

Alexandria to Moore Park Project Stage 1

Review of Environmental Factors

Roads and Maritime Services | November 2019



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Prepared by Jacobs Group (Australia) Pty Ltd and Roads and Maritime Services (Roads and Maritime)
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Executive summary

The proposal

Roads and Maritime Services (Roads and Maritime) propose to upgrade four intersections and introduce clearways between the Euston Road/Maddox Street intersection in Alexandria and the Anzac Parade/ Alison Road/Dacey Avenue intersection in Moore Park (the proposal). The proposal is located about three kilometres south of the central business district (CBD) in the suburbs of Alexandria, Waterloo, Moore Park within the City of Sydney local government area (LGA).

The proposal consists of:

- New clearways on both sides of Euston Road and McEvoy Street between Maddox Street and Bourke Street from 6:00am to 7:00pm Monday to Friday and 9:00am to 6:00pm on weekends
- New clearways at all times along Lachlan Street and Dacey Avenue between Bourke Street and Anzac Parade
- Right turn bans at most intersections without traffic signals and a right turn ban into Bunnings from McEvoy Street
- Improving intersection capacity at:
 - Fountain Street and McEvoy Street
 - Botany Road and McEvoy Street
 - Elizabeth Street and McEvoy Street
 - South Dowling Street, Lachlan Street and Dacey Avenue
- Minor kerb adjustments at:
 - Stokes Avenue and McEvoy Street
 - Kensington Lane and McEvoy Street
- Landscaping adjustments and replacement tree planting where works are undertaken
- Relocation of utilities and adjustments to traffic signals and street lights
- Property acquisitions, leases and adjustments
- Temporary construction facilities, including site compounds and stockpile sites at:
 - The car park on the south-west corner of the Stokes Avenue/McEvoy Street intersection, Alexandria (Site 1)
 - Road reserve at the southern end of Cope Street, Alexandria (Site 2)
 - Road reserve at the southern end of George Street, Alexandria (Site 3)
 - Vacant land (Lot 2 DP800705) at the corner of the Bourke Street/McEvoy Street intersection, Waterloo (Site 4)
 - Lot 1, 2 and 3 DP 76985, Lot 4 DP 86722 and Lot 14 DP80926 on the west corner of the Lachlan Street/Amelia Street intersection, Waterloo (Site 5).

Construction is expected to commence in early 2020 and would take around 36 months to complete.

The proposal is Stage 1 of a larger project that would include upgrades at other major intersections located along the Euston Road, McEvoy Street, Lachlan Street and Dacey Avenue corridor, subject to future planning, funding and environmental impact assessment processes. Stage 1 has a reduced scope and would improve traffic performance and can be implemented early with minimal property acquisitions.

Need for the proposal

The main intersections with the north south arterial roads located along this east west corridor are already congested and long delays are common during peak periods at South Dowling Street and Botany Road. The intersections at Bourke Street and Elizabeth Street are also currently close to capacity. The opening of major transport projects as well as planned urban renewal developments at Green Square, Waterloo and Redfern would also contribute to increases in congestion. If conditions remain as they are, average speeds on the local network are expected to decrease by 20 to 30 per cent in peak periods by 2021.

Road safety is already an issue on the corridor with crash rates much higher than would normally be expected for a road of this type in Sydney. The likelihood of congestion related crashes would increase as traffic grows.

Major bus routes cross the corridor at Elizabeth Street, Bourke Street and Botany Road and demand from more commuters moving into the urban renewal precincts along the corridor would further highlight performance issues. The average speed for buses along the corridor is forecast to decrease to 15 per cent in peak periods by 2021 with bus routes along Botany Road, Bourke Street and Elizabeth Street experiencing an increase in delays and a drop in reliability.

The proposal is needed to improve traffic flow and road safety along the road corridor and at priority intersections where the proposal is located as well as support substantial nearby urban renewal and transport projects with better amenity and safety for customers.

Proposal objectives

The primary objectives of the proposal are to:

- Improve intersection performance, safety and trip reliability within the Alexandria to Moore Park corridor
- Provide value for money
- Minimise the social and environmental impact of the development
- Maintain existing flood immunity.

Options considered

Two options were considered in developing this proposal. Both options assumed that the CBD and South East Light Rail (CSELR), motorway interchange at St Peters and the Green Square projects would be in place by 2021.

- **Option A:** Do minimum option: This option assumes no further upgrades along the corridor. Normal road maintenance would continue to be carried out
- **Option B:** Proposal option: This option assumed that the corridor would be upgraded as per the Alexandria to Moore Park Stage 1 proposal described in this review of environmental factors (REF). This would result in the corridor being two through lanes in each direction during the day, achieved through a combination of new clearways and new turning lanes at four intersections. A wide range of sub-options as outlined in Section 2.4 of this REF were considered at each intersection.

After assessment against the proposal objectives, Option B was selected as the preferred option as it would:

- Improve intersection performance, safety and trip reliability within the Alexandria to Moore Park corridor
- Provide value for money
- Minimise the social and environmental impact of the development
- Maintain existing flood immunity.

Statutory and planning framework

Clause 94 of State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) 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 the purpose of a road and is to be carried out by Roads and Maritime, development consent from City of Sydney is not required. The proposal is not State significant infrastructure or State significant development and can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Roads and Maritime is the determining authority for the proposal. Roads and Maritime 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). This REF has been prepared as part of the assessment process.

Community and stakeholder consultation

Roads and Maritime sought feedback on the corridor strategy and preliminary concept design during a two-week consultation period from 30 November to 16 December 2016 and a four-week consultation period from 8 June 2017 to 7 July 2017. Consultation involved a project update newsletter, community drop in sessions, a project webpage, an interactive online map and stakeholder meetings.

The feedback from the consultation carried out to date was concerned the following broad themes:

- Property and access
- Parking
- The environment, including trees
- Public transport
- Active transport
- Traffic issues including lane configurations
- Clearway times.

In response to the feedback and further engagement with City of Sydney, the proposal was changed in key areas. Property impacts and impacts to trees were reduced, and clearway operating hours were reduced to mainly daytime hours only.

Roads and Maritime has formally consulted with the City of Sydney Council in accordance with the requirements of the ISEPP.

Since the ultimate concept design was displaced in 2017, Roads and Maritime have been carrying out further stakeholder engagement including with City of Sydney. Since this time major changes have been made to the ultimate concept design including a decision to stage it and a major reduction in the number and extent of intersection works being considered.

Roads and Maritime would continue to consult with the community and stakeholders during future development of the proposal and invites comments on this REF. Submissions received during the public display period for the REF would be addressed in a formal submissions report and, if a decision is made to proceed with the proposal, would be considered during detailed design of the proposal.

Environmental impacts

The development of the proposal would have some adverse impacts during construction. There would also be longer-term impacts once the proposal is operating. These are summarised below.

The main environmental impacts of the proposal are:

Traffic and access

Traffic modelling shows that peak period traffic demand at intersections would increase by between six to 45 per cent (depending on location and peak) by 2021, resulting in average speeds across the network reducing by 20 to 30 per cent in peak periods. By 2031, additional planned network changes and proposed urban renewal are forecast to further increase peak period traffic demands.

The proposal would result in:

- Improved average speed of buses by about 12 per cent in the morning peak and three per cent in the afternoon peak in 2021
- Improved average travel speeds by 33 per cent and 15 per cent in the 2021 morning and afternoon peak hours respectively
- A better performing route that would attract additional traffic, of which some would be removed from surrounding local streets
- The introduction of further right turn bans at local streets along the proposal. This would improve safety, but would result in less direct local access
- Reduce risk of right turn related crashes at minor intersections and reduced congestion related crashes along the proposal.

During construction there would be travel delays that would affect commuter, bus and heavy vehicle traffic. There may also be temporary restrictions on property access for residents and businesses.

To mitigate impacts to traffic, businesses and residents, construction is proposed in four separate construction zones with night works as required. Roads and Maritime would consult with affected people along the corridor about property access before the start of construction.

Parking

The proposal would result in a change in the availability of the 252 on-street parking spaces in the proposal of which 228 already operate under No Parking restrictions during morning or afternoon peaks. This includes some loading zones and other dedicated parking spaces, located along Euston Road and McEvoy Street.

The clearways would operate as follows:

- New clearways on both sides of Euston Road and McEvoy Street between Maddox Street and Bourke Street from 6:00am to 7:00pm Monday to Friday and 9:00am to 6:00pm on weekends
- New clearways at all times along Lachlan Street and Dacey Avenue between Bourke Street and Anzac Parade.

The parking assessment determined that local side streets in the study area would generally have capacity to accommodate any on-street parking places displaced by the clearway operation, with the exception of three locations that are expected to experience 'moderate' or 'substantial' impacts on parking availability. 'Moderate' impacts are defined as between five and 10 vehicles displaced from parking on downstream local streets, while 'substantial' impacts are defined as between 10 to 15 vehicles displaced from parking on downstream local streets. The three locations where moderate to substantial impacts are expected are:

- On the northern side of McEvoy Road between Harley Street and Fountain Street
- On the northern side of McEvoy Road between Fountain Street and Loveridge Street
- On the northern side of McEvoy Road between Botany Road and Elizabeth Street.

The proposal would also result in the loss of off-street parking including up to:

- Twenty-six public parking spaces at 102-112 McEvoy Street, Alexandria
- Two customer parking spaces at 35 Lachlan Street, Waterloo.

The parking assessment found that there was capacity to accommodate off-street parking lost at Lachlan Street, Alexandria as a result of the proposal. There would however be limited capacity to accommodate off-street parking lost at 102-112 McEvoy Street, Alexandria due to the severity of impacts from the loss of on-street parking from the proposal at these side streets. These impacts may be ameliorated through the use of commercial car parks located at:

- Fountain Street Car Park, which offers casual drive up parking from 6:00am to 6:00pm daily
- Virtus Health Car Park at Bowden Street, which offers drive up parking from 6:00am to 7:00pm weekdays.

Further mitigation measures to ameliorate and manage the areas where there are moderate and substantial impacts would be investigated and developed during detailed design. This may include the introduction of timed restrictions in areas that currently have no parking restrictions along side streets to allow for a greater turnover of parked vehicles during business hours. Roads and Maritime would also investigate options to re-instate some of the public parking spaces at 102-112 McEvoy Street, Alexandria as part of detailed design and in consultation with surrounding property owners.

Noise

Construction would result in noise impacts at nearby sensitive receiver locations, such as at dwellings and schools. The majority of the sensitive receivers are located in apartment blocks and multi storey dwellings.

Where possible the proposal would be constructed during standard construction hours. However, activities such as utility relocation works and civil works would be required to be carried out outside of standard construction hours due to safety and traffic disruption reasons.

Consultation would be carried out with the potentially affected receivers. Respite periods would be provided in accordance with Roads and Maritime *Construction Noise and Vibration Guidelines*.

During construction, vibratory rolling would be carried out within 100 metres of residences and commercial buildings and this would also create disturbance.

During operation, the assessment identified that up to 48 buildings which could be considered for additional noise mitigation. Roads and Maritime have identified potential mitigation measures to reduce these noise impacts. This includes management of noise and vibration during construction such as deploying acoustic screening around noisy plant and programming construction work to avoid out of hours work where possible. At-property architectural treatments would be provided if feasible and reasonable, to mitigate any operational noise impacts.

Non-Aboriginal heritage

A Statement of Heritage Impact (SoHI) was completed for the proposal. The SoHI found that there are five heritage listed items (two State and three Local) and five unlisted potential heritage items within the proposal area. There are a further 20 listed heritage items next to or able to be seen from the corridor.

The key heritage impacts would be:

- Temporary visual impacts to Former Sydney Water Pumping Station & Valve House listed on the Sydney Local Environment Plan 2012 (Sydney LEP) and Sydney Water section 170 Register due to the establishment of a temporary construction compound (Site 4) immediately next to the heritage item

- Minor impact to 'Centennial Park, Moore Park, Queens Park and Moore Park Heritage Conservation Area' listed on the State Heritage Register (SHR), Register of national estate (RNE) and Sydney LEP may occur during construction.
- Minor impact to 'Waterloo Park & Oval Including Grounds and Landscaping' and 'Waterloo Heritage Conservation Area' both listed on the Sydney LEP associated with slight modifications to the northwest and northeast corners of the Elizabeth Street/McEvoy Street intersection.

The proposal would also have a major impact on sections of sandstone kerbs along Kensington Lane, McEvoy Street and Lachlan Street which are unlisted items of heritage significance. Sandstone kerbs would be retained where possible. If retention is not feasible, they would be reinstated or replaced.

In addition the proposal would involve the removal of 25 mature trees and 24 immature trees within the construction footprint, this would result in visual impacts across the study area. None of the trees to be removed are listed on the City of Sydney's *Register of Significant Trees* (2013) or within a heritage conservation area part of a heritage listed item.

Several areas of historical archaeological potential have been identified within the proposal area. A section 139 excavation permit covering the works in an area formerly occupied by the St Silas School and Church near to the Botany Road/McEvoy street intersection would be obtained from the NSW Heritage Division. Test excavations would be designed to investigate the presence of intact structural remains and/or artefact deposits associated with the former building within the construction footprint and subsequently provide management advice for the proposal.

Aboriginal heritage

An assessment of impacts to Aboriginal heritage has been undertaken in accordance with stage two of Roads and Maritime's *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI). The proposal would not impact previously recorded items under the Aboriginal Heritage Information Management system (AHIMS). The proposal would only impact areas that have been assessed as of very low to low Aboriginal archaeological sensitivity, therefore impacts to Aboriginal objects are considered unlikely.

Flooding and hydrology

A Flood Impact Assessment has been carried out. Flood impacts resulting from the proposal are predicted to be negligible.

Landscape, visual amenity and urban design

Visual and landscape impacts would occur during the proposal's construction and operation. Temporary construction impacts would result from construction plant, equipment, temporary compounds and stockpiles.

Permanent visual and landscape changes would result from the removal of street trees.

In order to mitigate these impacts and help reinstate the character of the area, new street trees would be planted in accordance with the City of Sydney's Street Tree Masterplan where possible and in consultation with the City of Sydney.

Biodiversity

Natural fauna habitats in the locality have been largely removed and/or heavily modified by residential and industrial development and road infrastructure. The habitat that is present in the study area is limited to planted roadside and parkland vegetation. The habitats within the study area generally lack important features for shelter such as hollow bearing trees (although some of the larger fig trees have hollows), dense litter layer, or woody debris.

Impacts to vegetation from the proposal are limited to the removal of 25 mature and 24 immature planted trees and landscaping including shrubs and exotic groundcover. The proposal would not be likely to significantly impact threatened species, populations or ecological communities or their habitats.

Social and economic factors

The proposal would have both wider regional and local benefits through reduced delays, improved reliability for public transport, improved safety for all road users and improved access due to the provision of new road and pedestrian infrastructure.

During construction, the community and businesses in the area would likely experience temporary traffic delays, noise and air quality and visual amenity impacts. In addition, it is expected that construction would have an impact on community values, particularly local areas comprised of restaurants/cafés with outside eating areas and open spaces such as Waterloo Park/Oval, Moore Park and Centennial Park. Relocation and adjustment of utility services including power, water, sewerage, gas and telecommunications networks would occur as part of the proposal. Minor disruptions to these utility services may occur. Property owners likely to be impacted by any disruptions and access restrictions would be notified before work starts.

The proposal requires strip acquisition of three privately owned commercial properties of between one and 29 square metres. There are a further nine landscaping lots that are already in public ownership that would be required.

An assessment of the impacts on businesses due to the loss of on-street and off-street parking determined that overall, there is expected to be a low impact to businesses located along Euston Road and McEvoy Street from proposed changes in parking conditions, with businesses in many locations along the proposal likely to experience either no or negligible impacts to customer or staff parking due to the proposal. The exception to this includes four locations where moderate to high impacts on businesses are expected. This includes businesses:

- On the northern side of Euston Road between Maddox Street and Harley Street
- On the northern side of McEvoy Road between Harley Street and Loveridge Street
- On the southern side of McEvoy Road / Euston Road between Bowden Avenue and Maddox Street
- On the southern side of McEvoy Road between Stokes Avenue and Bowden Street.

Mitigation measures, such as providing more localised timed parking on nearby side streets, would be considered to minimise the loss of on-street parking from clearways. Roads and Maritime would investigate options to re-instate some of the public parking spaces at 102-112 McEvoy Street, Alexandria as part of detailed design.

Justification and 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 environmental matters affecting or likely to be affected by the proposal.

The proposal's environmental impacts are not considered significant and an environmental impact statement is not required. Therefore, approval is not required from the Minister for Planning under Division 5.2 of the EP&A Act. The proposal is unlikely to significantly affect threatened species, populations or ecological communities or their habitats, within the meaning of the *Biodiversity Conservation Act 2016* (BC Act) or *Fisheries Management Act 1994* and a Species Impact Statement or entry into the Biodiversity Offset Scheme is not required. The proposal is unlikely to affect Commonwealth land or have a significant impact on any matters of national environmental significance.

