Section 3.1.2 Biodiversity matters	Assessment against proposal
For all other activities to which these guidelines apply, the activity must: 1. Avoid an adverse impact on threatened ecological communities, threatened species and their habitats, both on the site of the activity and on adjoining land that is avoided land.	Design development to date has sought to avoid impacts to avoided land, however, due to the nature and objectives of the proposal, impacts to two BC Act entities within 'excluded land' (which is defined below) are unable to be avoided. Impacts to these entities would be offset in accordance with the no net-loss objective of the Biodiversity Offset Scheme (refer further to Section 6.3)
2. Avoid an adverse impact on habitat connectivity and fauna movement, including koala and wildlife corridors, both on the site of the activity and on adjoining land that is avoided land	The primary connectivity features within the construction footprint are those areas of native vegetation associated with Cosgroves Creek and Oaky Creek. Oaky Creek terminates in the site of the WSA, south of the construction footprint, while vegetated areas of Cosgroves Creek continue south for around 1.3 kilometres before terminating in private property. Given this context, habitat connectivity through the construction footprint is not used to access substantive areas of habitat in either direction and, therefore, has limited function as a fauna movement corridor. Common species, such as macropods, are most likely to use this corridor, and given their mobility are likely to still do so following the construction of the proposal. The study area for the biodiversity assessment does not contain a recognised fauna corridor or a corridor for Koala, protected under the CPCP.
3. Avoid an adverse impact on the integrity and resilience of the biophysical, ecological, and hydrological environments, including surface and groundwater, and the quality of the natural flow of water in a riparian corridor	It is not anticipated that the proposal would adversely impact upon components listed in this criterion, and in the case of surface water quality, is likely to have a beneficial effect post-construction via improvement of the current stormwater system
4. Avoid an adverse impact on Matters of National Environmental Significance (MNES) referred to in Chapter 2, Part 3, Division 1 of the EPBC Act	Assessments of significance have been carried out for Matters of National Environmental Significance (MNES) under the EPBC Act. A significant impact to any MNES is not considered likely. Further details of the assessments of significance under the EPBC Act are provided in Appendix G (Biodiversity Assessment Report)
5. Install temporary koala-exclusion fencing before construction in areas identified as koala habitat protected by the CPCP and maintain the integrity of any existing koala-exclusion fencing	No koala habitat mapped and protected by the CPCP is present within the construction footprint or study area for the biodiversity assessment (refer to Section 6.3). As such, this criterion does not apply

Section 3.1.2 Biodiversity matters	Assessment against proposal
6. Design linear infrastructure to include appropriate access treatments such as gates or koala bridges to ensure the integrity and connectivity of koala corridors and habitat protected under the CPCP is maintained.	No koala habitat mapped and protected by the CPCP is present within the construction footprint or study area for the biodiversity assessment (refer to in Section 6.3). As such, this criterion does not apply

Certified – urban capable land

This category identifies land where future urban development can occur, subject to other development approvals. Development in these areas does not require further site by site biodiversity assessment under the EPBC Act and BC Act, if consistent with the CPCP's biodiversity approvals, which includes application of the CPCP's mitigation measures.

The construction footprint intersects with small patches of this land category in multiple locations, as outlined in Figure 4-2. The proposal would address mitigation requirements outlined in Section 3.3 of the infrastructure guidelines, and therefore would not require further site by site biodiversity assessment. Furthermore, under Section 8.4 (5) of the BC Act, a determining authority under Part 5 of the EP&A Act is not required to consider the effect on biodiversity, of an activity to be carried out on biodiversity certified land.

Section 9.3 of Appendix G (Biodiversity Development Assessment Report) provides detail on how the proposed safeguards and management measures would address the mitigation requirements in Section 3.3 of the infrastructure guidelines.

Excluded land

This category identifies land that has been excluded from the CPCP and for which NSW strategic biodiversity certification and approval through the federal strategic assessment process would not be sought. The construction footprint largely resides within this land category, within the existing Elizabeth Drive road corridor as outlined in Figure 4-2. The infrastructure guidelines do not apply to activities conducted on excluded land.

Summary

The CPCP and infrastructure guidelines would apply to the proposal, as the construction footprint would intersect with the land categories: 'avoided areas' and 'certified-urban capable land'. The proposal would be assessed against Section 3.1.2 and Section 3.3 of the infrastructure guidelines, relevant requirements of the BC Act, and approval sought under the EPBC Act, if required.

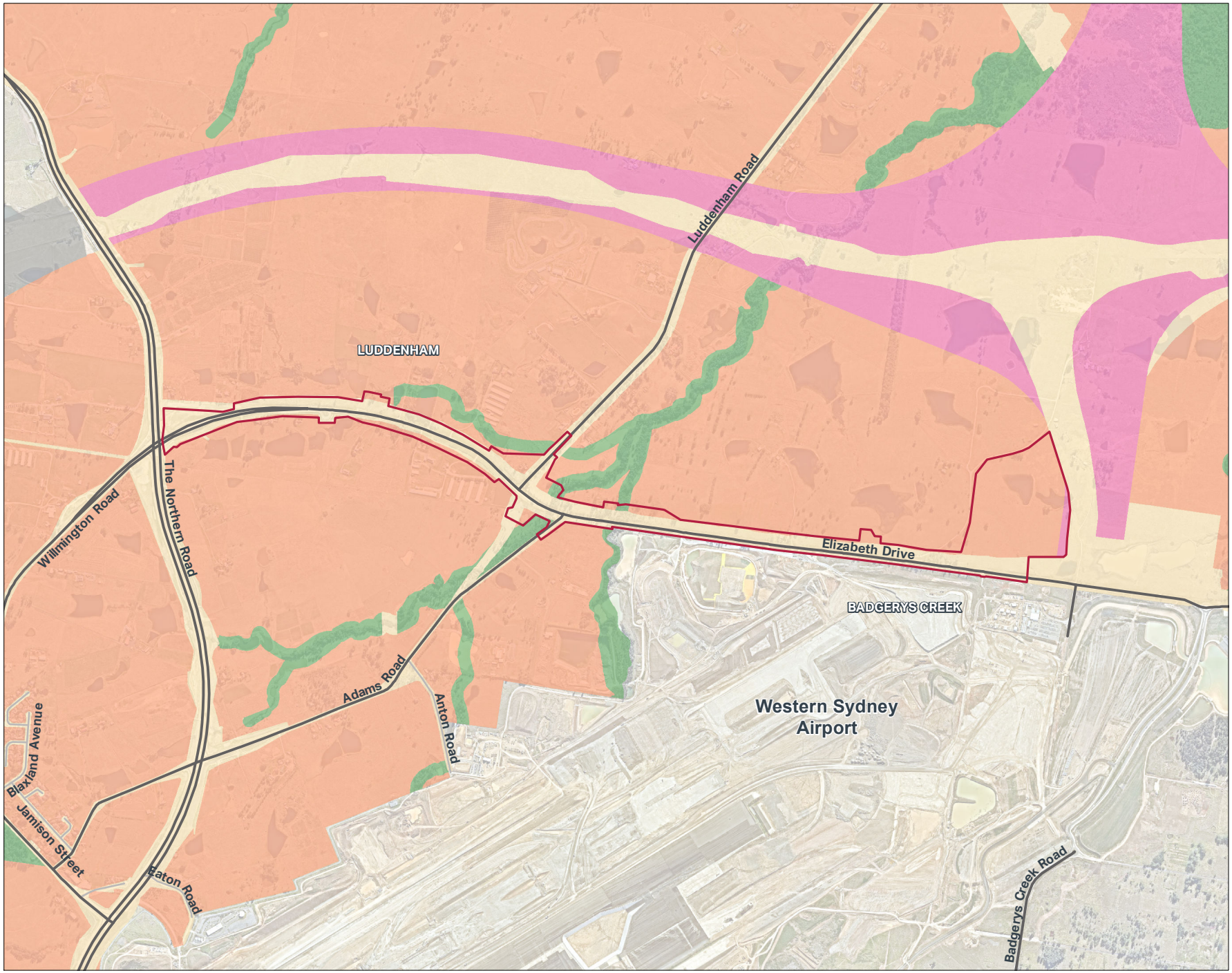


FIGURE 4-2:
CUMBERLAND PLAIN CONSERVATION PLAN LAND CATEGORIES WITHIN THE PROPOSAL AREA

N

0 250 500 m

Legend

- Construction footprint
- Primary road
- Local road

Land Category

- Avoided land
- Certified - major transport corridor
- Certified - urban capable land
- Excluded land
- Major transport corridor (strategically assessed only)

4.1.4 Local Environmental Plans

The proposal is located within the Penrith and Liverpool LGAs. The proposal is partially located on land subject to the WPCSEPP (considered in Section 4.1.1); therefore, the Liverpool LEP 2008 and Penrith LEP 2010 do not apply within these areas.

Further to the above, and where the construction footprint encroaches into the Penrith and Liverpool LGAs, as discussed in Section 4.1.1, clause 2.109 overrides the requirement for development consent. The consent requirements of each Council, therefore, do not apply to the proposal.

4.2 Other relevant NSW legislation

4.2.1 Roads Act 1993

The *Roads Act 1993* (Roads Act) provides for the operation, maintenance and use of roadways in NSW.

Elizabeth Drive is a classified State road, and the proposal also includes unclassified regional roads (Luddenham Road and Badgerys Creek Road), and local roads (Adams Road and Taylors Road).

Section 138 of the *Roads Act 1993* (Roads Act) relates to works and structures, whereby *a person must not erect a structure or carry out a work in, on or over a public road… otherwise than with the consent of the appropriate road's authority*. Under the Roads Act, Transport is the roads authority for 'classified roads' and local governments are the roads authority for 'non-classified roads.'

Under section 72 (1b) Transport can carry out works on unclassified roads if the proposed activity would be of benefit to classified roads in the vicinity of the road in which works are carried out (the proposal). Therefore, road authority consent is not required for the proposal.

Under Section 143 of the Roads Act, a roads authority can use a public road in the exercise of a function conferred by the Roads Act, so long as the function is exercised in a way that will not unduly interfere with the rights of passage and access that exist with respect to the public road. As outlined in Section 6.2, there would be short-term impacts to traffic movements on Elizabeth Drive and surrounding local roads during construction of the proposal; however, safe access would be maintained throughout the construction period.

4.2.2 Crown Lands Management Act 2016

The *Crown Land Management Act 2016* provides a framework for Crown land administration and management, outlining the permissions and authorisation requirements for development activities on Crown Land.

A search of NSW Government Sharing and Enabling Environmental Data (SEED) mapping indicated that there is no Crown land within the construction footprint.

4.2.3 Biodiversity Conservation Act 2016

The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community consistent with the principles of ecologically sustainable development.

Under Part 2 of the BC Act it is an offence to harm animals and plants; damage areas of outstanding biodiversity value; or damage habitat of threatened species or ecological communities. Under Part 2, Division 2 of the BC Act it is a defence to a prosecution if the harm or damage was necessary for the carrying out of an activity under Division 5.1 of the EP&A Act.

Section 7.3 of the BC Act states that a test should be used to determine whether a proposed development or activity is 'likely to significantly affect threatened species'. Section 7.8 specifies that if an activity under Division 5.1 of the EP&A Act is likely to significantly affect threatened species, then a Species Impact Statement (SIS) or a Biodiversity Development Assessment Report (BDAR) is required to be prepared.

An assessment of the potential impacts to biodiversity and measures to manage potential impacts are discussed in Section 6.3. The assessment found that the proposal is likely to have a significant impact on threatened species under the BC Act and, therefore, a BDAR has been prepared for the proposal.

Further to Section 4.1.3, biodiversity certification under Part 8 of the BC Act is being sought as part of the strategic biodiversity certification of four nominated areas. Biodiversity certification would apply to the land categories mapped under the CPCP as 'Certified-urban capable land' and 'certified-major transport corridors'. As outlined in Section 4.1.3, the construction footprint intersects with small patches of the CPCP land category of 'Certified – urban capable land'.

Under Section 8.4 (5) of the BC Act, a determining authority under Part 5 of the EP&A Act is not required to consider the effect on biodiversity, of an activity to be carried out on biodiversity certified land.

4.2.4 Aboriginal Land Rights Act 1983

The *Aboriginal Land Rights Act 1983* provides land rights for Aboriginal persons and for representative Aboriginal Land Councils in New South Wales. The Act establishes Aboriginal Land Councils. Under Section 36(2) of the Act, the NSW Aboriginal Land Council may make a claim for Crown land on its own behalf or on behalf of one or more Local Aboriginal Land Councils (LALCs).

As noted in Section 4.2.2, there is no Crown land within the construction footprint, and subsequently no Aboriginal land claims related to Crown Land.

4.2.5 National Parks and Wildlife Act 1974

The NPW Act governs the establishment, preservation and management of national parks, state reserves, historic sites and certain other areas, and the protection of certain fauna, native plants and Aboriginal heritage. The NPW Act is the primary legislation for the protection of Aboriginal cultural heritage in NSW. The NPW Act gives the Minister for Environment and Heritage responsibility for the proper care, preservation and protection of 'Aboriginal objects' and 'Aboriginal places'. Section 86 of the NPW Act identifies offences relating to the harm of Aboriginal objects or places. An Aboriginal Heritage Impact Permit (AHIP) issued under section 90 of the NPW Act is required if impacts to Aboriginal objects and/or places cannot be avoided.

Potential impacts to Aboriginal cultural heritage as a result of the proposal have been assessed in accordance with Stage 3 of the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) and Heritage NSW's *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (NSW Roads and Maritime Services, 2011).

Transport has prepared a Stage 3 PACHCI assessment for the proposal, which has assessed the significance of the proposal's Aboriginal heritage impact, as well as informed the mitigation measures for the proposal.

One Aboriginal archaeological site identified within the construction footprint is anticipated to be directly impacted by the proposal. An AHIP would be required for Aboriginal archaeological sites that are impacted by the proposal. A summary of the Aboriginal cultural heritage assessment (Stage 3 PACHCI) carried out for the proposal is in Section 6.5.

4.2.6 Fisheries Management Act 1994

The FM Act provides for the protection of threatened fish species and marine vegetation and for the management of associated threatening processes. Part 7A Division 4 of the FM Act prohibits, without a licence or permit, activities that damage habitats or harm threatened species, populations or ecological communities. The FM Act also specifies requirements with respect to dredging, reclamation, obstruction of fish passage and waterway crossings.

The FM Act has an objective to preserve key fish habitats. The proposal would impact Cosgroves Creek and Oaky Creek which are both identified as Key Fish Habitat for the purposes of the FM Act.

Construction work required for the proposed bridge over Cosgroves Creek and culvert structures (including the installation of temporary in-stream structures) may be considered to be reclamation and/or dredging work in accordance with the definitions in section 198A of the FM Act. Section 199 of the FM Act states that a public authority is required to give the Minister for Agriculture written notice of the proposed work and consider any matter received from the Minister within 21 days of the notice. Section 219 of the FM Act makes it an offence to obstruct fish passage without a permit issued under Part 7 of the FM Act. Temporary and permanent structures for the proposal have been designed and would be installed to not obstruct fish passage. Consultation regarding the proposal would be carried out with the Department of Primary Industries regarding relevant aspects of the proposal.

While it is likely that impacts to aquatic environments associated with the proposed work would be negligible, Transport may be required to provide formal notification to the Department of Primary Industries under Section 199 of the FM Act as the study area is mapped as containing Key Fish Habitat. Nonetheless, requirements for work adjacent to Key Fish Habitat is determined on a case by case basis, and would be determined by consultation with a local fisheries officer.

4.2.7 Water Management Act 2000 and Water Act 1912

The *Water Management Act 2000* (WM Act) provides for the management of surface water and groundwater in NSW. Transport, as a public authority, is generally exempt from the provisions of the WM Act. However, access licences may be required under certain conditions.

Land impacted by the proposal is covered by the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* and the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources,* and as such the proposal is subject to the provisions of the WM Act.

Under clause 21 (1) of the *Water Management (General) Regulation 2018* (Water Management Regulation) and Schedule 4 Part 1, Transport, as a 'roads authority', is exempt from the need to obtain an access licence in relation to water required for road construction and road maintenance.

Sections 89 to 91 of the WM Act establish three types of approvals that a proponent may be required to obtain. These are water use approvals, water management work approvals (including water supply work approvals, drainage work approvals and flood work approvals) and activity approvals (including controlled activity approvals and aquifer interference approvals).

Typically a controlled activity approval would be required under section 91E(1) of the WM Act to allow for construction within 40 metres of a watercourse. However, clause 41 of the Water Management Regulation, exempts public authorities such as Transport from section 91E(1) of the WM Act in relation to all controlled activities that it carries out in, on or under waterfront land.

Under section 3.3 of the NSW Aquifer Interference Policy, the proposal is exempt from requiring an aquifer interference approval as cuttings, trenches and pipelines (intersecting the water table) would be considered as having a minimal impact on water-dependent assets, if a water access licence is not required.

The *Water Act 1912* remains relevant for aquifer interference activities such as construction dewatering as the requirement for aquifer interference approvals under the WM Act has not yet commenced. While the proposal may intercept groundwater during earthworks and excavation required, especially around Cosgrove Creek and Oaky Creek, the volume of dewatering required would be minor. A water access licence is not required. The works would be subject to an exemption under the *Water Management (General) Regulation 2018* as the water taken would likely be less than three megalitres in volume, would not be taken for consumption or supply and would be for a proposal to which Division 5.1 of the EP&A Act applies.

An assessment of the potential impacts to surface water and groundwater and measures to manage potential impacts are discussed in Section 6.9.

4.2.8 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) establishes the State's environmental regulatory framework and includes licencing requirements for certain scheduled activities. The POEO Act is administered by NSW Environment Protection Authority (NSW EPA).

Under Part 3.2 of the POEO Act, an environmental protection licence (EPL) is required for scheduled activities or scheduled development work as defined in Schedule 1 of the Act. Schedule 1, clause 35 (road construction) is relevant to the proposal. Road construction is defined by clause 35(1) as '…the construction, widening or re-routing of roads, but does not apply to the maintenance or operation of any such road'.

The proposal is considered a scheduled activity under section 35(3)(b)(ii), as it is in a metropolitan area and would result in four trafficable lanes for a continuous length of more than three kilometres. As Elizabeth Drive is classified as a main road under the *Roads Act 1993*, an EPL would be required for the proposal.

4.2.9 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) provides for the protection and conservation of NSW's environmental heritage. The Heritage Act makes provision for a place, building, work, relic, moveable object, precinct, or land to be listed on the State Heritage Register.

If an item is the subject of an interim listing, or is listed on the State Heritage Register, a person must obtain approval under section 60 of the Heritage Act for works or activities that may impact on these items. There are no items subject to a listing or interim listing on the State Heritage Register within the construction footprint or the study area for non-Aboriginal heritage.

Under section 139 of the Heritage Act, approval is also required prior to the disturbance or excavation of land if it would, or is likely to, result in a relic being discovered, exposed or damaged. Further detail on heritage impacts of the proposal is provided in Section 6.4 (in relation to non-Aboriginal heritage) and Section 6.5 (in relation to Aboriginal cultural heritage).

4.2.10 Waste Avoidance and Resource Recovery Act 2001

The purpose of the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act) is to develop and support the implementation of regional and local programs to meet the outcomes of a State-wide strategy for waste avoidance and resource recovery. It also aims to 'minimise the consumption of natural resources and final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste'. The proposal would generate waste that requires management and disposal, and safeguards would be implemented to promote the objectives of the WARR Act (refer to Section 6.14).

4.2.11 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) addresses bio-security risks, including pest animals, plants diseases and noxious weeds. Under the Biosecurity Act, all plants including weeds are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose.

The proposal has the potential to spread weeds during vegetation removal and through the movement of vehicles and machinery into or out of the construction footprint. Management measures have been recommended to manage these weed species in accordance with the requirements of the Biosecurity Act (refer to Section 6.3).

4.2.12 Contamination Land Management Act 1997

The *Contaminated Land Management Act 1997* establishes a process for investigating and remediating land where required. The Act imposes a duty on landowners to notify the EPA and potentially investigate and remediate land contamination if levels are above EPA guidelines. A search of the NSW EPA Contaminated land register on 31 January 2022 indicated that there are no previously registered contaminated lands within the construction footprint (refer Section 6.11 for the contamination assessment for the proposal).

4.2.13 Land Acquisition (Just Terms Compensation) Act 1991

The Just Terms Act 1991 applies to the acquisition of land (by agreement or compulsory process) by a public authority authorised to acquire the land by compulsory process. The proposal requires partial acquisition of land directly adjoining Elizabeth Drive and cross streets, and lease agreements with landowners for land to be used as site compounds. Details of the property acquisition required for the proposal are provided in Chapter 3 and Appendix C (Property acquisition). The final details of property acquisition needed for the proposal would be confirmed by Transport through detailed design and in consultation with those with interests in land.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These matters are considered in this REF in Appendix A (Consideration of section 171 factors and matters of national environmental significance and Commonwealth land) and based on the assessment in Section 6.3.

A referral is not required for proposed road activities that may affect nationally listed threatened species, endangered ecological communities and migratory species. This is because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015. However, potential impacts to these biodiversity matters are considered as part of Section 6.3 and Appendix A (Consideration of section 171 factors and matters of national environmental significance and Commonwealth land).

Findings – matters of national environmental significance (other than biodiversity matters)

The assessment of the proposal's impact on matters of national environmental significance found that there is unlikely to be a significant impact on these matters.

While the proposal itself is not located on Commonwealth land, the proposal would be adjacent to an area of Commonwealth land to the south-west of the construction footprint. This area currently includes a construction site and activities to construct the WSA and is planned to commence operations in 2026. A self-assessment has been carried out to determine whether the

proposal would have a significant impact on the environment of Commonwealth land, with reference to the Significant impact guidelines 1.2 – Actions on, or impacting upon, Commonwealth land, and Actions by Commonwealth agencies (Department of Sustainability, Environment, Water, Population and Communities 2013).

The self-assessment is provided in Appendix A (Consideration of section 171 factors and matters of national environmental significance and Commonwealth land). The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land.

Accordingly, the proposal has not been referred to the Australian Government Department of Climate Change, Energy, the Environment and Water.

Findings – nationally listed biodiversity matters (where the strategic assessment applies)

As detailed in Section 6.3 and Appendix G (Biodiversity Development Assessment Report), several threatened ecological communities and threatened species have been identified within the construction footprint that are listed under the EPBC Act. No migratory species were detected within the construction footprint. EPBC Act Significant Impact Criteria assessments were carried out for relevant threatened entities identified within the construction footprint.

As outlined in Appendix G (Biodiversity Development Assessment Report), the assessment concluded that there is unlikely to be a significant impact on relevant matters of national environmental significance. Section 6.3 describes the safeguards and management measures to be applied.

4.3.2 Other relevant Commonwealth legislation

Airports Act 1996

The *Airports Act 1996* (Airports Act) provides the regulatory framework for the development and operation of the airport site. The Airports Act promotes the development of civil aviation within Australia, as well as the efficient and economic development and operation of airports.

The WSA borders Elizabeth Drive to the south. The M12 Motorway would be the primary access road for the WSA and the proposal would tie in with the M12 Motorway thereby improving connectivity and access for the surrounding local road network. The proposal has been designed to avoid the WSA, and no work would be carried out on the airport site.

As described in Section 3.2.4, the proposal would be located wholly within the OLS for the WSA, which is a prescribed airspace for the purposes of the *Airports Act 1996*. Transport would consult with WSA in relation to potential impacts the proposal would have on operations to determine if a permit is required under the *Airports Act 1996*.

Native Title Act 1993

The *Native Title Act 1993* recognises and protects native title. The Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions which may affect native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements along with the National Native Title Register. Under the Act a 'future act' includes proposed public infrastructure on land or waters that affects native title rights or interest.

A search of the 'Schedule of Applications' (unregistered claimant applications), 'Register of Native Title Claims, National Native Title Register', 'Register of Indigenous Land Use Agreements and Notified Indigenous Land Use Agreements' was carried out in July 2022. These searches returned no registered native title determinations, claims or Indigenous Land Use Agreements.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and road infrastructure facilities and is being carried out by or on behalf of a public authority. Under Clause 2.108 of the Transport and Infrastructure SEPP the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Division 5.1 of the EP&A Act.

Transport is the determining authority for the proposal. This REF fulfils Transport's obligation under clause 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

Transport has formed the view that the proposal is not likely to significantly affect the environment and would not require the preparation of an environmental impact statement (EIS).

The following additional approvals and permits would be required for the proposal:

- Under Section 90 of the NPW Act, an AHIP would be required for the proposal
- Under Part 3.2 of the POEO Act, an EPL would be required for the proposal
- Under Section 199 of the FM Act, Transport would notify the Department of Primary Industries in writing of any proposed dredging or reclamation in Cosgroves Creek or Oaky Creek, if required
- Under Section 219 of the FM Act, Transport would seek a permit from the Department of Primary Industries for any temporary blockage of fish passage, if required. Transport would consider any matters raised by the Minister.

5. Consultation

This chapter discusses the consultation carried out to date for the proposal and the consultation proposed for the future.

5.1 Consultation strategy

Transport has consulted with the community and stakeholders throughout the development of the proposal. This consultation was carried out in accordance with the *Community and Stakeholder Engagement Plan* (Transport, 2020) that was prepared for the proposal.

The communication and engagement objectives for the proposal are to:

- Inform the community and other stakeholders of the proposal, the benefits and what to expect
- Provide the community and stakeholders with regular and timely information about the proposal
- Create stakeholder awareness and understanding of the proposal and its objectives including:
  - Improving safety for motorists
  - Reducing congestion and travel times
  - Provide better access to the WSA and strategic centres
  - New paths to encourage walking and cycling
  - Improve freight movement to key commercial centres
  - Support economic and population growth, and the development of a Western Parkland City
- Provide information on how the community can provide its feedback
- Listen to feedback, investigate suggestions and report back to the community and stakeholders to encourage participation
- Engage in a manner that is collaborative, innovative and inclusive
- Ensure that community and stakeholder enquiries about the proposal are managed and resolved efficiently.

Section 5.2 to Section 5.6 provide a summary of the consultation carried out to date.

This REF would be publicly displayed for a minimum four week period. During this time, community information sessions would be held. Stakeholders and the community would be encouraged to participate, provide feedback and make a submission on the REF.

Section 5.7 and Section 5.8 provide details on the consultation to be carried out during and after public display of the REF.

5.2 August 2022 email consultation – Community surveys

A community survey was carried out in August 2022 to seek community feedback about the proposal and to inform the socio-economic impact assessment. The survey had three sections for respondents to answer:

- Section 1 – Business survey
- Section 2 – Residential survey
- Section 3 – Demographic questions (optional).

The surveys were emailed on 2 August 2022 to 171 registered stakeholders who had signed up for Elizabeth Drive proposal updates and letter box dropped to 175 properties along the alignment between The Northern Road and Cecil Road on 3 August 2022. Respondents were given the option to complete the survey online or return a hardcopy via post to Transport before the survey closing date of 10 August 2022. A total of 38 respondents participated in the survey of which 28 stakeholders responded via the emailed link and nine by mail.

Further detail on the survey results is in Section 6.7 and Appendix J (Socio-economic Impact Assessment).

5.3 Community involvement

Transport has involved the community during the design development phases of the proposal. The broader Elizabeth Drive upgrade (inclusive of the proposal) was announced to the community in November 2018 during the strategic design phase.

Community consultation was initially carried out in June 2019 to inform the community of the proposed access strategy for the proposal, invite feedback and gather local knowledge.

Further consultation was carried out for the broader Elizabeth Drive upgrade in March to April 2020 to inform the community of the strategic design and alignment of the proposed upgrades. The strategic design presented to the community and stakeholders built on the proposed access strategy that was consulted on in June 2019 and identified:

- Where future road widening may occur
- Where the future key intersections would be along Elizabeth Drive
- How the intersections would look and improve safety for all road users.

A summary of the consultation activities carried out during the June 2019 consultation periods (and feedback received) is provided in Sections 5.3.1 below.

A Consultation Report and other community updates can be found on the Elizabeth Drive Upgrade webpage: https://roads-waterways.transport.nsw.gov.au/projects/elizabeth-drive-upgrade/index.html

5.3.1 June 2019 consultation – access strategy

The access strategy for the Elizabeth Drive upgrade was released for consultation on 10 June 2019, and feedback was collected over a period of four weeks until 10 July 2019. Two community consultation sessions were held on 19 and 22 June 2019 at the Kemps Creek Public School.

The purpose of the community consultation was to:

- Inform community members and stakeholders about the access strategy for the Elizabeth Drive upgrade
- Provide information about next steps after the access strategy
- Seek comment, feedback, ideas and suggestions from the community to be considered prior to reservation of the road corridor
- Provide an opportunity for the community to meet with the project team to ask questions and provide feedback on the access strategy
- Build a database of community members and stakeholders for Transport to engage with through the development of the Elizabeth Drive upgrade.

Activities carried out as part of the access strategy consultation are summarised in Table 5-1 . Key issues raised during these consultation activities are outlined in Table 5-2.

Table 5-1 Consultation activities carried out for access strategy

Tool/activity	Approximate reach	Detail
Newspaper advertisements	Distribution area of the Western Weekender	A newspaper advertisement appeared in the local newspaper, the Western Weekender on 14 June 2019 to raise awareness of the consultation and information sessions
Social media	48,500 within Facebook page	Four social media posts were published on the NSW Roads Facebook page to promote the community consultation sessions
Community update	5,868 newsletters distributed	A community update newsletter was distributed via a letterbox drop to 5,868 local properties
Letter to property owners	93 letters distributed	A total of 93 letters were distributed to individual property owners to provide an update on the proposal
Webpage	501 page views	The proposal web page was updated on 13 June 2019 with the latest proposal information including the proposal update and how to submit feedback
Community information sessions	More than 67 people in attendance	Two community information sessions were held: • Wednesday 19 June 2019, 5:30pm-8:30 pm at Kemps Creek Public School at 100 Cross Street, Kemps Creek. This session was attended by 48 people • Saturday 22 June 2019, 10:00am-1:00 pm at Kemps Creek Public School at 100 Cross Street, Kemps Creek. This session was attended by 19 people

Table 5-2 Summary of issues raised by the community

Issue category	Sub issue	Issue raised	Response / where addressed in REF
Access strategy	Emergency Services access	• Access onto Elizabeth Drive from the rural fire station for emergency response needs to be considered	The rural fire service would be consulted as part of the proposal, including for construction planning (subject to determination of the REF). Emergency services access would be maintained, and this would be further investigated during detailed design.
	Connection between M12 Motorway and Elizabeth Drive at the entry into the WSA	• Connection between the M12 and Elizabeth Drive • Connection between Elizabeth Drive and WSA	The proposal would connect into new intersections constructed as part of the M12 Motorway project and enable access to WSA. The eastern end of the proposal would tie into a section of Elizabeth Drive that is being upgraded at part of the M12 Motorway project. East of the proposal, Elizabeth Drive would carry traffic above the new Sydney Metro Western Sydney Airport line, interchanging with the M12's connection into WSA. At its western end, the proposal would tie into The Northern Road, which also interchanges with the M12 Motorway. The proposal is further described in Chapter 3 (Description of the proposal), and a traffic assessment is provided in Section 6.2. The key features of the proposal are shown in Figure 3-1 to Figure 3-4.
	Access across Elizabeth Drive	• What type and level of access will be provided between either side of Elizabeth Drive?	North-south road connections across Elizabeth Drive would be provided at traffic light intersections. All other intersections would be restricted due to the proposed median (eg generally left in / left out turns from local roads and private property). The proposal is further described in Chapter 3 (Description of the proposal), and a traffic assessment is provided in Section 6.2. The key features of the proposal are shown in Figure 3-1 to Figure 3-4.
	Traffic lights	• The number of traffic lights proposed would increase the traffic congestion along Elizabeth Drive • Request for additional traffic light intersections to support planned redevelopment of land adjacent to Elizabeth Drive	The proposal would provide one new signalised intersection at Luddenham Road. Traffic lights would provide safe and efficient access and movement into and out of Elizabeth Drive from the surrounding road network. Travel times and congestion is further discussed in Section 6.2 and in Appendix F (Traffic and Transport Assessment Report). The Western Sydney Planning Partnership (of which Transport is a member) finalised the Western Sydney Aerotropolis Precinct Plan in March 2022 following feedback from the community. The Precinct Plan identifies proposed future signalised intersections, as well as future connections to the road network across the Aerotropolis area. An updated version of the plan was published in May 2023 with minor amendments, including to planning controls at some properties. Access arrangements for future new developments would be considered by Transport on a case-by-case basis.

Issue category	Sub issue	Issue raised	Response / where addressed in REF
Information	Information about the proposal	• More information should be available about the proposal including timeframes, scope and road width • Funding commitment for construction • Traffic modelling assumptions	Further proposal information and updates would be provided at future community engagement sessions (refer Section 5.7 and Section 5.8). Subject to detailed design and construction planning, construction of the proposal is anticipated to take about 48 months to complete. Further information regarding scope, road formation and width, and the proposed design are provided in Chapter 3 (Description of the proposal). Progression of the proposal from detailed design and construction would be subject to government funding and REF determination. Traffic modelling assumptions are provided in Section 5 of Appendix F (Traffic and Transport Assessment Report).
Property	Acquisition	• Information on which properties will be impacted needs to become available • Federal land should be used instead of private land for the road upgrade	A design options assessment was carried out during strategic design as described in Chapter 2 (Need and options considered). Considerations included constructability, flood prevention, impact to adjoining properties, number of properties affected, environmental impacts, and other projects planned in the area. The proposal has been designed to minimise impacts to properties; however, some partial property acquisition is required, which is described in Section 3.4. Property and land use impacts are assessed in Section 6.6. The proposal would not encroach on land owned by the Commonwealth for the purpose of the WSA.
Road design	Vehicle size	• What design vehicle is being used for the project?	The road design would be based on B-double (26-metre) sized vehicles to determine intersection designs. Elizabeth Drive is currently a designated B-double route and will continue to be so in the future. A traffic, transport and access assessment is provided in Section 6.2.
	Median barrier	• Transport should consider the use of median barriers to reduce the cross-sectional width and reduce impacts to adjoining land	Transport has considered the option of including a central barrier to reduce the median width. However, the preference is not to include barriers and reserve a wider median as it reduces maintenance requirements and associated safety risks for workers when carrying out maintenance in the median on a high-speed road. The central median would also facilitate further widening in future to three lanes in each direction (not included in this proposal and subject to a separate assessment and approval process). The wider median would also increase safety for road users with a greater separation of opposing traffic flows without obstruction of barriers in the clear zone. Safety barriers would be installed at various locations under the proposal according to safety design requirements (eg on approach to bridges and for shared walking and cycling paths at bridges, at intersections, around trees within the nature strip, and on the back of verges).
	Speed	• What will the proposed speed limit for the road be?	The road is being designed for a posted speed limit of 80 kilometres per hour.

Issue category	Sub issue	Issue raised	Response / where addressed in REF
	Public transport	• The upgraded road design should consider the public transport needs of the corridor	Careful consideration of public transport opportunities along Elizabeth Drive has been given during the planning and design development process. The proposal includes provision of new indented bus bays and 'queue jump-start' bus lanes at traffic lights (refer to Figure 3-1 to Figure 3-4 for key features of the proposal).
Active Transport	Shared bicycle and pedestrian paths	• Cyclists need to be considered including priority for cyclists at road and driveway crossings, intersections and cycle way sheltered from significant flood events	Transport promotes safe cycling and would provide a shared walking and cycling path as part of the proposal. The proposal would be designed to a flood immunity of a 100-year average recurrence interval (ARI) for the main road alignment, and a one year ARI for the shared walking and cycling path.

5.4 Aboriginal community involvement

The Aboriginal community has been involved throughout the development of the proposal in accordance with the requirements of the DPE Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010) and Transport's PACHCI. This is a staged process for investigating potential impacts to Aboriginal cultural heritage as a result of Transport road planning, development, construction and maintenance activities.

An initial Stage 2 PACHCI was completed for the proposal by Kelleher Nightingale Consulting in June 2018. Results from the Stage 2 PACHCI are documented in Appendix I. When the June 2018 Stage 2 PACHCI was conducted, the construction footprint only encompassed the road reserve and did not include land that was privately owned. As such, another Stage 2 PACHCI was prepared by AECOM in 2022 which encompassed the current construction footprint. A Stage 3 PACHCI was then prepared by Kelleher Nightingale Consulting in August 2023. The two completed Stage 2 PACHCIs, Stage 3 PACHCI and the Aboriginal community consultation carried out are shown in Table 5-3. Consultation carried out with the Aboriginal community is further documented in Appendix I.

Table 5-3 Summary of Transport Procedure for Aboriginal Cultural Heritage Consultation and Investigation completed for the proposal

Stage	Description
Stage 1	A desktop risk assessment was carried out by Transport as part of the initial scoping to determine if the proposal is likely to harm Aboriginal cultural heritage. There was no direct consultation with the Aboriginal community carried out during this stage.
Stage 2 (2019)	A Stage 2 PACHCI was carried out in July 2019 and involved further assessment and a survey to assess the proposal's potential to harm Aboriginal cultural heritage, and to determine whether widespread Aboriginal community consultation and a cultural heritage assessment report would be required. Aboriginal stakeholders consulted as part of the Stage 2 PACHCI included Deerubbin LALC, Gandangara LALC and the (then) registered Native Title Claimant Group. Both parties participated in an archaeological survey of the study area carried out in July 2019.
Stage 2 (2022)	An additional Stage 2 PACHCI was carried out by AECOM in 2022. As part of this assessment, AECOM conducted an archaeological survey in July 2022. A total of three areas were subject to survey, two north of Elizabeth Drive, within the boundaries of the Deerubbin LALC, and one south of Elizabeth Drive, within the boundaries of the Gandangara LALC. Each property was surveyed by a field team consisting of one AECOM archaeologist and one relevant LALC site officer. Due to access issues the archaeological survey was only possible on publicly accessible properties and where access agreements could be reached with private landowners. It was recommended that a Stage 3 PACHCI assessment be prepared for the proposal including archaeological test excavation. The purpose of the archaeological test excavation would be to identify whether any subsurface Aboriginal objects are present within areas identified as potentially containing archaeological deposits, as well as determine the nature, extent and condition of any associated deposits, and the impacts of the proposal (refer further to Section 6.5 and Appendix I (Stage 2 PACHCI – Archaeological Survey Report)).
Stage 3 (2023)	An Aboriginal cultural heritage assessment report (CHAR) was prepared by Transport in accordance with Stage 3 of the Transport PACHCI in August 2023. The CHAR involved an Aboriginal archaeological assessment and further consultation with the Aboriginal community. This consultation is summarised below and outlined further in Appendix I. Consultation was undertaken with 35 Aboriginal community groups and individuals, and included: • Advertisement for Registered Aboriginal Parties (RAPs) that would be interested in consultation regarding the proposal • Provision of proposed archaeological and CHAR assessment methodology to RAPs for review over a 28 day period • Provision of draft CHAR to RAPs for review over a 28 day period, and the facilitation of an Aboriginal focus group meeting during this review period to discuss investigation results • Ongoing consultation with the local Aboriginal community

5.5 Transport and Infrastructure SEPP consultation

Consultation with local council and other public authorities is required by Part 2.2 Division 1 of the Transport and Infrastructure SEPP, which applies to development carried out by or on behalf of a public authority that may be carried out without consent. Table 5-4 outlines the Transport and Infrastructure SEPP consultation requirements for the proposal.

Appendix B (Statutory consultation checklists) contains a Transport and Infrastructure SEPP consultation checklist that documents how Transport and Infrastructure SEPP consultation requirements have been considered for the proposal.

Table 5-4 Transport and Infrastructure SEPP consultation required for the proposal

Agency	Transport and Infrastructure SEPP clause	Date of response
Penrith City Council and Liverpool City council	2.10(1)(a) *Will have a substantial impact on stormwater management services provided by council* 2.10(1)(b) *Is likely to generate traffic to an extent that will strain the capacity of the road system in a local government area* 2.10(1)(d)) *Involves connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council* 2.12 *Development with impacts on flood liable land* 2.16 *Consideration of Planning for Bush Fire Protection*	• Penrith City Council on 22/07/2022 • Liverpool City Council on 15/07/2022
NSW State Emergency Services	2.13 *Development with impacts on flood liable land*	No response received
Western Parkland City Authority	Section 2.15 *Development within a Western City operational area specified in the Western Parkland City Authority Act 2018, Schedule 2 with a capital investment value of $30 million or more*	No response received

Issues that have been raised as a result of this consultation are outlined below in Table 5-5.

Table 5-5 Transport and Infrastructure SEPP consultation required for the proposal

Issue raised	Response / where addressed in REF
Liverpool City Council	
Liverpool City Council requested to meet Transport representatives to discuss potential impacts of the proposal on: • Stormwater management • Flooding models • Forecast traffic demands for the proposed intersection treatments • Planning for bush fire protection.	A Hydraulic Impact and Flooding Assessment was developed for the proposal, which is appended to Appendix L (Surface Water and Groundwater Assessment Report) and discussed in Section 6.10. Forecast traffic demands for the proposed intersection treatments are provided in Appendix F (Traffic and Transport Assessment Report) and discussed in Section 6.2. Bushfire protection is discussed in Section 6.15. Transport would continue to liaise with Liverpool City Council throughout detailed design of the proposal.
Penrith City Council	
Penrith City Council encourages consultation to occur with the Department of Planning and Environment to ensure that the road corridor extent and land which will be acquired for permanent stormwater infrastructure is zoned appropriately under WPCSEPP or is identified for acquisition.	Transport would continue to liaise with DPE and Sydney Water (as the Regional Stormwater Manager) during detailed design regarding permanent stormwater infrastructure and connections from Elizabeth Drive. Land acquired for the operation of Elizabeth Drive would be zoned as SP2 (Infrastructure), consistent with the existing Elizabeth Drive.
Penrith City Council suggests liaising with its Metro team to ensure the construction work is aligned with Metro's construction program.	Transport would continue to liaise with Penrith City Council throughout detailed design.
Penrith City Council suggests liaising with other infrastructure projects to consider cumulative impacts of construction of the proposal.	A cumulative impact assessment has been carried out as part of this REF and is included in Section 6.16.
Penrith City Council comments that several properties along Elizabeth Drive will be impacted by the proposed median island which will impose a left-in / left-out arrangement. Penrith City Council requests these properties are to be consulted, with supporting evidence of consultation and subsequent solutions provided in the REF.	Transport would consult with property owners during detailed design regarding property access.
Penrith City Council comments that consideration should be given to providing a left turn out of Adams Road to create a left-in / left-out arrangement. This will enable motorist wishing to travel eastbound from Adams Road to utilise the U-turn function at the Luddenham Road signalised intersection.	Transport would continue to consult with property owners during detailed design regarding property access.

Issue raised	Response / where addressed in REF
Penrith City Council suggested a dedicated bus lane for the rapid bus service to be provided along Elizabeth Drive in each direction as an interim measure until the delivery of the M12. It would allow the bus lane to be converted to a traffic lane post M12 delivery, thus enable Elizabeth Drive's expansion to a six-lane roadway without the removal of the central median.	Currently there are no rapid bus services that operate within the construction footprint. The proposal would include priority infrastructure (indented bus bays for two new bus stops and 'queue jump-start' bus lanes at traffic lights). These are described further in Chapter 3 (Description of the proposal).
There is currently a bus stop proposed at the Luddenham Road signalised intersection in each direction. Penrith City Council has noted that the proposed bus stops appear over 1.5km from The Northern Road which does not reflect an appropriate walking catchment. Consideration should be given to additional bus stops along Elizabeth Drive.	There are no existing bus routes that operate along the western section of Elizabeth Drive. It is currently proposed to provide bus priority facilities at the new signalised intersection of Luddenham Road. Consultation would be carried out during detailed design to determine any provisions for bus stops for future bus routes.
Penrith City Council have requested that bus stops and shelters are to be compliant with the *Disability Discrimination Act 1992*, and glass panels are not to be used in bus shelters due to issues with vandalism. They suggest, in consultation with them, that bus stops are to be constructed using perforated mesh and consideration of climate adapted bus shelters along Elizabeth Drive to provide shelter/shade/cooling.	Design of bus infrastructure (bus bays) would be considered further during detailed design and would be in compliance with the *Disability Discrimination Act 1992*.
Penrith City Council wishes to confirm that the classification of Elizabeth Drive will remain as a state road post construction and delivery of the M12 Motorway.	Elizabeth Drive would continue to be a State Road after the completion of the M12 Motorway and the proposal.
In relation to active transport, Penrith City Council requests: • Shared bike lanes and walking path from road users • Compliance with current Transport specification and Cycleway Design Toolbox (2020b) • Appropriately merge active transport corridors with existing shared path at the Northern Road • Lighting on approaches to all traffic signals • Shade/canopy provided along the proposed shared walking and cycling path • All intersection designs should maximise pedestrian/cyclist amenity and safety • Maximise pedestrian safety and comfort by providing minimum kerb radii of the corner, while providing adequate accommodation for vehicles • Kerb radii should be minimised, while accommodating the turning movements of vehicles anticipated, to shorten crossing distances, increase pedestrian visibility and to slow turning traffic • The preferred treatment for an intersection where the cycleway interacts with a side street is a continuous cycleway with priority given to people cycling to provide a high level of service and improved safety for riders • Pedestrian crossing points are provided on each approach to signalised intersections which is supported as it provides good pedestrian amenity	The proposal would include shared paths for cyclists and pedestrians. The shared walking and cycling path would be lit by the road lighting that would be provided to illuminate Elizabeth Drive. All kerb radii have been designed to cater for the design vehicles. Crossing lengths have been minimised as far as practicable. Landscaping, including trees, would be provided on the outer side of the active transport corridor along the route. All active transport crossings at intersections would be signalised and compliant with current design guidelines and standards. Intersection treatments have been designed in line with Austroads AGRD Part 6A, where it is specified that the preferred treatment is a connection without the use of other devices.

Issue raised	Response / where addressed in REF
• Consideration for limiting illegal pedestrian crossings due to poor amenity by potentially implementing slip lane traffic symbols, pedestrian green time phasing.	
Penrith City Council requests that an air quality assessment is prepared by a suitably qualified environmental consultant that addresses impacts to local air quality and sensitive receivers during the construction and operation. Mitigation measures are to be put forward that suitably address any identified impacts.	Appendix N (Air Quality Impact Assessment and Report) and Section 6.12 outline potential air quality impacts of the proposal, and include safeguards and management measures to mitigate these potential impacts.
In relation to biodiversity, Penrith City Council requests: • Address requirements of the BC Act • Adopt the 'avoid, minimise, offset' approach (from the BC Act) • Consideration for threatened ecological communities, notably the Cumberland Plain Woodland • Consideration for fauna movement in design and implementation of management measures such as a fauna underpass, rope bridge and fencing	Appendix G (Biodiversity Development Assessment Report) and Section 6.3 discuss potential biodiversity impacts for construction and operation of the proposal, in accordance with relevant requirements of the BC Act. Impacts have been avoided where possible, including through reducing the extent of the construction footprint to avoid impacts to 'avoided land' under the CPCP. Safeguards and management measures in Section 6.3 would be applied to minimise and manage impacts to biodiversity during construction and operation.
Penrith City Council requests that an acoustic assessment is to be prepared by a suitably qualified acoustic consultant that addresses noise and vibration impacts during the construction and operation. Consideration is to be given to the proposed hours of work and potential sleep disturbance impacts. Recommendations are to be made regarding how noise impacts will be managed, particularly in relation to sensitive land uses.	Appendix E (Noise and Vibration Assessment Report) and Section 6.1 outline potential noise and vibration impacts of the proposal. The assessment includes consideration of construction and operational impacts (including the potential for sleep disturbances) and provided safeguards and management measures to address potential impacts.
Penrith City Council requests demonstration that the construction footprint is suitable for the purpose of the proposal by carrying out a Phase 1 Preliminary Site Investigation or Phase 2 Detailed Site Investigation. All reporting must be completed by a suitably qualified environmental consultant.	A Phase 1 Contamination Assessment has been completed by a qualified environmental consultant, as outlined in Appendix M (Phase 1 Contamination Assessment Report) and summarised in Section 6.11. A Phase 2 Contamination Assessment (detailed site investigation) would also be carried out prior to the construction of the proposal.
Penrith City Council requests an Unexpected Finds Protocol is to be developed by an appropriately qualified environmental consultant to address the management of any contamination found on the site during the proposal, including at a minimum, contaminated soils, groundwater, buried building materials, asbestos, odour and staining.	The potential risk associated with contamination has been discussed in Section 6.11 and Appendix M (Phase 1 Contamination Assessment Report). Safeguards and management measures, including the requirements for an Unexpected Finds Procedure would be implemented as part of a CEMP.

Issue raised	Response / where addressed in REF
In relation to soil and water management, Penrith City Council requests the following: • Site specific Erosion and Sediment Control Plan • Water efficiency and conservation should be maximised • Preference for the use of recycled (runoff) water to reduce reliance on potable water • Water sensitive urban design to be incorporated as per Penrith City Council's policies: – Water Sensitive Urban Design (WSUD) (2017) – WSUD Technical Guidelines (2020) – Cooling the City Strategy (2015).	A site-specific Erosion and Sediment Control Plan/s would be prepared and implemented as part of the Soil and Water Management Plan, within the CEMP. Recycled water would be used for construction and operation of the proposal where possible. The drainage design for the proposal has considered Council's Water Sensitive Urban Design policies and has incorporated several Water Sensitive Urban Design elements. Proposed drainage infrastructure is discussed further in Section 3.2.6.
Penrith City council encourages consultation to occur with Sydney Water as to identify locations for basins. Penrith City Council notes that the land currently identified for acquisition under WPCSEPP indicates that basins are proposed in the same area as those being proposed by Transport. Penrith City Council requests that dewatering plans for the dams/basins be developed for the proposal to ensure decommissioned dams are done so with consideration of water quality and quantity during dewatering and ecological impacts.	Transport liaised with Sydney Water on 4 August 2021 to present the drainage infrastructure strategy for Elizabeth Drive. The strategy involved utilising existing farm dams where possible, and the provision of new basins where required. Dewatering plans would be developed as part of the CEMP.
Penrith City Council has noted that the proposal is in proximity to Aboriginal and non-Aboriginal heritage sites, and requests the following: • An Aboriginal Heritage Impact Statement and a Non-Aboriginal Heritage Impact Statement, both of which must be prepared accordance with relevant legislation and by appropriately qualified and experienced heritage consultants • Development of (or near) a heritage item must protect the setting of the heritage item and retain significant internal and external fabric and building elements and spaces (curtilage) • Prior to work commencing, archival recording shall occur (subject to any owner's consent requirements) of the heritage item/s in its current setting. A copy of this recording shall be submitted to Penrith City Council's library for reference • Dilapidation report in relation to heritage items • If relics are discovered during construction work should cease immediately and the relevant authority shall be contacted • Consultation should occur with owners of heritage items, Heritage NSW, local council and Aboriginal Land Council's (where relevant) • If any protection work or otherwise is required to be completed to a heritage item, contact shall first be made with Penrith City Council for guidance and/or comments.	Appendix I (Stage 3 PACHCI –Aboriginal Cultural Heritage Assessment Report) and Section 6.5 outline the potential construction and operation impacts of the proposal on Aboriginal heritage. Safeguards and management measures to manage potential impacts have also been provided in this section, including compliance with the Transport's EMF-HE-PR-0076 Unexpected Heritage Items Procedure 2022. Appendix H (Non-Aboriginal Heritage Impact Assessment) and Section 6.4 provide an assessment of the potential construction and operational impacts of the proposal to non-Aboriginal heritage items. Safeguards and management measures to manage potential impacts are also provided in this section. Any archaeological deposits identified during construction would be governed by Transport's EMF-HE-PR-0076 Unexpected Heritage Items Procedure 2022. A dilapidation report would not be required, as the proposal would be located at a minimum of 190 metres from listed non-Aboriginal heritage items (refer to Section 6.4).

Issue raised	Response / where addressed in REF
In relation to flooding, Penrith City Council requests the following: • The proposal should not have any adverse flood impacts to properties located upstream or downstream • Adhere to the South Creek Floodplain Management Plan (Advisian, 2020) • Consideration for improving the existing drainage structures • Drainage infrastructure should consider future climate change scenarios • Work should be carried out in a way that minimises the impact on Cosgrove Creek, Oaky Creek and the catchment area • Consideration of the road standards required for the flood evacuation should be included in the design • Transport should consult with NSW SES to identify hydraulic/ hydrologic standards required for flood evacuation.	The South Creek Floodplain Risk Management Plan was used to inform design guidelines, standards and specifications of the proposal. Further information is provided in the flooding impact assessment appended to Appendix L (Surface Water, Groundwater Assessment Report). A description of the proposed upgrades to drainage infrastructure is provided in Chapter 3 (Description of the proposal). Safeguards and management measures to manage potential impacts to surface water and groundwater have been provided in Section 6.9, and for hydrology and flooding in Section 6.10. A climate change sensitivity assessment has been carried out for flooding impacts during operation. Consultation has been carried out with NSW SES (refer to Section 5.5). The proposal has considered climate change, as detailed in Section 6.13.
In relation to water management, Penrith City Council has requested the following: • Compliance with the Waterway health and flow management objectives for the Wianamatta South Creek Catchment • Water sensitive urban design guideline – Applying water sensitive urban design principles to NSW transport projects (Roads and Maritime Services, 2017), should be considered with respect to incorporating WSUD into the design of the road and associated infrastructure • The preparation of a Stormwater Management Strategy by a suitably qualified chartered professional engineer with experience in modelling and in consultation with the relevant stormwater management authority • The preparation of a Water and Soil Management Strategy • An appropriate water monitoring strategy should be prepared and implemented to ensure the water management measures are maintained and appropriately functioning • All stormwater treatment measures associated with the construction and operation of the proposal, should be owned and maintained by Transport and not be dedicated to Penrith City Council • Impacts to existing creeks should be minimised and where possible restored to the standards recommended by the Natural Resources Access Regulator.	A Drainage and Water Quality Management Report has been prepared for the proposal. The Water sensitive urban design (WSUD) guidelines have has been used to inform the design as discussed in Section 6.9. A Soil and Water Management Plan (SWMP) would be prepared for the proposal and implemented as part of the CEMP. Under this plan, monitoring of surface water and groundwater quality would be carried out prior to, during and after construction. This would include key watercourses, and farm dams potentially impacted by the proposal. A water monitoring strategy would also be included as part of the SWMP. Stormwater impacts would be managed by proposed stormwater treatment devices. Stormwater treatment measures associated with the construction and operation of the proposal would be maintained by Transport. Safeguards and management measures to manage potential impacts to existing creeks have been provided in Section 6.9.

Issue raised	Response / where addressed in REF
Penrith City Council requests the following: • Abide by cooling the city principles as per Council's Cooling the City Strategy (2015) (i.e. use of lighter coloured materials / greening / tree canopy cover) • Minimise tree removal through design, retain all trees possible. Replace trees if removed • Consider circular economy principles in the design and construction of the proposal • Proposal refers to 'landscaping' but ignores canopy infrastructure, in particular airport canopy requirements • Provide an urban design response for the corridor that addresses landscape and context, beyond the pavement. This should include addressing key intersections with urban design driven interventions • The design of the construction ancillary facilities should be responsive to the surrounding areas that have visibility to them, so a positive visual amenity is achieved.	Appendix K (Urban Design, Landscape Character and Visual Impact Assessment) was developed for the proposal in accordance with Beyond the Pavement – Urban design policy procedures and design principles (Transport for NSW, 2020). The requirement for tree removal has been minimised through design and vegetation would be retained where possible. Circular economy principles have been integrated as part of the proposal. Canopy infrastructure has been considered and outlined in Appendix K (Urban Design, Landscape Character and Visual Impact Assessment). The proposal has considered WSA requirements including the selection of tree species from an approved species list designed to manage tree canopy in the vicinity of the WSA. Section 6.8.4 includes measures to minimise potential visual amenity impacts of construction ancillary facilities. Construction ancillary facility areas would be reinstated to the original condition or better, following construction.
Penrith City Council will not accept any increased financial commitment for road maintenance as a result of any Transport development. Penrith City Council will not accept any maintenance responsibilities for these areas, and all maintenance responsibilities shall remain with Transport.	Transport would continue to maintain Elizabeth Drive.
NSW State Emergency Services	
No response received	N/A
Western Parkland City Authority	
No response received	N/A

5.6 Government agency and stakeholder involvement

Various government agencies and stakeholders have been consulted about the proposal, including:

- Liverpool City Council
- Penrith City Council
- Liverpool City Council
- NSW Department of Planning and Environment (DPE)
- NSW SES
- Sydney Water Corporation
- Western Sydney Parklands
- Western Sydney Airport.

A summary of the key issues raised by government agencies and stakeholders during the consultation activities is provided in Table 5-6 .

Table 5-6 Government agency and stakeholder consultation

Agency / stakeholder	Consultation carried out / key issues raised
Liverpool City Council	Consultation was carried out with Liverpool City Council in accordance with the requirements of the Transport and Infrastructure SEPP. A summary of issues raised in the Transport and Infrastructure SEPP consultation process, and where these have been addressed in the REF is provided in Section 5.5
Penrith City Council	Consultation was carried out with Penrith City Council in accordance with the requirements of the Transport and Infrastructure SEPP. A summary of issues raised in the Transport and Infrastructure SEPP consultation process, and where these have been addressed in the REF is provided in Section 5.5
NSW DPE	Monthly meetings have been carried out with DPE regarding the proposal during concept design development. It has been noted that further consultation would occur during the detailed design phase.
NSW SES	Consultation was carried out with NSW SES in accordance with the requirements of the Transport and Infrastructure SEPP. As outlined in Section 5.5, no response was received from SES
Sydney Water Corporation	Consultation was carried out with Sydney Water Corporation to discuss design options for planned relocation and/or protection of utility facilities, including ongoing access requirements. Initial discussions have also been carried out with Sydney Water Corporation regarding the Western Sydney Aerotropolis integrated water system, which would continue during detailed design. It has been noted that further consultation would occur during the detailed design phase.
Western Sydney Parklands Trust	Consultation was carried out with Western Sydney Parklands Trust to discuss the proposal, and the adjacent proposed Elizabeth Drive East Upgrade. The following proposed design elements of the proposals were discussed: • Shared walking and cycling path • Pedestrian safety fencing • Landscaping and plant species Further consultation would occur with the Western Sydney Parklands Trust during the detailed design phase.

Agency / stakeholder	Consultation carried out / key issues raised
Western Sydney Airport	Consultation was carried out with WSA regarding the adjacent WSA site boundary, future planned development, and the proposal concept design. Further consultation would be carried out during detailed design.

5.7 Consultation during the public display of the REF

Transport is committed to continue the engagement of the community and stakeholders throughout the development of the proposal. The REF would be placed on public display and comments invited. Consultation activities during this display period would include:

- Briefing meetings and email distributions
- Community information sessions and displays
- Advertisement in local newspapers
- Social media initiatives
- Door knocking and phone calls
- Updates to the 'Have your say' webpage
- Online livestream with the project team
- Proposal update newsletters distributed to the community and stakeholders inviting feedback on the proposal.

5.8 Consultation following public display of the REF

Following the public display of the REF, Transport will prepare a submissions report which will summarise and provide a response to submissions received for the proposal. The submissions report would include a summary of any changes to the proposal in response to the submissions and other feedback during the display period. The community would continue to be informed during the development and construction of the proposal. Transport would also continue to consult with relevant government agencies and other stakeholders as the proposal develops.

During the construction of the proposal, a Communication Plan would be implemented as part of the CEMP to help provide timely and accurate information. This would include, at a minimum, mechanisms to provide detail and timing of proposed activities to affected residents, including changed traffic and access conditions; and a contact number for complaints and feedback. Consultation would also be carried out with directly affected landowners (ie where property acquisition or adjustments are proposed) and impacted businesses throughout the construction period, in accordance with the safeguards and management measures in Section 7.2.

6. Environmental assessment

6.1 Noise and vibration

A noise and vibration assessment has been prepared to assess the potential impacts of the proposal. A summary of this assessment is presented in this section, with the full report provided in Appendix E (Noise and Vibration Assessment Report).

6.1.1 Methodology

Overview

The noise and vibration assessment involved:

- Identifying and describing the noise and vibration assessment study area, sensitive receivers and noise catchment areas (NCAs)
- Measuring existing background noise levels at three noise monitoring locations (WNL1, WNL2 and WNL3; refer to Figure 6-1) between 18 October and 29 October 2021, and at one additional location (WNL4) between 5 November and 15 November 2021 (due to monitoring equipment failure during the October 2021 monitoring event). Concurrent traffic counts were carried out during this monitoring period for the purposes of validating the noise model
- Defining construction noise management levels (NMLs) and vibration limits applicable to identified sensitive receivers for both construction and operational phases of the proposal
- Defining representative 'worst-case' construction scenarios, plant and equipment, working times and duration of activities that would apply to construction of the proposal. These scenarios are based on the Construction Noise and Vibration Guideline (CNVG, RMS, 2016)
- Assessing the likely construction noise and vibration levels in accordance the Interim Construction Noise Guideline (ICNG; DECC, 2009) and CNVG
- Calculating and assessing construction vibration using source vibration levels and minimum working distances in accordance with relevant guidelines
- Assessing the predicted operational road traffic noise levels in accordance with the Road Noise Policy (DECCW, 2011), including an assessment of potential maximum noise levels with reference to the Environmental Noise Management Manual (Roads and Traffic Authority, 2001)
- Assessing the predicted operational noise levels from the proposed audio-tactile push buttons (associated with the pedestrian crossing traffic control systems) at the Luddenham Road-Elizabeth Drive intersection in accordance with Transport's management framework – Management of noise from traffic control signal audio-tactile push buttons (RMS, 2005)
- Recommending safeguards and management measures to be implemented to minimise noise and vibration impacts during construction and operation of the proposal, with reference to the CNVG and Road Noise Mitigation Guideline (RMS, 2015a).

The assessment has considered two study areas:

- The construction noise study area, which comprises a number of NCAs where receivers have a similar land use and ambient noise environment, as detailed in Section 6.1.2
- The operational road traffic noise study area, which extends to areas where noise levels are dominated by other roads that are not being assessed as part of this proposal. This includes a maximum distance of 600 metres from the centre line of the outermost traffic lane on each side of the road under consideration (ie the upgraded Elizabeth Drive).

Background noise monitoring

Noise monitoring was carried out to determine the existing background noise environment near the proposal. Unattended noise monitoring was carried out in the construction footprint during October and November 2021. The noise monitoring locations (refer to Figure 6-1) were chosen to be representative of the NCAs surrounding the construction footprint, within the construction noise study area. The noise monitoring equipment continuously measured existing noise levels in 15-

minute periods during the daytime, evening and night-time. Traffic count surveys were carried out alongside the long-term unattended noise monitoring surveys to calibrate the road traffic noise volumes.

Short-term attended noise monitoring was also completed at each monitoring location, to determine the nature of the local noise environment and confirm road traffic as the controlling noise source (for the validation of the operational noise model).

Construction noise and vibration assessment model and scenarios

Construction noise at sensitive receivers was modelled using SoundPLAN Version 8.2 software. Nine construction scenarios were developed for the purpose of the noise modelling to provide reasonable 'worst-**case' activity sequences for different construction** activities, with reference to the CNVG. These scenarios comprise:

- Site establishment and enabling work
- Utility work and property adjustments
- Demolition
- Vegetation removal
- Earthworks
- Drainage work
- Bridge work
- Pavement work
- Landscaping and finishing work.

The scenarios represent one possible way that the proposal could be constructed and may not necessarily be the same methodology that the contractor engaged to construct the proposal would use. The final construction methodology (including the full plant and equipment list) and the expected construction noise levels would be confirmed during detailed design. Further detail on the activities, equipment and noise levels relevant to each scenario is provided in Section 5.1 of Appendix E (Noise and Vibration Assessment Report).

The assessment has considered potential noise impacts from work during standard working hours for all scenarios as well as during evening and night-time periods for the 'site establishment and enabling work'. The 'site establishment and enabling work' scenario is considered to represent a reasonable worst-case assessment of the types of activities which are likely to take place outside of standard construction work hours. Some construction work outside of standard working hours would be necessary to minimise disruption to daily traffic and disturbance to surrounding landowners and businesses. The proposed construction hours are included in Chapter 3 (Description of the proposal).

Construction traffic noise assessment

The potential impacts from construction traffic associated with the proposal when travelling on public roads are assessed under the NSW EPA Road Noise Policy (DECCW, 2011). An initial screening test was first applied to evaluate whether existing road traffic noise levels were expected to increase by more than 2 dB(A) as a result of construction traffic from the proposal. Where this was considered likely, further assessment is required using criteria set out in the Road Noise Policy and Road Noise Criteria Guideline (RMS, 2015b). The Road Noise Policy (DECCW, 2011) does not require assessment of noise impact to commercial or industrial receivers.

Operational road traffic noise assessment scenario and models

Road traffic noise levels were calculated using SoundPLAN Version 8.2 software which uses the CoRTN algorithm. Various inputs and parameters were applied to the model including local topography, surrounding buildings, typical vehicle speeds, traffic volumes, vehicle types and road surfaces (refer Section 6.1 of Appendix E (Noise and Vibration Assessment Report) for further detail).

Existing road traffic noise levels were modelled with existing (2021) road traffic volumes. This was validated with noise measurements and concurrent road traffic surveys.

Future operational traffic noise levels were then modelled for the following scenarios:

- A 'do minimum' scenario, which includes the existing Elizabeth Drive (if the proposal was not constructed) and all other major existing and approved arterial roads

- A 'design' scenario, which includes the proposal and all other existing and approved major arterial roads.

Both scenarios have been assessed for the proposed year of opening of the proposal (2030) and the design year (2040).

Audio-tactile push button noise assessment

Audio-tactile push buttons are installed at traffic signals to allow pedestrians with hearing or visual impairments to cross the road safely.. The audio-tactile push buttons are designed to produce an audio signal with a built-in gain control that is automatically lowered in volume as the surrounding ambient noise level reduces and increased in volume as the surrounding ambient noise level increases.

Noise levels from proposed audio-tactile push buttons at the Luddenham Road-Elizabeth Drive intersection were assessed in accordance with Transport's management framework – Management of noise from traffic control signal audio-tactile push buttons (RMS, 2005). The framework sets noise goals for audio-tactile push buttons to avoid potential noise impacts, including sleep disturbance impacts. Noise goals have been developed based on background noise levels at WNL3, which is the noise logger closest to the residential receivers around the proposed intersection. These noise goals are detailed in Section 6.1.3.

6.1.2 Existing environment

Noise catchment areas and sensitive receivers

The construction noise and operational road traffic noise study areas, as defined in Section 6.1.1, cover several suburbs surrounding the existing Elizabeth Drive, between The Northern Road at Luddenham, to near Badgerys Creek Road at Badgerys Creek. These areas include a mixture of receivers sensitive to noise and vibration such as residential properties, recreational areas, agriculture, commercial and industrial properties. Receivers surrounding the construction footprint are mostly single or double storey residential dwellings. There are also a number of industrial and commercial receivers in Luddenham and Badgerys Creek. WSA is also located to the south of the construction footprint.

Four NCAs have been identified for the proposal, which each represent an area where receivers have a similar land use and ambient noise environment. The NCAs are shown in Figure 6-1 and described in Table 6-1. A list of 'other sensitive' receivers (non-residential) identified within the construction noise study area is provided in Section 3.2 of Appendix E (Noise and Vibration Assessment Report).

Non-aboriginal heritage and other sensitive structures (including those of Aboriginal heritage significance) have the potential to be more sensitive to vibration than standard buildings. Non-Aboriginal heritage items around the construction footprint are identified in Section 6.4.3. No structures of Aboriginal heritage significance have been identified in the construction noise study area.

Table 6-1 NCAs

NCA	Description
NCA1	Generally includes sheds, residential and commercial receivers in Luddenham to the north and west of Elizabeth Drive
NCA2	Generally includes sheds, residential and commercial receivers in Luddenham to the south and east of Elizabeth Drive
NCA3	Generally includes sheds and residential receivers in Badgerys Creek to the north of Elizabeth Drive
NCA4	Includes WSA (under construction), located to the south of Elizabeth Drive in Badgerys Creek, as well as some residential receivers

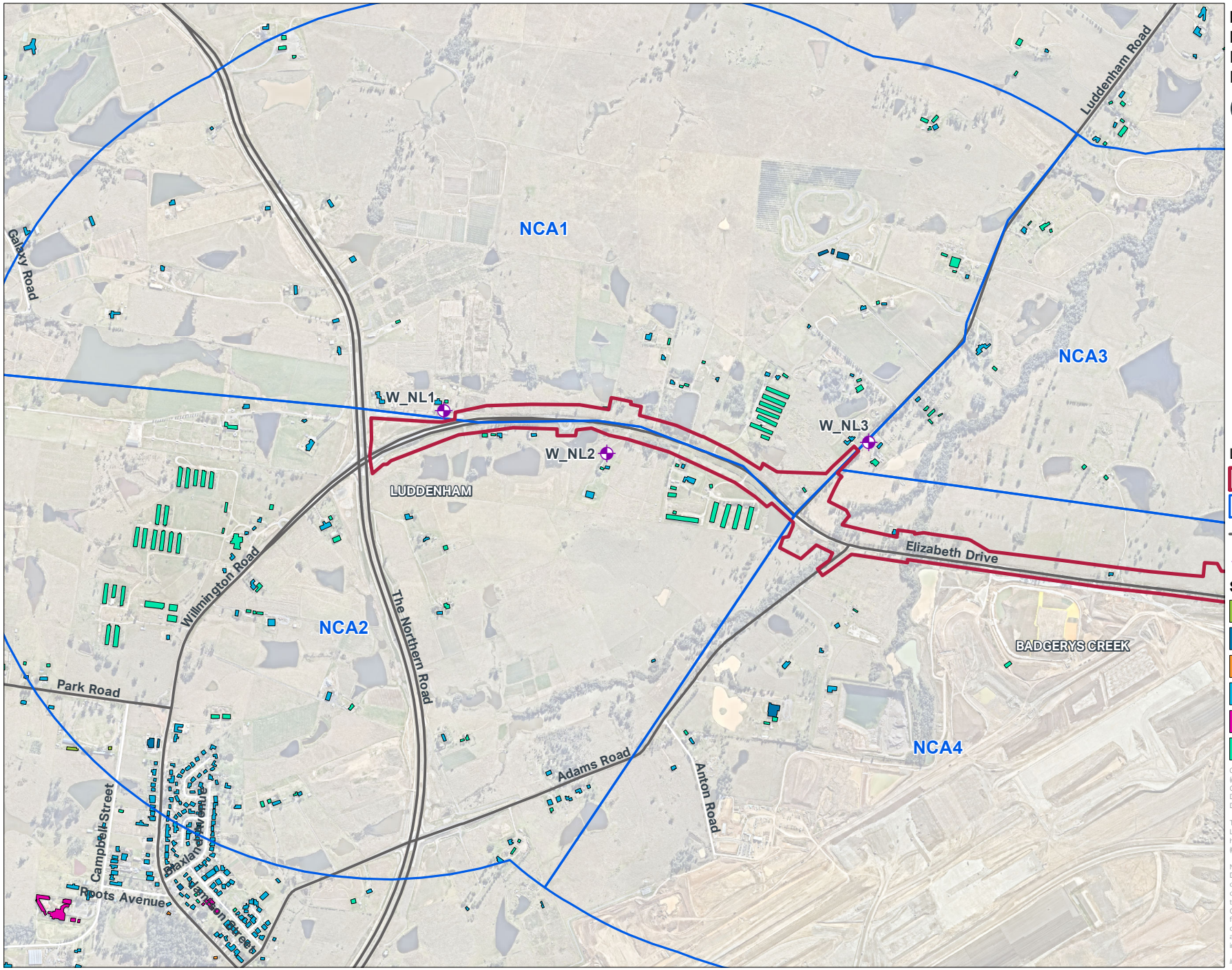


FIGURE 6-1A:
NOISE CATCHMENT AREAS, RECEIVERS AND NOISE MONITORING LOCATIONS

Legend

- Construction footprint
- Noise catchment area
- Primary road
- Noise logger location

Sensitive Receivers

- Active Recreation
- Commercial
- Place of Worship
- Residential
- School
- Shed

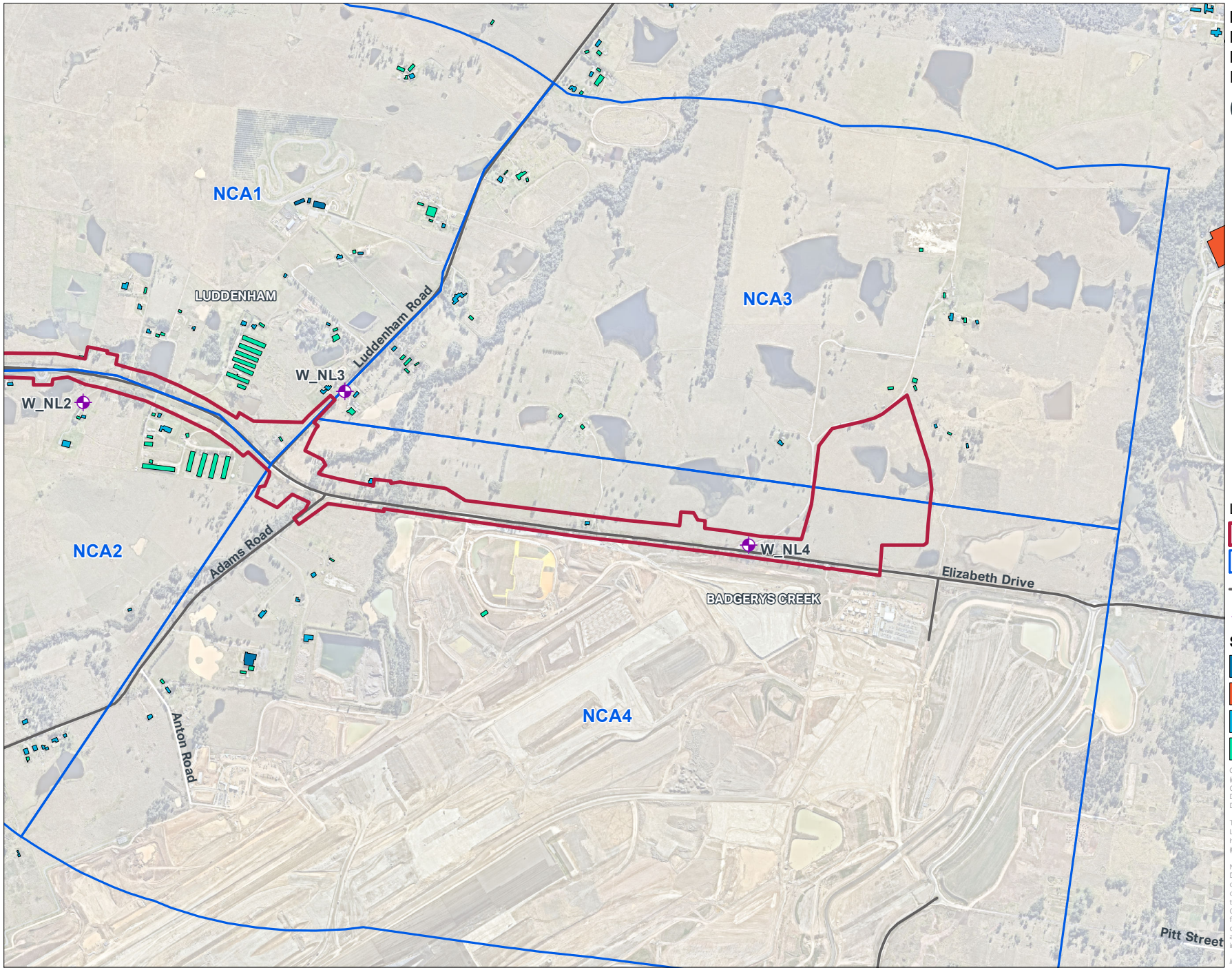


FIGURE 6-1B:
NOISE CATCHMENT AREAS, RECEIVERS AND NOISE MONITORING LOCATIONS

Existing noise levels

Existing key sources of noise include transport infrastructure, such as the existing Elizabeth Drive, The Northern Road, Willmington Road, Luddenham Road and Badgerys Creek Road, industrial/commercial properties and construction noise from WSA.