The proposal would support improved access through the area and facilitate pedestrian, cyclist and vehicle access to next to urban renewal projects.

On balance, the proposal's long-term benefits outweigh its impacts, and the proposal is considered to be justified.

Display of the review of environmental factors

This REF is on display for comment between 27 November 2019 and 18 December 2019.

You can access the documents in the following ways:

Internet

The documents are available as pdf files on the Roads and Maritime website at <https://www.rms.nsw.gov.au/a2mp>

Printed copies

The documents can be viewed at the following locations:

City of Sydney Council Office	(Level 2, 456 Kent Street, Sydney NSW 2000)
Roads and Maritime Ennis Road Office	(20-44 Ennis Rd, Milsons Point NSW 2061)
Green Square Library	(355 Botany Rd, Zetland NSW 2017)
Waterloo Library	(770 Elizabeth St, Waterloo NSW 2017).

Copies by request

Printed and electronic copies are available by contacting the project team on 1800 875 557 or email a2mp@rms.nsw.gov.au, noting that there may be a charge for hard copies, CD or USB.

Staffed displays

Moore Park Supa Centre (ground floor) – 2A South Dowling Street, Moore Park
Friday 06 December 2019 11am to 1pm

Cliff Noble Community Centre – 24 Suttor Street, Alexandria
Saturday 07 December 2019 10am to 1pm
Thursday 12 December 2019 5pm to 8 pm

How can I make a submission?

To make a submission about this proposal, please send your written comments to:

Mail 71-79 Pyrmont Bridge Road, Pyrmont NSW 2009

Email a2mp@rms.nsw.gov.au

Submissions must be received by 18 December 2019. Submissions will be managed in accordance with the Roads and Maritime Privacy Statement which can be found here <https://transportnsw.info/about-us/privacy> or by contacting 131 500 for a copy.

What happens next?

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

After this consideration, Roads and Maritime 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, Roads and Maritime will continue to consult with the community and stakeholders prior to and during construction.

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1. Introduction

This chapter introduces the proposal and provides the context of the environmental assessment. In introducing the proposal, the objectives and project development history are detailed and the purpose of the report provided.

1.1 Proposal identification

Transport for New South Wales (Roads and Maritime) propose to upgrade four intersections and introduce clearways between the Euston Road/Maddox Street intersection in Alexandria and the Anzac Parade/Alison Road/Dacey Avenue intersection in Moore Park (the proposal). The proposal is located about three kilometres south of the central business district (CBD) in the suburbs of Alexandria, Waterloo, Moore Park within the City of Sydney local government area (LGA), as shown in **Figure 1-1**.

The proposal objectives align with the strategic objectives articulated in the *Greater Sydney Region Plan* (Greater Sydney Commission, 2018) and the *Road Safety Plan 2021* (Transport for New South Wales, 2018) and *Future Transport Strategy 2056* (Transport for NSW, 2018). The strategic context of this proposal is discussed further in **Section 2.1**.

The proposal consists of:

- New clearways on both sides of Euston Road and McEvoy Street between Maddox Street and Bourke Street from 6:00am to 7:00pm Monday to Friday and 9:00am to 6:00pm on weekends
- New clearways at all times along Lachlan Street and Dacey Avenue between Bourke Street and Anzac Parade
- Right turn bans at most intersections without traffic signals and a right turn ban into Bunnings from McEvoy Street
- Improving the intersections and road re-surfacing at:
 - Fountain Street and McEvoy Street
 - Botany Road and McEvoy Street
 - Elizabeth Street and McEvoy Street
 - South Dowling Street, Lachlan Street and Dacey Avenue
- Kerb adjustments at:
 - Stokes Avenue and McEvoy Street
 - Kensington Lane and McEvoy Street
- Landscaping adjustments and replacement tree planting where works are undertaken
- Relocation of utilities and adjustments to traffic signals and street lights
- Property acquisitions, leases and adjustments
- Temporary construction facilities, including site compounds and stockpile sites at:
 - The car park on the south-west corner of the Stokes Avenue/McEvoy Street intersection, Alexandria (Site 1)
 - Road reserve at the southern end of Cope Street, Alexandria (Site 2)
 - Road reserve at the southern end of George Street, Alexandria (Site 3)
 - Vacant land (Lot 2 DP800705) at the corner of the Bourke Street/McEvoy Street intersection, Waterloo (Site 4)
 - Lot 1, 2 and 3 DP 76985, Lot 4 DP 86722 and Lot 14 DP80926 on the west corner of the Lachlan Street/Amelia Street intersection, Waterloo (Site 5).

An overview of the proposal is provided in **Figure 1-2** and detailed layout plans are included in **Appendix A**. The proposal is also described in further detail in **Chapter 3**.

The proposal as shown in **Figure 1-2** would be constructed in four separate construction zones centred around the four main intersections that are to be upgraded. This approach would minimise traffic impacts on residents and businesses. The duration of construction impacts within each of the four intersection construction zones would typically be between 12 - 36 months. Construction is expected to commence in early 2020 and would take around 36 months to complete. Further details of construction staging are provided in **Section 3.3.2**.

The proposal is the first stage of a larger project that would potentially include upgrades at other major intersections located along the Euston Road, McEvoy Street, Lachlan Street and Dacey Avenue corridor, subject to future planning, funding and environmental impact assessment processes. Stage 1 of the project (the proposal) has a reduced scope and project would improve traffic performance and can be implemented early with minimal property acquisitions.

1.2 Location

The proposal is located in a modified urban environment in a fast growing redevelopment area. Land use surrounding the proposal includes a mix of residential, commercial/business, recreational, industrial and transport related land uses. The existing environment surrounding the proposal is provided in **Chapter 6**. The main features of the area and its surrounds, including key developments (refer to **Section 6.11.2**) are shown in **Figure 1-3** and include:

- Moore Park, Moore Park Golf Course and E.S. Marks Athletics Field
- Centennial Park which includes the Kensington Ponds
- Tay Street Reserve
- The Supa Centa Moore Park shopping complex
- Residential properties to the south (Tay Street) and north-east (Martin Road) and apartments along the western side of South Dowling Street
- New unit developments in Green Square
- Royal Randwick Race Course, Sydney Cricket Ground, Moore Park Showground and Allianz Stadium
- The approved CBD and South East Light Rail (CSELR) corridor, which is currently being constructed and runs along Anzac Parade and Alison Road
- The Green Square Urban Renewal Precinct and other urban renewal projects
- Commercial premises including retail at the western end of the road corridor
- Waterloo Oval and Waterloo Park.



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Legend

- Proposal area
- Road
- Railway line



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Figure 1-1 | The locality
Alexandria to Moore Park Stage 1



Proposed clearways in both directions
Maddox Street to Bourke Street
 CLEARWAY
 Monday - Friday: 6am-7pm
 Weekends: 9am-6pm

Legend

- Concept design
- Road
- Proposal area**
- Construction impacts:
 - Construction footprint
 - Construction compounds
- Operational impacts:
 - Clearways and intersection upgrades
 - Parking changes in side streets



Data sources
 Jacobs 2016
 LPI 2016
 Roads and Maritime 2016
 ARUP 2016

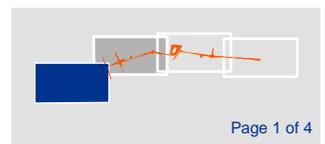
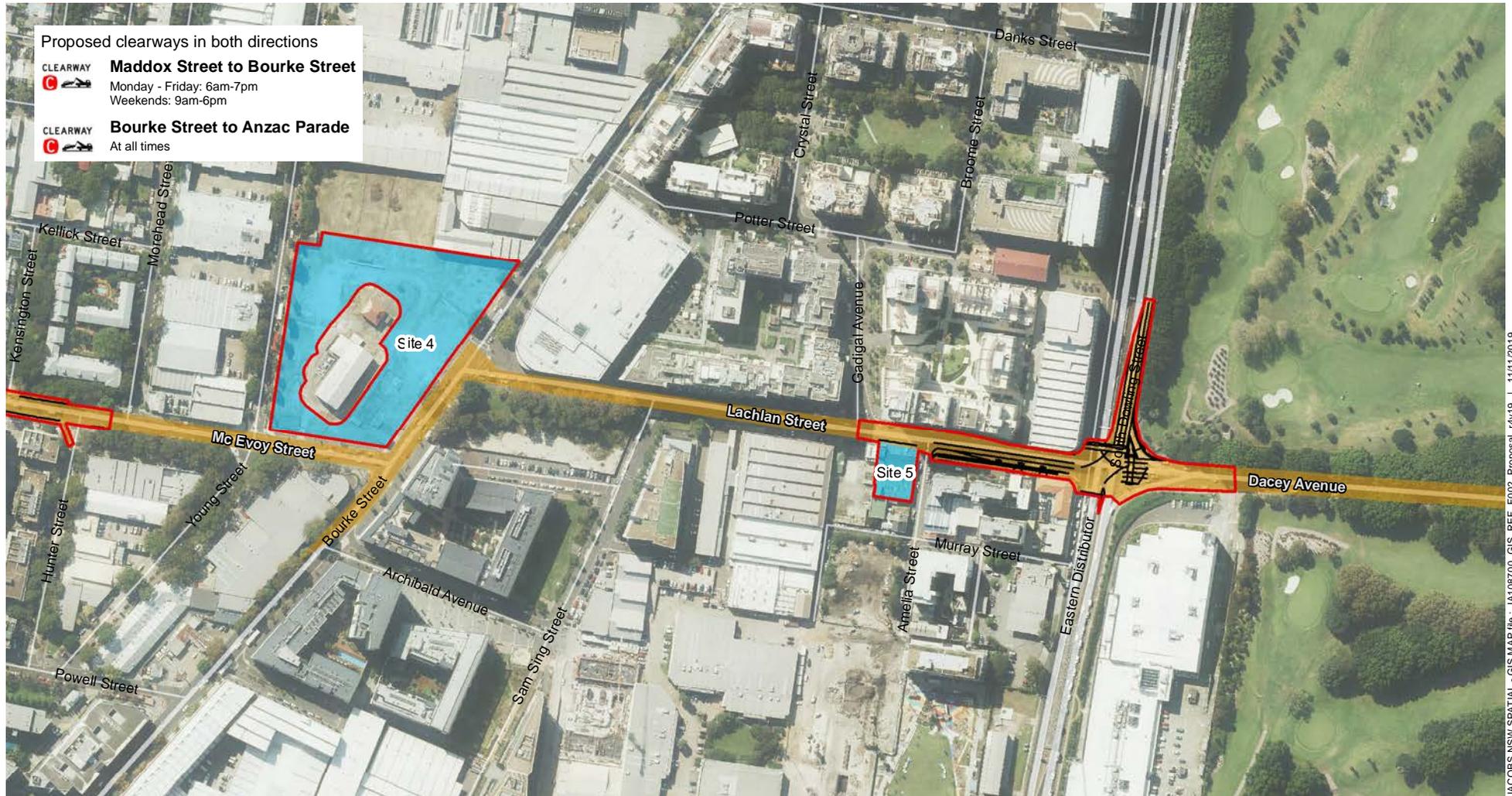


Figure 1-2a | The proposal
 Alexandria to Moore Park Stage 1

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Legend

- Concept design
- Road
- Proposal area**
- Construction impacts:**
 - Construction footprint
 - Construction compounds
- Operational impacts:**
 - Clearways and intersection upgrades
 - Parking changes in side streets



Data sources
 Jacobs 2016
 LPI 2016
 Roads and Maritime 2016
 ARUP 2016

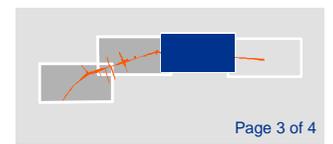


Figure 1-2c | The proposal
 Alexandria to Moore Park Stage 1



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Legend

- Concept design
- Road

Proposal area

Construction impacts:

- Construction footprint
- Construction compounds

Operational impacts:

- Clearways and intersection upgrades
- Parking changes in side streets



Data sources
 Jacobs 2016
 LPI 2016
 Roads and Maritime 2016
 ARUP 2016

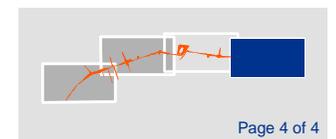
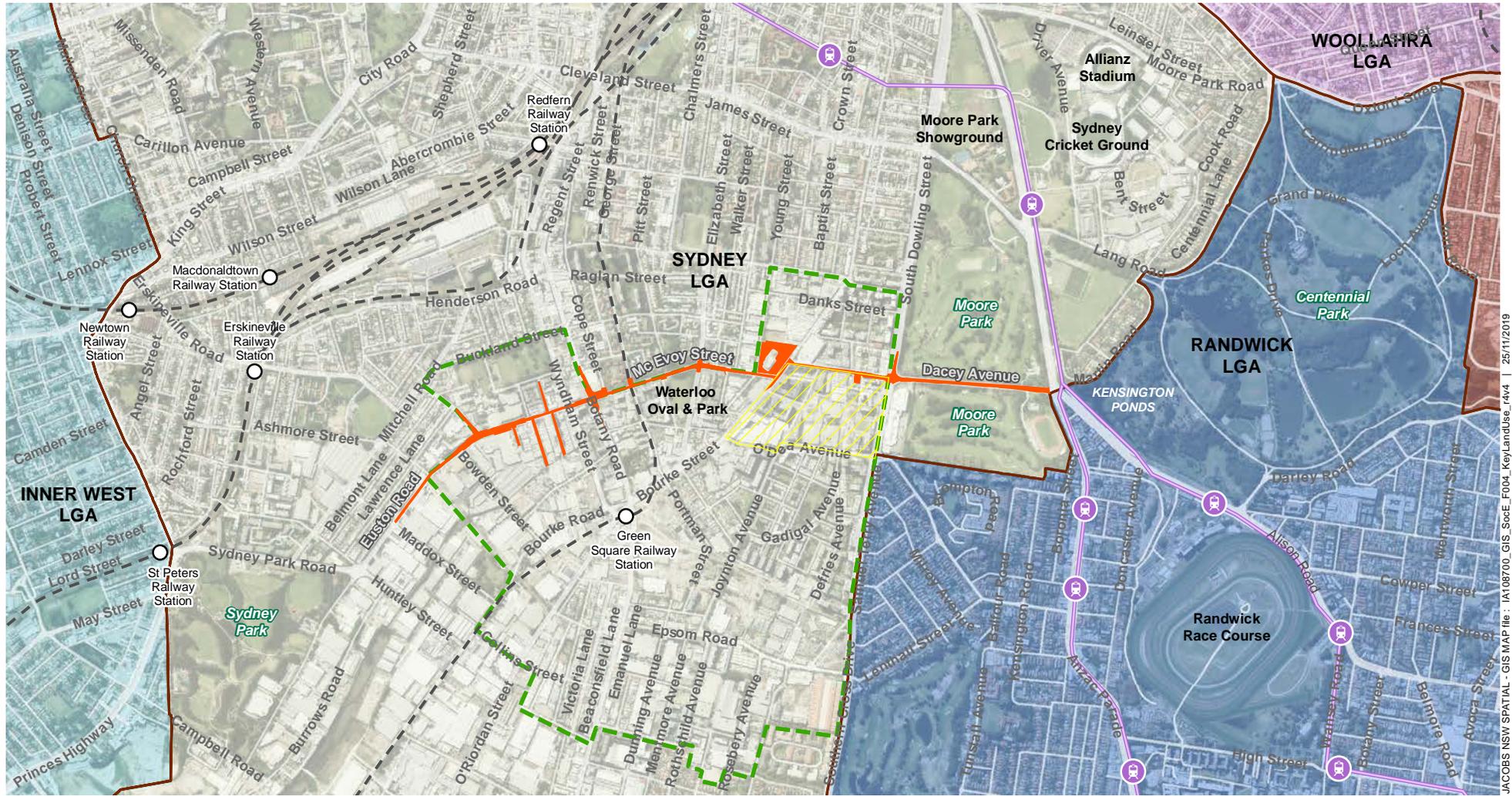


Figure 1-2d | The proposal
 Alexandria to Moore Park Stage 1



JACOBS NSW SPATIAL - GIS MAP file: I:\108700_GIS_SocE_Food_KeyLandUse_14v4 | 25/11/2019

Legend

- Proposal area
- LGA boundary
- Road
- Railway line
- CSELR station (proposed)
- CSELR alignment (proposed)
- Lachlan Precinct
- Green Square Urban Renewal

Local Government Area

- INNER WEST
- RANDWICK
- SYDNEY
- WAVERLEY
- WOOLLAHRA



Figure 1-3 | Urban development context
Alexandria to Moore Park Stage 1

1.2.1 Terms used in this report

The following terms are used in this review of environmental factors (REF):

- 'The proposal' refers to the concept design for the stage 1 of the Alexandria to Moore Park Project, NSW
- 'Ultimate concept design' refers to the full project displayed in the July 2017 Project Update (refer to **Appendix A**)
- 'The proposal area' refers to the area that would be directly impacted by the proposal during operation of the proposal, refer to **Figure 1-2**. It encompasses all of the components of the proposal and includes the concept road design and includes properties that would be acquired as well as any utility relocations
- The 'construction footprint' refers to the area that would be directly impacted by the proposal during construction of the proposal, refer to **Figure 1-2**. The construction footprint includes compound sites, stockpile sites and any other areas that would be temporarily disturbed and which are located within the four separate construction zones
- 'The study area' encompasses the proposal area and the area that may be indirectly impacted by the proposal and varies for specialist studies
- 'The locality' encompasses the area in a 10 kilometre radius of the proposal
- 'Direct impacts' occur through direct interaction of an activity with the environment. For biodiversity, direct impacts include the removal of trees/vegetation by the proposal
- 'Indirect impacts' on the environment are those that are not a direct result of the proposal and are often produced away from or as a result of a complex impact pathway. Indirect impacts are also known as secondary impacts. For biodiversity indirect impacts include construction machinery compacting soil over tree roots or accidental damage by construction machinery.

1.3 Purpose of the report

This review of environmental factors (REF) has been prepared by Jacobs on behalf of Roads and Maritime Greater Sydney Project Office. For the purposes of these works, Roads and Maritime 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 mitigation and management measures to be implemented.

The description of the proposed work and assessment of associated environmental impacts has been undertaken in the context of clause 228 of the Environmental Planning and Assessment Regulation 2000, the factors in *Is an EIS Required? Best Practice Guidelines for Part 5 of the Environmental Planning and Assessment Act 1979* (Is an EIS required? guidelines) (DUAP, 1995/1996), *Roads and Related Facilities EIS Guideline* (DUAP 1996), the *Biodiversity Conservation Act 2016 (BC Act)*, the *Fisheries Management Act 1994 (FM Act)*, and the *Australian Government's 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 Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

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 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 (BDAR)
- 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 whether 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 Australian Government Department of the Environment and Energy for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

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

The main intersections with the north south arterial roads located along this east west corridor are already congested and long delays are common during peak periods at South Dowling Street and Botany Road. The intersections at Bourke Street and Elizabeth Street are also currently close to capacity. Congestion is expected to increase due to a substantial growth in residential population of more than 40,000 people within 1.5 kilometres of the corridor over the next 15 years. The opening of major transport projects as well as planned urban renewal developments at Green Square, Waterloo and Redfern would also contribute to increases in congestion.

If conditions remain as they are, average speeds on the local network are expected to decrease by 20 to 30 per cent in peak periods by 2021.

Road safety is already an issue on the corridor with crash rates much higher than would normally be expected for a road of this type in Sydney. The likelihood of congestion related crashes would increase as traffic grows.

Major bus routes cross the corridor at Elizabeth Street, Bourke Street and Botany Road and demand from more commuters moving into the urban renewal precincts along the corridor would further highlight performance issues. The average speed for buses along the corridor is forecast to decrease to 15 per cent in peak periods by 2021 with bus routes along Botany Road, Bourke Street and Elizabeth Street experiencing an increase in delays and a drop in reliability.

The proposal is needed to improve intersection performance, safety and trip reliability along the road corridor and at priority intersections where the proposal is located as well as support substantial nearby urban renewal and transport projects with better amenity and safety for customers.

The proposal responds to the NSW Government's aim to deliver a fully integrated transport network in the Sydney CBD over a 20-year period. The focus of the proposal is to improve traffic flow and road safety along the proposal and at priority intersections in the southern CBD fringe suburbs of Alexandria, Waterloo and Moore Park and interface with other transport initiatives. The proposal would support local urban renewal initiatives planned in the area including such developments as Green Square by providing access and improved road infrastructure.

A number of Commonwealth and State strategic plans specifically refer to the significance of the improving safety and efficiency in roads in Sydney's CBD. The proposal is consistent with these strategic plans, which are discussed in further detail below.

2.1.1 Building Momentum: The State Infrastructure Strategy 2018-2038

The *State Infrastructure Strategy 2018-2038* (Infrastructure New South Wales, 2017) (the State Infrastructure Strategy) sets out the government's priorities for the next 20 years, and combined with the *Future Transport Strategy 2056*, the *Greater Sydney Region Plan* and the *Regional Development Framework*, brings together infrastructure investment and land-use planning for our cities and regions.

The State Infrastructure Strategy) outlines Infrastructure NSW's recommendations for priority infrastructure projects and initiatives for Sydney and NSW to 2038, In particular the strategy identifies road building and upgrading as crucial to enabling Sydney's growth and the associated requirement for new dwellings over the next 20 years.

The proposal would assist in meeting the priorities of the State Infrastructure Strategy as it would reduce congestion and improve traffic and passenger flows along the proposal.

2.1.2 Future Transport Strategy 2056

The Future Transport Strategy 2056 (Transport for NSW, 2018) underpins and supports the State Infrastructure Strategy and sets the 40-year vision, strategic directions and outcomes for customer mobility in NSW. It would be delivered through a series of supporting plans, including the Future Transport Strategy, the Tourism and Transport Plan, the Greater Sydney Services and Infrastructure Plan, and the Regional NSW Services and Infrastructure Plan.

To support these outcomes, the strategy contains policy, service and (road, rail, active) infrastructure improvements and potential initiatives. The proposal supports the State-wide outcomes for transport in NSW identified above. In particular the proposal would improve safety by providing additional turning lanes at priority intersections and by enhancing pedestrian and cycle facilities within the proposal area.

The proposal would also support *The Future Transport Strategy 2056* as it would reduce congestion at intersections and improve bus efficiency and reliability along the proposal.

The Future Transport Strategy 2056 also includes a Movement and Place framework for road planning to meet the needs of a growing population and the need to move increasing levels of people and goods. The Movement and Place Framework underpins *The Future Transport Strategy 2056* and aims to allocate road space in a way that improves the liveability of places. The framework recognises that roads serve two primary roles:

- Movement of people and goods
- Places for people.

The proposal corridor is identified as a movement corridor which provides for the movement of general traffic, freight and buses in an east-west direction. The corridor does have some place characteristics, with a combination of commercial, recreational and residential developments generating pedestrian and cyclist activity

2.1.3 Directions for a Greater Sydney 2017-2056

Directions for a Greater Sydney 2017-2056 (Greater Sydney Commission, 2017) aims to better integrate land use and infrastructure in Greater Sydney to accommodate a population that would grow from five to eight million people over the next 40 years. It builds on the 'three cities' approach identified in *Towards our Greater Sydney 2056*. *Directions for a Greater Sydney* identifies ten directions, including:

- A city supported by infrastructure
- A city for people
- Housing the city
- A city of great places
- Jobs and skills for the city
- A well connected city
- A city in its landscape
- An efficient city
- A resilient city
- A collaborative city.

Strategies for progress towards these ten directions are highlighted in the State Infrastructure Strategy (Infrastructure NSW, 2018) and *Future Transport Strategy 2056* (NSW Government, 2018) and methods for implementation are detailed in District Plans along with relevant local environmental plans, agency programs and transport programs.

The proposal would support this vision improving road network performance, resilience and efficiency, enabling sustained growth and productivity across Greater Sydney. The proposal would assist in improving travel times along the corridor and improve access between nearby urban renewal precincts, Sydney Park and Moore Park.

2.1.4 Metropolis of Three Cities – the Greater Sydney Region Plan

Metropolis of Three Cities – the Greater Sydney Region Plan (Greater Sydney Commission, 2018) aims to rebalance growth and deliver its benefits more equally and equitably to residents across Greater Sydney. A Metropolis of Three Cities – the Greater Sydney Region Plan has been prepared concurrently with *Future Transport 2056* and the *State Infrastructure Strategy*, aligning land use, transport and infrastructure planning to reshape Greater Sydney as three unique but connected cities.

The Central District Plan is the district level guide for implementing the *Greater Sydney Region Plan*. In its the plan focuses on the Green Square – Mascot Precinct it states that ‘the centre would benefit from improved city serving and centre serving transport to address growing congestion and improve access to surrounding areas.’ Enhancing access to a broader range of jobs and services within 30 minutes is also key consideration of the plan. The proposal would support the plan as it would improve road networks and transport corridors supporting future growth.

2.1.5 Road Safety Plan 2021

The *Road Safety Plan 2021* (Transport for New South Wales, 2018) details the NSW Government’s commitment to improving safety on NSW roads. Key targets relevant to the proposal include:

- Road safety targets for:
 - 2021: Reduce road fatalities by at least 30 per cent from 2008-2010 levels (State Priority Target)
 - 2056: Zero fatalities and serious injuries on our roads.

As one of the proposal’s primary objectives is to improve road safety, it would assist in meeting the goals of the plan.

2.1.6 NSW Freight and Ports Strategy

The aim of the *NSW Freight and Ports Strategy* (Transport for NSW, 2013b) is to provide a transport network in NSW that enables the efficient flow of goods to the market.

The *NSW Freight and Ports Strategy* identifies that in 2011 the NSW road network carried 63 per cent of the total freight volume, while rail carried 33 per cent. The role of heavy vehicles in moving freight across NSW is substantial and would continue to be for the foreseeable future. The strategy identifies the challenge of increasing road capacity to support the forecast growth in freight.

The proposal is consistent with the following strategic action programs identified in the strategy:

- Network efficiency – The proposal would improve network efficiency, delivering travel time savings. This would provide more efficient movement of freight that need to use the corridor, which would increase productivity, reduce maintenance and thereby reduce operational freight costs
- Network capacity – The proposal would increase intersection capacity along the proposal for freight movement which is currently heavily congested

- Network sustainability – The proposal would lead to long-term savings in greenhouse gas emissions by achieving travel time savings and reducing vehicle hours travelled.

2.1.7 Other relevant strategies

Centennial Parklands Conservation Management Plan

The *Centennial Parklands Conservation Management Plan* (CMP) (Urbis, 2010) is a guide for the conservation management of all heritage values of Centennial Parklands, including natural, Aboriginal and Non-Aboriginal heritage. It sits under the Plan of Management 2006-2016 and informs other plans, strategies and policies such as Queens Park, Moore Park and Moore Park South Master Plans. The CMP has the purpose of setting the direction for the conservation management of the Centennial Parklands in the context of its role as a living historic place providing a diversity of community needs and uses. The CMP communicates the key principles and policies relating to the management of the heritage significance of Centennial Parklands.

The CMP has been taken into consideration in this REF and in the development of the proposal, particularly in regard to the protection and enhancement of the Park's cultural heritage values and natural environments.

Centennial Parklands Master Plan 2040

The *Centennial Park Master Plan 2040* (BVN Donovan Hill, 2013) seeks to provide a blueprint for the Park for the next 25 years while enhancing its unique landscape character. It would sit under the *Centennial Parklands Conservation Management Plan*, and alongside the Queens Park, Moore Park and Moore Park South Master Plans. The purpose of the plan is to provide a long term vision to guide potential changes to the Park's physical environment. This includes management and preservation of the Park's natural and cultural values, management of an ageing tree population, responding to changing and diverse recreational visitor requirements and ensuring the Park can support increased visitor attendance. The plan also considers the need for financial sustainability and provides a strategic vision which sees Centennial Park become an international destination and world-leading park.

The proposal has considered the *Centennial Park Master Plan 2040* and would assist in improving access to the Park by the surrounding road network that would provide for future population growth and increased visitor attendance to the Park. The proposal has also considered the Master Plans strategic goal for the protection and enhancement of the Park's environment and minimised the impacts by incorporating the Park's natural and cultural value.

Green Square Master Plan

The *Green Square Master Plan* includes the Lachlan Precinct. Part of the initial planning work associated with the area identified as Lachlan Precinct includes a planning proposal for rezoning of the area to introduce mixed use and infrastructure zones. The rezoning planning proposal identifies the section of the proposal footprint located within the Green Square Urban Renewal Precinct (refer to **Figure 1-3**) as being safeguarded for development by Roads and Maritime for future road widening works within the area.

The proposal would make allowance for the future Eastern Transit Corridor (a dedicated new public transport corridor servicing Green Square).

Connecting our city

Connecting our city (City of Sydney, 2012) is a 25-year integrated transport and land use strategy endorsed by Sydney City Council which would help the council plan for central Sydney's future. *Connecting our city* recognises that the public transport services and major roads in the local area are already running close to

capacity, and at peak times, close to breaking point. It highlights that an integrated transport network needs to be put in place now to create a sustainable city and accommodate the high growth in residents, workers and visitors to the local area in the future.

One of the actions of *Connecting our city* is that the Sydney City Council would develop a comprehensive parking policy with the objective to minimise growth in private vehicle use. One of the key actions, would be to limit parking in areas with high access to public transport and service over time. The proposal area has good access to public transport including bus rail and soon to be CSELR, refer to **Section 2.2.1**.

Consultation with City of Sydney indicates that improving public transport in the area should be a key priority.

2.2 Existing infrastructure

Figure 2-1 shows the location of the proposal in the context of other significant arterial routes in and around the CBD.

The proposal runs along Euston Road, McEvoy Street, Lachlan Street and Davey Avenue connecting with major roads that lead north to the city centre and south to Mascot and the airport. At the eastern extent of the proposal, Dacey Avenue intersects with Anzac Parade and Alison Road which are major arterial roads that provide for vehicles travelling south-east to Sydney's eastern suburbs. The western extent of the proposal interfaces with the new M5 works at Maddox Street and Euston Road.

For the purposes of this REF the proposal is discussed in two segments:

- Euston Road/McEvoy Street corridor (Western Section)
- Bourke Street to the eastern end of Dacey Avenue (Eastern Section).

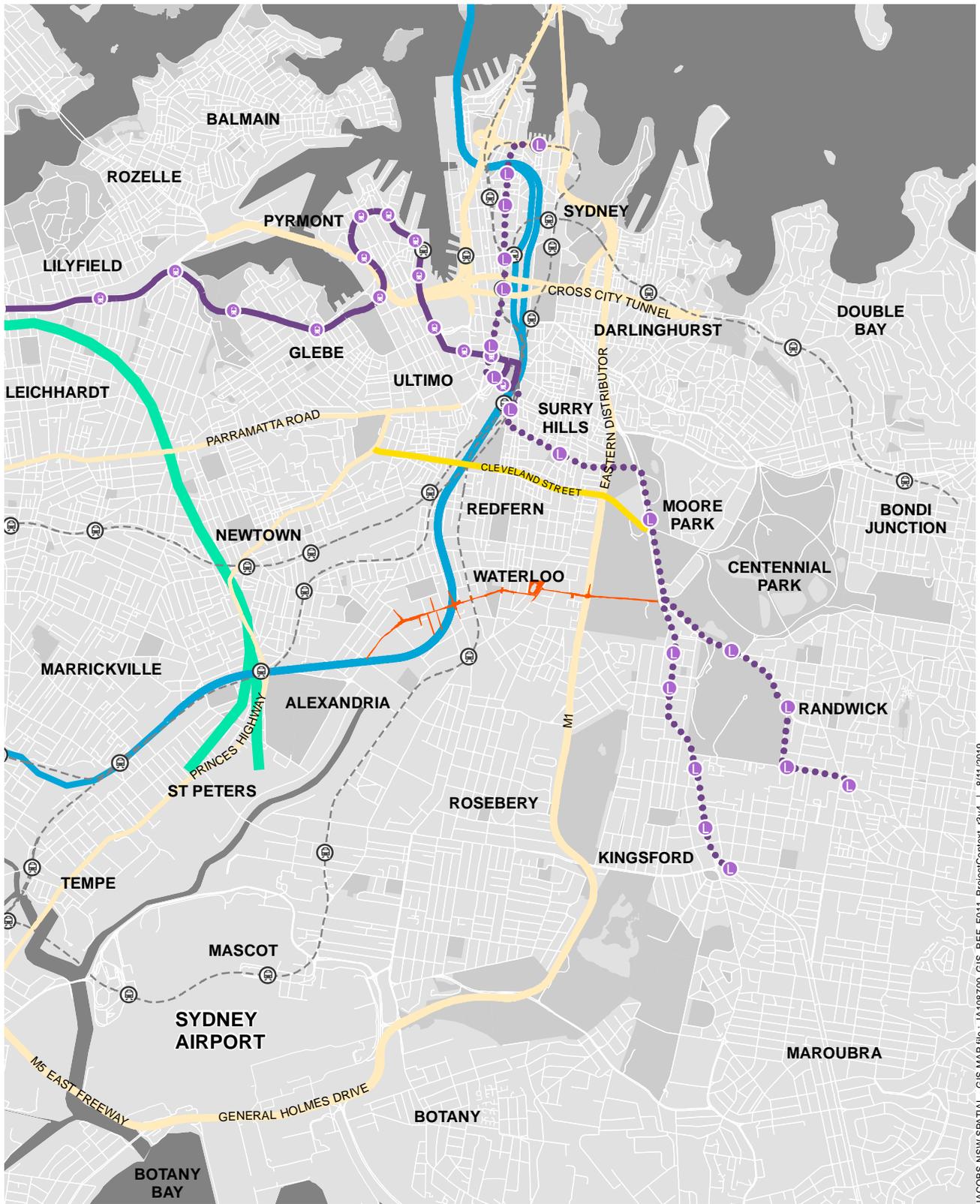
Western Section - Euston Road/McEvoy Street corridor

Around 260 metres of Euston Road east of the intersection with Maddox Street and the whole of McEvoy Street are located within the proposal.