The background noise levels are represented in Table 6-2 as 'rating background noise levels', which refer to the median value of background noise levels measured across the monitoring period, the 'L_{Aeq}'.

The noise levels presented in Table 6-2 at the measurement locations are typical of those located along transport corridors in suburban areas, with characteristically intermittent traffic flows and/or limited commerce/industry.

Table 6-2 Existing rating background noise levels

Noise monitoring location	Rating background level, dB(A)		
	Day (7am to 6pm) $L_{A90,15\ min}$	Evening (6pm to 10pm) $L_{A90,15\ min}$	Night (10pm to 7am) $L_{A90,15\ min}$
WNL1	40	39	33
WNL2	39	39[1] (40)	30
WNL3	45	43	31
WNL4	44[2] (47)	38[2] (41)	35[2] (38)

Notes:

1 *Application notes to the Noise Policy for Industry indicate that the community generally expects a greater control of noise during the evening and night as compared to the daytime. Therefore, the rating background level for the evening is set to no more than that for the daytime.*

2 *It was estimated that construction noise from WSA had an equal contribution to measured background levels as road traffic on Elizabeth Drive; therefore, the measured background noise levels have been reduced by 3 dB.*

6.1.3 Criteria

Construction noise management levels and sleep disturbance criteria

The ICNG requires project-specific NMLs to be established for noise-affected receivers. The residential NMLs for the proposal have been determined based on the rating background levels (refer to Table 6-2) as defined in the Noise Policy for Industry (NSW EPA, 2017) plus an additional allowance of 10 dB during the standard work hours and 5 dB outside of standard hours. The construction NMLs for residential receivers in each NCA are provided in Table 6-3.

Maximum noise levels generated by construction noise have the potential to cause disturbance to sleep. Residential sleep disturbance screening criteria has been established for each NCA and are provided in Table 6-3. In addition to the sleep disturbance criteria, a screening criterion of 65 dB(A) has been applied to represent potential awakenings for each NCA.

Table 6-3 Construction NMLs

NCA	Representative monitoring location	Period	Rating background level, dB(A)	Construction NML[1,2,3]	Sleep disturbance screening $L_{A1(1min)}$ criteria, dB(A)[4]
NCA1	WL1	Day	40	50 (45)[3]	-
		Evening	39	44	-
		Night	33	38	48
NCA2	WL2	Day	39	49 (44)[3]	-
		Evening	39	44	-
		Night	30	35	45
NCA3	WL3	Day	45	55 (50)[3]	-
		Evening	43	48	-
		Night	31	36	46
NCA4	WL4	Day	44	54 (49)[3]	-
		Evening	38	43	-
		Night	35	40	50

Notes:
1 *Day NMLs = rating background level + 10 dB(A)*
2 *Evening/night NMLs = rating background level + 5 dB(A)*
3 *Day Out of Hours Management level given in brackets = rating background level + 5 dB(A)*
4 *Sleep disturbance = rating background level + 10 dB(A)*

NMLs for 'other sensitive' receivers have been determined using the ICNG and are presented in Table 6-4.

Table 6-4 Construction NMLs – non-residential sensitive land uses

Land use	Construction NML, $L_{Aeq(15\ min)}$
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Places of worship	Internal noise level 45 dB(A)
Active recreation areas	External noise level 65 dB(A)
Passive recreation areas	External noise level 60 dB(A)
Community centres	Dependant on the intended use of the centre. Refer to Section 4.2 of Appendix E (Noise and Vibration Assessment Report) for further detail
Industrial premises	External noise level 75 dB(A)
Offices, retail outlets	External noise level 70 dB(A)

Construction vibration

Construction vibration impacts have been assessed using minimum working distances for human comfort, building contents and structural/cosmetic damage.

Minimum distances for vibration intensive work

Minimum working distances have been developed for typical vibration intensive construction equipment, based on the recommendations of the Construction Noise and Vibration Guideline (RMS, 2016) and previous project experience. Further detail on the minimum working distances is provided in Section 5.4 of Appendix E (Noise and Vibration Assessment Report).

Structural damage criteria

If vibration from construction work is sufficiently high, it can cause cosmetic damage to structural elements of affected buildings. Industry standard cosmetic damage vibration limits are specified in British Standard BS 7385 (BSI, 1993) and German Standard DIN 4150 (Deutsches Institute fur Normung, 1999). Structural damage criteria for heritage items have been taken from DIN 4150, while criteria for commercial/residential items have been taken from BS 7385. Further detail on criteria for structural damage is provided in Section 4.3 of Appendix E (Noise and Vibration Assessment Report).

Human comfort vibration

Humans are sensitive to vibration such that they can detect vibration levels well below those required to cause any risk of damage to a building or its contents. Criteria to avoid annoyance are, therefore, more stringent than those to prevent structural damage. The EPA's Assessing Vibration: A Technical Guideline (DEC, 2006) was used to determine the criteria for intermittent vibration based on the vibration dose value, as well as preferred values for continuous and impulsive vibration. Further detail on criteria for human comfort vibration is provided in Section 4.3 of Appendix E (Noise and Vibration Assessment Report).

Operational traffic noise

The Road Noise Policy (DECCW, 2011) has been used to assess and manage potential noise impacts from new and redeveloped road projects. This assessment has been carried out with guidance from the Road Noise Criteria Guideline, which is Transport's interpretation of the Road Noise Policy and provides a consistent approach to identifying road noise criteria for infrastructure projects.

The Road Noise Criteria Guideline criteria (RMS, 2015b) for residential receivers are shown in Table 6-5, and for 'other sensitive' receivers in Table 6-6. The Road Noise Criteria Guideline does not consider commercial and industrial receivers as being sensitive to operational road traffic noise impacts.

Table 6-5 Operational road traffic noise assessment criteria for residential land use

Road category	Type of proposal/land use	Assessment criteria dB(A)	
		Day (7am 10pm)	**Night (10pm 7am)**
Freeway/ arterial/sub-arterial	Existing residences affected by operational noise from redevelopment of existing freeways/arterial/sub-arterial roads	$L_{Aeq(15\ hr)}$ 60 (external)	$L_{Aeq(9\ hr)}$ 55 (external)

Table 6-6 Road traffic noise assessment criteria for non-residential land use

Existing sensitive land use	Assessment criteria	
	Day (7am 10pm)	**Night (10pm 7am)**
School classrooms	$L_{Aeq(1\ hr)}$ 40 (internal)	-
Places of worship	$L_{Aeq(1\ hr)}$ 40 (internal)	$L_{Aeq(1\ hr)}$ 40 (internal)
Open space (active use)	$L_{Aeq(15\ hr)}$ 60 (external)	-
Childcare facilities	Sleeping rooms: $L_{Aeq(1\ hr)}$ 35 (internal) Indoor play areas: $L_{Aeq(1\ hr)}$ 40 (internal) Outdoor play areas: $L_{Aeq(1\ hr)}$ 55 (external)	–

The Road Noise Mitigation Guideline (RMS, 2015a) provides three triggers where a receiver may qualify for consideration of noise mitigation (beyond the adoption of road design and traffic management measures). These are:

- The predicted design noise level exceeds the Road Noise Criteria Guideline (RMS, 2015a) controlling criterion and the noise level increase due to the proposal (ie the noise predictions for the proposal minus the noise levels without the proposal) is greater than 2 dB(A), or
- The predicted design noise level is 5 dB(A) or more above the criteria (meets or exceeds the cumulative limit) and the receiver is significantly influenced by road noise, regardless of the incremental impact of the proposal, or
- The predicted design noise level increase due to the proposal ie the noise predictions for the proposal minus the noise levels without the proposal) is 12 dB(A) or more.

In addition, if the noise level contribution from the road proposal is acute (daytime $L_{Aeq(15\ hr)}$ 65 dB(A) or higher, night-time $L_{Aeq(9\ hr)}$ 60 dB(A) or higher) then the receiver qualifies for consideration of noise mitigation even if noise levels are dominated by another road.

The hierarchy of noise mitigation is firstly to consider at-source noise mitigation measures such as road design and traffic management, then the use of quieter pavements. If these measures cannot be designed to meet the noise criteria the use of 'in corridor' mitigation measures should be considered, which are generally noise barriers and mounds. Finally, if the applicable noise criteria cannot be met by using a combination of all these methods, at-receiver mitigation measures can be considered such as architectural treatments and property boundary walls.

Maximum noise level during operation

Maximum noise levels generated by road traffic noise have the potential to cause disturbance to sleep. Transport recognises the potential impacts and requires an assessment of maximum noise levels be made where impacts may occur during the night. Guidance for assessing maximum noise levels is provided in Practice Note iii of the Environmental Noise Management Manual (Roads and Traffic Authority, 2001).

The maximum noise level assessment considers the following:

- Calculation of maximum noise levels
- The extent to which the maximum noise levels for individual vehicle pass-bys exceed the L_{Aeq} noise level for each hour of the night (ie L_{Amax} noise levels greater than 65 dB(A) where $L_{Amax} - L_{Aeq(1hr)} \geq 15$ dB(A))
- The number of times the maximum noise levels for individual vehicle pass-bys exceed the L_{Aeq} noise level for each hour of the night.

Audio-tactile push button noise at pedestrian crossings

The applicable noise goals for proposed audio-tactile push buttons at the Luddenham Road-Elizabeth Drive intersection are summarised in Table 6-7.

Table 6-7 External compliance noise goals for each signalised intersection

Noise logger	Rating background level, dB(A)			Compliance noise goal, L_{Amax}, dB(A)		
	Day (7am to 6pm) $L_{A90,15\ min}$	**Evening (6pm to 10pm) $L_{A90,15\ min}$**	**Night (10pm to 7am) $L_{A90,15\ min}$**	**Day (7am to 6pm)**	**Evening (6pm to 10pm)**	**Night (10pm to 7am)**
WNL3	45	43	31	60	58	46

Notes:
1 Where the compliance noise goal is more stringent than the noise goal of 60 dB(A) L_{Amax} discussed above, the criteria is shown in bold.

6.1.4 Potential impacts

Construction

Construction noise impacts to residential receivers

Table 6-8 presents the construction noise modelling results for residential receivers. It shows the number of properties where the construction noise management levels are likely to be exceeded during the daytime and night-time. The table also presents the number of receivers where noise levels are predicted to exceed the highly affected level (75 dB(A)) for each NCA. The potential community perception of noise is defined as 'noticeable', 'clearly audible', 'moderately intrusive' and 'highly intrusive', based on the community perception categories defined in the ICNG (DECC, 2009).

The assessment is representative of the worst-case 15-minute period of construction activity, while the construction equipment is at the nearest location to each sensitive receiver location. The assessed scenario does not represent the ongoing day to day noise impact at noise sensitive receivers for an extended period of time. In reality, separation distances would vary between plant and sensitive receivers. For linear work (work that moves along the road alignment, rather than work located at a construction ancillary facility), noise exposure at each receiver would reduce due to increases in distance as the work progress along the alignment. Typical noise levels could be 5 to 10 dB(A) lower dependent on the site and nature of work.

The ICNG states that where a construction noise impact level of greater than 75 dB(A) is predicted, a receiver is considered to be 'highly noise affected' and afforded additional consideration for mitigation. The number of potentially highly affected noise receivers in each NCA is also included in Table 6-8.

The potential for highly noise affected receivers would be confirmed during detailed construction planning. These receivers would receive additional consultation with regards to specific timing and impacts of construction work. Respite periods would also be considered for these receivers in accordance with the ICNG.

Vegetation removal is predicted to result in the greatest number of exceedances of the daytime construction noise management levels. During this scenario, about 50 receivers during work within standard construction hours across the construction footprint may experience noise levels above the NMLs. Seven receivers may be highly noise affected (refer to Figure 6-2, which shows receivers that may be highly noise affected during any of the assessed work scenarios). Noise levels would be moderately intrusive at up to 13 receivers and highly intrusive at up to 10 receivers across the construction footprint during standard construction hours. The magnitude of these impacts is consistent with other major work projects.

Site establishment and enabling work is likely to be completed before any other construction stages begin. This scenario would also represent a reasonable worst-case assessment of the types of activities which are likely to take place during the evening and night-time outside of standard construction work hours (as described in Section 3.3.13). Findings of the worst-case construction noise impact assessment indicate the following:

- About 29 receivers during work within standard construction hours and 136 receivers during work outside of standard construction hours across the construction noise study area may experience noise levels above the NMLs
- Six receivers may be highly noise affected. These receivers are shown in Figure 6-2, along with other receivers that may be highly noise affected during any of the assessed work scenarios
- Night-time mitigation measures would be required for about 58 receivers with perceptions of noise ranging from 'clearly audible' to 'highly intrusive'
- About 136 receivers would require notification of night-time work, as construction noise may be 'noticeable' at these receivers.

To manage potential construction noise impacts, feasible and reasonable mitigation measures would be detailed in the Construction Noise and Vibration Management Plan (refer to Section 6.1.5).

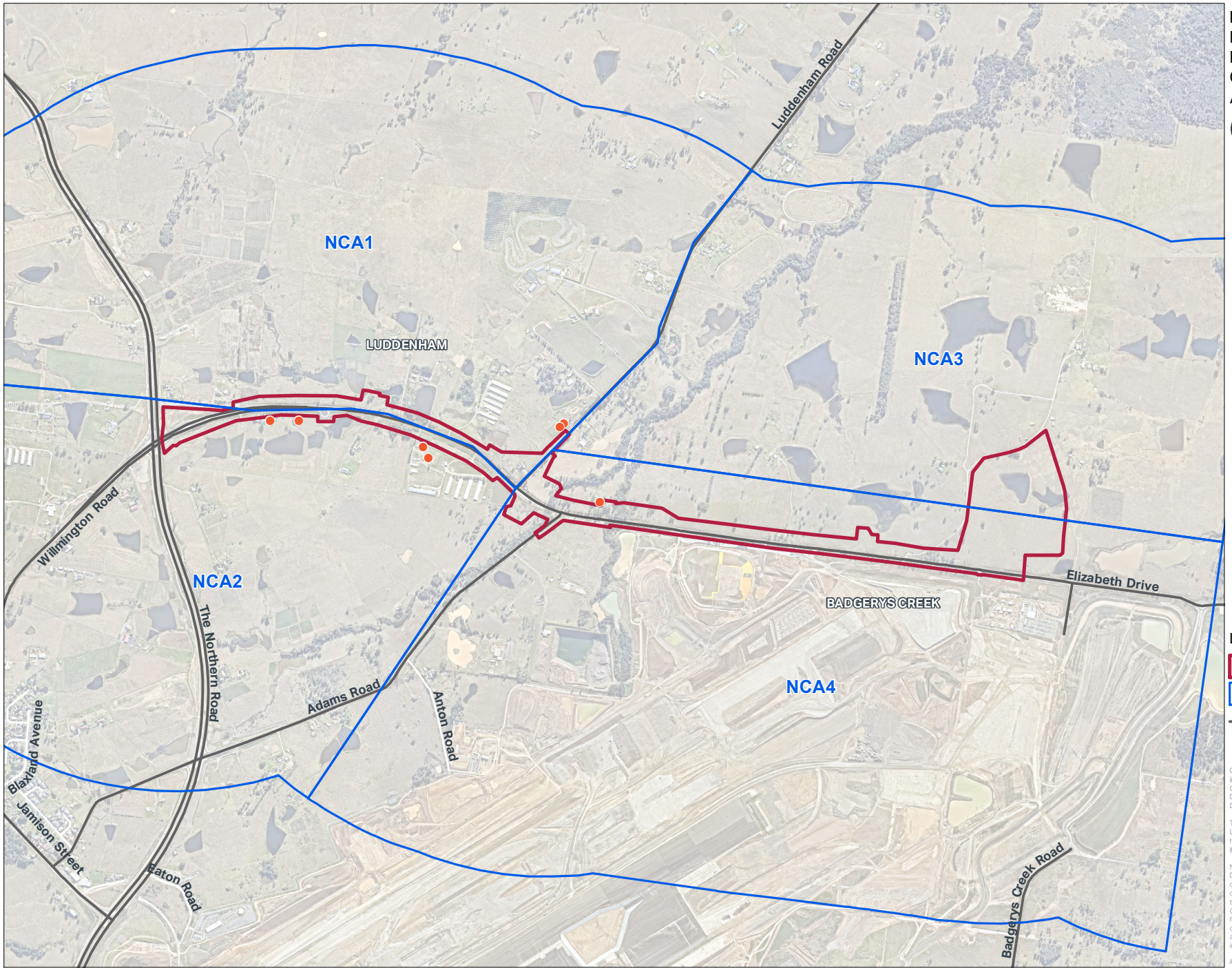


FIGURE 6-2:
HIGHLY NOISE AFFECTED RECEIVERS DURING CONSTRUCTION (FROM ANY WORK SCENARIO)

Table 6-8 Number of residential buildings where noise levels may exceed construction noise management levels for all construction scenarios

Scenario	Number of residential buildings where noise levels may exceed construction noise management levels							
	Standard construction hours			**Outside of standard construction hours (night time)**				**Highly affected > 75 dB(A)**
	1 10 dB (Clearly audible)	**11 20 dB (Moderately intrusive)**	**> 20 dB (Highly intrusive)**	**1 5 dB (Noticeable)**	**6 15 dB (Clearly audible)**	**16 25 dB (Moderately intrusive)**	**> 25 dB (Highly intrusive)**	
NCA1								
Site establishment	8	2	2	6	8	6	4	2
Utility work	9	2	-	n/a	n/a	n/a	n/a	-
Demolition	13	3	-	n/a	n/a	n/a	n/a	-
Vegetation removal	10	4	4	n/a	n/a	n/a	n/a	2
Earthworks	12	2	3	n/a	n/a	n/a	n/a	1
Drainage work	9	1	-	n/a	n/a	n/a	n/a	-
Bridge work	3	-	-	n/a	n/a	n/a	n/a	-
Pavement work	8	3	2	n/a	n/a	n/a	n/a	-
Finishing work	3	2	2	n/a	n/a	n/a	n/a	1
NCA2								
Site establishment	6	1	4	69	16	6	5	3
Utility work	4	2	3	n/a	n/a	n/a	n/a	-
Demolition	10	1	-	n/a	n/a	n/a	n/a	-
Vegetation removal	10	6	5	n/a	n/a	n/a	n/a	4

Scenario	Number of residential buildings where noise levels may exceed construction noise management levels							
	Standard construction hours			**Outside of standard construction hours (night time)**				**Highly affected > 75 dB(A)**
	1 10 dB (Clearly audible)	**11 20 dB (Moderately intrusive)**	**> 20 dB (Highly intrusive)**	**1 5 dB (Noticeable)**	**6 15 dB (Clearly audible)**	**16 25 dB (Moderately intrusive)**	**> 25 dB (Highly intrusive)**	
Earthworks	8	3	3	n/a	n/a	n/a	n/a	1
Drainage work	6	3	2	n/a	n/a	n/a	n/a	-
Bridge work	2	-	-	n/a	n/a	n/a	n/a	-
Pavement work	7	3	3	n/a	n/a	n/a	n/a	1
Finishing work	4	1	3	n/a	n/a	n/a	n/a	2

Scenario	Number of residential buildings where noise levels may exceed construction noise management levels							
	Standard construction hours			**Outside of standard construction hours (night time)**				**Highly affected > 75 dB(A)**
	1 10 dB (Clearly audible)	**11 20 dB (Moderately intrusive)**	**> 20 dB (Highly intrusive)**	**1 5 dB (Noticeable)**	**6 15 dB (Clearly audible)**	**16 25 dB (Moderately intrusive)**	**> 25 dB (Highly intrusive)**	
NCA3								
Site establishment	2	2	-	1	2	3	3	-
Utility work	1	-	-	n/a	n/a	n/a	n/a	-
Demolition	1	-	-	n/a	n/a	n/a	n/a	-
Vegetation removal	4	3	-	n/a	n/a	n/a	n/a	-
Earthworks	1	1	1	n/a	n/a	n/a	n/a	1
Drainage work	-	-	-	n/a	n/a	n/a	n/a	-
Bridge work	1	-	-	n/a	n/a	n/a	n/a	-
Pavement work	-	1	-	n/a	n/a	n/a	n/a	-
Finishing work	3	-	-	n/a	n/a	n/a	n/a	-
NCA4								
Site establishment	1	-	1	2	3	1	1	1
Utility work	1	-	1	n/a	n/a	n/a	n/a	-
Demolitions	4	-	-	n/a	n/a	n/a	n/a	-
Vegetation removal	3	-	1	n/a	n/a	n/a	n/a	1
Earthworks	4	1	0	n/a	n/a	n/a	n/a	-

Scenario	Number of residential buildings where noise levels may exceed construction noise management levels							
	Standard construction hours			**Outside of standard construction hours (night time)**				**Highly affected > 75 dB(A)**
	1 10 dB (Clearly audible)	**11 20 dB (Moderately intrusive)**	**> 20 dB (Highly intrusive)**	**1 5 dB (Noticeable)**	**6 15 dB (Clearly audible)**	**16 25 dB (Moderately intrusive)**	**> 25 dB (Highly intrusive)**	
Drainage work	-	-	1	n/a	n/a	n/a	n/a	1
Bridge work	4	-	-	n/a	n/a	n/a	n/a	-
Pavement work	3	-	1	n/a	n/a	n/a	n/a	1
Finishing work	-	-	1	n/a	n/a	n/a	n/a	1

Construction noise impacts to non-residential receivers

The construction noise modelling for non-residential properties indicates that there are no additional properties where the construction NMLs are likely to be exceeded during their hours of use. This assessment is representative of the worst-case 15-minute period of construction activity, while the construction equipment is at the nearest location to each receiver location.

Potential overlapping construction activities

While most construction activities are expected to occur at distinct scheduled times and at different locations, it is possible that noisy construction activities for the proposal may occur at the same time in close proximity to each other. In these cases, it is possible that an increase of up to 3 dB(A) of the highest noise level predicted for any construction stage may occur (assuming that at any one location equal noise levels from two stages of work are experienced). This may increase the number of receivers where noise levels would be greater than 20 dB(A) above the construction NMLs.

Noise from use of the construction ancillary facility areas may also contribute to construction noise at receivers. However, it is likely that the other construction stages would dominate cumulative noise levels, and any increase in the overall noise level from the proposal would be less than 3 dB(A).

Overlapping construction stages and receivers subject to increased noise levels would be determined during detailed design. Where required, consideration would be given to additional safeguards and management measures during detailed design.

Sleep disturbance impacts

Table 6-9 presents the number of residential buildings where noise levels may exceed sleep disturbance criteria during night work. Site establishment and enabling work are the only activities proposed to be carried out during both standard hours and out of hours.

Noise levels at about 45 residential receivers in total for the proposal are predicted to exceed the sleep disturbance screening level for site establishment and enabling work during the construction period. Eleven awakening reactions may be expected to occur in total across the entire proposal footprint. As the work is expected to be staged, the number of affected residential receivers at any one time would be limited. The highest impacts are expected during truck movements.

Table 6-9 Number of residential buildings where noise levels may exceed sleep disturbance criteria for night work

NCA	Scenario	Number of residential buildings where noise levels may exceed the sleep disturbance screening level and/or the awakening reaction level	
		Sleep disturbance screening level $L_{A1(1\ minute)}$, dB(A)	**Awakening reaction level $L_{A1(1\ minute)}$, dB(A)**
NCA1	Site establishment	14	4
NCA2	Site establishment	19	4
NCA3	Site establishment	8	2
NCA4	Site establishment	4	1

Construction road traffic noise

During construction of the proposal, it is anticipated that peak traffic generation would include:

- About 140 heavy vehicle movements per day
- About 400 light vehicle movements per day.

Movement refers to a one-way movement. A vehicle entering and then leaving a construction site represents two movements.

Construction traffic would be distributed across the construction ancillary facilities and along the proposal alignment, depending on the stage of construction and progression of construction activities. Heavy vehicle movements, which are likely to have the largest impact, would mainly be related to earthworks or spoil movement, but would also include other movements such as girder delivery and plant delivery. The roads used as haulage routes (described in Chapter 3 (Description of the proposal)) would have the highest volumes of construction vehicles and, therefore, receivers along these routes are most likely to be affected by construction traffic.

Existing traffic flows on Elizabeth Drive are substantially greater than the proposed construction traffic numbers. While construction traffic may cause minor increases in road traffic noise in some areas, no increases in road traffic noise of greater than 2 dB(A) have been identified along Elizabeth Drive for construction traffic during the daytime and night-time periods.

Construction vibration

Minimum working distances for vibration intensive construction equipment are provided Section 5.4 of Appendix E (Noise and Vibration Assessment Report). If these minimum working distances are complied with, no adverse impacts from vibration intensive work are likely in terms of human response or cosmetic damage. Equipment size would be selected by the construction contractor and would take into account the minimum working distances and the distance between the area of construction and the nearest receiver.

Work carried out within minimum working distances for cosmetic damage may cause damage to buildings. If vibration intensive work is required within these minimum working distances, safeguards and management measures to control excessive vibration would be implemented as outlined in Section 6.1.5.

The non-Aboriginal heritage assessment prepared for the proposal does not identify any heritage items that are likely to be impacted by construction vibration, due to their distance from vibration intensive work. Further detail on potential non-Aboriginal heritage impacts is provided in Section 6.4.

Work carried out within the human comfort minimum working distances may cause some people to experience annoyance and concern for cosmetic damage. Several residential receivers are located within these distances. Receivers located within the minimum distances for human comfort would be notified of the potential impacts as part of the notification of highly noise affected receivers (refer to Section 6.1.5).

Operation

Operational traffic noise impacts

Receivers are generally most affected by the proposal in the design year (2040) compared to the opening year (2030). This is because there is expected to be more traffic in 2040 than 2030. Therefore, this scenario is considered to control the assessment in terms of determining the worst-case impacts and requirements for mitigation.

Predicted operational noise levels (with the proposal) in the design year (2040) night-time period are shown on Figure 6-3 and summarised as follows:

- Road traffic noise levels are predicted to exceed the Road Noise Policy L_{Aeq} noise criteria at a total of 60 residential receivers. Generally, these exceedances would occur at receivers directly adjacent to the Elizabeth Drive road corridor
- Of these 60 residential receivers:
  - Noise levels are not predicted to increase by more than 2 dB(A) at any residential receiver
  - Noise levels are predicted to exceed the cumulative limit at seven residential receivers (ie ≥ LAeq(15 hr) or LAeq(9 hr) noise criterion + 5 dB(A))
  - Noise levels are predicted to exceed the acute noise limit at four residential receivers (ie ≥ LAeq(15 hr) 65 dB(A) or LAeq(9 hr) 60 dB(A))
- Seven sensitive receivers are identified to be eligible for the consideration of feasible and reasonable noise mitigation measures, all directly adjacent Elizabeth Drive. These receivers are shown on Figure 6-4
- No exceedances of the criteria are predicted at non-residential land uses during operation.

The proposal would not substantially change the operational road traffic noise levels in the study area. Noise levels are not predicted to increase by more than 2 dB(A) at any residential receiver, compared to a scenario without the proposal. The predicted exceedances at residential receivers are largely due to existing high traffic noise levels. To address these road traffic noise impacts, noise mitigation measures would be considered, including at-property treatments. To address aircraft noise from the operation of WSA, the WSA may implement at-receiver noise mitigation at one receiver, prior to this proposal opening.

Safeguards and management measures would be implemented to reduce road traffic noise levels and reduce maximum noise levels at receivers (refer to Section 6.1.5).

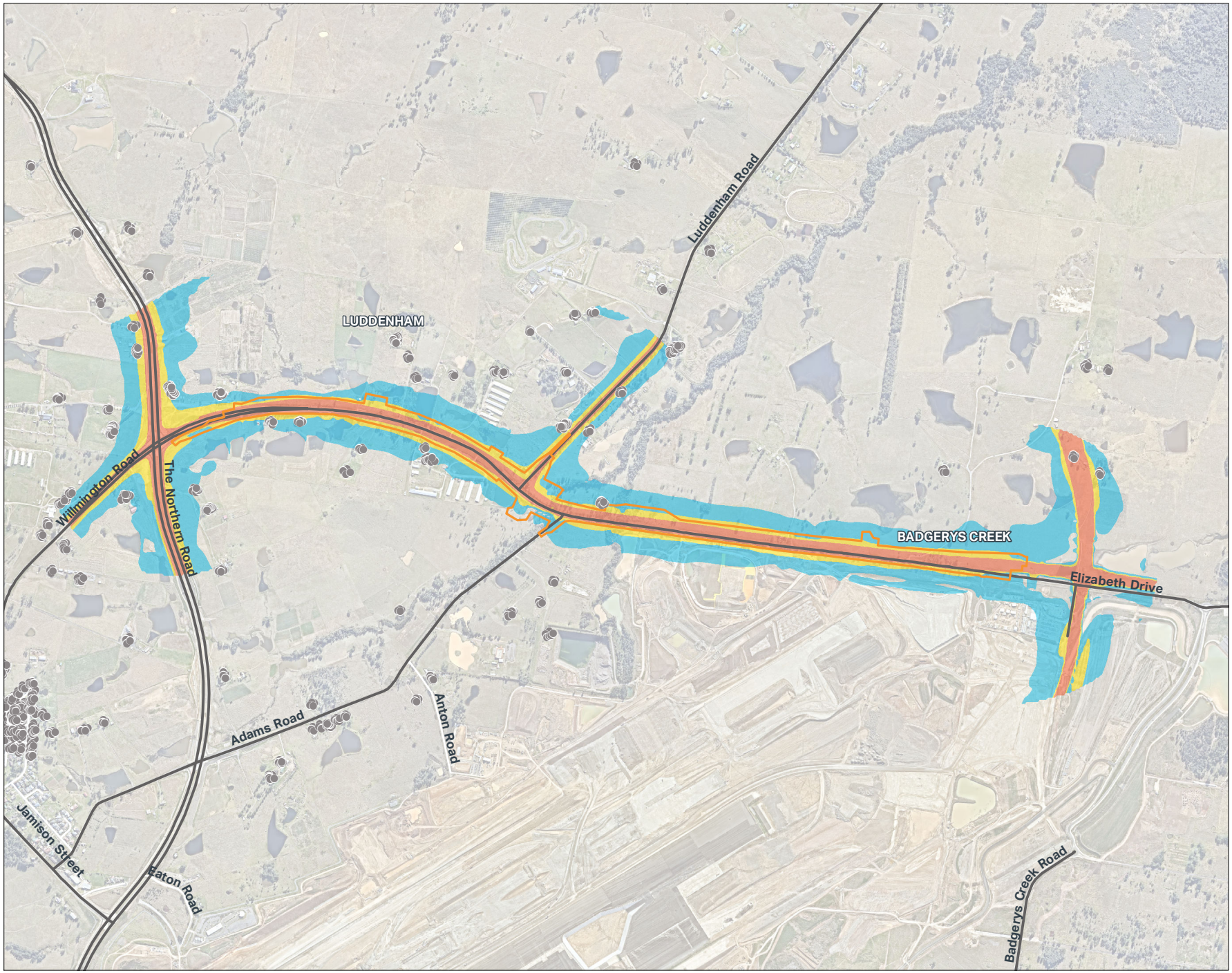


FIGURE 6-3:

PREDICTED OPERATIONAL NOISE LEVELS WITH THE PROPOSAL (NIGHT TIME 2040)

N

0 250 500 m

Legend

- Operational footprint
- Primary road
- Receiver

Sound Pressure Level, LAeq 9hr dB(A)

55 60 65

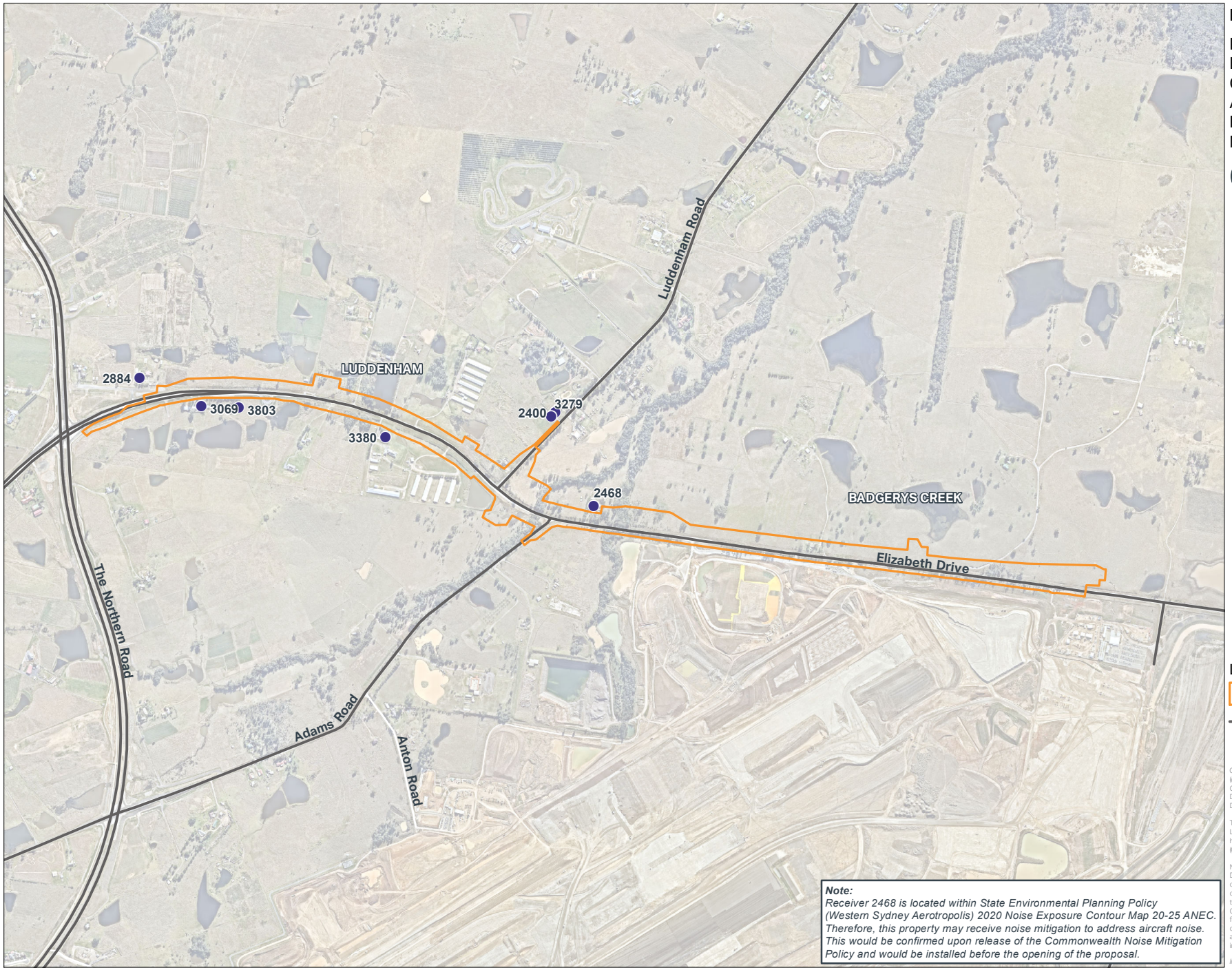


FIGURE 6-4:

RESIDENTIAL RECEIVERS ELIGIBLE FOR THE CONSIDERATION OF ADDITIONAL FEASIBLE AND REASONABLE NOISE MITIGIATION MEASURES

N

0 250 500 m

Legend

- Operational footprint
- Primary road
- Eligible residential receiver

Maximum noise levels

Maximum noise levels are generally dependent on truck engine braking events due to changes in gradient, and/or the presence of intersections; however, loud exhausts and horns may also contribute. A truck may engage its engine brakes at any location on Elizabeth Drive. The likelihood depends on a range of factors, such as road gradient, proximity to junctions, truck condition and individual driver behaviour. Maximum noise events are less likely further away from the alignment.

Noise monitoring results for the existing Elizabeth Drive indicate that the surrounding area is already exposed to maximum noise level events that have the potential for awakening reactions (detailed further in Section 6.3 of Appendix E (Noise and Vibration Assessment Report)). While this is generally attributed to road traffic noise, other noise sources recorded in the area may include WSA construction activities.

The type of truck, and speed of travel to a lesser extent, contribute to the maximum noise level. Given the proposal would introduce traffic lanes and a new central median, some maximum noise events may occur further away from residential receivers compared with the existing situation, leading to slightly reduced maximum noise levels. In some instances where the upgraded road is located closer to receivers (compared to the existing road), maximum noise levels may increase slightly. Currently, some congestion occurs on Elizabeth Drive during morning and afternoon peak periods. The proposal would reduce this congestion and, therefore, this would likely reduce the number of maximum noise events as sudden braking and acceleration from slow speeds would not occur as frequently.

Audio-tactile push button noise

The proposed intersection of Luddenham Road and Elizabeth Drive, Luddenham Road would be signalised and have pedestrian crossing areas. A total of 14 audio-tactile push buttons would be located at the pedestrian crossing areas. The proposed intersection is shown on Figure 3-9.

The indicative locations of the audio-tactile push buttons are presented in Section 7.1 of Appendix E (Noise and Vibration Assessment Report). The nearest residential receivers include:

- 2141 Elizabeth Drive, Luddenham – about 308 metres from the closest audio-tactile push button
- 887 Luddenham Road, Luddenham – about 302 metres from the closest audio-tactile push button
- 889 Luddenham Road, Luddenham – about 280 metres from the closest audio-tactile push button
- 892 Luddenham Road, Luddenham – about 345 metres from the closest audio-tactile push button.

Noise predictions during the ‘walk’ signal phase were calculated for the nearest audio-tactile push button to each nearby residential receiver. According to the Transport management framework (RMS, 2005), audio-tactile push buttons have a three-setting switch which has a gain adjustment potential of 6 dB(A). The maximum noise source level would occur at the ‘high’ setting. There would be a 3 dB(A) reduction at the ‘normal’ setting and a 6 dB(A) reduction at the ‘low’ setting. The noise level for each setting (low, medium and high) has been assessed.

Noise level predictions for the four residential dwellings located in proximity to the intersection are presented in Table 6-10 with the night-time criterion, which is the most stringent. Noise from audio-tactile push buttons is predicted to comply with applicable noise goals (refer to Table 6-7) at all nearby residential receivers during the daytime, evening and night-time periods, for all push buttons on the ‘high’ setting.

Table 6-10 Predicted noise impacts from audio-tactile push button noise

Residential receiver location	Compliance noise goal, L_{Amax} dB(A) Night time (10pm to 7am)	Predicted L_{Amax} noise level, dB(A)		
		High setting	Medium setting	Low setting
2141 Elizabeth Drive, Luddenham	46	35	32	29
887 Luddenham Road, Luddenham	46	35	32	29
889 Luddenham Road, Luddenham	46	36	33	30
892 Luddenham Road, Luddenham	46	34	31	28

6.1.5 Safeguards and management measures

Section 8.2 of Appendix E (Noise and Vibration Assessment Report) provides detail on the approach to assessing feasible and reasonable safeguards and management measures to mitigate operational traffic noise impacts.

In summary, the hierarchy of noise mitigation is firstly to consider at-source noise mitigation measures such as road design and traffic management, then the use of quieter pavements. If these measures cannot be designed to meet the noise criteria, the use of 'in corridor' mitigation measures should be considered, which are generally noise barriers and mounds. Finally, if the applicable noise criteria cannot be met by using a combination of all these methods, at-receiver mitigation measures can be considered such as architectural treatments and property boundary walls.

The use of a low noise pavement, such as open graded asphalt, would be investigated further during detailed design. Noise barriers would not be considered reasonable for the proposal, as the receivers eligible for consideration of additional noise mitigation are not closely spaced in a group of four or more.

Table 6-11 describes the proposed safeguards and management measures that would be implemented to manage potential noise and vibration impacts, which include the recommendation for at-receiver noise treatments.

In addition to these safeguards and management measures, Transport and its contractor would also comply with any relevant noise and vibration management measures specified in the environment protection licence (EPL), which would be sought for the proposal (refer to Section 4.2.8).

Table 6-11 Safeguards and management measures - noise and vibration

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration	A Construction Noise and Vibration Management Plan will be prepared as part of the CEMP. The Construction Noise and Vibration Management Plan will identify: • The location of noise and vibration sensitive receivers • Potential significant noise and vibration generating activities • Feasible and reasonable mitigation measures to be implemented during construction to minimise noise and vibration impacts, such as restrictions on working hours, staging, placement and operation of work compounds, parking and storage areas, temporary noise barriers,	Contractor	Pre-construction and construction	Section 4.6 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Responsibility	Timing	Reference
	construction haulage route road maintenance and controlling the location and use of vibration generating equipment • A monitoring program to assess performance against relevant noise and vibration criteria • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • An out of hours work procedure, including approval process and proposed mitigation measures			
Noise and vibration	All sensitive receivers (eg schools, local residents) likely to be affected will be notified at least five days prior to commencement of any work associated with the modelled scenario that may have an adverse noise or vibration impact (eg moderately intrusive during the day and clearly audible at night). The notification will include the following details: • The proposal description • Construction period and construction hours • Contact information for project management staff • Complaint and incident reporting and how to obtain further information	Contractor	Pre-construction and construction	Additional safeguard
Noise and vibration	Where reasonable and feasible, construction will be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels will be scheduled during less sensitive time periods, where possible. Any variations to the standard construction hours will follow the approach in RTA Environmental Fact Sheets – Noise Management and Night Work, including consultation with the affected local community	Contractor	Construction	Additional safeguard
Noise and vibration	Where properties have been identified for architectural treatment and are likely to be impacted by noise from construction work, Transport will consult with those property owners on the early installation of treatments to provide noise mitigation during the construction of the proposal	Contractor / Transport	Pre-construction	Additional safeguard
Noise and vibration	Where feasible and reasonable, high noise generating activities (75 dB(A) L_{Aeq} at receiver) will be carried out during standard construction hours and in continuous blocks of no more than three hours with at least one hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receiver	Contractor	Construction	Additional safeguard
Noise and vibration	The following will be implemented for deliveries to and from the proposal: • Loading and unloading of materials/deliveries as far as possible from sensitive receivers • Dedicated loading/unloading areas will be shielded if close to sensitive receivers • Delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• The construction site will be arranged to limit the need for reversing associated with regular/repeatable movements			
Noise and vibration	Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work	Contractor	Construction	Additional safeguard
Noise and vibration	Where practicable, work will be scheduled to avoid major student examination periods such as before or during the Higher School Certificate and at the end of higher education semesters	Contractor	Construction	Additional safeguard
Noise and vibration	In circumstances where the noise levels are predicted to exceed construction noise management levels after implementation of the standard actions listed in Transport's Construction Noise and Vibration Guideline, additional mitigation measures will be implemented, such as the following: • Monitoring • Notification (letterbox drop or equivalent) • Specific notifications • Phone calls • Individual briefings • Respite offers and periods • Alternative accommodation	Contractor	Construction	Additional safeguard
Noise and vibration	Vibration intensive equipment size will be selected to avoid working within the structural damage minimum working distances. The use of less vibration intensive methods of construction or equipment will be considered where feasible and reasonable	Contractor	Construction	Additional safeguard
Noise and vibration	Where the use of vibration intensive equipment within the relevant minimum working distances cannot be avoided, prior to the commencement of vibration intensive work, a detailed inspection will be carried out and a written and photographic report prepared to document the condition of buildings and structures within the minimum working distances. A copy of the report will be provided to the relevant landowner or land manager	Contractor	Pre-construction	Additional safeguard
Noise and vibration	To confirm that the noise levels targets are achieved, a post-construction noise monitoring program will be carried out in accordance with the Road Noise Mitigation Guideline	Transport	Operation	Additional safeguard

6.2 Traffic, transport and access

A traffic and transport assessment has been prepared to assess the potential impacts of the proposal. A summary of this assessment is presented in this section, with the full report provided in Appendix F (Traffic and Transport Assessment Report).

6.2.1 Methodology

The methodology for the traffic and transport assessment involved the following:

- Examination of the existing traffic and transport conditions for the study area (shown on Figure 6-5), including:
  - Key existing roads and intersections
  - Traffic volumes and patterns for the year 2018, using a base traffic model developed with Aimsun software
  - Road safety and crash history data
  - Public transport provisions
  - Facilities for active transport users (pedestrians and cyclists)
- Assessing the impacts of additional traffic on the road network generated during construction of the proposal
- Estimation of forecast traffic volumes for the opening year of the proposal (2030) and 10 years from the opening year (2040)
- Assessment of impacts of the proposal on the road network during operation, including consideration of the following scenarios using Aimsun microsimulation modelling:
  - 2030 without Elizabeth Drive upgrades (a 'do nothing' scenario, which includes the M12 Motorway)
  - 2030 with Elizabeth Drive upgrades
  - 2040 without Elizabeth Drive upgrades (a 'do nothing' scenario, which includes the M12 Motorway)
  - 2040 with Elizabeth Drive upgrades
- Analysis of the operational transport impacts of the proposal, to assess the impacts on the midblock and intersections of Elizabeth Drive. The network statistics have been presented for a two-hour weekday peak model simulation period between 7am to 9am and 4pm to 6pm
- Assessment of the impact to property access, freight transport, public transport, pedestrians and cyclists during construction and operation of the proposal
- Assessment of the impact of proposed U-turns on vehicle travel times along Elizabeth Drive, during operation of the proposal
- Identification of safeguards and management measures to manage the identified impacts.

As identified in Section 1.1, the proposal is one of two adjacent planned upgrades of Elizabeth Drive: Elizabeth Drive West Upgrade (this proposal) and Elizabeth Drive East Upgrade (subject to a separate REF). Collectively, these are referred to as the 'Elizabeth Drive upgrades'.

Given the proximity of the Elizabeth Drive upgrades, and that each upgrade is proposed to have an opening year of 2030, traffic modelling for this assessment has been based on a study area that encompasses both proposed upgrades. It is noted that the benefits of the Elizabeth Drive West Upgrade are expected to be fully realised after the Elizabeth Drive East Upgrade is completed. This is because the improvement along Elizabeth Drive as a result of the Elizabeth Drive East Upgrade has the potential to cause delays along the western extent of Elizabeth Drive (the location of the proposed Elizabeth Drive West Upgrade). This would be due to an anticipated increase in traffic through the priority controlled intersections along the Elizabeth Drive West Upgrade road corridor. The extents of the proposal (the operational footprint) and the modelled study area are shown in Figure 6-5.

Intersection level of service

Level of service (LoS) is the standard measure, based on the average delay per vehicle, used to assess the intersection performance in terms of average delay (seconds per vehicle). There are six levels of service, ranging from LoS A (good

operation) to LoS F (extra capacity required). LoS D or better is considered to be an acceptable level of service. The assessment of intersection operation is based on criteria outlined in Table 6-12.

Table 6-12 Transport intersection LoS criteria

Level of service	Average delay (seconds per vehicle)	Criteria
A	<14	Good operation
B	15 to 28	Good operation with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Near capacity
E	57 to 70	At capacity, incidents at signals will cause excessive delays
F	>70	Extra capacity required

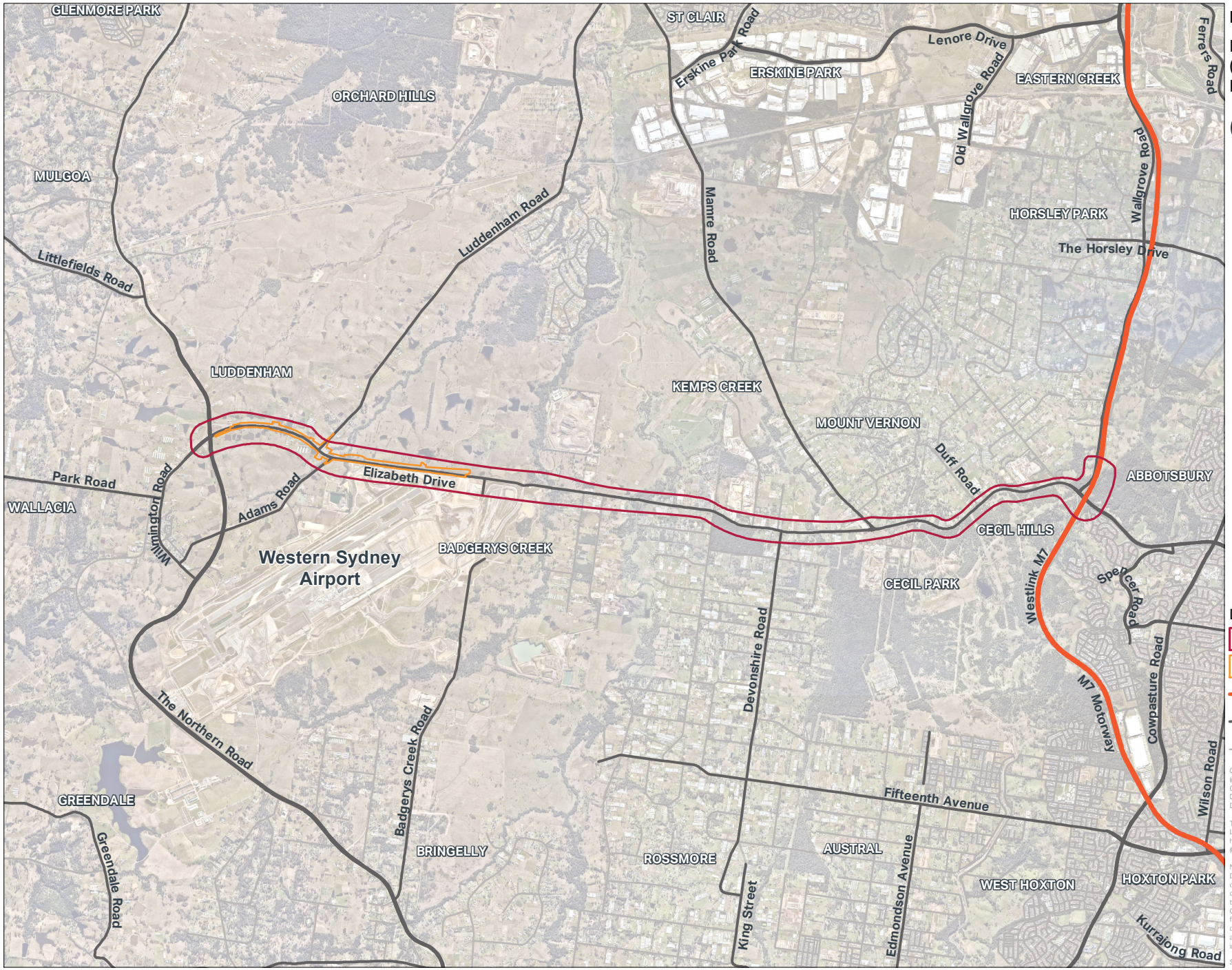


FIGURE 6-5:

MODELLED STUDY AREA (ELIZABETH DRIVE WEST AND EAST)

Source: Imagery © Nearmap 2022.

6.2.2 Existing environment

Existing road network

Elizabeth Drive is a key east-west corridor stretching about 24 kilometres in length and connects Liverpool to the surrounding suburbs and Luddenham in Western Sydney.

Elizabeth Drive is predominantly two lanes in each direction for 10 kilometres between Liverpool and the M7 Motorway and a single carriage way in each direction with no median for 14 kilometres between the M7 Motorway and Luddenham. The surrounding land use is mainly rural, rural/residential and enterprise/industrial. The WSA and Western Sydney Aerotropolis are located south of Elizabeth Drive and west of Badgerys Creek and would be a catalyst for significant land use change.

Roads are classified by Transport in a hierarchy according to whether roads have primarily a movement function or predominantly an access function carrying low levels of traffic. The road hierarchy of the existing road network and wider study area is shown in Figure 6-6 and outlined below.

State roads:

- The Northern Road
- Elizabeth Drive
- Mamre Road
- The M7 Motorway.

Regional roads:

- Luddenham Road
- Badgerys Creek Road
- Devonshire Road.

FIGURE 6-6:
ROAD HIERARCHY IN THE WIDER STUDY AREA

Legend

- Regional road
- State road

Source: Imagery © Nearmap 2022.

Key intersections

The key intersections with Elizabeth Drive within the construction footprint are detailed in Table 6-13 and shown in Figure 3-2 to Figure 3-3. A complete description of all key intersections in the wider study area is provided in Section 4.2 of Appendix F (Traffic and Transport Assessment Report).

Table 6-13 Summary of key intersections within the construction footprint

Intersection	Existing layout
The Northern Road	• A signalised intersection with slip lanes on each approach. Bus only lanes with bus-jump-start facilities are provided on The Northern Road for buses travelling north and south • No restrictions on turning movements
Luddenham Road	• Unsignalised T-intersection • No restrictions on turning movements • Turning lanes provided on both east and west approaches on Elizabeth Drive • Luddenham Road provides north-south connection to Mamre Road
Adams Road	• Unsignalised T-intersection • No restrictions on turning movements

Road network performance

The year 2018 has been selected as the base case for traffic modelling, which is considered to provide a suitable base case for traffic modelling prior to the influence of COVID-19 lockdowns which temporarily impacted road travel. Peak hour directional midblock performance, travel speeds and intersection performance were assessed for the study area. The results are detailed in Appendix F (Traffic and Transport Assessment Report) and summarised below.

Traffic volumes

The two assessed midblock sections of the road within the construction footprint operate with a volume capacity ratio of less than 0.5, indicating sufficient capacity along those sections (refer to Table 6-14).

Table 6-14 Midblock traffic volumes from 2018 base year model

Section	Direction	AM Vehicles	AM volume capacity ratio	PM Vehicles	PM volume capacity ratio
Badgerys Creek to Luddenham Road	Eastbound	660	0.28	400	0.17
	Westbound	380	0.16	590	0.26
Luddenham Road to The Northern Road	Eastbound	750	0.31	360	0.16
	Westbound	290	0.12	590	0.25

The proportion of heavy vehicles on Elizabeth Drive within the construction footprint is relatively high, up to 17 per cent travelling in the eastbound direction and up to 35 per cent travelling in the westbound direction during the peak hours, indicating that Elizabeth Drive is a key heavy vehicle route. It is likely that the existing high heavy vehicle percentage is attributed to the ongoing WSA construction activities.

Travel speeds on Elizabeth Drive

Elizabeth Drive has a posted speed limit of 80 kilometres per hour between Badgerys Creek Road and The Northern Road. The existing average speeds along Elizabeth Drive are generally close to the posted speed indicating uninterrupted flow during the peak hours (refer to Table 6-15).

Table 6-15 Existing travel speeds

Section	Direction	AM average travel speed (km/h)	PM average travel speed (km/h)
Badgerys Creek to Luddenham Road	Eastbound	67	69
	Westbound	78	76
Luddenham Road to The Northern Road	Eastbound	81	83
	Westbound	69	64

Existing intersection performance

The average delay at the modelled (unsignalised) intersections within the construction footprint is an indication of the average time needed to join the traffic flow on Elizabeth Drive. This delay is either less than 13 seconds per vehicle or between 21 and 24 seconds per vehicle, indicating good operation at these intersection with acceptable delays and spare capacity (refer to Table 6-16). The two intersections operate at LoS B or better.

Table 6-16 Intersection performance from 2018 base year model

Intersection with Elizabeth Drive	Time period	Delay (s)	LoS
Badgerys Creek Road	AM	21	B
	PM	24	B
Luddenham Road	AM	13	A
	PM	8	A

Crash data

Historical crash data within the construction footprint was collected between January 2016 to December 2020 (Figure 2-1 in Chapter 2 (Need and options considered)). Five crashes were reported at the intersection of Elizabeth Drive and Luddenham Road (within the construction footprint), with one incident recording a serious injury and two incidents recording moderate injuries. The five crashes involved vehicles travelling from the opposite direction.

Outside of the construction footprint, nine crashes were reported at the intersection of Elizabeth Drive and Badgerys Creek Road. The crashes resulted in two incidents of serious injuries, three incidents of moderate injuries and three incidents of minor injuries. Eight out of the nine crashes involved vehicles travelling from the opposite direction.

Public transport

There is currently limited public transport provision within the construction footprint. There are no rail links to the suburbs immediately north or south of Elizabeth Drive to the west of Cecil Hills. The nearest main train stations are St Marys, Leppington and Edmondson Park stations.

Overall, the bus network coverage in the study area is very poor, with few services provided and low frequencies. This reflects the rural land use and low population density of the study area generating a low demand for public transport.

Active transport

There are limited dedicated walking and cycling facilities along Elizabeth Drive. Shoulders and verges are the only available means for pedestrians to travel along Elizabeth Drive within the construction footprint exposing them to live traffic.

The lack of footpaths and cycling paths is a safety issue for pedestrians and cyclists along Elizabeth Drive and the adjoining side roads.

Limited off-road cycling facilities are provided in the wider study area. The Northern Road has a shared path running along the northbound direction with cycling crossing facilities at the intersections with side roads.

Parking

There is no on street parking located along Elizabeth Drive within the construction footprint. Additionally, no off-street parking locations have been identified within the construction footprint. As such, impacts to parking due to the proposal are not anticipated and have not been assessed further.

6.2.3 Potential impacts

Construction

Traffic impacts

During construction of the proposal, it is anticipated that peak traffic generation would be from about 200 light vehicles and 70 heavy vehicles per day. Construction traffic would be distributed across the construction ancillary facilities and along the proposal alignment, depending on the stage of construction and progression of construction activities. Heavy vehicle movements, which are likely to have the largest impact, would mainly be related to earthworks or spoil movement, but would also include other movements such as girder delivery and plant delivery.

For the purposes of the assessment, it is assumed that each vehicle would generate two movements per day (ie to enter and exit a construction ancillary facility), as per the following estimated breakdown:

- 200 light vehicles would arrive at site before the start of weekday standard construction working hours at 7am (outside the AM peak hour of 7-8am)
- 200 light vehicles would depart site after standard construction working hours end at 6pm (outside the PM peak hour of 4-5pm)
- 70 heavy vehicles per day (140 two-way movements), spread evenly across the day resulting in 10 to 15 vehicle movements per hour.

For the purposes of the assessment, it has been assumed that 10 light vehicle movements (five vehicles entering and five vehicles exiting) and 15 heavy vehicles could be generated during the road network AM and PM peak hours (7am to 8am and 4pm to 5pm).

Initially, construction traffic would access construction ancillary facilities via the existing Elizabeth Drive alignment. Temporary access roads connecting construction ancillary facilities to construction sites would be established along the new Elizabeth Drive road alignment early in the construction program to minimise impacts on the ongoing operation of the existing Elizabeth Drive.

The additional 25 construction vehicle movements (10 light vehicles and 15 heavy vehicles) generated during the AM and PM peak hours would represent an increase in peak hourly traffic volumes along Elizabeth Drive of about two to three per cent. These traffic volume increases are minor and expected to be manageable given that they are within the realm of daily traffic variations typically experienced across the Sydney road network including Elizabeth Drive.

The majority of light vehicle movements are likely to arrive and/or depart the construction ancillary facilities outside the AM and PM peak hours, and during the hours of 6am – 7am and 6pm – 7pm. At these times, traffic volumes on Elizabeth Drive are less than during the peak hours. Therefore, the addition of the construction vehicle movements during these hours, would result in similar road network performance as during the existing peak hours.

Overall, it is expected that the road network would have the capacity to accommodate these additional movements generated by construction activities during and outside the peak hours.

It is likely that a sizable proportion of the existing heavy vehicle movements on Elizabeth Drive is attributed to the ongoing construction activities of WSA. With the completion of WSA in 2026, a reduction in the numbers of those heavy vehicles is expected. The increase in the number of heavy vehicles with the construction of the proposal would likely be offset by the expected reduction of the heavy vehicles from the WSA construction. Overlapping construction activities between WSA and the proposal is expected to be limited in duration and is likely to coincide with the early construction work of the proposal.

Temporary reduced speed limits and lane closures on the existing Elizabeth Drive would be required during construction. Final construction methods and sequencing would be refined to minimise traffic and transport impacts during detailed design; however, traffic restrictions would be unavoidable during some construction activities.

Most construction work would be carried out during standard working hours and would have some impact on traffic operations. Work may also be carried out outside of standard working hours under a Road Occupancy Licence to avoid

impacts during peak traffic periods. Where practical, heavy vehicle movements would be outside the traffic peak hours to minimise impacts on the existing road network operation during construction.

Further to the above, potential traffic impacts arising from the construction of the proposal include:

- Increased travel time due to reduced speed limits around construction sites
- Increased travel time due to increased truck and construction machinery movements
- Temporary lane closure and altered property access during construction. Property access would be maintained as far as practicable throughout construction.

Measures to manage potential construction traffic impacts are listed in Section 6.2.4.

Property access

While property access would be maintained as far as possible during the construction period, temporary disruptions to private property access would be required to facilitate certain construction activities. Planned disruptions to property access would be subject to engagement with the affected property owner, with alternative access arrangements provided where feasible. The proposal would not affect access to the WSA construction site.

Temporary alternative routes for traffic

By the time the proposal commences construction, the M12 Motorway would be open to traffic (with construction expected to be complete by the end of 2025). This will form a convenient detour route for vehicle traffic. For a vehicle wishing to travel from the intersection with The Northern Road up to Badgerys Creek, two routes shown on Figure 6-7 would be available:

- Route 1 (via Elizabeth Drive, with roadwork): total travel distance of about 4.5 kilometres
- Route 2 (via the new M12 Motorway, no roadwork): total travel distance of about 6.5 kilometres.

The alternative route (Route 2) would be about two kilometres longer than Route 1 and would have two additional sets of signalised intersections. However, Route 2 is a dual carriageway road, and it has a higher posted speed than Elizabeth Drive. The M12 Motorway would have a 100 kilometre per hour posted speed, which is 40 kilometres per hour higher than the posted speed of 60 kilometres per hour proposed during the construction of the proposal.

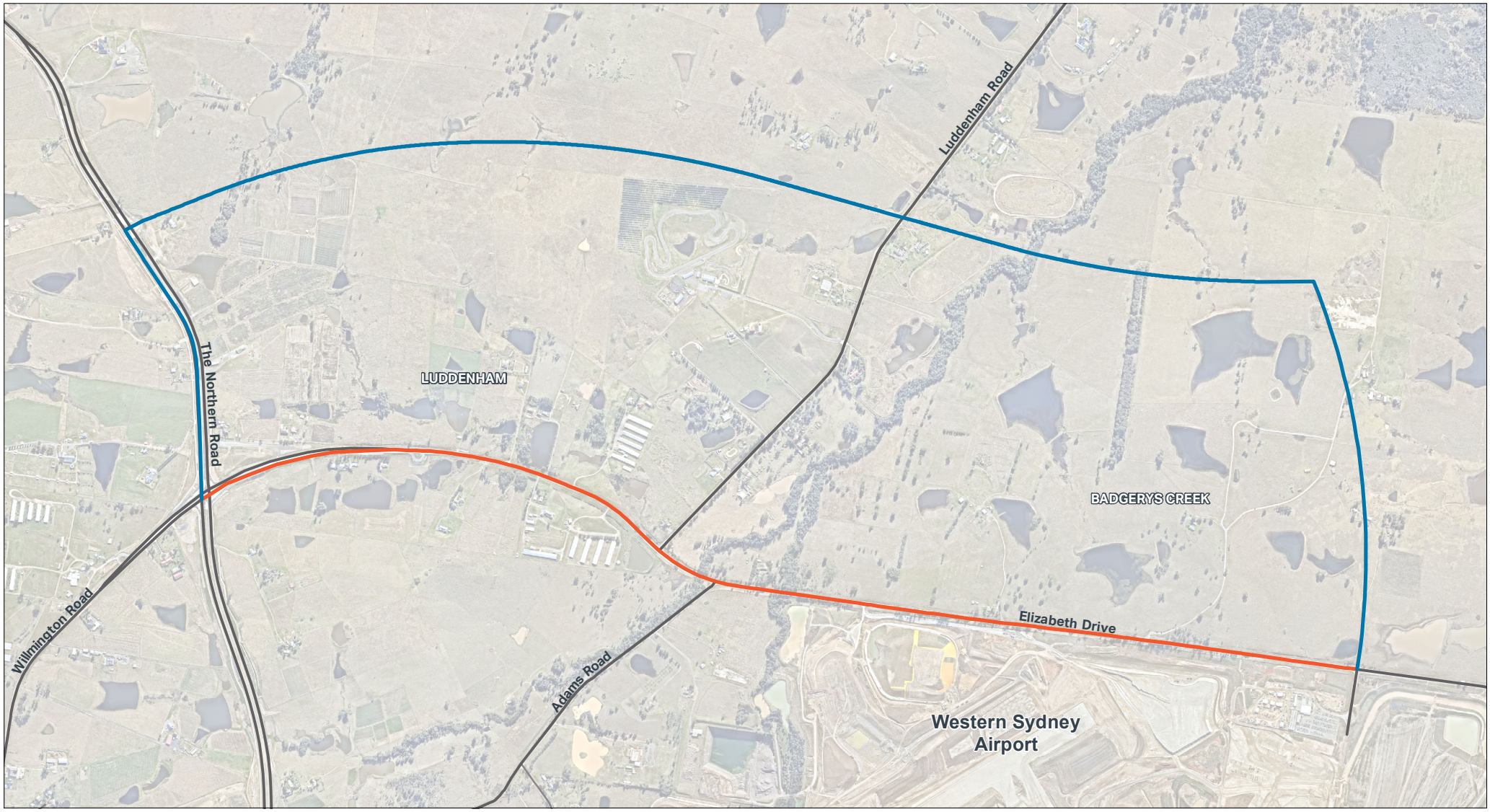


FIGURE 6-7: TEMPORARY ALTERNATIVE ROUTES FOR TRAFFIC

Legend

- Route 1
- Route 2

N

0 0.25 0.5 km

AECOM

Source: Imagery © Nearmap 2022.

Haulage routes

Indicative construction haulage routes for the proposal are shown in Figure 3-11 to Figure 3-13. The proposed haulage routes have been designed to minimise use of local roads where possible and are subject to detailed design.

Construction of the proposal would increase heavy vehicle traffic along haulage routes. Elizabeth Drive and its connecting roads – The Northern Road, the M7 Motorway and the future M12 Motorway, are classified as heavy vehicle routes as per the NSW Combined Higher Mass Limits and Restricted Access Vehicle network. These roads would be utilised during construction for transportation of materials onto site for all construction activities as well as disposal of spoil. At this time, spoil sites have not been identified.

Potential impacts from haulage routes during construction would be managed in accordance with a Traffic Management Plan (TMP).

Active transport

It is not expected construction work would impact any existing pedestrian access routes or crossings. Currently, there are no formal footpaths along Elizabeth Drive within the construction footprint and any pedestrian movement is restricted to grass verges. Pedestrian and cyclist access would be maintained throughout construction. Where that is not feasible or necessary, temporary alternative access arrangements would be provided following consultation with affected landowners and the local road authority.

Construction work would impact on-road cyclists. As a consequence, the M12 Motorway has been identified as an alternative route for cyclists to avoid construction work. Shared paths are planned in the design of the M12 Motorway.

The alternative routes for traffic and cycling would be documented in the TMP for the proposal.

Public transport

The proposal is not expected to disrupt public transport. All existing bus services along Elizabeth Drive (all of which operate outside of the construction footprint) would be maintained during construction, with potential for minor delays to bus services due to a reduction in speed limits during construction. Through the implementation of a community engagement plan, the community, including public transport operators, would be informed of upcoming activities that may affect the operation of public transport.

Operation

Road network performance and average speed

The impact of the proposal on road network performance and average speed is outlined in Table 6-17.

Table 6-17 Study area network statistics 2030 and 2040

Attribute	Peak (2hrs)	2030			2040		
		Do nothing	ED upgrades	Change	Do nothing	ED upgrades	Change
Total traffic demand (vehicles)	AM	40,361	40,188	-	50,981	51,027	-
	PM	40,715	39,949	-	51,677	51,411	-
VKT (km)[1]	AM	164,153	178,210	9%	164,734	212,655	29%
	PM	156,900	181,987	16%	162,884	213,786	31%
VHT (hours)[2]	AM	3,404	3,241	-5%	4,729	4,853	3%
	PM	4,684	3,440	-27%	7,112	5,152	-28%

Attribute	Peak (2hrs)	2030			2040		
		Do nothing	ED upgrades	Change	Do nothing	ED upgrades	Change
Total vehicles entering the network	AM	39,317	40,184	2%	45,433	50,757	12%
	PM	39,050	39,945	2%	46,358	50,097	8%
Average trip speed (km/h)[3]	AM	48.2	55	14%	34.8	43.8	26%
	PM	33.5	52.9	58%	22.9	41.5	81%
Total unreleased trips[4]	AM	1,044	3	-1,040	5,548	270	-5,278
	PM	1,665	3	-1,662	5,319	1,314	-4,006

Notes:

1 *Vehicle kilometres travelled (VKT) – the total distance travelled by vehicles travelling through the subnetwork. Generally, the higher the VKT, the better the network operates*

2 *Vehicle hours travelled (VHT) – the total time taken by all vehicles to enter and drive through the network. Generally, for a given number of vehicles the lower the total travel time, the better the network operates*

3 *Average trip speed – the average speed of all vehicles. Generally, the higher the average speed, the better the network operates.*

4 *Unreleased trips – refers to traffic that is being held outside the extents of the study area due to congested entry points. Those trips are included in the traffic demand but not included in other network statistics for failing to join the traffic in the network*

Analysis of the network performance indicates the following:

- Traffic demands remain relatively consistent between the 'do nothing' and Elizabeth Drive upgrades scenarios in 2030 and 2040
- VKT increases during the peak hours by up to 16 per cent in 2030 and by up to 31 per cent in 2040 with Elizabeth Drive upgrades compared to the 'do nothing' scenario indicating an improved network performance
- A reduction in the VHT during the peak hours by up to 27 per cent in 2030 and by up to 28 per cent in 2040 with Elizabeth Drive upgrades compared to the 'do nothing' scenario indicating an improved network performance
- In the 2040 'do nothing' scenarios, 10.9 per cent of vehicles in the AM peak period and 10.3 per cent of vehicles in the PM peak period of the forecast demand are unable to enter the network. This percentage drops to only 0.5 per cent of vehicles in the AM peak and 2.6 per cent of vehicles in the PM peak with the Elizabeth Drive upgrades. It is anticipated that real time signal coordination and the ITS would further reduce the congestion on the road network when those systems are fully deployed.

Table 6-6 of Appendix F (Traffic and Transport Assessment) presents the modelled average speeds along Elizabeth Drive during peak hours within the study area. The results indicate improved average speeds of up to 17 per cent in 2030 and up to 18 per cent in 2040, which suggests a reduction in congestion.

Elizabeth Drive upgrades would generally improve traffic conditions in the study area in both 2030 and 2040, particularly in the PM peak hour. The upgrades are expected to reduce delays, increase the average speed across the network and accommodate the majority of the future traffic demands. In addition, the proposal would provide an important arterial function as it sits adjacent to precincts in the Western Sydney Aerotropolis that are planned for enterprise, agri-business and light industrial uses.

Further detail on network performance modelling results is provided in Appendix F (Traffic and Transport Assessment).

Midblock performance

The peak hour directional traffic flows within the construction footprint are summarised in Appendix F (Traffic and Transport Assessment). In the 'do nothing' scenarios, delays are expected for local traffic conflicting with major through traffic movements along Elizabeth Drive. Significant congestion occurs for vehicles entering and exiting Elizabeth Drive in the 'do

nothing' scenarios. Furthermore, there are a number of unreleased trips in the model at the end of the modelling period for the 'do nothing' scenarios. These unreleased trips were unable to travel along side roads or Elizabeth Drive. This indicates that the level of congestion along the Elizabeth Drive would likely be worse than the midblock performance results indicate.

The results for the scenarios with the proposal indicate that there would be sufficient capacity on Elizabeth Drive to accommodate the 2030 and 2040 future demands.

Intersection performance

Modelled future performance of key intersections within in the study area is shown in Table 6-18.

The new signalised intersections located at Luddenham Road, M12 Motorway / WSA Connection and Badgerys Creek Road are expected to operate satisfactorily (LoS D or better) in the 'do nothing' and with the proposal scenarios in 2030 and 2040. This is with the exception of Elizabeth Drive and Badgerys Creek Road which is expected to operate with LoS F in the 2040 AM peak scenario, both with and without the proposal. This indicates that the projected traffic demands would exceed available capacity.

Results indicate that the intersection of Elizabeth Drive / M12 Motorway / WSA connection would operate satisfactorily with LoS C in the 2030 conditions and LoS C/D in the 2040 conditions, both with and without the proposal. The intersection is the main interface between Elizabeth Drive and the WSA and is being constructed as part of the M12 Motorway project.

Traffic modelling indicates that providing a through lane on the western approach at the intersection of Elizabeth Drive and Badgerys Creek Road would improve the performance at the intersection in the 2040 conditions (with the proposal). The proposal would provide a wide median on Elizabeth Drive to allow for the future provision of an additional third lane on both sides of the road. This would increase the capacity at the intersection.

Table 6-18 LoS intersection performance in 2030 and 2040

Intersection with Elizabeth Drive	Peak	2030 (Do nothing)		2030 (The proposal)		2040 (Do nothing)		2040 (The proposal)	
		Delay (s)	LoS	Delay (s)	LoS	Delay (s)	LoS	Delay (s)	LoS
Luddenham Road	AM	17	B	22	B	18	B	26	B
	PM	10	A	27	B	15	B	30	C
M12 / Western Sydney Airport Connection (by others)	AM	31	C	31	C	35	C	47	D
	PM	34	C	33	C	46	D	46	D
Badgerys Creek Road (by others)	AM	34	C	28	C	77	F	91	F
	PM	28	B	26	B	47	D	31	C

Heavy vehicle traffic

It is expected that the WSA and Western Sydney Aerotropolis and the associated developments would attract heavy vehicle traffic during the operation of the proposal (eg for freight and construction activities). Forecast daily heavy vehicle traffic volumes in 2040 (refer to Table 6-5 of Appendix F) show the continued reliance on Elizabeth Drive as a key heavy vehicle route. The proposed upgrade of Elizabeth Drive would provide a safe and reliable freight network which would integrate with other key infrastructure in the area.

Road safety

With the projected increase in future traffic demands, and without improving the existing conditions, the potential for vehicle crashes is likely to increase, especially at major intersections along Elizabeth Drive. Providing new signalised key intersections as part of the proposal would help ease the expected traffic congestion, resulting in improved safety conditions.

As discussed in Section 6.2.2, previous crashes at the intersection of Luddenham Road involved vehicles travelling from the opposite direction. The proposal would improve safety by introducing a central median, thus reducing the risk of head on crashes.

The proposal would include the provision of new shared walking and cycling paths along the full length of the proposal on both sides of Elizabeth Drive, tying into the shared walking and cycling path at The Northern Road. This would also provide safe passage for cyclists and pedestrians, and potentially facilitate connections to employment opportunities in the Western Sydney Aerotropolis precincts. This would remove the risk of cycling and pedestrian crashes with motor vehicles. The proposal is expected to positively impact road safety for pedestrians and cyclists.

Property access

To improve the safety features of the road, the construction of a central median is proposed on Elizabeth Drive as part of the proposal. This would result in a loss of direct access to properties along Elizabeth Drive from the opposite direction of travel.

To mitigate the loss of this direct property access, the proposal would provide two U-turn facilities to be used primarily for local property access. The following U-turn facilities are existing or proposed in the vicinity of the construction footprint:

- Willmington Road: an existing U-turn facility west of the intersection to facilitate travelling eastbound on Elizabeth Drive
- Luddenham Road: a proposed provision for a U-turn function as part of the proposal on the southern approach to facilitate travelling westbound on Elizabeth Drive.

Property owners would need to use the existing U-turn facility and proposed U-turn function to access properties in the opposite direction of travel which would slightly increase travel time. Modelled results estimate there would be a maximum increase of 17 seconds for residents to access properties between The Northern Road and Luddenham Road in 2040 with the proposal. Further details on the estimated travel times is provided in Appendix F (Traffic and Transport Assessment Report).

Active transport

The proposal would improve active transport facilities by providing shared walking and cycling paths on both sides of Elizabeth Drive with cycling crossing facilities at the intersection of Elizabeth Drive with Luddenham Road.

The new shared walking and cycling path would improve the connectivity for cyclists on the network, by connecting into the existing new shared path along The Northern Road and the future M12 Motorway shared path.

Public transport

The proposal would provide bus priority infrastructure on Elizabeth Drive (indented bus bays for two new bus stops and ‘queue jump-start’ bus lanes at traffic lights).

The new public transport infrastructure would be able to support the provision of bus services in the construction footprint. The improvement in public transport infrastructure would in turn increase accessibility, connectivity and facilitate for the increase in public transport options within the construction footprint. This would provide critical infrastructure to support the planned economic centre in Western Sydney.

6.2.4 Safeguards and management measures

Table 6-19 describes the proposed safeguards and management measures that would be implemented to manage potential traffic and transport impacts.

Table 6-19 Traffic and transport safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport	A TMP will be prepared and implemented as part of the CEMP. The Traffic Management Plan will be prepared in accordance with the Transport's Traffic Control at Work Sites Manual (Transport for NSW, 2020) and QA Specification G10 Control of Traffic (Transport for NSW, 2020). The Traffic Management Plan will include: • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network • Details of access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic • Monitoring, review and amendment mechanisms	Contractor	Detailed design / Pre-construction	Additional safeguard
Traffic and transport	Disruptions to property access and traffic will be notified to landowners at least five days prior in accordance with the relevant community consultation processes outlined in the Traffic Management Plan. Where access is not feasible, temporary alternative access arrangements will be provided following consultation with affected landowners and the relevant local council	Contractor / Transport	Construction	Additional safeguard
Traffic and transport	Pre-construction and post construction road condition reports for local roads likely to be used during construction will be prepared. Any damage resulting from construction (not normal wear and tear) will be repaired unless alternative arrangements are made with the relevant road authority. Copies of road condition reports will be provided to the local council	Contractor	Pre and post construction	Additional safeguard
Traffic and transport	Pedestrian and cyclist access will be maintained during construction. Where that is not feasible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners and the local council	Contractor	Construction	Additional safeguard
Traffic and transport	The community, including public transport operators, will be informed of upcoming activities that may affect the operation of public transport	Contractor	Pre and post construction	Additional safeguard

6.3 Biodiversity

A Biodiversity Development Assessment Report (BDAR) has been prepared to assess the potential impacts of the proposal on biodiversity. A summary of this assessment is presented in this section, with the full report provided in Appendix G (Biodiversity Development Assessment Report).

6.3.1 Methodology

A BDAR has been prepared as required under the BC Act and as a requirement of the Biodiversity Assessment Method (BAM; Department of Planning, Industry and Environment, 2020).

The biodiversity assessment involved:

- Defining the study area for the assessment, which comprises the following elements:
  - The construction footprint for the proposal, which has been used to calculate potential direct impacts of the proposal
  - Indirect impact zone – a 25-metre buffer of the construction footprint has been used to assess potential indirect impacts of the proposal
  - The subject land – defined as the land within a 100-metre buffer from the outside of the construction footprint. The 100-metre buffer is used as it allows for the detection and assessment of impacts to breeding habitat of fauna such as forest owls and cockatoos
  - The assessment area – the subject land and the area of land within a 500-metre buffer zone surrounding the subject land, which is applied for linear developments such as the proposal.
- Describing the existing environment and landscape features, and identifying threatened species, populations and communities listed under the BC Act and the EPBC Act that may be potentially affected by the proposal, informed by background research and desktop-based assessment
- Conducting field surveys to identify the biodiversity values within the study area and to determine the likelihood of threatened species and their habitats occurring in the construction footprint or being affected. Field surveys were carried out across November and December 2022, and January and February 2023
- Mapping and classifying native vegetation within the study area in accordance with the Plant Community Type (PCT) classification system
- Identification and assessment of likely direct and indirect impacts to biodiversity
- Identifying safeguards and management measures for avoiding, managing or reducing impacts on biodiversity values associated with the study area
- Carrying out preliminary calculations of biodiversity offsets required for the proposal, where impacts cannot be avoided.

It is noted that some areas of vegetation within the study area are classified as Certified-Urban Capable Land. This refers to land that has been subject to biodiversity certification under Section 8.2 of the BC Act. On 17 August 2022, strategic biodiversity certification was conferred upon 11,165 hectares of land under the Order Conferring Strategic Biodiversity Certification – CPCP. As a result, portions of the subject land within the Western Sydney Aerotropolis Growth Area designated as 'Certified-Urban Capable Land' do not require biodiversity assessment or approval under the BC Act. These areas do, however, require assessment under the EPBC Act, and have been assessed accordingly in this chapter and in Appendix G (Biodiversity Development Assessment Report).

Further detail on the methodology for the assessment is provided in the following sections.

Background research and desktop assessment

Background research and a desktop assessment was carried out to provide context for the assessment area and obtain records of flora and fauna. This included a review of the following resources:

- Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool for matters protected by the EPBC Act
- DCCEEW national Fly-fox monitoring viewer (DCCEEW, 2023)

- NSW BioNet – the database for the Atlas of NSW Wildlife, Environment, Energy and Science (EES), for species, populations and ecological communities listed under the BC Act
- NSW BAM Calculator (BAM-C)
- Biodiversity values map
- Native vegetation regulatory map
- BAM Important Areas maps
- PlantNET (The Royal Botanic Gardens and Domain Trust)
- BirdLife Australia, the New Atlas of Australian Birds 1998-2015 database.

Field survey

The subject land was surveyed in accordance with the BAM, which involved:

- The identification and mapping of PCTs, including categorising these into vegetation zones
- Carrying out floristic plots within each vegetation zone, considering varying condition states and avoidance of ecotones, areas of disturbance, and edges
- The identification of native and exotic plant species
- Targeted searches for plant species of conservation significance
- Identification of previous and current factors threatening the ecological function and survival of native vegetation within and adjacent to the construction footprint
- An assessment of the natural resilience of the vegetation of the site
- Identifying and mapping fauna habitats (e.g. hollow-bearing trees, rock outcropping etc.), assessing their condition and value to threatened fauna species, and considering threatened species' habitat constraints
- Observations of animal activity and searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, scratches and diggings)
- Targeted surveys for candidate flora and fauna species requiring assessment, as described further in the following sections.

Threatened flora survey

A targeted threatened flora survey was carried out between November 2022 and February 2023, in accordance with the required BAM survey guideline. Targeted threatened flora survey was carried out throughout potential habitat for the targeted species within the construction footprint at a minimum, and often expanded to the subject land boundary if habitat was present.

Further detail on the threatened flora survey approach is provided in Appendix G (Biodiversity Development Assessment Report).

Fauna survey

Fauna habitat assessment was carried out between November 2022 and February 2023 to determine the presence of microhabitats and other critical habitat components suitable for fauna species identified as potentially present in the subject land (including candidate species identified in Table 6-24).

The habitat assessments focused on identifying elements of the subject land that may indicate use by these species, such as habitat trees (including large and/or hollow-bearing trees), trees, presence and condition of watercourses, and woody debris and leaf litter. This allowed for planning of further targeted survey for select species, or the exclusion of the potential for occurrence of various candidate species from the subject land. The survey method used for each candidate species is further summarised in Table 6-24. Further detail on the fauna survey approach is provided in Appendix G (Biodiversity Development Assessment Report).

6.3.2 Existing environment

Existing environmental context and landscape features

The subject land includes the existing Elizabeth Drive, and is surrounded by extensively cleared land, which is predominantly used for residential, recreational, industrial and agricultural purposes. Native vegetation present comprises highly fragmented, remnant patches occurring along the road verges of Elizabeth Drive and within private properties. Some relatively intact vegetation exists along the riparian corridors of Cosgroves Creek and Oaky Creek, which flow south to north through the subject land.

Landscape features of the study area are summarised in Table 6-20.

Table 6-20 Landscape features of the study area

Feature	Description
Native vegetation cover	The total area of the 500-metre buffer around the subject land is 781 hectares, with the area of native vegetation mapped within the buffer being 143 hectares. This is a native vegetation cover of 18 per cent. Cleared areas within the assessment area include 638 hectares.
IBRA Bioregions and subregions	The assessment area occurs within the Sydney Basin Interim Biogeographic Regionalisation of Australia (IBRA) bioregion and the Cumberland IBRA subregion.
Rivers, streams, wetlands and water bodies	Four waterways flow through the subject land. These are Cosgroves Creek (fourth stream order waterway), including two unnamed tributaries (second stream order waterways) and one unnamed tributary (first stream order waterway); and Oaky Creek (third stream order waterway). Both Cosgroves Creek and Oaky Creek are identified as Key Fish Habitats as mapped on the Key Fish Habitat Maps published by the NSW Department of Primary Industries (DPI) (DPI, 2013). The subject land does not contain any wetlands. The subject land does, however, contain several man-made waterbodies (dams), predominantly located on the north and south side of Elizabeth Drive, west of Cosgroves Creek, which are fed by tributaries of Cosgroves Creek. There are a further three dams at the eastern end of the subject land, on the northern side of Elizabeth Drive Further detail on the existing surface water environment, including surface water quality, is provided in Section 6.9.2. Further detail on existing hydrological features is provided in Section 6.10.2.
Connectivity	Primary connectivity features which occur directly within or adjacent to the subject land include the riparian corridors of Cosgroves Creek and Oaky Creek. These connectivity features provide breeding, foraging and dispersal resources for terrestrial and arboreal mammals, flying mammals, avifauna, amphibians and invertebrates, and may form areas of permanent residency for some species. Secondary connectivity features include small patches of remnant and secondary plant community types (PCTs) scattered across the landscape which form stepping stone connectivity suitable for highly mobile birds and flying mammals.
Geological features of significance	There are no recorded karst, caves, crevices, cliffs or other areas of geological significance within the subject land or within the assessment area.
Areas of outstanding biodiversity value	There are no areas of outstanding biodiversity value mapped within the subject land.
NSW (Mitchell) Landscape	The subject land spans two Mitchell Landscapes associated with the Sydney Basin Bioregion; the Cumberland Plain and Hawkesbury-Nepean Channels and Floodplains. The majority of the subject land occurs on the Cumberland Plain component of the Cumberland landscape. Associated vegetation within this landscape consists of dry sclerophyll woodlands and pockets of dry sclerophyll forests throughout, with forested wetlands occurring on poorly drained valley floors.

Plant community types

Four PCTs were identified and assessed as present within the subject land:

- PCT 835: Cumberland Riverflat Forest
- PCT 849: Cumberland Shale Plains Woodland

- PCT 1071: *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion
- PCT 1800: Cumberland Swamp Oak Riparian Forest.

Each PCT has been assigned a zone based on its condition. Key features of each PCT and zone are described in Table 6-21.

Small areas of vegetation (totalling 3.9 hectares) within the subject land mapped as Urban Native / Exotic could not reliably be attributed to a PCT. These areas have been assessed as non-native vegetation.

Table 6-21 PCTs within the study area

Zone	PCT	Condition	Relevant Threatened ecological community (TEC) under the BC Act / EPBC Act	Area in subject land (ha)	Patch size class (ha)	Vegetation integrity score
1	835: Cumberland Riverflat Forest	Moderate	**BC Act:** River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered) **EBPC Act:** Does not meet the relevant condition thresholds for the associated TEC	3.45	>100	52
2	835: Cumberland Riverflat Forest	Good	**BC Act:** River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered) **EBPC Act:** River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (Critically endangered)	1.21	>100	100
3	849: Cumberland Shale Plains Woodland	Derived native grassland	**BC Act:** Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically endangered) **EPBC Act:** Does not meet the relevant condition thresholds for the associated TEC	1.18	>100	22.2
4	849: Cumberland Shale Plains Woodland	Derived native shrubland	**BC Act:** Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically endangered) **EPBC Act:** Does not meet the relevant condition thresholds for the associated TEC	0.16	>100	13.2
5	849: Cumberland Shale Plains Woodland	Moderate	**BC Act:** Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically endangered) **EPBC Act:** Does not meet the relevant condition thresholds for the associated TEC	3.16	>100	38.7
6	849: Cumberland Shale Plains Woodland	Non-offsetable grassland	**BC Act:** Does not meet the relevant condition thresholds for the associated TEC **EPBC Act:** Does not meet the relevant condition thresholds for the associated TEC	89.94	>100	3.9

Zone	PCT	Condition	Relevant Threatened ecological community (TEC) under the BC Act / EPBC Act	Area in subject land (ha)	Patch size class (ha)	Vegetation integrity score
7	1071: *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion	Moderate	**BC Act:** Does not meet the relevant thresholds for the associated TEC **EBPC Act:** Not listed	0.78	>100	80.7
8	1800: Cumberland Swamp Oak riparian forest	Moderate	**BC Act:** Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered) **EPBC Act:** Does not meet the relevant condition thresholds for the associated TEC	2.36	>100	30
9	1800: Cumberland Swamp Oak riparian forest	Good	**BC Act:** Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered) **EPBC Act:** Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and Southeast Queensland (Endangered) – in part, including areas along Cosgroves Creek and Okay Creek	4.47	>100	65.4

Threatened ecological communities

A summary of TECs identified within the subject land, associated with the PCTs described in Table 6-21, is provided in Table 6-22.

Table 6-22 Threatened ecological communities in the subject land

TEC	Listing status	Area in subject land (hectares)
BC Act TECs		
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered	4.61
River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Endangered	4.66
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Endangered	7.42

TEC	Listing status	Area in subject land (hectares)
EPBC Act TECs		
Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community	Endangered	4.47
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	1.21

Groundwater dependent ecosystems

Terrestrial groundwater dependent ecosystems (GDEs) identified in the National Atlas of Groundwater Dependent Ecosystems (BOM, 2019) that are present within the assessment area include:

- Cumberland Shale Plains Woodland (low potential GDE)
- Cumberland Riverflat Forest (high potential GDE).

Two additional PCTs mapped by this assessment within the subject land are also likely to have some level of groundwater dependence:

- PCT 1800: Cumberland Swamp Oak riparian forest
- PCT 1071: *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion.

There are no aquatic or subterranean GDEs within the assessment area. Further detail on the existing groundwater environment is provided in Section 6.9.2.

Threatened flora species

Several species credit plant species were identified as 'candidate species' for assessment and targeted survey. These species are identified in Table 6-23. Targeted survey has been carried out to assess each of the candidate species, the results of which are summarised in Table 6-23. Surveys identified seven individuals of *Marsdenia viridiflora subsp. viridiflora* – endangered population, and six individuals of *Pultenaea parviflora.*

The full assessment for threatened plant species is provided in Appendix G (Biodiversity Development Assessment Report).

Table 6-23 Candidate flora species credit species requiring further assessment

Species name	Common name	Survey result
Acacia bynoeana	Bynoe's Wattle	Not recorded
Acacia pubescens	Downy Wattle	Not recorded
Callistemon linearifolius	Netted Bottle Brush	Not recorded
Cynanchum elegans	White-flowered Wax Plant	Not recorded
Deyeuxia appressa	-	Not recorded
Dillwynia tenuifolia	-	Not recorded
Eucalyptus benthamii	Camden White Gum	Not recorded
Grevillea juniperina subsp. *juniperina*	Juniper-leaved Grevillea	Not recorded
Gyrostemon thesioides	-	Not recorded
Haloragis exalata subsp. *exalata*	Square Raspwort	Not recorded

Species name	Common name	Survey result
Marsdenia viridiflora subsp. *viridiflora* – endangered population	Native Pear	Seven individuals recorded within small patches of roadside PCT 849 (moderate condition)
Maundia triglochinoides	-	Not recorded
Persicaria elatior	Tall Knotweed	Not recorded
Persoonia bargoensis	Bargo Geebung	Not recorded
Persoonia hirsuta	Hairy Geebung	Not recorded
Pimelea curviflora var. *curviflora*	-	Not recorded
Pilularia novae-hollandiae	Austral Pillwort	Not recorded
Pimelea spicata	Spiked Rice-flower	Not recorded
Pomaderris brunnea	Brown Pomaderris	Not recorded
Pultenaea parviflora	-	Six individuals recorded within small patches of roadside PCT 849 (moderate condition)
Pultenaea pedunculata	Matted Bush-pea	Not recorded

Threatened fauna species

Fauna habitat within the subject land was generally found to be degraded by past land use practices which have resulted in a loss of key habitat features across the landscape such as large tree-hollows, large patches of intact, well-structured vegetation not subject to edge effects, and high quality connectivity corridors. More localised areas of higher quality fauna habitats were found to occur along Cosgroves Creek and Oaky Creek, however, fauna habitats in these locations were still considered sub-optimal.

Several fauna species were identified as 'candidate species' for habitat assessment and/or survey. These species are listed in Table 6-23, along with the survey method adopted.

Table 6-24 Candidate fauna species credit species requiring further assessment

Species name	Common name	Survey method adopted
Callocephalon fimbriatum	Gang-gang Cockatoo	Targeted tree hollow surveys and habitat assessment
Haliaeetus leucogaster	White-bellied Sea-Eagle	Targeted nest tree (stick nest) surveys and habitat assessment
Hieraaetus morphnoides	Little Eagle	Targeted nest tree (stick nest) surveys and habitat assessment
Litoria aurea	Green and Golden Bell Frog	Habitat assessment and targeted survey
Lophoictinia isura	Square-tailed Kite	Targeted nest tree (stick nest) surveys and habitat assessment
Meridolum corneovirens	Cumberland Plain Land Snail	Active searches, habitat assessment
Myotis macropus	Southern Myotis (bat species)	Habitat assessment, microbat acoustic detection surveys

Species name	Common name	Survey method adopted
Ninox connivens	Barking Owl	Targeted tree hollow surveys and habitat assessment
Ninox strenua	Powerful Owl	Targeted tree hollow surveys and habitat assessment
Pandion cristatus	Eastern Osprey	Targeted nest tree (stick nest) surveys and habitat assessment
Petaurus volans	Greater Glider	Habitat assessment and targeted survey
Petaurus norfolcensis	Squirrel Glider	Habitat assessment and targeted survey
Phascolarctos cinereus	Koala	Habitat assessment, incidental scat/scratch searches
Pommerhelix duralensis	Dural Land Snail	Active searches, habitat assessment
Pteropus poliocephalus	Grey-headed Flying-fox	Habitat assessment
Tyto novaehollandiae	Masked Owl	Targeted tree hollow surveys and habitat assessment

Through survey efforts (including microbat acoustic detection surveys), the Southern Myotis (listed as vulnerable under the BC Act) and several other microbat species were recorded as being present in the subject land, including the following threatened species:

- Eastern False Pipistrelle, *Falsistrellus tasmaniensis* (vulnerable, BC Act).
- Large Bent-winged Bat, *Miniopterus orianae oceanensis* (vulnerable, BC Act)
- Eastern Coastal Free-tailed Bat, *Mormopterus norfolkensis* (vulnerable, BC Act)
- Yellow-bellied Sheathtail-bat, *Saccolaimus flaviventris* (vulnerable, BC Act)
- Greater Broad-nosed Bat, *Scoteanax rueppellii* (vulnerable, BC Act)
- Grey-headed Flying-fox, *Pteropus poliocephalus* (vulnerable, BC Act and EPBC Act).

Additionally, one threatened species, Grey-headed Flying-fox, *Pteropus poliocephalus* (listed as vulnerable under the EPBC Act and BC Act) was detected foraging on two occasions in February 2023. Other threatened species listed in Table 6-23 were not identified through habitat assessment or survey.

The full survey results and assessments for threatened fauna species are provided in Appendix G (Biodiversity Development Assessment Report).

6.3.3 Potential impacts

Where possible, the proposal has sought to minimise potential impacts to biodiversity by:

- Utilising cleared and/or disturbed areas as much as possible, including strategic location of construction facilities
- Utilising and widening the existing road corridor (as opposed to an entirely new road corridor) and minimising widening outside of this where possible
- Reducing the extent of the construction footprint, including minimisation of encroachment into 'Avoided Land' mapped under the CPCP by reducing the extent of a construction ancillary site located at the north-western corner of the Elizabeth Drive and Luddenham Road intersection.

Section 5.1 of Appendix G (Biodiversity Development Assessment Report), and Chapter 2 (Need and options considered) of this REF, provide further detail as to how design development sought to avoid and minimise potential impacts to biodiversity. Biodiversity impacts that were not able to be avoided are assessed in the following sections.

An assessment of impacts against other relevant biodiversity legislation and policy is provided in Section 9 of Appendix G (Biodiversity Development Assessment Report).

Direct impacts

Direct impacts to biodiversity would include vegetation clearing. The extent of vegetation clearing has been calculated from the area of proposed lot boundaries, roads and easements for service infrastructure.

The proposal would result in the direct loss of about 29.31 hectares of native vegetation in total, a subset of which would include four TECs subject to assessment under the BC Act (6.28 hectares) and two TECs subject to assessment under the EPBC Act (1.49 hectares). This includes both land which is certified (7.24 hectares) and not certified (22.10 hectares) for removal. Additionally, about 0.22 hectares of urban native/exotic vegetation is proposed to be removed on land which is not biodiversity certified. Vegetation removal would directly impact the areas presented in Table 6-25.

Table 6-25 Removal of native vegetation

Plant community type	Areas removed which are listed under the BC Act	Areas removed which are listed under the EPBC Act	Other areas removed
Cumberland Riverflat Forest (PCT 835)	About 1.82 hectares in moderate condition About 0.27 hectares in good condition	About 0.27 hectares in good condition	-
Cumberland Shale Plains Woodland (PCT 849)	About 0.29 hectares of derived native grassland About 0.16 hectares of derived native shrub About 1.32 hectares in moderate condition	-	About 18.83 hectares of non-offsetable grassland
Phragmites australis and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071)	About 0.03 hectares in moderate condition	-	-
Cumberland Swamp Oak Riparian Forest (PCT 1800)	About 0.8 hectares in moderate condition About 1.59 hectares in good condition	1.22 hectares in good condition (adjoining Cosgroves Creek and Oaky Creek)	-

Impacts associated with vegetation clearing would include removal of:

- Native vegetation and flora and fauna habitats
- Known habitat for threatened flora species, and individual plants (described further in Table 6-26)
- Known and assumed habitat for threatened fauna species
- BC Act and EPBC Act listed TECs
- Habitats considered that are candidates to be assessed for risk of serious and irreversible impacts (refer to following sections for further assessment)
- Native vegetation and threatened flora and fauna habitat from 'Certified Land'
- Thirty-two potential hollow-bearing trees within the construction footprint, 10 of which require assessment for removal by the proposal. This is because:
  - Three trees are located on Certified – Urban Capable Land, and as such their removal would not require assessment under the BC Act
  - Of the remaining 29 trees, the majority (19) are stags that do not contain hollows, and as such cannot be said to be hollow-bearing trees in accordance with the BAM. These trees, however, contain cracking and fissuring which could be used by microbats

– Of the 10 hollow-bearing trees assessed for removal by the proposal, seven contain small hollows only, and three contain one medium hollow each. These medium hollows were assessed as not being suitable for Gang-gang Cockatoo.

Safeguards and management impacts identified in Section 6.3.4 would minimise the potential impacts to biodiversity values that remain present within the subject land.

Table 6-26 Summary of direct impacts species credit habitat or individuals

Species	Sensitivity to gain class	Area (ha)
Marsdenia viridiflora subsp. *viridiflora* - endangered population	Moderate	3.08
Pultenaea parviflora	Moderate	0.47
Southern Myotis	High	5.69

Indirect impacts

A range of indirect impacts also have potential to occur due to the proposal in addition to the direct impacts, within 25 metres of the construction footprint, including:

- Inadvertent impacts on adjacent habitat or vegetation
- Reduced viability of adjacent habitat due to edge effects
- Reduced viability of adjacent habitat due to noise, dust or light spill
- Transport of weeds and pathogens from the site to adjacent vegetation
- Increased risk of starvation, exposure and loss of shade or shelter
- Loss of breeding habitats, through the removal of hollow-bearing trees.

Indirect impacts would largely be minimised through implementation of several safeguards and management measures in accordance with the CEMP (refer further to 6.3.4), and through detailed design development.

Prescribed impacts

Prescribed impacts are those that may affect biodiversity values in addition to, or instead of, impacts from clearing vegetation during both construction and operation. These are described in Table 6-27.

Table 6-27 Summary of potential prescribed impacts

Potential impact	Extent	Consequence
Habitat removal from removal of human-made structures and non-native vegetation	Habitat removal, possible direct impacts from demolition, resulting from the removal and replacement of one bridge, removal of three sheds and a dwelling, as well as 1.8 hectares of non-native vegetation	The removal of 0.22 hectares of non-native vegetation is unlikely to have any impact to the threatened bats recorded during targeted surveys. However, the removal of human-made structures, in particular the bridge over Cosgroves Creek, is an impact that has the potential to cause mortality of individuals if not managed adequately. Safeguards in Section 6.3.4 include the preparation of a Microbat Management Plan with the aim of preventing this from occurring. As such, this impact is not considered to adversely affect the local or bioregional persistence of the threatened microbats recorded
Habitat connectivity impacts, including an increase in fragmentation	Habitat connectivity at Cosgroves Creek and Oaky Creek, which at present is interrupted by the about 12 metres across Elizabeth Drive, would be increased to about 100 metres post-construction. The proposal would not result in the creation of barriers which would prevent the movement of the	The threatened bats recorded during targeted surveys, being highly mobile, are unlikely to be impacted by the fragmenting of habitat connectivity detailed above, as they would not be prevented from moving between habitats critical for the maintenance of their life cycle

Potential impact	Extent	Consequence
	recorded threatened species between habitats critical for the maintenance of their life cycle, nor prevent genetic exchange of flora species that are part of a TEC	
Removal of waterbodies, worsening of present water quality and alteration of current hydrological processes	Three farm dams would be partially or fully removed for the proposal. Southern Myotis may use these water bodies for foraging, however, commensurate resources are plentiful within the assessment area and broader landscape. The construction activities may also impact on water quality surrounding the construction footprint (refer further to Section 6.9)	The removal of waterbodies (farm dams) would reduce foraging habitat for Southern Myotis, however, this is considered unlikely to have a measurable impact on the species. Modelling for the proposal suggests that impacts to water quality can be adequately managed during construction and operation (refer further to Section 6.9). Similarly, no material change to current hydrological processes that sustain the threatened entities recorded is anticipated. As such there is unlikely to be a negative impact to Southern Myotis
Increase in risk of vehicle strike	The extent to which vehicle strike would impact fauna during construction and operation of the proposal is partly unknown. It has been assumed that with increased traffic volumes and a widening of crossing distance across Elizabeth Drive, vehicle strikes, or at least the risk thereof, would increase during operation of the proposal. There is generally a higher potential for impact in areas where refuge/forage habitat exists immediately adjacent to the road, such as Cosgroves Creek and Oaky Creek	The threatened bats recorded during targeted surveys, being highly mobile, aerial and nocturnal, are unlikely to be impacted by increased risk of strike with construction traffic or vehicular traffic during operation of the proposal. Where vehicle strike presents a risk to other species, it is unlikely that this would occur to a degree as to jeopardise the persistence of such animals at the local or bioregional scale

Impacts to GDEs

There is potential that construction activities could impact upon PCT 835 and PCT 1800 where they occur associated with Cosgrove Creek and Oaky Creek. Construction activities associated with bridge work have the potential to disrupt groundwater flow, impact groundwater levels, and impact on water quality. However, as discussed in Section 6.9, impacts are anticipated to be minor as groundwater levels are expected to recover to pre-construction levels following construction. Further, the provision of proposed stormwater treatment devices is anticipated to result in a net benefit to operational water quality resulting from the proposal.

Serious and irreversible impacts

The BC Act and *the Local Land Services Act 2013* require a decision-maker to determine whether residual biodiversity impacts of a proposed development are serious and irreversible impacts. In accordance with Clause 6.7 of the *Biodiversity Conservation Regulation 2017* an impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct.

Cumberland Plain Woodland in the Sydney Basin Bioregion (PCT 849) is identified as threatened biodiversity at risk of serious and serious and irreversible impacts, and is present within the subject land. As such, serious and irreversible impact assessment has been carried out for Cumberland Plain Woodland, with reference to Clause 6.7 of the *Biodiversity Conservation Regulation 2017*. This assessment has indicated the following:

- The proposal would not cause a further decline of the ecological community, given that the overall condition of PCT 849 within the construction footprint is considered low. Existing moderate condition vegetation largely comprises exotic groundcover species and is a fragmented linear patch directly adjacent to an existing road. Therefore, the long-term viability of the existing vegetation if left in situ, is considered significantly compromised due to its existing condition and its location within a highly modified and urban landscape

- The proposal would not further reduce the population size of the ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, given that design development of the proposal has sought to minimise vegetation removal, and safeguards and management measures would also be put in place to adequately protect the biological diversity of native flora and fauna within the subject land, including Cumberland Plain Woodland (refer to Section 6.3.4).

A detailed serious and irreversible impacted assessment for Cumberland Plain Woodland in the Sydney Basin Bioregion (PCT 849) is provided in Appendix 5 of Appendix G (Biodiversity Development Assessment Report).

Significant impact criteria assessments

The findings of significant impact criteria assessments for EPBC-listed threatened species and TECs are summarised in Table 6-28, and further detail is provided in Appendix 6 of Appendix G (Biodiversity Development Assessment Report). The assessments indicate that these EPBC-listed species and TECs are not likely to be significantly impacted by the proposal.

Table 6-28 Summary of significant impact criteria assessments

Species	Summary of assessment
Pultenaea parviflora (listed as vulnerable under the EPBC Act)	The proposal would result in the removal of up six Pultenaea parviflora individuals and to about 0.47 hectares of potential habitat for the species. These individuals are not considered to comprise an important population of the species as they are not considered key population for dispersal, are highly unlikely to be necessary for maintaining genetic diversity and are not near the limit of the species range. The proposal would not likely to significantly impact Pultenaea parviflora, within the subject land or wider area, as: • The proposal would not impact upon an important population of the species • The proposal would not interfere substantially with the recovery of the species
Grey-headed Flying-fox *Pteropus poliocephalu* (listed as vulnerable under the EPBC Act)	The proposal would result in the removal of or disturbance to about 8.31 hectares of foraging habitat for the species in the form of treed Cumberland Riverflat Forest (PCT 835), Cumberland Swamp Oak Riparian Forest (PCT 1800) and Cumberland Shale Plains Woodland (PCT 849). The proposal is not likely to significantly impact the Grey-headed Flying-fox within the subject land or wider locality, as: • The removal of about 8.31 hectares of habitat would not constitute a significant impact, given the availability of similar resources in the locality • The vegetation removal associated with the proposal represents foraging habitat and would not fragment or isolate this mobile population • The proposal would be unlikely to introduce disease that may cause the species to decline • The proposal would not substantially contribute to a key threatening process for Grey-headed Flying-fox or impact upon priority conservation actions for the species
River-flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria (critically endangered under the EPBC Act)	River-flat Eucalypt Forest aligns with good and moderate Cumberland Riverflat Forest (PCT 835), of which 0.27 hectares in good and moderate condition would be removed by the proposal. The proposal is not likely to significantly impact River-flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria, within the subject land or wider locality, as: • The proposal would result in the clearing of 0.27 ha of river-flat Eucalypt Forest, from the edge of a larger patch • The proposal would not result in fragmentation of the patch of the community • The proposal would be unlikely to alter the structural integrity or species composition of the patch of the community • The proposed work is not expected to significantly interfere with the recovery of the ecological community

Species	Summary of assessment
Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and Southeast Queensland ecological community (endangered under the EPBC Act)	Coastal Swamp Oak Forest aligns with the portions of Cumberland Swamp Oak Riparian Forest (PCT 1800) in good condition, associated with Cosgroves Creek and Oaky Creek. The proposal would result in the removal of about 1.22 hectares of this community, north and south of Elizabeth Drive. The proposal is not likely to significantly impact Coastal Swamp Oak Forest, within the subject land or wider locality, as: • The proposal would result in the minor reduction of the community in a linear manner, either side of the existing Elizabeth Drive • The proposal would result in increased fragmentation of the patch; however, as no barrier to genetic transfer would be introduced, and no substantial increase to already present edge effects would result, the community is expected to remain viable in the long-term • The proposed work is not expected to significantly interfere with the recovery of the ecological community

6.3.4 Safeguards and management measures

Table 6-29 describes the proposed safeguards and management measures that would be implemented to manage potential biodiversity impacts.

Table 6-29 Biodiversity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity – displacement of resident fauna	A Flora and Fauna Management Plan will be prepared in accordance with Transport's Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to: • Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • Pre-clearing survey requirement • Clearing protocols • Procedures for unexpected threatened species finds and fauna handling • Fauna will be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)	Transport / Contractor	Pre-construction and construction	Additional safeguard
Biodiversity – displacement of resident fauna	Carry out thorough inspection during higher-activity season (October to March) of all structures that contain potential microbat habitat will be caried out, in accordance with Transport for NSW Microbat Management Guidelines (Transport for NSW, 2023). If microbats are detected, advice from a microbat specialist will be sought to determine the need for a Microbat Management Plan	Transport / Contractor	Pre-construction and construction	Additional safeguard
Biodiversity – indirect impacts on native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity – indirect impacts on native vegetation and habitat	Where practicable, native vegetation will be re-established in accordance with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
Biodiversity – indirect impacts on native vegetation and habitat	Weed species will be managed in accordance with Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
Biodiversity – indirect impacts on native vegetation and habitat	Pathogens will be managed in accordance with Guide 7 Pathogen management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
Biodiversity – indirect impacts on native vegetation and habitat	Shading and artificial light impacts will be minimised through detailed design	Transport / Contractor	Detailed design	Additional safeguard
Biodiversity – prescribed impacts	The requirement to replace trees and hollows within non-native vegetation will be calculated in accordance with the Tree and Hollow Replacement Guidelines (Transport for NSW, 2022). Only non-native trees that have amenity value are required to be replaced. If onsite replacement is sought, a Tree and Hollow Replacement Plan will be prepared and/or equivalent payment to the Transport Conservation Fund will be made	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
Biodiversity – prescribed impacts	If microbats are found to be inhabiting the development footprint, habitat removal will be carried out in accordance with Transport for NSW Microbat Management Guidelines (Transport for NSW, 2023)	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
Biodiversity – prescribed impacts	To manage biodiversity impacts to water bodies, water quality and hydrology: • Changes to existing surface water flows will be minimised through detailed design • Interruptions to water flows associated with GDEs will be minimised through detailed design	Transport / Contractor	Detailed design	Additional safeguard
Biodiversity – prescribed impacts	To manage risk of vehicle strike: • Construction fencing will be established to prevent fauna from entering construction zones • Construction traffic within construction sites and machinery will be restricted to 30 kilometres per hour and signage erected informing personnel of this restriction	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity – Adaptive management strategies	Adaptive management will include an agreed monitoring, evaluation, reporting and improving cycle, for impacts on biodiversity that are uncertain such as: • Inadvertent impacts to native vegetation adjacent the construction footprint • Introduction of pests, pathogens and weeds to native vegetation adjacent the construction footprint and further afield • Degradation of downstream habitats via worsening of water quality or alteration to hydrological processes • Vehicle strikes	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
Biodiversity - loss of hollow-bearing and amenity trees	Trees and hollows that require replacement will be identified in accordance with the Tree and Hollow Replacement Guidelines, and prior to the commencement of work: • A Tree and Hollow Replacement Plan will be prepared, or • Payment will be made to the Transport Conservation Fund.	Transport / Contractor	Pre-construction	Additional safeguard

Other safeguards and management measures that are relevant to the management of potential biodiversity impacts are identified in the following sections:

- Section 6.9.4, which outlines safeguards and management measures regarding surface water and groundwater, including the preparation of a Soil and Water Management Plan and site-specific Erosion and Sediment Control Plan.

6.3.5 Biodiversity offsets

The BC Act together with the *Biodiversity Conservation Regulation 2017* outlines the framework for assessment of biodiversity impacts and introduces a Biodiversity Offset Scheme (BOS), which Transport would comply with for this proposal.

Although design refinements have been made to limit the impact on biodiversity, potential residual impacts would still occur. The proposal's biodiversity offset obligation for impacts on biodiversity values were determined using the BAM Calculator. The required ecosystem and species credit obligations are provided in Appendix G (Biodiversity Development Assessment Report). Following the application of the BAM, associated guidelines and the BAM Calculator, a total of 173 ecosystem credits and 189 species credits would be required for the proposal. This would include:

- 47 ecosystem credits for areas of Cumberland Riverflat Forest (PCT 835) in moderate condition
- 14 ecosystem credits for areas of Cumberland Riverflat Forest (PCT 835) in good condition
- 4 ecosystem credits for areas of Cumberland Shale Plains Woodland (PCT 849) which are classified as derived native grassland
- 32 ecosystem credits for areas of Cumberland Shale Plains Woodland (PCT 849) in moderate condition
- 1 ecosystem credit for areas of Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) in moderate condition
- 12 ecosystem credits for areas of Cumberland Swamp Oak Riparian Forest (PCT 1800) in moderate condition
- 63 ecosystem credits for areas of Cumberland Swamp Oak Riparian Forest (PCT 1800) in good condition
- 9 species credits for *Marsdenia viridiflora subsp. viridiflora* – endangered population
- 9 species credits for *Pultenaea parviflora*
- 171 species credits for Southern Myotis.

6.4 Non-Aboriginal heritage

The heritage values attached to the construction footprint and the potential impact of the proposal on those heritage values are assessed in the Non-Aboriginal Heritage Impact Assessment. A summary of this assessment is presented in this section, with the full report provided in Appendix H (Non-Aboriginal Heritage Impact Assessment).

6.4.1 Methodology

The heritage impact assessment was carried out in accordance with Assessing Heritage Significance (NSW Heritage Office, 2001) and Statements of Heritage Impact (NSW Heritage Office, 2002).

The heritage impact assessment adopted the following methodology:

- Review of proposal general arrangement drawings and scoping design reports
- Review of the following key documents:
  - Heritage register listings
  - Historic plans
  - Previous reports and other relevant documentation
- Background research into the historical development of the construction footprint and surrounding areas using the historic plans, historical photographs, newspapers and other primary and secondary historical sources as relevant
- Site inspection on 17 June 2022 by AECOM staff assessing the existing road and adjoining properties along with the existing character of the construction footprint and surrounding land uses
- Significance assessment of heritage items in accordance with Assessing Heritage Significance (NSW Heritage Office, 2001)
- Impact assessment of any direct or indirect construction and/or operational impacts to identified heritage significance
- Review of relevant projects in the area and their impact on heritage to determine conclusions regarding cumulative impacts on non-Aboriginal heritage
- Summary of statement of heritage impact, as assessed against the criteria outlined in in Statements of Heritage Impact (NSW Heritage Office, 2002)
- Identification of suitable safeguards and management measures to minimise the proposal's potential impact on the non-Aboriginal heritage.

For the purposes of the assessment, the following boundaries have been adopted:

- The construction footprint is the construction and operational footprint
- The study area comprises a 200-metre buffer around the construction footprint, which also includes those adjoining properties that extend outside the 200 metre buffer. The study area is shown in Figure 6-8.

6.4.2 Existing environment

Heritage database searches

A search of heritage databases was carried out on 14 July 2022 to identify listed heritage items within the study area. This search identified the following two heritage items:

- Luddenham Road Alignment – local heritage item listed in Schedule 5 of Penrith LEP 2010
- McGarvie Smith Farm – local heritage item listed in Schedule 2 of WPCSEPP 2021. This item was recently delisted from Schedule 5 of Penrith LEP 2010.

The location of the two listed heritage items is shown in Figure 6-8. Further details on the listed heritage items are provided in Table 6-30.

Table 6-30 Listed heritage items in the study area

Item	Description	Listing	Significance level	Proximity to construction footprint
Luddenham Road Alignment	Part of the former road alignment of Luddenham Road is now a 'paper road' and is subject to local heritage listing because of its importance as an early route connecting John and Gregory Blaxland's colonial estates	Penrith LEP #843	Local	Within construction footprint
McGarvie Smith Farm	The McGarvie Smith University Farm is considered to have heritage significance for its historic, technical and associative values. It is associated with John McGarvie Smith, Sir Frederick Tout and the University of Sydney	WPCSEPP #11	Local	Within construction footprint; however, significant buildings located within the curtilage of the item are located about 115 to 160 metres (closest buildings) from the boundary of the construction footprint and separated from the proposal by an access track

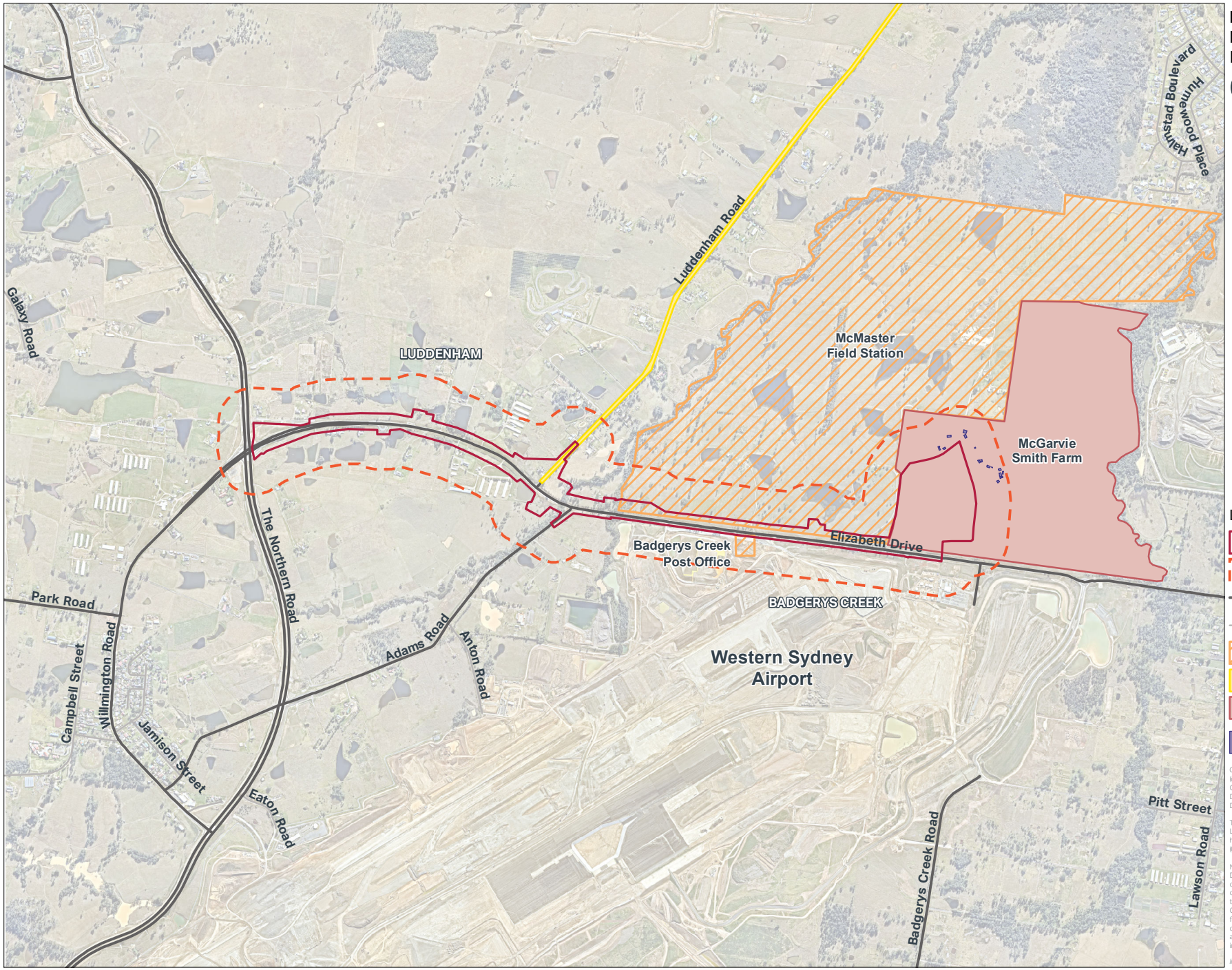


FIGURE 6-8:
NON-ABORIGINAL HERITAGE ITEMS IN THE STUDY AREA

Desktop literature review

Historical context

A literature review was carried out to identify the historical context of development within the construction footprint, and the subsequent factors that have influenced this development.

A summary of the key historical context findings of the construction footprint is provided in Table 6-31.

Table 6-31 Summary of key historical context findings

Date	Summary of key historical context findings
Early 1800s	Luddenham Road was constructed to connect the farms of Gregory Blaxland's 'Lee Holm' (or 'Leeholme') estate near St Marys, and John Blaxland's Luddenham estate. However, it is likely that this was a track until late in the 19th century and was not opened
1813	John Blaxland receives a large land grant which becomes the estate of Luddenham. Most of the former Blaxland land grant was principally used for agricultural purposes until its resumption by the Commonwealth government and construction for the WSA and Western Sydney Aerotropolis in 2018
1819	William Johnston and Michael Henderson receive two large land grants to the north of the Luddenham estate. William Johnston sold his land to his neighbour to the north, Captain John Piper, who subsequently sold his large holding to William Cox in 1831. The Cox family retained ownership of the land until 1859, after which it passed through a number of owners until it was acquired by the University of Sydney
1820s	Forming the boundary running east-west between local government areas and parishes, Elizabeth Drive has been a road since at least the 1820s
1850s	Elizabeth Drive had acquired the name 'Orphan School Road' and sealing of the road was in progress
1859	The Luddenham estate was subdivided and offered for sale for 42 large rural plots. These lots were subdivided further in the later 19th century, and the village of Badgerys Creek formed in the eastern portion
1886	Luddenham Road opened and as an indication of its importance to the area, the road was also metalled (surfaced with small rocks, rather than left as dirt) (refer to Figure 6-8)
1894-1896	Following further subdivision of the Luddenham estate, a Receiving Office was run from the property of Mr Henry Williams on Orphan School Road, Badgerys Creek. In 1896 it was converted to a full post office (Badgerys Creek post office) (refer to Figure 6-8)
1936	On 10 December 1936, the Commonwealth Government transferred parts of the former Johnston's (Piper's) farm to the Commonwealth Council for Scientific and Industrial Research (CSIR – now known as the CSIRO). The McMaster Field Station was established as an animal and agricultural research station. Its aim was to research diseases and parasites affecting the pastoral industry, with a particular reference to sheep (refer to Figure 6-8). Adjacent and to the east of the McMaster Field Station is McGarvie Smith Farm. Land for the McGarvie Smith Farm was purchased by the University of Sydney in 1936 with funds from the McGarvie Institute
1938	The McGarvie Smith Farm opens. The McGarvie Smith Farm was established as a collaboration between the McGarvie Institute and the University of Sydney to teach students veterinary science and animal husbandry (refer to Figure 6-8)
1940s-1950s	The focus of activities on the McGarvie Smith Farm expanded to include the application of science to farm management. Other activities included experiments with fodder crops as well as the testing and refinement of irrigation equipment
1950	Sealing of Orphan School Road begins
1964	Liverpool City Council announces the renaming of Orphan School Road to Elizabeth Drive
1996	An Environmental Impact Statement was prepared for the upgrade of Elizabeth Drive between Mamre Road in the east and Luddenham Road in the west

Date	Summary of key historical context findings
2004	The McMaster Field Station was in operation until 2004, when it was sold to the Medich family. It is now owned by BHL Group

Review of previous assessments

Previous non-Aboriginal heritage assessments for other nearby projects were reviewed to identify potential unlisted items of heritage significance, and areas of archaeological potential, within the construction footprint. A summary of the key findings of these assessments is outlined in the following sections.

M12 Motorway Non-Aboriginal Heritage Assessment Report, Jacobs Group (Australia) Pty Ltd, 2019

The M12 Motorway Non-Aboriginal Heritage Assessment Report (the assessment) was carried out by Jacobs as part of the EIS for the proposed M12 Motorway and covered the entirety of the M12 Motorway footprint. The assessment reviewed listed and potential non-Aboriginal heritage items that may be impacted by the proposed M12 Motorway. The assessment identified the following listed or potential items of heritage significance:

- McGarvie Smith Farm – local heritage item listed in Schedule 2 of the WPCSEPP (within construction footprint)
- Luddenham Road Alignment – local heritage item listed in Schedule 5 of Penrith LEP 2010 (within construction footprint)
- McMaster Field Station – unlisted item of potential local heritage significance (within construction footprint)
- Fleurs Radio Telescope site – local heritage item listed in Schedule 2 of the WPCSEPP (outside of study area)
- Fleurs Aerodrome – unlisted item of local heritage significance (outside of study area)
- James Badgery's Exeter Farm site – unlisted item of local heritage significance (outside of study area)
- South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape – unlisted item of local heritage significance (outside of study area).

The heritage items located within the study area are shown in Figure 6-8.

M12 Motorway – Non-Aboriginal Photographic Archival Recording Report, Artefact Heritage, 2022

The M12 Motorway – Non-Aboriginal Photographic Archival Recording Report (the report) comprises a photographic record of the non-Aboriginal heritage items that may be impacted by the construction of the M12 Motorway. These items include the McGarvie Smith Farm, McMaster Field Station, and the Fleurs Radio Telescope site and Fleurs Aerodrome (located outside the study area). Each site recording includes a historical background review, significance assessment, a physical description, mapping and photographs.

The archival recording of McMaster Field Station shows that most of the buildings had been constructed in the 1960s and 1970s. There are now 21 surviving buildings and other elements considered to be of heritage significance.

The archival recording of McGarvie Smith Farm indicates 13 buildings and other structural elements that are of heritage significance. McGarvie Smith Farm Buildings 10, 11 and 12 are outside and to the east of the M12 Motorway footprint and adjacent to the construction footprint. The location of these items is shown in Figure 5-13 of Appendix H (Non-Aboriginal Heritage Impact Assessment).

Sydney Metro – Western Sydney Airport: Non-Aboriginal Heritage, Artefact Heritage, 2020

Sydney Metro – Western Sydney Airport: Non-Aboriginal Heritage assessment (the assessment) covered non-Aboriginal heritage outside and within the WSA, including land comprising the construction footprint. The assessment identified McMaster Field Station, McGarvie Smith Farm and Luddenham Road as items of heritage significance. It did not identify any additional items of potential heritage significance in the vicinity of the construction footprint.

The assessment found that the proposed rail link would cause an overall major impact to McGarvie Smith Farm through demolition of sheds and buildings 10 and 11, and an irreversible visual impact to the rural farming landscape.

In addition, it was identified that the proposed rail link would cause a moderate impact to McMasters Field Station through removal of significant elements such as one remnant dam and two former feeder troughs, and an irreversible visual impact to the rural farming landscape.

In relation to the Luddenham Road Alignment, a proposed viaduct crossing over Luddenham Road was assessed as having no impact to its heritage significance as the alignment was not to be altered. However, it was considered to have a minor visual impact on the surrounding rural landscape of the Luddenham Road Alignment.

Western Sydney Aerotropolis Initial Precincts: Draft Aboriginal and non-Aboriginal Cultural Heritage Assessment, Extent, 2020

The Western Sydney Aerotropolis Initial Precincts assessment (the assessment) was prepared to provide a strategic overview of built, Aboriginal and non-Aboriginal heritage values associated with the WSA. The following properties were identified as potentially containing State significant archaeological deposits:

- McMaster Field Station – unlisted item of potential local heritage significance (within construction footprint)
- McGarvie Smith Farm – local heritage item listed in Schedule 2 of the WPCSEPP (within construction footprint).

Other items identified outside, but nearby to the study area include:

- Fleurs Radio Telescope Site – local heritage item listed in Schedule 2 of the WPCSEPP
- James Badgery's Exeter Farm site – unlisted potential archaeological site of local heritage significance.

European and Other Heritage Technical Report, RPS Australia East Pty Ltd, 2016

The European and Other Heritage Technical Report (the assessment) was prepared to support the EIS for the WSA. The assessment covered the entire WSA footprint, assessing listed and potential non-Aboriginal heritage items. The assessment identified two heritage items in the construction footprint, being the McMaster Field Station and the McGarvie Smith Farm.

Archaeological potential

The land immediately south and north of Elizabeth Drive is part of a historic rural landscape, with large parcels owned by well-known colonial figures since the early 19th century. However, land use since that time has mostly been agricultural, resulting in a low potential for significant archaeological deposits to remain.

In addition, Elizabeth Drive has been graded and widened numerous times since the early 19th century, which is likely to have removed any archaeological deposits along the roadside. It is still possible that the remains of unrecorded structures along the Elizabeth Drive West alignment may occur, including the remains of the former Badgerys Creek Post Office; however, that potential is assessed as low.

Non-significant archaeological deposits, such as former road surfaces on Elizabeth Drive and Luddenham Road, may also be uncovered during construction. These former bitumen road surfaces are not considered to be significant archaeological deposits and would not require work to stop, as per Transport's *EMF-HE-PR-0076 Unexpected Heritage Items Procedure 2022* (Transport for NSW, 2022). However, any original non-bitumen road surfaces, such as stones, may be of local heritage significance, and *EMF-HE-PR-0076 Unexpected Heritage Items Procedure 2022* (Transport for NSW, 2022) would be followed.

Summary of database searches and literature review

The search of heritage databases and a literature review identified four items of non-Aboriginal heritage within the study area; Luddenham Road Alignment, McGarvie Smith Farm, McMaster Field Station and Badgerys Creek post office, as outlined below and shown in Figure 6-8.

McMaster Field Station

The McMaster Field Station curtilage is partially located within the construction footprint; however, the significant buildings within the property are located about 350 metres north of the construction footprint.

Badgerys Creek Post Office

Based on the literature review, it appears that Badgerys Creek Post Office (the site) was located partially within the footprint of the WSA and partially within the construction footprint. While the land parcel associated with the site is easily identified, the exact location of the former post office within that land parcel is uncertain. However, this site has been significantly altered by construction activities associated with the WSA, and any traces of the Badgerys Creek Post Office have, therefore, likely been removed.

McGarvie Station Farm

The McGarvie Smith Farm is located within the construction footprint, however, the significant buildings associated with the McGarvie Smith Farm are located adjacent to, but outside of, the construction footprint. Heritage significant buildings located within the curtilage of the item are located about 115 to 160 metres from the boundary of the construction footprint.

Luddenham Road Alignment

The southern section of the Luddenham Road Alignment intersects with Elizabeth Drive, within the construction footprint.

Visual inspection

A visual inspection of the study area was carried out on 17 June 2022. The site visit identified the southern extent of the Luddenham Road Alignment as extending into the construction footprint at the intersection of Elizabeth Drive. McGarvie Smith Farm buildings located immediately outside of the construction footprint were identified as being in a dilapidated condition, confirming observations made by the M12 Motorway – Non-Aboriginal Photographic Archival Recording Report (Artefact, 2022).

The Badgerys Creek Post Office has been noted as significantly reconfigured by construction work associated with the WSA. Photographs of this site were not able to be taken owing to heavy traffic conditions and safety issues.

Although the property comprising McMaster Field Station is located partially within the construction footprint, the buildings comprising its heritage values are located about 350 metres north of the construction footprint. As these buildings are located at a distance from the construction footprint, the McMaster Field Station was, therefore, not included in the visual site inspection.

6.4.3 Potential impacts

Construction

McGarvie Smith Farm

During the construction of the proposal, construction ancillary facility 3 would be located within part of the heritage curtilage of the McGarvie Smith Farm; however, heritage significant buildings and structures would be located outside of the construction footprint. The establishment and use of construction ancillary facility 3 may result in temporary indirect (visual) impacts to the landscape character of this item. Although work would take place within the heritage curtilage of the item, there would be no direct impacts to the heritage values of the McGarvie Smith Farm.

The proposal would not have a significant impact on the heritage values of McGarvie Smith Farm, as the principal heritage values attached to this item relate to its historic use as a veterinary research facility and the historical and aesthetic significance of the 1936 buildings.

The proposal would not impact the significant buildings located within the curtilage of the item which are located outside the construction footprint (about 115 to 160 metres away from the boundary of the construction footprint) and separated by an access track, including those buildings which relate to its historic use as a veterinary research facility.

Construction ancillary facility 3 would be located entirely on land that is currently being used to support construction of the M12 Motorway. Cumulative heritage impacts of the proposal and the M12 Motorway are assessed in Section 6.18.

Luddenham Road Alignment

The Luddenham Road Alignment is expected to be directly impacted by the proposal during the construction phase. The proposal would widen the existing Luddenham Road alignment to about 60 metres, for a length of about 100 metres north of the intersection with Elizabeth Drive, before tapering into the existing alignment. The principal heritage values attached to the Luddenham Road Alignment relate to the historic context and the aesthetic appeal of the alignment with long stretches of post and rail fencing. As the proposed reconfiguration of the intersection of Luddenham Road and Elizabeth Drive would not alter the alignment itself, the item would continue to fulfil its historical purpose as an essential link between St Marys and Luddenham.

McMaster Field Station

Buildings comprising the McMaster Field Station are located about 350 metres north of the construction footprint; therefore, this item is unlikely to be impacted by the proposal.

Badgerys Creek Post Office

The site of the Badgerys Creek Post Office has been significantly altered by construction activities associated with the WSA, and any traces of the former post office have likely been removed. Should any archaeological deposits be uncovered during construction relating to the Badgerys Creek Post Office or any other site, these would be managed in accordance with Transport's *EMF-HE-PR-0076 Unexpected Heritage Items Procedure* 2022 (Transport for NSW, 2022).

Operation

Operational impacts are generally indirect in nature and relate to the ongoing use of the road. Given the type and proximity of non-Aboriginal heritage items in the vicinity of the proposal, there are no operational impacts expected.

A small portion of the widened road corridor would be located within the heritage curtilage of the McGarvie Smith Farm. During operation this section of the widened road corridor would be located along the boundary of the curtilage, over 450

metres away from heritage significant buildings on the site. As such the proposal is not anticipated to have an impact on the significance of McGarvie Smith Farm.

6.4.4 Safeguards and management measures

Table 6-32 describes the proposed safeguards and management measures that would be implemented to manage the proposal's potential non-Aboriginal heritage impacts.

Table 6-32 Safeguards and management measures - non-Aboriginal heritage

Impact	Environmental safeguards	Responsibility	Timing	Reference
Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage	Contractor	Detailed design / pre-construction	Section 4.10 of QA *G36 Environment Protection*
Non-Aboriginal heritage	Any unexpected heritage finds identified during construction will be governed by Transport's EMF-HE-PR-0076 Unexpected Heritage Items Procedure 2022 (Transport for NSW, 2020). Work will only resume once the requirements of the procedure have been satisfied	Contractor	Construction	Additional safeguard

6.5 Aboriginal cultural heritage

An Aboriginal Cultural Heritage Assessment Report (ACHAR) has been prepared to assess the potential impacts of the proposal. A summary of this assessment is presented in this section, with the full report provided in Appendix H (Aboriginal Cultural Heritage Assessment Report).

6.5.1 Methodology

The ACHAR has been prepared for the broader Elizabeth Drive upgrades, including both the Elizabeth Drive East Upgrade (the proposal) and Elizabeth Drive West Upgrade, as described in Section 1.1. Given the geographic proximity of these two proposals, Transport plans to seek a single Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the NPW Act as the proposal has the potential to directly or indirectly impact Aboriginal objects in the construction footprints for both the proposal and the Elizabeth Drive West Upgrade. As such, a single ACHAR has been prepared to support the AHIP application. Preparation of a single ACHAR for the Elizabeth Drive upgrades has also allowed for efficiencies in Aboriginal stakeholder consultation, allowing this to be carried out concurrently for both proposals.

The ACHAR has been prepared in accordance with Stage 3 of Transport's PACHCI. The ACHAR has also been prepared with reference to the Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (OEH, 2010a).

The ACHAR involved the following methodology:

- Review of the environmental context of the study area, with consideration to its implications for past Aboriginal land use and the survival of associated archaeological materials, as well as a review of the ethnographic and archaeological contexts
- Review of relevant past Aboriginal heritage assessment reports for the study area, including Kelleher Nightingale Consulting (2018) Stage 2 PACHCI for an earlier iteration of the proposal, and a Stage 2 PACHCI prepared by AECOM (2022) for the Elizabeth Drive East Upgrade
- Consultation with Aboriginal stakeholders, which is described further in Section 5
- Identification of Aboriginal sites and objects with the potential to be impacted by the proposal
- Description of the cultural heritage values, including the significance of the Aboriginal objects/sites that exist across the study area that would be affected by the proposal, and the significance of these values
- Archaeological test excavation carried out by Kelleher Nightingale Consulting and field representatives from registered Aboriginal parties in March and April 2023, including at two sites within the study area (and a further four sites relevant to the Elizabeth Drive East Upgrade)
- Assessment of the actual or likely harm posed to the Aboriginal objects/sites from the proposal
- Identification of environmental safeguards and management measures for impacted Aboriginal objects/sites.

The study area for the Aboriginal cultural heritage assessment discussed in this chapter comprises the construction footprint for the proposal (which also encompasses the operational footprint).

Several portions of the study area are overlapped by existing approvals for major infrastructure projects, including the M12 Motorway (SSI-9364), Upper South Creek Advanced Water Recycling Centre (SSI 8609189) and the Western Sydney Airport. These approvals are considered active/current where they intersect the current study area, and include conditions related to Aboriginal heritage considerations within their boundaries. These areas are therefore excluded from impact assessment for the current project, and Transport would ensure that any activities carried out as part of the proposal undertaken within these existing approval areas would comply with all relevant conditions.

Consultation

The aim of Aboriginal stakeholder consultation for the ACHAR is to integrate cultural and archaeological knowledge and ensure registered Aboriginal parties have information to make decisions on Aboriginal cultural heritage. Aboriginal stakeholder consultation has been carried out with reference to the PACHCI, the Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH, 2010b), and the requirements of Clause 60 of the *National Parks and Wildlife Regulation 2019*.

The consultation carried out for the ACHAR is outlined in Table 6-33. An Aboriginal community consultation log is also provided in Appendix C of Appendix H (Aboriginal Cultural Heritage Assessment Report).

Table 6-33 Consultation for the ACHAR

Consultation stage	Description
Stakeholder identification and registration of interest	Transport advertised the proposal in local media (including advertisements in the *Koori Mail*, *Penrith Western Weekender* and *The District Reporter* in November 2022) and contacted potentially relevant Aboriginal stakeholders with letters to invite them to register their interest in the community consultation process for the ACHAR. Following this process a list of 35 registered Aboriginal stakeholders was compiled. A list of the contacted and registered stakeholders is provided in Appendix H (Aboriginal Cultural Heritage Assessment Report)
Provision of proposed assessment methodology	Registered Aboriginal stakeholders were provided with a copy of the proposed assessment methodology for the ACHAR and archaeological test excavation in January 2023. Stakeholders were requested to review the information and provide any comments or cultural information that may affect, inform or refine the methodology. Responses were received from nine stakeholders, eight of whom expressed support for the methodology and one provided no comment. The full responses are provided in a consultation log appended to Appendix I (Aboriginal Cultural Heritage Assessment Report)
Review of the draft ACHAR by Aboriginal Focus Group	The draft ACHAR and accompanying test excavation report were provided to registered Aboriginal stakeholders for review and comment in July 2023. All registered Aboriginal stakeholders were provided a 28-day period for review. Stakeholders were also invited to attend an Aboriginal Focus Group meeting during the review period to discuss the draft ACHAR and the assessment findings. Stakeholders were invited to comment on the cultural significance of the study area and identified Aboriginal heritage. Two stakeholders provided written comment on the draft ACHAR, both expressing agreement with the findings and recommendations made. Further detail on the responses is provided in Appendix H (Aboriginal Cultural Heritage Assessment Report)

6.5.2 Existing environment

Environmental, ethnohistoric and archaeological context

The study area and surrounding region are known to have been important to and extensively used by past Aboriginal people. Language group mapping places the study area within the traditional lands of the Darug language group.

Interaction between groups was common as people frequently travelled across Country for economic, social and ceremonial reasons. Darug groups around the study area would have interacted with numerous other groups for initiation ceremonies, arrangement of marriages, corroborees, trade and exchange and the discussion and establishment of lore. The complex network of people's connections to and across Country forms a key part of the cultural landscape.

Early colonial interest in the area led to interactions between the British and the local Aboriginal people relatively soon after the arrival of Europeans to Australia. Aboriginal people's use of the wider Cumberland Plain, in which the study area is located, is well-documented in historic accounts and the area has demonstrated cultural importance and value to the contemporary Aboriginal community. In particular, the cultural value of the multiple creek systems within the wider region has been identified. Cosgroves and Oaky Creek, Badgerys Creek and South Creek are specifically highlighted as significant landscape features in the region with cultural value. Of these, Oaky Creek and Cosgroves Creek traverse the construction footprint.

Stakeholders consulted have expressed that they had a responsibility to look after the land, including the heritage sites, plants and animals, creeks and the land itself. Several stakeholders also indicated that they held additional cultural, spiritual, personal and familial connections to the area. Aboriginal community consultation undertaken for the proposal has demonstrated that members of the contemporary Aboriginal community continue to experience connection with the area through cultural and familial associations.

Archaeological investigations have been undertaken in the region over several decades that have revealed physical traces of a range of Aboriginal land use activities which have survived in the form of Aboriginal archaeological sites. The Aboriginal archaeological sites identified in the region have been predominantly surface artefact scatters, isolated artefacts and subsurface archaeological deposits of varying artefact density and integrity, with modified trees and grinding grooves less common. Areas of potential archaeological deposit (PAD) have also been recorded.

Soil landscape, vegetation and land use practices have been identified as factors influencing the preservation of Aboriginal archaeological sites in the region. Soil landscapes subject to high levels of erosion or fluvial activity are unlikely to retain in

situ Aboriginal objects while areas where sediment has been deposited often contain Aboriginal objects that are without spatial context. Stable, residual or alluvial soil landscapes with low levels of disturbance are most likely to contain intact subsurface deposits.

Previous Aboriginal heritage investigations

Previous archaeological assessment for the Elizabeth Drive upgrades (both the proposal and the Elizabeth Drive East Upgrade) has been undertaken following the process outlined in the PACHCI and Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (OEH, 2010a). Investigations relating to the preceding PACHCI stage (Stage 2) are summarised in Table 6-34.