Euston Road has two lanes in both directions. Parking is not permitted eastbound along Euston Road between 6:00am to 10:00am and is not permitted westbound between 3:00pm to 7:00pm. Euston Road has a 50 kilometre per hour speed limit and the road is undivided with kerb and guttering.

Pedestrian pathways are present along both sides of Euston Road. Signalised intersections allow for pedestrian crossings. No dedicated mid-block crossings are present within the section, and there are no dedicated cycle ways, share use provisions or cycle road markings.

McEvoy Street has two lanes in both directions between Euston Road and George Street. About 60 metres east of Pitt Street, the second lane in both directions ends and only one lane in each direction is provided along McEvoy Street to the Bourke Street/McEvoy Street intersection.



JACOBS NSW SPATIAL - GIS MAP file : IA108700_GIS_REF_F011_ProjectContext_L3v4 | 8/11/2019

Legend

- Proposal area
- Cleveland Street
- WestConnex indicative alignment
- Major road
- Parks and open space
- Existing heavy rail
- Proposed CBD Light Rail
- Existing light rail
- Sydney Metro



1:55,000 @ A4

Figure 2-1 | Project and transport context
Alexandria to Moore Park Stage 1

'No parking' restrictions are in place along McEvoy Street between Botany Road and Bourke Street for the kerbside lanes. Parking is not permitted eastbound along McEvoy Street between 6:00am to 10:00am and is not permitted westbound between 3:00pm to 7:00pm.

Pedestrian pathways are present along both sides of the McEvoy Street corridor. A small section of McEvoy Street (around 165 metres between Bowden Street and Harley Street) is a designated cycle route, however, there are no other dedicated cycle ways, share use provisions or road markings along McEvoy Street.

The intersections along Euston Road are described in Table B-1 and Table B-2 in **Appendix B**.

Eastern Section - Bourke Street/Lachlan Street/South Dowling Street

Bourke Street is a major north-south route for access into the CBD fringe suburb of Surry Hills and the CBD area and has two lanes in each direction. Vehicles passing east-west along the proposal go through the McEvoy Street/Bourke Street intersection and the Bourke Street/Lachlan Street intersections in quick succession. This area is a highly congested pinch point for traffic in the area.

Bourke Street has a 50 kilometre per hour speed limit with kerb and guttering, including sections of old sandstone blocks. The McEvoy Street/Bourke Street intersection and the Bourke Street/Lachlan Street intersection are signalised intersections described in Table B-3 in **Appendix B**. Shared pathways are present along both sides of the Bourke Street between McEvoy Street and Powell Street and along the eastern side of Bourke Street between McEvoy Street and Lachlan Street. There is an on-road cycle route along Bourke Street to the north of the Bourke Street/Lachlan Street intersection extending to the intersection of Phillip Street.

From Bourke Street, Lachlan Street extends about 440 metres to the Lachlan Street/South Dowling Street/Dacey Avenue intersection.

The western extent of Lachlan Street has one eastbound lane and two westbound lanes that extend from Gadigal Avenue to Bourke Street. East of Gadigal Avenue there are two lanes eastbound and a short section of two lanes westbound prior to a merge back to one lane. No parking is available at any time along Lachlan Street, South Dowling Street and Dacey Avenue, with 'no stopping' zones (at all times) in place along these roads.

Lachlan Street has a 50 kilometre per hour speed limit and is undivided although a painted island is located to the west of Gadigal Avenue. Kerb and guttering is present including sections of old sandstone blocks.

There are four intersections along the Lachlan Street corridor, and these are described in detail in Table B-3 in **Appendix B**.

Access to Lachlan Street from Sam Sing Street, Gadigal Avenue and Amelia Street (all local roads) is difficult in peak periods due to east-west queuing along Lachlan Street from the Bourke Street and South Dowling Street Intersections.

Pedestrian pathways are present along both sides of Lachlan Street and there are no dedicated cycle ways, share use provisions or cycle road markings.

South Dowling Street is a major north-south route which runs parallel to the M1 Eastern Distributor for much of its length. South Dowling Street is a classified arterial road, predominantly comprised of four-lanes (two in each direction), with additional turning bays for intersections as required. The road has a posted speed limit of 60 kilometres per hour and kerb and guttering.

South Dowling Street also provides access to and from the M1 Eastern Distributor. The M1 Eastern Distributor is located underneath South Dowling Street in the vicinity of the proposal and is a major arterial network road, providing the connection between the Sydney CBD and the airport. In addition, it is a key bypass route for vehicles travelling north-south across Sydney to avoid the inner city local roads.

The access off the M1 Eastern Distributor onto South Dowling Street for southbound traffic is located just to the north of the South Dowling Street, Lachlan Street and Dacey Avenue intersection. In this location, South Dowling Street currently has two lanes north of the M1 Eastern Distributor exit ramp. These lanes merge into one lane prior to the addition of the exit from the M1 Eastern Distributor.

The M1 Eastern Distributor and exit ramp onto South Dowling Street has a posted speed limit of 80 kilometres per hour. The two lanes are separated by a painted median. The speed limit is different on each side of this painted median for about 200 metres before the speed in the right lane is reduced to 60 kilometres per hour.

Pedestrian pathways are present along both sides of the section of South Dowling Street that is located within the proposal. Signalised pedestrian crossings are located on all four legs of the South Dowling Street/McEvoy Street/Dacey Avenue intersection. Pedestrian crossings are also located across the left turning lanes of Dacey Avenue and the northern leg of South Dowling Street. There is a shared pedestrian cycle path on the north-eastern leg of South Dowling Street on the western side of Moore Park. The South Dowling Street/Lachlan Street/Dacey Avenue intersection is shown in **Photo 2-1** to **Photo 2-4**.



Photo 2-1 Looking north along the northbound lanes of the southern leg of South Dowling Street, Lachlan Street to the west.



Photo 2-2 Looking east towards Dacey Avenue and the southbound lanes of the northern leg of South Dowling Street.



Photo 2-3 Looking south along South Dowling Street and the left turning lane into Dacey Avenue along Moore Park.



Photo 2-4 Looking to the north across Dacey Avenue to the southbound lanes of South Dowling Street and the south-west corner of Moore Park.

Dacey Avenue is located wholly within the proposal and services the suburb of Alexandria and provides east west access between the M1 Eastern Distributor, Anzac Parade and Alison Road. Dacey Avenue is

bordered by the Moore Park Golf Course (north and south), E.S Marks Athletics Field (south) and the Supa Centa (south). Dacey Avenue is around 650 metres long and is comprised of two lanes in both directions. Parking is not permitted along Dacey Avenue.

Dacey Avenue has a 50 kilometre per hour speed limit and is generally undivided except near the major intersections at either end of the road extent where there are raised traffic islands separating eastbound and westbound traffic. Dacey Avenue has kerb and guttering present including sections of old sandstone blocks.

A detailed description of the three intersections located along Dacey Avenue are included in Table B-4 in **Appendix B**.

Pedestrian footpaths are present along both sides of Dacey Avenue. On the north side of the road the footpath is separated from the road by vegetation for about half of the route. No dedicated mid-block crossings are present within the section. There are no dedicated cycle ways, share use provisions or cycle road markings along this section of Dacey Avenue. There is however a cycle path on the northern side of Dacey Avenue behind the fig trees. Around 470 metres from South Dowling Street there is a golf buggy bridge that connects both sections of the golf course.

2.2.1 Existing public transport infrastructure

Bus transport

Twelve public bus transport routes are located along and within the proposal area. Three cross the corridor at Elizabeth Street, five cross at Bourke Street and two cross at Botany Road. There are no bus routes that travel along the full extent of the proposal area between Alexandria and Moore Park. Sections of Euston Road/McEvoy Street are used by a small number of bus routes (eg 305 and 370). The existing public transport infrastructure is shown in **Photo 2-5** to **Photo 2-10**.

Eleven bus stops are located along the Euston Road/McEvoy Street corridor, refer to **Figure 2-2**.

Five bus stops are located on the adjoining streets at the intersections along the corridor including at the western side of Fountain Street, the north-east and south-west sides of Botany Road, the north-east side of Elizabeth Street and the south-east side of Hunter Street. School buses may also use the route at school start and end times.

Lachlan Street and South Dowling Street are not identified as primary or secondary bus routes and there are no bus routes along these streets.

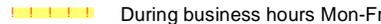
Bourke Street is a secondary bus route supporting five bus routes (301, 302, 303, 304 and M20), each servicing the Eastgardens and Mascot region. A bus stop is located immediately to the south of the McEvoy Street/Bourke Street/South Dowling Street intersection on Bourke Street, and two bus shelters are present on the eastbound and westbound sides of McEvoy Street to the west of its intersection with Bourke Street. A bus shelter is also present on the westbound approach to the Lachlan Street/Bourke Street intersection. Some school buses may use Lachlan Street, Bourke Street and South Dowling Streets.

Two bus stops are located on each side of Dacey Avenue just to the west of the Anzac Parade/Alison Road/Dacey Avenue intersection (refer to **Figure 2-2**).



JACOBS NSW SPATIAL - GIS MAP file : I:\108700_GIS_PA_FOOT_ExistingParking_rv10 | 21/11/2019

- | | | | | |
|--|---------------------|--|--|--|
|  2 | No. of parking bays |  1/2P |  2P |  Disabled |
|  1P | |  No restriction |  Bus zone |  Mail zone |

- Specific no parking restrictions
- | | |
|--|--|
|  6am-10am Mon-Fri |  During business hours Mon-Fri |
|  3pm-7pm Mon-Fri |  Authorised car share vehicles excepted |

- | |
|---|
|  3pm-7pm Mon-Fri & 1/2P 8:30am-3pm Mon-Fri |
|  6am-10am & 3pm-7pm Mon-Fri & 1/2P 10am-3pm Mon-Fri & 8:30am-12:30pm Sat |

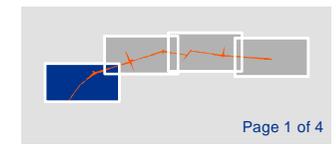
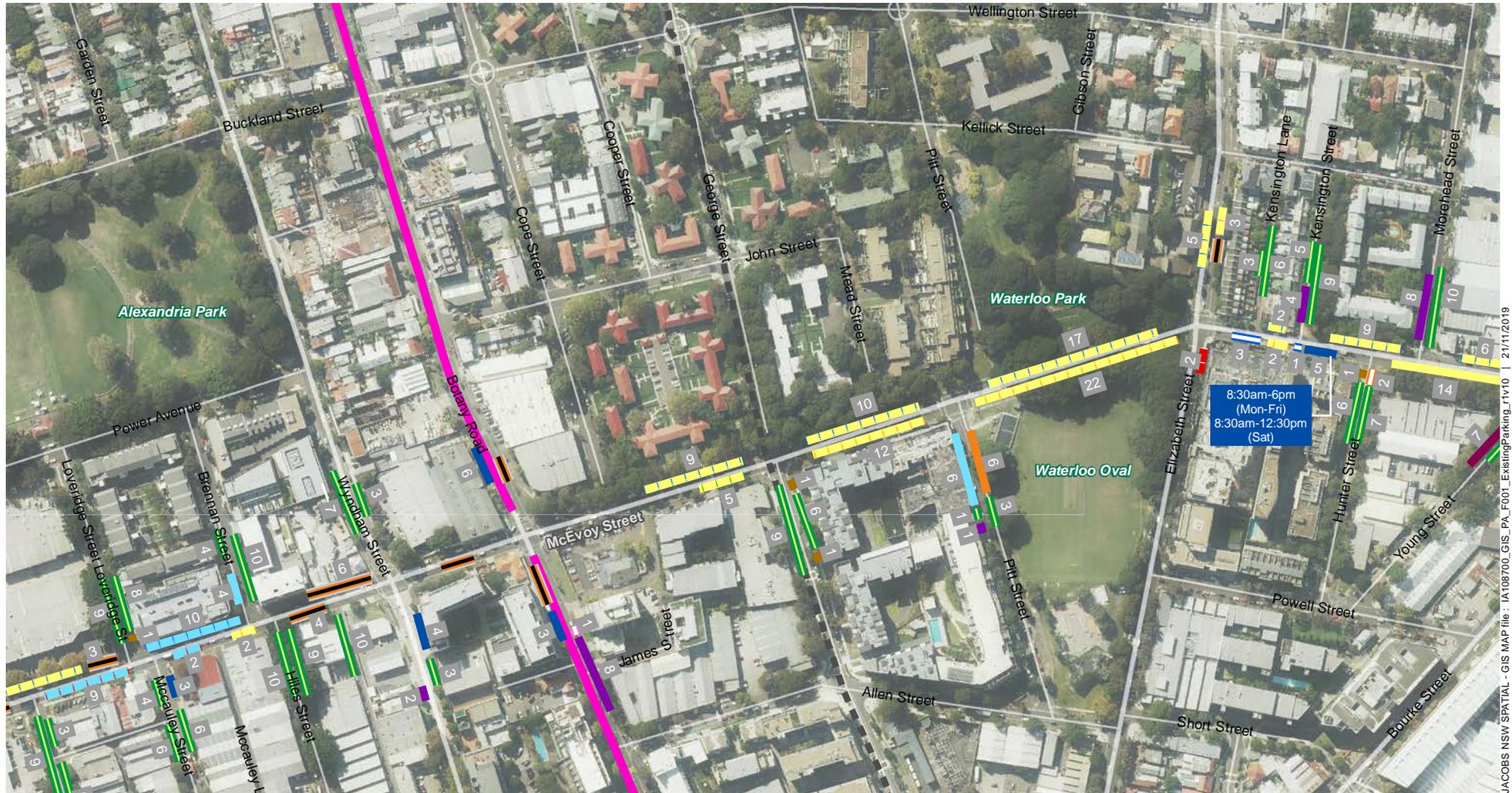


Figure 2-2a | Existing parking conditions
Alexandria to Moore Park Stage 1



JACOBS NSW SPATIAL - GIS MAP file: IA108700_GIS_PA_FOOT_ExistingParking_r1v10 | 21/11/2019

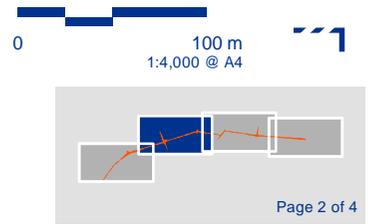
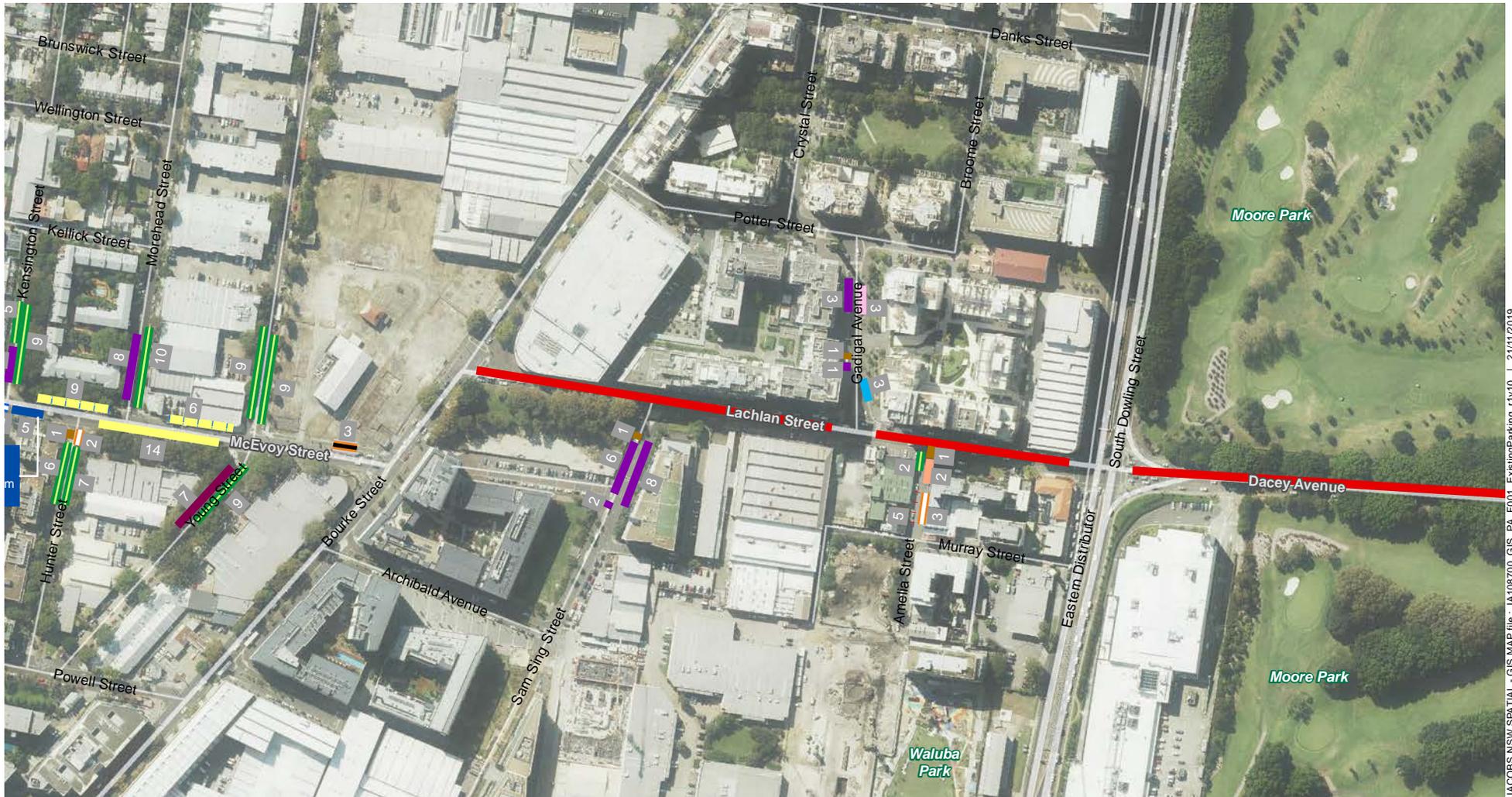