Table 6-34 Previous Aboriginal heritage investigations

Investigation	Description
Kelleher Nightingale Consulting – Elizabeth Drive Upgrade M7 to the Northern Road: Aboriginal Stage 2 PACHCI Archaeological Survey Report (2018) and Addendum (2019)	In 2018, Kelleher Nightingale Consulting was engaged to complete a Stage 2 PACHCI Archaeological Survey Report for an earlier iteration of the current proposal with a different construction footprint. The overall study area for this assessment comprised the existing road corridor (road reserve) of Elizabeth Drive between The Northern Road in the west and the M7 Motorway in the east, with a 100-metre buffer on either side of the road reserve. The assessment included a review of the landscape context, previous archaeological investigations and an archaeological field survey. An addendum Aboriginal archaeological assessment, including an archaeological survey, was later undertaken for an additional area along the Elizabeth Drive upgrade corridor associated with a proposed intersection servicing the Western Sydney Airport at Badgerys Creek (KNC, 2019). Overall, the assessments confirmed that the Elizabeth Drive corridor (within the construction footprint) had been extensively altered by ground surface disturbance related to road construction, drainage and utilities, reducing the likelihood of in situ Aboriginal objects or intact archaeological deposits
Stage 2 PACHCI Archaeological Survey Report – AECOM (2022)	In 2022, AECOM prepared archaeological survey reports for the proposal as well as the Elizabeth Drive East Upgrade. The assessments were undertaken in accordance with Stage 2 of the PACHCI and included background research, environmental and landscape assessment, field survey (where property access was possible), consultation with Gandangara and Deerubbin LALCs, and incorporation of the previous results from the Kelleher Nightingale Consulting 2018 Stage 2 PACHCI assessment. Background research for the Elizabeth Drive West Upgrade (the proposal) identified two previously recorded sites in or within the vicinity of the proposal: Elizabeth Drive/Adams Road AFT 1 around Oaky Creek and Cosgroves Creek, and B95 within the Western Sydney Airport site (which has since been removed as part of the Western Sydney Airport development). Survey was carried out which confirmed the location and extent of previously recorded site Elizabeth Drive/Adams Road AFT 1 around Oaky and Cosgroves Creeks. The assessment identified that Elizabeth Drive/Adams Road AFT 1 would be at least partially impacted by the proposal and further assessment under Stage 3 of the PACHCI was recommended, including a test excavation program

Archaeological test excavation

An archaeological test excavation methodology was developed as part of the PACHCI Stage 3 process in consultation with the registered Aboriginal stakeholders. In total, six Aboriginal archaeological sites/PADs were recommended for the test excavation program for the Elizabeth Drive upgrades, one of which falls within or partially within the study area.

Testing was subsequently undertaken within the study area at Elizabeth Drive/Adams Road AFT 1 (Aboriginal Heritage Information Management System (AHIMS) ID 45-5-5105), located around Oaky and Cosgroves Creeks.

Test squares (of 50 x 50 centimetres) were excavated at regular intervals across the study area to sample the identified site/PAD areas within the impact corridor. The results of the test excavations are summarised in Table 6-35.

Table 6-35 Archaeological test excavation results

Archaeological site / PAD	Total area sampled	Total number of artefacts uncovered	Average artefact density	Peak artefact density
Elizabeth Drive/Adams Road AFT 1	5.75 square metres	65	11.3 per square metre	80 per square metre

The test excavation undertaken at Elizabeth Drive/Adams Road AFT 1 established the presence of subsurface archaeological deposits which varied in density and integrity across the landform. The highest intensity of Aboriginal occupation was encountered on the eastern side of Oaky Creek, with artefacts and a diversity of raw materials located in intact soil deposits.

Cultural values

Consultation with Aboriginal stakeholders (as described in Section 5) was used to identify Aboriginal cultural heritage values for the area in which the Elizabeth Drive upgrades are located.

The region has cultural value for the local Aboriginal community. The identified cultural value includes a feeling of attachment and responsibility for the land. These values become tangible when tied to identified Aboriginal objects found at archaeological sites. In this way, the Aboriginal objects can be seen as exhibiting both scientific information and cultural meaning, knowledge about the past tied with social values and belief systems. The presence of Aboriginal objects is not required for a site to hold value for the Aboriginal community. Aboriginal sites may have social, spiritual or landscape values which are not tangible.

Some of the Aboriginal cultural heritage values expressed by stakeholders for the study area and wider region include:

- Responsibility to look after the land, including the heritage sites, plants and animals, creeks, rivers, and the land itself
- Artefact sites and landscape features
- Culturally modified trees
- Intangible sites of spiritual significance
- Connectivity of sites and pathways throughout the landscape
- Creek lines, particularly larger landscape features and waterways such as South Creek
- Indigenous plants and animals
- General concern for burials, as their locations are not always known, and they can be found anywhere.

One stakeholder expressed the high cultural significance of the local area, particularly noting that nearby major waterways are and have been utilised by Aboriginal people for tens of thousands of years. The diversity and abundance of natural resources in the area was also highlighted.

Specific cultural values for the recorded archaeological sites within the study area have not been identified by stakeholders to date.

Summary of identified sites and PADs, and assessment of significance

One Aboriginal site was located within (or partially within) the study area, as summarised in Table 6-36. A further 10 sites were identified within the study area for the Elizabeth Drive East Upgrade, which is subject to a separate REF.

The scientific significance of the site was assessed as moderate. This assessment is based on a consideration of the research potential, representativeness, intactness and rarity of the sites. Sites of moderate significance demonstrate higher quality archaeological information, a greater density of artefacts and/or less severe landscape disturbance relative to sites of lower significance.

Table 6-36 Aboriginal sites within the study area

Site name	AHIMS ID	Site feature	Assessed significance
Elizabeth Drive/Adams Road AFT 1	45-5-5105	Artefact (surface and subsurface)	Moderate

6.5.3 Potential impacts

Construction

Construction work for the proposal (such as earthworks and the addition of new traffic lanes) would disturb the ground surface within the study area. Locating the proposal along the existing road corridor, has contributed to avoidance of impacts to Aboriginal cultural heritage; however, some level of impact is unavoidable due to the position of the existing road and presence of Aboriginal objects within the disturbed road corridor.

One Aboriginal site is partially located within the study area – Elizabeth Drive/Adams Road AFT 1. Table 6-37 provides a summary of the impact of the proposal on this site.

The impacted portions of Elizabeth Drive/Adams Road AFT 1 is considered to display moderate significance based on the scientific value and potential to inform on Aboriginal landscape use of South Creek and its tributaries. The significance of harm to the portions of the site within the study area is moderate, given the sites' moderate archaeological significance.

The archaeological value of the site is linked to the information that it contains. Recovery of this information through archaeological salvage excavation would be carried out to manage the impact of the proposal and offer an opportunity to better understand the activities which were undertaken at the site. While the intrinsic Aboriginal cultural value of impacted sites cannot be wholly offset or mitigated; salvaged information from this site could assist in a better understanding of and future management of archaeological sites in the region. Safeguards and management measures for Aboriginal cultural heritage, including archaeological salvage, are discussed further in Section 6.5.4.

Transport's EMF-HE-PR-0076 Unexpected Heritage Items Procedure 2022 (Transport for NSW, 2022) would also be followed in the event that unknown or potential Aboriginal objects or sites are encountered during construction (refer to Section 6.5.4 for further detail).

Table 6-37 Construction impact assessment

Site name	AHIMS ID	Nature / extent of impact	Significance	Consequence of impact
Elizabeth Drive/Adams Road AFT 1	45-5-5105	Direct / Partial	Moderate	Partial loss of value

Operation

The proposal is not expected to impact on any additional items of Aboriginal heritage or cultural values when it is operational, as earthworks and disturbance would be restricted to the construction phase.

6.5.4 Safeguards and management measures

Table 6-38 describes the proposed safeguards and management measures that would be implemented to manage potential impacts to Aboriginal cultural heritage.

In addition to these measures, Transport would apply for and obtain an AHIP under section 90A of the NPW Act for the land and associated objects within the boundaries of the study area, excluding areas subject to existing planning approvals (as described in 6.5.1). This would be obtained prior to the commencement of pre-construction and construction activities associated with the proposal that would affect these sites.

Table 6-38 Safeguards and management measures – Aboriginal cultural heritage

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal cultural heritage – Salvage excavation	Archaeological salvage excavation will be carried out within the impacted portions of Elizabeth Drive/Adams Road AFT 1. Salvage excavation will be completed prior to any activities (including pre-construction activities) which may harm Aboriginal objects at this location. Salvage excavation activities will be undertaken in accordance with the methodology attached as Appendix D of Appendix H (Aboriginal Cultural Heritage Assessment Report)	Transport / Contractor	Detailed design	Additional safeguard
Aboriginal cultural heritage – Community collection	Community collection of surface artefacts will be carried out at Elizabeth Drive/Adams Road AFT 1. Community collection will be completed prior to any activities (including pre-construction activities) which may harm Aboriginal objects at these locations. Community collection activities will be undertaken in accordance with the methodology attached as Appendix D of Appendix H (Aboriginal Cultural Heritage Assessment Report)	Transport / Contractor	Detailed design	Additional safeguard
Aboriginal cultural heritage – Site protection	The boundary of the area subject to an Aboriginal Heritage Impact Permit, adjacent to the non-impacted portion of Elizabeth Drive/Adams Road AFT 1, will be demarcated with protective fencing. These areas will be identified as “no-go zones” in the CEMP for the proposal. Construction workers will be inducted as to appropriate protection measures and requirements to comply with conditions in the adjacent Aboriginal Heritage Impact Permit	Contractor	Pre-construction / construction	Additional safeguard
Aboriginal cultural heritage – Overlapping projects	Activities carried out as part of the proposal undertaken within existing approval areas of other projects (including the M12 Motorway (SSI-9364), Upper South Creek Advanced Water Recycling Centre (SSI-8609189) and the Western Sydney Airport) would comply with all relevant conditions relating to Aboriginal heritage management for these projects. Where required, consultation will be undertaken with these projects to confirm the relevant conditions and requirements for these areas	Transport / Contractor	Pre-construction / construction	Additional safeguard
Aboriginal cultural heritage – Unexpected finds	Transport’s EMF-HE-PR-0076 Unexpected Heritage Items Procedure 2022 (Transport for NSW, 2022) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. Work will only re-commence once the requirements of that Unexpected Heritage Items Procedure have been satisfied	Contractor	Pre-construction / construction	Section 4.9 of QA G36 Environment Protection

6.6 Property and land use

6.6.1 Methodology

The property and land use impact assessment adopted the following methodology:

- Identification of existing and anticipated future land use and planning controls that apply to the construction footprint through a review of the following:
  - Penrith LEP
  - Liverpool LEP
  - WPCSEPP
  - e-Planning Spatial Viewer (DPE, 2022)
  - The Western Sydney Aerotropolis Plan (Western Sydney Planning Partnership, 2020)
  - Western Sydney Aerotropolis Precinct Plan (Department of Planning and Environment, 2022)
- An assessment of potential construction impacts due to property acquisition, adjustments, temporary leases of land and access
- An assessment of potential operation impacts due to property acquisition, adjustments, and access
- Identification of suitable safeguards and management measures to minimise the proposal's potential impact on property and land use.

6.6.2 Existing environment

Land zoning

The proposal is located within Liverpool and Penrith LGAs. As discussed in Section 4.1.1, land use planning within the construction footprint is governed by the provisions of WPCSEPP. Land use zones within and surrounding the construction footprint are shown in Figure 4-1 and comprise:

- ENT – Enterprise
- AGB – Agribusiness
- ENZ – Environment and recreation
- SP2 – Infrastructure.

The construction footprint largely comprises semi-rural properties located around an established road corridor (ie Elizabeth Drive). Most of the land within the construction footprint is zoned 'SP2: Infrastructure' for use as a classified road (Elizabeth Drive). There are several utilities located within the construction footprint, with a large number of these located within the existing road corridor, as described in Section 3.3.4.

Land located immediately south of Elizabeth Drive is zoned as 'SP2: Western Sydney International (Nancy-Bird Walton)' and 'AGB: Agribusiness'. The 'SP2: Western Sydney International (Nancy-Bird Walton)' zone provides for the WSA operations. The 'AGB: Agribusiness' zone provides for agribusiness, including related supply chain industries, agritourism and food production and processing activities.

Land located immediately north of Elizabeth Drive is largely zoned 'ENT: Enterprise' which complements the function of the WSA being a 24-hour transport hub. This zone enables land uses typically associated with employment lands supporting both commercial and industrial sectors.

Land centred around Cosgroves Creek and Oaky Creek is zoned as 'E2 – Environmental Conservation', which provides for the protection, management and restoration of high ecological, scientific, cultural or aesthetic values.

Land use and property

Land use to the north of Elizabeth Drive largely consists of agricultural land with scattered vegetation and buildings (residential and agricultural).

Key land uses and properties located north of Elizabeth Drive include:

- Private properties located along Elizabeth Drive, including residential and businesses (including manufacturer outlets and garden nurseries), and vacant and unknown land uses
- McGarvie Smith Farm, located immediately north of Elizabeth Drive and east of Luddenham Road at Badgerys Creek (located partially within the construction footprint). The farmland is a 344-hectare beef cattle farm used for research purposes and is locally heritage listed (however, heritage significant buildings are located over 115 to 160 metres from the construction footprint)
- Luddenham Lodge Horse Riding, located about 500 metres north of Elizabeth Drive on Luddenham Road
- Sydney Society of Model Engineers, located about 500 metres north of Elizabeth Drive on Luddenham Road immediately west of the Luddenham Lodge Horse Riding centre
- Luddenham Raceway – Go Karting Paintball and Motorsport Park, located about 800 metres north of Elizabeth Drive on Luddenham Road, immediately north-west of the Luddenham Lodge Horse Riding centre
- The future M12 Motorway, currently under construction, with a tie in planned at the eastern extent of the proposal.

Land use to the south of Elizabeth Drive largely consists of agricultural land with scattered vegetation and buildings, as well as the WSA, which is currently under construction (immediately south of the proposal).

Key land uses and properties located south of Elizabeth Drive include:

- Private properties, including residential properties, businesses, vacant properties and unknown land uses
- The WSA, which is currently under construction (immediately south of the construction footprint), as well as the Sydney Metro Western Sydney Airport (SMWSA) project, with two future metro stations located within the WSA (outside of the construction footprint). The SMWSA would support the WSA and Western Sydney Aerotropolis by providing an integrated transport system for the Western Parkland City
- A duck farm, located to the west of Adams Road (partially within the construction footprint along its frontage). Impacts of the proposal on the operation of this business have been assessed as part of the socio-economic impact assessment (refer to Section 6.7 and Appendix J (Socio-economic Impact Assessment)
- Workers Hubertus Country Club, located off Adams Road about 600 metres south of Elizabeth Drive.

Current and future development

Elizabeth Drive is located adjacent to the WSA and within the Western Sydney Aerotropolis. Key land use changes anticipated as a result of WSA and the Western Sydney Aerotropolis are discussed in the following sections.

Western Sydney Airport

The WSA will be a catalyst for land use change in the Western Parkland City. Construction of the WSA commenced in September 2018 and it is anticipated to be operational in December 2026.

Stage 1 of WSA is currently under construction and would provide one runway, a terminal and other support facilities to provide for the anticipated operational capacity. Access to the WSA would be via the M12 Motorway tie in located to the east of the construction footprint.

Western Sydney Aerotropolis

Elizabeth Drive is located within the Western Sydney Aerotropolis which would result in a transformational change in the area surrounding the proposal, providing significant employment opportunities for residents of the Western Parkland City and beyond. The WSA would facilitate future growth in employment in the Western Sydney Aerotropolis where a high-skilled employment hub would be located providing opportunities across the aerospace and defence, manufacturing, healthcare, freight and logistics, agribusiness, education and research sectors (DPE, 2022).

The structure plan for the Western Sydney Aerotropolis is provided in Figure 6-9.

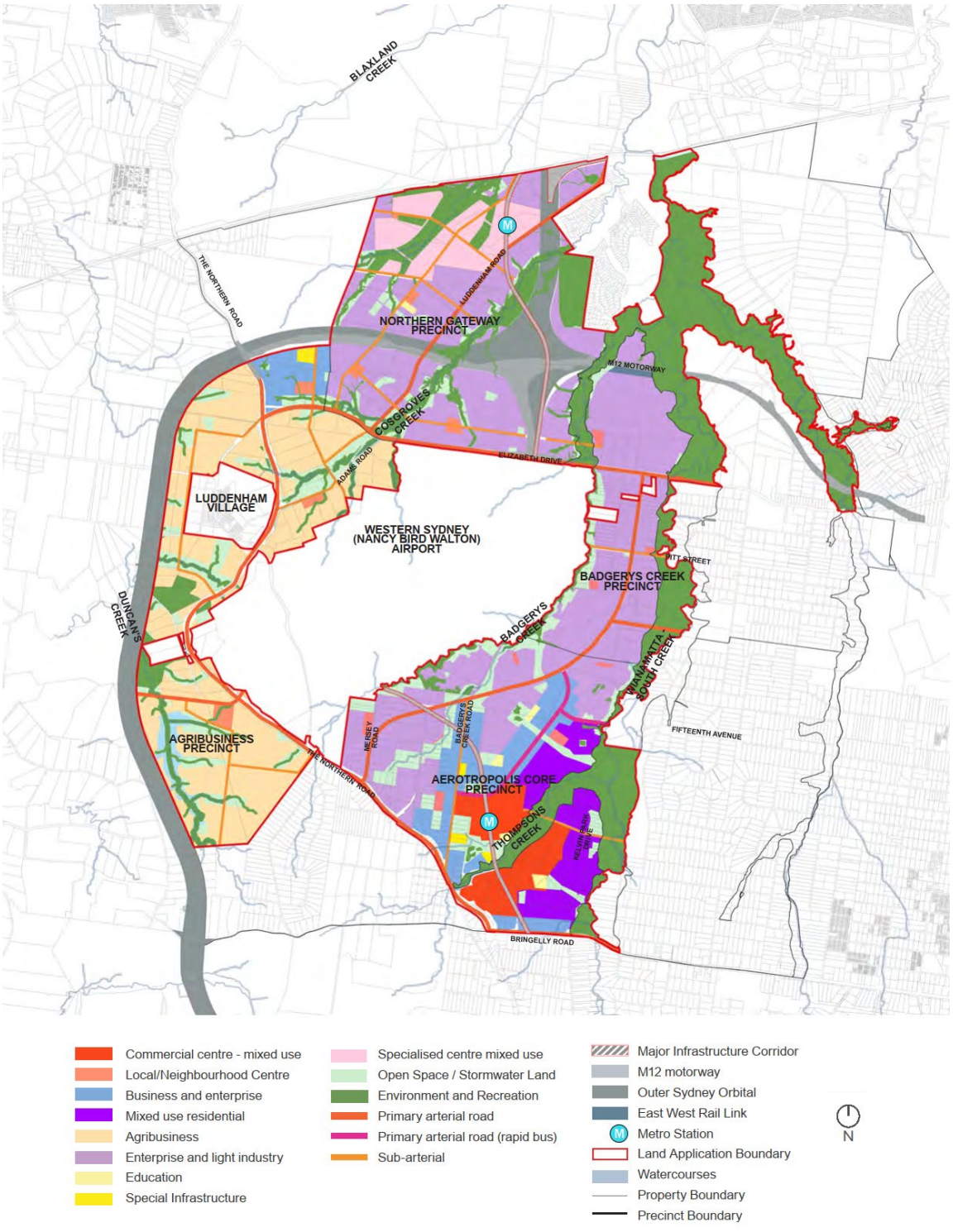


Figure 6-9 Western Sydney Aerotropolis Land Use and Structure Plan (Source: DPE, 2022)

6.6.3 Potential impacts

Construction

Property acquisition and adjustments

Indicative permanent property acquisition requirements have been identified for the proposal based on the concept design and likely construction methodology. Figure 3-11 to Figure 3-14 in Chapter 3 (Description of the proposal) show the indicative property acquisition requirements.

The proposal would require the partial acquisition of 18 privately owned lots (subject to detailed design), which may include the requirements for the demolition and relocation of infrastructure where it falls within the partial acquisition area. Properties to be partially acquired accommodate a mix of land uses, including residential, commercial, and vacant or unknown land uses. Where possible, the approach to partial property acquisition has sought to minimise impacts to dwellings and key infrastructure as well as severance of existing landowner's activities/operations. At the majority of properties, partial acquisition is anticipated to directly impact parts of driveways, internal tracks, or sheds, rather than dwellings. One property has been identified which potentially includes a dwelling within the area proposed to be partially acquired.

Further detail on property ownership and land to be acquired for the proposal is in Appendix C (Property acquisition).

Property acquisition has the potential to impact communities by placing additional pressure and stress on residents impacted by partial acquisition. WSA and Western Sydney Aerotropolis have been a catalyst for development within the area and may also lead to community sensitivity regarding acquisition. The socio-economic impacts of property acquisition are further discussed in Section 6.7 and Appendix J (Socio-economic Impact Assessment).

Property acquisition would be subject to negotiation between the landholder and Transport and would be carried out in accordance with the Property Acquisition Policy (Transport for NSW, 2021), the Land Acquisition Information Guide (Transport for NSW, 2014) and the *Land Acquisition (Just Terms Compensation) Act 1991*.

Property adjustments would also be required to accommodate the proposal. This would include adjustments to fencing, farm dams, sheds, driveways, parking spaces and letterboxes. Farm dams within the operational footprint that would potentially be impacted by the proposal are shown on Figure 3-1 to Figure 3-4. The proposal design evolution has sought to minimise the impact of severance on existing landowner's activities and operations as far as practicable. Any adjustments to properties required for the proposal would be carried out in consultation with the property owner.

Temporary leases of land

Construction of the proposal would require the temporary leasing of land to accommodate the proposed construction ancillary facilities and construction accesses. Subject to detailed design and construction planning, this would include temporary (partial) leases of three privately owned properties, all of which would also be subject to partial acquisition (within areas shown on Figure 3-11 to Figure 3-14). Land to be temporarily leased for the proposal is outlined in Chapter 3 (Description of the proposal) and Appendix C (Property acquisition).

The temporary leasing of and access to privately owned land would disrupt the affected landowners' ability to use the portion of land subject to the lease agreement. This impact would be temporary in nature, with all leased property being reinstated in accordance with the lease agreement, in consultation with the landowner.

Two of the properties identified for construction ancillary facilities have been previously used for similar purposes, including completed construction of the Northern Road Upgrade at construction ancillary facility 1, and current construction of the M12 Motorway at construction ancillary 3 (planned to be completed prior to the commencement of this proposal). This has avoided the need to disturb additional properties for the purpose of construction ancillary facilities.

Socio-economic implications of temporary leasing are assessed in Section 6.7 and Appendix J (Socio-economic Impact Assessment).

Land use changes

The construction footprint would directly impact about 68 hectares of land, of which the predominant land use is zoned as 'ENT – Enterprise'. Where the construction footprint extends outside the existing road corridor, it would largely be within semi-rural land, which is predominantly used for agricultural purposes. Construction activities would be temporary in nature and construction outside of the operational footprint would not result in permanent land use changes. Post construction, these areas would be restored to their previous use.

It is likely that the WSA would become operational during the construction phase of the proposal. Construction activities would be designed and planned to ensure that they would not impact on airport operations. Consultation would occur with the airport operators regarding any necessary permits required to enable construction to occur in the vicinity of the WSA.

Property access

Property access would be maintained where practical during construction, and temporary alternative access provided in consultation with the property owner, where required. Nearby properties may experience delays in access due to traffic control and increased movement of vehicles related to construction activities. Traffic and transport related construction impacts are discussed further in Section 6.2.

Operation

Property acquisition and adjustments

The proposal would require partial property acquisition and some adjustments to properties. While long term and permanent impacts of property acquisition would be fully realised during the operational phase of the proposal, the impacts would occur from the commencement of construction and, therefore, are discussed in the assessment of construction phase impacts in the section above.

Properties affected by changed access arrangements would be provided with restored or new permanent arrangements, as agreed with property owners.

Impacts to existing land uses

The operational footprint would directly impact about 37 hectares of land, to facilitate the widened road corridor, intersections with local access roads, drainage and ancillary infrastructure. Consistent with construction land use impacts outlined above, the predominant land use is zoned as 'ENT – Enterprise'. Land permanently acquired by the proposal within 'ENT – Enterprise', would be consistent with the land zone objectives, to provide facilities and services that meet the needs of businesses and workers, complementing the WSA being a 24-hour transport hub by providing an upgraded road corridor.

Land acquired within 'AGB – Agribusiness' would somewhat decrease the area of land for grazing. However, this is a small portion of the construction footprint, and as outlined in 'future uses' below, the proposal would support the transition from the existing largely rural and agricultural uses to future higher intensity urban uses consistent with the Western Sydney Aerotropolis.

Land zoned as 'ENZ – Environment and recreation' within the operational footprint stretches along the creek lines and ephemeral tributaries of Cosgroves and Oaky Creeks crossing Elizabeth Drive. The proposal would result in a permanent change to a small portion of this land use, to a transport infrastructure corridor. This would remove the ability of the land to be developed for public open space or recreational purposes, or for enhancement, restoration and protection of the natural and cultural heritage values of the land in the future.

The construction footprint and surrounding land have undergone substantial change in recent years, and this is anticipated to continue due to the development of the WSA and the proposed Western Sydney Aerotropolis, where large extents of rural properties have been identified for future urban use. The proposal would provide a key piece of connecting infrastructure and would support land use changes proposed as a result of these developments. The strategic context of the proposal is discussed further in Chapter 2 (Need and options considered).

Impacts to adjacent land uses during operation, such as amenity impacts, are discussed throughout Chapter 6 (Environmental assessment). Overall, impacts on existing land uses from the operation of the proposal are expected to be low. Impacts to adjacent land uses during operation, such as amenity impacts, are discussed in Section 6.7.

Impacts to future land uses

Once operational, the proposal would result in improved transport connections for communities, businesses and industry which would have a positive impact on planned development areas in Western Sydney. It would support future employment and land uses surrounding the proposal.

The proposal is consistent with future land use zones of the Western Sydney Aerotropolis as shown in Figure 6-9. It would support the transition from the existing largely rural and agricultural uses to future higher intensity urban uses, including commercial, industrial, residential, educational and recreation by providing enhanced access opportunities and transport linkages.

The Elizabeth Drive upgrades would connect the WSA, the Western Sydney Aerotropolis industrial and commercial developments, and new residential and employment hubs. By increasing the capacity of Elizabeth Drive and providing new signalised intersections, the proposal would support the nearby developments and planned economic growth in the area.

Sydney Water has been announced as the trunk drainage authority for stormwater in the Western Sydney Aerotropolis. Transport would liaise with Sydney Water regarding this scheme at the detailed design phase of the proposal, as relevant. Further detail is provided in Section 6.9.

6.6.4 Safeguards and management measures

Table 6-39 describes the proposed safeguards and management measures that would be implemented to manage the proposal's property and land use impacts.

Table 6-39 Safeguards and management measures – property and land use

Impact	Environmental safeguards	Responsibility	Timing	Reference
Property and land use	Transport will complete property adjustments including fencing, driveways/access and adjustments to other property infrastructure impacted by the proposal in consultation with affected property owners	Transport	Detailed design	Additional safeguard
Property and land use	All property acquisition will be carried out in accordance with Property Acquisition Policy (Transport for NSW, 2021), the Land Acquisition Information Guide (Transport for NSW, 2014) and the Just Terms Act.	Transport	Pre-construction and construction	Additional safeguard
Property and land use	Transport will consult with airport operators to avoid direct impacts to airport operations from the construction of the proposal. This will include obtaining any necessary permits required to enable construction to occur in the vicinity of Western Sydney Airport	Transport	Pre-construction and construction	Additional safeguard

Other safeguards and management measures that would contribute to the management of potential socio-economic impacts are identified in the following sections:

- Section 6.7, which outlines safeguards and management measures relating to socio-economic impacts associated with property acquisition, as well as communication and engagement with affected residents and businesses
- Section 6.9, which includes a management measure for Transport to liaise with Sydney Water regarding the Western Sydney Aerotropolis integrated water system at the detailed design phase of the proposal, as relevant.

6.7 Socio-economic

A socio-economic impact assessment (SEIA) has been prepared to assess the potential impacts of the proposal. A summary of this assessment is presented in this section, with the full report provided in Appendix J (Socio-economic Impact Assessment).

6.7.1 Methodology

The SEIA has assessed the impacts of the proposal in accordance with Environmental Impact Assessment Practice Note – Socio-economic assessment (EIA-N05) (Transport for NSW, 2020) (the Practice Note). The Practice Note outlines the requirements for establishing the socio-economic baseline and guides the process for assessing socio-economic impacts of the proposal.

The methodology for the socio-economic impact assessment involved the following:

- Definition of the social locality (or study area) for the proposal, taking into consideration the likely area of social influence associated with the construction and operation of the proposal
- Selection of a 'moderate' assessment as the appropriate level of assessment for the SEIA according to the Practice Note
- Consultation with the local community and other stakeholders who have an interest or could be affected by the proposal
- Review of relevant local, regional and state policies and plans, and the outcomes of consultation activities carried out for the proposal
- Development of a baseline profile of the existing socio-economic environment based on information available from the Australian Bureau of Statistics (ABS)
- Identification and assessment of the potential construction and operational impacts of the proposal on socio-economic matters, including an assessment of the significance of these impacts. These impacts have been informed by other technical assessments and sections within the REF including air quality, traffic and transport, noise and vibration, property and land use, and landscape and visual impacts
- Identification of safeguards and management measures to manage and monitor the potential socio-economic impacts of the proposal.

Study area (social locality)

The social locality (or study area) for the assessment of socio-economic impacts has been chosen based on the proposal's likely area of social influence. The social locality considers both local community impacts and those impacts likely to occur on a broader or more regional scale, such as economic and employment opportunities created by the proposal.

The social locality, shown on Figure 6-10, is bound by the following geographic areas, each defined by the ABS as a 'Statistical Area Level 2' (SA2):

- Austral – Greendale
- Badgerys Creek
- Horsley Park – Kemps Creek
- Mulgoa – Luddenham – Orchard Hills.

Within the social locality, a search radius of two kilometres has been used to identify social infrastructure facilities with the potential to be affected by the construction and operation of the proposal.

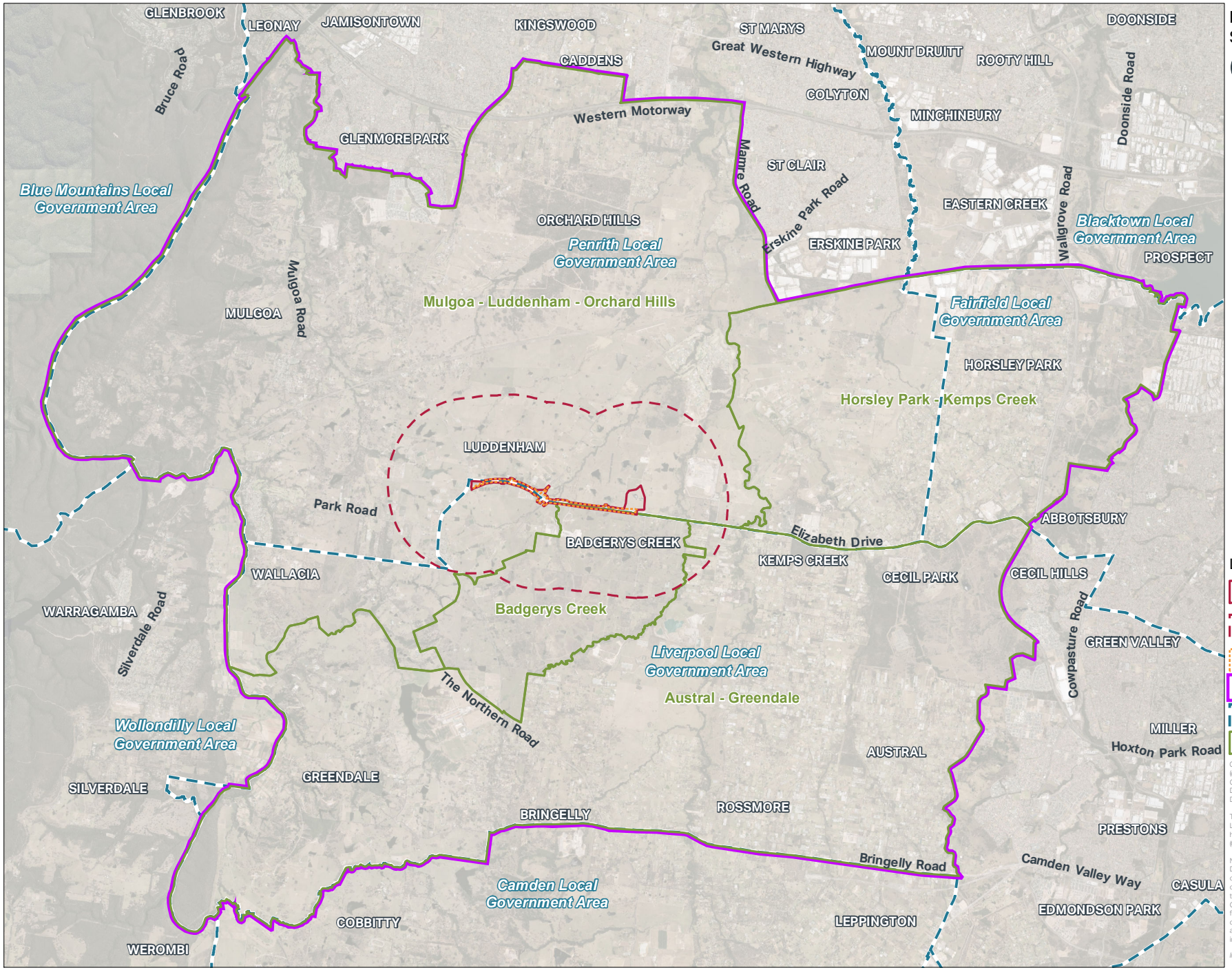


FIGURE 6-10:
SOCIAL LOCALITY

N

0 1 2 km

Legend

- Construction footprint
- 2km radius for social infrastructure consideration
- Operational footprint
- Social locality
- LGA boundary
- SA2 boundary

Consultation

To inform the SEIA, a socio-economic specific survey was carried out between 2 August 2022 and 10 August 2022 and encompassed the Elizabeth Drive upgrades (Elizabeth Drive West Upgrade and Elizabeth Drive East Upgrade, as described in Section 1.1).

The survey was emailed via a digital link to 171 stakeholders on 2 August 2022 and letter box dropped to 175 properties along the Elizabeth Drive upgrades alignment on 3 August 2022. Respondents were able to fill in the survey online or post it back to Transport until the survey closed on 10 August 2022.

The survey had three sections for respondents to answer:

- **Section 1: Business survey** – this included business survey questions, developed to understand businesses' reliance on Elizabeth Drive, their customer base, and their perception as to how their business may be affected (both positively and negatively) by the proposal
- **Section 2: Residential survey** – including questions developed to better understand the potential social impacts of the proposal on community members
- **Section 3:** Demographic questions (optional).

A total of 37 responses were received combined across the Elizabeth Drive West Upgrade and Elizabeth Drive East Upgrade. The results of the surveys are provided in Section 5 and Appendix B of Appendix J (Socio-economic Impact Assessment). This may be indicative of consultation fatigue relating to several other transport and development projects which are underway in the region, or a lack of interest in the proposal.

Due to the limited number of responses, the sentiment of all those who may be impacted by the proposal may not be captured in this assessment. Notwithstanding, the socio-economic consultation captured a sample of relevant views from within the community and has been considered alongside consultation for the broader proposal (documented in Chapter 5 (Consultation)) as well as recent census data for the social locality. Community and stakeholder engagement would continue throughout design and construction of the proposal.

Evaluation of the significance of social impacts

The assessment of the significance of socio-economic impacts in accordance with the Practice Note includes consideration of the magnitude of the impact and the sensitivity of the receivers. The criteria for assessing each impact were established based on:

- Magnitude of impact which comprises the scale and intensity, spatial extent and duration of an impact
- Sensitivity of affected stakeholders, which is defined by the susceptibility or vulnerability of people, receivers or receiving environments to adverse changes caused by the impact, or the importance placed on the matter being affected.

The assessment matrix provided in Table 6-40 has been used to determine the significance of each social impact as a function of the magnitude of the impact and the sensitivity of the affected receivers.

Table 6-40 Grading matrix to assess the significance of socio-economic impacts

	Magnitude			
Sensitivity	High	Moderate	Low	Negligible
High	High	High-Moderate	Moderate	Negligible
Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
Low	Moderate	Moderate-Low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

6.7.2 Existing environment

Strategic context

The social locality is located within the Fairfield, Liverpool and Penrith LGAs. Each of the LGAs have a Community Strategic Plan (CSP) which considers the changing needs for the respective LGA and holistically sets out the strategic plan for the community into the future. The CSPs are informed by community engagement and provide an understanding of the values and aspirations of the community.

The proposal would support a number of goals outlined in each of the CSPs, including those related to efficient transport infrastructure, active transport connectivity and employment opportunities. Further detail on each relevant CSP and how the proposal would support these is provided in Section 4.1 of Appendix J (Socio-economic Impact Assessment).

The proposal is also broadly consistent with a number of state-wide and regional strategic land use and transport plans. Further detail on the strategic context of the proposal is provided in Chapter 2 (Needs and options considered) and Section 4 of Appendix J (Socio-economic Impact Assessment).

Socio-economic profile

Key demographic indicators of relevance to the proposal have been derived from ABS 2016 Census data and are summarised for each SA2 in the social locality in Table 6-41. Additional indicators for each SA2 are provided in Appendix J (Socio-economic Impact Assessment).

Table 6-41 also presents data on the levels of socio-economic advantage and disadvantage in each SA2, derived from the Socio-economic Index for Areas (SEIFA). SEIFA data is produced by the ABS as an indicator of relative socio-economic advantage and disadvantage, including people's access to material and social resources, and their ability to participate in society. The SEIFA publication consists of four indices. The Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) and the Index of Economic Resources (IER) have been used for this assessment in accordance with guidance presented in the Practice Note.

Table 6-41 Key demographic data

SA2	Key demographic data
Austral – Greendale	• As of 2021, there were 12,533 people living in this SA2 • The median age was 34 years, slightly lower than that of Greater Sydney (37 years) • 1.8% of the population identified as Aboriginal and Torres Strait Islander. This is a similar proportion to Greater Sydney (1.7%) • A lower level of the population spoke only English at home (45.2%), compared to Greater Sydney (57.3%) • The top employment industries for residents of the SA2 were construction; health care and social assistance; and retail trade • The IRSAD for Austral – Greendale indicates slight relative advantage compared to the Australian median for 2021, and a slightly higher level of socio-economic advantage relative to other suburbs within NSW • The IER indicates that Austral – Greendale is in the 'advantaged' range
Badgerys Creek	• As of 2021, there were 25 people living in this SA2 • The median age was 46 years, lower than that of Greater Sydney (37 years) • No residents of the SA2 identified as Aboriginal and Torres Strait Islander • A low level of the population spoke only English at home (24%), compared to Greater Sydney (57.3%) • The top employment industries for residents in the SA2 were construction and agriculture, forestry and fishing • The IRSAD for Badgerys Creek indicates slight relative advantage compared to the Australian median for 2021, and a slightly higher level of socio-economic advantage relative to other suburbs within NSW • The IER indicates that Badgerys Creek is in the middle of the 'disadvantaged to advantaged' range
Horsley Park – Kemps Creek	• As of 2021, there were 4,344 people living in this SA2 • The median age was 44 years, slightly higher than that of Greater Sydney (37 years)

SA2	Key demographic data
	• 1.5% of the population identified as Aboriginal and Torres Strait Islander. This is a similar proportion to Greater Sydney (1.7%) • A lower level of the population spoke only English at home (44.3%), compared to Greater Sydney (57.3%) • The top employment industries for residents of the SA2 were construction, manufacturing and retail trade • The IRSAD for Horsley Park – Kemps Creek indicates slight relative advantage compared to the Australian median for 2021, and a higher socio-economic advantage relative to other suburbs within NSW • The IER indicates that Horsley Park – Kemps Creek is close to the 'most advantaged' range
Mulgoa – Luddenham – Orchard Hills	• As of 2021, there were 12,040 people living in this SA2 • The median age was 35 years, slightly lower than that of Greater Sydney (37 years) • 2.7% of the population identified as Aboriginal and Torres Strait Islander. This is a slightly higher proportion than in Greater Sydney (1.7%) • A very low level of the population spoke only English at home (21.5%), compared to Greater Sydney (57.3%) • The top employment industries for residents of the SA2 were construction; retail trade and heath care and social assistance • The IRSAD for Mulgoa – Luddenham – Orchard Hills indicates slight relative advantage compared to the Australian median for 2021, and a higher socio-economic advantage relative to other suburbs within NSW • The IER indicates that Mulgoa – Luddenham – Orchard Hills is close to the 'most advantaged' range

Social infrastructure

Social infrastructure refers to the facilities, structures and services that support the physical, social, cultural or intellectual development or welfare of the community. This includes a range of physical facilities such as schools, medical centres, sporting and recreational facilities (including passive open space), community facilities, libraries, as well as the activities and programs that operate within them.

Given the existing land use of the surrounding area (for example, agricultural and enterprise uses), social infrastructure in the vicinity of the construction footprint is generally limited. No social infrastructure has been identified within the construction footprint. Social infrastructure located within a two-kilometre radius of the construction footprint is identified in Table 6-42 and Figure 6-11.

Table 6-42 Social infrastructure in a two-kilometre radius of the construction footprint

ID	Facility / institution
Educational facilities	
SW1	Holy Family Catholic Primary School
SW2	Luddenham Public School
Health, medical and emergency services	
SW3	Luddenham Rural Fire Brigade
Sporting and recreational facilities	
SW6	Freeburn Park
SW7	Luddenham Lodge Horse Riding
SW8	Luddenham Raceway – Go Karting, Paintball & Motorsport Park
SW9	Luddenham Showground

ID	Facility / institution
SW10	Robert Green Oval
SW11	Sales Park
SW12	Sydney Society of Model Engineers Inc.
SW13	Wilmington Reserve
SW14	Workers Hubertus Country Club

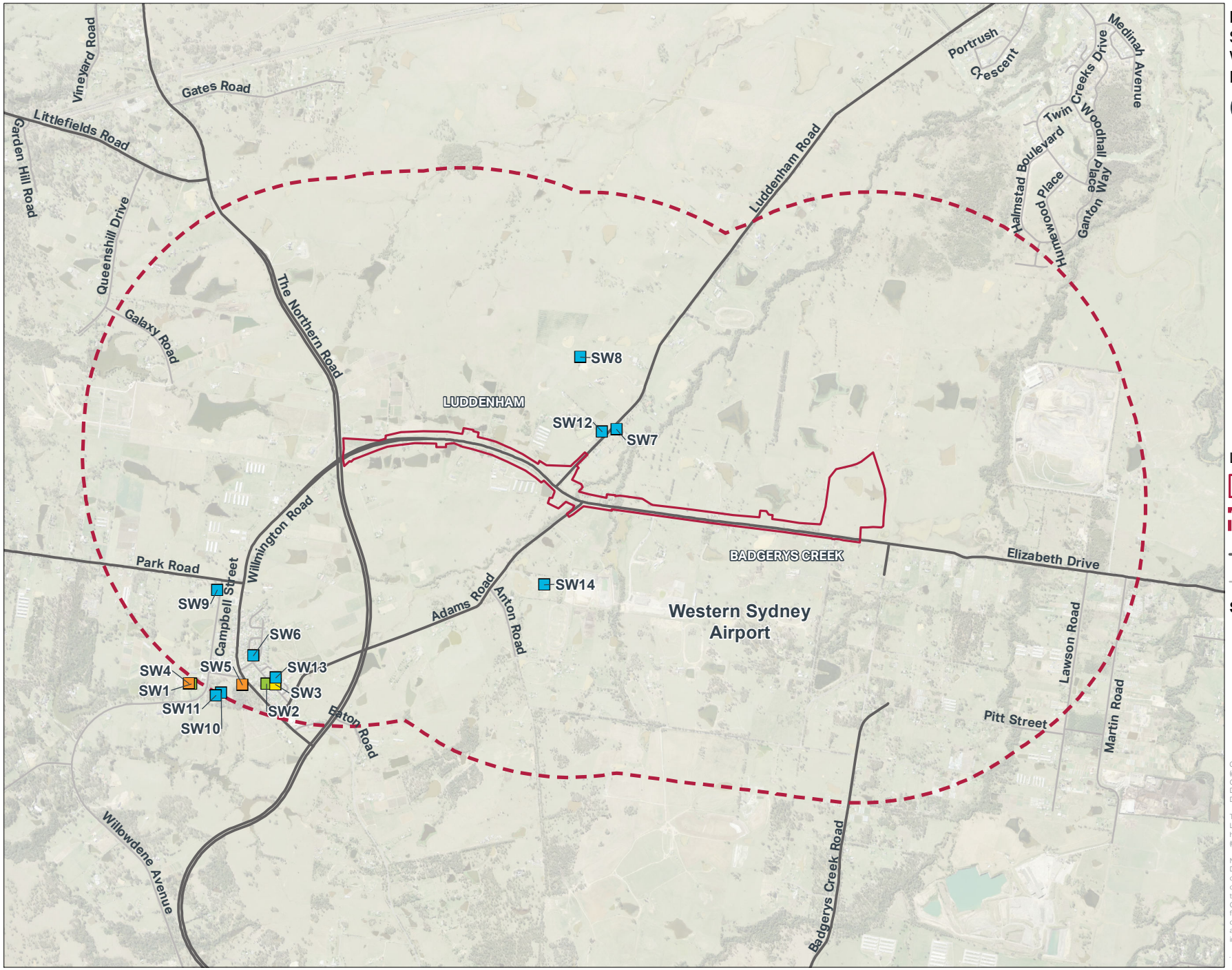


FIGURE 6-11:
SOCIAL INFRASTRUCTURE WITHIN A TWO-KILOMETRE RADIUS OF THE PROPOSAL

N

0 0.5 1 km

Legend

- Construction footprint
- 2km buffer for social infrastructure consideration
- Primary road
- Local road

Social Infrastructure

- Educational facilities
- Health, medical and emergency services
- Places of worship
- Sporting and recreational facilities

Economic characteristics

Several local businesses are present within the social locality. To the west of the proposal in Luddenham there is a local centre with stores which provide for the everyday needs of residents (for example, a grocery store and pharmacy). To the north and south of the construction footprint and along Elizabeth Drive, there are various commercial and industrial businesses. One business, a duck farm, is located immediately south of Elizabeth Drive, Luddenham, with the property frontage located partially within the construction footprint. The WSA currently under construction is located to the south of the construction footprint.

The gross regional product of Liverpool, Penrith and Fairfield LGAs have had an overall increasing (positive) trend over the past two decades, in keeping with NSW generally. With the development of the WSA, and the surrounding Western Sydney Aerotropolis and land rezoning and transport infrastructure upgrades already completed or underway, there is likely to be substantial investment in a broad range of industries, including logistics and warehousing and agri-business. This, along with planned population growth, would contribute to gross regional product in the local and wider region.

Access and connectivity

Key features of the transport network which provide for access and connectivity in the social locality are described below.

- **Road network:** Elizabeth Drive is a State road spanning multiple LGAs, servicing both residents and businesses as well as the Greater Sydney community. Elizabeth Drive west of the M7 Motorway frequently experiences congestion during peak times with growing crash and safety issues across the road corridor
- **Parking availability:** there are no existing designated parking facilities along Elizabeth Drive within the construction footprint and parking is prohibited in wider sealed shoulders in a number of locations
- **Public transport:** There is currently limited public transport provision within the social locality. This reflects the historic rural land use and low population density, generating a low demand for public transport.
- **Active transport (walking and cycling):** To the west of the M7 Motorway, road shoulders and verges are generally the only available means for pedestrians to travel along Elizabeth Drive, exposing them to live traffic. Limited off-road cycling facilities are also provided in the wider social locality. The recently upgraded Northern Road, has a shared path running along the northbound direction and cycling crossing facilities at intersections with side roads.

The existing transport network is described further in Section 6.2.

Consultation results

Residential surveys

Residents were asked a number of questions about their daily lives, values, use of Elizabeth Drive and, how they think the proposal would impact them. Key findings from the business surveys are summarised in Table 6-43.

Table 6-43 Key findings – residential surveys

Theme	Findings
Use of Elizabeth Drive	Of the residents surveyed, 96% use Elizabeth Drive weekly, most frequently to commute to and from work, travel to the shops and visit family and friends
Values	Residents were asked what they valued in their community. The top three themes were: • Feeling safe and secure (23%) • Community services such as shops, halls, sport grounds, places of worship, cycleways and footpaths (18%) • Employment and parks and landscape features (14%)
Aspirations for the community	Residents were asked to comment on concerns for their community and which aspects they would like improved. The top three aspirations of residents were: • Reduction of congestion (38%) • Improve public transport options (27%) • Better services for children and/or elderly people (14%)

Theme	Findings
Construction impacts for resident's day to day life	Residents were asked how they thought the construction of the proposal would impact their day-to-day life. Responses included the following: • Impact: most respondents (87%) thought that they would be affected by congestion, traffic delays, change in access arrangements, loss of amenity and decrease in safety during construction • Unsure or no impact: some respondents (13%) were unsure or did not think that the construction of the proposal would affect them
Construction impacts for resident's community	Residents were asked how they thought the construction of the proposal would impact their community. Responses included the following: • Benefit: the majority of respondents (88%) thought that the community would benefit from the construction of the proposal through employment opportunities and general growth of the area • Impact: some respondents (9%) thought that the community would be adversely affected by congestion, traffic delays, change in access arrangements, loss of amenity and decrease in safety during construction • Unsure or no impact: some respondents were unsure or did not think that the construction of the proposal would affect the community (3%)
Operational impacts for resident's day to day life	Residents were asked how they thought the operation of the proposal would impact their day-to-day life. Responses included the following: • Benefit: around half of respondents (55%) commented that the proposal would benefit them through improved travel time, access and reduced congestion • Impact: some respondents (27%) commented that the proposal would adversely affect them through changes in access arrangements, result in increased traffic, increased noise, loss of land to the upgrade and change the sense of place • Unsure or no impact: some respondents (18%) were either unsure or did not think that the proposal would affect them
Operational impacts for resident's community	Residents were asked how they thought the operation of the proposal would impact their community. Responses included the following: • Benefit: the majority of respondents (68%) thought that the proposal would benefit the community through improved access, less congestion, improved community cohesion and job opportunities • Impact: some respondents (23%) thought that the proposal would adversely affect the community through increased traffic, noise and sense of place • Unsure or no impact: some respondents (9%) were either unsure or did not think that the proposal would impact their community

Business surveys

Businesses were asked about their key characteristics (such as business type and customer base), and their perception as to how their business may be affected (both positively and negatively) by the proposal. Key findings from the business surveys are summarised in Table 6-44.

Table 6-44 Key findings – business surveys

Theme	Results
Businesses characteristics	The survey asked about business type, reliance on passing trade and their typical trading hours and customer base. Of the businesses surveyed, 44% said their business were moderately dependent on passing trade. Respondents also indicated that 25% of their business serviced all of Sydney

Theme	Results
Construction impacts	Businesses were asked how they thought the construction of the proposal would impact them. Responses included the following: • Impact: around half of respondents (56%) thought that their business would be adversely affected by changes in access to their businesses, loss of amenity, congestion and longer travel times during construction • No impact: some respondents (31%) thought that their business would not be affected by construction of the proposal • Unsure: some respondents (13%) were unsure if their business would be affected by construction of the proposal
Operational impacts	Businesses were asked how they thought the operation of the proposal would impact them. Responses included the following: • Impact: many respondents (69%) thought that their business would be adversely affected by changes in access and land acquisition during operation • No impact: some respondents (31%) thought that their business would not be affected by operation of the proposal, however, did not specify how

6.7.3 Potential impacts

Construction

Property – residential

The proposal has been designed to minimise the need for land acquisition, as far as practical, and to limit the potential for severance and sterilisation of private properties. Subject to detailed design and construction planning, construction of the proposal would require the partial acquisition of 18 privately owned lots. Lots to be partially acquired generally accommodate agricultural, commercial, residential or unknown land uses. A complete list of the properties proposed to be partially acquired, including the potentially affected infrastructure within each (based on desktop review and subject to landowner consultation), is included in Appendix C (Property acquisition).

The proposal has the potential to directly impact upon residential properties through partial acquisition of areas adjoining Elizabeth Drive. Of the properties proposed to be partially acquired, several accommodate residential uses. At the majority of these properties, partial acquisition is anticipated to directly impact parts of driveways or internal tracks, rather than dwellings or buildings.

Property acquisition has the potential to affect people with a deep connection to their property, which may have been in the family for generations. In some instances, it may be difficult to find another property with equivalent facilities and amenity to that being acquired.

Residents and owners affected by acquisitions are supported through the process by an acquisition support team, usually consisting of a Personal Manager, an Acquisition Manager and a Community Place Manager. The personal manager helps make the property acquisition and relocation process as easy as possible. They are trained to help people affected by the acquisition process, working with affected people to find solutions tailored to their unique circumstances.

A free and confidential support line is also provided by the NSW Government and is available 24 hours a day, 7 days a week. It is accessible by all property owners, their families, tenants, commercial property and business owners, and employees affected by property acquisition.

Property adjustments at the properties identified for partial acquisition would also be required and include adjustments to fencing, farm dams, sheds, driveways and letterboxes, and a loss of vegetation and grassed areas. This has the potential to affect communities by placing additional pressure and stress on residents due to loss of land used for various uses (for example, sheds).

Transport would consult with landowners subject to property acquisition throughout detailed design to identify opportunities to avoid impacts to buildings, where possible (refer to Section 6.7.4).

A hydraulic impact and flooding assessment carried out for the proposal identified buildings potentially impacted by above floor flooding in a one per cent AEP design flood event in the 'future base case' (without the proposal), and in the 'design case' (with the proposal). One building was identified as likely to experience above floor flood impacts in both the future base case or the design case. The depth of above floor flooding at this building is not anticipated to increase due to

construction of the proposal. These modelled results are indicative, however and a floor level and property survey would need to be carried out during detailed design at buildings within the modelled area, to ascertain ground floor heights and property types (e.g. residential or commercial). This is discussed further in Section 6.10. Transport would consult with landowners subject to above floor flooding throughout detailed design to identify opportunities to avoid impacts, where possible.

The significance assessment for residential property impacts is summarised in Table 6-45.

Table 6-45 Significance of residential property impacts

Impact	Magnitude of impact	Sensitivity of receivers	Significance
Partial acquisition of residential properties for the road corridor	Low	Moderate	Moderate-low (negative)

Property and land use impacts are discussed further in Section 6.6.

Property – business and commercial (including agricultural) uses

A section of a duck farm located on Lot 2 / DP 220176, would be partially acquired for the proposal, predominately along the border with Elizabeth Drive within the area shown on Figure 3-14 in Chapter 3 (Description of the proposal). While the majority of the property would not be acquired, partial acquisition would result in a minor reduction the availability of land within the property for agricultural use. Subject to detailed design and landowner consultation, acquisition is not anticipated to impact the existing farm dam located on this property.

Adjustments to the location of fencing and the driveway at Lot 2 / DP 220176 would also be required. Access to the driveway during the day and night for deliveries is required for the operation of this business. As part of detailed design, Transport would consult with the landowner to confirm the configuration of adjustments to the property, and to identify measures to maintain business access (refer further to Section 6.6.4). Impacts associated with access to businesses are discussed further below in the assessment of business and economic impacts.

Partial acquisition would affect other agricultural properties which may be used for commercial purposes. Impacts to these properties would likely include minor reductions in the availability of land for agricultural purposes, and adjustments to driveway access. Specific consultation would be carried out throughout detailed design and construction planning to confirm the nature of impacts, and to identify measures to manage these (refer to Section 6.6.4).

The magnitude of the impact of the acquisition process is considered to be low given that partial acquisition would result in relatively small reductions to the overall size of properties, and fair market compensation would be provided to landowners affected by partial acquisition. The sensitivity of the affected businesses would be moderate given the potential for disruption to business operations, noting that the businesses would likely have some capacity to adapt to change. As a result, the socio-economic significance of impact is considered to be a moderate-low negative impact.

Table 6-46 Significance of commercial property impacts

Impact	Magnitude of impact	Sensitivity of receivers	Significance
Partial acquisition of commercial properties for the road corridor	Low	Moderate	Moderate-low (negative)

Property – temporary use of properties for construction ancillary facilities

Construction of the proposal would require the temporary leasing of privately owned land to accommodate the three proposed construction ancillary facilities and associated access (as shown on Figure 3-14 in Chapter 3 (Description of the proposal)). This would result in a temporary disruption to the existing use of the land. The nature of the impact would depend upon the specific use of the land and the reliance on the land by the owner/occupier. Consultation with landowners would be ongoing to establish necessary agreements and arrangements for leasing and access prior to construction. The temporary leasing of the privately owned land would disrupt the affected landowners' ability to use the portion of land subject to the lease agreement. This impact would be temporary in nature, with all leased property to be reinstated in accordance with the lease agreement, in consultation with the landowner.

Construction ancillary facility 1 (on Lot 8 / DP 1240511) is located on land previously used for a similar purpose, to support the construction of the Northern Road Upgrade, which was completed in 2022. The ancillary facility would be located between a former section of Elizabeth Drive to the north and the existing Elizabeth Drive to the south. Use of this facility would avoid the requirement to lease land in the vicinity, and subsequent impacts to previously undisturbed land uses such as residences or commercial properties. While construction of the proposal would not commence until 2026, surrounding landowners may, however, experience construction fatigue from exposure to amenity impacts (such as noise and visual impacts). These impacts are addressed in the assessment of amenity impacts below.

Construction ancillary facility 3 would be located on land which is currently being used to support construction of the M12 Motorway. This would also avoid new impacts to land uses by using previously owned land. The continued use of this facility has the potential to result in construction fatigue and cumulative impacts to surrounding landowners, as discussed in Section 6.16.

Post construction, these areas would be restored to their previous use in consultation with the landowner.

Table 6-47 Significance of temporary leasing impacts during construction

Impact	Magnitude of impact	Sensitivity of receivers	Significance
Land leasing during construction for ancillary facilities	Low	Low	Low (negative)

Amenity

Socio-economic impacts to amenity have been considered in relation to potential traffic, noise and vibration, landscape and visual, and air quality impacts.

As detailed in Section 6.2, construction of the proposal would temporarily increase additional traffic volumes on Elizabeth Drive and local roads and may affect travel times, resulting in minor traffic disruptions and road safety changes. This may also disrupt the community's ability to access their homes, workplace, local businesses and community facilities in the local area. To address traffic and access impacts, all construction work would be managed in accordance with a TMP prepared prior to construction (as identified in Section 6.2.4).

Exposure to noise and vibration has the potential to affect people's work, recreation, social and home lives. This includes the potential to interfere with daily activities or the enjoyment of these activities. As detailed in Section 6.1 increased levels of noise and vibration would be generated during construction of the proposal, when compared to the existing noise environment. The level of noise generated by these activities would vary substantially through the construction period based upon the specific type of activity being carried out, and its location. Predicted exceedances in construction noise management levels would impact residential receivers, potentially leading to increased levels of fatigue, stress and anxiety. Safeguards and management measures would be implemented to manage potential impacts to these receivers (refer to Section 6.1.5).

Vibration impacts would only likely affect people if carried out within the human comfort minimum working distances. This may result in annoyance for some and concern for cosmetic damage to buildings. Receivers located within the minimum distances for human comfort would be notified of the potential impacts as part of the notification of highly noise affected receivers.

The implementation of the proposed noise and vibration safeguards and management measures (refer to Section 6.1.5) would minimise and manage noise and vibration impacts on noise sensitive receivers. These measures include carrying out noise intensive work during less sensitive time periods, implementation of respite periods, installation of at-receiver treatments and ensuring sensitive receivers are kept informed during construction.

The construction of the proposal would result in visual impacts to a variety of receptors. These include road users, residents and businesses. Visual amenity may be affected by removal of vegetation, establishment of construction ancillary facilities, installation of construction hoardings and the visual appearance of construction sites, equipment, materials and site sheds, as detailed in Section 6.8. However, these changes would be experienced in the short term and would be reversible to some extent.

During construction, activities such as demolition, earthworks and the use of construction vehicles and machinery have the capacity to generate dust, odour and emissions. The real and perceived changes to local air quality as a result of construction activities can affect residents and visitors to the area through direct health effects, as well as increasing anxiety about the safety of their environment. The source of emissions during the proposal construction phase would be due to the

combustion of petrol and diesel fuel. This would occur from the construction vehicles (light and heavy) traveling to and from the construction footprint, use of vehicles and machinery and use of mobile construction equipment and stationary equipment such as diesel generators. Given the existing volume of traffic utilising Elizabeth Drive, emissions from construction traffic are unlikely to result in a notable reduction in ambient air quality at nearby sensitive receptors. As detailed in Section 6.12, the air quality impact assessment carried out for the proposal determined that there is a low risk to human health due to the proposal. Potential impacts would be managed through the implementation of safeguards and management measures included in Section 6.12.4.

The significance assessment for these impacts is summarised in Table 6-48.

Table 6-48 Significance of amenity impacts during construction

Impact	Magnitude of impact	Sensitivity of receivers	Significance
Traffic	Moderate	Moderate	Moderate (negative)
Noise and vibration	Moderate	Moderate	Moderate (negative)
Landscape and visual	Moderate	Low	Moderate-low (negative)
Air quality	Low	Low	Low (negative)

Access and connectivity

Socio-economic impacts to access and connectivity have been considered in relation to property access, road network impacts, parking availability, public transport and active transport (walking and cycling).

During construction, access to private properties would be maintained as far as practicable, though some accesses to residential properties on Elizabeth Drive and adjoining roads (such as Luddenham Road and Adams Road) may be temporarily disrupted. Access for emergency services would be maintained at all times. Changes or disruptions to property access has the potential to cause stress and anxiety for residents. For businesses it may affect customer access or may affect the ability of the business to operate affectively if they require frequent access for delivery or distribution of goods and services. However, such access impacts would be limited to short term restrictions and alternate access arrangements would be provided wherever possible.

Construction activities are likely to require temporary lane closures and changes to speed limits on Elizabeth Drive. Motorists using these roads may experience temporary delays to their journey, which may result in stress, anxiety or frustration. Connectivity impacts may also affect local businesses through delays to deliveries, disruptions to customer access and reductions in passing trade. These impacts would vary according to the type of business and their specific sensitivity to such impacts.

Pedestrian and cyclist access along existing shoulders and within lanes (for cyclists) would generally be maintained where possible throughout construction. The TMP for the proposal would include measures to maintain pedestrian and cyclist access.

The proposal is not expected to noticeably disrupt public transport or parking availability, as there is currently limited public transport provision and no designated parking facilities along Elizabeth Drive within the construction footprint. The ancillary facilities would provide parking within the site for construction vehicles, both light and heavy, including sufficient parking for workers.

A detailed construction methodology, which would include the staging of work to maintain access, pedestrian and vehicle movements, and an associated TMP would be developed prior to commencement of construction to manage potential traffic and access impacts (as identified in Section 6.2.4).

The significance assessment for these impacts is summarised in Table 6-49.

Table 6-49 Significance of access and connectivity impacts during construction

Impact	Magnitude of impact	Sensitivity of receivers	Significance
Temporary changes or disruptions to property access	Low	Moderate	Moderate-low (negative)
Disruption to road network and connectivity impacts	Moderate	Moderate	Moderate (negative)
Parking availability	Negligible	Negligible	Negligible
Public transport	Negligible	Negligible	Negligible
Active transport	Low	Low	Low (negative)

Further detail on impacts to traffic and transport is provided in Section 6.2.

Community identity, values, aspirations and concerns

During construction, the proposal may cause temporary impacts to the community aspirations and values identified in the Liverpool, Penrith and Fairfield CSPs, due to temporary disruptions to traffic and accessibility. The proposal would result in changes to the local amenity during the construction phase. These changes may result in decreased feelings of safety or changes to the sense of place and community cohesion. This could be due to increased noise levels and dust emissions as well as reduced sightlines as result of construction hoarding, noting few pedestrians are likely to be present in the vicinity of these facilities.

The proposal would support employment and job opportunities during construction, which would address some of the aspirations identified in the CSPs. Economic benefits are discussed further below.

Overall, the magnitude of impact upon community values and aspirations is deemed to be low, given that any conflict with the values above would be temporary and relevant mitigation measures would be implemented. The sensitivity of the community to these matters is considered to be high due to their interest in promoting and achieving these aspirations. As such the overall socio-economic significance is a moderate (negative) impact.

Section 6.4 of Appendix J (Socio-economic Impact Assessment) provides an assessment of the proposal against the key themes of each CSP.

Demographic changes

Construction of the proposal has the potential to influence the social makeup of an area through the employment of a construction workforce and displacement of people for construction activities.

As identified above, partial property acquisition is expected to directly impact one residential dwelling within the area required for the upgraded Elizabeth Drive, which may require residents in this dwelling to relocate within the region or elsewhere. These changes are not expected to affect the overall demographic of the social locality as a whole. The expected population changes as a result of construction would be negligible in comparison to associated changes from surrounding planned development.

The construction workforce would comprise trades and construction personnel, subcontractor personnel and engineering. The workforce for construction of the proposal would be expected to be sourced locally, where appropriate skill sets are available. Given the duration of the construction program (expected to take around 48 months), there is a possibility that some of the construction workforce may choose to relocate to the study area to be close to work. However, this trend is expected to be very limited given the accessibility of the proposal by private vehicle and the location within Greater Sydney, in proximity to existing centres such as Liverpool. Overall, due to its duration, location and accessibility, it is likely that workers could be drawn from within Greater Sydney generally and as such it is not expected that workers would need or choose to relocate to live in or nearby the social locality. As such, the construction of the proposal would have a negligible effect on local residential population and demographics.

Cultural heritage

Section 6.5 identifies that the proposal would directly impact one Aboriginal site. Based on the nature of the Aboriginal cultural heritage impacts, which may have ongoing cultural impacts beyond the completion of the construction phase, and the results of the Stage 3 PACHCI, the magnitude of impact is considered to be moderate. The sensitivity of the receptors

affected by the impact are considered to be moderate. As such the overall significance of impact would be a moderate adverse impact.

The history and heritage of an area can form the identity of the community who live amongst it. There are four items of non-Aboriginal heritage within the study area: Luddenham Road Alignment, McGarvie Smith Farm, McMaster Field Station and Badgerys Creek post office. Construction phase impacts to these items are discussed in Section 6.4 and would be relatively minor and manageable through proposed safeguards.

The significance assessment for these impacts is summarised in Table 6-50.

Table 6-50 Significance of cultural heritage impacts during construction

Impact	Magnitude of impact	Sensitivity of receivers	Significance
Partial and whole loss of Aboriginal cultural sites	Moderate	Moderate	Moderate negative
Impact on non-Aboriginal heritage items	Low	Low	Low negative

Businesses and the economy

Construction of the proposal has the potential to impact upon business access and travel time, business amenity and the economy.

During construction, businesses may be affected due to delayed or hindered access to workplaces or servicing areas owing to local construction traffic constraints and congestion. Changes in business access and travel time have the potential to affect the customer base of a business, as patrons may be discouraged to attend a business due to the accessibility challenges, resulting in a potential loss of trade. Changes in travel time and property access may also impact the timing and efficiency of deliveries to and from a business if changes in traffic conditions are not accounted for.

Property access would be maintained as far as practicable throughout construction during both day and night time periods, including access to businesses. Final construction methods would be refined to minimise traffic and transport impacts where feasible. However, traffic restrictions would be unavoidable during some construction activities, such as road surfacing work at intersections and tie-in points and drainage and utility crossings. Where these are required, advance notice would be provided, and the duration of disruptions would be limited. Implementation of recommended management measures (such as advance notice and minimising duration of disruption), and consultation with businesses prior and during construction to identify their specific business needs, would help mitigate this impact (refer further to Section 6.6.4).

Four businesses have been identified within one kilometre of construction activities and ancillary facilities that may be affected by changes in amenity. There may be additional businesses within this area, which would be identified through consultation activities prior to the commencement of construction for the proposal. Identified businesses include recreational businesses (horse riding, a raceway, and country club) and a duck farm. Amenity impacts include any factors that affect the ability of customers, employees or business owners to enjoy their workplace and daily activities. These may include adverse change to noise and vibration levels, traffic, views or air quality. Adverse impacts on a business's amenity could potentially result in loss of trade as customers shop elsewhere to avoid disrupted conditions. Agricultural businesses may include livestock with sensitivity to amenity impacts (such as construction noise), which may also impact upon the operation of the business. As identified in Section 6.6.4, specific consultation would be carried out with businesses potentially impacted during construction. Consultation would aim to identify potential construction impacts to individual businesses, such as amenity impacts to sensitive components of the business. Based on this consultation, specific feasible and reasonable measures to address potential impacts would be identified and implemented.

Certain businesses in the region are also likely to benefit from the proposal's construction activities. These may include local construction contractors, businesses who service or supply goods to the construction industry such as food and beverage retailers, and other retail outlets that would cater to the day-to-day needs of the construction workforce as well as waste facilities. This temporary increase in revenue may subsequently lead to increased employment opportunities locally, which would inject additional money into the local economy.

The significance assessment for these impacts is summarised in Table 6-51.

Table 6-51 Significance of business and economic impacts during construction

Impact	Magnitude of impact	Sensitivity of receivers	Significance
Business access and travel time	Moderate	Low	Moderate-low (negative)
Business amenity	Low	Low	Low (negative)
Economic impacts	Moderate	Low	Moderate-low (positive)

Operation

Property

Land leased for the ancillary facilities and laydown areas would be restored following the construction period. Permanent property acquisition and changes to land use are addressed in the assessment of construction phase impacts above.

Amenity

Socio-economic impacts to amenity have been considered in relation to potential traffic, noise and vibration, landscape and visual, and air quality impacts.

As detailed in Section 6.2, the proposal would provide an increase in accessibility and decrease in congestion, likely enabling people to become better connected to their community. Improvements in the ease of commuting could lead to an improved sense of place and could facilitate better access to social infrastructure outside of the construction footprint like medical facilities, sports fields or community halls, increasing physical health and mental wellbeing.

Based on the concept design, the results of the operational road traffic noise assessment concluded that 60 noise sensitive receivers would experience noise levels above the operational noise criteria, seven of which would be eligible for the consideration of at-receiver noise treatment. Potential treatment options would seek to minimise noise levels such that adverse social impacts are avoided, compared to existing conditions.

The widened road corridor during operation would also affect landscape and visual amenity, as detailed in Section 6.8. During operation, landscaping would be provided along the length of proposal within the central median and along road verges, which would separate traffic lanes from the walking and cycling paths. Landscaping would be subject to detailed design and would aim to maximise the use of locally endemic native species. This landscaping and the introduction of shared walking and cycling paths would substantially improve the landscape and visual environment for pedestrians and cyclists using Elizabeth Drive and its upgraded intersections, compared to the existing environment which includes limited footpaths or separation from the road corridor for these road users.

However, where dwellings, businesses, recreational facilities and other buildings would be located closer to the widened road corridor, compared to the existing Elizabeth Drive, visual amenity may be decreased as the road would be more prominent in views from these areas. Landscaping and the shared walking and cycling paths would aid in providing a visual buffer between receivers and the road corridor. Visual amenity would generally improve overtime as landscaped vegetation matures.

As detailed in Section 6.12, the levels of some pollutants are anticipated to slightly decrease in the years 2030 and 2040 with the proposal compared to the existing scenario. This is due to anticipated changes in vehicle fleets, with expected increased uptake in vehicles with more stringent emissions standards (or no emissions such as electric vehicles) and reduced number of aging vehicles with lower emission standards. While presenting a positive change, the improvement in air quality is relatively minor and unlikely to have a substantial social impact on the surrounding community.

Elizabeth Drive would change from a more informal but busy rural road to an upgraded transport corridor with formalised kerb and gutters and pedestrian/cycle infrastructure. However, considering the ongoing development of the surrounding landscape in response to the construction of the M12 Motorway, WSA and Western Sydney Aerotropolis, these changes are considered appropriate.

The significance assessment for these impacts is summarised in Table 6-52.

Table 6-52 Significance of amenity impacts during operation

Impact	Magnitude of impact	Sensitivity of receivers	Significance
Increase in accessibility and decrease in congestion	Moderate	Moderate	Moderate (positive)
Increase in traffic noise	Low	Moderate	Moderate-low (negative)
Loss of visual amenity	Moderate	Low	Moderate-low (negative)
Increase in air quality	Low	Low	Low (positive)

Access and connectivity

Socio-economic impacts to access and connectivity have been considered in relation to property access, road network impacts, parking availability, public transport and active transport (walking and cycling).

All properties affected by changed access arrangements as a result of the proposal would be provided with restored or new permanent access arrangements prior to the completion of construction. The changed access arrangements are not expected to disadvantage residential properties. Driveways of properties would be adjusted or reconfigured where they have been impacted by road widening as part of the proposal. These adjustments would occur in consultation with property owners.

The upgraded road would facilitate the safer movement of cars along the construction footprint due to the provision of the central median, intersections and turning lanes. This, however, would remove direct access to businesses and properties along Elizabeth Drive from the opposite direction of travel. Vehicles would be able to continue to access these properties with minimal impact on travel times through the use of existing and proposed U-turn facilities, as described in Section 6.2.

During operation, the expected reduction in congestion on Elizabeth Drive would reduce travel times for private vehicles, public transport services and freight. This would result in a benefit to businesses and residents in the social locality. Improvements in the operation of the road network would lead to flow on benefits for the social environment. This may include improvements in community cohesion, sense of place and health and wellbeing though improved access to social infrastructure (outside of the construction footprint). It could also reduce stress and frustration associated with congestion, while also improving health outcomes directly through improved road safety.

There are no existing designated parking facilities along Elizabeth Drive. This would remain unchanged due to the proposal.

The proposal would provide bus infrastructure including ‘queue jump-start’ bus lanes and indented bus bays at the intersection of Elizabeth Drive and Luddenham Road. This would facilitate public transport services in the social locality increasing accessibility and connectivity.

The proposal would provide shared walking and cycling paths within the construction footprint along Elizabeth Drive. The new shared walking and cycling paths would improve the connectivity for pedestrians and cyclists on the network by connecting to the existing shared path along The Northern Road and the future M12 Motorway shared path. The inclusion of active transport infrastructure has the potential to contribute to a number of direct and indirect social and health benefits. The active transport link could facilitate community cohesion and reduce the number of residents who may feel isolated, improving the mental health of residents. Physical health of those in the social locality may increase due to the utilisation of the available and safe infrastructure. The active transport link would also provide an accessible connection for residents to the wider community and facilities.

The significance assessment for these impacts is summarised in Table 6-53.

Table 6-53 Significance of impacts to access and connectivity during construction

Impact	Magnitude of impact	Sensitivity of receivers	Significance
Property access	Low	Low	Low (positive)
Road network and connectivity	Moderate	Moderate	Moderate (positive)

Impact	Magnitude of impact	Sensitivity of receivers	Significance
Parking availability	Negligible	Negligible	Negligible
Public transport	Moderate	Low	Moderate-low (positive)
Active transport (walking and cycling)	High	Low	Moderate (positive)

Further detail on impacts to traffic, transport and access is provided in Section 6.2.

Cultural heritage

The proposal is not expected to result in additional impacts on any items of Aboriginal or non-Aboriginal heritage or cultural values once it is operational, as earthworks and disturbance would be restricted to the construction phase.

Should the proposal permanently impact upon access to culturally sensitive sites or landscapes, there is potential for ongoing impacts to Aboriginal cultural values, culture and wellbeing. Further consultation with Aboriginal stakeholders during detailed design development would be required to appropriately characterise and respond to this potential impact. As such, a significance rating has not been assigned for this impact.

Ongoing consultation with Aboriginal stakeholders and ensuring Aboriginal participation would inform ongoing design development so that Aboriginal culture and heritage is respected and integrated into the design where possible. This may include investigation of opportunities to incorporate Aboriginal heritage information and artwork interpretation into the design of the proposal (refer further to Section 6.7.4).

Community identity, values, aspirations and concerns

The proposal would address several community values, aspirations and concerns, which have been identified through the CSPs for the social locality and survey results. The road layout and safety improvements delivered by the proposal would lead to the decrease in congestion, improved travel times and may lead to improved feelings of safety and security within the area.

The proposal would also support the projected and planned development in the region and would play a key role in connecting people to strategic centres, thus improving employment opportunities through better access. The improvement of access and decrease in congestion would allow for employees to move about with greater ease and for supplies and products to be moved with fewer delays. This would have a flow on positive impact of lowering labour and fuel costs for employees, businesses and ultimately consumers.

The improvement in traffic conditions and accessibility on the widened area of Elizabeth Drive could lead to better connectivity between people and social infrastructure within the social locality. This, combined with the provision of active transport and landscaping features would be expected to result in a subsequent improvement in community cohesion, with flow on effects for health and wellbeing.

Overall, the magnitude of impact upon community values and aspirations would be moderate. The sensitivity of the community to these matters is considered to be moderate. The overall socio-economic significance is a moderate positive impact.

Section 7.4 of Appendix J (Socio-economic Impact Assessment) provides an assessment of the proposal against the key themes of each CSP.

Demographic changes

Operation of the proposal is not anticipated to result in a change to the demographic profile of the social locality in its own right. Rather, the safety and travel improvements associated with the proposal are expected to assist in facilitating and servicing the ongoing urban development and renewal that has and is continuing to occur in the social locality, which is having its own impacts on local demography. On this basis the overall social significance of the proposal on the demographic profile of the social locality is considered to be negligible.

Business and economic impacts

The proposal would provide an increase in transport amenity and improve access and connectivity in the social locality, which would facilitate and encourage increased economic productivity. The upgraded road would also facilitate an improved freight network to allow for the more efficient movement of goods and services.

The proposal is expected to contribute to economic and employment growth in the surrounding area. It would provide reliable transport connection to Greater Sydney, which can potentially aid in the stimulation of current and future businesses in the area. Enhanced traffic conditions for customers and staff would have a positive impact on businesses in the social locality and ultimately encourage employment connectivity. Improvements to accessibility allows for all residents within the social locality to independently travel with improved public and active transport options, which can further stimulate the local economy and create positive economic impacts.

The upgraded road would facilitate the safer movement of cars along the construction footprint due to the provision of the central median, intersections and turning lanes. This, however, would remove direct access to businesses and properties along Elizabeth Drive from the opposite direction of travel. This is likely to affect business's passing trade, of which 66 per cent of businesses said they were reliant upon. Vehicles would be able to continue to access these businesses through the use of existing and proposed U-turn facilities, as described in Section 6.2.

Driveways of properties would be adjusted or reconfigured where they have been impacted by road widening as part of the proposal, including for the duck farm and any impacted other businesses identified along the length of the proposal. These adjustments would occur in consultation with the business prior to the completion of construction. This would consider the specific needs of the business, for example the types of vehicles that access driveways for deliveries.

While businesses that rely on passing trade may experience a decrease in turnover in the short term, Western Sydney is planned to become a new economic and residential hub. The anticipated change to the social locality, through the planned growth of the Western Parkland City and Western Sydney Aerotropolis, is anticipated to increase the number of visitors and residents as well as the level of economic activity in the area, which is expected to benefit businesses in the social locality and along Elizabeth Drive.

On this basis the magnitude of impact is considered to be low positive. The sensitivity of affected people is considered to be moderate. As a result, the overall social significance of the proposal on business and economics of the social locality is considered to have a moderate-low positive impact.

6.7.4 Safeguards and management measures

Table 6-54 describes the proposed safeguards and management measures that would be implemented to manage the potential socio-economic impacts of the proposal.

Table 6-54 Safeguards and management measures – socio-economic impacts

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic impacts – Community consultation	A Communication Plan (CP) will be prepared in accordance with the Community Involvement and Communications Resource Manual (RTA, 2008) and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for complaints	Contractor	Detailed design, pre-construction and construction	Additional safeguard
Socio-economic impacts – Community consultation	Consultation with stakeholders and any further community and stakeholder engagement feedback received during the REF exhibition period will be responded to in a submissions report to support the REF. Where relevant, this feedback will also inform detailed design and construction planning	Transport	Detailed design	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Socio-economic impacts – Aboriginal cultural heritage	Consultation with Aboriginal stakeholders is ongoing, and will inform design development so that Aboriginal culture and heritage is respected and integrated into the design where possible. This may include investigation of opportunities to incorporate Aboriginal heritage and artwork interpretation into the design of the proposal in consultation with Aboriginal stakeholders	Transport	Detailed design	Additional safeguard
Socio-economic impacts – Property acquisition	Consultation will occur with directly affected landowners (i.e. where property acquisition or adjustments are proposed) during the REF exhibition period, throughout the development of the detailed design and during construction. Consultation will include: • Provision of information on relevant impacts during construction and operation • Identification of opportunities to avoid direct impacts to structures (such as sheds) • Consultation with affected landowners regarding proposed changes to the property (including adjustments and acquisition) in consultation with the relevant landowner/s	Transport	Detailed design and construction	Additional safeguard
Socio-economic impacts – Business impacts	Specific consultation will be carried out with businesses potentially impacted during construction. Consultation will aim to identify potential construction impacts to individual businesses. Based on this consultation, specific feasible and reasonable measures to maintain business access, signage and parking, and address other potential impacts as they arise through the consultation process, will be identified and implemented	Transport / Contractor	Detailed design and construction	Additional safeguard
Socio-economic impacts – Business impacts	Regular engagement will be carried out with affected businesses regarding the progress of the proposal to allow businesses time to prepare for changed local conditions through the area	Transport / Contractor	Construction	Additional safeguard
Socio-economic impacts – Community consultation	Construction workers, materials and equipment hire will be sourced from the local area where feasible	Contractor	Construction	Additional safeguard

Other safeguards and management measures that would contribute to the management of potential socio-economic impacts are identified in the following sections:

- Section 6.1, which outlines safeguards and management measures regarding noise and vibration
- Section 6.2, which outlines safeguards and management measures regarding traffic, transport and access
- Section 6.6, which outlines safeguards and management measures regarding property and land use
- Section 6.12Section, which outlines safeguards and management measures regarding air quality.

6.8 Landscape character and visual amenity

A Landscape Character and Visual Impact Assessment (LCVIA) has been prepared as part of the Urban Design and Landscape Character and Visual Impact Assessment to assess the potential impacts of the proposal. A summary of this assessment is presented in this section, with the full report provided in Appendix K (Urban Design, Landscape Character and Visual Impact Assessment).

6.8.1 Methodology

The LCVIA has been prepared in accordance with Beyond the Pavement (Transport for NSW, 2020a) and Transport's Environmental Impact Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment EIA-N04 (Transport for NSW, 2020b). In accordance with this guideline and other relevant guidelines, the methodology for the LCVIA included:

- Analysis of the regional and local context of the construction footprint
- Evaluation of the existing landscape character within the study area to inform the early stages of the urban design process, and to assess the anticipated landscape impacts as a result of the final design outcome. This included the identification of distinctive parts of the overall landscape to separately define landscape character zones (LCZ)
- Evaluation of the existing views and visual amenity within the study area to identify and assess possible impacts placed on the community by the proposal. Assessing potential impacts on visual amenity was based on the sensitivity of the viewpoint to change, and the magnitude of change likely to occur
- Completion of a site inspection to confirm the existing environment, assess landscape character and identify representative viewpoints
- Development of design outcomes safeguards and management measures to avoid, reduce or mitigate adverse impacts that the proposal may impose within the study area
- Preparation of an illustrative urban design concept that reflects the urban design strategy for the proposal (refer to Appendix K (Urban Design, Landscape Character and Visual Impact Assessment)).

Study area

The study area is the extent of the landscape surrounding the construction footprint assessed for landscape character and visual impact. The study area comprises a one-kilometre-wide corridor of land offset 500 metres either side of the centre line of the proposal.

Landscape character impact assessment

The landscape character impact assessment considers the impact of change due to the proposal on the landscape. As the construction phase is temporary, impact of the proposal on landscape character is assessed at the operation phase.

The consideration of potential impact on landscape character is determined based on each LCZ sensitivity to change and the magnitude of change that is likely to occur. Sensitivity and magnitude are both assigned a rating (high, moderate, low, negligible) based on a series of criteria, and a matrix is used to determine an overall impact rating. Two primary factors are used to determine the impact to an LCZ, as identified in Table 6-55.

Table 6-55 Primary factors to determine the extent of impact to a LCZ

Factor	Description
Sensitivity	The sensitivity rating of a LCZ to the proposal is based on: • Susceptibility to change and the ability of the landscape to accommodate the proposal without undue consequences for the maintenance of the existing situation or the achievement of landscape planning policies and strategies • The value of the landscape
Magnitude	The magnitude of impact refers to: • The physical scale of the proposal • How distant it is • The contrast it presents to the existing condition

Once the sensitivity and magnitude are determined, the rating matrix outlined in Table 6-56 is used to determine an overall rating of landscape character impact.

Table 6-56 Overall significance of landscape character effects

		Magnitude of effect			
Sensitivity		High	Moderate	Low	Negligible
	High	High	High - Moderate	Moderate	Negligible
	Moderate	High - Moderate	Moderate	Moderate - Low	Negligible
	Low	Moderate	Moderate - Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Visual impact assessment

A series of viewpoints were selected from publicly accessible locations to assess the changes and potential visual impacts of the proposal. The visual impact assessment analysed the effects of changes in views seen by receptors as a result of the proposal. Similar to the landscape character impact assessment, sensitivity and magnitude factors are used to determine an overall rating of effect using the matrix shown in Table 6-57.

Table 6-57 Primary factors to determine the extent of the impact to visual receptors

Factor	Description
Sensitivity	Dependent on factors such as: • Susceptibility to change • Value attached to the view experienced
Magnitude	Dependent on factors such as: • Size or scale of change in the view • Geographical extent of the visual impact from different viewpoints

6.8.2 Existing environment

Landscape context

The proposal comprises a portion of the boundary between Penrith and Liverpool LGAs. The proposal is located about 42 kilometres from the Sydney CBD and about 13 kilometres from Penrith's centre. The intersection of Elizabeth Drive and The Northern Road is about eight kilometres from the eastern edge of the Blue Mountains National Park, part of the 1.03 million hectare World Heritage Listed Greater Blue Mountains Area. The Western Sydney Parklands are located to the east of Elizabeth Drive, providing over 1,300 hectares of recreational space.

The surrounding landscape is predominantly rural agribusiness land, with the WSA located to the south of the road corridor, and the associated Western Sydney Aerotropolis precincts in the surrounding area. Luddenham Road and Adams Road are minor connecting roads that run north-south through the semi-rural landscape and intersect the central area of the proposal. Luddenham Road hosts several recreational businesses such as go-karting, paintball, horse riding and a model park with the township of Luddenham located to the southwest of Elizabeth Drive.

Several creek lines cross Elizabeth Drive between The Northern Road and Badgerys Creek Road, where the construction footprint is situated. Cosgroves Creek and Oaky Creek directly cross the construction footprint. The waterways are well vegetated with the surrounding land cleared for agricultural use. A large number of farm dams used for domestic and stock purposes are evident in the surrounding landscape. The majority of the land surrounding the proposal is Bringelly Shale with strips of Quaternary Alluvium which has resulted in the rolling rural and agricultural landscape over the region.

The combination of agricultural farming lands and general settlement patterns are consistent with the visual and landscape qualities of the surrounding region within south-western Sydney. The landscape is predominantly cleared land with

occasional trees which are predominantly eucalypts. Farm homesteads with associated structures are also visible from Elizabeth Drive.

Landscape character zones

To characterise landscape differences, the landscape has been divided into three LCZs that have been identified within the study area, as shown on Figure 6-12. A description on each LCZ is provided in Table 6-58.

Table 6-58 Landscape character zones

Zone	Imagery	Description
LCZ1: Rural	   	This LCZ comprises the majority of the landscape within the study area (including part of the existing Elizabeth Drive), and includes a spatially open rural landscape, compartmentalised by bands of vegetation associated with riparian corridors or along roads. Roads that pass through this LCZ experience a pattern of expansive views followed by visual enclosure as the road passes over riparian corridors which contain taller, dense vegetation. The character of this area would be subject to change in the near future, as land to the north of Elizabeth Drive is expected to undergo development in response to zoning for enterprise use Key features of the LCZ include the following: • Land use – predominantly zoned ENT Enterprise to the north of Elizabeth Drive, AGB Agribusiness to the south of Elizabeth Drive and to the west of the WSA. Bands of riparian corridors zoned ENZ Environment and Recreation cross the landscape. Elizabeth Drive is zoned SP2 Infrastructure • Topography – typically gently undulating, with farm dams positioned along drainage lines • Vegetation – lush, green pastures punctuated by occasional paddock trees with scattered trees lining the road and creek corridors • Built form – occasional rural homes set back from the road corridor • Spatial form – spatially open, with expansive views where clearings and topography permit While Elizabeth Drive presently comprises a busy road, the narrow, predominantly two lane road corridor with an absence of formalised concrete kerbs or formal planting, gives the road a rural quality. This is in contrast to the more formalised transport corridor character of major roads in the vicinity, such as The Northern Road. As such, the majority of the existing Elizabeth Drive is within LCZ1: Rural.

Zone	Imagery	Description
LCZ2: Transport corridor		This LCZ comprises the Northern Road and its linear elements within the greater landscape, characterised by wide stretches of asphalt, with lanes often separated by a vegetated median strip. This LCZ is used as a transport corridor for vehicles and often, but not always, has provision for cyclists to use the road. Key features of the LCZ include the following: • Land use – Elizabeth Drive is zoned SP2 Infrastructure and is a State road • Topography – typically flat to undulating • Vegetation – verges are landscaped to varying degrees, from formalised plantings of shrubs and native grasses near major intersections to less formal areas of pasture grasses and bands of shrub and tree planting • Built form – predominantly includes small scale road infrastructure such as signs, lighting, fencing and traffic lights at signalised intersection. Most of the corridor is paved in hard surfaces: the road pavement and footpaths. Occasional homes and commercial properties are positioned along the road corridor but are considered to lie within the adjoining LCZ 1: Rural • Spatial form – open road corridor bounded by scattered vegetation

Zone	Imagery	Description
LCZ 3: Future WSA		At present this LCZ is a large construction site where the WSA would be located. In future, the LCZ would comprise the WSA, including runways, a commercial park and parking areas. Key features of the LCZ include the following: • Land use – land is zoned SP2 Western Sydney International (Nancy-Bird Walton), providing for the future airport operations of the WSA • Topography – flat to gently undulating, and in future would include a flat, central rectangular portion of the site bounded by runways. A future commercial park and vehicle parking are located on either side of the main access road off Elizabeth Drive, with smaller commercial and vehicle parking areas located along the Northern Road • Vegetation – in future, vegetation would typically be kept low and well maintained, with some trees potentially lining the entry road and remnant bands of riparian vegetation along the southern and eastern boundaries of the site along Badgerys Creek • Built form – in future, would typically comprise smaller commercial buildings outside the perimeter runways, with the low sprawling terminal within the centre • Spatial form – spatially open, bounded by the Badgerys Creek riparian corridor to the east and south, Elizabeth Drive to the north, and the planned Agribusiness Precinct of the Western Sydney Aerotropolis to the west

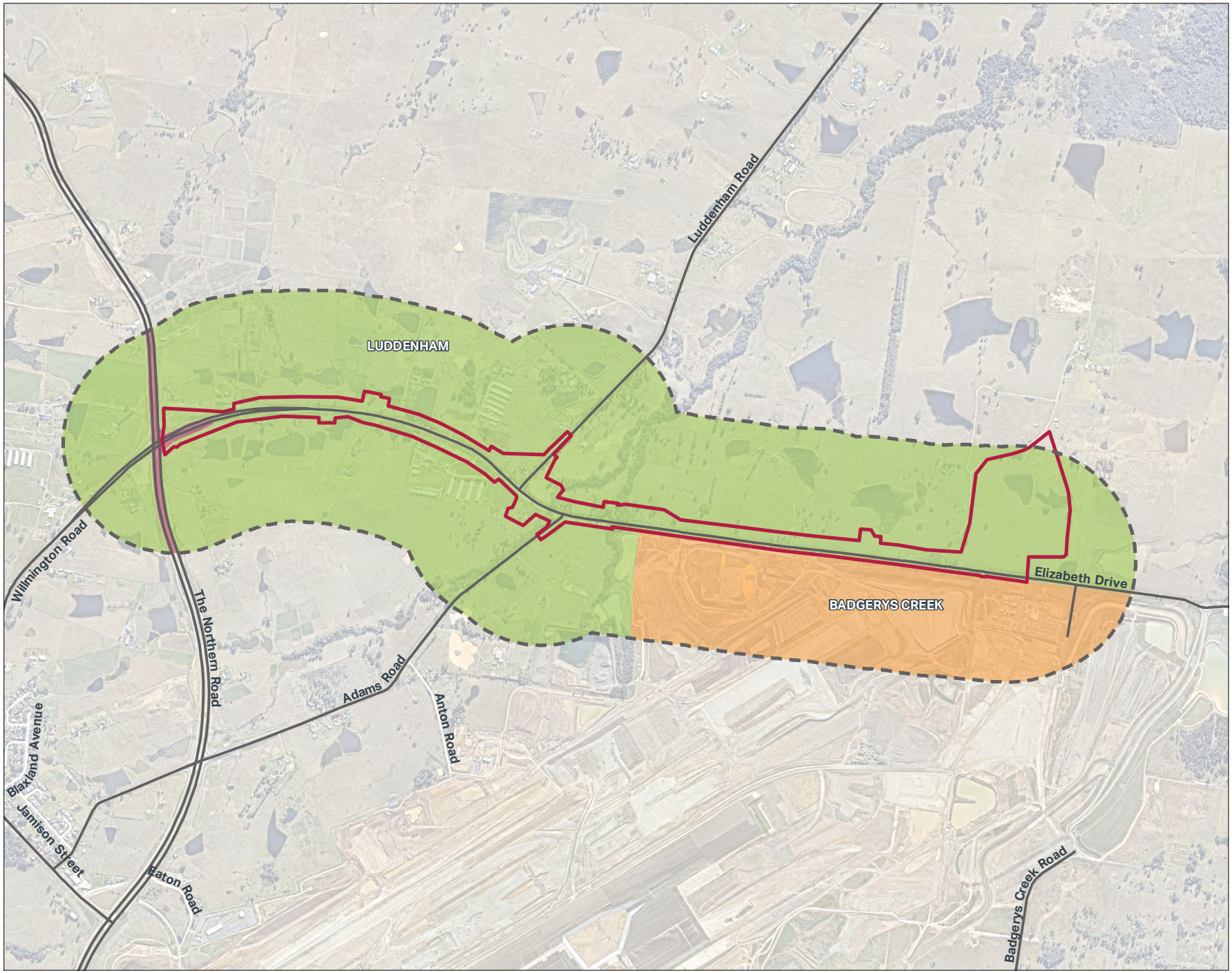


FIGURE 6-12:
LANDSCAPE CHARACTER ZONES

N

0 250 500 m

Legend

- Construction footprint
- Study area
- Primary road

Landscape Character Zones

- LCZ 1: Rural
- LCZ 2: Transport Corridor
- LCZ 3: Future Airport (Under Construction)

Visual receptors and representative viewpoints

Two visual receptor types have been defined, each of which are considered to typically share sensitivity to change in the character of the current views:

- Private domain – views from residences, workplaces and places of work or worship
- Public domain – motorists / cyclists using public roads, or views from parks, sports fields and other public facilities.

Given the current sparsely populated rural landscape surrounding the construction footprint, it is assumed that the proposal would be seen from a small number of homes, most of which are positioned along Elizabeth Drive. Workers on neighbouring rural properties would also be likely to obtain views to the changes. The highest number of visual receptors would be motorists travelling on Elizabeth Drive, Luddenham Road and Adams Road, nearing the intersection with Elizabeth Drive.

The visual environment of the construction footprint and surrounds is expected to change considerably with the development of the WSA and Western Sydney Aerotropolis, which will each provide concentrations of higher order jobs and a wide range of goods and services to nearby urban areas. Employment and agribusiness precincts would be introduced to the study area.

A total of seven representative viewpoints have been used to assess potential impacts from the proposal on existing views seen by receptors, as outlined in Table 6-59 and shown on Figure 6-13.

Table 6-59 Viewpoints from visual receptors

Viewpoint	Description
Viewpoint 1: The Northern Road	Representative view for motorists travelling south along The Northern Road with views to the east nearing Elizabeth Drive capturing the changes to the western end of Elizabeth Drive
Viewpoint 2: 2289 Elizabeth Drive, Luddenham	Representative view for residents at 2289 Elizabeth Drive, who would receive views to the new western alignment of the road and intersection with The Northern Road
Viewpoint 3: 2550 Elizabeth Drive, Luddenham	Representative view for motorists on Elizabeth Drive and residents at 2550 Elizabeth Drive to changes to the road corridor
Viewpoint 4: 889 Luddenham Road	Representative view for motorists on Luddenham Road travelling south-west towards the intersection with Elizabeth Drive and residents at 889 Luddenham Road
Viewpoint 5: Adams Road	Representative view for motorists travelling north along Adams Road towards the intersection with Elizabeth Drive. This viewpoint would see changes to the vegetation within the creek corridor to the west of Adams Road due to the proposal
Viewpoint 6: 2141 Elizabeth Drive, Luddenham	Representative view for motorists travelling east along Elizabeth Drive and approaching the crossing point of Oaky Creek
Viewpoint 7: Elizabeth Drive East	Representative view for motorists travelling east along Elizabeth Drive

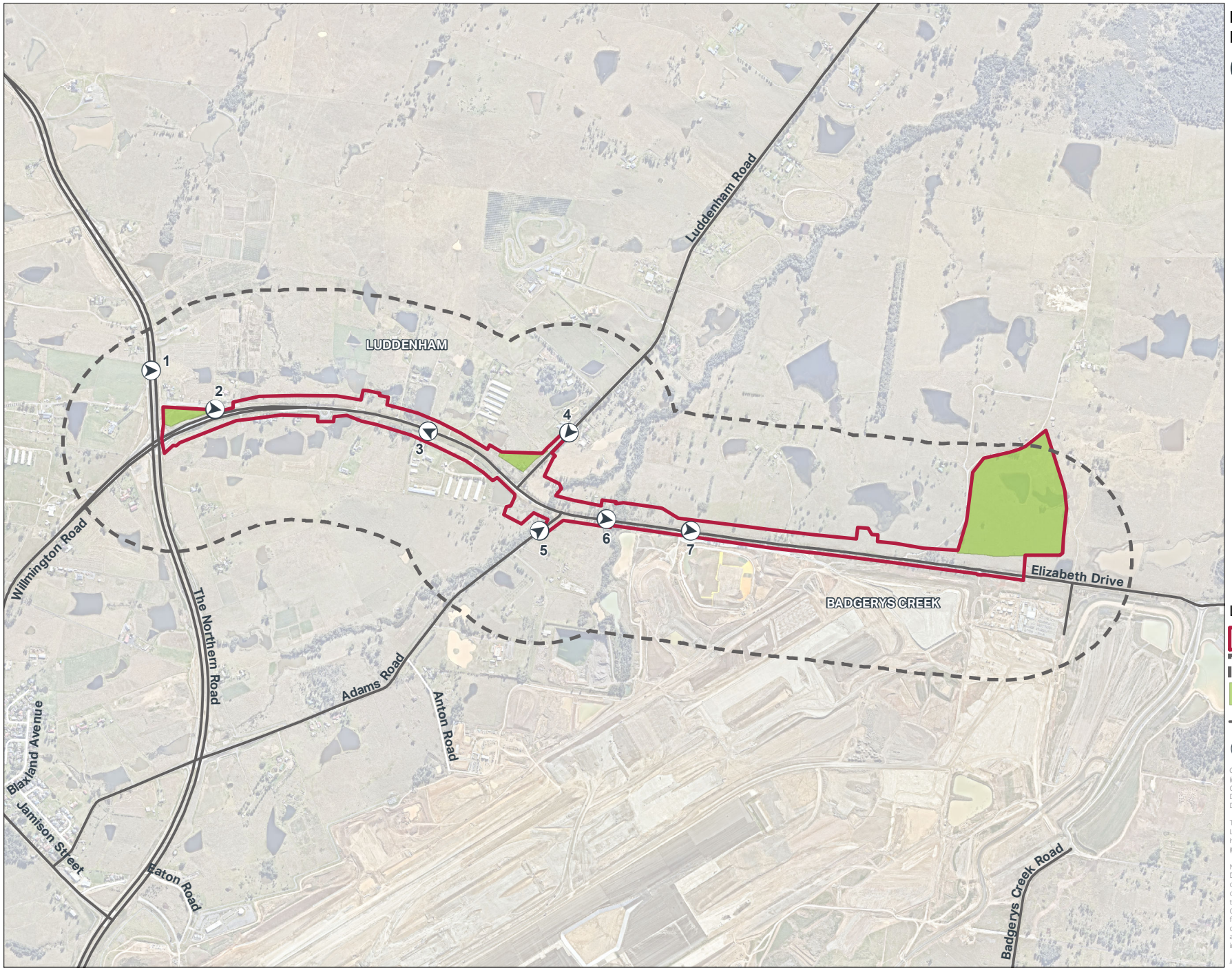


FIGURE 6-13:
REPRESENTATIVE VIEWPOINTS

Legend

- Construction footprint
- Study area
- Construction ancillary facility
- Primary road
- Viewpoint with direction of view

6.8.3 Potential impacts

Construction

Visual impacts

The potential visual impact of the proposal during construction has been assessed and summarised in Table 6-60. Visual construction elements would typically comprise construction activity within the road corridor (including the removal of roadside vegetation) and the presence of three ancillary facilities positioned within the study area (shown on Figure 6-13 and described in further detail in Chapter 3 (Description of the proposal)). The changes would be seen from a low number of visual receptors living or working in surrounding properties and a high number of visual receptors travelling along Elizabeth Drive and connecting roads (including the Northern Road, Adams Road and Luddenham Road). Further detail on the construction elements that would be visible at each viewpoint is provided in Appendix K (Urban Design, Landscape Character and Visual Impact Assessment).

Overall, the visual impact experienced by visual receptors during construction would be high to moderate (adverse). The changes would be seen by a high number of receptors within the road corridor with a lower sensitivity to change and a low number of receptors with a higher sensitivity to change from the surrounding landscape. The changes would be seen from close proximity in high degrees of detail, particularly as travellers drive along Elizabeth Drive past the changes. However, these changes would be experienced in the short term and would be reversible to some extent. The removal of roadside vegetation, particularly at creek crossings, would contribute to the overall adverse qualitative rating. Visual clutter associated with construction (such as construction equipment and activity) seen from a high proportion of viewpoints, and the potential for these changes to be seen in conjunction with other construction activity in the surrounding landscape (particularly within the WSA site), also contribute to the overall adverse rating.

Safeguards and management measures that would be implemented during construction affecting visual amenity have been identified in Section 6.8.4.

Table 6-60 Visual impact assessment summary - construction

Viewpoint	Sensitivity	Magnitude	Overall impact rating	Qualitative rating
Viewpoint 1: The Northern Road	Moderate	Low	Moderate to low	Neutral
Viewpoint 2: 2289 Elizabeth Drive, Luddenham	Moderate	High	High to moderate	Adverse
Viewpoint 3: 2550 Elizabeth Drive, Luddenham	Moderate	High	High to moderate	Adverse
Viewpoint 4: 889 Luddenham Road	Moderate	High	High to moderate	Adverse
Viewpoint 5: Adams Road	Low	High	Moderate	Adverse
Viewpoint 6: 2141 Elizabeth Drive, Luddenham	Moderate	High	High to moderate	Adverse
Viewpoint 7: Elizabeth Drive East	Low	High	Moderate	Adverse

Operation

Landscape character impacts

Of the three LCZs identified within the study area, LCZ3: Future WSA would experience negligible landscape impacts due to the operation of the proposal, and LCZ 2 and LCZ3 would experience low to moderate impacts (refer to Table 6-61).

The proposal would be consistent with the future character of the WSA, which is currently under construction and would substantially change the existing landscape.

Elizabeth Drive is presently a two-lane road, and although busy, characteristically fits within the rural landscape due to its narrow width, lack of footpaths, kerbs and gutters, and pasture grass verges. Once upgraded, the road would be altered in character from a piece of infrastructure subservient to the rural character of the surroundings to a formalised transport

corridor closer to the hierarchy of The Northern Road. This change would alter the landscape character in areas of LCZ 1: Rural to be consistent with that of LCZ 2: Transport Corridor, rather than within LCZ 1: Rural. Planting along the road corridor, including the planting of trees along the boundary, would integrate the proposal into the surrounding landscape.

While this would comprise a change within the local landscape setting, the character of the landscape is already undergoing a series of changes due to the development of the Western Sydney Aerotropolis and construction of the WSA. The zoning of Elizabeth Drive as SP2 Infrastructure, and the land to the north of the proposal as an Enterprise zone (ENT), creates an environment that allows for the ongoing development of this land, which somewhat lessens the impact of the proposal as a change within the landscape.

The impact of the proposal on LCZ 2: Transport Corridor would be low, with the proposal resulting in an extension of the extents of this LCZ within the study area.

Due to the above, the proposal would be considered to have a low effect on the overall landscape character of the area, with a neutral effect on the quality. The proposal is also considered appropriate given the anticipated future character of the surrounding landscape.

Table 6-61 Summary of landscape character impacts

LCZ	Sensitivity	Magnitude	Landscape character impact	Qualitative rating
LCZ 1: Rural	Low	Moderate	Moderate to low	Neutral
LCZ 2: Transport corridor	Low	Low	Low	Neutral
LCZ 3: Future WSA	Negligible	Negligible	Negligible	Neutral

Visual impacts

The potential visual impact of the proposal at operation has been assessed and summarised in Table 6-62. The most visually prominent changes would include the widening of Elizabeth Drive, with the addition of a vegetated central median strip separating carriageways with two lanes travelling in either direction and shared walking and cycling paths on both sides of the road. The widened road would result in the removal of existing roadside trees (assessed within the construction phase of the proposal) and the installation of new trees, turf and native grasses on both the verges and the central median strip. The proposed tree planting would potentially increase tree cover within the road corridor, which would partially offset adverse visual effects of the road widening.

As shown in Table 6-62, one visual receptor location would be subject to negligible visual impact and one would be subject to low impact. Three would be subject to moderate and moderate to low visual impact. The remaining two visual receptor locations would be subject to a visual impact ratings of high to moderate which are considered to comprise considerable impact on the views from those locations. Indicative photomontages of viewpoints 3, 6 and 7 are shown in Figure 6-13 to Figure 6-19. These viewpoints were selected to illustrate a range of typical changes to the road corridor, from adjoining roads and nearby receptors.

Overall, the potential visual impact of the proposal at operation is considered to be moderate (neutral). The scale of the proposal (ie the upgraded Elizabeth Drive) within the landscape would increase within views both to the road corridor and from within the road (ie the view seen by travellers on Elizabeth Drive). Elizabeth Drive would change from a more informal but busy rural road to an upgraded transport corridor with formalised kerb and gutters and pedestrian / cycle infrastructure. However, considering the ongoing development of the surrounding landscape in response to the construction of the WSA and Western Sydney Aerotropolis, these changes are considered appropriate.

Table 6-62 Visual impact assessment - operation

Viewpoint	Sensitivity	Magnitude	Overall impact rating	Qualitative rating
Viewpoint 1: The Northern Road	Moderate	Negligible	Negligible	Neutral
Viewpoint 2: 2289 Elizabeth Drive, Luddenham	Moderate	Low	Moderate to low	Neutral

Viewpoint	Sensitivity	Magnitude	Overall impact rating	Qualitative rating
Viewpoint 3: 2550 Elizabeth Drive, Luddenham	Moderate	High	High to moderate	Neutral
Viewpoint 4: 889 Luddenham Road	Moderate	Moderate	Moderate	Neutral
Viewpoint 5: Adams Road	Low	Low	Low	Neutral
Viewpoint 6: 2141 Elizabeth Drive, Luddenham	Moderate	High	High to moderate	Adverse
Viewpoint 7: Elizabeth Drive East	Low	High	Moderate	Neutral

Figure 6-14 Existing Viewpoint 3 looking west along Elizabeth Drive from the boundary of 2550 Elizabeth Drive

Figure 6-15 Proposed changes seen from Viewpoint 3 (indicative only, subject to detailed design)

Figure 6-16 Existing Viewpoint 6 looking east along Elizabeth Drive from the boundary of 2141 Elizabeth Drive, Luddenham

Figure 6-17 Proposed changes seen from Viewpoint 6 (indicative only, subject to detailed design)

Figure 6-18 Existing Viewpoint 7 looking east along Elizabeth Drive from the road corridor

Figure 6-19 Proposed changes seen from Viewpoint 7. Note that cleared area visible in the background on the right would be 'flattened out' with completion of the WSA (indicative only, subject to detailed design)

6.8.4 Safeguards and management measures

Table 6-63 describes the proposed safeguards and management measures that would be implemented to manage potential landscape character and visual amenity impacts.

Table 6-63 Landscape character and visual amenity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Landscape and visual	Where the view to the road corridor from residential properties will be impacted, community consultation will be carried out to determine appropriate planting measures. This could include the provision of formal planting (hedges or screen planting) along boundaries within private residential properties (in consultation with landowners), to be considered during detailed design	Transport	Detailed design	Additional safeguard
Landscape and visual	Tree species for the landscape design will be selected from the Western Sydney Aerotropolis Development Control Plan 2021, where possible, taking into consideration the relevant aviation safeguarding controls	Transport	Detailed design	Additional safeguard
Landscape and visual	Tree protection zones will be established around trees to be retained. Tree protection will be carried out in keeping with AS4970-2009 Protection of Trees on Development Sites and will include exclusion fencing of tree protection zones	Contractor	Detailed design / pre-construction	Additional safeguard
Landscape and visual	Shade cloth or construction hoarding (or similar material) (where necessary) will be installed to minimise visual impacts. Construction sites will be kept clean and tidy and refuse will be placed in appropriate receptacles. Hoardings and site fencing will be removed once construction is complete	Contractor	Construction	Additional safeguard
Landscape and visual	Cut-off or directed lighting will be provided within and outside of the construction site, with lighting location and direction considered to ensure glare and light spill is minimised	Contractor	Construction	Additional safeguard

6.9 Surface water and groundwater

A surface water and groundwater assessment has been prepared for the proposal. A summary of this assessment is presented in this section, with the full report provided in Appendix L (Surface Water and Groundwater Assessment Report).

6.9.1 Methodology

Surface water

The surface water assessment adopted the following methodology:

- Review of the legislative context within which the proposal sits and relevant guidelines
- Desktop review of publicly available information on water quality of surface waters, existing catchment conditions, general creek conditions (size and flow characteristics) and land use

- Definition of the catchments and identification of downstream environments and water users potentially impacted by the proposal
- Definition of the area that influences the surface water environment
- Identification of potential impacts of construction, including the proposed construction compound/laydown sites, and operational activities on surface water environments, including watercourse hydrology and potential impact on water quality with reference to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018) (ANZECC) water quality guidelines
- Identification of potential impacts during operation, assessed with Model for Urban Stormwater Improvement Conceptualisation (MUSIC) modelling to quantify the extent of treatment provided by the design
- Development of water quality treatment safeguards and management measures to mitigate the impact of construction on water quality, following the principles of the Managing Urban Stormwater: Soils and Construction, Volume 1 (Landcom, 2004) and Volume 2D (DECC, 2008)
- Development of water quality treatment safeguards and management measures to mitigate the impact of the operation of the proposal on water quality following the principle of Procedure for Selecting Treatment Strategies to Control Road Runoff (RTA, 2003) and Roads and Maritime Water Policy (RTA, 1997).

The study area for the surface water assessment (surface water study area) includes the catchments of local water courses which traverse or are in the vicinity of the construction footprint (Cosgroves Creek, Oaky Creek, Badgerys Creek and South Creek).

Groundwater

The groundwater assessment adopted the following methodology:

- Review of publicly available information on water quality of groundwater, existing groundwater catchment conditions, and aquifer uses
- Definition of the aquifer catchments that could be impacted by the proposal and identification of GDEs potentially impacted by the proposal
- Identification of potential impacts of construction on groundwater, including construction elements that may intercept groundwater
- Review of the proposal design and design elements likely to cause an impact on groundwater and operational activities
- Development of a conceptual model of the hydrogeological environment within the study area for the groundwater assessment
- Assessment of potential groundwater impacts against the criteria specified in the NSW Aquifer Interference Policy (NSW Department of Primary Industries (DPI), 2012)
- Consideration of potential impacts to GDEs
- Identification of safeguards and management measures to manage potential groundwater impacts.

The study area for the groundwater assessment (groundwater study area) includes all land within two kilometres of the construction footprint.

6.9.2 Existing environment

Surface water

Catchments, key watercourses and drainage infrastructure

The comstruction footprint lies within the South Creek sub-catchment, an area of the Hawkesbury-Nepean Catchment which has been extensively modified and disturbed due to land clearing for agriculture and increasing urbanisation. Surface waterways within the construction footprint include Cosgroves Creek, Oaky Creek, and several farm dams along the proposal alignment.

The proposal traverses Cosgroves Creek and Oaky Creek (west to east) which are both tributaries of South Creek. Badgerys Creek and Kemps Creek are also tributaries of South Creek and are located to the east of the proposal.

Key watercourses within the surface water study area include the following:

- **South Creek:** South Creek flows generally north, joined by seventeen tributaries including Badgerys Creek, Kemps Creek, Ropes Creek and Eastern Creek, until it flows into the Hawkesbury River, near Windsor. The proposal does not directly cross South Creek. However, two joining tributaries traverse the proposal, which are Cosgroves Creek and Oaky Creek
- **Cosgroves Creek:** Cosgroves Creek is an ephemeral third order stream at the location it traverses the proposal. The catchment is largely rural with some residential estates (Twin Creeks Golf and Country Club)
- **Oaky Creek:** at the location it traverses the proposal, Oaky Creek is an ephemeral third order stream. Land use within the Oaky Creek catchment consists of agricultural (grazing of naturalised and modified pastures) and rural residential
- **Badgerys Creek:** Badgerys Creek is about 16 kilometres in length and originates near Bringelly. The creek flows north to converge with South Creek.

Figure 6-20 shows key watercourses surrounding the proposal.

There are two existing main flow path crossings (bridges and culverts) that intersect the construction footprint – one at Cosgroves Creek and one at Oaky Creek. There are also a number of existing culvert crossings that convey flow beneath the road at local valleys across the Elizabeth Drive alignment.

The existing drainage network for Elizabeth Drive comprises a series of shallow swales along the side of the road carriageway, which ultimately discharge towards either the nearest creek (Cosgroves Creek, Badgerys Creek, South Creek and Kemps Creek) or transverse culvert location.

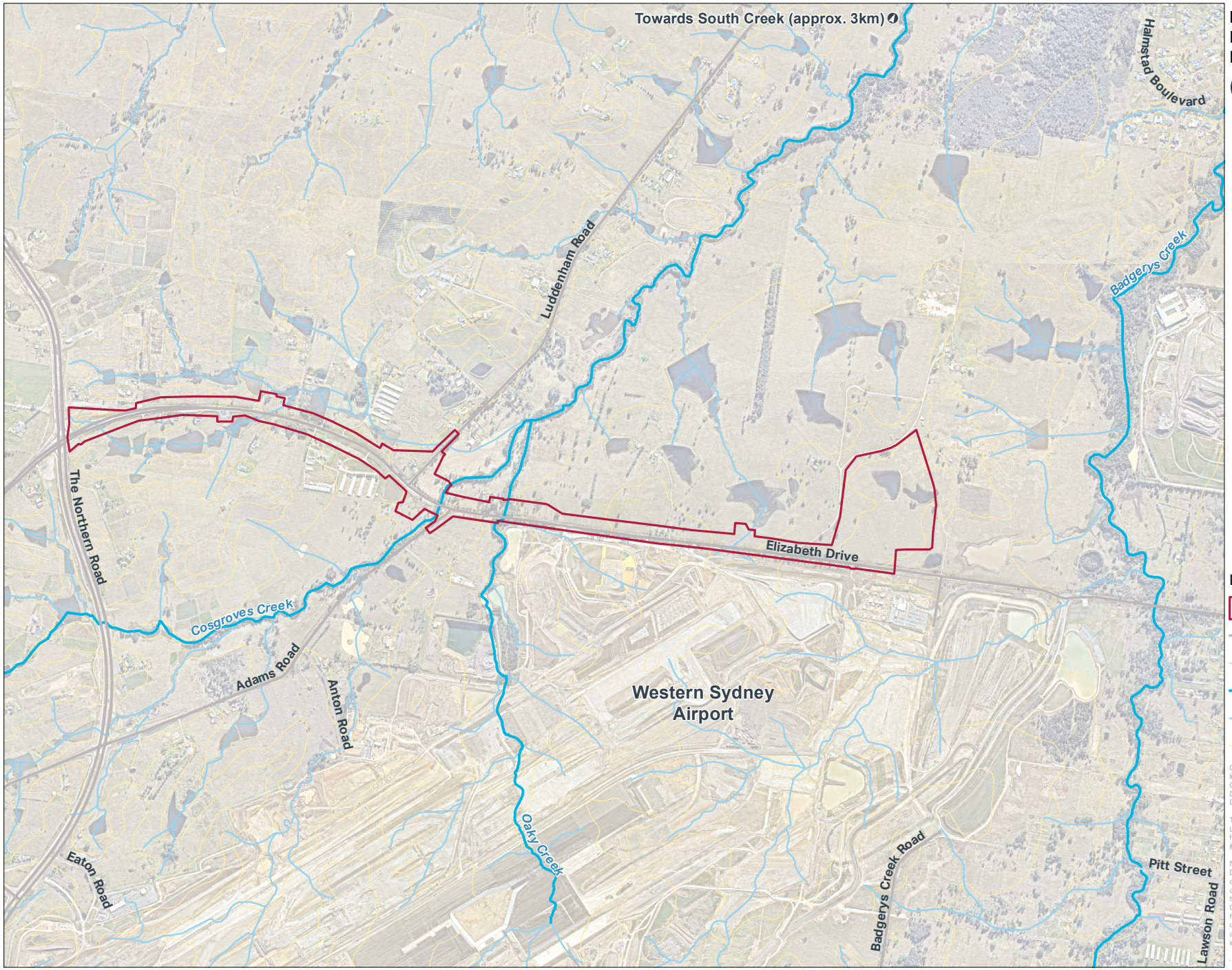


FIGURE 6-20:
KEY WATERCOURSES IN THE STUDY AREA

N

0 250 500 m

Legend

- Construction footprint
- Primary road
- Local road
- Watercourse
- Drainage line
- 10m contour

Climate

The proposal is in a region with a temperate climate. Two nearby Bureau of Meteorology (BoM) weather stations, the Badgerys Creek McMasters field station and the Badgerys Creek automatic weather station, were reviewed for annual rainfall statistics. These indicated an average annual rainfall of between 675 mm and 789 mm for the region respectively.

Rainfall data shows that there is variable annual rainfall, with a dry season between June and October and a wet period observed between November to July. Annual temperature statistics collected from Badgerys Creek McMasters Field Station show that January is the warmest month, with a mean monthly maximum temperature of 30.2°C, and July is the coolest month, with a mean temperature of 17.5°C.

Based on the climate change projections from the NSW and Australian Capital Territory Regional Climate Modelling project, rainfall in Metropolitan Sydney is projected to decrease by up to five per cent in the period between 2020 and 2039 in spring and winter and to increase in autumn and summer by up to five per cent (DPE, 2022). Further detail on the impact of climate change on weather patterns is provided in Section 6.13.2.

Soils

Information on soils where relevant to the surface water assessment is described in this section. Further detail on the existing soils environment and their respective limitations is provided in Section 6.11.2.

Reference to the Penrith 1:100,000 Soil Landscape Map (Bannerman and Hazelton, 1990), indicates that there are three different soil types within the construction footprint – Blacktown residual soils, Luddenham erosional soils and South Creek Alluvial deposits. These soil landscapes have characteristics that may influence the interaction between surface water and groundwater impacts, including erodibility; erosion hazard; acidity; salinity; shrink-well potential and seasonal waterlogging.

A search of the Atlas of Australian Acid Sulfate Soils (CSIRO) and the DPE Environmental Planning Instrument Acid Sulfate Soils indicates the acid sulfate soil risk within the construction footprint is class C, with extremely low probability of occurrence.

A review of the NSW DPE eSPADE soils database shows that soils within the western portion of the construction footprint generally have a moderate to high overall salinity hazard, while soils within the eastern portion of the construction footprint have a very high salinity hazard.

There is a high potential for contamination to be present in soils and fill in the construction footprint, associated with uncharacterised fill and areas of former and current agricultural land. Contamination risk is described further in Section 6.11.2.

Surface water quality

Water quality objectives that provide guideline levels to help manage water quality have been developed for each catchment in NSW (DECCW, 2006). These objectives are consistent with the agreed national framework of the ANZECC Water Quality Guidelines (2000). The following environmental values and water quality objectives have been identified for the Hawkesbury-Nepean catchment, and are considered in this assessment:

- Aquatic ecosystems – maintaining or improving the ecological condition of waterbodies and riparian zones over long term
- Visual amenity – aesthetic qualities of waters
- Primary contact recreation – maintaining or improving water quality for activities such as swimming where there is a high probability of water being swallowed
- Secondary contact recreation – maintaining or improving water quality of activities such as boating and wading, where there is a low probability of water being swallowed
- Irrigation water supply – protecting the quality of waters applied to crops and pastures
- Livestock water supply – protecting water quality to maximise production of healthy livestock
- Aquatic foods (cooked) –protecting water quality so that it is suitable for production of aquatic foods for human consumption and aquaculture activities.

Further detail on the water quality objectives, including the relevant indicators and guideline values, is included in Section 3 of Appendix L (Surface Water and Groundwater Assessment Report).

Surface water quality in the construction footprint is influenced by stormwater runoff. Stormwater entrains material (soluble or insoluble) in its path of flow and these materials may pollute the quality of runoff. Stormwater runoff quality in the construction footprint is likely to be influenced by surface pollutants of typical urban catchments, including:

- Oils and hydrocarbons
- Heavy metals
- Chemicals from spills, localised pesticide application or inappropriate waste disposal
- Sediments
- Gross pollutants including littering and debris.

A review of recent water quality data for Cosgroves Creek and Oaky Creek found that the creeks fail to meet several relevant ANZECC water quality guidelines for protection of aquatic ecosystems in the Hawkesbury-Nepean Catchment. Parameters that exceeded the guidelines include:

- Dissolved oxygen
- Conductivity
- Total Nitrogen
- Total Phosphorus
- Zinc
- Copper.

The existing water quality of Cosgroves Creek and Oaky Creek can, therefore, be classified as poor and degraded due to low dissolved oxygen concentrations and elevated nutrients. This has likely been caused by urban development and agricultural activities in the upstream catchment.

There are also a number of privately owned farm dams within the construction footprint. Existing water quality within these dams was not established as part of this REF; however, would be considered during detailed design.

Sydney Water stormwater network

Sydney Water, as the trunk drainage authority for stormwater in the Western Sydney Aerotropolis, is responsible for the stormwater network, as well as drinking water, wastewater and recycled water networks. The Western Sydney Aerotropolis integrated water system is currently in preparation in consultation with DPE and local councils, and would aim to include stormwater harvesting, treatment and reuse. Transport would liaise with Sydney Water regarding this scheme at the detailed design phase of the proposal, as relevant.

Groundwater

Regional and local hydrogeology

Two main groundwater system types lie within the groundwater study area. These include unconfined to semi-confined alluvial aquifers associated with Cosgrove Creek and Oaky Creek, and semi-confined to confined aquifers within the Bringelly Shale bedrock.

A groundwater investigation was carried out in August 2018 for the M12 Motorway project (RMS, 2019a), located north of the proposal, within the groundwater study area. Bores installed adjacent to creeks including Cosgroves Creek and Badgerys Creek indicated the alluvial deposit aquifers are located within the eastern portion of the construction footprint at depths ranging between 2.5 and seven metres below ground level. The aquifers are predominantly silty and gravelly clay with relatively thin alluvium deposits. Depth to water of the bores monitoring the alluvial deposit aquifers ranged between two and four metres below ground level. Shallow groundwater is expected to follow/flow towards the primary surface water features in the area (Cosgroves Creek and Oaky Creek). Groundwater is likely predominantly recharged from rainfall and from surface water features hydraulically connected to alluvial sediments.

The Bringelly Shale aquifers are comprised of variable sedimentary rock types. Review of available data indicates that depth to water for the groundwater system ranges widely, from one to 24 metres below ground level, likely due to the stratified conditions of the shale. Screening of bores for groundwater quality indicated that the Bringelly Shale had elevated heavy metals and nutrient concentrations, likely due to agricultural land use in the area and fill material from unknown sources. Screening also indicated saline to highly saline concentrations of total dissolved solids. Regional groundwater within the Bringelly Shale is inferred to flow in a westerly direction towards the Nepean River and Warragamba Dam located over six

kilometres from the construction footprint. Groundwater is likely predominantly recharged from rainfall in areas of subcrop and outcrop and, to a lesser extent, from connectivity to surface water features.

Groundwater quality

A groundwater investigation was carried out in August 2018 for the M12 Motorway project (RMS, 2019a) located north of the proposal within the groundwater study area, which included samples from five bores. Potential sources of identified elevated heavy metals and nutrient concentrations in groundwater include agricultural land use in the area and fill material from unknown sources. There is potential that concentrations are representative of background concentrations (RMS, 2019b).

The total dissolved solid concentrations identified in the samples were determined comparable to groundwater concentrations within fractures of Wianamatta Group shales of Western Sydney, which are typically 5,000 – 30,000 milligrams per litre (McNally, 2009).

Groundwater users

There are 18 registered bores located within the groundwater study area. Three bores had a purpose relating to water supply (ie irrigation, stock and domestic, water supply or commercial/industrial), and at least two of these three bores are inferred to be accessing the Bringelly Shale groundwater system. The closest of these three bores, relating to water supply, is located about 90 metres north of the construction footprint.

The location of groundwater bores is shown in Figure 6-21.

Groundwater dependent ecosystems

Terrestrial GDEs identified in the National Atlas of GDEs that may be present within the groundwater study area are shown in Figure 6-21, and include:

- Cumberland River Flat Forest (high potential GDE)
- Cumberland Shale Hills Woodland (moderate potential GDE)
- Cumberland Shale Plains Woodland (low potential GDE).

There are no aquatic or subterranean GDEs within the groundwater study area.

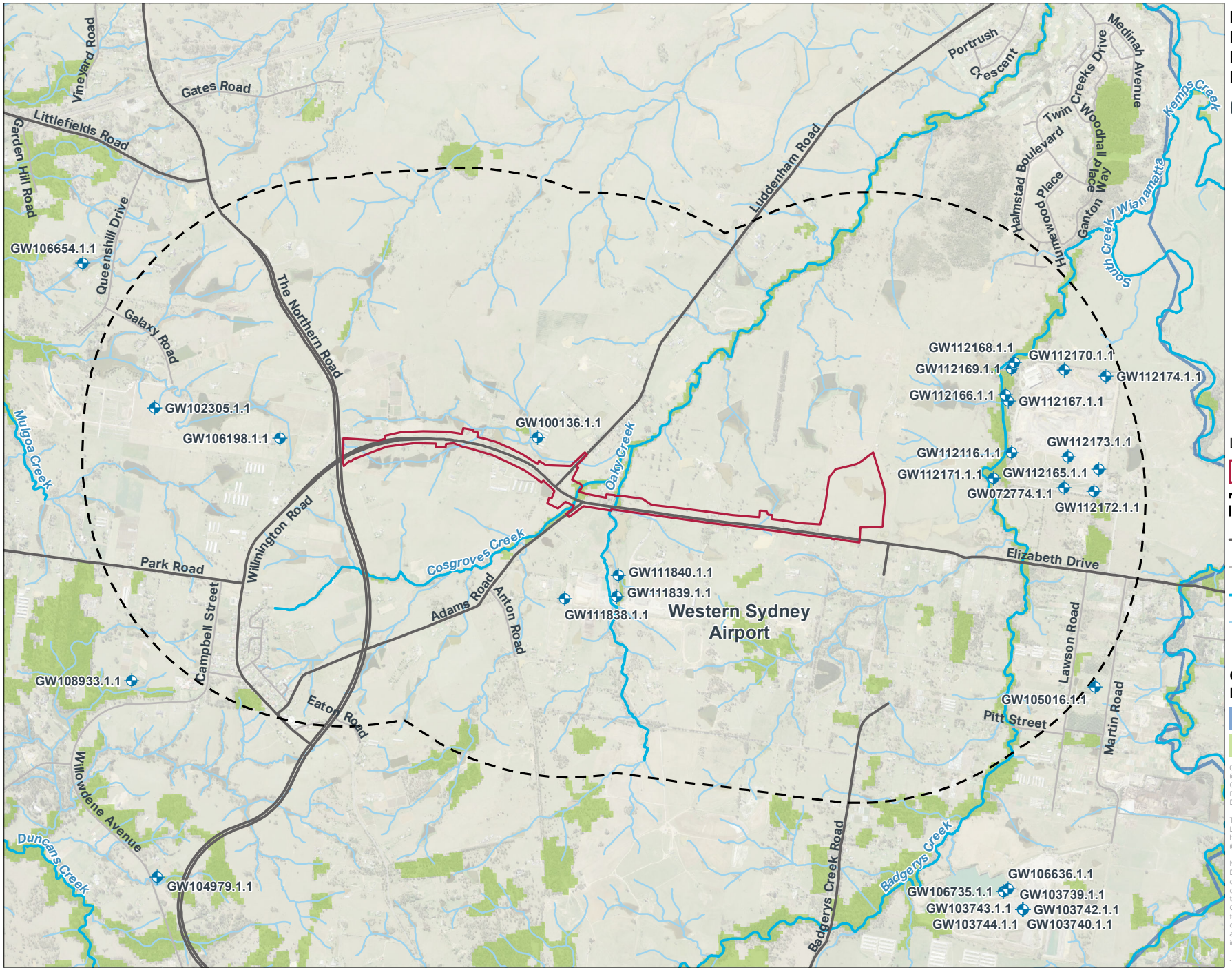


FIGURE 6-21:
REGISTERED GROUNDWATER BORES AND GROUNDWATER DEPENDENT ECOSYSTEMS

Legend

- Construction footprint
- 2km buffer from construction footprint
- Primary road
- Local road
- Watercourse
- Drainage line
- Registered groundwater bore

Groundwater Dependent Ecosystems

- Aquatic
- Terrestrial

6.9.3 Potential impacts

Construction – surface water

Surface water drainage

Earthworks have the potential to increase surface runoff, disrupt existing flow paths and to impact surface water quality with the mobilisation of sediments and contaminant laden stormwater.

The proposal would involve bridge construction work at Cosgroves Creek (as described in Chapter 3 (Description of the proposal)). Potential impacts associated with the construction work could include:

- Localised ponding
- Runoff moving as concentrated rather than sheet flows, which could potentially create drainage/flooding issues within neighbouring properties or downstream
- Impact to the stability of banks, creek bed, and existing surface water drainage behaviour from instream bridge construction work at and during temporary diversion of Cosgroves Creek.

Surface water quality

Construction activities represent a risk to surface water quality within local receiving waters. During runoff events or flood conditions, sediment laden waters, chemicals stored on site, and construction waste have the potential to mobilise and enter watercourses. Generation of sediment laden waters and offsite transport can occur during activities such as:

- Clearing and grubbing
- Stockpiling of materials
- General earthworks
- Temporary work (ie access roads, compounds, laydown areas and pads)
- Construction of bridge piers and abutments
- Instream drainage work
- Placement of fill for embankments.

If not adequately managed, these construction activities could lead to erosion of exposed soil and stockpiled materials and an increase in sediment loads entering nearby watercourses. Sediment laden waters pose a potential risk to downstream surface water quality. The proposal could also result in the accumulation of potential contaminated sediments in sedimentation and water quality basins. Water quality impacts include increased turbidity and elevated concentrations of nutrients and other pollutants. Erosion and sedimentation controls outlined in Section 6.9.4 would minimise the potential for impacts.

Other potential sources that may impact surface water quality during construction include:

- Fuel or oils used by construction plant and equipment
- Waste and litter from building activities and personnel
- Release of nutrients from fertilisers, herbicides and pesticides (eg used in site landscaping)
- Paint and paint wastes
- Acids from acid-based washes
- Poorly treated discharge from dewatering activities, including open excavations and farm dams
- Disturbance of contaminated soils and/or acid sulfate soils, which may adversely affect water chemistry including pH and dissolved solids. Contamination risk is assessed in Section 6.11.

Table 6-64 provides a summary of the potential surface water quality related impacts from construction activities on receiving waterways including Cosgroves Creek, Oaky Creek, Badgerys Creek and South Creek. Each of the potential impacts is considered with respect to the environmental values and water quality objectives identified in Section 6.9.2 and Section 3 of Appendix L (Surface Water and Groundwater Assessment Report).

Table 6-64 Potential impacts to surface water quality during construction

Activity/source	Pollutants or factor of concern	Potential impact to receiving waterways and associated water quality objectives
Clearing of vegetation and the resultant exposed soils could result in mobilisation and release of sediment laden runoff from construction areas or stockpiles of soil The direct disturbance of waterway bed and/or banks as a result of earthworks and construction of instream structures could result in soil and bank erosion and mobilisation of sediments into receiving waterways The loading and transporting of building materials, stockpiling, earthworks, and demolition of structures (including the existing Cosgroves Creek bridge) could result in dust, litter and other pollutants being mobilised by wind and stormwater runoff into waterways Vehicle movement across construction ancillary facilities may loosen soils and transport sediment onto public roads and into the waterways either by runoff carrying sediment from loosened soils or through sediments attached to the vehicles traversing drainage lines	Sediment, nutrients, contaminants, gross pollutants, and damage to vegetation	• Sediments could smother receiving waterways impacting aquatic ecosystems • Increased turbidity, lower dissolved oxygen levels, and increases in toxicant concentrations could impact aquatic ecosystems • Nutrients associated with sediments could lead to algal blooms and aquatic weed growth, which could impact aquatic ecosystems, recreation, irrigation, livestock, and aquatic foods • Reduced visual amenity could result from turbid water and visible gross pollutants, impacting recreation and visual amenity
Spills from machinery or equipment, during refuelling or accidental spill could potentially result in pollutants such as petroleum hydrocarbons, lubricants, effluent, oils, and greases being conveyed to downstream waterways	Hydrocarbons, oil and grease, hydraulic fluids, other hazardous chemicals	• Oil sheen on water surface could impact amenity or recreation • Increases in toxicant concentration could lead to fish kills and other aquatic ecosystem impacts, livestock, and aquatic foods
Concreting activities could impact receiving waterways as follows: • Concrete washout water being discharged into waterways • Chemicals used in treatment and curing of concrete and mobilisation of concrete dust through wind and runoff could impact waterways • Spills of excess or waste concrete could be discharged into stormwater systems	High pH, chromium, contaminants, waste, sediment, gross pollutants	• Increases in alkalinity and toxicant concentration which could lead to impacts to aquatic ecosystems such as fish kills and undesirable impacts to livestock • Increased turbidity could impact aquatic ecosystems, amenity, and recreation

Activity/source	Pollutants or factor of concern	Potential impact to receiving waterways and associated water quality objectives
Earthworks and changes to the site resulting in concentrated flows, as opposed to sheet flow, that have potential to disrupt existing surface water flow paths, scour the earth and increase sediment loads carried by surface waters	Sediment, nutrients, contaminants	• Increased turbidity, lower dissolved oxygen levels and increased nutrients which could lead to algal blooms and aquatic weed growth which could impact aquatic ecosystems • Increases in toxicant concentration • Reduced visual amenity (turbidity) • Localised ponding could occur creating drainage/flooding issues within nearby properties and surrounding downstream environment
Dewatering of open excavations following periods of rainfall, which may contain sediments and other pollutants mobilised by the rainfall	Sediment, nutrients, contaminants	• Increased turbidity, lower dissolved oxygen levels and nutrients which could lead to algal blooms and aquatic weed growth could impact aquatic ecosystems, amenity, recreation, livestock, and irrigation • Increases in toxicant concentration could impact aquatic ecosystems, livestock, and aquatic foods
Dewatering of farm dams	Sediment, nutrients, contaminants, suspended solids/soils	• Increased turbidity, lower dissolved oxygen levels and nutrients which could lead to algal blooms and aquatic weed growth could impact aquatic ecosystems, amenity, recreation, livestock, and irrigation • Increases in toxicant concentration could impact aquatic ecosystems, livestock, and aquatic foods
Construction within areas of moderate to very high-risk saline soils could expose saline soils, allowing salts to be entrained in runoff to the receiving environment	Salts	• Saline runoff could impact aquatic ecosystems with the potential for fish kills and loss of biodiversity and the loss of aquatic foods • Salts could make water unsuitable for uses such as irrigation, and livestock • Construction within areas of moderate to very high-risk saline soils would be managed in accordance with the Soil and Water Management Plan (refer to Section 6.9.4)
Poorly treated discharge could result in impacts to ambient water quality	Heavy metals, pH, oil and grease, sediment, nutrients	• Increases in alkalinity and toxicant concentration which could lead to fish kills and other undesirable impacts to aquatic ecosystems, livestock, and aquatic foods • Increased turbidity, lower dissolved oxygen levels and nutrients which could lead to algal blooms and aquatic weed growth, which could impact aquatic ecosystems, amenity, recreation, irrigation, livestock, and aquatic foods

Construction – groundwater

Groundwater may be impacted where construction activities intersect groundwater and/or where construction impacts on the surface water regimes hydraulically connected to shallow groundwater, including:

- Reshaping of waterways and embankments to accommodate the bridge work at Cosgroves Creek
- Construction of a new culvert under Elizabeth Drive at Oaky Creek

- Trenching for new or realigned stormwater drainage and utilities
- Fill embankments and cuttings
- Dewatering of open excavations and farm dams.

The following sections provides an assessment of the potential impacts that the proposal may have on groundwater conditions during construction.

Groundwater recharge

The impervious surface area within the construction footprint is expected to increase due to the construction of the new paved surfaces. However, this area would be relatively small, and the net impact on regional recharge due to construction of the proposal would be negligible.

Groundwater levels and flows

There is potential that dewatering would be required during construction. Dewatering may be necessary where excavations, or cuts in the topography to achieve the desired road grades, have the potential to intersect groundwater. A number of farm dams are also proposed to be dewatered.

Excavation work during construction would generally be shallow (about one to two metres deep) as required to install stormwater pipes or services. However, there is a small potential that groundwater may be as high as one to two metres below ground level, particularly following rainfall. Dewatering (including of farm dams) may lead to localised groundwater drawdown and cause the surrounding groundwater to flow toward the excavation work. Dewatering would be temporary and generally only required while the construction activity is being carried out to provide safe working conditions.

Minimal dewatering would be required during the bridge construction work. It is a requirement under Transport's QA Specification B59 that temporary casing is to be used whilst bridge pilings are being constructed if groundwater is encountered during construction work. The specifications would be outlined in the Soil and Water Management Plan (refer to Section 6.9.4).

Temporary diversion of the Cosgroves Creek channel to allow construction work to be carried out within the existing creek channel has the potential to impact on groundwater flow patterns and levels, and there is potential for induced hydraulic connectivity between groundwater and surface water locally.

The construction of embankments has the potential to result in localised groundwater mounding conditions, particularly in areas that flood. Inundation can occur from any embankment that obstructs natural drainage pathways. To manage groundwater flow, drainage infrastructure would be constructed in association with the earthworks for the proposal, where possible.

Groundwater quality

Groundwater quality is expected to remain generally consistent with the existing conditions (as described in Section 6.9.2). There is a risk that groundwater quality could be impacted during construction from activities such as the following:

- Unintended spills and leaks of hydrocarbons (oils, fuels and lubricants) and other chemicals related to use of heavy plant, equipment, and fuel storages
- Migration of water mixtures and emulsions related to washdown areas
- Upward seepage along piles/soil interfaces of groundwater from the deeper semi-confined aquifer into the alluvial aquifers
- Compounds leaching from ballast materials through the soil profile to shallow groundwater
- Salts mobilised from surface soils during excavation and/or shallow groundwater level changes
- Disturbance of contaminated land near watercourses resulting in contaminated runoff entering watercourses and potentially to recharge areas
- Seepage from spoil areas / material won from the proposal that may contain unstable sulphide minerals when unsaturated.

Small leaks and spills in the order of a few litres would likely remain in the topsoil until the affected soil is recovered and removed. The concrete slurry which would be used for the installation of bridge pilings at Cosgroves Creek would be alkaline, and could have an impact on the pH and salinity of the groundwater. It is noted that the groundwater in this area is considered to be saline. Changes are likely to be temporary, localised and small given the small contact areas of piling surfaces and groundwater compared to the scale of the groundwater flow systems. The groundwater quality of seepage to

the cuts is expected to be saline. The estimated inflow rate to cuts in rock during construction is likely to be low based on the low hydraulic conductivity of the units.

As stated in Section 6.9.2, there is an extremely low probability of acid sulfate soil occurrence within the construction footprint; however, there is potential for acid sulfate soil to be encountered in water bodies. Where potential acid sulfate soils are present, they would be expected to be limited in vertical extent in localised areas associated with pilings and footings for the bridge structures.

The construction of the proposal has the potential to exacerbate dryland salinity in the construction footprint. Naturally occurring salts, generally present in the soil or groundwater would be transported by rising groundwater associated with the removal of deep-rooted vegetation or other activities which could raise the groundwater table above normal seasonal levels and result in the mobilisation of salts. Moderate to very high-risk areas of saline soils are present throughout the construction footprint. During construction activities, the saline soils have the potential to be disturbed and, as a result, can impact on surface water, shallow groundwater, soil erosion and constructed structures associated with the proposal.

Groundwater users

The closest registered groundwater bore used for extraction purposes (water supply) is about 90 metres north of the construction footprint. Groundwater levels may decrease at bores located within the extent of the groundwater drawdown due to dewatering required for cuts/excavations that intersect shallow groundwater. All dewatering work would be temporary in nature, and a Soil and Water Management Plan would be implemented to monitor groundwater level prior to and during construction. If drawdown at registered boreholes is found to exceed two metres, measures would be taken to address ('make good') the impact in accordance with the NSW Aquifer Interference Policy (NSW DPI, 2012). Further detail on the approach to managing potential impacts to groundwater users is included in Section 6.9.4.

Groundwater dependent ecosystems

There is potential that construction activities could impact the Cumberland River Flat Forest (terrestrial vegetation), an identified high potential terrestrial GDE that intercepts the proposal at Cosgrove Creek and Oaky Creek. Construction activities associated with bridge work have the potential to disrupt groundwater flow, impact groundwater levels, and impact on water quality. Options to minimise interruption to water flows would be considered during detailed design.

Surface water and groundwater interaction

There may be interaction between surface water and groundwater in close proximity to the watercourses traversed by the construction footprint. Primary interactions between surface water and groundwater in proximity to the study area are likely to include:

- Surface water acting as recharge to underlying groundwater units, where hydraulic gradients permit
- Groundwater discharging to surface water as baseflow, especially in areas of low elevation, where hydraulic gradients permit
- Induced flow of surface water into groundwater due to potential groundwater drawdown resultant from dewatering work during construction.

Surface water and groundwater interactions may occur during construction activities involving diversion/reshaping of waterways and embankments and dewatering of farm dams to accommodate the bridgework via induced flow from dewatering activities.

Operation – surface water

Surface water drainage

The proposal's road longitudinal drainage has been designed to accommodate the 10-year average recurrence interval (ARI) storm event (10 per cent annual exceedance probability (AEP)) for the minor storm event and 50 years ARI (two per cent AEP) for the major storm event. The existing impervious area within the operational footprint is about 4.9 hectares. Following the construction of the proposal, this would increase to an impervious area of about 14.1 hectares. About 38.5 per cent of the operational footprint would be impervious.

Increased runoff from impervious areas has the potential to alter the performance of drainage systems immediately downstream of the operational footprint. Appropriate drainage infrastructure would be implemented as part of the proposal to reduce the risk of flooding and scour/erosion.

Surface water quality

Table 6-65 provides a summary of the potential surface water quality related impacts from operation activities on receiving waterways including Cosgroves Creek and Oaky Creek. Each of the potential impacts is considered with respect to the

environmental values and water quality objectives identified in Section 6.9.2 and Section 3 of Appendix L (Surface Water and Groundwater Assessment Report).

With the implementation of safeguards and management measures outlined in Section 6.9.4, as well as proposed stormwater treatment devices and procedures for spills management, potential operational impacts to surface water quality would be appropriately managed. Potential impacts would, therefore, be minor and would not be expected to impact the environmental values and water quality objectives of the receiving environment.