Figure 2-2b | Existing parking conditions
Alexandria to Moore Park Stage 1



JACOBS NSW SPATIAL - GIS MAP file: IA108700_GIS_PA_FOOT_ExistingParking_r1v10 | 21/11/2019

- | | | | | |
|----------------------------------|---------------------|--|---|----------------------------|
| 2 | No. of parking bays | 2P (8am -10pm Mon-Sun) | No Stopping (8:30am-6:30pm Mon-Fri) | 2P & 4P |
| 1P | | 2P (8am-10pm) | Work zone (7:30am-5:30pm Mon-Fri & 7:30am-3:30pm Sat) | Bus zone |
| No restriction | | No Stopping(7:30am-5:30pm Mon-Fri & 7:30am-3:30pm Sat) | 2P | Disabled |
| 1/2P & 4P | | Authorised car share vehicles excepted | | No stopping (at all times) |
| Specific no parking restrictions | | | | |
| 6am-10am Mon-Fri | | | | |

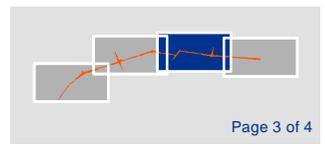


Figure 2-2c | Existing parking conditions
Alexandria to Moore Park Stage 1



JACOBS NSW SPATIAL - GIS MAP file : IA108700_GIS_PA_FOOT_ExistingParking_r1v10 | 21/11/2019

- 2 No. of parking bays
- 2P
- No stopping (at all times)
- Bus zone
- No restriction

Specific no parking restrictions

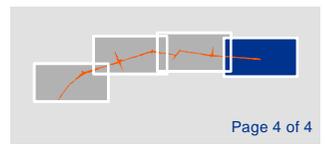


Figure 2-2d | Existing parking conditions
Alexandria to Moore Park Stage 1



Photo 2-5 Looking east along the westbound lanes of Euston Road and bus stop located just to the east of Maddox Road.



Photo 2-6 Looking east along the westbound lanes of McEvoy Street and bus stop located just to the east of Hiles Street (Source: Google Earth Pro).



Photo 2-7 Looking east along the westbound lanes of McEvoy Street and bus stop located just to the west of Botany Road.



Photo 2-8 Looking east along the westbound lanes of McEvoy Street and bus stop located just to the west of Bourke Street.



Photo 2-9 Looking north towards the bus stop located on the northern side of McEvoy Street near the Bourke Street intersection.



Photo 2-10 Looking north across Dacey Avenue at the bus stop located next to the eastbound lanes of Dacey Avenue to the west of the Anzac Parade (Source: Google Earth Pro).

Development of light rail

In mid-2014 the NSW Government approved the development of the 12 kilometre long CSELR project. This project would provide light rail access between the city centre and the city's southern and eastern suburbs. The route features 19 stops, extending from Circular Quay along George Street to Central Station, through Surry Hills to Moore Park then diverges into two branch lines before terminating at Randwick and Kingsford. The Randwick branch line continues along the eastern side of Alison Road and the Kingsford branch line runs to the east of Anzac Parade and crosses the Anzac Parade/Alison Road/Dacey Avenue intersection prior to transferring to the middle of road about 100 metres farther south.

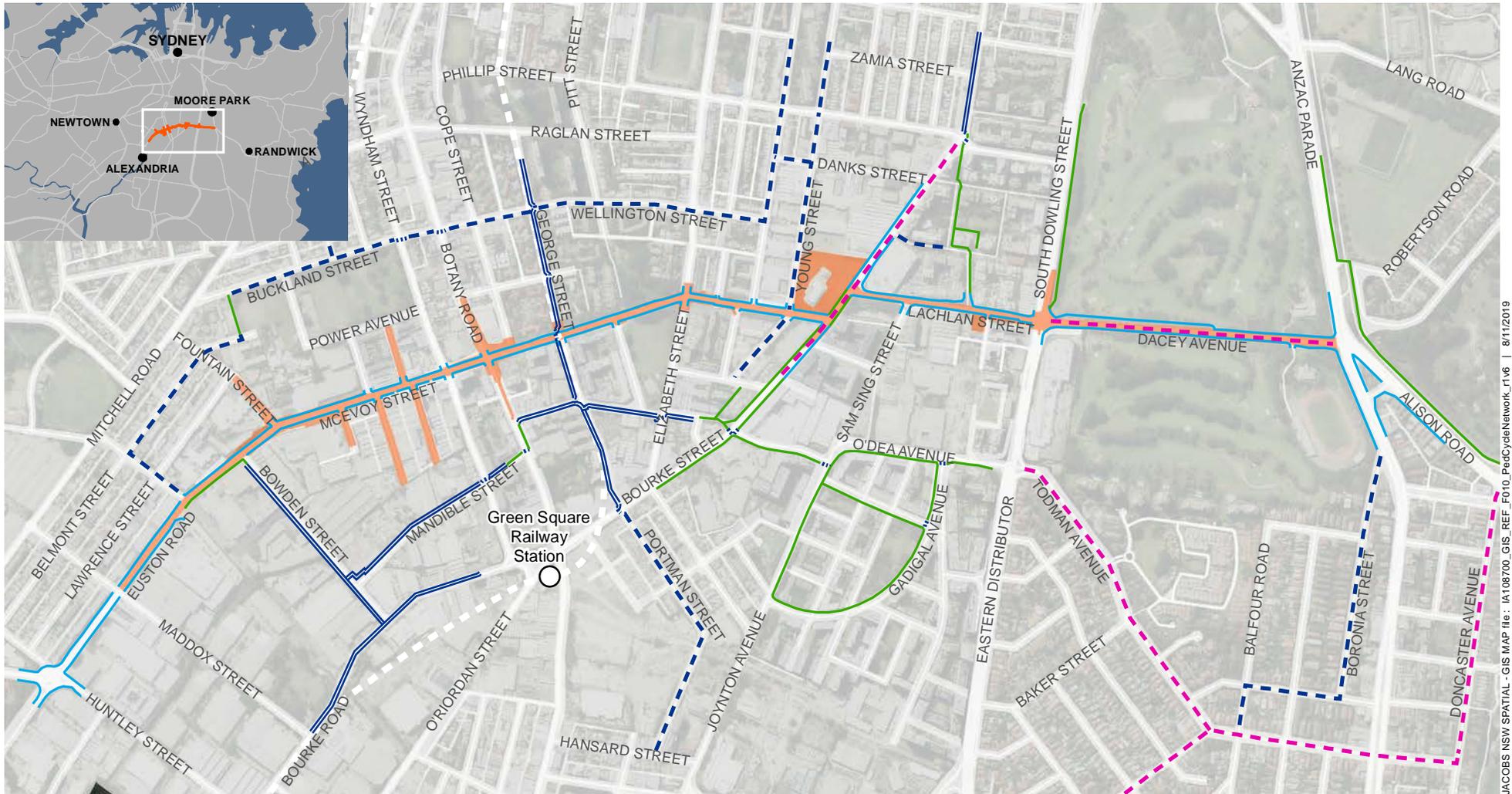
The CSELR would operate four minutes in each direction between Circular Quay and Robertson Road and every eight minutes in each direction from Robertson Road respectively to Randwick and Kingsford. The CSELR has the capacity to carry up to 13,500 passengers per hour, 6750 in each direction (Transport for New South Wales (Roads and Maritime), 2016).

Pedestrians and cyclists

Pedestrian pathways are present along both sides of all the roads located within the proposal area (refer to **Figure 2-3** and **Photo 2-11 to Photo 2-22**). The roads in the proposal are heavily trafficked with narrow footpaths in some locations. The pedestrian footpaths located on the north side of the Dacey Avenue and along the southbound lanes of South Dowling Street within the Moore Park boundary are separated in sections from the road by landscaped vegetation. Along the proposal, signalised intersections allow for pedestrian crossings; however, no dedicated mid-block crossings are present.

There is a pedestrian and cycle path on the eastern side of South Dowling Street. This path is separated from the road by landscaped vegetation and grade variations. A pedestrian crossing is provided across the left (east) turning lane for southbound traffic at the South Dowling Street/Dacey Avenue intersection. A pedestrian footpath is located on the western side of South Dowling Street. There are two pedestrian bridges crossing South Dowling Street into Moore Park to the north of the proposal that provide access for pedestrians, cyclists and golfers with golf buggies. One is located about 500 metres to the north of the Lachlan Street/South Dowling Street/Dacey Avenue intersection between Crescent Street and Maddison Street, and the other is located about 780 metres to the north of the Lachlan Street/South Dowling Street/Dacey Avenue intersection between Maddison Street and Cleveland Street.

A number of cycle routes including dedicated cycleways, shared pedestrian/cycleways, on road cycle routes with low to medium traffic and on road cycle routes with heavy traffic run parallel to or cross the proposal, refer to **Figure 2-3**.



JACOBS NSW SPATIAL - GIS MAP file: IA108700_GIS_REF_F010_PedCycleNetwork_r1v6 | 8/11/2019

Legend

- | | | | | | |
|---|---------------|---|--|--|--------------------------------------|
|  | Proposal area |  | Existing bicycle and pedestrian network |  | Existing shared path |
|  | Road |  | Cycle routes on dedicated cycleways |  | Existing footpath |
|  | Railway line |  | On-road cycle route with low to medium traffic |  | Existing cyclist pedestrian crossing |
| | |  | On-road cycle route with heavy traffic | | |



Figure 2-3 | Pedestrian and cycle networks near the proposal
Alexandria to Moore Park Stage 1



Photo 2-11 Looking north-east along the pedestrian pathway located next to the westbound lanes of Euston Road north of the Maddox Road intersection.



Photo 2-12 Looking north-east along the westbound lanes of Euston Road and showing one of the fig trees located between the roadway and the footpath.



Photo 2-13 Looking north-east across pedestrian crossing facilities located at the Euston Road and Bunnings Access Road intersection.



Photo 2-14 Looking easterly along the westbound lanes of McEvoy Street near the Fountain Street intersection showing the pedestrian pathway and green corridor in this location.



Photo 2-15 Looking south across the McEvoy Street and George Street intersection showing the paved pedestrian pathways on the northern leg of George Street.



Photo 2-16 Looking north-east along the pedestrian pathway in Waterloo Park located next to the eastbound lanes of McEvoy Street to the south of Elizabeth Street.



Photo 2-17 Looking east across the McEvoy Street and Bourke Street intersection showing the paved pedestrian facilities on the southern side of the roadways.



Photo 2-18 Looking north along the pedestrian pathway located next to the southbound lanes of Bourke Street.



Photo 2-19 Looking west across the westbound lanes of Lachlan Street towards Sam Sing Street and showing the sandstone kerbing located on the edge of the pedestrian pathway.



Photo 2-20 Looking north along the pedestrian pathway located next to the southbound lanes of South Dowling Street.



Photo 2-21 Looking east along Dacey Avenue towards the pedestrian overpass showing the narrow pedestrian footpaths located along both sides of the road.



Photo 2-22 Pedestrian overpass over Dacey Avenue linking the north and south sides of the Moore Park Golf Course.

2.2.2 Parking

Parking surveys were carried out as part of the *Alexandria to Moore Park - Parking Assessment* (Jacobs, 2019a), refer to **Appendix C**. The surveys were completed over a two-day period which included one weekday (Thursday 24 August 2017) and one day of the weekend (Saturday 26 August 2017). A parking audit of the existing parking conditions was completed by Jacobs on the 21 August 2019 to review existing parking conditions and identify any changes in existing conditions. The parking survey identified a total of 653 existing on-street parking spaces distributed as follows:

- Zone 1 – Euston Road, McEvoy Street, Lachlan Street - 252 spaces
- Zone 2 – Anzac Parade and Tay Street - 11 spaces
- Zone 3 – Boronia Street -16 spaces
- Zone 4 – Side streets off Euston Road, McEvoy Street, Lachlan Street - 373 spaces.

A variety of parking restrictions along the proposal and side streets intersect the proposal, including:

- Time restricted parking (1/2 hour, 1 hour, 2 hour, 4 hour)
- No parking - In general, there are morning peak No Parking restrictions on the northern side of Euston Road and McEvoy Street between 6:00am and 10:00am and afternoon peak No Parking restrictions on the southern side of the Euston Road and McEvoy Street between 3:00pm and 7:00pm
- No stopping
- Loading zones
- Bus zones
- Disabled parking
- Mail zone
- Work zones
- Areas of no restrictions.

The various types of parking and number of parking spaces currently available during the week and on weekends are shown in **Figure 2-2** and summarised in the parking assessment (Jacobs, 2019a) provided as **Appendix C**. Further discussion on parking is included in **Section 6.1.3**.

2.2.3 Drainage

Existing arterial drainage generally crosses the proposal grading south-westerly towards Alexandra Canal or Kensington with some localised high points in between. Existing secondary drainage lines are present along some sections of the proposal which convey collected roadway runoff towards the southbound arterial drainage carriers.

2.2.4 Property access

Over 60 properties have direct access to Euston Road and McEvoy Street. Most of the properties are commercial/light industrial warehouses and retail. Increasingly residential developments are occurring along the street but generally these are accessed from side streets. A number of commercial properties generate material traffic flows, including: Bunnings Warehouse, Petbarn and Dan Murphys. Other facilities that affect traffic flow through entries / exits include McDonalds, Nandos, IGA, and Anytime Fitness.

Around 12 properties have direct access to Lachlan Street. Most of the properties are residential or commercial in nature.

The Moore Park Golf Course is located on the northern and southern sides of Dacey Avenue, with access to the maintenance depot for the course being from the eastbound lane of Dacey Avenue near to the Anzac Parade/Alison Road/Dacey Avenue intersection. Two access roads connect from the westbound lane of Dacey Avenue, one near the east providing access to E.S Marks Athletics Field and the KU Centennial Parklands Childcare Centre, and one near the west, providing access into the Supa Centa.

2.3 Proposal objectives and development criteria

2.3.1 Proposal objectives and development criteria

The proposal objectives align with the strategic objectives articulated in *Greater Sydney Regional Plan* and the *Future Transport Strategy 2056*. The primary objectives of the proposal are to:

- Improve intersection performance, safety and trip reliability within the Alexandria to Moore Park corridor
- Provide value for money
- Minimise the social and environmental impact of the development
- Maintain existing flood immunity.

2.3.2 Urban design objectives

The *Future Transport Strategy 2056* (Transport for NSW, 2017) provides the framework for road planning to meet the needs of a growing population and the need to move increasing levels of people and goods.

In mid-2017 Sydney Planning commenced the preparation of road network plans. This new planning approach focuses on a multi-modal view of the road network.

The framework recognises that roads serve two primary roles:

- Movement of people and goods
- Places for people.

For this proposal, the Alexandria to Moore Park corridor principally provides for the movement of general traffic, freight and buses in an east-west direction. It also has place characteristics, with a combination of commercial, recreational and residential developments generating pedestrian and cyclist activity.

The vision is for an integrated transport corridor that promotes place making opportunities, urban streetscape amenity and pedestrian and cyclist connectivity but still manages traffic demand without excessive delays. To achieve this vision, the following urban design objectives apply:

- To be consistent with the movement and place framework, provide an integrated engineering and urban design outcome that fits sensitively into the built, and community environment, and is consistent with the streetscape typology and the cultural and heritage values of the surroundings
- Contribute to the accessibility, connectivity and wayfinding of people within the local communities
- Contribute to the quality of the public domain
- Identify opportunities to strengthen the open space links between parklands
- Apply 'green infrastructure' principles
- Ensure that all elements are robust, durable and low maintenance.

2.4 Alternatives and options considered

2.4.1 Identified route options

Along with Cleveland Street, the Alexandria to Moore Park corridor is one of the main connecting routes for the inner west suburbs to the eastern suburbs. Investigations into the two route options are described below. Stage 1 of the project (the proposal) evolved from the following considerations of the broader road network.

Route Option 1 – improving Cleveland Street

Early consideration by Roads and Maritime on Route Option 1, showed that property required to further develop Cleveland Street as a movement corridor would be impractical at this time. As a result, Route Option 1 was discounted from further consideration.

Route Option 2 – Alexandria to Moore Park

Route Option 2 was identified based on the need for an improved east-west corridor to service growth. To assist with understanding this issue, a multimodal traffic model was developed to consider and identify how the city's roads would perform over the coming years.

The intersections identified for further consideration included:

- Anzac Parade/Alison Road/Dacey Avenue intersection - this intersection was selected as it is already operating beyond capacity in both the morning and afternoon peak periods
- Lachlan Street/South Dowling Street/Dacey Avenue intersection and the McEvoy Street/Bourke Street and the Bourke Street/Lachlan Street intersections. The growth in population from the Lachlan Precinct would have substantial impacts on the function of these intersections and these intersections were selected based on their inability to meet future demands.

Roads and Maritime then carried out a corridor assessment which identified that there was scope for improvements at priority intersections and Route Option 2 was selected for further investigation and assessment.

2.4.2 Design development 2016 to 2018

Identified proposal options

With Route Option 2 chosen as the preferred route for intersection improvements, two options were identified for further assessment. Both options assumed that the CSELR, motorway interchange at St Peters and the Green Square projects would be in place by 2021. The two proposal options included:

- Option A – Do minimum option. Do minimum option: This option assumes no further upgrades along the corridor. Normal road maintenance would continue to be carried out
- Option B – Upgrade the Alexandria to Moore Park proposal corridor. This would generally provide four traffic lanes (two in each direction) along the corridor from Maddox Street to Anzac Parade. This would be achieved through the use of clearways in existing four lane sections and the addition of turning lanes at priority intersections. To assist with traffic flow, additional right turn bans would also be put into place at most minor street intersections and to further improve safety, a 50 kilometre per hour limit would be introduced west of south Dowling Street.

Analysis of options

Each option was reviewed against the proposal objectives outlined in **Section 2.3**.

Option A: Do minimum option

When considering the do minimum option against the primary proposal objectives, it was found that this option:

- Would not improve intersection performance, safety and trip reliability within the Alexandria to Moore Park corridor. Intersection delays would increase noticeably as population grows and major projects begin operation.

As the do nothing option did not fulfil any of the primary proposal objectives there was no further analysis of how the proposal performed against the secondary proposal objectives.

Option B: Upgrade the main intersections along the Alexandria to Moore Park proposal corridor

When considering Option B against the primary proposal objectives, it was found that this option would:

- Improve intersection performance, safety and trip reliability within the Alexandria to Moore Park corridor
- Provide value for money
- Minimise the social and environmental impact of the development
- Maintain existing flood immunity.

As it best meets the majority of the proposal objectives and the overall strategic need identified in **Section 2.1**, Option B was selected as the preferred proposal option.

Preferred option for preliminary concept design display

The preferred option for the concept design display was confirmed following the options development and assessment process. It is shown in the community update issued in June 2017, refer to **Appendix D**.

The preferred option displayed consisted of intersection improvements at:

- Anzac Parade and Alison Road
- South Dowling Street and Dacey Avenue
- Gadigal Avenue and Lachlan Street
- Bourke Street and McEvoy Street / Lachlan Street
- Elizabeth Street and McEvoy Street
- Botany Road and McEvoy Street
- Wyndham Street and McEvoy Street
- Euston Road and Fountain Street.

It also included improved active transport facilities along the length of the corridor and a new road pavement.

Design refinements

In response to feedback received from the display of the concept design in June 2017 (summarised in **Section 5.2**) a series of design refinements were made to the concept design. These refinements were primarily associated with reducing property impacts and business impacts caused by changes in availability of parking. The refinements included:

- Removal of some of the proposed medians along McEvoy Street between Harley Street and Hiles Street in order to reduce property acquisition (part of the ultimate concept design)
- Reduction in Clearway operating hours along Euston Road and McEvoy Street
- Removal of right hand turn into Bowden Street from the eastbound lane of McEvoy Street in order to reduce property acquisition (part of the ultimate concept design)
- Amendments to the Wyndham Street and Botany Road intersection configuration to reduce property impact (part of the ultimate concept design)
- Redesign of improved active transport facilities to reduce impacts on existing street trees including near Waterloo Park (part of the ultimate concept design)
- Redesign of shared pathway to reduce impacts on existing street trees including along Dacey Avenue along Moore Park (part of the ultimate concept design)
- Removal of a left turning lane from the eastbound lanes of McEvoy Street into Elizabeth Street to avoid impacts to Waterloo Park
- Banning of east west right turns at South Dowling Street, Lachlan Street and Dacey Avenue in order to reduce property acquisition
- Reduction in lane widths at Anzac Parade and Alison Road in order to reduce impacts on Moore Park (part of the ultimate concept design)
- A staged approach to delivery of improvements at the South Dowling Street intersection to avoid impacting fig trees early in construction (part of the ultimate concept design)
- Change to the length of shared path along the proposal to match the latest cycle plans for the area (part of the ultimate concept design).

2.4.3 Design development 2019

More detailed planning has been undertaken on the urban renewal precincts, and the broader integrated transport strategy for the Alexandria to Moore Park area.

In response to ongoing consultation and community feedback (refer to **Section 5.2**) the ultimate project concept design was reviewed to allow a staged approach and includes:

- Stage 1 which is the subject of this REF (refer to **Section 1.1** and **Figure 1-2**). Stage 1 would improve traffic performance along the Euston Road, McEvoy Street, Lachlan Street and Dacey Avenue corridor and can be implemented early with minimal property acquisitions
- Further stages may include the improved features previously presented in the July 2017 Project Update (refer to **Appendix D**) however this would depend upon future assessments.

3. Description of the proposal

This chapter describes the proposal including major design features and the construction method.

3.1 The proposal

Roads and Maritime propose to implement some minor upgrades at four intersections and clearways between the Euston Road/Maddox Street intersection in Alexandria and Lachlan Street/South Dowling Street/Dacey Avenue intersection in Moore Park as part of the proposal. The proposal is shown in **Figure 1-2** and illustrated in greater detail on the design drawings in **Appendix A**.

The proposal consists of:

- New clearways on both sides of Euston Road and McEvoy Street between Maddox Street and Bourke Street from 6:00am to 7:00pm Monday to Friday and 9:00am to 6:00pm on weekends
- New clearways at all times along Lachlan Street and Dacey Avenue between Bourke Street and Anzac Parade
- Right turn bans at most intersections without traffic signals and a right turn ban into Bunnings from McEvoy Street
- Improving the intersections and road re-surfacing at:
 - Fountain Street and McEvoy Street
 - Botany Road and McEvoy Street
 - Elizabeth Street and McEvoy Street
 - South Dowling Street, Lachlan Street and Dacey Avenue
- Kerb adjustments at:
 - Stokes Avenue and McEvoy Street
 - Kensington Lane and McEvoy Street
- Landscaping adjustments and replacement tree planting where works are undertaken
- Relocation of utilities and adjustments to traffic signals and street lights
- Property acquisitions, leases and adjustments
- Temporary construction facilities, including site compounds and stockpile sites at:
 - The car park on the south-west corner of the Stokes Avenue/McEvoy Street intersection, Alexandria (Site 1)
 - Road reserve at the southern end of Cope Street, Alexandria (Site 2)
 - Road reserve at the southern end of George Street, Alexandria (Site 3)
 - Vacant land (Lot 2 DP800705) at the corner of the Bourke Street/McEvoy Street intersection, Waterloo (Site 4)
 - Lot 1, 2 and 3 DP 76985, Lot 4 DP 86722 and Lot 14 DP80926 on the west corner of the Lachlan Street/Amelia Street intersection, Waterloo (Site 5).

An overview of the proposal is provided in **Figure 1-2** and detailed layout plans are included in **Appendix A**.

3.2 Design

The concept design was prepared to meet the proposal objectives. The concept design is described in the following sections. Concept design plans are included in **Appendix A**. The proposed concept design would be developed in more detail during the detailed design stage.

3.2.1 Design criteria

The proposal was designed in accordance with a *Design Management System certified under AS/NZS ISO 9001:2008 Quality Management Systems – Requirements*. Other design guides and policies considered during the development of the proposal included but were not limited to:

- *Austrroads Guide to Road Design* (Austrroads, 2009) and Roads and Maritime supplements to the Austrroads Guide
- Roads and Maritime's *Road Design Guide* (Roads and Maritime, undated)
- Roads and Maritime's *Delineation Guidelines* (Roads and Maritime, undated).

The following considerations have informed the concept design:

- The proposal objectives, as detailed in **Section 2.3**
- The urban and landscape design principles, as detailed in the *Alexandria to Moore Park Project Urban Design & Landscape Strategy and Visual Impact Assessment* (Context Landscape design (Context), 2019) (refer to **Appendix E**)
- Minimising adverse environmental impacts
- Planning temporary arrangements that minimise disruption to local and through traffic
- Maintaining access to nearby properties during construction
- Minimising land acquisition.

The road design criteria for the proposal is summarised in **Table 3-1** and drainage design criteria is included in **Table 3-2**.

Table 3-1 Proposal design criteria

Key element	Description
Design speed	The design speed varies throughout the proposal as follows: <ul style="list-style-type: none"> • Horizontal and vertical design speed of 60 kilometres per hour between Euston Road and Dacey Avenue • Posted speed limit of 50 kilometres per hour
Road width	Euston Street to Lachlan Street would generally be comprised of 3.2 metre through lanes and 3.0 metre turning lanes. Left turn bays would be provided at signalised intersections as required.
Design vehicle	Along the major roads the design vehicle is generally based on a 19 metre prime mover and semi-trailer and 5.2 metre passenger car.
Grade	Minimum vertical grade 0.5% for the majority of the proposal alignment, while matching as closely as possible to the existing pavement levels and the ultimate project concept design corridor levels.
Pavement type	The general design approach in areas of widening is to provide Full Depth Asphalt (FDA) in areas where there is existing flexible pavement, and provide thick asphalt over Heavily Bound Material (HBM) in areas where there is existing concrete pavement. This would allow the new pavement to match the existing configuration across the width of the road, allowing for a consistent maintenance strategy.

Key element	Description
	Consistent with the road design, the existing flexible/rigid pavement levels are to be matched as closely as possible where no widening is proposed, with the construction of varying thickness overlaying asphalt to address finished surface design levels.
Tie ins	The proposal ties in to the existing road surfaces along all roadways intercepted by the proposal.
Stopping sight distance	Stopping sight distance along Euston Road through to Lachlan Street and all local roads within the proposal is 65 metres, this allows for a reaction time of 1.5 seconds at 60 kilometres per hour design speed.
Shoulder width	No shoulders are proposed.
Drainage	Kerb and guttering along the length of the proposal.
Utilities	Relocations or protection of utilities such as gas, sewer, water, electricity and telecommunications has been designed in consultation with relevant authorities.
Property adjustments, demolitions and acquisition	<p>Three privately owned lots and six publicly owned lots. Land owned by Roads and Maritime would also be required for road widening and walkway adjustments. Privately owned lots required for the proposal comprise residential and commercial uses. These would mainly be affected by partial acquisition for landscape and walkway adjustments.</p> <p>Two public lots would be fully affected by the proposal. These lots are located at the frontage of commercial properties at 147-161 McEvoy Street and would be required for the establishment of a walkway and landscaping adjustments.</p> <p>Seven lots identified as road reserve would be required for proposal. These would mainly be affected by local road widening and walkway and landscaping adjustments.</p> <p>Further detail on property acquisitions is included in Section 3.6.</p>
Ancillary sites	<p>Five sites are proposed including:</p> <ul style="list-style-type: none"> • Site 1: The car park on the south-west corner of the Stokes Avenue/McEvoy Street intersection, Alexandria • Site 2: Road reserve at the southern end of Cope Street, Alexandria • Site 3: Road reserve at the southern end of George Street, Alexandria • Site 4: Vacant land (Lot 2 DP800705) at the corner the Bourke Street/McEvoy Street intersection, Waterloo • Site 5: Lot 1, 2 and 3 DP 76985, Lot 4 DP 86722 and Lot 14 DP80926 Lot 2 DP1054399 and road reserve on the west corner of the Lachlan Street/Amelia Street intersection, Waterloo.
Bus facilities	Minor location adjustment to the bus stop on McEvoy Street heading west near Botany Road.

3.2.2 Proposal constraints

The design and construction of the proposal needs to consider a number of issues and constraints. The main issues and constraints include:

- Physical constraints:
 - Several buildings are located close to the road reserve boundary, along the proposal, which are not proposed for acquisition/demolition
 - The areas next to Euston Road, McEvoy Street and Lachlan Street are heavily constrained by high density residential developments, which have been recently built
 - Limited land available for design options and construction
- Design:
 - The proposal area is located on land identified for redevelopment under the Green Square Master Plan as part of the Lachlan Precinct
 - Lane widening requirements for a 19.0 metre semi-trailer as the design vehicle
 - Design speed over the Elizabeth Street intersection and allowable vertical curve
 - Stopping sight distance requirements over the existing crest curve at Elizabeth Street
 - Existing road connections: several local roads intersect with the proposal and their vertical and horizontal alignment would need to be adjusted to tie in with the proposal
- Socio-economic:
 - Impacts to existing properties and businesses, including provision of access during construction
 - Large volumes of traffic using the proposal
 - Maintaining traffic, pedestrian and cyclist access during construction
 - Temporary impacts to existing bus timetables during construction
 - The close proximity of the proposal to existing dwellings, retail and commercial properties along the road corridor
 - Adjacent urban renewal and construction fatigue
- Infrastructure:
 - Existing utility services within and around the proposal including rail utility assets
 - Managing merging traffic from the M1 Eastern Distributor
 - Ausgrid 132(kilovolt) kV transmission cables
 - Sydney Water Waterloo Pumping Station
- Staging of the proposal:
 - The proposal would generally be constructed within the alignment of the existing road corridor. This would pose staging challenges to maintain traffic flows in both directions and access to local roads and properties
- Environmental constraints:
 - Minimising impacts to nearby properties and utility services
 - There are a number of heritage listed sites next to or within the proposal's area including the Sydney Water Pump Station
 - Proximity to Waterloo Park, Waterloo Oval, Moore Park and Centennial Park which all have high heritage and local community value
 - Geotechnical, groundwater, overland flow and drainage issues
 - State heritage land and heritage plantings along South Dowling Street. Curtilage and visual amenity impacts are key considerations

- Community anxiety and potential ‘construction fatigue’ associated with construction of CSELR and New M5, urban renewal and Sydney Metro
- Existing trees and proximity to trees to be retained
- Maintaining network capacity during construction
- Proximity to sensitive noise receivers
- The need to fit in with the surrounding visual amenity and landscape character.

3.2.3 Major design features

Major design feature 1: Clearways

A summary of the clearway times for the proposal shown on **Figure 3-1** The clearways are would be implemented using Roads and Maritime standard regulatory signage and edge linemarking. New clearways along the proposal would consist of:

- New clearways on both sides of Euston Road and McEvoy Street between Maddox Street and Bourke Street from 6:00am to 7:00pm Monday to Friday and 9:00am to 6:00pm on weekends
- New clearways at all times along Lachlan Street and Dacey Avenue between Bourke Street and Anzac Parade.

Major design feature 2: Turn restrictions

To facilitate the flow of traffic on the main corridor, the additional turning movement restrictions would be implemented. These turn restrictions include right turn bans at:

- Euston Road into Bunnings
- Euston Road eastbound into Bowden
- Bowden Street into Euston
- Stokes Avenue into McEvoy Street (emergency vehicle access maintained)
- Hiles Street into McEvoy Street
- McEvoy Street eastbound into Young Street.