Table 6-65 Potential impacts to surface water quality during operation

Activity/source	Pollutants or factor of concern	Potential impact to receiving waterways and associated water quality objectives
Stormwater runoff from hard surfaces being discharged to receiving waterways Litter from vehicles and incorrect disposal of rubbish can increase the potential for pollutants to occur in road runoff, stormwater systems, treatment systems and receiving environments Damage to or erosion of road pavements, landscaping, batters and stormwater assets from major storm events, leading to potential pollution of the receiving environment and waterways	Gross pollutants, Total Suspended Solids, nutrients, heavy metals, oil, and grease	• Sediments could smother receiving waterways impacting aquatic ecosystems • Increased turbidity, lower dissolved oxygen levels, and increases in toxicant concentrations could impact aquatic ecosystems and livestock • Nutrients in runoff could lead to algal blooms and aquatic weed growth, which could impact aquatic ecosystems, recreation, irrigation, livestock, and aquatic foods • Reduced visual amenity could result from turbid water and visible gross pollutants, impacting recreation and visual amenity These impacts would be largely mitigated by the proposed stormwater treatment devices. However, the environmental protection provided could be compromised by blockages or damage to stormwater treatment systems, leading to poor water quality improvement performance and potential increased pollution to receiving environments
Accidental spills or leakage events due to vehicle movements and operation of the highway	Oil and grease and various hazardous fuels and chemicals that may be transported by vehicles or caused by spills or road accidents	• Increases in toxicant concentration in soil, surface water and groundwater, which could impact aquatic ecosystems, livestock, and aquatic foods
Potential increase in stormwater runoff discharges due to increased imperviousness across the construction footprint	Stormwater runoff	• Increase in scour and erosion due to an increase in stormwater runoff rate and volume, which could impact aquatic ecosystems, amenity, and recreation These impacts would be largely mitigated by the proposed stormwater treatment devices. However, the attenuation protection provided could be compromised by blockages or damage to stormwater treatment systems

Activity/source	Pollutants or factor of concern	Potential impact to receiving waterways and associated water quality objectives
Maintenance of pavements, road assets, stormwater network and treatment systems, and vegetation including: • Repairs to pavement or other infrastructure • Collection of waste and pollutants • Disposal of waste and pollutants • Operation of maintenance equipment	Gross pollutants, sediment, TSS, nutrients, odour and noise, green waste.	• If waste recovered during maintenance operations is not disposed of correctly this could impact visual amenity and recreation, pollute receiving waterways, and negatively impact the downstream aquatic ecosystems

To mitigate the potential surface water quality impacts of the proposal, opportunities for stormwater treatment were considered during the design process. These options aimed to protect the health of waterways in the surface water study area by reducing pollutant loads in stormwater runoff generated by the proposal. To treat stormwater runoff from the proposal, grass swales are proposed for drainage along most of the proposal alignment. Bioretention systems (basins) have also been proposed for six locations along the proposal. No treatment would be provided in 12 per cent of the catchment area due to topographical constraints. The location of the proposed basins is shown in Figure 3-1 to Figure 3-4.

MUSIC modelling software has been used to quantify the extent of treatment provided for the design. The MUSIC modelling results showing the effectiveness of the proposed stormwater treatment train for the proposal in its entirety (including the untreatable catchments) are shown in Table 6-66.

The MUSIC model found that the treatment measures would result in a substantial reduction in pollutants being generated from the road surface of Elizabeth Drive. This reduction in pollutants would help to mitigate the impact to downstream environments and watercourses, which were identified as being in poor and degraded condition in Section 6.9.2.

Table 6-66 MUSIC modelling results for stormwater treatment provided by the proposal

Parameter	Sources (without treatment)	Residual load (with treatment)	Reduction
Flow (millilitres per year)	168	163	3.4%
Total suspended solids (kilograms per year)	59,400	17,200	71%
Total phosphorus (kilograms per year)	99.1	42.2	57.4%
Total nitrogen (kilograms per year)	404	226	44.1%
Gross pollutants (kilograms per year)	4,370	1,020	76.7%

The residual impact of the proposal (with stormwater treatment) was also assessed against the existing condition to determine if the total pollutants discharged to the receiving environment would change in comparison to the existing condition. These results are presented in Table 6-67.

This assessment showed that the proposal would likely result in a substantial reduction of total suspended solids (50 per cent) and total phosphorus (29 per cent), with minor reductions in total nitrogen (six per cent) pollutants in comparison to the existing condition and, therefore, would be of overall benefit to the receiving environment. Consequently, the water quality objectives are not expected to be impacted by the quality of stormwater runoff during the operation phase.

Table 6-67 MUSIC modelling comparison of the existing and post-development scenarios for pollutant load discharges to the receiving environment

Parameter	Existing	Residual load (with treatment)	Change
Flow (millilitres per year)	100	163	63% increase
Total suspended solids (kilograms per year)	37,400	17,200	50% reduction

Parameter	Existing	Residual load (with treatment)	Change
Total phosphorus (kilograms per year)	59.4	42.2	29% reduction
Total nitrogen (kilograms per year)	241	226	6% reduction
Gross pollutants (kilograms per year)	3,060	1,020	67% reduction

Operation – groundwater

Groundwater recharge

Groundwater within the groundwater study area is predominantly recharged by rainfall runoff and infiltration through the soil profile. The impervious surface area within the operational footprint is expected to increase due to the new paved surfaces associated with the proposal. However, this area is small relative to the overall aquifer such that the net impact on regional recharge due to operation of the proposal would be considered negligible.

Groundwater levels and flow

Cosgroves Creek would return to its original channel following construction, once temporary construction work has been removed and disturbed areas rehabilitated. Groundwater levels are expected to return to existing levels. There is potential for constructed embankments to lead to some localised mounding on one side of the embankment, leading to inundation in flood prone areas and/or impacts on local flow patterns and on groundwater levels. Further, long-term inundation areas have potential to impact on embankment stability. Drainage infrastructure as part of this proposal would mitigate potential impacts to groundwater levels and flow.

Groundwater quality

Groundwater quality has the potential to be impacted from accidental spills and leaks of substances as a part of normal operation and maintenance activities. Surface spills are less likely to affect groundwater where the proposal intersects the Bringelly Shale due to the lower rate of recharge and higher rate of runoff that occurs over the weathered bedrock. Should a major spill occur that reaches the water table, there is potential that the contaminated groundwater would slowly migrate towards the local creeks. With standard industry management techniques and the recommended safeguards, the potential for adverse impacts to occur to groundwater quality is considered low. Sufficient flow attenuation is provided in the road stormwater drainage network and treatment systems to allow for spills to be contained and treated through normal emergency response procedures.

Groundwater users

Potential impacts on groundwater users during the operation of the proposal are considered limited. No dewatering is required during operation and groundwater levels are expected to recover to pre-construction levels upon completion of construction. The nearest registered groundwater bore, used for stock, is located 90 metres north of the proposal. Impacts to groundwater availability would be negligible as the proposal does not require groundwater extraction during operation and would not inhibit recharge.

Groundwater dependent ecosystems

No dewatering would be required during the operation of the proposal. Cosgroves Creek would return to its original channel, temporary construction work would have been removed, and disturbed areas rehabilitated. Groundwater levels are also expected to recover to pre-construction levels after construction activities for the proposal have been completed. There is potential for GDEs to be impacted from poor groundwater quality due to contaminated surface water runoff caused by spills or leaks in areas of high hydraulic connectivity. The potential for interaction with groundwater during operation is low given the expected depth of groundwater along the proposal alignment.

Surface water and groundwater interaction

There is potential that contaminated surface water runoff, due to spills or leaks, may impact on groundwater quality where it is hydraulically connected. Potential contamination risk is assessed in Section 6.11.

6.9.4 Safeguards and management measures

Table 6-68 describes the proposed safeguards and management measures that would be implemented to manage the proposal's potential surface water and groundwater impacts.

Table 6-68 Safeguards and management measures – surface water and groundwater

Impact	Environmental safeguards	Responsibility	Timing	Reference
Surface water and groundwater – Sydney Water stormwater scheme	Transport will liaise with Sydney Water regarding the Western Sydney Aerotropolis integrated water system scheme at the detailed design phase of the proposal, as relevant Consultation will be carried out in regard to the stormwater network, drinking water, wastewater and recycled water networks	Transport	Detailed design	Additional safeguard
Surface water and groundwater	A Soil and Water Management Plan will be prepared in accordance with QA Specification G38 and implemented as part of the CEMP. The Soil and Water Management Plan will identify all reasonably foreseeable risks relating to surface water and groundwater quality, and water pollution associated with carrying out the activity. It will describe how these risks would be managed and minimised during construction. This will include arrangements for managing pollution risks associated with spillage or contamination on the site and adjoining areas. Monitoring of surface water and groundwater quality will be carried out prior to, during and after construction. This will include key watercourses, and farm dams potentially impacted by the proposal	Contractor	Pre-construction / Construction	Section 2.1 of QA G38 Soil and Water Managemen2
Surface water and groundwater	The anticipated water discharge from sediment basins will be assessed in line with the Guideline for Assessing the Impacts of Treated Water Discharge from Water Quality Treatment Controls (Transport for NSW, 2020). The results of such assessment will inform design of sediment basins to adhere to Environment Protection Licence discharge requirements	Contractor	Pre-construction	Additional safeguard
Surface water and groundwater	A site-specific Erosion and Sediment Control Plan (the plan) will be prepared and implemented and included in the Soil and Water Management Plan (part of the CEMP). The plan will identify detailed measures and controls to be applied to minimise erosion and sediment control risks including, but not limited to: • Runoff, diversion, and drainage points • Sediment basins and sumps • Scour protection • Stabilising disturbed areas as soon as possible • Check dams, fencing and swales • Installation of measures at work entry and exit points to minimise movement of material onto adjoining roads at entry and exit points • Staged implementation arrangements • Appropriate location and storage of construction materials, fuels, and chemicals, including bunding where	Contractor	Pre-construction / construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	appropriate • Arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather			
Surface water and groundwater	Stockpiles will be designed, established, operated, and decommissioned in accordance with the Stockpile Site Management Guideline (RMS, 2015)	Contractor	Pre-construction / construction	Additional safeguard
Surface water and groundwater	The rehabilitation of disturbed areas will be carried out progressively as construction stages are completed, and in accordance with: • Landcom's Managing Urban Stormwater: Soils and Construction series (Landcom, 2004) • RMS Landscape design guideline (RMS, 2018) • RMS Guideline for Batter Stabilisation using Vegetation (RMS, 2015)	Contractor	Construction	Additional safeguard
Surface water and groundwater	The proposed bioretention basins will be established as construction sediment basins during the construction stage of the proposal to capture sediment and other pollutants mobilised during construction	Contractor	Pre-construction/Construction	Additional safeguard
Surface water and groundwater	Road drainage will be treated by sediment basins. The requirements for sediment basins (ie number, location, and size) would be determined during the proposal detailed design phase	Contractor	Pre-construction/Construction	Additional safeguard
Surface water and groundwater	A site-specific emergency spill plan will include spill management measures in accordance with the Transport for NSW *Code of Practice for Water Management* (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport and EPA officers), regular inspections and maintenance of equipment and spill-control structures such as hardstand areas and containment	Contractor	Pre-construction	Section 4.3 of QA G36 Environment Protection
Surface water and groundwater	Waste recovered during maintenance will be disposed of correctly. The proposed bioretention basins will undergo regular scheduled maintenance to ensure the ongoing treatment efficiency during the road's operational life	Transport	Operation	Additional safeguard
Surface water and groundwater	Any dewatering activities will be carried out in accordance with the 'Technical Guideline – Environmental Management of Construction Site Dewatering' (Roads and Maritime, 2011) in a manner that prevents pollution of waters	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Surface water and groundwater	Construction within areas of moderate to very high-risk saline soils will be managed in accordance with the Soil and Water Management Plan and procedures set out in the Salinity Training Handbook (NSW Department of Primary Industries, 2014). Specific measures will also include (but not be limited to): • Identification and management of saline discharge sites, for example seepage from cuts • Testing to confirm the presence of saline soils in areas of high salinity potential prior to disturbance • Progressive stabilisation and revegetation of exposed areas following disturbance as soon as is practicable • Groundwater quality monitoring carried out prior to and throughout construction	Contractor	Construction	Additional safeguard
Surface water and groundwater	Prior to ground disturbance in areas of potential acid sulfate soil occurrence, testing will be carried out to determine the actual presence of acid sulfate soils. If acid sulfate soils are encountered, they will be managed in accordance with the Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998) and the Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (NSW Roads and Traffic Authority, 2005)	Contractor	Pre-construction / construction	Additional safeguard
Surface water and groundwater	Sediment and erosion controls are to be used for in-stream works to avoid impacts on water quality and fish passage e.g. erosion fencing, stockpile covers and silt curtains. Clean rock is to be used for any instream temporary rock platforms	Contactor	Construction	Additional safeguard

Other safeguards and management measures that are relevant to the management of potential surface water and groundwater impacts are identified in the following sections:

- Section 6.9, which outlines safeguards and management measures regarding hydrology and flooding
- Section 6.11, which outlines safeguards and management measures regarding geology, soils and contamination.

6.10 Hydrology and flooding

A Hydraulic Impact and Flooding Assessment was prepared for the broader Elizabeth Drive upgrades (ie inclusive of the proposal as well as Elizabeth Drive – East Upgrade) and is appended to Appendix L (Surface Water and Groundwater Assessment Report). Relevant aspects for the proposal have been summarised in this section. A description of drainage infrastructure to be constructed as part of the proposal is outlined in Chapter 3 (Proposal description).

6.10.1 Methodology

The hydrology and flooding assessment adopted the following methodology:

- Definition of the catchments that would be impacted by the proposal and identification of upstream and downstream environments potentially impacted by the proposal, based on publicly available information
- Review of existing, publicly available flood studies and existing flood conditions. This included review of previous hydrologic (DRAINS) and hydraulic (TUFLOW) models developed by Lyall and Associates (2019) for the existing Elizabeth Drive
- Development of updated flood modelling using TUFLOW software with hydrologic inputs derived from the flood model RAFTS for a number of design events including, 50 per cent, 20 per cent, 10 per cent, five per cent, two per cent and one per cent. The 0.05 per cent AEP and Probable Maximum Flood (PMF) events were also assessed. The design events were assessed within an approximate extent of 4.4 kilometres downstream and 3.5 kilometres upstream of the construction footprint. The assessment outlined in this chapter focusses primarily on the one per cent AEP event, with further detail on other events included in the Hydraulic Impact and Flooding Assessment (appended to Appendix L (Surface Water and Groundwater Assessment Report)). Development of the updated flood modelling was carried out to:
  - Apply recommendations of Australian Rainfall and Runoff (ARR) 2019 guidelines, noting that the previous model applied ARR 1987 guidelines
  - Incorporate a 'future base case' scenario, which includes the existing Elizabeth Drive and associated hydraulic infrastructure, and the WSA and the M12 Motorway to represent existing flood conditions
  - Incorporate the proposal design, including the proposed road design and drainage upgrades
  - Review of the 'future base case' scenario to identify existing flood conditions in relation to Cosgroves Creek and Oaky Creek (noting that the modelling results are generally specific to the construction footprint)
- Identification of potential impacts of construction (including the proposed construction compound/laydown sites) and operation on existing flow paths and flooding
- Establishment of key design criteria, for which flooding at bridge crossings during operation has been assessed against
- Review of existing flood conditions and the design flood simulations to determine the flood immunity for the proposal, and the potential for off-site impacts downstream and upstream
- Preliminary desktop based assessment to estimate the number of buildings potentially impacted by above floor flooding in the 'future base case' and 'design case' conditions during a one per cent AEP flood event. This included:
  - Identification of potentially impacted building extents, based on data sourced from Bing Maps (2020)
  - Identification of the ground level centroid of each building, using LiDAR data
  - Review of one per cent AEP peak flood levels at the centroid of each building, using the TUFLOW hydraulic model
  - In the absence of floor level survey, all building floor levels were assumed to be 300 millimetres above ground level at the centroid of each building. A floor level survey would be required during detailed design to ascertain ground floor heights
- Preliminary desktop based lot-by-lot property impact assessment to identify potential property areas that may experience afflux during a one per cent AEP flood event. This included the identification of the following:
  - Lot numbers of potentially impacted properties, based on data sourced from SIX maps
  - Afflux within each property, categorised into flood depths of over 10 millimetres, 20 millimetres, 50 millimetres or 100 millimetres
  - Extent of afflux within each property by calculation of area (m2) and percentage of flooded areas
  - Identification of newly flooded areas of land (i.e. was previously dry, now wetted)
  - Completion of a sensitivity analysis of the one per cent AEP flood event assessment during operation to assess potential impacts of climate change on flood levels
  - Completion of a sensitivity analysis of the PMF event assessment during operation to identify potential worst case impacts

- Identification of safeguards and management measures to manage potential flooding impacts.

Flood modelling was carried out for the wider Elizabeth Drive upgrades (Elizabeth Drive West Upgrade and Elizabeth Drive East Upgrade) and included models for the Cosgroves Creek catchment (including sub catchments of Cosgroves Creek and Oaky Creek) and South Creek catchment (including sub catchments of Badgerys Creek, South Creek and Kemps Creek). The Cosgroves Creek model catchment is relevant to the proposal.

6.10.2 Existing environment

A hydraulic Impact and flooding assessment carried out by AECOM identified the general existing flood conditions along Elizabeth Drive for the Cosgroves Creek model catchment, which includes Cosgroves Creek and Oaky Creek. The assessment determined that Elizabeth Drive is subject to relatively shallow depth of flood inundation for events as frequent as the 50 per cent (1 in 2) AEP.

The construction footprint is located on the floodplain of Cosgroves Creek, which is a major tributary of the Hawkesbury-Nepean River and generally to the north, is joined by Oaky Creek which then joins to South Creek, until it flows into the Hawkesbury River, near Windsor.

The Cosgroves Creek model catchment area largely comprises agricultural-related land uses (such as grazing modified pastures and farm infrastructure), and some rural and rural residential areas. The WSA (currently under construction), located to the south and south-east of the catchment, and M12 Motorway located within the model catchment in an east-west alignment, have been considered in identifying the terrain for the flood modelling. Run-off from WSA is anticipated to contribute to the Cosgroves Creek model catchment, and the M12 Motorway has the potential to influence the flood behaviours around Elizabeth Drive.

Along the existing Elizabeth Drive road corridor, the flood hazard category is generally H1 (generally safe) on the crest and H2 (unsafe for small vehicles) on the verge during the one per cent AEP event. Cosgroves Creek and Oaky Creek reach up to hazard classification H5 (unsafe for all people/vehicles) and H6 (unconditionally dangerous) during the one per cent AEP event.

There are two existing main flow path crossings along the section of Elizabeth Drive within the construction footprint – a bridge at Cosgroves Creek and a culvert at Oaky Creek. There are also a number of existing culvert crossings that convey flow beneath the road at local valleys across the Elizabeth Drive alignment.

The baseline flood behaviour for both creek crossings is described in the following sections.

Figure 6-22 shows the existing flooding environment (ie the future base case) during the one per cent AEP event.

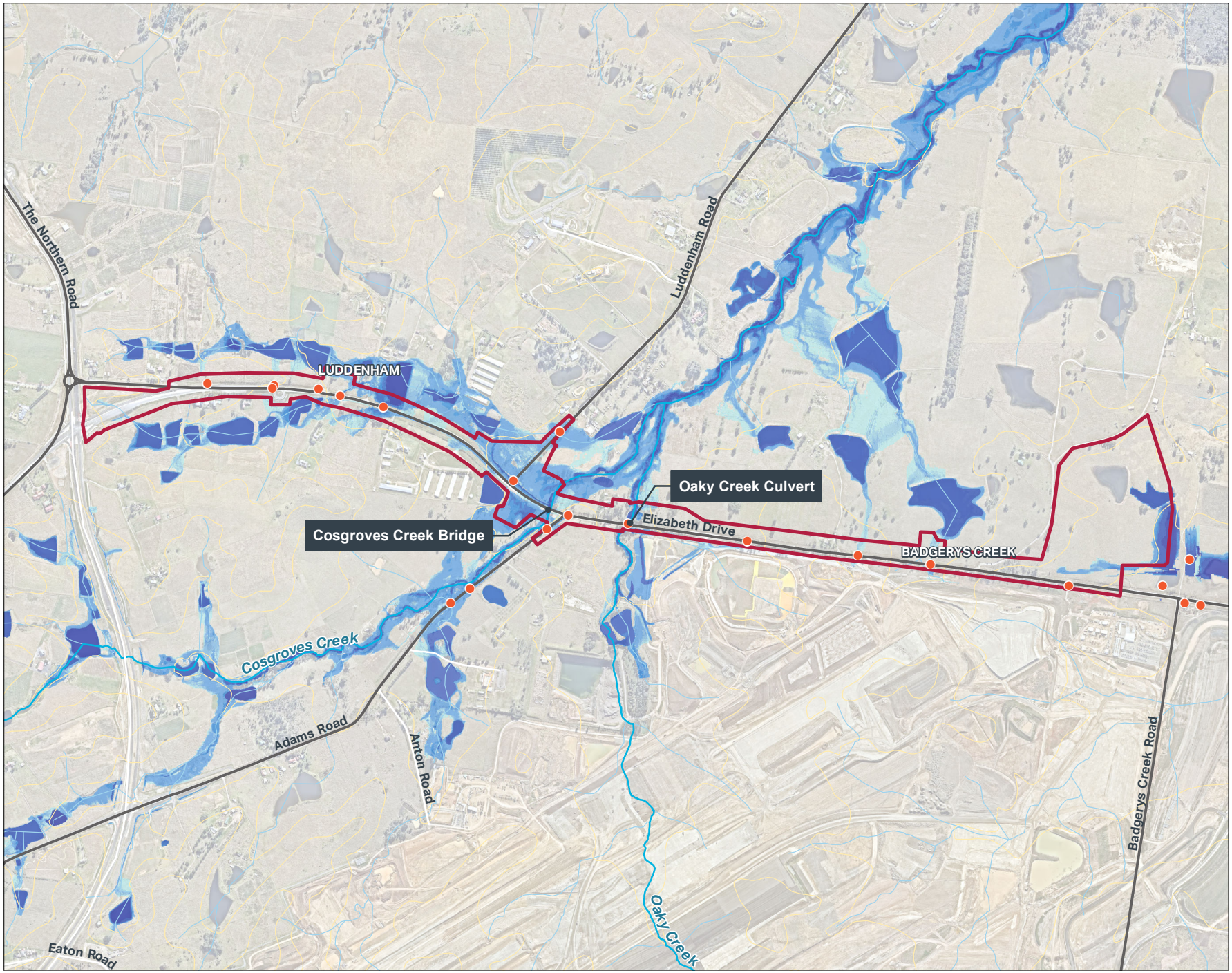


FIGURE 6-22:
EXISTING FLOODING CONDITIONS (ONE PER CENT AEP EVENT)

N

0 250 500 m

Legend

- Construction footprint
- Primary road
- Watercourse
- Drainage line
- 10m contour
- Culvert

1% AEP Peak Flood Depth (m)

- <=0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.12 - 0.5
- 0.52 - 0.75
- 0.75 - 1.00
- 1.00 - 2.00
- 2.00 - 7.00
- >7.00

Cosgroves Creek

Cosgroves Creek is the main tributary in the modelled catchment. Review of the future base case modelling results indicates that the flowpath starts about 2.5 kilometres upstream of the construction footprint. Overland flow is generally H1 hazard category (generally safe) for the one per cent AEP, along the western and eastern sides of Cosgroves Creek, up to 60 metres. One per cent AEP flows are mostly contained within Cosgroves Creek with no significant overland flow, indicating that the area is not substantially flood prone.

The total flow passing under Cosgroves Creek bridge is estimated to be about 230 cubic metres per second in the one per cent AEP flood event. Freeboard is not achieved at the bridge soffit, but the bridge deck is not overtopped. Peak flood velocities generally do not exceed 2.5 metres per second.

Overtopping occurs over Luddenham Road and Elizabeth Drive in the one per cent AEP storm event, with generally shallow depths (less than 200 millimetres), and some sections of Elizabeth Drive overtopped by depths of up to 500 millimetres. There are multiple farms dams within the area acting as flood storage areas.

Oaky Creek

Oaky Creek is connected to Cosgroves Creek (the main tributary) and intercepts Elizabeth Drive about 300 metres to the east of Cosgroves Creek bridge. One per cent AEP flows are contained within the banks of Oaky Creek, with no significant overland flow, indicating that the area is not substantially flood prone. These flows are estimated to be about 16 cubic metres per second in the one per cent AEP storm event, with adequate freeboard.

6.10.3 Potential impacts

Construction

The following construction activities have the potential to impact existing flood behaviour and hydrology:

- Construction and operation of ancillary facilities, which may include site establishment, delivery of plant, equipment and materials, storage of fuels and chemicals, concrete batching, material crushing and spoil management
- Construction of the twin bridges over Cosgroves Creek and culvert at Oaky Creek
- Upgrade of the Elizabeth Drive-Luddenham Road intersection
- Road widening and construction of shared walking and cycling paths along Elizabeth Drive.

Further detail on proposed construction activities is provided in Chapter 3 (Description of the proposal).

Potential impacts associated with flooding could occur where construction activities are located within the flood affected zones. If inundated during a flood, the material, fuel, chemicals and equipment stored in stockpile and compound sites could wash away. This could impact the surrounding environment, particularly adjacent waterbodies. Compounds and stockpiles could also affect flood flow paths, if inappropriately located.

Potential impacts during construction may include:

- Work sites may increase runoff volumes and peak flows (eg maximum flow rates) following rainfall events due to an increase in impermeable surfaces or soil compaction
- Drainage infrastructure may become blocked (eg by soil, vegetation, waste) or temporarily diverted due to construction activities
- Earthworks during construction could alter overland flow paths, which could direct more flow to some areas. This would risk overloading existing drainage systems
- Instream construction work and temporary diversion of Cosgroves Creek could impact existing surface water behaviour.

Passage of floodwaters are not likely to change as a result of construction activities if existing drainage paths are not blocked or redirected. If existing cross drainage structures were to become partially or fully blocked as part of construction work, then floodwaters could potentially overtop the road during frequent rainfall events. This would present a safety risk to traffic moving along Elizabeth Drive and other nearby roads. Construction activities would be managed to minimise the potential for drainage infrastructure to become blocked or obstructed.

Figure 6-23 shows the peak flood depths in the study area for the one per cent AEP storm events.

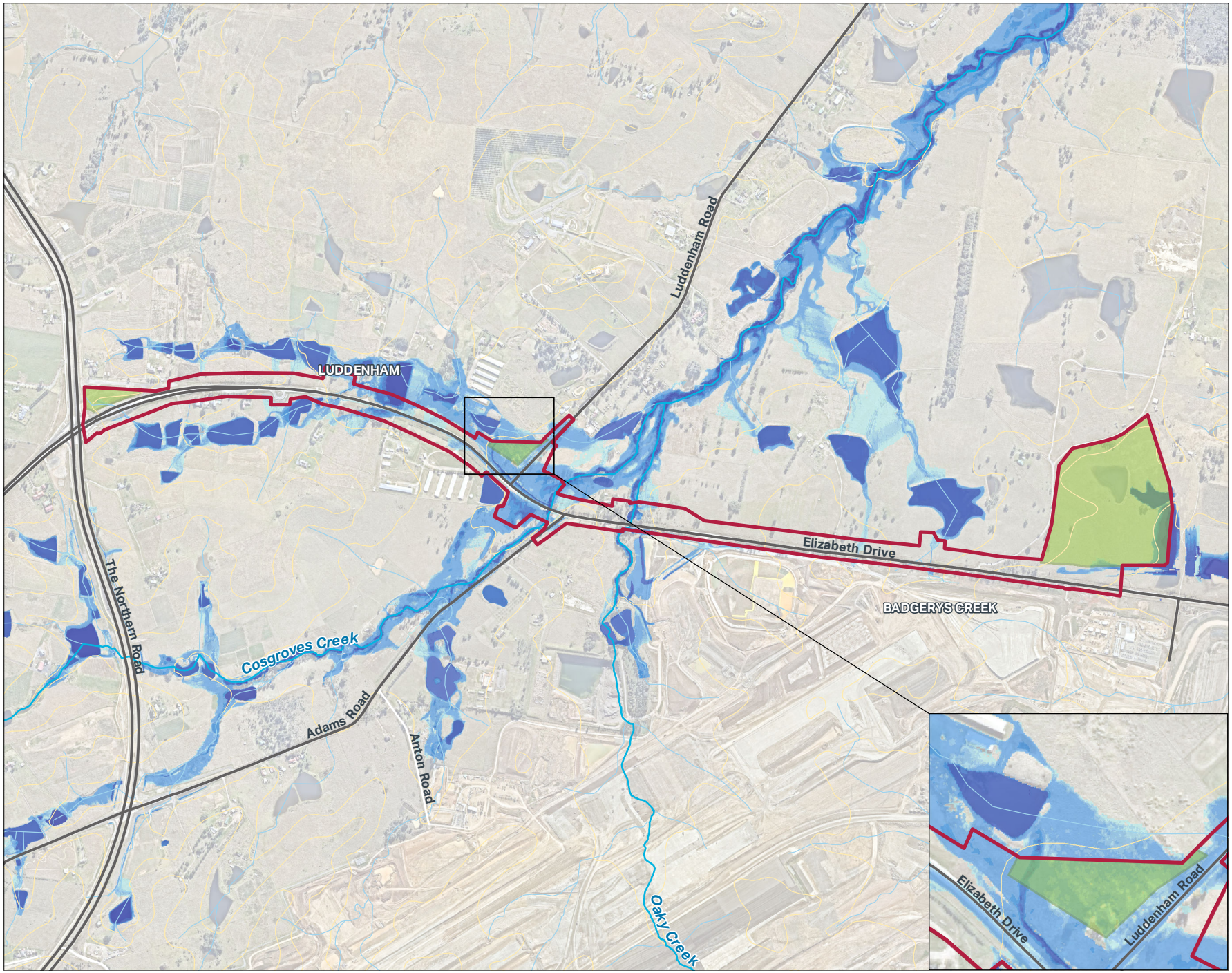


FIGURE 6-23:
CONSTRUCTION ANCILLARY FACILITIES UNDER A ONE PER CENT AEP STORM EVENT

N

0 250 500 m

Legend

- Construction footprint
- Construction ancillary facility
- Primary road
- Watercourse
- Drainage line
- 10m contour

1% AEP Peak Flood Depth (m)

- <=0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.12 - 0.5
- 0.52 - 0.75
- 0.75 - 1.00
- 1.00 - 2.00
- 2.00 - 7.00
- >7.00

Operation

One per cent AEP assessment

An overview of the changes in flood levels (afflux) during operation of the proposal for the one per cent AEP flood event is shown in Figure 6-24.

Flood modelling carried out for the proposal for flood events up to and including the one per cent AEP show that:

- Elizabeth Drive would not be overtopped by flooding during the one per cent AEP flood event
- Afflux of greater than 100 millimetres would generally be contained to isolated areas within the road corridor, with the exception of one privately owned land parcel located immediately south-west of the Elizabeth Drive and Adams Road intersection (Lot 106 / DP 846962). This property has the potential to experience a maximum afflux of 130 millimetres. This increase would generally be contained within Cosgroves Creek on land zoned as ENZ – Environment and Recreation. No buildings have been identified in the affected area based on a review of aerial imagery
- Flood extents would be materially unchanged compared to the future base case
- Flow velocities on the floodplain would not significantly increase. The maximum velocities during the one per cent AEP flood event would not exceed 2.5 metres per second, consistent with the future base case
- There would be no material increases in flood hazard categorisation outside of the construction footprint. Modelling results indicate that potential increases in flood hazard would be generally contained within creeks and design drains located in land zoned as ENZ – Environment and Recreation, while other areas are also estimated to result in reductions in flood hazard.

A building impact assessment was carried out for the Cosgroves Creek model catchment. One building was identified as likely to experience above floor flood impacts in both the future base case (without the proposal) or the design case (with the proposal), assuming that floor levels are about 300 millimetres above ground level. The depth of above floor flooding at this building is not anticipated to increase due to construction of the proposal.

Potential impacts to buildings cannot be fully assessed in the absence of a detailed building floor level survey. Further survey would be carried out to confirm floor levels of potentially affected properties (refer to Section 6.10.4).

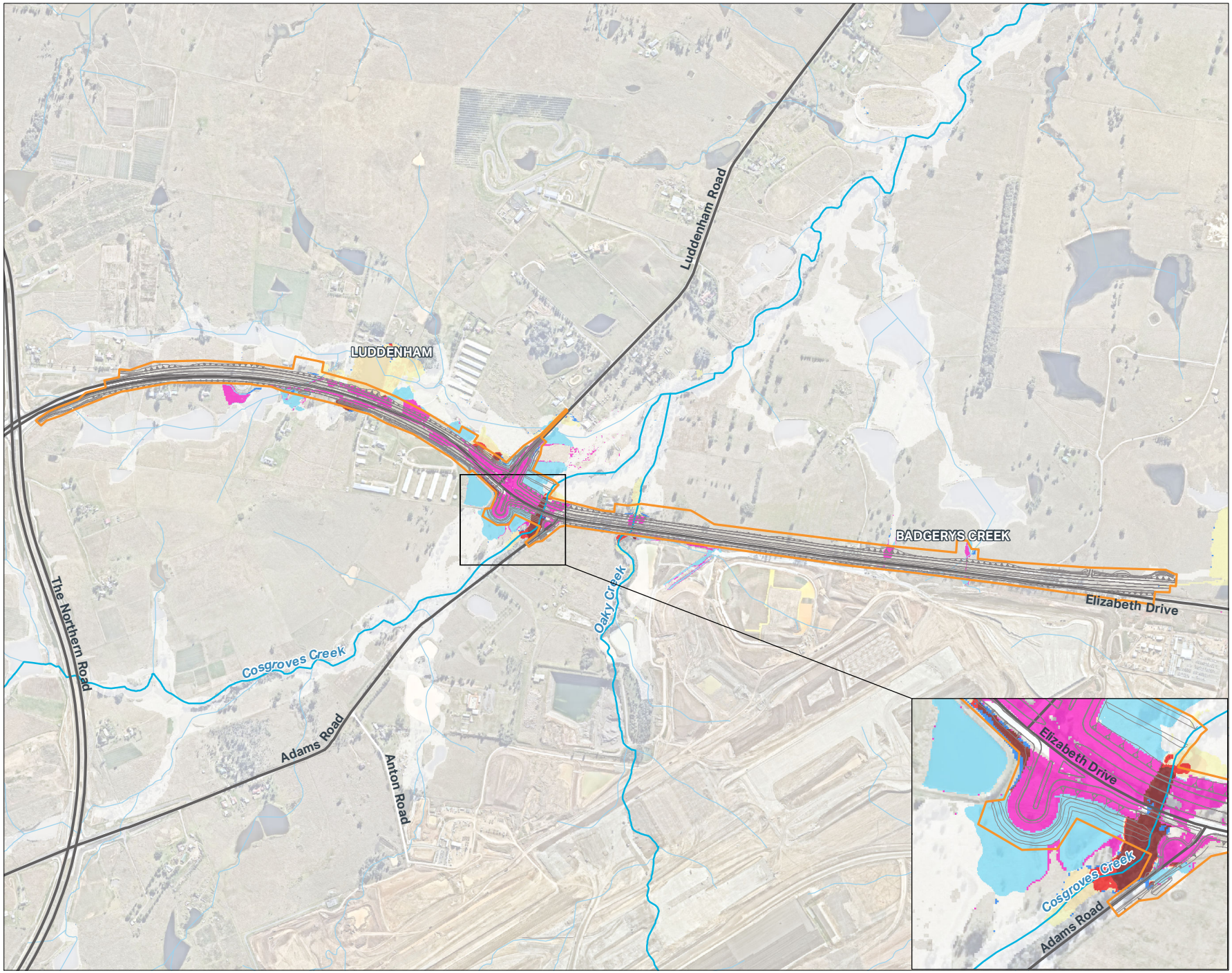


FIGURE 6-24:
CHANGES IN FLOOD LEVELS DURING OPERATION (ONE PER CENT AEP EVENT)

N

0 250 500 m

Legend

- Operational footprint
- Road design
- Primary road
- Watercourse
- Drainage line

Afflux (mm)

- <10
- -10 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- >100
- Was dry, now wet
- Was wet, now dry

A property impact assessment was carried out for lots within the modelled area. A detailed tabulated summary of these modelled results is provided in the Hydraulic Impact and Flooding Assessment (appended to Appendix L (Surface Water and Groundwater Assessment Report)). A summary of these results is provided below:

- A total of 10 properties have been modelled to experience afflux that is greater than 100 millimetres over more than five square metres of the lot area
- A total of 11 properties have been modelled to contain newly inundated land with the 'design case', which were not previously inundated in the 'future base case' across an area of land that is greater than five square metres
- One property has been modelled to contain newly inundated land with the 'design case', which was not previously inundated in the 'future base case', across an area of land that is greater than five per cent of the lot area.

During detailed design, consideration would be given to minimising and mitigating this afflux where possible.

As the proposed Elizabeth Drive road corridor would not be overtopped during a one per cent AEP design flood event, there would be no increase in the duration of road inundations. There would also be a substantial reduction in the frequency of road closures, and a subsequent safety improvement for road users as a result of the proposal.

Climate change assessment

An assessment of climate change impacts has also been carried out to consider a worst-case scenario during the one per cent AEP flood event. Inclusion of these impacts would result in substantial increases of flood levels compared to the operational levels assessment (without climate change). This would include an increase in flood levels of up to 110 millimetres in the Cosgroves Creek channel, and by about 130 millimetres at the Cosgroves Creek crossing. A small section of road overtopping would occur to the west of the bridge over Cosgroves Creek. There would also be additional areas which were 'dry' and are 'wet' extending from the creeks. These additional 'wet' areas would not affect any additional habitable dwellings.

PMF assessment

A PMF assessment has been carried out to provide an indication of the worst-case flow rate and associated impacts, which would generally be greater compared to more frequent flood events. Results indicate that increased impacts upstream of the Elizabeth Drive road corridor are predicted due to more water being held by the road. Consequently, there would be some reductions in the water level downstream. Further, afflux upstream of the road corridor compared to the future base case would exceed 1,600 millimetres and 700 millimetres at Cosgroves Creek and Oaky Creek respectively. Velocities would slightly exceed two metres per second on the floodplain. The majority of the road corridor would also be overtopped, with about a 150-metre stretch changing from 'dry' and to 'wet', where depths would vary substantially.

6.10.4 Safeguards and management measures

Table 6-69 describes the proposed safeguards and management measures that would be implemented to manage the proposal's potential hydrology and flooding impacts.

Table 6-69 Safeguards and management measures – hydrology and flooding

Impact	Environmental safeguards	Responsibility	Timing	Reference
Flooding and hydrology	Further design refinement will be carried out generally within the vicinity of creeks which traverse the proposal, to minimise potential increases in the afflux where possible (for example, refining the sizing of culverts and drainage infrastructure)	Transport	Detailed design	Additional safeguard
Flooding and hydrology	Floor level surveys will be carried out at buildings within the modelled area, to ascertain ground floor heights	Transport	Detailed design	Additional safeguard
Flooding and hydrology	A Flood Response Management Plan will be prepared as part of the CEMP. The Flood Response Management Plan will address, but not necessarily be limited to: • Processes for monitoring and mitigation flood risk	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• Steps to be taken in the event of a flood warning including removal or securing of loose material, equipment, fuels and chemicals • Monitoring long term rainfall forecasts and scheduling high risk work activities around these forecasts • Identifying contingency locations for the temporary flood storage of equipment and materials outside of potential inundation areas • Contingency measures to secure and stabilise work areas and compound sites prior to flooding			

Other safeguards and management measures that are relevant to the management of potential flooding and hydrology impacts are identified in Section 6.9, which outlines safeguards and management measures regarding surface water and groundwater.

6.11 Geology, soils and contamination

The potential contamination risk associated with the proposal has been assessed as part of the Phase 1 Contamination Assessment. A summary of this assessment is presented in this section, with the full report provided in Appendix M (Phase 1 Contamination Assessment Report).

6.11.1 Methodology

The geology and soils assessment adopted the following methodology:

- Desktop review of publicly available information on geology, soils and land use within the study area
- Definition of the construction footprint likely to impact soils
- Identification of potential impacts of construction (including construction ancillary facilities) on soils, and assessment of soil erosion risk
- Identification of potential impacts of operational activities on soils, including consideration of soil contamination
- Identification of safeguards and management measures to manage potential impacts to geology and soils.

The contamination assessment adopted the following methodology:

- Desktop review of the land use history of the study area through the review of publicly available information including historic aerial photograph, and previous investigation reports
- Review of NSW EPA databases on the contaminated land record and NSW EPA's POEO Act licences for the construction footprint and Liverpool and Penrith LGAs
- Examination of mapping related to:
  - Geology, soil, topography, and registered groundwater bore maps
  - Acid sulfate soil and salinity risk maps
  - Department of Defence unexploded ordnance risk mapping
  - NSW EPA priority per- and polyfluoroalkyl substances (PFAS) investigation risk sites within 10 kilometres of the proposal extents/sites

- A site inspection on 31 May 2022, limited to a visual inspection along the Elizabeth Drive alignment. The inspection looked for obvious signs of contamination and ground truthed the desktop review, taking photographs and notes accordingly
- Identification of Areas of Potential Environmental Concern (APECs) based on information gathered during the desktop review and site inspection
- Development of a Conceptual Site Model (CSM) to describe potential sources of contamination, pathways by which contaminants may be transmitted through the environment and the receivers that may be exposed to the contaminants
- Identification of safeguards and management measures to manage potential contamination impacts.

The study area for geology, soils and contamination is a one kilometre buffer from the construction footprint.

6.11.2 Existing environment

Topography

The study area slopes to the east from an initial elevation of about 90 metres Australian Height Datum (AHD) and reaches about 60 metres AHD at the eastern boundary of the construction footprint.

Geology

According to the Penrith 1:100,000 Geological Map (Geological Survey of NSW, 1991), there are two surface geological units within the study area: Quartenary alluvium, and Middle Triassic Bringelly Shale of the Wianamatta Group. Quartenary alluvium is comprised of fine-grained sand, silt and clay and is present within areas of surface water features including Cosgroves Creek and Oaky Creek. The Bringelly Shale is comprised of shale, carbonaceous claystone, claystone, laminate, fine to medium grained lithic sandstone, rare coal and tuff.

Soils

There are three different soil types within the study area, outlined in Table 6-70.

Table 6-70 Soil landscape characteristics

Soil landscape	Landscape	Soil limitations
Blacktown residual soils	Residual soils located in gently undulating terrain on Bringelly Shale between creek channels.	• Moderate erodibility • Strongly acidic • Hard setting • High shrink-swell potential • Low permeability • Low salinity
Luddenham erosional soils	Erosional soils located on the undulating to rolling low hills on Bringelly Shale within the western portion of the proposal	• High erosion hazard • High shrink-swell potential • Low wet strength • Low permeability
South Creek alluvial deposits	Alluvial deposits located within the drainage depressions of Cosgrove and Oaky Creek	• High to very high erodibility • Hard setting • Strongly acidic • Saline • Seasonal waterlogging

Saline soils

As outlined in Section 6.9.2, soils within the western portion of the construction footprint generally have a moderate to high overall salinity hazard, while soils within the eastern portion of the construction footprint have a very high salinity hazard.

Acid sulfate soils

As outlined in Section 6.9.2, the acid sulfate soil risk within the study area is class C, with extremely low probability of occurrence.

Contamination

Site history

A review of site history information, including historical aerial photographs of the study area and surrounds, indicates that the construction footprint has been a road since before 1949. The alignment of the road does not appear to have altered significantly since 1949; therefore, it is unlikely any other site uses would have been present along the alignment since its construction.

The surrounding area was originally vacant farmland. Development intensified during the 1970s, where the greatest changes to the land through land clearing and construction occurred. The predominant land use of the area to this day is rural / agricultural.

Existing contamination

A review of relevant contamination databases and mapping identified the following:

- No sites within the study area that are on the contaminated land public register
- No PFAS investigation or management program sites located within proximity to the construction footprint
- One registered Waste Management and Liquid Fuel Facility (Sita Australia Pty Ltd) located about 930 metres east of the construction footprint, which is a landfill
- Three licenced activities under the POEO Act within the study area, including road construction activities, broiler farming (with a listed activity of bird accommodation), and crushing, grinding or separating operations
- A number of former licenced activities under the POEO Act within proximity to the study area that are now listed as revoked or surrendered, generally relating to extraction and waste storage or application of herbicides.

No obvious signs of contamination were identified within the study area during the site inspection.

Areas of potential environmental concern

Although no obvious signs of contamination were detected during the desktop review and site inspection, based on the desktop review, APECs were identified within the study area associated with the uncharacterised fill, fly tipped waste and areas of former and current agricultural land. These APECs, the relevant contaminants of potential concern, and the likelihood for risk of contamination are described further in Table 6-71.

Table 6-71 APECs and likelihood of risk

Source area	Location	Contaminants of potential concern	Likelihood for risk of contamination
Uncontrolled fill within the construction footprint	Within the construction footprint	Asbestos, heavy metals, Organochlorine pesticides (OCP) and Organophosphate pesticides (OPP)	High – There is the potential for contaminated fill which could potentially be widespread. More information is required through the collection of samples to characterise this potential source. This would be carried out as part of the Phase 2 Contamination Assessment (refer to Section 6.11.4)
Contaminated material produced from fly tipping	Within the construction footprint	Asbestos, heavy metals, OCP and OPP	Low – No obvious signs of fly tipping were observed during the site inspection. Any instances of fly tipping are unlikely to be widespread
Areas of former and current agricultural land including former building structures	Within the construction footprint	Asbestos, heavy metals, OCP and OPP, petroleum hydrocarbons	High – There is the potential for contamination to be present based on past or current agricultural land use and past demolition of former structures

6.11.3 Potential impacts

Construction

Erosion and sedimentation

The proposal would involve:

- Stripping, stockpiling and management of topsoil, sub-soil, and material unsuitable for re-use
- Earthworks associated with filling for the new road, including the construction of raised embankments, retaining walls and sections of cutting
- Vegetation removal.

If not adequately managed, these construction activities could potentially have the following impacts:

- Erosion of exposed soil and stockpiled materials
- An increase in sediment loads entering nearby watercourses.

With the implementation of erosion and sedimentation controls outlined in Section 6.9.4 and Section 6.11.4, potential construction related erosion and sedimentation impacts would be appropriately managed and would be minor. Surface water quality impacts associated with construction of the proposal are described further in Section 6.9.

Salinity

The construction of the proposal has the potential to exacerbate dryland salinity in the construction footprint where the groundwater table is impacted by construction work. Given impacts to the groundwater table are anticipated to be minor (refer to Section 6.9), the proposal is unlikely to contribute to dryland salinity.

Acid sulfate soils

Given there is an extremely low probability of acid sulfate soil occurrence within the construction footprint, there is a low risk of encountering acid sulfate soils during construction of the proposal.

Contamination

A Conceptual Site Model (CSM) was developed to identify the mechanisms by which potential and/or complete exposure pathways may exist between known or potential sources of site impacts, and human or ecological receptors. Whilst the CSM did not identify obvious sources of contamination, at this preliminary stage of assessment, it was determined that likely sources would include, uncontrolled fill, fly tipped waste and current / former agricultural land.

The CSM identified human receptors and exposure pathways as outlined in Table 6-72 below.

Table 6-72 CoPC and relevant exposure pathways to human receptors

CoPC within the construction footprint	Potential exposure pathways to human receptors	Potential receptors (as described in Section 6.11.2)
Asbestos	• Inhalation of soil derived dust in indoor and/or outdoor air • Inhalation of soil (dust) within a trench	• On site intrusive (ie ground excavation) maintenance workers (eg demolition contractors) • Off site residents • Off site groundwater bores • Off site recreational users • Off site intrusive maintenance workers
Heavy metals (lead) OCP and OPP Petroleum hydrocarbons	• Dermal contact and incidental ingestion of soil • Inhalation of soil derived dust in indoor and/or outdoor air • Dermal contact and incidental ingestion of surface water • Inhalation of soil vapours in outdoor air	• On site intrusive (ie ground excavation) maintenance workers (eg demolition contractors) • Off site residents • Off site groundwater bores • Off site recreational users • Off site intrusive maintenance workers

CoPC within the construction footprint	Potential exposure pathways to human receptors	Potential receptors (as described in Section 6.11.2)
	• Inhalation of soil (dust) within a trench	

Ecological receptors within the study area would likely be restricted to grass patches along the border of Elizabeth Drive.

Additional potential sensitive ecological receptors located within the study area would include:

- Cosgrove and Oaky Creeks which cross the alignment near Adams Road
- Private dams located on various properties that border the Elizabeth Drive alignment

Terrestrial GDEs mapped within a two kilometre buffer from the construction footprint, including:

- Cumberland River Flat Forest – high potential GDE located to the north, south, east and southwest of the construction footprint in isolated areas and along Cosgroves Creek and Oaky Creek, that transect the proposal, and Badgerys Creek to the east
- Cumberland Shale Hills Woodland – moderate potential GDE located to north, south and east
- Cumberland Shale Plains Woodland – low potential GDE located to the north and south of the construction footprint.

The above ecological receptors are unlikely to be affected by groundwater, given the depth across the study area and the limited extent of vegetation; however, shallow fill may occur across the study area. It is understood that subterranean biota may pass through the layer; however, it would not be considered a typical habitat. As such, it is not considered that the presence of the fill layer would cause a negative impact on the overall ecological properties of the site.

Existing contamination present within soils in the construction footprint has the potential to be exposed or disturbed during construction activities, such as excavation and earthworks. Potential disturbance of contaminated land during construction could result in impacts to the human and ecological receptors.

Further investigation of potential contamination risk would be carried out as part of the Phase 2 Contamination Assessment (detailed site investigation), which would include the collection of samples of fill material, fly tipped waste (if present) and samples of soils from areas of current and former agricultural land. The Phase 2 Contamination Assessment would confirm the contaminants on site and the potential for complete pathways to human and ecological receptors.

Accidental spills and leaks of fuels and oils from plant and equipment during construction would potentially result in unintentional contamination on-site and the potential for additional contamination to mobilise off-site. However, with the implementation of site management controls, the potential for accidental spills and leaks to occur during construction would be low.

Operation

During the operation of the proposal, the risk of soil erosion and exposure to potentially contaminated soil would be minor as all areas impacted during construction would be sealed or rehabilitated and landscaped to prevent soil erosion from occurring.

There are minor contamination risks associated with the operation of the proposal which would be limited to:

- Spills from industrial heavy vehicles such as oil tankers
- Accidents involving light and heavy vehicles causing oil and petrol spills.

Spills and other contamination sources during operation would be appropriately managed by implementing standard emergency spill environmental safeguards.

Saline soils have the potential to cause instability and erosion of concrete structures such as batters and bridge structures. Revegetation of construction support sites and other areas of soil disturbance after construction of the proposal would be carried out to minimise risk to surrounding environments and land use associated with saline soils post construction. Following planting of this vegetation, saline soils are unlikely to impact upon the operation of the proposal.

6.11.4 Safeguards and management measures

Table 6-73 describes the safeguards and management measures that would be implemented to manage the proposal's potential geology, soils and contamination impacts.

Table 6-73 Safeguards and management measures - geology, soils and contamination

Impact	Environmental safeguards	Responsibility	Timing	Reference
Geology, soils and contamination	A Phase 2 Contamination Assessment (detailed site investigation) will be completed and will include the collection of samples of fill material, fly tipped waste (if present) and soil from areas of current and former agricultural land. It will be carried out via test pitting along the alignment and at areas known to be construction staging areas or ancillary facilities to characterise the material. Given the length of the alignment, samples collected are to focus on any areas that may indicate signs of potential contamination as well as area coverage	Transport	Pre-construction	Additional safeguard
Geology, soils and contamination	The CEMP will include an unexpected finds protocol for potentially contaminated material encountered during construction work	Contractor	Construction	Section 4.2 of QA G36 Environment Protection
Geology, soils and contamination	An Asbestos Management Plan will be developed and implemented to manage asbestos and asbestos containing material if encountered during the construction. The plan will include: • Identification of potential asbestos on site • Procedures to manage and handle any asbestos • Mitigation measures if asbestos is encountered during construction Procedures for disposal of asbestos in accordance with the NSW EPA guidelines, Australian Standards and relevant industry codes of practice	Transport	Pre-construction	Additional safeguard
Geology, soils and contamination	Batters and bridge structures will be designed and constructed to minimise risk of exposure, instability and erosion, and to support long-term, on-going best practice management, in accordance with RMS 'Guideline for Batter Surface Stabilisation using Vegetation' (RMS, 2015)	Contractor / Transport	Construction / operation	Additional safeguard

Other safeguards and management measures that are relevant to the management of potential geology, soils and contamination impacts are identified in Section 6.9, which outlines safeguards and management measures regarding surface water and groundwater. This includes measures to manage erosion and sediment control, accidental spills, acid sulfate soils and saline soils.

6.12 Air quality

An air quality impact assessment has been prepared to assess the potential impacts of the proposal on air quality. A summary of this assessment is presented in this section, with the full report provided in Appendix N (Air Quality Impact Assessment).

6.12.1 Methodology

An assessment of air quality impacts has been carried out in accordance with relevant legislation, policy and guidance material, as outlined in Section 5.2 and Section 5.3 of Appendix N (Air Quality Impact Assessment). Ambient air quality criteria, standards and the adopted assessment criteria for the proposal are outlined in Section 5.4 and Section 5.5 of Appendix N (Air Quality Impact Assessment).

Construction assessment methodology

Dust

Potential impacts from dust generation during construction have been assessed using the UK Institute of Air Quality Management (IAQM) 2014 Guidance on the assessment of dust from demolition and construction. The IAQM assessment process provides a four-stage qualitative risk assessment process for the potential unmitigated impact of dust generated from construction work, including demolition, earthmoving, construction activities and trackout (which refers to the transport of dust and dirt the construction site).

The IAQM assessment process is described in detail in Appendix N (Air Quality Impact Assessment) and is summarised in Table 6-74.

Table 6-74 IAQM assessment process

Assessment step	Description
Step 1 – screening assessment	Identification of 'human' and 'ecological receptors' within the following areas: • Human receptors within 350 metres of the construction footprint • Ecological receptors within 50 metres of the construction footprint • Human or ecological receptors within 50 metres of the route used by construction vehicles on public roads up to 500 metres from construction activities
Step 2 – dust risk assessment	• **Step 2A – dust emission magnitude:** involves estimating dust emission magnitudes according to scale of construction work, which are classified as either 'small', 'medium' or 'large' • **Step 2B – sensitivity of the surrounding area:** involves defining the surrounding area's sensitivity to dust soiling, human health effects and ecological impacts. The sensitivity of the surrounding area is rated 'high, 'medium', or 'low' • **Step 2C – unmitigated risks of impacts:** involves combining dust emission magnitudes determined in Step 2A are with the sensitivities defined in Step 2B to ascertain the risk of impacts with no mitigation applied. The risk of dust impacts from demolition, earthworks, construction and track-out is defined in Table 5-11 of Appendix N (Air Quality Impact Assessment)
Step 3 – management strategies	Determine the level of management that is required to ensure that dust impacts on surrounding sensitive receptors are maintained at an acceptable level. A high or medium-level risk rating means that suitable management measures must be implemented during construction
Step 4 – reassessment	Determine whether significant residual impacts due to the proposal remain following the application of identified safeguards and management measures

Odour and combustion emissions

A qualitative assessment of potential construction impacts arising from odour and combustion emissions has been carried out. The odour assessment was largely limited to potential disturbance of acid sulfate soils or from uncontrolled fill along the road alignment during earthworks. The combustion emissions assessment considered construction plant and on-site traffic.

Operational assessment methodology

A quantitative assessment of operational impacts was carried out as a Level 2 Assessment in accordance with The Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales (EPA, 2017) (The Approved Methods), using the dispersion model known as 'GRAL', and the flow field model 'GRAMM'.

The pollutants modelled included nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM_{10}), particulate matter ($PM_{2.5}$), volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs).

Modelled scenarios include:

- One 'baseline' scenario based on the 2021 existing traffic operations with the existing traffic lane layout (single lane in each direction)
- Two 'do nothing' scenarios for 2030 and 2040, which considered predicted traffic volumes without the proposal and assumed an unchanged traffic lane layout
- Two 'do something' scenarios for 2030 and 2040 which included traffic volumes with the proposal and an upgraded traffic lane layout (two lanes in each direction).
- In NSW, air quality impact assessment criteria are listed under Section 7 of The Approved Methods. Although these criteria were not developed for road projects, they provide an indication of the proposal's effect on air quality during operation of the proposal. Modelled scenarios were assessed against relevant EPA criteria as shown in Table 6-75.

Table 6-75 NSW EPA air quality criteria

Pollutant	Averaging period	Criteria (micrograms per cubic metre)
Nitrogen Dioxide	1 Hour Maximum	164
	Annual Average	31
Carbon Monoxide	1 Hour Maximum	30,000
	8 Hour Maximum	10,000
Particulate matter (PM_{10})	24 Hour Maximum	25
	Annual Average	8
Particulate matter ($PM_{2.5}$)	24 Hour Maximum	25
	Annual Average	8
Benzene	99.9th Percentile 1-hour average	29
Formaldehyde	99.9th Percentile 1-hour average	20
1,3-butadiene	99.9th Percentile 1-hour average	40
Toluene	99.9th Percentile 1-hour average	360
Acetaldehyde	99.9th Percentile 1-hour average	42
Ethylbenzene	99.9th Percentile 1-hour average	8,000
Xylene	99.9th Percentile 1-hour average	190
PAHs (as Benzo(a)pyrene)	**99th Percentile 1 Hour**	**0.4**

Study area

The assessment has considered two study areas:

- The construction assessment study area, which comprises the buffer distances of 20 metres, 50 metres, 100 metres, 200 metres and 350 metres from the construction footprint. The potential sensitivity of receptors to dust impact was assessed within these buffer areas
- The operation assessment study area, which comprises the modelling domains shown on Figure 6-25.

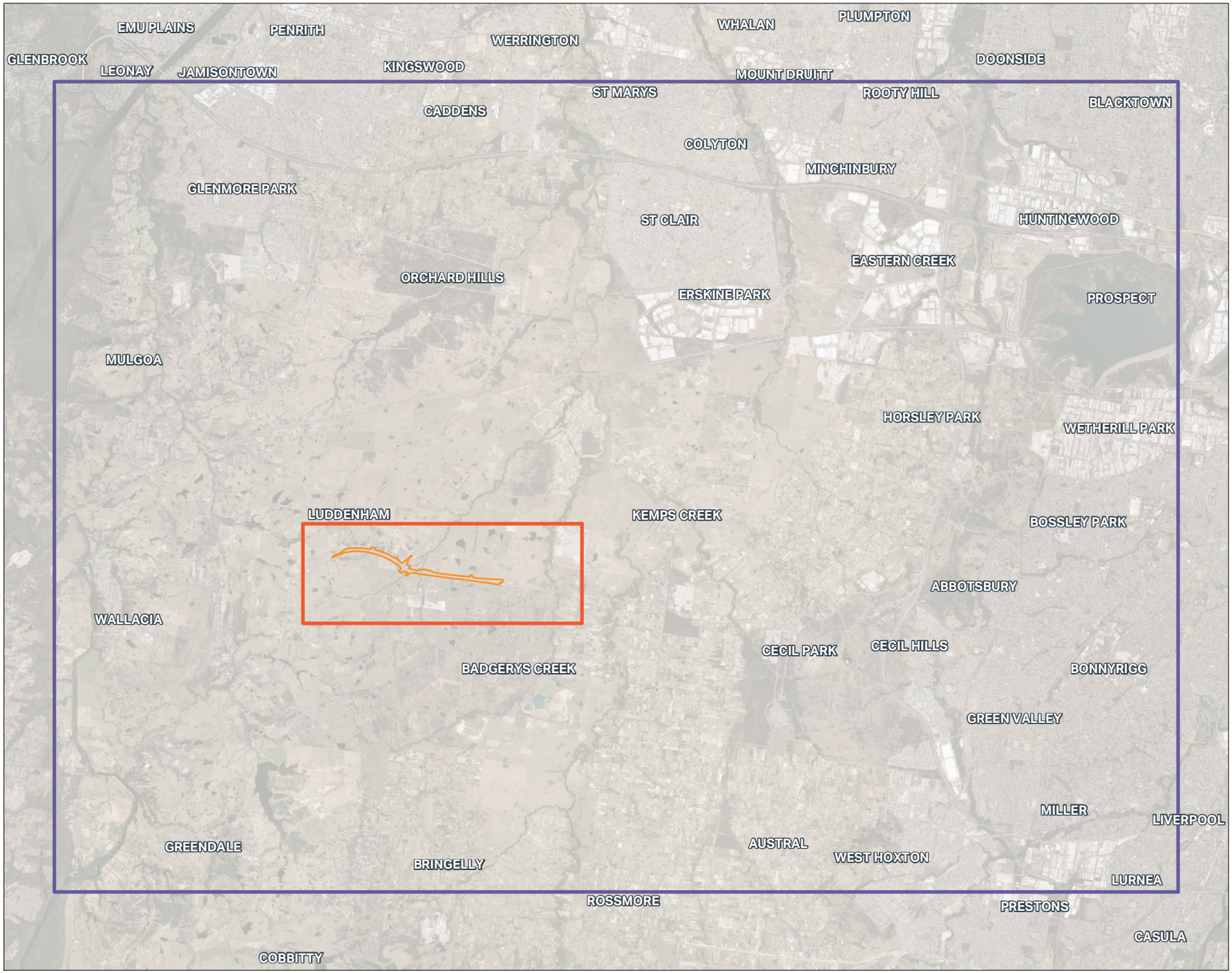


FIGURE 6-25:
OPERATION ASSESSMENT STUDY AREA

N

0 1 2 km

Legend

- Operational footprint
- GRAL modelling domain
- GRAMM modelling domain

6.12.2 Existing environment

Climate and weather

The Badgerys Creek air quality monitoring station is located three kilometres south of Elizabeth Drive in similar terrain to the construction footprint, and was used to collect wind speed and wind directional data.

The climate and weather at Badgerys Creek are affected by several factors such as terrain and land use. The most frequent winds at Badgerys Creek are from the south-west, with between 20 to 30 per cent of all wind blowing from this direction. The strongest winds (over seven metres per second) are typically from the south-west and west with an average wind speed of 2.8 metres per second and calm conditions (winds less than 0.5 metres per second) occurring about eight per cent of the time. Calm conditions are relatively common at night, with up to about 13 per cent of hours calm on summer nights, and at least 10 per cent in the other seasons. Average wind speeds at night range from 1.9 metres per second in summer to 2.3 metres per second in winter.

Ambient air quality

The potential air emission effects on the surrounding environment due to the proposal must be considered in the context of the existing air pollution sources in the region. Evaluating cumulative effects requires a knowledge of the existing or background concentrations of the contaminants being assessed.

Existing sources of air pollution in the construction footprint were identified via a search of the National Pollutant Inventory. For ambient air quality within and around the proposed road corridor, pollutants of concern include CO, NOx and particulate matter equal to or less than 10 microns in diameter (PM10) and less than 2.5 microns in diameter (PM2.5).

The Bringelly and St Marys air quality monitoring stations were used to measure NO_2, PM_{10} and $PM_{2.5}$. The proximity of these stations to the proposal, means that concentrations measured would be representative of conditions in the construction footprint.

As CO is not monitored at either Bringelly or St Marys, concentrations were sourced from the nearest station with CO data, which was at the Liverpool DPE monitoring station. Monitoring data for each station is discussed in Section 4 of Appendix N (Air Quality Impact Assessment).

Sensitive receptors and land use

Land use surrounding the construction footprint is predominantly rural residential or farming and rural industries. There are small areas of riparian vegetation along Cosgroves Creek and Oaky Creek, and the WSA is located immediately south of the construction footprint.

Residential sensitive receptors located in proximity to the construction footprint are generally more than 50 metres from the existing Elizabeth Drive road corridor. About 27 properties have been identified that reside within 350 metres of the proposal (refer to Figure 24 within Appendix N Air Quality Impact Assessment).

A number of ecological areas were determined to have 'very high' and 'high' constraints for the proposal as outlined below:

- 'Very high' ecological constraints:
  - Isolated, small local occurrence of Cumberland Plain Woodland (Plant Community Type (PCT) 849) within the road corridor of Elizabeth Drive (and within the construction footprint), east of Oaky Creek. This vegetation community is listed under the EPBC Act
  - *Pultenaea parviflora,* listed under the EPBC Act and the BC Act and Native Pear individuals, listed under the BC Act
- 'High' ecological constraints:
  - Larger patches of Swamp Oak Floodplain Forest (PCT 1800) listed under the BC Act
  - River-flat Eucalypt Forest (PCT 835) listed under the EPBC Act
  - Potential micro-bat roost habitat in bridges/culverts spanning larger watercourses. The two vegetation communities are EPBC-listed.

6.12.3 Potential impacts

Construction

Construction of the proposal is anticipated to take about 48 months. Construction activities are likely to generate dust, odour and other gaseous emissions. These would typically be associated with construction activities such as demolition, earthworks, the use of plant equipment and vehicle movement and trackout.

Construction activity magnitude

Potential dust impacts during the construction period have been determined based on the IAQM construction dust assessment guidance documentation and the expected scale of the construction activities outlined in Section 3.3.

Potential dust generating activities and associated magnitudes are outlined in Table 6-76. The magnitude of the unmitigated emissions from the construction activities are rated as 'large' for earthworks and construction and 'medium' for demolition and trackout activities due to the expected extent of construction activities.

Table 6-76 Dust emission magnitude

Activity	Potential dust generating activities	Magnitude
Demolition	• Demolition volumes are estimated to be less than 20,000 m^3 as there would be relatively few structures that would require demolition, including Cosgroves Creek bridge. Progressive demolition of building structures would occur using modified excavators • Demolition would include dusty material and may require onsite crushing of concrete and waste material • Details of building removal and demolition work are outlined in Section 3.3.5	Medium
Earthworks	• Earthworks would be completed to achieve the required design levels of the proposal. This would include about 172,800 m^3 of fill material and about 48,700 m^3 of cut material • Earthworks associated with boring for bridge structural supports and landscaping work, and utility adjustment or relocation of the following: electricity, water and sewerage, gas and telecommunications • Stockpiling would occur at several locations • The operation of heavy earth moving vehicles would be required during earthworks. An indicative list of plant and equipment is provided in Section 3.3.7	Large
Construction	• Construction activities as outlined in Section 3.3 • Construction of ancillary facilities as described in Section 3.3.2 • Dust generating materials would be required for construction. Estimated quantities of construction materials are provided in Section 3.3.20 • A range of plant and equipment would be used during construction, as outlined in Section 3.3.19	Large
Trackout	• Construction would generate a large number of light and heavy vehicles movements. Trackout for construction work has been rated 'Medium' due to an estimated peak heavy vehicle movement of 70 vehicles per day • Construction vehicle activities would include the movement of construction workers, delivery of construction materials, spoil movement and waste removal and delivery of construction equipment and machinery	Medium

Sensitivity of surrounding area

Several dust risk ratings were estimated for the proposal, based on IAQM guidance and are provided in Table 6-4 to Table 6-6 in Appendix N (Air Quality Impact Assessment). The ratings were estimated prior to the implementation of mitigation measures, and are as follows:

- Low risk of dust soiling and low risk to human health, as a total of 11 residential receptors have been identified within 100 metres of the construction footprint
- Low risk to ecological receptors based on the low receptor sensitivity rating, and distance (less than 20 metres) from the construction footprint.

The overall potential construction dust risks of the proposal were found to be 'low', as shown in Table 6-77.

Despite an unmitigated risk rating of 'low' for the proposal, mitigation measures are recommended to reduce the risk of dust generation and hence impact on the surrounding environment. Safeguards and management measures are discussed in Section 6.12.4.

Table 6-77 Summary of unmitigated risk assessment

Activity	Step 2A: Potential for dust emissions	Step 2B: Sensitivity of area			Step 2C: Risk of unmitigated dust impacts		
		Dust soiling	Human health	Ecological	Dust soiling	Human health	Ecological
Demolition	Medium	Low	Low	Low	Low	Low	Low
Earthworks	Large	Low	Low	Low	Low	Low	Low
Construction	Large	Low	Low	Low	Low	Low	Low
Trackout	Medium	Low	Low	Low	Low	Low	Low

Odour

Potential odour impacts from construction activities would be temporary in nature, and potential sources would primarily occur should acid sulfate soils or contaminated soils be disturbed during earthworks. However, based on the findings outlined in Appendix M (Phase 1 Contamination Assessment Report), the probability of intercepting acid sulfate soils across the construction footprint is extremely low.

There is the potential for odorous contaminants, such as petroleum hydrocarbons to be contained with uncontrolled fill that is present along the alignment, and areas of former and current agricultural land use. More information is required through the collection of samples to characterise this potential source (refer to Appendix M Phase 1 Contamination Assessment Report).

Combustion emissions

Combustion emissions impacts during construction are likely to be generated by light and heavy vehicles travelling to and from the construction footprint as well as onsite mobile construction equipment and stationary equipment, such as diesel generators. Typical emissions released by construction vehicles and plant equipment are likely to include CO, particulate matter (PM_{10} and $PM_{2.5}$), NO_2, SO_2, VOCs, and PAHs.

Due to existing traffic volumes, combustion emissions on Elizabeth Drive and the adjacent road network are unlikely to result in a notable reduction in ambient air quality at nearby sensitive receptors. Given the typically transitory nature of construction traffic, as well as use of mobile and stationary plant and equipment, exhaust emissions are unlikely to have a significant impact on local air quality. When the safeguards and management measures listed in Table 6-78 are applied, adverse air quality impacts from the operation of construction vehicles and plant equipment are not anticipated.

Operation

Nitrogen dioxide

The predicted ground level NO_2 concentration (1- hour maximum and annual average) in 2030 and 2040 are predicted to decrease when compared to existing ground level concentrations. This is due to anticipated changes in future vehicle fleets, with expected increased uptake in vehicles with more stringent emission standards, and reduced number of aging vehicles with lower emission standards. This is evident between 2030 and 2040 modelled scenarios with a smaller difference in predicted ground level concentrations between the proposal and 'do nothing scenario' due to the weighting of emission factors on the results.

The proposal may result in slightly higher 1 hour maximum and annual average NO_2 concentrations at sensitive receptors than without the proposal ('do nothing'). The highest changes would be about 50 µg/m^3 at two receptors north of Elizabeth Drive, along Luddenham Road, and one receptor south of Elizabeth Drive, between the Northern Road and Luddenham Road (receptors 4, 14 and 15 shown in Appendix F of Appendix N (Air Quality Impact Assessment). However, the differences are minor compared with the EPA criterion of 164 µg/m^3 shown in Table 6-75.

Despite a potential slight increase in NO_2 concentrations in 2030 and 2040 for the proposal, predicted roadside concentrations are expected to decrease when compared to the existing situation.

Carbon monoxide

Similar to NO_2 mentioned above, ground level CO concentrations (1 hour maximum and 8 hour maximum) in 2030 and 2040 are predicted to decrease when compared to existing roadside concentrations. This is due to the same anticipated changes in vehicle fleets. Predicted incremental and cumulative CO 1-hour and 8-hour maximum concentrations were identified as well below EPA criteria at all sensitive receptors.

The proposal may result in slightly higher 1-hour and 8-hour maximum CO concentrations at sensitive receptors compared with the 'do nothing' scenarios. These changes are very minor within the context of the EPA criteria 1-hour maximum of 30,000µg/m^3 and 8-hour maximum of 10,000µg/m^3, which would equate to less than one percent at the worst affected sensitive receptors.

Particulate Matter

Ground level $PM_{2.5}$ and PM_{10} concentrations (24 hour maximum and annual average concentrations) in 2030 and 2040 are predicted to decrease at most receptors when compared to the existing roadside concentrations largely due to anticipated changes in vehicle fleets.

Analysis of changes in contribution of 24 hour maximum and annual average $PM_{2.5}$ and PM_{10} concentrations indicate that the proposal may result in slightly higher concentrations at some sensitive receptors than without the proposal. These increases, however, were very minor when compared to the EPA criteria.

Predicted annual average $PM_{2.5}$ values for the proposal were also examined for future scenarios; and compared against recommended guidelines to assess incremental health risk. At the worst affected sensitive receptors, changes to annual average $PM_{2.5}$ concentrations would be considered acceptable; with most sensitive receptors lying within the Acceptable Risk category. There were no sensitive receptors with an annual $PM_{2.5}$ value deemed an unacceptable risk.

Increases are also expected for PM_{10} concentrations for 2030 and 2040 at most receptors for the proposal compared to the 'do nothing' scenarios. However, the increases are minor, equating to about two per cent of the 24-hour criterion of 50 µg/m^3 and less than one percent of the annual average criterion of 25 µg/m^3.

Volatile organic compounds

Analysis of changes in contribution of predicted 1-hour 99.9th percentile benzene and formaldehyde concentrations indicate there is no substantial difference in predicted ground level VOC concentrations at sensitive receptors with or without the proposal for 2030 and 2040. Predicted changes in contribution for both benzene and formaldehyde have the lowest 1-hour 99th percentile criteria of 29 µg/m^3 and 20 µg/m^3 and were found to be less than one percent of the individual VOC species criteria.

Polycyclic aromatic hydrocarbons

Similarly, analysis of changes in contribution of predicted 1-hour 99.9th percentile PAH concentrations indicate there is no substantial difference in predicted ground level total PAH concentrations at sensitive receptors with or without the proposal for 2030 and 2040. Predicted changes in contribution for total PAHs were generally 0.00004 µg/m^3 which would equate to less than one percent of the EPA criterion of 0.4 µg/m^3.