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- 100% Concept Design
- 2 No. of parking bays
- Proposed clearway
- Unrestricted parking outside of clearway hours

- Bus zone (at all times)
- Mail zone (outside of clearway hours)
- Disabled (outside of clearway hours)

- Restrictions pertaining to side streets
- 1P
 - 1/2P
 - 2P
 - No restriction
 - No parking (authorised car share vehicles excepted)

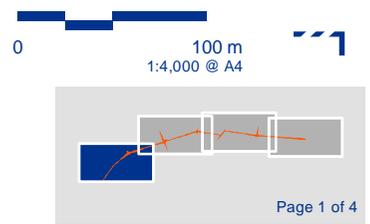
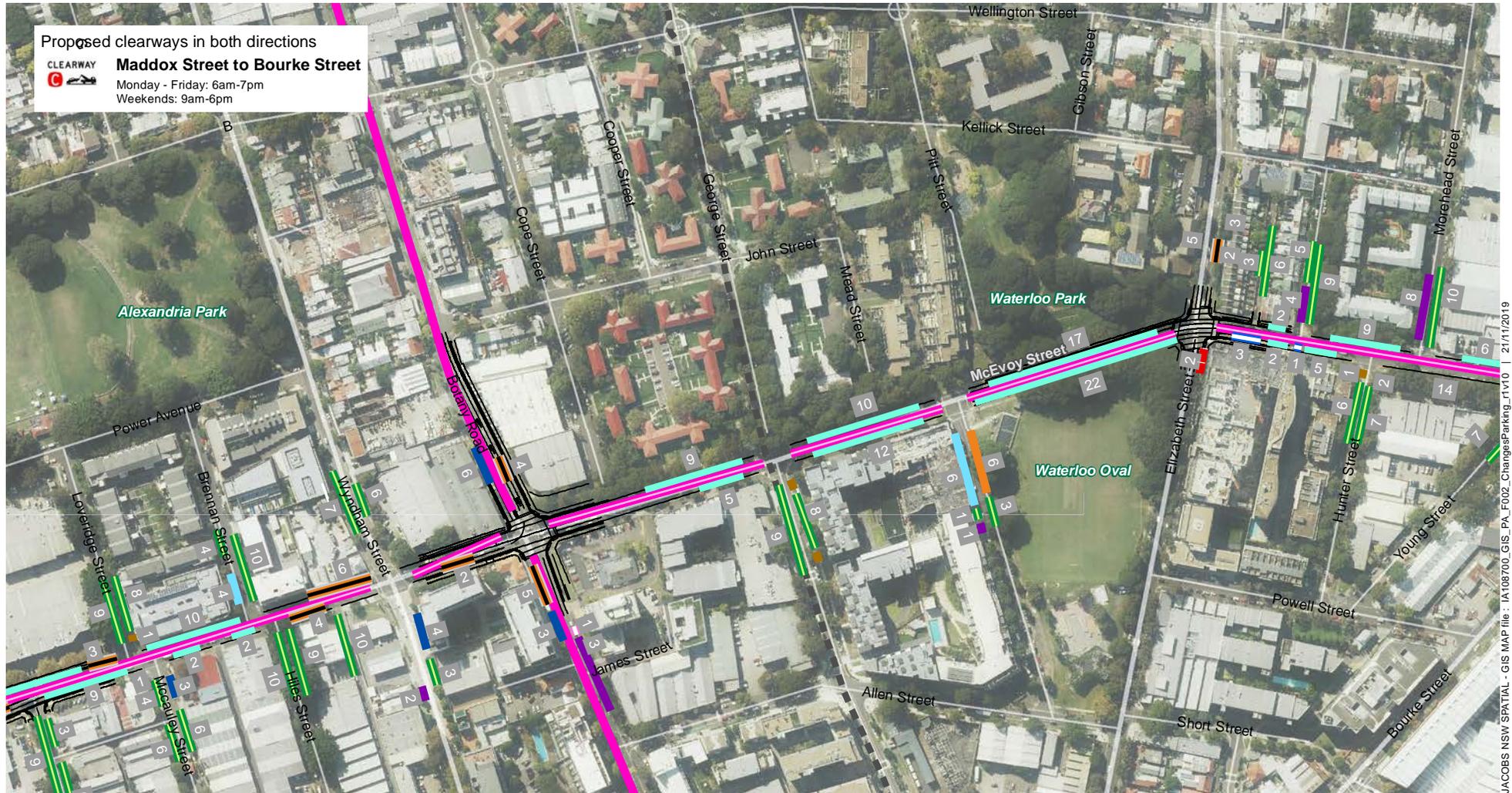


Figure 3-1a | Proposed parking conditions
Alexandria to Moore Park Stage 1



JACOBS NSW SPATIAL - GIS MAP file: IA108700_GIS_PA_F002_ChangesParking_r1v10 | 21/11/2019

— 100% Concept Design

2 No. of parking bays

Proposed clearway

Existing clearway (6am-10am & 3pm-7pm Mon-Fri)

Unrestricted parking outside of clearway hours

Bus zone (at all times)

Mail zone (outside of clearway hours)

Disabled (outside of clearway hours)

Restrictions pertaining to side streets

1P

1/2P

2P

4P

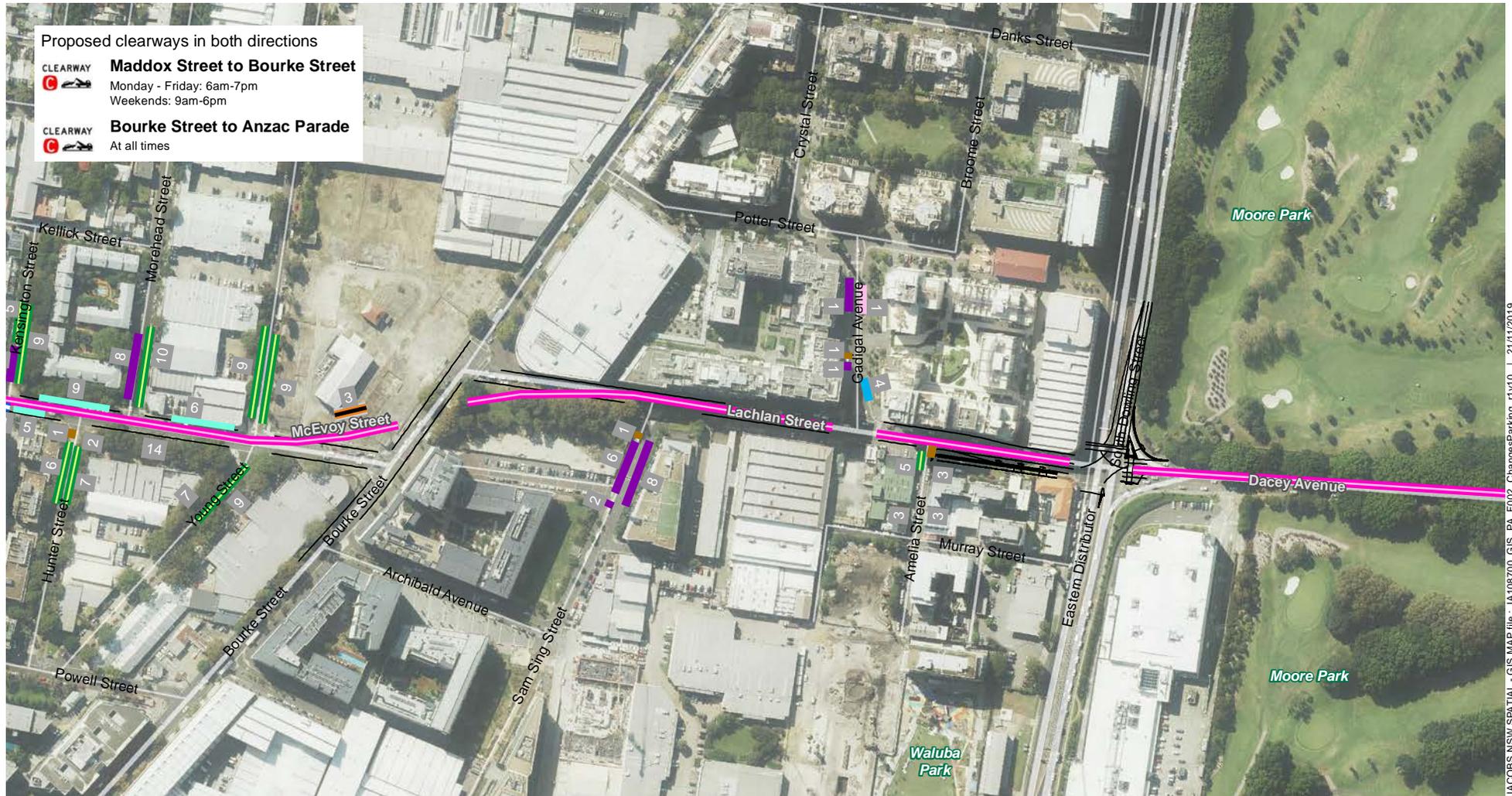
No stopping (4pm-6pm Mon-Fri)

No restriction

No parking (authorised car share vehicles excepted)



Figure 3-1b | Proposed parking conditions
Alexandria to Moore Park Stage 1



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- 100% Concept Design
- 2 No. of parking bays
- Proposed clearway
- Unrestricted parking outside of clearway hours
- Bus zone (at all times)
- Disabled (outside of clearway hours)
- Restrictions pertaining to side streets
 - 1/2P & 4P
 - 2P
 - 2P & 4P
 - No restriction
 - No parking (authorised car share vehicles excepted)

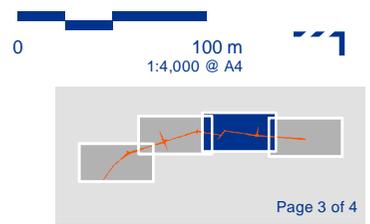
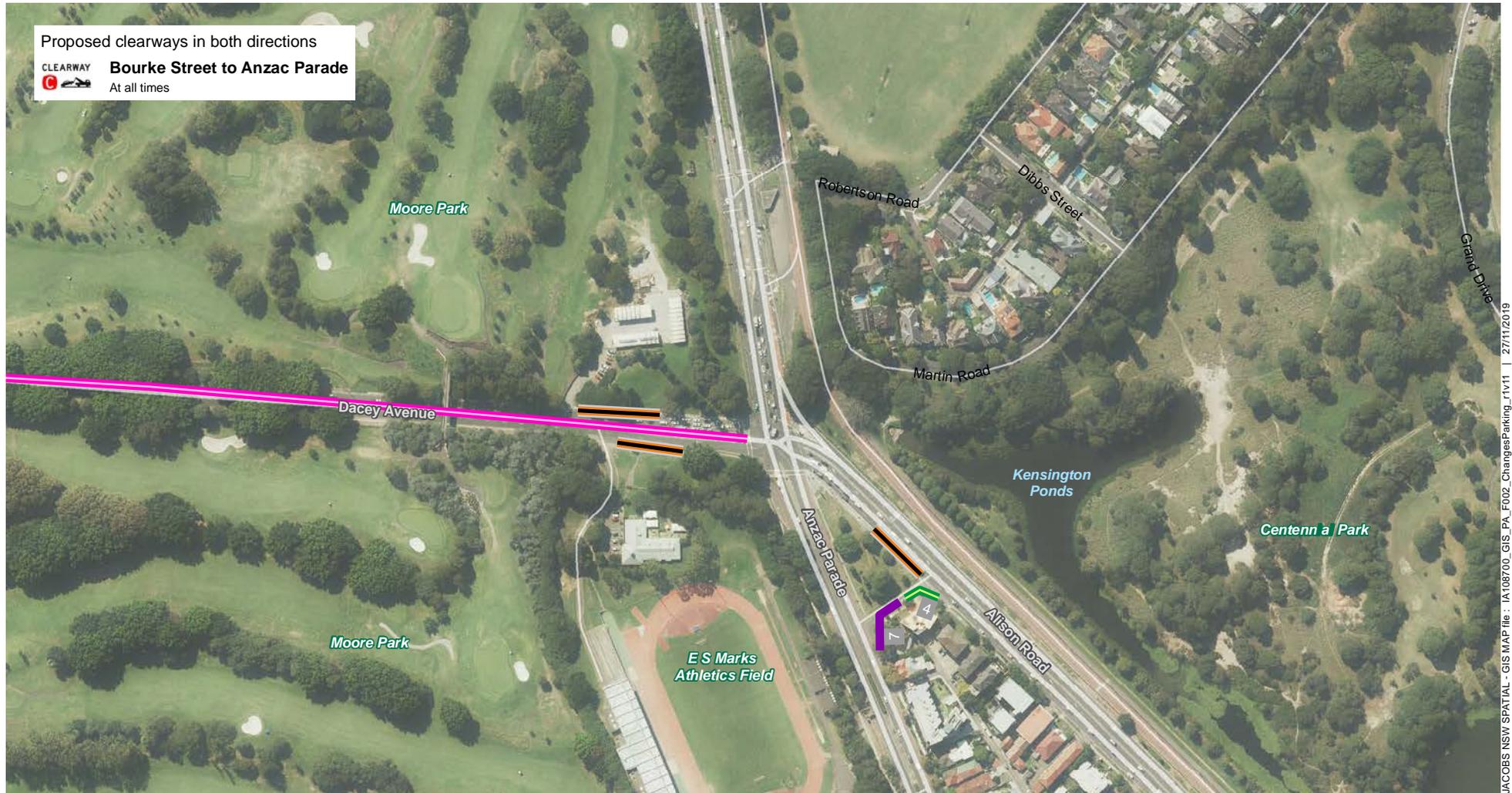
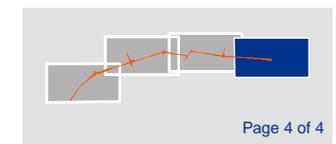


Figure 3-1c | Proposed parking conditions
Alexandria to Moore Park Stage 1



Proposed clearways in both directions
CLEARWAY Bourke Street to Anzac Parade
 At all times

- 2 No. of parking bays
- Bus zone (at all times)
- Restrictions pertaining to side streets
- 2P
- No restriction
- Proposed clearway



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Figure 3-1d | Proposed parking conditions
 Alexandria to Moore Park Stage 1

Major design feature 3: Improving the intersections at Fountain Street and McEvoy Street

The intersection improvement at Fountain Street and McEvoy Street would include widening on the northern side of McEvoy Street between Fountain Street and Harley Street. As well as widening on the southern side of McEvoy Street between Fountain Street and Stokes Avenue to provide a westbound right hand turning lane into Fountain Street from McEvoy Street, refer to **Figure 3-2**.

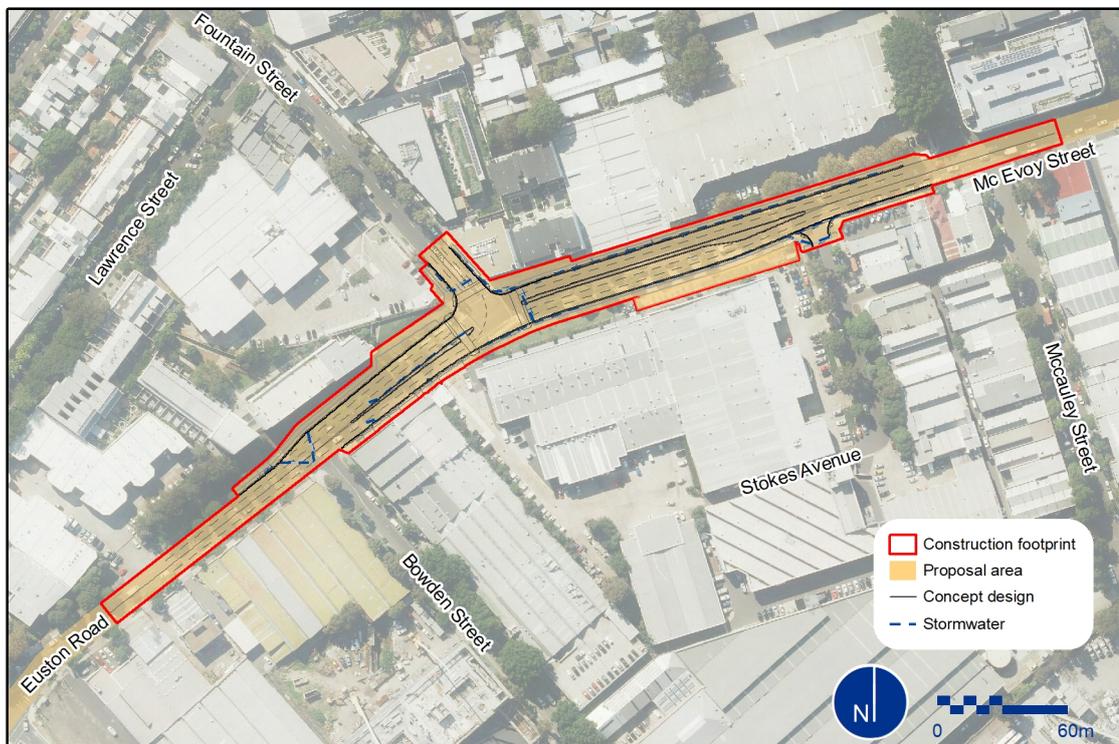


Figure 3-2 Fountain Street/McEvoy Street intersection

The main features of the Fountain Street/McEvoy Street intersection following construction of the proposal includes:

- Two eastbound through lanes along McEvoy Street
- Two westbound through lanes along McEvoy Street
- A 95 metre long eastbound left turning lane along McEvoy Street
- A 100 metre long westbound right turning lane along McEvoy Street
- A 1.7 metre wide median along the eastern leg of the intersection
- A 0.8 to 2.4 metre wide median along the western leg of the intersection
- A 2.5 metre wide footpath along the south side of McEvoy Street between Bowden Street and Stokes Avenue
- A 2.0 – 3.6 metre wide footpath on the north side of McEvoy Street west of the Fountain Street/McEvoy Street intersection
- A 1.6 – 2.7 metre wide footpath on the north side of McEvoy Street west of the Fountain Street/McEvoy Street intersection
- Relocated traffic lights to accommodate additional lanes
- New line marking.