Traffic network analysis

Traffic movements along Elizabeth Drive have the potential to create emissions to air from the combustion and evaporation of fuels used to power vehicles and non-combustion processes such as tyre, brake and road wear. It is anticipated that upgrading or improving the existing road network would reduce congestion and associated vehicle emissions within some areas of the network. Changes in traffic numbers as part of road infrastructure upgrades may also influence the spatial distribution of air pollutants within a local air shed.

Traffic modelling has predicted that there would be an increase in road traffic on Elizabeth Drive as a direct result of the proposal. This increase in traffic would result in the air pollutant predictions at several locations showing a small increase in pollutant concentrations at sensitive receptors (despite an increase in vehicle speed and efficiency). This is due to increased traffic numbers and queuing on Elizabeth Drive close to these receptor locations.

The modelled results do not include the potentially beneficial changes in road traffic volumes on the surrounding road network which may be influenced by the proposal. It would be expected that in the airshed immediately surrounding the proposal, the distribution of air pollutant emissions would change as a result of the proposal. These changes would potentially result in some areas experiencing higher traffic volumes and hence higher impacts, whilst other locations may experience lower traffic numbers and hence lower pollutant concentrations. This would provide vehicles with the option to use the less congested upgraded Elizabeth Drive.

6.12.4 Safeguards and management measures

Table 6-78 describes the proposed safeguards and management measures that would be implemented to manage potential air quality impacts.

Table 6-78 Air quality safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air quality	An Air Quality Management Plan will be prepared and implemented as part of the CEMP. The Air Quality Management Plan will include, but not be limited to: • Potential sources of air pollution • Air quality management objectives consistent with any relevant published EPA and/DPE guidelines • Mitigation and suppression measures to be implemented • Methods to manage work during strong winds or other adverse weather conditions • A progressive rehabilitation strategy for exposed surfaces	Contractor	Detailed design / Pre-construction	Section 4.4 of QA G36 Environment Protection
Air quality – Combustion emissions	Use of diesel or petrol-powered generators will be avoided where practicable and mains electricity or battery powered equipment will be used where practicable	Contractor	Construction	Additional safeguard
Air quality – Combustion emissions	Vehicles and plant will be switched off when engines are stationary. Idling vehicles will be avoided where practicable	Contractor	Construction	Additional safeguard
Air quality – Dust emissions	During periods of high potential for increased air quality impacts and/or prolonged dry or windy conditions, the frequency of site inspections will be increased by the construction contractor's environmental representative or accountable personnel for air quality and dust issues	Contractor	Construction	Additional safeguard
Air quality – Dust emissions	At each construction zone, the site arrangement will be planned so that dust generating activities are carried out to minimise dust at nearby receptors. Measures may include stockpiles located as far away from receptors as possible; dust barriers being erected around dusty activities/site boundary, or similar.	Contractor	Construction	Additional safeguard
Air quality – Dust emissions	A maximum speed limit of 15 kilometres per hour on unsurfaced roads and construction work areas will be imposed and signposted	Contractor	Construction	Additional safeguard
Air quality – Dust emissions	Adequate water supply will be provided on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	Contractor	Construction	Additional safeguard

6.13 Climate change

6.13.1 Methodology

Climate change has the potential to impact on the proposal through changes to weather events and be impacted by the proposal through the emission of greenhouse gases (GHG), which contribute to climate change. The impact of the proposal on climate change has been considered in a qualitative assessment guided by the emissions scopes described below and by considering the likely construction methods, materials, and maintenance activities.

The impact of climate change on the proposal has been reviewed in consideration of the existing climate conditions and forecast climate conditions. Forecast climate conditions were taken from the Metropolitan Sydney Region Climate change snapshot of the NSW and ACT Regional Climate Modelling project in collaboration with Environment and Heritage Group, DPE.

GHG have been categorised into scopes which relate to whether they were a direct or indirect emission and their origin. There are three scopes of GHG emissions:

- Scope 1: GHG emissions released directly from on-site activities associated with the proposal, such as the combustion of fossil fuels in vehicles and motors and from the removal of vegetation
- Scope 2: GHG emissions released indirectly from an off-site activity, for example the generation of electricity which is used during the construction and operation of the proposal
- Scope 3: GHG emissions released indirectly as a result of acquiring and disposing of materials for the proposal, for example the combustion of fossil fuels to transport building materials to a construction ancillary facility, and the consequent break down of building wastes such as vegetation and wood releasing carbon dioxide emissions in the decay process. GHG emissions would also be associated with the offsite production and transport of materials used in the maintenance of the road.

6.13.2 Existing environment

The existing climate within the Western Sydney area is characterised by hot summer days and cool dry winters. Western Sydney is in a summer dominated rainfall pattern; however, heavy isolated falls have been known during winter (NSW Government, 2014). Average maximum and minimum temperatures and average rainfall for the Western Sydney area is provided in Table 6-79. The closest bureau station is based in Badgerys Creek.

Based on the climate change projections from the NSW and ACT Regional Climate Modelling project, Metropolitan Sydney is expected to experience an increase in all temperature variables (average, maximum and minimum) for the near (2020-39) and far (2060-79) future. Rainfall is projected to decrease by up to five per cent in the period between 2020 and 2039 in spring and winter and to increase in autumn and summer by up to five per cent. The climate projections are shown further in Table 6-79 alongside the existing environment. In general, the climate in Western Sydney is expected to become hotter and drier which is likely to result in more intense storms, floods, droughts and bushfire events.

Table 6-79 Existing and forecast climate at Greater Sydney (NSW Government, 2014)

Climate variable	Existing	Projected increase or decrease	
		2020 2039 (Near future)	2060 2079 (Far Future)
Average maximum temperatures	28-30°C	0.7°C	1.9°C
Average minimum temperatures	8-10°C	0.6°C	2.0°C
Average rainfall (Summer)	310 millimetres	-14 to +15	-7 to + 28
Average rainfall (Autumn)	287 millimetres	-22 to +43	-15 to+42
Average rainfall (Winter)	185 millimetres	-19 to + 23	-38 to +38
Average rainfall (Spring)	217 millimetres	-27 to +17	-14 to +37

6.13.3 Potential impacts

Construction

Impact of the proposal on climate change

The likely sources of GHG emissions during construction of the proposal are listed in Table 6-80. While measures would be carried out where possible to reduce GHG emissions, most of the emissions would be largely unavoidable. However, the proposal is anticipated to have a negligible impact on climate change during construction, on a national and global scale.

Table 6-80 Likely GHG emissions during the construction of the proposal

GHG sources	Details	Assessment
Scope 1 emissions		
Construction equipment	GHGs would be generated from fossil fuel combustion in plant, equipment and vehicles used for construction activities	Construction activities would be planned to minimise movements on-site and use lower emission equipment; however, GHG emissions related to construction activities would be unavoidable
Generator use	Generators may be required during construction. This would create GHG emissions through the combustion of diesel or other fossil fuels	The use of generators would be limited to facilitate circumstances that would reduce the overall length of the construction program, for example to power lights during night work or to power equipment prior to connection to the local power supply.
Vegetation removal	Areas of native and non-native vegetation would need to be cleared to accommodate the proposal, as described in Section 6.3.3	The proposal has been designed to minimise the extent of vegetation clearing that would otherwise release stored carbon and reduce the ongoing GHG retention within vegetated areas. Where vegetation removal cannot be avoided, Transport would offset biodiversity impacts as outlined in Section 6.3.5
Scope 2 emissions		
Electricity	It is expected that a small amount of electricity would be required during construction to power on-site construction buildings and worker facilities	Electricity would be purchased from the grid, which largely comprises of electricity generated from fossil fuels
Scope 3 emissions		
Construction materials	Extraction and production of materials used for construction of the proposal, such as concrete, steel, road base, pipes, cables, conduits and other materials would result in GHG emissions	Recycled materials or materials left over from other projects would be used where possible; however, GHG emissions related to the production of materials would be unavoidable
Construction waste	The mulching of cleared vegetation would result in increased GHG emissions, as the breakdown of organic matter to waste material directly releases stored carbon dioxide to the atmosphere	GHG emissions related to the processing of construction waste would be unavoidable
Construction transport	GHGs would be generated by staff travelling to and from the construction ancillary facilities and by any transportation related to the movement of construction materials, equipment or plant to the proposed road corridor	Construction staging would be developed to minimise haulage and other construction vehicle movements; however, GHG emissions would be unavoidable

Impact of the proposal on climate change

Climate change projections for the near future represent an average of projections for the period of 2020 to 2039 (refer to Table 6-81). These projections would be applicable to the construction period for the proposal.

Construction of the proposal may be susceptible to climate change impacts, including changes in frequency of temperature extremes, and frequency and intensity of rainfall events. The potential impacts associated with these changes include:

- Effect of extreme temperatures on the health and safety of construction workers
- Delays in expected timeframes as a result of weather including rainfall and flooding events
- Increase in risk of erosion and sedimentation, and other environmental impacts from extreme rainfall and flooding.

Operation

Impact of the proposal on climate change

The likely sources of GHG emissions during the operation of the proposal are listed in Table 6-81.

Table 6-81 Likely GHG emissions during the operation of the proposal

GHG sources	Details	Assessment
Scope 2 emissions		
Electricity	Electricity would be required during the operation of the proposal for lighting at reconfigured intersections	Electricity would be purchased from the grid, which largely comprises electricity generated from fossil fuels. Lighting would only be installed at the proposal's connections and not along the entire alignment, minimising electricity use
Scope 3 emissions		
Traffic	The proposal would cater for a projected growth in traffic volumes which would occur independent of the proposal	The proposal would enable traffic to continue at a more consistent speed rather than slowing and increasing speed when travelling along Elizabeth Drive. In addition, the proposal would include the provision of new walking and cycling infrastructure, facilitating alternative modes of transport along the proposal alignment and reducing vehicle emissions.
Road infrastructure maintenance	Diesel fuel use for the operation of maintenance equipment and the delivery of maintenance materials	Maintenance activities would be planned to minimise movements on-site and use lower emission equipment. Recycled materials or materials left over from other projects would be used where possible
Road infrastructure maintenance	Use of materials for maintaining the road pavement	Emissions generated from maintenance activities would be relatively small in comparison with the indirect emissions associated with the fuel consumed by maintenance vehicles using the road

Impact of climate change on the proposal

Climate and weather can have an impact on the road surface and the safety of a road. The biggest influences on road surface are moisture and temperature, both of which can lead to faster rates of deterioration (Austroads, 2004).

As rainfall decreases overall, the rate of moisture related road surface deterioration should slow (Austroads, 2004). However, this could be offset by an increase in ambient temperatures, which may accelerate the rate of deterioration of any seal binders. Drier conditions may also cause pavements to age more quickly due to oxidation and embrittlement (Austroads, 2004). However, these effects are expected to be minor over time and in combination with Transport's maintenance regime are likely to have a negligible impact.

More intense rainfall and flooding events could put pressure on drainage infrastructure for the road including culverts and open drainage channels. Recognising this, the drainage design for the proposal achieves 1% AEP flood immunity from regional flooding, with a minimum of one lane trafficable in each direction, minimises potential flooding impacts on upstream and downstream properties and has factored in an increase in rainfall intensity to consider the effect of climate change.

6.13.4 Safeguards and management measures

Table 6-82 describes the proposed safeguards and management measures that would be implemented to manage potential impacts to climate change.

Table 6-82 Safeguards and management measures - climate change

Impact	Environmental safeguards	Responsibility	Timing	Reference
Climate change	Construction equipment, plant and vehicles will be appropriately sized for the task, serviced frequently and will not be left idling when not in use	Contractor	Construction	Additional safeguard
Climate change	Opportunities to use low emission construction materials, such as recycled aggregates in road pavement and surfacing, and cement replacement materials will be investigated and incorporated where feasible and cost-effective	Contractor	Construction	Additional safeguard
Climate change	Raw materials will be managed to reduce energy requirements for their processing. For example, stockpiled materials will be stored undercover where possible to reduce moisture content of materials and, therefore, the process and handling requirements	Contractor	Construction	Additional safeguard
Climate change	Materials with lower emissions intensity will be specified in the selection of maintenance materials	Transport	Operation	Additional safeguard
Climate change	The most energy efficient street lighting appropriate for proposal needs will be specified	Transport	Operation	Additional safeguard

6.14 Resource use and waste

Various waste streams would be generated during the construction and operational phases of the proposal. These would include demolition wastes, green waste (vegetative matter), packaging materials, liquid wastes and excavated material.

6.14.1 Methodology

A qualitative assessment of potential resource use and waste management has been carried out for the proposal.

6.14.2 Existing environment

Existing waste streams within the construction footprint are limited to household and agricultural waste as well as roadside litter and other waste material associated with roadside maintenance.

6.14.3 Potential impacts

Construction

Resource use

The proposal would require the use of a number of resources which include (but are not limited to):

- Resources associated with the operation of construction vehicles and machinery, such as diesel and petrol
- Material required for drainage construction, road surface construction and bridgework including road base, asphalt, spray seal, sand, concrete and aggregate

- Materials for earthworks, such as topsoil, mulch, general fill and select fill
- Materials required for road signage, linemarking, roadside barriers and guideposts
- Construction water (for concrete mixing and dust suppression).

The initial estimated source and quantities for these materials are outlined in Section 3.3. The materials required for construction of the proposal are not currently limited in availability; however, any non-renewable materials would be used conservatively. The reuse of waste on-site would assist in minimising resources required for construction. Where possible, excavated spoil would be re-used again on site in construction and landscaping activities. Excess spoil, not suitable for reuse, would be disposed of in accordance with safeguards and management measures outlined in Section 6.14.3.

Transport contractors are required to use recycled-content materials where they are cost and performance competitive and are the environmental equivalent (or better) than non-recycled alternatives as described in the *Roads and Maritime Environmental Sustainability Strategy 2019-2023*.

Waste generation

The proposal has the potential to generate waste from the following activities:

- Vegetation removal (including native vegetation and noxious weeds)
- Earthworks
- Utility adjustments
- Removal of the existing pavement
- Demolition of structures
- Operation of site office and compound facilities.

Waste streams likely to be generated during construction of the proposal include:

- Excess spoil unsuitable for reuse – excavated wastes, such as soil and rock, that are unable to be reused within the proposal as it would not meet engineering specifications or are in excess of the proposal requirements
- Demolition waste such as pipe work, bricks, corrugated iron and pavements
- Surplus material from construction and general site establishment – including fencing, sediment, concrete, reclaimed asphalt, sandbags and scrap metal
- Packaging materials from items delivered to the site such as pallets, crates, cartons, plastics and wrapping materials
- Green waste as a result of vegetation clearing. Noxious weed material would be separated from native green waste
- Packaging and general waste from staff (lunch packaging, beverage containers)
- Effluent generated at site amenities during construction including portable toilets
- Chemicals and oils used for plant and vehicle maintenance such as fuel, oil and chemical containers
- Wastewater from wash-down, bunded areas and farm dams
- Redundant erosion and sediment controls
- Asphalt waste from the removal of the existing pavement
- Potential asbestos and other hazardous waste.

Waste would be managed in accordance with the guidance in the *Re-use of waste off-site: Waste Fact Sheet 9* which identifies potential off-site reuses for typical wastes and the Management of Wastes on Roads and Maritime Services Land Procedure which includes best practice and contingency planning for construction wastes on sites.

Waste management

Transport is committed to ensuring responsible management of unavoidable waste and to promoting the reuse of such waste through appropriate measures in accordance with the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act 2001). The resource management hierarchy principles in order of priority as outlined in the WARR Act are:

- Avoidance of unnecessary resource consumption

- Resource recovery (including reuse, reprocessing, recycling and energy recovery)
- Disposal.

By adopting the above principles, Transport encourages the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ecologically sustainable development (ESD).

Surplus or contaminated material would be classified and disposed of at a licensed waste facility in accordance with EPA Waste Classification Guidelines (EPA, 2014) or reused in accordance with EPA resource recovery orders and exemptions. The transport and disposal of contaminated and hazardous waste would be carried out in accordance with the Protection of the Environment Operations (Waste) Regulation 2014 which includes notification and tracking requirements.

An unexpected finds procedure would be developed as part of the CEMP for the construction area and would be implemented during the construction phase. An asbestos management plan would also be prepared and implemented. The plan would include procedures to identify, manage and handle asbestos and would outline procedures for correct disposal of asbestos in accordance with NSW EPA guidelines, Australian Standards and relevant industry codes of practice.

Operation

During the operational phase of the proposal, roadside litter would also be found along the length of the road. Additional wastes would be generated during routine maintenance and repair activities required over time. The type and volume of wastes generated would be dependent on the nature of the activity, but would predominately consist of green waste, oils, road materials used in repair and maintenance work as well as contaminated waste resulting from fuel spills and leaks.

With the implementation of standard work practices during routine maintenance and repair activities, the overall impact of operational waste streams and volumes would be minimal.

Construction and operational waste impacts would be managed in accordance with the relevant State legislation and government policies including the WARR Act 2001 and Waste Avoidance and Resource Recovery Strategy 2014-21 (NSW EPA, 2014).

6.14.4 Safeguards and management measures

Table 6-83 describes the proposed safeguards and management measures that would be implemented to manage potential impacts to resource use and waste.

Table 6-83 Safeguards and management measures - resource use and waste

Impact	Environmental safeguards	Responsibility	Timing	Reference
Resource use and waste	Use of recycled-content materials will be considered during the detailed design	Transport	Detailed design	Additional safeguard
Resource use and waste	A Waste Management Plan will be prepared and implemented as part of the CEMP. The Waste Management Plan will provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriate handling and disposal of unavoidable waste. The Waste Management Plan will include, but will not necessarily be limited to: • Measures to avoid and minimise waste associated with the proposal • Classification of wastes generated by the proposal and management options (re-use, recycle, stockpile, disposal) • Classification of wastes received from off-site for use in the proposal and management options • Identification of any statutory approvals required for managing both on and off-site	Contractor	Pre-construction/ construction	Section 4.2 of *QA G36 Environment Protection*

Impact	Environmental safeguards	Responsibility	Timing	Reference
	waste, or application of any relevant resource recovery exemptions • Procedures for storage, transport and disposal • Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions The Waste Management Plan will be prepared taking into account the Roads and Maritime Environmental Procedure – Management of Wastes on Roads and Maritime Services Land and relevant Transport Waste Fact Sheets			
Resource use and waste	The following resource management hierarchy principles will be followed: • Avoid unnecessary resource consumption as a priority • Avoidance would be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) • Disposal would be a last report (in accordance with the WARR Act 2001)	Contractor	Pre-construction / construction	Additional safeguard

Other safeguards and management measures that are relevant to the management of hazard and risk are identified in Section 6.11, which outlines safeguards and management measures regarding geology, soils and contamination.

6.15 Hazard and risk

6.15.1 Existing environment

Existing hazards and risks in the vicinity of the proposal are generally associated with the operation of the existing road network and the flood prone areas associated with Cosgroves Creek and Oaky Creek. As discussed in Section 6.11, there is also a high risk of contamination from a range of potential contaminants and sources within the construction footprint.

Land within the vicinity of the construction footprint is identified on the NSW Government central resource for Sharing and Enabling Data in NSW (SEED) mapping tool as bushfire prone land. The northern side of the construction footprint is predominately mapped as Vegetation Category 3 bushfire prone land, the southern side as Vegetation Category 2 bushfire prone land, and an intersection along Cosgrove Creek and Oaky Creek as Vegetation Category 1 bushfire prone land.

Vegetation Category 3 is considered to hold medium bushfire risk, while Vegetation Category 2 has lower combustibility and/or limited potential fire size due to the vegetation area shape and size, land geography and management practices.

The highest risk of bushfire is considered to be in the area where the proposal intersects Vegetation Category 1 bushfire prone land. This vegetation category has the highest combustibility and likelihood of forming fully developed fires including heavy ember production. For Vegetation Category 1, a 100-metre external buffer zone applies and for Vegetation Category 2 and 3, a 30-metre external buffer. This buffer area is the area where developments and people are most likely to be affected by bushfire burning on adjacent land.

6.15.2 Potential impacts

Construction

Hazards and risks relating to the construction of the proposal would include:

- Spills or leakage of contaminants such as fuels, chemicals and hazardous substances entering the surface and groundwater or contaminating soils
- Encountering unexpected utilities or contaminated material during earthworks
- Discharge of turbid run-off, resulting in pollution of waterways
- Flooding during extreme rain events
- Spread of noxious weeds
- Fire from offsite or due to construction activities such as hot work, including welding
- Work in proximity to the WSA protected airspace
- Changed traffic conditions leading to incidents.

These potential impacts have been addressed in other sections of this REF, including:

- Biodiversity (refer to Section 6.3)
- Surface water and groundwater (refer to Section 6.9)
- Hydrology and flooding (refer to Section 6.10)
- Geology, soils and contamination (refer to Section 6.11)
- Traffic and transport (refer to Section 6.2)
- Resource use and waste management (refer to Section 6.14).

Bushfire risks would be managed with the implementation of the mitigation measures in Section 6.15.3.

Overall, the hazards and risks associated with the proposal during construction are considered low and would be managed with the implementation of the standard safeguards and management measures such as those identified in Section 6.14.3.

Operation

Operational hazards and risks relating to the proposal could include:

- Fuel and oil spills during maintenance activities or vehicle incidents polluting the natural environment
- Vehicle incidents
- Flooding to proposal approach roads. Although the proposal design provides flood immunity for the 1 in 100 year flood event for bridges structures, access via approach roads to the proposal may be impacted during flooding.
- Operation and maintenance of the proposal in proximity to WSA protected airspace and public safety area.

Potential fuel and oil spills during operation are discussed in Section 6.11. Vehicle crashes are an inherent aspect of the operation of any road. During the design of the proposal, Transport has adopted the requirements of all relevant standards as listed in Section 3.2.

The proposal is in close proximity to WSA, with surrounding airspace protected to maintain a safe operating environment for aircraft near the airport. The design of the proposal has taken airport operational requirements into consideration and avoids encroachment into WSA. As identified in Section 3.2.5, as section of the proposal (including the existing Elizabeth Drive) is likely to be partially located within a public safety area associated with the end of a runway at WSA, near the Elizabeth Drive connection to the M12 Motorway. Potential interaction between the proposal design and the public safety would be the subject of consultation during detailed design to ensure that the relevant guidelines from the NASF are considered appropriately, minimising risks to public safety.

During operation, it is anticipated that hazards and risks associated with the proposal would be low and would be managed with the implementation of standard safeguards and management measures identified below.

6.15.3 Safeguards and management measures

Table 6-84 describes the proposed safeguards and management measures that would be implemented to manage potential hazards and risk.

Table 6-84 Safeguards and management measures - hazard and risk

Impact	Environmental safeguards	Responsibility	Timing	Reference
Hazard and risk	Encroachment into WSA will be avoided and managed in accordance with criteria for safe airspace outlined in the 'Procedure for Air Navigation Services – Operations (PANS-OPS)' for WSA	Transport	Detailed design	Additional safeguard
Hazard and risk	A Hazard and Risk Management Plan will be prepared and implemented as part of the CEMP. The Plan will identify: • Hazards and risks associated with the activity and measures to minimise these risks • Record keeping arrangements to manage materials on site • Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations	Contractor	Pre-construction / construction	Additional safeguard
Hazard and risk	A Bushfire Management Plan will be prepared and included as part of the CEMP. The Plan will identify: • Asset protection zone locations and management details • Landscaping requirements including indicative design layout and vegetation density thresholds • Access provisions such as locations, passing bays and alternate emergency access • Water supplies and bush fire suppression systems • Details regarding the Bush Fire Emergency Management and Evacuation Plan and any other essential bush fire safety requirements	Contractor	Pre-construction / construction	Additional safeguard
Hazard and risk	Construction activities involving flammable materials and ignition sources (for example, welding) will be proactively managed to ensure that the potential for fire is effectively minimised. High risk construction activities, such as welding and metal work, will be subject to a risk assessment on total fire ban days and restricted or ceased as appropriate. Construction personnel will be inducted into the requirement to safely dispose of cigarette butts	Contractor	Pre-construction / construction	Additional safeguard

Other safeguards and management measures that are relevant to the management of hazard and risk are identified in:

- Section 6.9, which outlines safeguards and management measures regarding surface water and groundwater
- Section 6.10, which outlines safeguards and management measures regarding flooding and hydrology
- Section 6.11, which outlines safeguards and management measures regarding geology, soils and contamination.

6.16 Cumulative impacts

6.16.1 Methodology

Cumulative impacts have the potential to occur when one project interacts or overlaps with other project(s) and can potentially result in a larger combined effect (positive or negative) on the environment or local communities. Cumulative impacts may occur when projects are constructed or operated concurrently or consecutively. Projects constructed consecutively or sequentially can have construction activities occurring over extended periods of time with little or no break in construction activities for affected receivers.

The extent to which another project could interact with the construction and/or operation of the proposal would depend on its scale, location and/or timing of construction. Generally, cumulative impacts would be expected to occur where multiple long-duration construction activities are carried out close to, and over a similar timescale to, construction activities for the project; or where consecutive construction occurs in the same area.

The cumulative impact assessment methodology for this proposal included:

- Identification of potentially relevant projects that could be included in the cumulative impact assessment, within the suburbs of Cecil Hills, Cecil Park, Mount Vernon, Kemps Creek, Badgerys Creek, Luddenham. Resources used for this include:
  - The NSW Government Major Projects website
  - Projects on the Transport for NSW website
  - Development application registers on the Fairfield City Council, Liverpool City Council and Penrith City Council websites
- Application of the following criteria to determine which projects should be included in the cumulative impact assessment
  - Spatially relevant – the project overlaps with (for road projects which intersect with Elizabeth Drive, due to potential traffic impacts) or occurs within the vicinity of the proposal
  - Timing – the expected timing of its construction and/or operation overlaps or occurs consecutively to construction and/or operation of the proposal
  - Scale – large-scale major development or infrastructure projects that have the potential to result in cumulative impacts with the proposal, as listed on the NSW Government Major Projects, Transport for NSW website and on relevant council websites
  - Status – projects in development with sufficient publicly available information and an adequate level of detail to assess the potential cumulative impacts
- Assessment of the potential cumulative impacts of the projects screened into the cumulative impact assessment, including identification of relevant issues likely to have material cumulative impacts during operation and/or construction of this proposal
- Identification of suitable safeguards and management measures to manage potential cumulative impacts.

6.16.2 Other projects and developments

Projects identified for consideration in the cumulative impact assessment are listed in Table 6-85. Projects identified for inclusion in the cumulative impact assessment have met the criteria listed above.

Table 6-85 Other projects and developments

Project	Construction impacts	Operational impacts
Elizabeth Drive East Upgrade As identified in Section 1.1, the proposal is one of two adjacent planned upgrades of Elizabeth Drive between The Northern Road, Luddenham and Duff Road, Cecil Hills. These include the Elizabeth Drive West Upgrade (this proposal), and Elizabeth Drive East Upgrade (referred to collectively as the Elizabeth Drive upgrades). The Elizabeth Drive East Upgrade has been considered in this cumulative impact assessment, and involves the following: • Upgrade of about 7.8 kilometres of Elizabeth Drive between Badgerys Creek Road near the future M12 Motorway and about 600 metres east of Duff Road at Cecil Hills • REF subject to determination by Transport • Located about 700 metres east of the construction footprint • Subject to detailed design and construction planning, construction is anticipated to take about 48 months to complete • Construction and operation timeframes are anticipated to overlap with the proposal	Potential construction impacts, subject to detailed design of the project may include: • Noise impacts from construction activities, resulting in exceedance of relevant criteria at receivers along Elizabeth Drive. This includes potential sleep disturbance impacts to some receivers from noise during the site establishment and enabling work phase • Minor road network performance impacts from the generation of up to 100 light vehicle and 70 heavy vehicle movements per day during peak construction • Removal of about 38.81 hectares of native vegetation, containing PCTs 724, 725, 781, 835, 849, 883 and 1800 • Partial or whole impact to up to 10 Aboriginal sites • Landscape and visual impacts associated with construction activities in an existing low density and semi-rural area	Operational impacts, subject to detailed design of the project may include: • Improvements to road network performance (once operational alongside the Elizabeth Drive West Upgrade) • Positive impacts to road user safety through the provision of new shared walking and cycling paths on both sides of Elizabeth Drive • Operational road traffic noise, resulting in exceedances of relevant noise criteria at 245 residential receivers, in proximity to the Elizabeth Drive road corridor • Increases in flood depths outside of the construction footprint for the upgrade • Positive socio-economic impacts for residents and businesses associated with improved travel times and road safety
Western Sydney Airport (WSA) • Construction of WSA to provide additional aviation capacity in Greater Sydney • Approved project under the EPBC Act • Land for the WSA is located immediately south-west of the proposal • At the time of writing, construction is in progress, due for completion in 2026	Construction impacts of the project may include: • Land clearing, impacting flora and fauna, and a major bulk earthworks program • Generation of an estimated 202,500 tonnes of vegetation and construction materials waste • Growth in employment opportunities in the region • Temporary visual impacts for sensitive receivers in Luddenham and Bringelly • Disturbance of Aboriginal heritage sites	Operational impacts of the project may include: • Growth in investment, infrastructure and employment opportunities in Western Sydney Long-term noise from aircraft noise and ground-based noise • Increase in nitrogen dioxide, particulate matter, carbon monoxide, sulfur dioxide and air toxics emissions • Increased traffic volumes on Elizabeth Drive, to and from the WSA, increasing the LoS on Elizabeth Drive (west of the M7) from D/E to E/F in 2031

Project	Construction impacts	Operational impacts
• It has been assumed that the majority of construction work would be complete once the proposal construction phase commences. Residual construction activities are expected to be limited in duration. Operation timeframes are anticipated to overlap	• Removal of 20 non-Aboriginal heritage items within the project footprint • About 160 additional vehicle movements per hour (to and from the airport site) on Elizabeth Drive during the AM peak and about 150 additional vehicle movements per hour (to and from the airport site) on Elizabeth Drive during the PM peak • Dust emissions	• Long-term transformation of the environment from a predominately rural landscape, to one that is urban • Changes in social amenity and lifestyle • Visual impacts from the WSA and overflights in areas close to the airport
Sydney Metro Western Sydney Airport (SSI-10051) • Construction and operation of a new metro railway around 23 kilometres in length between the existing Sydney Trains suburban rail network at St Marys in the north and the Western Sydney Aerotropolis Core precinct in the south, via WSA • Approved state significant infrastructure project, and approved under the EPBC Act (for components on WSA land) • The project's construction footprint is immediately south of Elizabeth Drive, within the WSA site • At the time of writing, construction is in progress, due for completion in 2026. • It has been assumed that the majority of construction work would be complete once the proposal construction phase commences. Residual construction activities are expected to be limited in duration. Operation timeframes are anticipated to overlap	Construction impacts of the project may include: • Road closures and diversions around construction sites, particularly around St Marys Station • An additional 2,044 construction related vehicle movements during peak hours on the surrounding road network • Noise and vibration close to construction sites, especially close to tunnel boring machines or where background noise levels are low • Clearing of threatened ecological communities • Impacts to non-Aboriginal heritage items, including a major impact to the McGarvie Smith Farm, a moderate impact on the McMaster Field Station and a minor impact on the Luddenham Road Alignment • Impacts on Aboriginal heritage sites	Operational impacts of the project may include: • Seamless integration with the proposed station precincts and existing and future transport interchange facilities, leading to a decreased traffic demand growth on the road network • Increased peak flood levels in isolated locations, including Badgerys Creek
M12 Motorway (SSI-9364) • A new dual-carriageway motorway to connect the M7 Motorway with the WSA and The Northern Road • Approved state significant infrastructure project • Includes an interchange between Elizabeth Drive and the M12 Motorway at the WSA entrance, within the construction footprint • Construction is in progress, due for completion in 2025 • Construction work for the M12 Motorway is expected to be completed prior to the proposal construction	Construction impacts of the project may include: • Clearing of vegetation including threatened ecological communities • Up to 1,560 additional construction vehicles on haulage routes per day • Major impacts to McMaster Field Station and McGarvie Smith Farm heritage items • Partial or whole impact to 19 Aboriginal sites	Operational impacts of the project may include: • Improved intersection performance along the Elizabeth Drive corridor between The Northern Road and Mamre Road • Removal / reduction of some "rat running" from local roads by providing better level of service and reduce delay on higher order of roads and encouraging more utilisation of higher order roads • Introduction of substantial infrastructure into the existing Cumberland Plain landscape

Project	Construction impacts	Operational impacts
commencing. Operation timeframes are anticipated to overlap	• Visual impacts of construction activities, including building and tree removal and temporary lighting, structures, and noise barriers • Noise, vibration, dust, traffic and light spill impacts on local amenity of communities close to construction work • Release of pollutants into downstream waterways and sensitive receiving environments and erosion and sedimentation of downstream water courses	• Changes in localised flow from one sub-catchment to the next
Westlink M7 Widening (SSI-663-Mod-6) • Construction and operation of an additional lane in both directions within the existing median of the M7 Motorway, from about 140 metres south of the Kurrajong Road overhead bridge at Prestons to the M7 Motorway bridge at Richmond • Modification to a state significant infrastructure project, approved in February 2023 • Located about eight kilometres east of the construction footprint • Construction expected to occur between 2023 and 2025 • Construction work is expected to be completed prior to the proposal construction commencing. Operation timeframes are anticipated to overlap	Construction impacts of the project may include: • Removal of 7.48 hectares of modified native vegetation containing seven PCTs, aligning to six TECs Other temporary construction impacts have not been considered in this assessment, given that construction of the Westlink M7 Widening is expected to be completed prior to the construction of this proposal. Notwithstanding there is potential for construction fatigue within the surrounding community, as the proposal would be constructed consecutively with this project	Operational impacts of the project may include: • Improvements in network performance, travel times and roadway level of service along the length of the project • Traffic noise impacts resulting in a number of sensitive receivers being eligible for the consideration of feasible and reasonable noise mitigation measures • Overall moderate to low visual impacts, with the highest impact in areas near the widened motorway and bridges and areas where vegetation has been removed • Social impacts associated with operational amenity issues (noise and visual), such as increasing stress and anxiety

6.16.2.1 Potential impacts

Potential cumulative impacts of the proposal with other projects and developments in the area are presented in Table 6-86.

The potential cumulative impacts associated with property and land use, soils, geology and contamination, resource use and waste, climate change, and hazard and risk were considered to be of a minor nature. The safeguards and management measures identified in Chapter 7 (Environmental management) are considered appropriate and adequate to address any potential residual cumulative impacts for these issues.

Table 6-86 Potential cumulative impacts

Environmental factor	Construction	Operation
Noise and vibration	While most construction activities for the proposal and other projects are expected to occur at separate times and/or locations, it is possible that noisy construction activities may occur at the same time in close proximity to each other. In these cases, it is possible that predicted noise levels may increase by up to 3 dB(A). It is noted this would potentially increase the number of receivers affected experiencing noise levels greater than 20dB above the NMLs. However, the following information should be considered: • Predicted construction noise impacts at each receiver are considered to be reasonable worst-case 15-minute impacts and noise levels are likely to be lower than stated in this assessment for substantial periods of time • Where a receiver is affected by noise from two projects simultaneously it is likely that noise levels from one would be dominant and, therefore, overall noise levels would increase only slightly, if at all • Detailed construction planning for these projects would be required for a more detailed assessment. In summary, it is unlikely that the number of receivers affected by 'moderately intrusive' noise levels would increase, and the implementation of noise management measures described in Section 7.2 would ensure the potential for adverse impacts at sensitive receivers are minimised.	The operational impact assessment carried out for road noise has included modelled traffic volumes from a number of approved major projects within the vicinity of the proposal. The potential for these projects to influence operational noise outcomes of the proposal have, therefore, been assessed and considered, as outlined in Section 6.1. It is also noted that sensitive receivers may be affected by the cumulative impacts of the WSA aircraft operations and surrounding road traffic. To address aircraft noise from the operation of WSA, the WSA may implement at-receiver noise mitigation at one receiver, prior to the proposal opening.
Traffic and transport	The WSA and Sydney Metro Western Sydney Airport is planned for completion in 2026 and, therefore, any overlapping construction activities with Elizabeth Drive upgrades would be limited in duration and are likely to coincide with the enabling construction activities of the proposal. When the construction of WSA and Sydney Metro WSA is completed it is likely that there would be an expected reduction in associated heavy vehicle movements in the study area and on surrounding road network.	As identified in Section 6.2, operational traffic modelling has considered both Elizabeth Drive upgrades. As such, cumulative benefits and impacts on road network performance have been considered in Section 6.2. Other cumulative impacts of the Elizabeth Drive upgrades include the following: • The Elizabeth Drive upgrades would connect the WSA, the Western Sydney Aerotropolis industrial and commercial developments, and new residential and employment hubs • The Elizabeth Drive upgrades would collectively improve conditions for cyclists and pedestrians in the region by providing shared walking and cycling paths, which are connected to the wider cycling network, and cycling crossings facilities. By the time construction of the Elizabeth Drive upgrades are completed, several other approved road projects would be open to traffic. The upgraded road network is anticipated to ease traffic congestion and reduce travel times. Intelligent Transport Services proposed along Elizabeth Drive and the adjacent projects would

Environmental factor	Construction	Operation
		provide better network coordination and incident management across the region which would help provide further improvements to travel times on the network.
Biodiversity	Collectively, the proposal and a number of approved proposed developments in the Western region are anticipated to result in cumulative biodiversity impacts. These projects include, WSA, Sydney Metro Western Sydney Airport, M12 Motorway and the Elizabeth Drive East Upgrade. Given the extent of vegetation to be removed to enable these projects, and to accommodate planned population growth in the region, it is likely that there would be moderate cumulative biodiversity impacts in the region. The proposal and the Elizabeth Drive East Upgrade would require the removal of a combined total of about 68.12 hectares of native vegetation. In accordance with the safeguards and management measures in Section 7.2, during the detailed design further opportunities would be sought to minimise the potential biodiversity impacts of the proposal.	There are no additional predicted cumulative impacts to biodiversity, beyond those identified during the construction phase. The proposal, WSA and other major transport projects considered in this cumulative impact assessment would be operational at the same time. As a result, impacts such as injury and mortality of fauna and noise, light and vibration may be greater than if the projects were operating in isolation, resulting in potential cumulative biodiversity impacts associated with their current operation.
Non-Aboriginal heritage	Collectively, the construction associated with the WSA, Sydney Metro Western Sydney Airport and M12 Motorway projects would have major impacts on the McGarvie Smith Farm. However, the proposal would make a negligible contribution to this cumulative impact, as direct impacts are not anticipated. There would be some temporary visual impacts to the landscape character of the McGarvie Smith Farm through its partial use as a construction compound and laydown area, which would contribute to the existing visual impacts from construction of the WSA. However, these visual impacts would be temporary for the duration of construction. Overall, the contribution to cumulative impact on non-Aboriginal heritage of this proposal is considered negligible.	No additional cumulative impacts to non-Aboriginal heritage are predicted to occur beyond those identified for the construction phase of the proposal.
Aboriginal cultural heritage	As identified in Section 6.5, one recorded Aboriginal site is anticipated to be directly impacted by the proposal. This Aboriginal site has not been identified as being subject to impacts from other surrounding projects. The proposal has the potential to contribute to cumulative impacts on the Aboriginal cultural record of the area, along with other surrounding projects, through its direct impacts to the finite resource of Aboriginal sites. This includes the potential combined total impact of 11 Aboriginal sites with the Elizabeth Drive East Upgrade.	As identified in Section 6.5, no further impacts to Aboriginal sites are predicted during the operation of the proposal. As such, there are no predicted cumulative impacts to Aboriginal cultural heritage beyond those identified during the construction phase.
Socio-economic	Potential cumulative social impacts during construction could include safety risks arising from increased traffic, increased amenity impacts as a result of noise, visual change, dust emissions, and health and wellbeing impacts from construction fatigue. Cumulative traffic and access impacts leading to delays in travel during construction	The cumulative benefit of the proposal with other transport projects within the vicinity is expected to result in a substantial net benefit for the community. Considered together with these projects, the proposal would provide: • Improved accessibility and connectivity within the social locality • Improved access to employment areas

Environmental factor	Construction	Operation
	could also lead to indirect social impacts such as anxiety, stress and frustration during the construction period. Nearby projects would also provide employment opportunities to the local area through labour for trades people, and business opportunities from supplying materials or renting construction equipment. As such there is the potential for a positive cumulative impact in this regard. A number of the projects considered in the cumulative impact assessment would have overlapping or consecutive construction periods with the proposal. This could induce construction fatigue in people living and working in the area. This may be due to the combined impacts of different projects (eg traffic impacts from one project and noise impacts from another), or simply from the concurrent or consecutive nature of disruptions in the area. When considering the proposed construction start and duration for each, as well as their proximity, this impact is likely to be most felt by residents and businesses in Cecil Park, Kemps Creek, Badgerys Creek and Luddenham. Construction fatigue impacts may also be particularly experienced near ancillary facilities that have would been used previously for construction projects, including the M12 Motorway project at construction ancillary facility 3, and the completed Northern Road Upgrade at construction ancillary facility 1. Overall, the magnitude of cumulative socio-economic impacts would be moderate. The sensitivity of the receivers affected by the impact are also considered to be moderate. As such the overall significance of impact would be a moderate negative impact.	• An increase in economic activity, businesses and employment opportunities. Overall, the magnitude of cumulative socio-economic impacts would be moderate. The sensitivity of the receivers affected by the impact are also considered to be moderate. As such the overall significance of impact would be a moderate positive impact.
Landscape and visual amenity	The landscape surrounding the proposal is undergoing a series of changes due to the development of the Western Sydney Aerotropolis and other projects in the area the WSA, the M12 Motorway and the proposed Elizabeth Drive East Upgrade. These changes affect the overall landscape character of the surrounding area and the views available within the study area for the landscape and visual assessment. Considering the visual impact of the construction of these projects, construction activity (including vegetation clearing, earthworks, construction of built elements, and movement of construction vehicles within the construction sites and on the local road network and construction compounds) would become a typical element seen within the surrounding landscape, including along the entire length of Elizabeth Drive between the Northern Road and the Westlink M7. While this change in views from the existing rural setting would be an overall adverse impact in combination with the proposal, the effect would be temporary (yet sustained due to the ongoing development) and, like the change in the character of the surrounding landscape, would be an anticipated change considering the development and its supporting infrastructure. A highly impacted group would be travellers on Elizabeth Drive, where	Once the proposal is operational, the M12 Motorway, WSA, Sydney Metro Western Sydney Airport, and Elizabeth Drive East Upgrade would have contributed to a changed landscape character and views in the area. The proposal is considered to make a moderate contribution to this changed landscape by transforming the existing rural road corridor to a more formalised, prominent transport corridor. The projects collectively would transition the existing rural landscape with paddocks, occasional housing and agricultural enterprises, to a more a more urban landscape with more visually prominent transport infrastructure. These changes are considered appropriate given the strategic context of the area, which is envisaged to undergo significant development as part of the Western Sydney Aerotropolis. In the longer term, as this development progresses, the project would visually blend with this surrounding urban landscape.

Environmental factor	Construction	Operation
	construction activity and equipment would become a characteristic element within the views along the road corridor between the Northern Road and the Westlink M7.	
Surface water quality, hydrology and flooding	Given the proximity to the proposal, the Elizabeth Drive East Upgrade, WSA and Sydney Metro Western Sydney Airport projects were considered in assessing potential cumulative impacts of the proposal to surface water (including to watercourses of Badgerys Creek, Oaky Creek and Cosgrove Creek) Whilst the Sydney Metro Western Sydney Airport project would include large-scale earthworks, these would predominantly occur within non-flooded areas. Where this project intersects the study area for the flooding assessment carried out for this proposal (refer to Section 6.10), flooding impacts are not anticipated to occur as the Sydney Metro Western Sydney Airport sections on a viaduct would not obstruct creek flows. Provided that hydrology and flooding impacts in the construction footprint are managed and mitigated appropriately (in accordance with the measures in Section 6.10.4), surface waters discharged by this proposal are unlikely to contribute to potential cumulative impacts.	Once the proposal is operational, there would be limited potential for cumulative impacts to surface water, beyond those identified for the construction phase Flood modelling carried out for the operational impact assessment has considered a number of approved major projects within the vicinity of the proposal. The potential for these projects to influence operational hydrology and flooding outcomes of the proposal have, therefore, been assessed and considered, as outlined in Section 6.10
Groundwater	The cumulative impact assessment for groundwater considers impacts related to the quality and quantity of the groundwater resource and how it can impact GDEs, groundwater users, and/or groundwater-surface water interactions. In particular, the following projects have been identified as likely to contribute to a cumulative impact of the proposal for groundwater: • WSA – Earthworks proposed are substantial and there would be dewatering around areas of subsurface infrastructure and up-gradient of cuttings where seepage is occurring. Groundwater drawdown effects due to inflows would be limited following the initial effects of bulk earthworks and excavation. Significant groundwater inflows to underground infrastructure are not expected and would be controlled, if necessary, through the use of lining or other engineering controls. • Sydney Metro Western Sydney Airport – There would be dewatering associated with underground infrastructure during the construction phase. During operation, the underground infrastructure are designed as 'tanked' structures such that groundwater ingress would be limited • Elizabeth Drive Upgrade East – Minimal dewatering associated with cuts in the topography to achieve desired road grades, shallow excavations and during bridge construction over Badgerys, South and Kemps Creeks. The majority of construction work for the WSA and Sydney Metro Western Sydney Airport projects identified for the cumulative impact assessment are scheduled to	Cumulative groundwater drawdown impacts during the operational phase are considered to be unlikely as potential areas of drawdown associated with the proposal would be localised. Additionally, groundwater seepage to underground infrastructure associated with the WSA and Sydney Metro Western Sydney Airport projects would be managed and/or mitigated through design to minimise long-term groundwater drawdown.

Environmental factor	Construction	Operation
	conclude prior to commencement of the construction work for the proposal. However, where final construction work overlaps, there would be the potential for cumulative impacts from overlapping groundwater drawdown areas associated with minor and localised excavation dewatering being carried out during the proposal and other projects. The cumulative impacts, including those from Elizabeth Drive Upgrade East are likely to be temporary and/or localised as groundwater drawdown associated with these projects would be minimised after construction completion.	
Air quality	Projects considered in the cumulative impact assessment are located at a distance sufficiently removed from the proposal construction footprint. Due to its proximity and concurrent timing of the Elizabeth Drive East Upgrade, there is potential for cumulative air quality impacts with the proposal during construction. However, construction impacts from this proposal would be managed in accordance with the safeguards and management measures listed in Section 7.2. As a result, the potential for cumulative impacts with surrounding projects are expected to be negligible.	An assessment of potential cumulative air quality impacts with the Elizabeth Drive East Upgrade concluded that there would be very little change in concentrations when both the proposal and the Elizabeth Drive East Upgrade would operate concurrently, compared with the two projects operating in isolation (refer to Appendix N (Air Quality Impact Assessment) for detailed assessment results). Potential cumulative effects of the proposal and the Elizabeth Drive East Upgrade are, therefore, considered to be negligible. Operation of WSA (beyond 2026) would coincide with the operation of the proposal. Operational emissions from WSA would primarily consist of combustion emissions associated with fuel use. Emissions from WSA would likely increase the measured background concentrations utilised in the assessment of the proposal, thereby increasing the predicted cumulative concentrations. Despite the potential for higher background concentrations and possible exceedances from the operation of WSA, this would not affect emissions from the proposal. The difference between the proposal and 'do-nothing' scenarios would, therefore, remain unchanged.

6.16.3 Safeguards and management measures

Table 6-87 describes the proposed safeguards and management measures that would be implemented to manage potential cumulative impacts.

Table 6-87 Cumulative safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative impacts – construction	Co-ordination and consultation with the following stakeholders will occur where required to manage the interface of the WSA, Sydney Metro Western Sydney Airport and Elizabeth Drive East Upgrade projects during overlapping construction activities: • Transport for NSW • Construction contractors • Other relevant stakeholders Consultation and co-ordination with these stakeholders will include: • Provision of regular updates to the detailed construction program, construction sites and haul routes • Identification of key potential overlap points and activities • Development of mitigation and management strategies to manage these conflicts and potential impacts, for example, co-ordination of respite periods	Transport / Contractor	Construction	Additional safeguard

7. Environmental management

This chapter describes how the proposal would be managed to reduce potential environmental impacts during detailed design, construction and operation. A framework for managing potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are listed.

7.1 Environmental management plans

Safeguards and management measures have been identified in this REF to minimise adverse impacts which could potentially arise from the construction or operation of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Project Environmental Management Plan (PEMP) and a CEMP would be prepared to describe the safeguards and management measures identified. During detailed design, the PEMP would be the overarching document in the environmental management system for the proposal that includes a number of management documents. During construction, the CEMP would provide a framework for establishing how these measures would be implemented and who would be responsible for the implementation.

The CEMP would be prepared prior to construction of the proposal and would be reviewed and certified by the Transport Environment Officer prior to the commencement of any on-site work. The CEMP would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan), QA Specification G40 – Clearing and Grubbing, and QA Specification G10 – Traffic Management.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF would be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures would minimise any potential adverse impacts arising from the proposed work on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

The table includes reference to the applicable section of a Transport specification, where relevant to a safeguard or management measure. Where there is no applicable specification, the safeguard or management measure is identified as an 'additional safeguard'.

Table 7-1 Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN1	General – minimise environmental impacts during detailed design	A Project Environmental Management Plan (PEMP) will be prepared to outline and describe the key environmental issues associated with the proposal. The PEMP will be the overarching document in the environmental management system for the proposal that includes a number of management documents. It will be applicable to all staff and contractors associated with the development, design and construction of the proposal. The PEMP will be prepared and implemented with the Environmental Management System (EMS) which has been prepared in accordance ISO14001:2016	Contractor / Transport	Detailed design / Pre-construction	Additional safeguard
GEN2	General - minimise environmental impacts during construction	A CEMP will be prepared and submitted for review and endorsement of the Transport Environment Officer prior to commencement of the activity. As a minimum, the CEMP will address the following: • Any requirements associated with statutory approvals • Details of how the project will implement the identified safeguards outlined in the REF • Issue-specific environmental management plans • Roles and responsibilities • Communication requirements • Induction and training requirements • Procedures for monitoring and evaluating environmental performance, and for corrective action • Reporting requirements and record-keeping • Procedures for emergency and incident management • Procedures for audit and review	Contractor / Transport	Detailed design / Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		The endorsed CEMP will be implemented during construction of the proposal			
GEN3	General - notification	Notifications will be sent to residential properties and other key stakeholders affected by a construction activity at least five working days prior to the work activities starting	Contractor / Transport	Pre-construction	Additional safeguard
GEN4	General - environmental awareness	All personnel working on site will receive training to ensure awareness of environmental protection requirements and procedures to be implemented during the proposal. This will include up-front site induction and regular "toolbox" style briefings. Site specific training will be provided to personnel engaged in activities or areas of higher risk. Briefings will also identify: • Areas of Aboriginal and non-Aboriginal heritage, including areas with potential archaeological deposits • Threatened species habitats • Adjoining residential areas requiring noise management measures	Contractor / Transport	Pre-construction	Additional safeguard
NV1	Noise and vibration	A Construction Noise and Vibration Management Plan will be prepared as part of the CEMP. The Construction Noise and Vibration Management Plan will identify: • The location of noise and vibration sensitive receivers • Potential significant noise and vibration generating activities • Feasible and reasonable mitigation measures to be implemented during construction to minimise noise and vibration impacts, such as restrictions on working hours, staging, placement and operation of work compounds, parking and storage areas, temporary noise barriers, construction haulage route road maintenance and controlling the location and use of vibration generating equipment • A monitoring program to assess performance against relevant noise and vibration criteria • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures • An out of hours work procedure, including approval process and proposed mitigation measures	Contractor	Pre-construction and construction	Section 4.6 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV2	Noise and vibration	All sensitive receivers (eg schools, local residents) likely to be affected will be notified at least five days prior to the start of any work associated with the modelled scenario that may have an adverse noise or vibration impact (eg moderately intrusive during the day and clearly audible at night). The notification will include the following details: • The description of work • Management of any disruption (e.g noise mitigation measures) • Construction period and construction hours • Contact information for project management staff • Complaint and incident reporting and how to obtain further information	Contractor	Pre-construction and construction	Additional safeguard
NV3	Noise and vibration	Where reasonable and feasible, construction will be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels will be scheduled during less sensitive time periods, where possible. Any variations to the standard construction hours will follow the approach in RTA Environmental Fact Sheets – Noise Management and Night Work, including consultation with the affected local community	Contractor	Construction	Additional safeguard
NV4	Noise and vibration	Where properties have been identified for architectural treatment and are likely to be impacted by noise from construction work, Transport will consult with those property owners on the early installation of treatments to provide noise mitigation during the construction of the proposal	Contractor / Transport	Pre-construction	Additional safeguard
NV5	Noise and vibration	Where feasible and reasonable, high noise generating activities (75 dB(A) L_{Aeq} at receiver) will be carried out during standard construction hours and in continuous blocks of no more than three hours with at least one hour respite between each block of work generating high noise impact, where the location of the work is likely to impact the same receiver	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV6	Noise and vibration	The following will be implemented for deliveries to and from the proposal: • Loading and unloading of materials/deliveries as far as possible from sensitive receivers • Dedicated loading/unloading areas will be shielded if close to sensitive receivers • Delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible • The construction site will be arranged to limit the need for reversing associated with regular/repeatable movements	Contractor	Construction	Additional safeguard
NV7	Noise and vibration	Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work	Contractor	Construction	Additional safeguard
NV8	Noise and vibration	Where practicable, work will be scheduled to avoid major student examination periods such as before or during the Higher School Certificate and at the end of higher education semesters	Contractor	Construction	Additional safeguard
NV9	Noise and vibration	In circumstances where the noise levels are predicted to exceed construction noise management levels after implementation of the standard actions listed in Transport's Construction Noise and Vibration Guideline, additional mitigation measures will be implemented, such as the following: • Monitoring • Notification (letterbox drop or equivalent) • Specific notifications • Phone calls • Individual briefings • Respite offers and periods • Alternative accommodation	Contractor	Construction	Additional safeguard
NV10	Noise and vibration	Vibration intensive equipment size will be selected to avoid working within the structural damage minimum working distances. The use of less vibration intensive methods of construction or equipment will be considered where feasible and reasonable	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV11	Noise and vibration	Where the use of vibration intensive equipment within the relevant minimum working distances cannot be avoided, prior to the commencement of vibration intensive work, a detailed inspection will be carried out and a written and photographic report prepared to document the condition of buildings and structures within the minimum working distances. A copy of the report will be provided to the relevant landowner or land manager	Contractor	Pre-construction	Additional safeguard
NV12	Noise and vibration	To confirm that the noise levels targets are achieved, a post-construction noise monitoring program will be carried out in accordance with the Road Noise Mitigation Guideline	Transport	Operation	Additional safeguard
TT1	Traffic and transport	A TMP will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Transport's Traffic Control at Work Sites Manual (Transport for NSW, 2020) and QA Specification G10 Control of Traffic (Transport for NSW, 2020). The TMP will include: • Confirmation of haulage routes • Measures to maintain access to local roads and properties • Site specific traffic control measures (including signage) to manage and regulate traffic movement • Measures to maintain pedestrian and cyclist access • Requirements and methods to consult and inform the local community of impacts on the local road network • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads • A response plan for any construction traffic incident • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic Monitoring, review and amendment mechanisms	Contractor	Detailed design / Pre-construction	Additional safeguard
TT2	Traffic and transport	Disruptions to property access and traffic will be notified to landowners at least five days prior in accordance with the relevant community consultation processes outlined in the TMP. Where access is not feasible, temporary alternative access arrangements will be provided following consultation with affected landowners and the relevant local council	Contractor / Transport	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
TT3	Traffic and transport	Pre-construction and post construction road condition reports for local roads likely to be used during construction will be prepared. Any damage resulting from construction (not normal wear and tear) will be repaired unless alternative arrangements are made with the relevant road authority. Copies of road condition reports will be provided to the local council	Contractor	Pre and post construction	Additional safeguard
TT4	Traffic and transport	Pedestrian and cyclist access will be maintained during construction. Where that is not feasible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners and the local Council	Contractor	Construction	Additional safeguard
TT5	Traffic and transport	The community, including public transport operators, will be informed of upcoming activities that may affect the operation of public transport	Contractor	Pre and post construction	Additional safeguard
B1	Biodiversity – displacement of resident fauna	A Flora and Fauna Management Plan will be prepared in accordance with Transport's Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to: • Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • Pre-clearing survey requirement • Clearing protocols • Procedures for unexpected threatened species finds and fauna handling Fauna will be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)	Transport / Contractor	Pre-construction and construction	Additional safeguard
B2	Biodiversity – displacement of resident fauna	Thorough inspection during higher-activity season (October to March) of all structures that contain potential microbat habitat will be caried out, in accordance with Transport for NSW Microbat Management Guidelines (Transport for NSW, 2023). If microbats are detected, advice from a microbat specialist will be sought to determine the need for a Microbat Management Plan	Transport / Contractor	Pre-construction and construction	Additional safeguard
B3	Biodiversity – indirect impacts on native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B4	Biodiversity – indirect impacts on native vegetation and habitat	Where practicable, native vegetation will be re-established in accordance with Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
B5	Biodiversity – indirect impacts on native vegetation and habitat	Weed species will be managed in accordance with Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
B6	Biodiversity – indirect impacts on native vegetation and habitat	Pathogens will be managed in accordance with Guide 7 Pathogen management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011)	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
B7	Biodiversity – indirect impacts on native vegetation and habitat	Shading and artificial light impacts will be minimised through detailed design	Transport / Contractor	Detailed design	Additional safeguard
B8	Biodiversity – prescribed impacts	The requirement to replace trees and hollows within non-native vegetation will be calculated in accordance with the Tree and Hollow Replacement Guidelines (Transport for NSW, 2022). Only non-native trees that have amenity value are required to be replaced. If onsite replacement is sought, a Tree and Hollow Replacement Plan will be prepared and/or equivalent payment to the Transport Conservation Fund will be made	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
B9	Biodiversity – prescribed impacts	If microbats are found to be inhabiting the development footprint, habitat removal will be carried out in accordance with Transport for NSW Microbat Management Guidelines (Transport for NSW, 2023)	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
B10	Biodiversity – prescribed impacts	To manage biodiversity impacts to water bodies, water quality and hydrology: • Changes to existing surface water flows will be minimised through detailed design Interruptions to water flows associated with GDEs will be minimised through detailed design	Transport / Contractor	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B11	Biodiversity – prescribed impacts	To manage risk of vehicle strike: • Construction fencing will be established to prevent fauna from entering construction zones Construction traffic within construction sites and machinery will be restricted to 30 kilometres per hour and signage erected informing personnel of this restriction	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
B12	Biodiversity – Adaptive management strategies	Adaptive management will include an agreed monitoring, evaluation, reporting and improving cycle, for impacts on biodiversity that are uncertain such as: • Inadvertent impacts to native vegetation adjacent the construction footprint • Introduction of pests, pathogens and weeds to native vegetation adjacent the construction footprint and further afield • Degradation of downstream habitats via worsening of water quality or alteration to hydrological processes • Vehicle strikes	Transport / Contractor	Pre-construction, construction, and post-construction	Additional safeguard
B13	Biodiversity - loss of hollow-bearing and amenity trees	Trees and hollows that require replacement will be identified in accordance with the Tree and Hollow Replacement Guidelines, and prior to the commencement of work: • A Tree and Hollow Replacement Plan will be prepared, or • Payment will be made to the Transport Conservation Fund.	Transport / Contractor	Pre-construction	Additional safeguard
NAH1	Non-Aboriginal heritage	A Non-Aboriginal Heritage Management Plan (NAHMP) will be prepared and implemented as part of the CEMP. It will provide specific guidance on measures and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage	Contractor	Detailed design / pre-construction	Section 4.10 of QA *G36 Environment Protection*
NAH2	Non-Aboriginal heritage	Any unexpected heritage finds identified during construction will be governed by Transport's EMF-HE-PR-0076 Unexpected Heritage Items Procedure 2022 (Transport for NSW, 2020). Work will only resume once the requirements of the procedure have been satisfied	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
ACH1	Aboriginal cultural heritage – Salvage excavation	Archaeological salvage excavation will be carried out within the impacted portions of Elizabeth Drive/Adams Road AFT 1. Salvage excavation will be completed prior to any activities (including pre-construction activities) which may harm Aboriginal objects at this location. Salvage excavation activities will be undertaken in accordance with the methodology attached as Appendix D of Appendix H (Aboriginal Cultural Heritage Assessment Report)	Transport / Contractor	Detailed design	Additional safeguard
ACH2	Aboriginal cultural heritage – Community collection	Community collection of surface artefacts will be carried out at Elizabeth Drive/Adams Road AFT 1. Community collection will be completed prior to any activities (including pre-construction activities) which may harm Aboriginal objects at these locations. Community collection activities will be undertaken in accordance with the methodology attached as Appendix D of Appendix H (Aboriginal Cultural Heritage Assessment Report)	Transport / Contractor	Detailed design	Additional safeguard
ACH3	Aboriginal cultural heritage – Site protection	The boundary of the area subject to an Aboriginal Heritage Impact Permit, adjacent to the non-impacted portion of Elizabeth Drive/Adams Road AFT 1, will be demarcated with protective fencing. These areas will be identified as “no-go zones” in the CEMP for the proposal. Construction workers will be inducted as to appropriate protection measures and requirements to comply with conditions in the adjacent Aboriginal Heritage Impact Permit	Contractor	Pre-construction / construction	Additional safeguard
ACH4	Aboriginal cultural heritage – Overlapping projects	Activities carried out as part of the proposal undertaken within existing approval areas of other projects (including the M12 Motorway (SSI-9364), Upper South Creek Advanced Water Recycling Centre (SSI-8609189) and the Western Sydney Airport) will comply with all relevant conditions relating to Aboriginal heritage management for these projects. Where required, consultation will be undertaken with these projects to confirm the relevant conditions and requirements for these areas	Transport / Contractor	Pre-construction / construction	Additional safeguard
	Aboriginal cultural heritage – Unexpected finds	Transport’s EMF-HE-PR-0076 Unexpected Heritage Items Procedure 2022 (Transport for NSW, 2022) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. Work will only re-commence once the requirements of that Unexpected Heritage Items Procedure have been satisfied	Contractor	Pre-construction / construction	Section 4.9 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
PLU1	Property and land use	Transport will complete property adjustments including fencing, driveways/access and adjustments to other property infrastructure impacted by the proposal in consultation with affected property owners	Transport	Detailed design	Additional safeguard
PLU2	Property and land use	All property acquisition will be carried out in accordance with the with the Property Acquisition Policy (Transport for NSW, 2021) and the Just Terms Act	Transport	Pre-construction and construction	Additional safeguard
PLU3	Property and land use	Transport will consult with airport operators to avoid direct impacts to airport operations from the construction of the proposal. This will include obtaining any necessary permits required to enable construction to occur in the vicinity of Western Sydney Airport	Transport	Pre-construction and construction	Additional safeguard
SE1	Socio-economic impacts – Community consultation	A Communication Plan (CP) will be prepared in accordance with the Community Involvement and Communications Resource Manual (RTA, 2008) and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The CP will include (as a minimum): • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for complaints	Contractor	Detailed design, pre-construction and construction	Additional safeguard
SE2	Socio-economic impacts – Community consultation	Consultation with stakeholders and any further community and stakeholder engagement feedback received during the REF exhibition period will be responded to in a submissions report to support the REF. Where relevant, this feedback will also inform detailed design and construction planning	Transport	Detailed design	Additional safeguard
SE3	Socio-economic impacts – Aboriginal cultural heritage	Consultation with Aboriginal stakeholders is ongoing, and will inform design development so that Aboriginal culture and heritage is respected and integrated into the design where possible. This may include investigation of opportunities to incorporate Aboriginal heritage and artwork interpretation into the design of the proposal in consultation with Aboriginal stakeholders	Transport	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SE4	Socio-economic impacts – Property acquisition	Consultation will occur with directly affected landowners (i.e. where property acquisition or adjustments are proposed) during the REF exhibition period, throughout the development of the detailed design and during construction. Consultation will include: • Sharing information on relevant impacts during construction and operation • Identification of opportunities to avoid direct impacts to structures (such as sheds) • Consultation with affected landowners regarding proposed changes to the property (including adjustments and acquisition) in consultation with the relevant landowner/s	Transport	Detailed design and construction	Additional safeguard
SE5	Socio-economic impacts – Business impacts	Specific consultation will be carried out with businesses potentially impacted during construction. Consultation will aim to identify potential construction impacts to individual businesses. Based on this consultation, specific feasible and reasonable measures to maintain business access, signage and parking, and address other potential impacts as they arise through the consultation process, will be identified and implemented	Transport / Contractor	Detailed design and construction	Additional safeguard
SE6	Socio-economic impacts – Business impacts	Regular engagement will be carried out with affected businesses regarding the progress of the proposal to allow businesses time to prepare for changed local conditions through the area	Transport / Contractor	Construction	Additional safeguard
SE7	Socio-economic impacts – Community consultation	Construction workers, materials and equipment hire will be sourced from the local area where feasible	Contractor	Construction	Additional safeguard
LV1	Landscape and visual	Where the existing view to the road corridor from residential properties will be impacted, community consultation will be carried out to determine appropriate planting measures. This could include the provision of formal planting (hedges or screen planting) along boundaries within private residential properties (in consultation with landowners), to be considered during detailed design	Transport	Detailed design	Additional safeguard
LV2	Landscape and visual	Tree species for the landscape design will be selected from the Western Sydney Aerotropolis Development Control Plan 2021, where possible, taking into consideration the relevant aviation safeguarding controls	Transport	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
LV3	Landscape and visual	Tree protection zones will be established around trees to be retained. Tree protection will be carried out in keeping with AS4970-2009 Protection of Trees on Development Sites and will include exclusion fencing of tree protection zones	Contractor	Detailed design / pre-construction	Additional safeguard
LV4	Landscape and visual	Shade cloth or construction hoarding (or similar material) (where necessary) will be installed to minimise visual impacts. Construction sites will be kept clean and tidy and refuse will be placed in appropriate receptacles. Hoardings and site fencing will be removed once construction is complete	Contractor	Construction	Additional safeguard
LV5	Landscape and visual	Cut-off or directed lighting will be provided within and outside of the construction site, with lighting location and direction considered to ensure glare and light spill is minimised	Contractor	Construction	Additional safeguard
SW1	Surface water and groundwater – Sydney Water stormwater scheme	Transport will liaise with Sydney Water regarding the Western Sydney Aerotropolis integrated water system scheme at the detailed design phase of the proposal, as relevant. Consultation will be carried out in regard to the stormwater network, drinking water, wastewater and recycled water networks	Transport	Detailed design	Additional safeguard
SW2	Surface water and groundwater	A Soil and Water Management Plan will be prepared in accordance with QA Specification G38 and implemented as part of the CEMP. The Soil and Water Management Plan will identify all reasonably foreseeable risks relating to surface water and groundwater quality, and water pollution associated with carrying out the activity. It will describe how these risks would be managed and minimised during construction. This will include arrangements for managing pollution risks associated with spillage or contamination on the site and adjoining areas. Monitoring of surface water and groundwater quality will be carried out prior to, during and after construction. This will include key watercourses, and farm dams potentially impacted by the proposal	Contractor	Pre-construction / Construction	Section 2.1 of QA G38 Soil and Water Management
SW3	Surface water and groundwater	The anticipated water discharge from sediment basins will be assessed in line with the Guideline for Assessing the Impacts of Treated Water Discharge from Water Quality Treatment Controls (Transport for NSW, 2020). The results of such assessment will inform design of sediment basins to adhere to EPL discharge requirements	Contractor	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SW4	Surface water and groundwater	A site-specific Erosion and Sediment Control Plan (the plan) will be prepared and implemented and included in the Soil and Water Management Plan (part of the CEMP). The plan will identify detailed measures and controls to be applied to minimise erosion and sediment control risks including, but not limited to: • Runoff, diversion, and drainage points • Sediment basins and sumps • Scour protection • Stabilising disturbed areas as soon as possible • Check dams, fencing and swales • Installation of measures at work entry and exit points to minimise movement of material onto adjoining roads at entry and exit points • Staged implementation arrangements • Appropriate location and storage of construction materials, fuels, and chemicals, including bunding where appropriate • Arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather	Contractor	Pre-construction / construction	Additional safeguard
SW5	Surface water and groundwater	Stockpiles will be designed, established, operated, and decommissioned in accordance with the Stockpile Site Management Guideline (RMS, 2015)	Contractor	Pre-construction / construction	Additional safeguard
SW6	Surface water and groundwater	The rehabilitation of disturbed areas will be carried out progressively as construction stages are completed, and in accordance with: • Landcom's Managing Urban Stormwater: Soils and Construction series (Landcom, 2004) • RMS Landscape design guideline (RMS, 2018) • RMS Guideline for Batter Stabilisation using Vegetation (RMS, 2015)	Contractor	Construction	Additional safeguard
SW7	Surface water and groundwater	The proposed bioretention basins will be established as construction sediment basins during the construction stage of the proposal to capture sediment and other pollutants mobilised during construction	Contractor	Pre-construction/Construction	Additional safeguard
SW8	Surface water and groundwater	Road drainage will be treated by sediment basins. The requirements for sediment basins (ie number, location, and size) would be determined during the proposal detailed design phase	Contractor	Pre-construction/Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SW9	Surface water and groundwater	A site-specific emergency spill plan will include spill management measures in accordance with the Transport for NSW Code of Practice for Water Management (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport and EPA officers), regular inspections and maintenance of equipment and spill-control structures such as hardstand areas and containment	Contractor	Pre-construction	Section 4.3 of QA G36 Environment Protection
SW10	Surface water and groundwater	Waste recovered during maintenance will be disposed of correctly. The proposed bioretention basins will undergo regular scheduled maintenance to ensure the ongoing treatment efficiency during the road's operational life	Transport	Operation	Additional safeguard
SW11	Surface water and groundwater	Any dewatering activities will be carried out in accordance with the 'Technical Guideline – Environmental Management of Construction Site Dewatering' (Roads and Maritime, 2011) in a manner that prevents pollution of waters	Contractor	Construction	Additional safeguard
SW12	Surface water and groundwater	Construction within areas of moderate to very high-risk saline soils will be managed in accordance with the Soil and Water Management Plan and procedures set out in the Salinity Training Handbook (NSW Department of Primary Industries, 2014). Specific measures will also include (but not be limited to): • Identification and management of saline discharge sites, for example seepage from cuts • Testing to confirm the presence of saline soils in areas of high salinity potential prior to disturbance • Progressive stabilisation and revegetation of exposed areas following disturbance as soon as is practicable • Groundwater quality monitoring carried out prior to and throughout construction	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SW13	Surface water and groundwater	Prior to ground disturbance in areas of potential acid sulfate soil occurrence, testing will be carried out to determine the actual presence of acid sulfate soils. If acid sulfate soils are encountered, they will be managed in accordance with the Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998) and the Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (NSW Roads and Traffic Authority, 2005)	Contractor	Pre-construction / construction	Additional safeguard
SW14	Surface water and groundwater	Sediment and erosion controls are to be used for in-stream works to avoid impacts on water quality and fish passage e.g. erosion fencing, stockpile covers and silt curtains. Clean rock is to be used for any instream temporary rock platforms	Contractor	Construction	Additional safeguard
FH1	Flooding and hydrology	Further design refinement will be carried out generally within the vicinity of creeks which traverse the proposal, to minimise potential increases in the afflux where possible (for example, refining the sizing of culverts and drainage infrastructure)	Transport	Detailed design	Additional safeguard
FH2	Flooding and hydrology	Floor level surveys will be carried out at buildings within the modelled area, to ascertain ground floor heights	Transport	Detailed design	Additional safeguard
FH3	Flooding and hydrology	A Flood Response Management Plan will be prepared as part of the CEMP. The Flood Response Management Plan will address, but not necessarily be limited to: • Processes for monitoring and mitigation flood risk • Steps to be taken in the event of a flood warning including removal or securing of loose material, equipment, fuels and chemicals • Monitoring long term rainfall forecasts and scheduling high risk work activities around these forecasts • Identifying contingency locations for the temporary flood storage of equipment and materials outside of potential inundation areas • Contingency measures to secure and stabilise work areas and compound sites prior to flooding	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GSC1	Geology, soils and contamination	A Phase 2 Contamination Assessment (detailed site investigation) will be completed and will include the collection of samples of fill material, fly tipped waste (if present) and soil from areas of current and former agricultural land. It will be carried out via test pitting along the alignment and at areas known to be construction staging areas or ancillary facilities to characterise the material. Given the length of the alignment, samples collected are to focus on any areas that may indicate signs of potential contamination as well as area coverage	Transport	Pre-construction	Additional safeguard
GSC2	Geology, soils and contamination	The CEMP will include an unexpected finds protocol for potentially contaminated material encountered during construction work	Contractor	Construction	Section 4.2 of QA G36 Environment Protection
GSC3	Geology, soils and contamination	An Asbestos Management Plan will be developed and implemented to manage asbestos and asbestos containing material if encountered during the construction. The plan will include: • Identification of potential asbestos on site • Procedures to manage and handle any asbestos • Mitigation measures if asbestos is encountered during construction • Procedures for disposal of asbestos in accordance with the NSW EPA guidelines, Australian Standards and relevant industry codes of practice	Transport	Pre-construction	Additional safeguard
GSC4	Geology, soils and contamination	Batters and bridge structures will be designed and constructed to minimise risk of exposure, instability and erosion, and to support long-term, on-going best practice management, in accordance with RMS 'Guideline for Batter Surface Stabilisation using Vegetation' (RMS, 2015)	Contractor / Transport	Construction / operation	Additional safeguard
AQ1	Air quality	An Air Quality Management Plan will be prepared and implemented as part of the CEMP. The Air Quality Management Plan will include, but not be limited to: • Potential sources of air pollution • Air quality management objectives consistent with any relevant published EPA and/DPE guidelines • Mitigation and suppression measures to be implemented • Methods to manage work during strong winds or other adverse weather conditions • A progressive rehabilitation strategy for exposed surfaces	Contractor	Detailed design / Pre-construction	Section 4.4 of QA G36 Environment Protection

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
AQ2	Air quality – Combustion emissions	Use of diesel or petrol-powered generators will be avoided where practicable and mains electricity or battery powered equipment will be used where practicable	Contractor	Construction	Additional safeguard
AQ3	Air quality – Combustion emissions	Vehicles and plant will be switched off when engines are stationary. Idling vehicles will be avoided where practicable	Contractor	Construction	Additional safeguard
AQ4	Air quality – Dust emissions	During periods of high potential for increased air quality impacts and/or prolonged dry or windy conditions, the frequency of site inspections will be increased by the construction contractor's environmental representative or accountable personnel for air quality and dust issues	Contractor	Construction	Additional safeguard
AQ5	Air quality – Dust emissions	At each construction zone, the site arrangement will be planned so that dust generating activities are carried out to minimise dust at nearby receptors. Measures may include stockpiles located as far away from receptors as possible; dust barriers being erected around dusty activities/site boundary, or similar.	Contractor	Construction	Additional safeguard
AQ6	Air quality – Dust emissions	A maximum speed limit of 15 kilometres per hour on unsurfaced roads and construction work areas will be imposed and signposted	Contractor	Construction	Additional safeguard
AQ7	Air quality – Dust emissions	Adequate water supply will be provided on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	Contractor	Construction	Additional safeguard
CC1	Climate change	Construction equipment, plant and vehicles will be appropriately sized for the task, serviced frequently and will not be left idling when not in use	Contractor	Construction	Additional safeguard
CC2	Climate change	Opportunities to use low emission construction materials, such as recycled aggregates in road pavement and surfacing, and cement replacement materials will be investigated and incorporated where feasible and cost-effective	Contractor	Construction	Additional safeguard
CC3	Climate change	Raw materials will be managed to reduce energy requirements for their processing. For example, stockpiled materials will be stored undercover where possible to reduce moisture content of materials and, therefore, the process and handling requirements	Contractor	Construction	Additional safeguard
CC4	Climate change	Materials with lower emissions intensity will be specified in the selection of maintenance materials	Transport	Operation	Additional safeguard
CC5	Climate change	The most energy efficient street lighting appropriate for proposal needs will be specified	Transport	Operation	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
RU1	Resource use and waste	Use of recycled-content materials will be considered during the detailed design	Transport	Detailed design	Additional safeguard
RU2	Resource use and waste	A Waste Management Plan will be prepared and implemented as part of the CEMP. The Waste Management Plan will provide specific guidance on measures and controls to be implemented to support minimising the amount of waste produced and appropriate handling and disposal of unavoidable waste. The Waste Management Plan will include, but will not necessarily be limited to: • Measures to avoid and minimise waste associated with the proposal • Classification of wastes generated by the proposal and management options (re-use, recycle, stockpile, disposal) • Classification of wastes received from off-site for use in the proposal and management options • Identification of any statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • Procedures for storage, transport and disposal • Monitoring, record keeping and reporting, including any documentation management obligations arising from resource recovery exemptions The Waste Management Plan will be prepared taking into account the Roads and Maritime Environmental Procedure – Management of Wastes on Roads and Maritime Services Land and relevant Transport Waste Fact Sheets	Contractor	Pre-construction/ construction	Section 4.2 of *QA G36 Environment Protection*
RU3	Resource use and waste	The following resource management hierarchy principles will be followed: • Avoid unnecessary resource consumption as a priority • Avoidance would be followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery) • Disposal would be a last report (in accordance with the *WARR Act 2001*)	Contractor	Pre-construction / construction	Additional safeguard
HR1	Hazard and risk	Encroachment into WSA will be avoided and managed in accordance with criteria for safe airspace outlined in the 'Procedure for Air Navigation Services – Operations (PANS-OPS)' for WSA	Transport	Detailed design	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
HR2	Hazard and risk	A Hazard and Risk Management Plan will be prepared and implemented as part of the CEMP. The Plan will identify: • Hazards and risks associated with the activity and measures to minimise these risks • Record keeping arrangements to manage materials on site • Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations	Contractor	Pre-construction / construction	Additional safeguard
HR3	Hazard and risk	A Bushfire Management Plan will be prepared and included as part of the CEMP. The Plan will identify: • Asset protection zone locations and management details • Landscaping requirements including indicative design layout and vegetation density thresholds • Access provisions such as locations, passing bays and alternate emergency access • Water supplies and bush fire suppression systems • Details regarding the Bush Fire Emergency Management and Evacuation Plan and any other essential bush fire safety requirements	Contractor	Pre-construction / construction	Additional safeguard
HR4	Hazard and risk	Construction activities involving flammable materials and ignition sources (for example, welding) will be proactively managed to ensure that the potential for fire is effectively minimised. High risk construction activities, such as welding and metal work, will be subject to a risk assessment on total fire ban days and restricted or ceased as appropriate. Construction personnel will be inducted into the requirement to safely dispose of cigarette butts	Contractor	Pre-construction / construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
C1	Cumulative impacts – construction	Co-ordination and consultation with the following stakeholders will occur where required to manage the interface of the WSA, Sydney Metro Western Sydney Airport and Elizabeth Drive East Upgrade projects during overlapping construction activities: • Transport for NSW • Construction contractors • Other relevant stakeholders Consultation and co-ordination with these stakeholders will include: • Provision of regular updates to the detailed construction program, construction sites and haul routes • Identification of key potential overlap points and activities • Development of mitigation and management strategies to manage these conflicts and potential impacts, for example, co-ordination of respite periods	Transport / Contractor	Construction	Additional safeguard

7.3 Licensing and approvals

Table 7-2 summarises the licensing and approvals that would be required for the proposal.

Table 7-2 Summary of licensing and approvals required

Instrument	Requirement	Timing
Protection of the Environment Operations Act 1997 (s43)	EPL for scheduled activities (road construction)	Prior to start of the activity
Fisheries Management Act 1994 (s199)	Notification to the Minister for Agriculture prior to any dredging or reclamation works. *While it is likely that impacts to aquatic environments associated with the proposed works would be negligible, Transport may be required to provide formal notification to the Department of Primary Industries under Section 199 of the FM Act as the study area is mapped as containing Key Fish Habitat. Nonetheless, requirements for works adjacent to Key Fish Habitat is determined on a case by case basis, and would be determined by consultation with a local fisheries officer*	A minimum of 28 days prior to the start of work
Fisheries Management Act 1994 (s219)	Permit to obstruct the free passage of fish (temporary or permanent) from the Minister for Agriculture	Prior to start of the activity
National Parks and Wildlife Act 1974 (s90)	AHIP from Heritage NSW for the disturbance of the Aboriginal sites that would be impacted by the proposal	Prior to start of the activity
Roads Act 1933 (s138)	A Road Occupancy Licence would need to be obtained from the relevant roads authority by the contractor	Prior to start of the activity

8. Conclusion

This chapter provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in clause 193 of the Environmental Planning and Assessment Regulation 2021.

8.1 Justification

Elizabeth Drive is the main east-west road connection between The Northern Road, Luddenham (at its western extent) and Elizabeth Street, Liverpool (at its eastern extent). Currently, Elizabeth Drive provides vital east-west transport links for residents and enterprises, including freight between Luddenham and the surrounding suburbs with the nearest strategic centres in Liverpool.

Elizabeth Drive is located within the Western Parkland City, which is set to experience substantial growth in population and employment opportunities associated with WSA (planned to commence operation in 2026) and the Western Sydney Aerotropolis. The Western Sydney Aerotropolis has been planned to become a thriving economic hub for the emerging Western Parkland City, delivering new jobs, homes, infrastructure and services for people in the region. Further, it is projected to prompt the expansion of industrial, residential and commercial precincts and planned land releases for employment and residential zones in the area. The WSA and the transformational nature of planned development in the Western Sydney Aerotropolis is expected to generate significant traffic volumes and place substantial pressure on the local and wider road network, including Elizabeth Drive. As part of the artery of the Western Parklands City, Elizabeth Drive is set to become an important thoroughfare in Western Sydney, connecting the WSA and the Western Sydney Aerotropolis with the western Sydney strategic centres and the wider Sydney region.

The proposal would support this planned development by easing anticipated capacity constraints and facilitating increased movement and connectivity to surrounding growth areas. Further, the proposal would playing a crucial role in connecting people and freight movement between the nearest strategic centres in Western Sydney and the wider Sydney Region.

In combination with the planned road upgrades including Elizabeth Drive East Upgrade, M12 Motorway project (under construction), Westlink M7 Widening, and Mamre Road Upgrade, the proposal would provide critical infrastructure to support the planned economic centre in Western Sydney, facilitating a jobs hub across aerospace and defence, manufacturing, healthcare, freight and logistics, agribusiness, education and research industries.

Improvements in road safety is also a key driver of the proposal. Between 2013 and 2017, Elizabeth Drive recorded a crash rate that was three times higher than that of a typical arterial road. Of particular relevance to the construction footprint, between January 2016 to December 2020, five crashes were recorded at the intersection of Elizabeth Drive and Luddenham Road, and nine crashes at the intersection of Elizabeth Drive and Badgerys Creek Road.

The proposal would include several safety measures to minimise the potential for harm, such as the removal of roadside hazards and implementation of safety barriers where required. The provision of new shared walking and cycling paths along the full length of the proposal on both sides of Elizabeth Drive, would also improve safety for pedestrians and cyclists.

8.1.1 Social factors

During operation, the proposal would result in positive long-term social impacts by:

- Contributing to a reduction in congestion and improved travel times along Elizabeth Drive, compared to a ‘do nothing’ option without the Elizabeth Drive upgrades
- Improving safety for pedestrians and cyclists through the provision of a new shared walking and cycling paths on both sides of Elizabeth Drive
- Improving safety for road users through the provision of a of a new central median to reduce the risk of head on crashes
- Improving the landscape and visual environment for pedestrians and cyclists with locally endemic native species separating traffic lanes from the walking and cycling paths and providing shade
- Providing bus priority infrastructure on Elizabeth Drive to enable improvements in public transport services, including indented bus bays and ‘queue jump-start’ bus lanes at traffic lights.

However, the proposal may result in some adverse impacts to the local community associated with:

- Temporary amenity impacts from increased traffic, noise, vibration, visual impacts and dust during construction
- Property acquisition and access adjustments for landholders along Elizabeth Drive, including partial acquisition of 18 properties. Partial acquisition would impact one identified business premises (a duck farm) and one residential dwelling (where it is located within the area proposed to be partially acquired)
- Marginal increases in travel time (of less than about one minute) for some property owners during operation, due the proposed central median removing direct access from opposite direction of travel and requiring the use of existing and proposed provision for U-turn function to enable access
- Road traffic noise impacts along Elizabeth Drive during operation of the proposal, resulting in exceedances of noise criteria at 60 residential receivers. Noise levels would increase by less than 2dB at these properties, compared to a scenario without the proposal. Seven properties have been identified as meeting requirements for specific reasonable and feasible additional mitigation such as at-property treatment in accordance with the Road Noise Policy
- Afflux of greater than 100 millimetres would generally be contained to isolated areas within the road corridor, with the exception of one privately owned land parcel located immediately south-west of the Elizabeth Drive and Adams Road intersection (Lot 106 / DP 846962). This property has the potential to experience a maximum afflux of 130 millimetres. The depth of above floor flooding is not anticipated to increase at any buildings due to construction of the proposal.
- Direct impacts to one Aboriginal site, which may include surface and sub-surface artefacts

Several safeguards and management measures would be implemented during detailed design and construction of the proposal to minimise these impacts (refer to Section 6.17).

Detailed design development would include continued consultation with directly affected landholders and the local community as well as further refinement of the design and construction methodology to identify opportunities to avoid or minimise impacts. Overall, the social benefits of the proposal associated with improved road network performance and safety along Elizabeth Drive are considered to outweigh the potential adverse social impacts identified.

8.1.2 Biophysical factors

The design of the proposal has sought to minimise removal of native vegetation, where possible. However, these impacts cannot be completely avoided. The proposal would result in the direct loss of about 29.35 hectares of native vegetation, a subset of which would include four TECs subject to assessment under the BC Act (6.28 hectares) and two TECs subject to assessment under the EPBC Act (1.49 hectares). These include impacts to threatened ecological communities listed under the BC Act and EPBC Act, removal of habitat for threatened flora (including *Pultenaea parviflora*, *Marsdenia viridiflora* subsp. *viridiflora* and Southern Myotis) and fauna, and removal of about 32 hollow bearing trees.

Additionally, about 0.22 hectares of urban native/exotic vegetation is proposed to be removed on land which is not biodiversity certified. Opportunities to further minimise the extent of vegetation removal required would be explored during the detailed design and pre-construction phases of the proposal.

The BDAR prepared for the proposal has determined that the proposal is not likely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the EPBC Act.

If not adequately managed, construction activities for the proposal could lead to erosion of exposed soil and stockpiled materials and an increase in sediment loads entering nearby watercourses. This would pose a risk to downstream surface water quality. The implementation of safeguards and management measures outlined in Chapter 7 (Environmental management), including erosion and sediment controls, are expected to appropriately manage potential impacts.

Groundwater may be impacted where construction activities intersect groundwater and/or where construction impacts on the surface water regimes hydraulically connected to shallow groundwater, for example during dewatering of open excavations. Dewatering may lead to localised groundwater drawdown and cause the surrounding groundwater to flow toward the excavation work. Dewatering would, however, be temporary and generally only required while the construction activity is being carried out to provide safe working conditions. Groundwater quality is also expected to remain generally consistent with the existing conditions.

There is potential that construction activities could impact the Cumberland River Flat Forest (terrestrial vegetation), an identified high potential terrestrial groundwater dependent ecosystem (GDE) that intercepts the proposal at Cosgrove Creek and Oaky Creek. Construction activities associated with bridge work have the potential to disrupt groundwater flow, impact

groundwater levels, and impact on water quality. Options to minimise interruption to water flows would be considered during detailed design. The potential for groundwater impacts during operation, including impacts to GDEs would be limited

8.1.3 Economic factors

The area surrounding Elizabeth Drive is expected to experience substantial growth and development due to the WSA and Western Sydney Aerotropolis and Sydney Metro – Western Sydney Airport.

The proposal would support this growth by providing increased road capacity along Elizabeth Drive, through widening of the road corridor from two lanes to four, and provision of and central median which would allow for potential future expansion to six lanes. As such, the proposal would cater for the projected increase in traffic volumes.

The proposal, in conjunction with the Elizabeth Drive East Upgrade, would reduce delays, increase the average speed across the network and accommodate the majority of the future traffic demands. In addition, the proposal would provide an important arterial function as it sits adjacent to precincts in the Western Sydney Aerotropolis that are planned for enterprise, agri-business and light industrial uses.

This would have a long-term positive impact on the local economy, as it would contribute to improved productivity and reduced costs associated with traffic delays for road users. This is expected to benefit commuters travelling to work, surrounding businesses and industry as well as freight operators travelling through Western Sydney.

Construction may result in temporary amenity impacts (such as noise, traffic and dust) which may affect the operation of some businesses where they are sensitive to these impacts. One business, a duck farm, is located immediately south of Elizabeth Drive, Luddenham, with the property frontage located partially within the construction footprint. Partial acquisition of this property for the proposal would result in a minor reduction in the land area available for agricultural use. Property access would be maintained as far as practicable throughout construction during both day and night time periods, including access to businesses. Where temporary changes to property access are required, advance notice would be provided, and the duration of disruptions would be limited. Consultation would be carried out with businesses prior and during construction to identify their specific business needs, and to identify feasible and reasonable measures to avoid and mitigate impacts.

These long-term benefits for road transportation are considered to outweigh the short-term impacts on the local community and businesses during construction of the proposal associated with temporary amenity impacts from increased traffic, noise, vibration, visual impacts and dust during construction.

8.1.4 Public interest

The proposal would improve road user safety with the provision of a central median (reducing the risk of head on crashes) and shared walking and cycling paths (addressing existing safety issues due to a lack of footpaths in this area). In addition, the proposal would improve connectivity and provide necessary infrastructure to support the planned growth of the Western Parkland City. This would be achieved through the widening of the road corridor to four lanes, with the potential for widening to six lanes as required in future, and provision for increased public transport services in the region by providing bus priority infrastructure.

The proposal would therefore be in the public's interest as the upgrade to road infrastructure would fulfil the needs of the existing and future community. The proposal represents a cost-efficient investment in public infrastructure to maximise the long-term social and economic benefits, while minimising the long-term negative impacts on communities and the environment.

During the construction phase, the proposal would result in some temporary impacts on visual amenity, traffic, noise and air quality. Compared with the 'do nothing' option, these impacts would be outweighed by the long-term benefits of the proposal. The overall result would be improved safety and traffic efficiency outcomes and improved active transport outcomes once the proposal is operational.

Overall, the potential environmental impacts of the proposal such as noise and vibration, traffic and transport, landscape and visual character, non-Aboriginal heritage, Aboriginal heritage, property and land use, socio-economic, flooding, contamination, soils and surface water, groundwater, waste and resource management, air quality, bushfire and sustainability, climate change and greenhouse gas have also been assessed in this REF (refer to Chapter 6 (Environmental assessment)). Environmental impacts have been minimised where possible and would be mitigated through safeguards and management measures summarised in Chapter 7 (Environmental management). The benefits of the proposal are considered to outweigh the potential impacts and the proposal is considered to be justified.

8.2 Objects of the EP&A Act

Table 8-1 describes how the proposal is consistent with the objects of the EP&A Act.

Table 8-1 Objects of the Environmental Planning and Assessment Act 1979

Instrument	Requirement
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources	The proposal would provide social and economic benefits through reducing the potential for congestion and improve road safety along Elizabeth Drive. The proposed shared walking and cycling paths would also improve access and safety for pedestrians and cyclists in the area. As such the proposal would promote the social and economic welfare of the community. Socio-economic impacts have been assessed in Section 6.7. Construction work may result in temporary amenity and property access impacts that could lead to disruptions of nearby businesses. Consultation would be carried out with businesses prior and during construction to identify their specific business needs, and to identify feasible and reasonable measures to avoid and mitigate impacts. The proposal would have minimal impact on the state's key natural and other resources: agricultural land, natural areas, forests or minerals. Safeguards and management measures have been identified to avoid and/or minimise any adverse impacts associated with the proposal
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment	The proposal has considered relevant economic, environmental and social considerations. ESD is considered in Section 6.20.1, which demonstrates that the proposal has integrated these factors into decision-making. Potential impacts would be further mitigated through the implementations of safeguards and management measures identified in Chapter 7 (Environmental management)
1.3(c) To promote the orderly and economic use and development of land	The proposal would be located in the Western Parkland City, which is set to experience substantial growth in jobs and residents. Within the Western Parkland City, the WSA and the transformational nature of development in the Western Sydney Aerotropolis would place significant pressure on the local and wider road network. The proposal would promote the orderly development and economic use of the surrounding area by providing sufficient road capacity to support planned growth in the area. By utilising the existing road corridor to support increased demand, as opposed to delivery of a new greenfield development, the proposal would support the orderly and economic use of the construction footprint
1.3(d) To promote the delivery and maintenance of affordable housing	Not relevant to the proposal
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats	The proposal would result in the direct loss of about 29.35 hectares of native vegetation in total, a subset of which would include four TECs subject to assessment under the BC Act (6.28 hectares) and two TECs subject to assessment under the EPBC Act (1.49 hectares). Additionally, about 0.22 hectares of urban native/exotic vegetation is proposed to be removed on land which is not biodiversity certified. Assessments of significance have been conducted for the proposal and indicate that impacts to threatened biodiversity are unlikely to be significant under the BC Act or EPBC Act. Where potential impacts have been identified on native animals and plants, ecological communities and their habitats, safeguards and management measures have been proposed to avoid or minimise the impacts (refer to Section 6.3)

Instrument	Requirement
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)	Impacts to non-Aboriginal and Aboriginal heritage are assessed in Section 6.4 and 6.5, respectively. The proposal would not result in significant impacts to non-Aboriginal heritage. The proposal would directly impact one Aboriginal site, including surface and sub-surface artefacts. Management measures to minimise residual impacts on Aboriginal and non-Aboriginal heritage are included in Section 6.17.
1.3(g) To promote good design and amenity of the built environment	An illustrative urban design concept has been prepared for the proposal (refer to Appendix K (Urban Design, Landscape Character and Visual Impact Assessment) to promote high quality design of the proposal. Urban design objectives have also been prepared to guide the design of the proposal, based on the principles of Urban Design Policy – Beyond the Pavement (Transport for NSW, 2020) (refer to Chapter 5 (Description of the proposal) for further detail. These objectives have been considered in the concept design development, and would continue to be implemented during detailed design
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants	Not relevant to the proposal
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State	Not relevant to the proposal
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment	Transport has carried out consultation with the community and relevant key stakeholders during the development of the proposal. Details of this consultation can be found in Chapter 5 (Consultation). Consultation will occur with directly affected landowners (ie where property acquisition or adjustments are proposed) during the REF exhibition period, throughout the development of the detailed design and during construction. The community will be invited to provide a submission on the proposal during the public display of this REF, which provides an opportunity to participate in the environmental planning and assessment process. Transport would review and respond to the community submissions before determining whether to proceed with the proposal. Where relevant, these submissions will also inform detailed design and construction planning

8.2.1 Ecologically sustainable development

ESD is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

The precautionary principle has guided the assessment of environmental impacts for this REF and the development of safeguards and management measures. Specialist studies have been incorporated into the REF for the majority of environmental aspects, to gain a detailed understanding of the existing environment and potential impacts.

The REF has sought to take a precautionary approach to minimise environmental impacts, including through assessing impacts based on the 'worst-case' or conservative scenarios. For example, the construction noise assessment has been carried out for reasonable 'worst-case' scenarios, with reference to the CNVG (refer to Appendix E (Noise and Vibration Assessment Report) for further detail). The air quality assessment has also adopted conservative assessment scenarios, for example assuming that draft mandates to lower vehicle emission standards in future have not been applied (refer to Appendix N (Air Quality Impact Assessment Report) for further detail).

Safeguards and management measures have been developed using the best available technical information, environmental standards and guidelines. These measures would be applied throughout detailed design and construction of the proposal. The selected construction contractor would be required to prepare a CEMP before commencing construction, to provide a framework for establishing how these measures would be implemented.

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The proposal has integrated both short and long-term economic, social and environmental considerations so that any likely impacts are not left to be addressed by future generations.

As part of the options selection process, the upgrade of Elizabeth Drive was selected (rather than the 'do nothing' option) to provide for the future predicted traffic increases associated with planned growth of the region due to the WSA and Western Sydney Aerotropolis. As such, the proposal would provide long-term transport and socio-economic benefits for future generations. The proposal design has been developed in consideration of the potential future needs of the road corridor. For example, the proposal provides sufficient space for a future road arrangement with three lanes in each direction, should this be required.

Issues with potential long-term implications for intergenerational equity have been minimised or avoided, for example consumption of non-renewable resources, waste disposal, greenhouse emissions, removal of vegetation and impacts on water quality, through design development. These environmental aspects would continue to be managed through the implementation of safeguards and management measures.

Conservation of biological diversity and ecological integrity

Preserving biological diversity and ecological integrity requires that ecosystems, species, and biological diversity are maintained to ensure their survival. The design for the proposal has been sought to minimise removal of native vegetation, where possible. However, to enable to the delivery of the proposal, about 22.11 hectares of native vegetation which is not biodiversity certified would be removed; a subset of which would include four TECs subject to assessment under the BC Act (6.28 hectares) and two TECs subject to assessment under the EPBC Act (1.49 hectares). This includes the removal of habitat for threatened flora (including *Pultenaea parviflora*, *Marsdenia viridiflora* subsp. *viridiflora* and Southern Myotis)

Design development of the proposal has sought to minimise the removal of native vegetation where practicable, including through a reduction in the construction footprint boundary to avoid substantial impact to an area of 'avoided land' under the CPCP (refer to Section 2.4). Opportunities to further minimise the extent of vegetation removal would be explored during the detailed design and pre-construction phases of the proposal. The adherence to the safeguards and management measures outlined in this REF would help to ensure that biological diversity and ecological integrity of receiving environments would be retained.

The landscape strategy prepared for the proposal (refer to Appendix K (Urban Design, Landscape and Visual Impact Assessment) includes an indicative species list, which has been informed by the requirements of the Western Sydney Aerotropolis Development Control Plan (2021). Species have been selected for their appropriateness to the region, and located to avoid the risk of bird strike.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources that may be affected by the carrying out of a project, including air, water, land and living things.

Environmental issues were considered as key matters in design development for the proposal. The value placed on environmental resources is demonstrated in the extent of the planning and environmental investigations, and in the design of the safeguards and management measures described in Section 6.17. Implementation of these safeguards and management measures would result in an economic cost to Transport, which would be included in both the capital and operating cost of the proposal.

8.3 Conclusion

The proposal is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats, and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the EPBC Act.

Potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal, as described in the REF, best meets the project objectives but would still result in some impacts on biodiversity, operational road traffic noise impacts, Aboriginal heritage, socio-economic factors, as well as some temporary construction related impacts to traffic, water quality and noise and vibration. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also result in long-term benefits on road safety and movement along Elizabeth Drive and would support the planned growth of the Western Parkland City, WSA and Western Sydney Aerotropolis, which is considered to outweigh the potential adverse impacts.

On balance, the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared nor approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance nor the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). A referral to the Australian Department of Climate Change, Energy, the Environment and Water is not required.

9. Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Name:	Catherine Brady
Position:	Technical Director – Environment
Company name:	AECOM Australia Pty Ltd
Date:	September 2023

I certify that I have reviewed and endorsed the contents of this REF and, to the best of my knowledge, it is in accordance with the EP&A Act, the EP&A Regulation and the Guidelines approved under Section 170 of the EP&A Regulation, and the information is neither false nor misleading. I accept it on behalf of Transport for NSW.

Name:	Mark Barrett
Position:	Senior Project Development Manager
Transport region/program:	Infrastructure and Place
Date:	September 2023

10. EP&A Regulation publication requirement

Table 10-1 EP&A Regulation publication requirement

Requirement	Yes/No
Does this REF need to be published under section 171(4) of the EP&A Regulation?	Yes

11. References

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Terms and acronyms used in this REF

Term / Acronym	Description
100% Concept Design	Concept Design
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AEP	Annual Exceedance Probability
AHIMS	Aboriginal Heritage Management System
AHIP	Aboriginal Heritage Impact Permit
ALR Act	*Aboriginal Land Rights Act 1983* (NSW)
APEC	Areas of Potential Environmental Concern
ARI	Average Recurrence Interval
ARR	Australian Rainfall and Runoff guidelines (2019)
ASR	Archaeological Survey Report
AusLink	Mechanism to facilitate cooperative transport planning and funding by Commonwealth and state and territory jurisdictions
B-Double	Prime mover towing two semi-trailers all connected by B-couplings.
BAM	Biodiversity Assessment Method
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BDAR	Biodiversity Development Assessment Report
BoM	Bureau of Meteorology
BTEXN	Benzene, toluene, ethylbenzene, p-xylene and naphthalene
CCTV	Closed Circuit Television
CEMP	Construction environmental management plan
CLM Act	*Crown Lands Management Act 2016* (NSW)
CNVG	Construction Noise and Vibration Guideline (RMS, 2016)
CO	Carbon monoxide
CoPC	Contaminants of Potential Concern
CPCP	Cumberland Plain Conservation Plan (DPE, 2022)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSM	Conceptual Site Model
CSP	Community Strategic Plan
DCEEW	Australian Department of Climate Change, Energy, the Environment and Water
DCP	Development Control Plan
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DUAP	Department of Urban Affairs and Planning, now Department of Planning, Infrastructure and Environment
EIA	Environmental impact assessment
EMS	Environmental Management System

Term / Acronym	Description
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW). Provides the legislative framework for land use planning and development assessment in NSW.
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
EPL	Environment protection licence
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
FM Act	*Fisheries Management Act 1994* (NSW)
GDE	Groundwater dependent ecosystems
GHG	Greenhouse gas
Heritage Act	*Heritage Act 1977* (NSW)
IAQM	UK Institute of Air Quality Management
IBRA	Interim Biogeographic Regionalisation of Australia
IRSAD	Index of Relative Socioeconomic Advantage and Disadvantage
ITS	Intelligent Transport Systems
LALC	Local Aboriginal Land Council
LCVIA	Landscape Character and Visual Impact Assessment
LCZ	Landscape character zone
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local Government Area
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
LSPS	Local Strategic Planning Statement
MNES	Matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NASF	National Airports Safeguarding Framework (Australian Government, 2018)
NCA	Noise catchment area
NML	Noise management level
NO_2	Nitrogen dioxide
NPI	National Pollutant Inventory
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
OCP	Organochlorine pesticides
OLS	Obstacle limitation surface
OPP	Organophosphate pesticides
PACHCI	Transport for NSW's *Procedure for Cultural Heritage Consultation and Investigation*
PAD	Potential archaeological deposit

Term / Acronym	Description
PAH	Polycyclic aromatic hydrocarbons
PAN-OPS	Procedure for Air Navigation Services – Operations for the Western Sydney Airport
PCT	Plant Community Type
PEMP	Project Environmental Management Plan
PFAS	Per- and polyfluoroalkyl substances
PM_{10}	Particulate matter (particles with a diameter of 10 micrometres or less)
$PM_{2.5}$	Particulate matter (particles with a diameter of 2.5 micrometres or less)
PMF	Probable Maximum Flood
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
QA Specifications	Specifications developed by Transport for NSW for use with road work and bridge work contracts let by Transport for NSW.
RBM	Relevant Biodiversity Measure
REF	Review of Environmental Factors
Roads Act	*Roads Act 1993*
Roads and Maritime	NSW Roads and Maritime Services, now known as Transport for NSW
ROL	Road occupancy licence
RMS	NSW Roads and Maritime Services (refer to 'Roads and Maritime' above)
RTA	Roads and Traffic Authority, previously Roads and Maritime Services, now known as Transport for NSW
SCATS	Sydney Coordinated Adaptive Traffic System
SEED	Sharing and Enabling Environmental Data maps
SEIA	Socio-economic Impact Assessment
SEIFA	Socio-economic Indexes for Areas
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SEPP (Biodiversity and Conservation)	State Environmental Planning Policy (Biodiversity and Conservation) 2021
SEPP (Resilience and Hazards)	State Environmental Planning Policy (Resilience and Hazards) 2021
SES	State Emergency Services
SIS	Species Impact Statement
TEC	Threatened ecological community
TMP	Traffic management plan
Transport	Transport for NSW
Transport and Infrastructure SEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021
TRH	Total Recoverable Hydrocarbons
VMS	Variable message signs
VOC	Volatile organic compounds
WARR Act	*Waste Avoidance and Resource Recovery Act 2001* (NSW)
WSA	Western Sydney International (Nancy-Bird Walton) Airport (Western Sydney Airport)

Term / Acronym	Description
WSASEPP	State Environmental Planning Policy (Western Sydney Aerotropolis) 2020
WPCSEPP	State Environmental Planning Policy (Precincts – Western Parkland City) 2021
WM Act	*Water Management Act 2000* (NSW)
WSPT	Western Sydney Parklands Trust

Appendix A - Consideration of Section 171 factors and matters of national environmental significance and Commonwealth land

Section 171 Factors

In addition to the requirements of the Guideline for Division 5.1 assessments (DPE, 2022) and the Roads and Related Facilities EIS Guideline (DUAP 1996) as detailed in the REF, the following factors, listed in Section 171 of the Environmental Planning and Assessment Regulation 2021, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
• Any environmental impact on a community?	
Construction activities would result in short-term negative impacts relating to visual amenity, dust, traffic, access and noise impacts, which would temporarily impact on a community (assessed in detail in Chapter 6 (Environmental assessment). These impacts would be short-term and minimised through the implementation of safeguards and management measures outlined in Chapter 7 (Environmental management).	Short-term negative
Permanent acquisition of land adjacent to Elizabeth Drive would bring the roadway closer to the residential dwellings and business premises. The proposal would also result in a permanent change in land use from the existing land uses to road corridor. This would also remove the ability of the land acquired to be developed for other purposes. Consultation would be carried out with directly affected landowners and all land acquisitions would be carried out in accordance with the Just Terms Act.	Long-term negative
During operation, road traffic noise levels are predicted to exceed the Road Noise Policy (DECCW, 2011) L_{Aeq} noise criteria at a total of 245 residential receivers. Reasonable and feasible noise mitigation have been considered for both residential and non-residential receivers in accordance with the Road Noise Policy.	Long-term negative
Minor increases in flood depths are predicted at privately owned properties. One property is predicted to experience increases in flood depth greater than 100 millimetres (up to 130 millimetres), compared to a scenario without the proposal. No buildings have been identified in the affected area based on a review of aerial imagery A building impact assessment has been carried out and determined that the proposal would not increase above floor flooding at any building. Impacts to buildings would be confirmed by carrying out a floor level survey during detailed design development	Long term negative
The proposal would improve road safety and movement along Elizabeth Drive through the provision of a new shared walking and cycling path tying in with the M12 Motorway and The Northern Road shared user paths. Road safety would also improve through the provision of a signalised intersection at Luddenham Road and the introduction of a central median, thereby reducing the risk of head on crashes.	
Overall, while the proposal would result in short-term negative amenity impacts to the surrounding area, and some long-term negative impacts associated with property acquisition, these are considered to be outweighed by the long-term positive impacts of improvements to the road network and safety. As such the negative impacts are considered acceptable.	Long-term positive
• Any transformation of a locality?	
Construction activities would result in visual amenity, traffic, and noise impacts, which would temporarily transform the locality (assessed in Chapter 6 (Environmental assessment). These impacts would be short-	Short-term negative

Factor	Impact
term and minimised through the implementation of safeguards and management measures as outlined in Section 7.2. The proposal involves widening of an existing road corridor and is located within an area set to undergo substantial development as part of the Western Sydney Aerotropolis and Western Parkland City. During operation, the proposal would modify the landscape character from semi-rural land to a transport corridor (as detailed in Section 6.8); however, the proposal would be consistent with the planned development of the area and would support this growth. The operation of the proposal would support planned development and future economic growth within the locality through the provision of: – Improved road safety through the provision of a signalised intersection at Luddenham Road and the introduction of a central median, thereby reducing the risk of head on crashes – Increased capacity and movement along Elizabeth Drive and connection to nearby planned development, through widening of the road corridor from two lanes to four – New shared walking and cycling path tying in with the M12 Motorway and The Northern Road shared user paths Overall, the proposal would contribute to a positive transformation of a locality.	Long-term positive
• Any environmental impact on the ecosystems of the locality? The proposal would result in the loss of native vegetation, including TECs, habitat for threatened flora (including *Pultenaea parviflora*, *Marsdenia viridiflora* subsp. *viridiflora* and Southern Myotis) and fauna, removal of threatened flora and hollow bearing trees. The proposal would be carried out in accordance with the Transport No Net Loss Policy (Transport 2022a) and would trigger the consideration of offset	Long term negative
• Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? The proposal may result in a temporary reduction in the aesthetic and recreational quality of the area during the construction phase in the form of landscape and visual, noise and dust related impacts. The proposal may also result in a temporary reduction in environmental quality due to water quality impacts during construction. These impacts would be short-term and minimised through the implementation of safeguards and management measures as outlined in Section 7.2. During operation, amenity impacts may also impact upon the recreational and aesthetic quality of the surrounding area. In particular, this would include increases in traffic noise, which would impact residential receivers, and landscape and visual changes, with the road corridor becoming more prominent from several viewpoints. These impacts would be managed through landscaping, and the implementation of safeguards and management measures as outlined in Section 7.2. The introduction of shared walking and cycling paths along Elizabeth Drive as part of the proposal would improve pedestrian and cyclist safety, thereby improving recreational qualities of the construction footprint. The proposal would involve the removal of about 22.11 hectares of native vegetation which is not biodiversity certified; a subset of which would include four TECs subject to assessment under the BC Act (6.28 hectares) and two TECs subject to assessment under the EPBC Act (1.49 hectares). This includes the removal of habitat for threatened flora (including *Pultenaea parviflora*, *Marsdenia viridiflora* subsp. *viridiflora* and Southern Myotis). The removal of native vegetation would adversely impact upon the environmental qualities of the construction footprint. Construction work for the proposal (such as earthworks) is anticipated to directly impact one previously recorded Aboriginal site, which includes	Short-term negative Long-term negative Long term positive Long term negative Long term negative

Factor	Impact
surface and subsurface artefacts, resulting in a partial loss of value at this site.	
• Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? During operation, the proposal would modify the landscape character from semi rural land to a transport corridor (as detailed in Section 6.8); however, the proposal would be consistent with the planned development of the area and would support this growth. The proposal would not directly impact non-Aboriginal heritage items or values. The proposal would directly impact one Aboriginal site, including a partial loss of value. Where possible, the proposal has been designed to avoid impacts to these items. Safeguards and mitigation measures are outlined in Section 7.2.	Long-term negative
• Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? The proposal would result in the loss of native vegetation, including habitat for threatened fauna and removal of 32 hollow bearing trees. The proposal would be carried out in accordance with Transport No Net Loss Policy (Transport 2022a) and would trigger the consideration of offset.	Long term negative
• Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal would result in the loss of native vegetation, including habitat for threatened flora (including *Pultenaea parviflora*, *Marsdenia viridiflora* subsp. *viridiflora* and Southern Myotis) and fauna and removal of 32 hollow bearing trees (this includes the removal of habitat for threatened flora). The removal of *Pultenaea parviflora* would likely remove the vast majority of the local occurrences, thereby putting the remainder at very high risk of extinction (refer to Section 6.3). The proposal would be carried out in accordance with Transport No Net Loss Policy (Transport 2022a) and would trigger the consideration of offset.	Long term negative
• Any long-term effects on the environment? The proposal would result in long-term negative impacts on the environment including: – The loss of biodiversity, including removal of about 22.11 hectares of native vegetation which is not biodiversity certified; a subset of which would include four TECs subject to assessment under the BC Act (6.28 hectares) and two TECs subject to assessment under the EPBC Act (1.49 hectares). This includes the removal of habitat for threatened flora (including *Pultenaea parviflora*, *Marsdenia viridiflora* subsp. *viridiflora* and Southern Myotis) – Direct impact to one Aboriginal heritage site, resulting in partial loss of value – Noise impacts through increased road traffic along Elizabeth Drive. – Operation of the proposal would result in long-term positive impacts on the environment including: – Improved traffic conditions which would reduce delays, increase the average speed across the network, and capacity for the future traffic demands – Increased safety through the provision of a new shared walking and cycling path, a new signalised intersection and central median – Improved drainage infrastructure. – Through these benefits, the proposal would support the planned growth of the area and transition of land uses from low density semi-rural uses, to enterprise and residential uses.	Long-term negative Long-term positive

Factor	Impact
• Any degradation of the quality of the environment? Construction activities would result in visual amenity, traffic, air quality and noise impacts which have the potential to temporarily reduce the quality of the environment. The proposal may also result in a temporary reduction in environmental quality due to water quality impacts during construction, particularly during instream work and work within the vicinity of Cosgroves Creek and Oaky Creek. These impacts would be short-term and minimised through the implementation of safeguards and management measures as outlined in Section 7.2. The proposal design and further detailed design would continue to include appropriate landscaping, urban design, drainage and noise mitigation measures. As a result, the overall quality of the environment is not likely to be degraded.	Short-term negative Long-term neutral
• Any risk to the safety of the environment? The safeguards and management measures included in Section 7.2 be introduced to manage potential environmental safety risks including contamination, environmental hazards, and pedestrian safety risks. Providing these measures are implemented, managed, monitored and maintained, there would be a minor short-term impact. The proposal would include the provision of new shared walking and cycling path along the full length of the proposal on both sides of Elizabeth Drive. This would also provide safe passage for cyclists and pedestrians. This would remove the risk of cycling and pedestrian crashes with motor vehicles. Road safety would also improve through the provision of a signalised intersection provided at Luddenham Road and the introduction of a central median, thereby reducing the risk of head on crashes (refer to Section 6.2 for further detail). Environmental safety risks, such as accidental spills, would be minimised with the implementation of standard safeguards and management measures, as outlined in Section 7.2.	Short-term negative Long-term positive
• Any reduction in the range of beneficial uses of the environment? The proposal involves the expansion of a road corridor in a generally low density, sparsely populated area adjoining the existing road. The proposal would develop this land in a manner which supports the planned development of the surrounding area as part of the Western Parkland City and Western Sydney Aerotropolis. As such, the proposal would not result in a reduction in the range of beneficial uses of the environment.	Nil
• Any pollution of the environment? Construction activities would result in noise, and potentially dust impacts. The proposal also has the potential to result in accidental spills and leaks. These impacts would be short-term and minimised through the implementations of safeguards and management measures outlined in Section 7.2. Once the proposal is operational, the proposal may result in some additional road traffic noise due to increased traffic on Elizabeth Drive. This would represent a minor contribution to the existing road traffic noise along Elizabeth Drive. Properties have been identified for additional mitigation in Section 6.1 to mitigate this impact. Potential accidental spills and leaks during operation would be appropriately managed through standard environmental safeguards. Further, stormwater runoff from the proposal would be redirected and treated by grass swales along most of the proposal alignment, and bioretention systems (basins) along the proposal.	Short-term negative Long-term neutral
• Any environmental problems associated with the disposal of waste? The disposal of waste would be managed in accordance with the *Waste Avoidance and Resource Recovery Act 2001 and* would be recycled where possible. The proposal has the potential to disturb contaminated land associated with former agricultural uses and fly tipped waste. Sampling	Nil

Factor	Impact
and testing of soils in areas of potential environmental concern would be carried out to characterise the soils (with respect to contamination) and determine the appropriate waste classification. Provided that the safeguards included in Chapter 7 (Environmental management) are implemented to manage waste, the proposal is unlikely to result in any environmental problems associated with waste.	
• Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? The proposal is unlikely to affect any resources that are or are likely to become in short supply.	Nil
• Any cumulative environmental effect with other existing or likely future activities? During construction, there is potential for short term cumulative noise, biodiversity, dust, and visual impacts, generally associated with the Elizabeth Drive East Upgrade which would be under construction at the same time as the proposal (refer to Section 6.16). This includes a cumulative impact with the Elizabeth Drive East Upgrade of a combined total of about 68.12 hectares of native vegetation removal. These impacts would be short-term and minimised through the implementations of safeguards and management measures outlined in the REF. By the time construction of the Elizabeth Drive upgrades are completed, several other approved road projects would be open to traffic. The upgraded road network is anticipated to ease traffic congestion and reduce travel times. Surrounding projects and the proposal would contribute to changes to landscape and visual amenity, as the area would become more urbanised; however, this is considered appropriate given the planned growth of the area as part of the Western Sydney Aerotropolis and Western Parkland City. The proposal and surrounding projects, overall would result in net positive long-term positive cumulative impacts, improving connectivity throughout the Western Parkland City.	Short-term negative Long-term positive
• Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposal would be located about 50 kilometres west of the coast. The proposal would not impact coastal processes or hazards including those predicted under climate change conditions.	Nil
• Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1, Section 2.1.5 describes the compatibility of the proposal with various regional, district and local strategic plans. The proposal is broadly consistent with these plans. In particular, the proposal would support the planned growth of the Western Sydney Aerotropolis and Western Parkland City envisaged in the Western City District Plan (Greater Sydney Commission, 2018).	Not applicable
• Other relevant environmental factors. In considering the potential impacts of this proposal all relevant environmental factors have been considered. Refer further to Chapter 6 (Environmental assessment) of this assessment.	

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Department of Climate Change, Energy, the Environment and Water.

A referral is not required for proposed actions that may affect nationally-listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor	Impact
• Any impact on a World Heritage property? There are no World Heritage properties within or near the construction footprint.	Nil
• Any impact on a National Heritage place? There are no National Heritage properties within or near the construction footprint.	Nil
• Any impact on a wetland of international importance? There are no wetlands of international importance within or near the construction footprint.	Nil
• Any impact on a listed threatened species or communities? EPBC Act listed threatened species that have a medium or higher likelihood of occurrence in the area assessed for biodiversity impacts (refer to Appendix G), with the potential to be impacted by the proposal include: six *Pultenaea parviflora* individuals recorded within the subject land (a buffer of 100 metres from the construction footprint), and the Grey-headed Flying-fox. The *Pultenaea parviflora* individuals within the subject land are not considered to constitute or be members of an important population of the species. A significant impact to the species is, therefore, not anticipated. In regard to the Grey-headed Flying-fox, no camps would be directly impacted and habitat removal would be minor in the context of the surrounding landscape, therefore, a significant impact is not anticipated. EPBC listed TEC that would be impacted by the proposal include River-flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria (of which about 0.27 hectares in good condition would be removed by the proposal), and Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and Southeast Queensland ecological community (of which about 1.22 hectares in good condition would be removed by the proposal). A significant impact to either TEC is not anticipated given the extent of removal proposed in relation to the size of the patches of the TECs.	The proposal is unlikely to have a significant impact on any nationally listed entity
• Any impacts on listed migratory species? No migratory species are considered to have a medium or higher likelihood of occurring within the subject land. One migratory species, the White-bellied Sea-eagle was surveyed as part of the BDAR (refer to Appendix G) and not recorded.	The proposal is unlikely to have a significant impact on any nationally listed entity
• Any impact on a Commonwealth marine area? There are no Commonwealth marine areas within or near the construction footprint.	Nil
• Does the proposal involve a nuclear action (including uranium mining)? The proposal would not involve nuclear action.	Nil
• Additionally, any impact (direct or indirect) on the environment of Commonwealth land? The proposal would not directly impact on Commonwealth land. The proposal is adjacent to Commonwealth land (the WSA), located to the south of the construction footprint and zoned SP2 (Infrastructure). Potential impacts have been evaluated below in accordance with the Significant impact guidelines 1.2 – Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies (Department of Sustainability, Environment, Water, Population and Communities, 2013).	Minor indirect impacts

Self assessment for a significant impact on Commonwealth land

Assessment step	Response
Step 1: Environmental context	
• What are the components of features of the environment in the area where the action will take place?	The proposal involves the construction and operation of an upgraded section of Elizabeth Drive. The proposal is not located on Commonwealth land. The existing environment within the construction footprint includes the existing road corridor and adjoining semi-rural land, accommodating residential and agribusiness land uses. The area of Commonwealth land to the south of the construction footprint currently includes a construction site and activities to construct the WSA, which is planned to commence operations in 2026. The site has been cleared and is largely disturbed. It has been assumed that the majority of construction work would be complete once the proposal construction phase commences. Sections of Oaky Creek and Badgerys Creek adjoin the western and eastern boundary of the WSA site, respectively. Oaky Creek also traverses the WSA site
• Which components or features of the environment are likely to be impacted?	The proposal is located adjacent to the WSA and would not directly encroach the WSA land parcel. Given that the site has been cleared and disturbed as part of WSA construction work, there are limited components or features of the environment with the potential to be impacted. Once the WSA is operational, airport operations may have the potential to be impacted by construction activities associated with the proposal if appropriate safeguards are not in place. Construction activities would be designed and planned to ensure there would be no impact on airport operations. Consultation would occur with the airport operators regarding any necessary permits required to enable construction to occur in the vicinity of the WSA
• Is the environment which is likely to be impacted, or are elements of it, sensitive or vulnerable to impacts?	Given that the site has been cleared and disturbed as part of WSA construction work, the environment of Commonwealth land is not considered to be sensitive or vulnerable to impacts
• What is the history, current use and condition of the environment which is likely to be impacted.	Since 2018, the land has been used as a construction site for WSA. Land clearing and bulk earthworks have been carried out across the site. Prior land uses include agricultural and light commercial uses. It has been assumed that the majority of construction work would be complete once the proposal construction phase commences in 2026
Step 2: Potential impacts	
• What are the components of the action?	The proposal would involve the construction and operation of an upgraded section of Elizabeth Drive. Activities located adjacent to Commonwealth land may include: • Site establishment and earthworks • Utility adjustments, relocations and replacements • Vegetation removal • Earthworks and drainage work • Adjustments to existing farm dams • Cosgroves Creek bridge work, including construction of new bridge structure and demolition/removal of the existing culvert • Pavement work • Landscaping and finishing work
• What are the predicted adverse impacts associated with the action, including indirect consequences?	The proposal would not result in any adverse impacts upon the environment of Commonwealth land:

Assessment step	Response
	Surface water quality: Construction activities represent a risk to surface water quality within local receiving watercourses partially within and adjoining the Commonwealth land, including Oaky and Badgery's Creek. During rainfall, sediment laden waters and chemicals stored on site have the potential to runoff into receiving waterways. This risk is considered to be limited with the implementation of standard safeguards and management measures. Further detail is included in Section 6.9. **Groundwater:** Construction activities associated with bridge work (including dewatering) have the potential to disrupt groundwater flow, impact groundwater levels, and impact on water quality. Potential impacts of the proposal on groundwater are considered to be minor and manageable, with the implementation of the mitigation measures outlined in the report. **Non-Aboriginal heritage:** The former Badgerys Creek post office (an unlisted heritage site of local significance) is known to be partially located within the footprint of the WSA and partially within the construction footprint. Whilst the exact location of the item is uncertain, it can be assumed that any traces of the heritage item are likely to have been removed due to construction work associated with the WSA. The proposal is, therefore, not expected to impact upon the site. Further detail is included in Section 6.4. **Hydrology and flooding:** Flood modelling carried out for the proposal has included the approved WSA. Minor increases in flood depths less than 10 millimetres or less and minor additional wetted areas are expected during the one per cent AEP event, in areas generally along the boundary of the site. Drainage structures will be designed to manage overland paths outside the WSA boundary. As such, there would be no flooding impact on WSA land. Further detail is included in Section 6.10
• How severe are the potential impacts?	The potential impacts described above are predicted to be minor to negligible, and manageable through the implementation of standard management measures
• What is the extent of uncertainty about potential impacts?	The construction activities and potential impacts are reasonably certain; however, the proposal is subject to further detailed design and construction planning which would continue to minimise potential impacts, where possible
Step 3: Impact avoidance and mitigation?	
Will any measures to avoid or mitigate impacts ensure, with a high degree of certainty, that impacts are not significant?	Chapter 7 (Environmental management) includes an overview of the approach to environmental management and proposed safeguards and management measures. Of relevance to the impacts described above: • A Soil and Water Management Plan will be implemented during construction to manage and monitor risks to surface water and groundwater quality. This will include controls to minimise risk of erosion and sedimentation and entry of materials to waterways • Any dewatering activities will be carried out in accordance with the 'Technical Guideline – Environmental Management of Construction Site Dewatering' (Roads and Maritime, 2011) in a manner that prevents pollution of waters • Should any archaeological deposits be uncovered during construction relating to the former Badgerys Creek post office, these would be managed in accordance with Transport's EMF-HE-PR-0076 Unexpected Heritage Items Procedure 2022 (Transport for NSW, 2022) • Further design refinement of drainage infrastructure will be carried out during detailed design.

Assessment step	Response
	These measures would ensure, with a high degree of certainty, that the potential impacts are not significant
Step 4: Are the impacts significant?	
Considering all of the matters in steps 1 to 3 above, is the action likely to have a significant impact on the environment confirmed against the significance criteria set out in these guidelines?	The action is not considered to have a significant impact on the environment of Commonwealth land, due to the disturbed nature of the site from the construction of WSA, the distance of the proposal from the Commonwealth land and the safeguards and management measures to be implemented as part of the proposal

With reference to the Significant impact guidelines 1.2 – Actions on, or impacting upon, Commonwealth land, and Actions by Commonwealth agencies (Department of Sustainability, Environment, Water, Population and Communities 2013) the proposal is considered unlikely to have a significant impact on matters of national environmental significance and/or the environment of Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of Climate Change, Energy, the Environment and Water.

Appendix B - Statutory consultation checklists

Transport and Infrastructure SEPP

Certain development types (Part 2.3 Development controls, Division 17 Roads and traffic)

Development type	Description	Yes / No	If yes consult with	SEPP (Transport and Infrastructure) Section
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No	Penrith City Council, Liverpool City Council	Section 2.110
Bus Depots	Does the project propose a bus depot?	No	Penrith City Council, Liverpool City Council	Section 2.110
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	Penrith City Council, Liverpool City Council	Section 2.110

Development within the Coastal Zone (Part 2.2 General, Division 1 Consultation)

Development type	Description	Yes / No	If yes consult with	SEPP (Transport and Infrastructure) Section
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	Penrith City Council, Liverpool City Council	Section 2.14

Council related infrastructure or services (Part 2.2 General, Division 1 Consultation)

It is noted that consultation has been carried out with Penrith City Council and Liverpool City Council, as outlined in Chapter 5 (Consultation) of the REF. Further assessment as part of the REF, has determined that the proposal would not have a substantial impact upon the features outline below, and would not require consultation under Section 2.10 of the SEPP (Transport and Infrastructure). Notwithstanding, feedback from Councils have been considered throughout the REF as described in Chapter 5 (Consultation).

Development type	Potential impact	Yes / No	If yes consult with	SEPP (Transport and Infrastructure) Section
Stormwater	Are the works likely to have a *substantial* impact on the stormwater management services which are provided by council?	No	Penrith City Council, Liverpool City Council	Section 2.10
Traffic	Are the works likely to generate traffic to an extent that will *strain* the capacity of the	No	Penrith City Council, Liverpool City Council	Section 2.10

Development type	Potential impact	Yes / No	If yes consult with	SEPP (Transport and Infrastructure) Section
	existing road system in a local government area?			
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No	Penrith City Council, Liverpool City Council	Section 2.10
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a *substantial* volume of water?	No	Penrith City Council, Liverpool City Council	Section 2.10
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	No	Penrith City Council, Liverpool City Council	Section 2.10
Road & footpath excavation	Will the works involve more than *minor* or inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	Penrith City Council, Liverpool City Council	Section 2.10

Local heritage items (Part 2.2 General, Division 1 Consultation)

It is noted that consultation has been carried out with Penrith City Council due to the potential for the proposal to impact the McGarvie Smith Farm (a local heritage item). Following further assessment as part of the REF (refer to Section 6.4), it has been determined that the proposal would not have an impact on this item and, therefore, would not require consultation under Section 2.10 of the SEPP (Transport and Infrastructure). Notwithstanding, feedback from Councils have been considered throughout the REF as described in Chapter 5 (Consultation).

Development type	Potential impact	Yes / No	If yes consult with	SEPP (Transport and Infrastructure) Section
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than minor or inconsequential?	No	Penrith City Council, Liverpool City Council	Section 2.11

Flood liable land (Part 2.2 General, Division 1 Consultation)

Consultation has been carried out with Penrith City Council, Liverpool City Council and State Emergency Services as outlined in Chapter 5 (Consultation) of the REF.

Development type	Potential impact	Yes / No	If yes consult with	SEPP (Transport and Infrastructure) Section
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a *minor* extent?	Yes	Penrith City Council, Liverpool City Council	Section 2.12
Flood liable land	Are the works located on flood liable land? (to any extent). If so, do the works comprise more than minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance?	Yes	State Emergency Services	Section 2.13

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled Floodplain Development Manual: the management of flood liable land published by the New South Wales Government.

Public authorities other than councils (Part 2.2 General, Division 1 Consultation)

Development type	Potential impact	Yes / No	If yes consult with	SEPP (Transport and Infrastructure) Section
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	No	DPE	Section 2.15
National parks and reserves	Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	DPE	Section 2.15
Navigable waters	Do the works include a fixed or floating structure in or over navigable waters?	No	Transport for NSW	Section 2.15
Artificial light	Would the works increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	Director of the Siding Spring Observatory	Section 2.15
Defence communications buffer land	Are the works on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in section 5.15 of Lockhart LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	Secretary of the Commonwealth Department of Defence	Section 2.15
Mine subsidence land	Are the works on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	No	DPE	Section 2.15

Development type	Potential impact	Yes / No	If yes consult with	SEPP (Transport and Infrastructure) Section
Bush fire prone land	Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service	Section 2.16

Appendix C – Property acquisition

Indicative property acquisition and temporary leases required for the proposal are described in the table below. Further detail on property acquisition and temporary leasing, including consultation, is included in Section 3.4 of the REF.

Address	Lot and plan	Existing land use zone	Ownership	LGA	Acquisition type	Approximate total property area (ha)	Indicative area to be acquired/leased (ha) and percentage of property to be acquired/leased	Potentially affected infrastructure (eg driveway, shed)*
2700 Elizabeth Drive, Luddenham	8 / DP1240511	AGB: Agribusiness ENT: Enterprise	Private property	Liverpool and Penrith	Partial acquisition and lease	7.81	Proposed acquisition: 0.22 (2.8%) Additional proposed lease area for construction ancillary facility 1: 1.14 (14.6%)	N/A
2650 Elizabeth Drive, Luddenham	9 / DP1240511	AGB: Agribusiness	Private property	Liverpool	Partial acquisition	11.58	0.04 (0.4%)	Driveway
2289-2309 Elizabeth Drive, Luddenham	4 / DP32026	ENT: Enterprise ENZ: Environment and Recreation	Private property	Penrith	Partial acquisition	10.13	0.14 (1.3%)	Driveway, internal tracks
2273-2287 Elizabeth Drive, Luddenham	5 / DP32026	ENT: Enterprise ENZ: Environment and Recreation	Private property	Penrith	Partial acquisition	10.21	0.59 (5.8%)	Shed
2255-2271 Elizabeth Drive, Luddenham	6 / DP32026	ENT: Enterprise ENZ: Environment and Recreation	Private property	Penrith	Partial acquisition	10.12	0.59 (5.9%)	N/A
2241-2253 Elizabeth Drive, Luddenham	7 / DP32026	ENT: Enterprise ENZ: Environment and Recreation	Private property	Penrith	Partial acquisition	10.16	0.46 (4.5%)	Driveway
2225-2239 Elizabeth Drive, Luddenham	8 / DP32026	ENT: Enterprise ENZ: Environment and Recreation	Private property	Penrith	Partial acquisition	10.14	0.91 (8.9%)	Driveway

Address	Lot and plan	Existing land use zone	Ownership	LGA	Acquisition type	Approximate total property area (ha)	Indicative area to be acquired/leased (ha) and percentage of property to be acquired/leased	Potentially affected infrastructure (eg driveway, shed)*
2600 Elizabeth Drive, Luddenham	1 / DP220176	AGB: Agribusiness	Private property	Liverpool	Partial acquisition	11.62	0.53 (4.6%)	Farm dams, driveway, internal road
2207-2223 Elizabeth Drive, Luddenham	1 / DP529885	ENZ: Environment and Recreation ENT: Enterprise	Private property	Penrith	Partial acquisition	36.62	0.62 (1.7%)	Farm dam, driveway
2179 Elizabeth Drive, Luddenham (Primary) 2179A Elizabeth Drive, Luddenham (Secondary)	10 / DP32026	ENZ: Environment and Recreation ENT: Enterprise	Private property	Penrith	Partial acquisition	10.12	0.54 (5.4%)	Driveway
2510-2550 Elizabeth Drive, Luddenham	2 / DP220176	AGB: Agribusiness	Private property	Penrith	Partial acquisition	11.61	1.77 (15.3%)	Driveway
2161-2177 Elizabeth Drive, Luddenham (Primary) 887 Luddenham Road, Luddenham (Secondary) 880 Luddenham Road, Luddenham (Secondary)	11 / DP32026	ENZ: Environment and Recreation ENT: Enterprise	Private property	Penrith	Partial acquisition and lease	10.12	Proposed acquisition: 0.94 (9.3%) Additional proposed lease area for construction ancillary facility 2: 2.69 (26.6%)	Sheds, driveway
2143-2157 Elizabeth Drive, Luddenham (Primary) 892 Luddenham Road, Luddenham (Secondary) 892B Luddenham Road, Luddenham (Secondary)	12 / DP32026	ENZ: Environment and Recreation ENT: Enterprise	Private property	Penrith	Partial acquisition	7.80	1.36 (17.4%)	N/A
230 Adams Road, Luddenham	106 / DP846962	AGB: Agribusiness ENZ: Environment and Recreation	Private property	Liverpool	Partial acquisition	42.48	0.58 (1/4%)	N/A
2470 Elizabeth Drive, Luddenham	281 / DP571171	AGB: Agribusiness ENZ: Environment and Recreation	Private property	Liverpool	Partial acquisition	42.48	0.58 (1.4%)	N/A
2111-2141 Elizabeth Drive, Luddenham	13 / DP32026	ENZ: Environment and Recreation	Private property	Penrith	Partial acquisition	6.66	1.46 (21.9%)	Driveway

Address	Lot and plan	Existing land use zone	Ownership	LGA	Acquisition type	Approximate total property area (ha)	Indicative area to be acquired/leased (ha) and percentage of property to be acquired/leased	Potentially affected infrastructure (eg driveway, shed)*
		ENT: Enterprise SP2: Infrastructure (Elizabeth Drive)						
1953-2109 Elizabeth Drive, Badgerys Creek	1 / DP1287712 (Formerly 82 / DP1277406)	ENZ: Environment and Recreation ENT: Enterprise SP2: Infrastructure (Elizabeth Drive)	Private property	Penrith	Partial acquisition	279.80	8.46 (3%)	Dwelling, driveway, shed
1793-1951 Elizabeth Drive, Badgerys Creek	74 / DP1277011	ENT: Enterprise	Private Property (The University of Sydney)	Penrith	Partial acquisition and lease	75.53	Proposed acquisition: 0.43 (0.6%) Additional proposed lease area for construction ancillary facility 3: 20.67 (27.4%)	N/A Current use of the lease area is a construction ancillary facility for the M12 Motorway project

*Based on desktop review, subject to detailed design and landowner consultation

Appendix D – State Environmental Planning Policy (Biodiversity and Conservation) 2021, Chapter 6 considerations

SEPP (Biodiversity and Conservation) 2021 - Development in regulated catchments - controls on development generally

Consideration	Response / where addressed in the REF
6.6 Water quality and quantity	
1) In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consider the following	
(a) whether the development will have a neutral or beneficial effect on the quality of water entering a waterway	The proposal would require construction activities to be carried out over Cosgroves Creek and Oaky Creek. If not adequately managed, construction activities could lead to erosion of exposed soil and stockpiled materials and an increase in sediment loads entering nearby watercourses. Sediment laden waters pose a potential risk to downstream surface water quality. Erosion and sedimentation controls outlined in Section 7.2 would adequately minimise the potential for these impacts. With the implementation of safeguards and management measures outlined in Section 6.9, as well as proposed stormwater treatment devices and procedures for spills management, potential operational impacts to surface water quality would be appropriately managed. Potential impacts would, therefore, be minor and would not be expected to impact the environmental values and water quality objectives of the receiving environment. Refer to Section 6.9 for further detail
(b) whether the development will have an adverse impact on water flow in a natural waterbody	As described in Chapter 3 (Description of the proposal), a new twin bridge over Cosgroves Creek, and culvert over Oaky Creek is proposed. The installation of temporary waterway crossings to facilitate bridge construction work is not anticipated to substantially alter the flow of water, as temporary culverts would be installed to ensure flow is maintained. With the implementation of environmental safeguards and management measures outlined in Section 7.2 and further refinement of each new bridge during detailed design, the proposal is not anticipated to have an adverse impact on water flow in natural water bodies
(c) whether the development will increase the amount of stormwater run-off from a site	The proposal has been designed with drainage infrastructure including bioretention basins and grass swales to minimise impacts of stormwater runoff. With the implementation of appropriate controls during construction (refer Section 7.2), an increase in the amount of stormwater run-off is unlikely
(d) whether the development will incorporate on-site stormwater retention, infiltration or reuse	The proposal has been designed with drainage infrastructure including bioretention basins and grass swales to minimise impacts of stormwater runoff. Captured stormwater would be reused on-site as a dust suppressant where possible. Stormwater infrastructure design would be further refined during detailed design
(e) the impact of the development on the level and quality of the water table	Potential impacts of the proposal on the water table have been considered in Section 6.9. The construction of the proposal has the potential to exacerbate dryland salinity in the construction footprint. Naturally occurring salts, generally present in the soil or groundwater would be transported by rising groundwater associated with the removal of deep-rooted vegetation or other activities which could raise the groundwater table above normal seasonal levels and result in the mobilisation of salts. These impacts are anticipated to be minor and manageable with the implementation of safeguards and management measures outlined in Section 7.2

Consideration	Response / where addressed in the REF
(f) the cumulative environmental impact of the development on the regulated catchment	Section 6.16 includes an assessment of potential cumulative impacts. Provided surface water impacts in the construction footprint are managed and mitigated appropriately (in accordance with the measures in Section 7.2), the proposal is unlikely to contribute to potential cumulative impacts
(g) whether the development makes adequate provision to protect the quality and quantity of groundwater	Safeguards and management measures to manage potential impacts to groundwater are included in Section 6.9
6.7 Aquatic ecology	
(a) whether the development will have a direct, indirect or cumulative adverse impact on terrestrial, aquatic or migratory animals or vegetation	The proposal would require construction activities to be carried out over Cosgroves Creek and Oaky Creek. Construction activities would have the potential to result in minor aquatic impacts such as sedimentation downstream, erosion of stream banks from physical disturbance and potential bed erosion if sufficient scour protection is not in place. There would also be loss of riparian habitat to facilitate the bridge and culvert construction work at Cosgroves Creek and Oaky Creek, respectively. The installation of temporary waterway crossings to facilitate bridge construction work is not anticipated to substantially alter the flow of water, as temporary culverts would be installed to ensure flow is maintained. No threatened aquatic species, populations and communities have been identified or are considered likely to occur within the study area. The hydrology of existing waterways associated with culvert work would be altered to facilitate the flow of water at an angle with the replacement culverts. This is not considered likely to have any lasting detrimental effects. The culvert work, in conjunction with rehabilitation work, may potentially improve water flow and improve aquatic fauna movements. Refer to Section 6.3 for further detail
(b) whether the development involves the clearing of riparian vegetation and, if so, whether the development will require— (i) a controlled activity approval under the *Water Management Act 2000*, or (ii) a permit under the *Fisheries Management Act 1994*	There would be loss of riparian vegetation to facilitate the bridge and culvert construction work at Cosgroves Creek and Oaky Creek, respectively. Measures to protect aquatic habitat would be implemented to manage potential impacts (refer to Section 6.3). This would include rehabilitation of disturbed areas and landscaping in accordance with the urban design and landscape plan. The proposal would not require a controlled activity permit under the *Water Management Act 2000* (refer to Section 4.7.2). Transport may be required to provide formal notification to the Department of Primary Industries under Section 199 of the FM Act as the construction footprint is mapped as containing Key Fish Habitat. Nonetheless, requirements for work adjacent to Key Fish Habitat is determined on a case by case basis and would be determined in consultation with a local fisheries officer (refer to Section 4.2.6)
(c) whether the development will minimise or avoid— (i) the erosion of land abutting a natural waterbody, or (ii) the sedimentation of a natural waterbody	Erosion and sediment control measures would be implemented to minimise and manage potential impacts to water bodies (refer to Section 7.2). Measures would be included in a Soil and Water Management Plan which would be implemented throughout construction
(d) whether the development will have an adverse impact on wetlands that are not in the coastal wetlands and littoral rainforests area	The construction footprint does not include any land mapped as wetlands
(e) whether the development includes adequate safeguards and rehabilitation measures to protect aquatic ecology	Measures to protect aquatic ecology which would be implemented are outlined in Section 6.3

Consideration	Response / where addressed in the REF
(f) if the development site adjoins a natural waterbody—whether additional measures are required to ensure a neutral or beneficial effect on the water quality of the waterbody	With the implementation of safeguards and management measures outlined in Section 6.9, as well as proposed stormwater treatment devices and procedures for spills management, potential construction and operational impacts to surface water quality would be appropriately managed. Potential impacts would, therefore, be minor and would not be expected to impact the environmental values and water quality objectives of the receiving environment. Refer to Section 6.9 for further detail
6.8 Flooding	
In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consider the likely impact of the development on periodic flooding that benefits wetlands and other riverine ecosystems	The proposal is not located adjacent to a wetland or riverine ecosystem and would not have an impact on these features. Potential flooding impacts are assessed in Section 6.10, and are unlikely to include impacts to periodic flooding
6.9 Recreation and public access	
(a) the likely impact of the development on recreational land uses in the regulated catchment	The proposal would not affect the use of the Hawkesbury-Nepean River for recreation due its distance from the river. Existing recreational opportunities associated with tributaries of the river are limited; however, the proposal would not reduce the potential for recreational activities to occur in these areas
(b) whether the development will maintain or improve public access to and around foreshores without adverse impact on natural waterbodies, watercourses, wetlands or riparian vegetation	The proposal would maintain existing access to waterbodies in the construction footprint, noting that the existing recreational opportunities associated with these are limited
6.10 Total catchment management	
In deciding whether to grant development consent to development on land in a regulated catchment, the consent authority must consult with the council of each adjacent or downstream local government area on which the development is likely to have an adverse environmental impact	Transport has carried out consultation with Penrith City Council and Liverpool City Council regarding the proposal and its potential impacts (refer to Chapter 5 (Consultation))

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Consideration	Response / where addressed in the REF
6.11 Land within 100m of a natural water body	
(a) the land uses proposed for land abutting the natural waterbody are water-dependent uses	The existing Elizabeth Drive is located within 100 metres of natural water bodies including Cosgroves Creek and Oaky Creek. The proposal would involve upgrade of Elizabeth Drive to continue this existing use
(b) conflicts between land uses are minimised	The impacts of the proposal have been minimised where possible. The proposal would include an expansion of the existing use of Elizabeth Drive as a road corridor, including widening and bridge work in areas where the existing Elizabeth Drive is already located within 100 metres of a water body
6.13 Hawkesbury-Nepean conservation area sub-catchments	
(a) whether the development will minimise human interference with the condition of the sub-catchment	The proposal would maintain the existing use of Elizabeth Drive as a road corridor. The proposal would not change the potential for human interference with water bodies in the sub-catchment.
(b) whether the development will maintain and enhance the structure and floristics of native vegetation in the sub-catchment	The proposal would result in the loss of about 22.11 hectares of native vegetation which is not biodiversity certified; a subset of which would include four TECs subject to assessment under the BC Act (6.28 hectares) and two TECs subject to assessment under the EPBC Act (1.49 hectares). This includes the removal of habitat for threatened flora (including *Pultenaea parviflora*, *Marsdenia viridiflora subsp. viridiflora* and Southern Myotis). Measures to manage potential biodiversity impacts would be implemented, as outlined in Section 6.3. The proposal would also include rehabilitation of disturbed areas and landscaping in accordance with the urban design and landscape plan
(c) whether the development will maintain or enhance the scenic quality of the locality	Potential landscape and visual impacts of the proposal are assessed in Section 6.8. The proposal would not appreciably impact the scenic quality of the existing locality within the construction footprint
(d) whether development has previously been carried out on the development site	The proposal would use the existing Elizabeth Drive road corridor to minimise potential impacts to biodiversity and landowners. Where encroachment outside of the existing road corridor would be required, cleared and/or disturbed areas has been sought in the concept design, where possible, such as proposing construction ancillary facilities on land previously used for similar purposes

Appendix E – Noise and Vibration Assessment Report

Appendix F – Traffic and Transport Assessment Report

Appendix G – Biodiversity Development Assessment Report

Appendix H – Non-Aboriginal Heritage Impact Assessment

Appendix I – Stage 3 PACHCI – Aboriginal Cultural Heritage Assessment Report

Appendix J – Socio-economic Impact Assessment

Appendix K – Urban Design, Landscape Character and Visual Impact Assessment

Appendix L – Surface Water and Groundwater Assessment Report

Appendix M – Phase 1 Contamination Assessment Report

Appendix N – Air Quality Impact Assessment Report

NSW GOVERNMENT