The introduction of left and right turn lanes at the intersection would require the existing bus stops and shelters to be relocated.

Major design feature 4: Improving the intersections at Botany Road and McEvoy Street

The intersection improvement at Botany Road and McEvoy Street would include a southbound right hand turning lane on Botany Road turning westbound into Botany Road (refer to **Figure 3-3**). The main features of the Botany Road/McEvoy Street intersection following construction of the proposal includes:

- Two eastbound through lanes along McEvoy Street
- Two westbound through lanes along McEvoy Street
- Two northbound lanes along Botany Road
- Two south bound lanes along Botany Road
- A 100 metre long southbound right turn lane on the northern leg of Botany Road
- A 2.5 metre wide footpath on the eastern side of Botany Road north of McEvoy Street
- A 1.7 metre wide footpath on the northern side of McEvoy Street west of Botany Road
- A 2.5 metre wide footpath on the northern side of McEvoy Street east of Botany Road
- New line marking.



Figure 3-3 Botany Road/McEvoy Street intersection

Major design feature 5: Elizabeth Street and McEvoy Street

The intersection improvement at Elizabeth Street and McEvoy Street and McEvoy Street would include some minor kerb and footpath adjustments, refer to **Figure 3-4**. The main features of the Elizabeth Street/McEvoy Street intersection following construction of the proposal includes:

- Two eastbound through lanes along McEvoy Street
- Two westbound through lanes along McEvoy Street
- Two northbound lanes along Elizabeth Street
- Two south bound lanes along Elizabeth Street
- Left turn ban for northbound turning movement from Elizabeth street for vehicle over nine metres in length.
- A 2.0 metre wide footpath on the northern side of McEvoy Street to the east of Elizabeth Street
- A 1.3 – 1.8 metre wide footpath on the northern side of McEvoy Street to the west of Elizabeth Street
- New line marking.

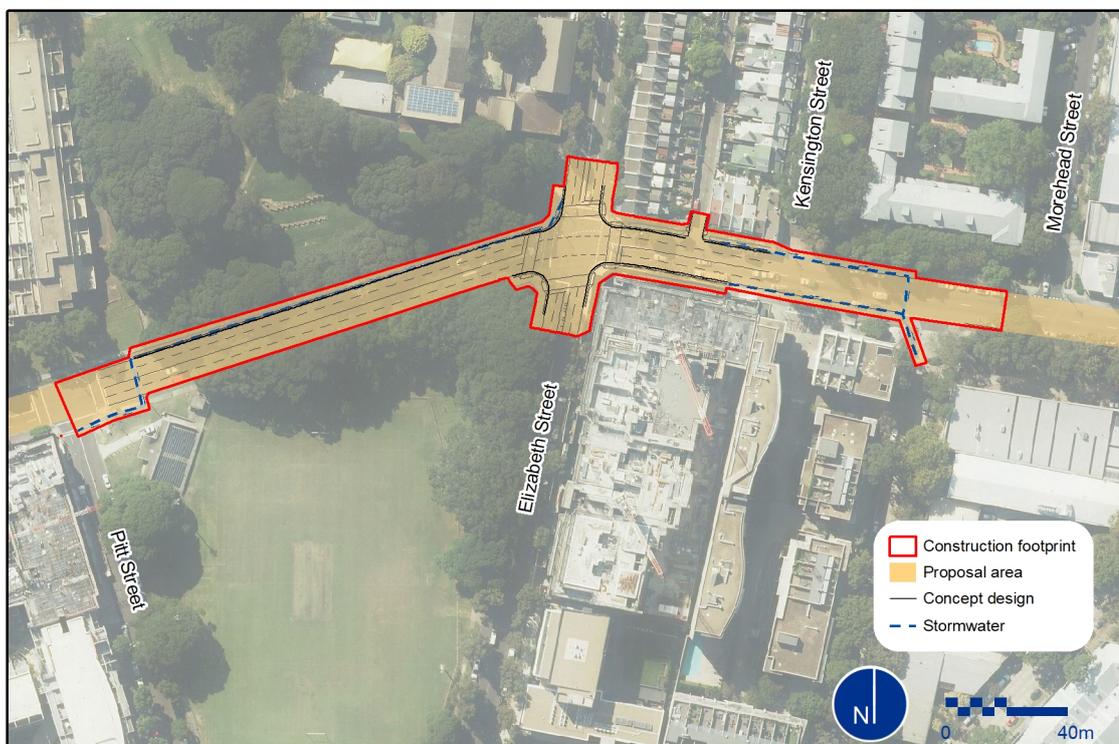


Figure 3-4 Elizabeth Street and McEvoy Street

Major design feature 6: Improving the intersections at South Dowling Street, Lachlan Street and Dacey Avenue

The intersection improvement at South Dowling Street, Lachlan Street and Dacey Avenue would include changing the existing south bound lane markings to have two right turn lanes and two through lanes and a left turn slip lane and improving signal timings and banning of right turns from Dacey Avenue heading north and from Lachlan Street heading south, refer to **Figure 3-5**. The main features of the Lachlan Street/South Dowling Street/Dacey Avenue intersection following construction of the proposal includes:

- Two eastbound through lanes
- Two westbound through lanes, which would merge into one lane after 80 metres on the western exit of the Lachlan Street/South Dowling Street/Dacey Avenue intersection

- Two southbound right turning lanes along South Dowling Street
- A 2.5 metre wide footpath on the southern side of Lachlan Street
- Traffic light controlled pedestrian crossings on all sides of Lachlan Street, South Dowling Street and Dacey Avenue, including the crossings at traffic islands to improve pedestrian and cyclist safety.

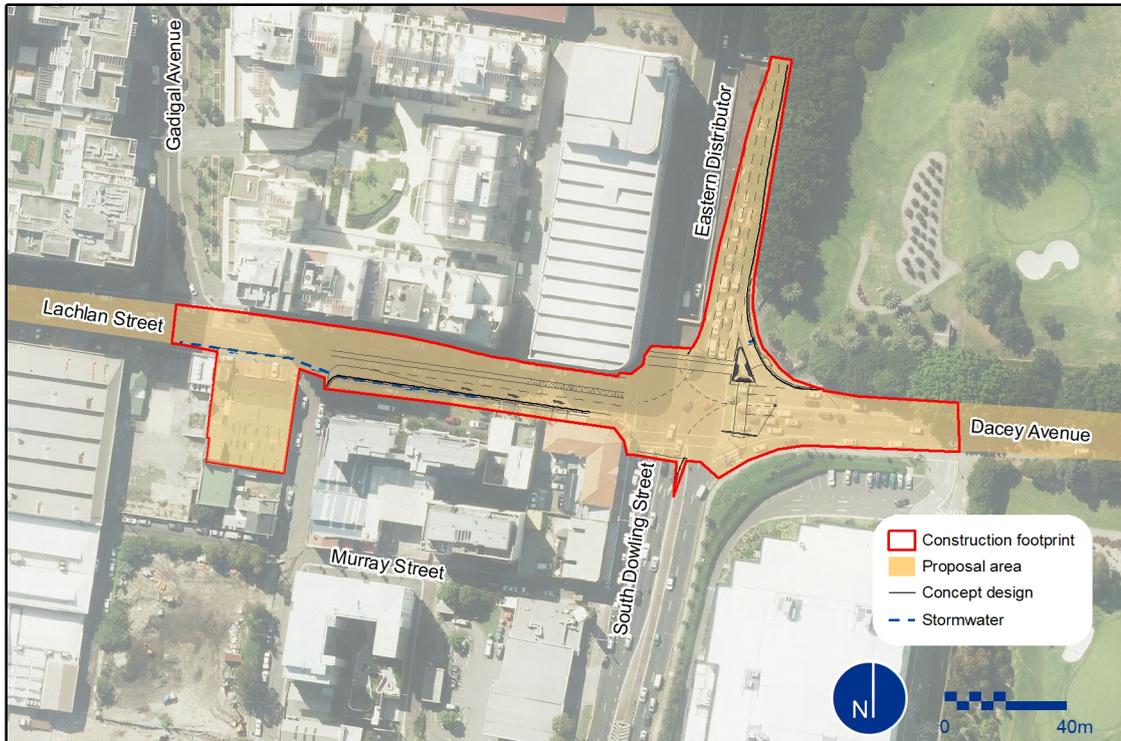


Figure 3-5 Lachlan Street, South Dowling Street, and Dacey Avenue

Major design feature 7: Drainage

Sub-surface drainage would be upgraded as part of the proposal to remove stormwater from the road way and would connect to existing stormwater infrastructure. Drainage features at each of the four main intersections are shown in **Figure 3-2** to **Figure 3-5**. The main drainage features that would be installed as part of the of the proposal includes:

- Pavement interface drains that would either traverse or run parallel to the road corridor
- Pavement trench drains
- Combined trench and parallel drains
- Sub-surface drainage pipes.

3.3 Construction activities

This section provides a summary of the likely construction methodology, staging, work hours, plant and equipment that would be used to construct the proposal and associated activities. For the purpose of this REF, an indicative construction plan and methodology are provided.

The detailed construction staging plans and methods would be confirmed by the construction contractor(s) after completion of the detailed design. The actual construction methods may vary from the description in this chapter due to:

- The identification and location of underground utilities and services

- On-site conditions identified during pre-construction activities
- Ongoing refinement of the detailed design
- Community consultation, including consideration of submissions received
- Statutory requirements, including any work, health and safety (WH&S) regulations and all conditions of approval issued following determination of the REF.

A contractor environmental management framework to manage and mitigate impacts is presented in **Chapter 7**. The final construction plan and methods chosen by the contractor would also be required to be consistent with this framework.

3.3.1 Work methodology

The proposal would be constructed in four construction zones (refer to **Figure 3-6**) between 12 to 36 months and includes:

- Zone 1: Fountain Street/McEvoy Street intersection
- Zone 2: Botany Road/McEvoy Street intersection
- Zone 3: Elizabeth Street/McEvoy Street intersection
- Zone 4: Lachlan Street/South Dowling Street/Dacey Avenue intersection.

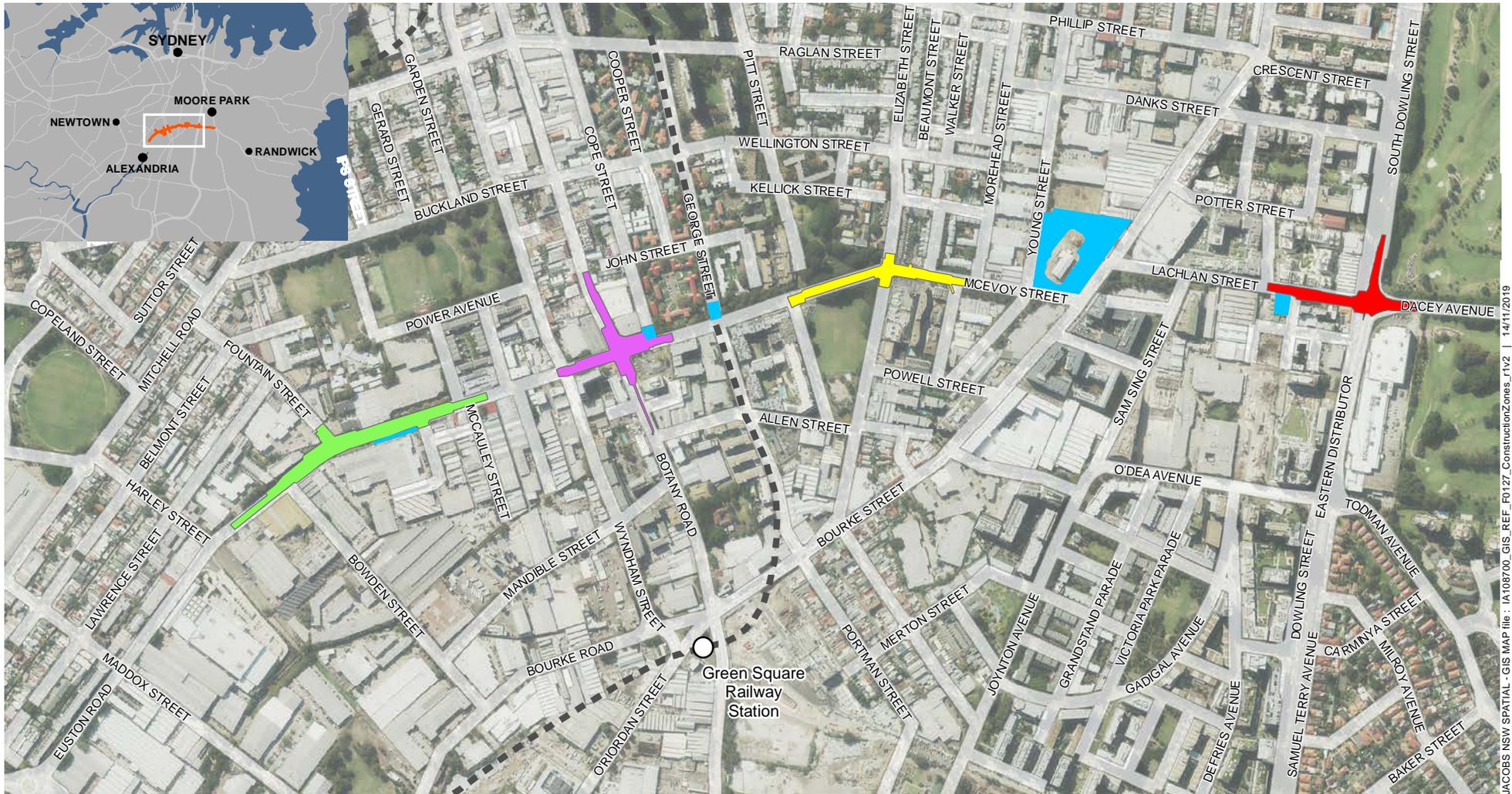
The construction would be divided into phases in each of the four construction zones to meet the following conditions:

- Minimum number of lanes agreed with CBD Taskforce and Transport Management Centre (TMC) are maintained
- Current number of turning lanes and length of storage are maintained
- Lane widths may be reduced to about 3.2 metres (desirable) for through lanes and three metres for turning lanes
- Speed limit reduced to 40 kilometres per hour approaching and next to construction works
- Driveway accesses to properties are maintained, or alternate arrangements provided
- Footpath connections are maintained.

Construction activities in each of the four zones are divided into four phases and include:

- Pre-construction activities
- Daily site activities
- Road upgrade construction activities
- Post construction activities.

Each of the construction activities associated with these four phases are described in **Table 3-2**.



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Legend

-  Road
-  Railway line
-  Construction compounds
-  Construction zones
-  Zone 1
-  Zone 2
-  Zone 3
-  Zone 4



Figure 3-6 | Construction zones
Alexandria to Moore Park Stage 1

Table 3-2 Proposed construction activity

Phase	Activities
Pre-construction activities	<ul style="list-style-type: none"> • Finalisation and approval of the Construction Environmental Management Plan (CEMP) • Installation of temporary safety barriers where required. This would include end measures to ensure safety of temporary traffic arrangements and protection of construction zone from traffic • Assessment of the condition of existing road surface shoulder for design traffic loading requirements, if used as temporary road surface • Ensuring that all temporary erosion and sediment controls are in place • Removal of all redundant road surface markings before traffic switches and installation of new temporary markings in accordance with Roads and Maritime specification <i>R141 – Pavement Marking</i> • Establish ancillary sites, temporary equipment laydown areas and stockpile sites • Establish construction site entry and exit points • Establish environmental controls in accordance with CEMP • Installation of construction fencing and screening • Clearing and grubbing of vegetation • Transport plant and equipment to the site.
Daily site activities	<ul style="list-style-type: none"> • Establish temporary amenities and environment and safety controls • Establish traffic management measures and detours including provision of alternative pedestrian and cyclist pathways as required • Remove waste and clean-up site, including road sweeping • Remove temporary traffic controls • Remove temporary amenities and environment and safety controls • Reopen traffic lanes (if closed).
Road upgrade/drainage/utility relocation construction activities	<ul style="list-style-type: none"> • Relocation of existing utilities (power, gas, communications) and stormwater • Removal of trees • Construction of temporary and permanent drainage connections • Widening of road pavements (temporary and new pavement) • Reconstruction of existing pavements, final surfacing and restorations • Reconstruction of kerbs and pedestrian pathways • Installation of road furniture and signage • Landscaping.
Post-construction activities	<ul style="list-style-type: none"> • Transport stockpiled waste and spoil to licensed facility • Clean up and decommissioning of the construction site compounds, temporary equipment laydown areas and stockpile sites • Remove plant and equipment from site • Remove construction environmental controls • Reinststate the site, roadways and all property accesses.

In addition to the phasing of construction activities for each of the four separate construction zones a number of sub-stages have been identified for each construction zone to allow for ongoing traffic flow through the construction zone via the implementation of lane closures and traffic switches. There would also be day time and night time activities. The construction sub-stages for each of the four zones has been broken down as follows:

- Zone 1: Fountain Street/McEvoy Street intersection has been divided into preliminary works and then six sub-stages (A-F) as outlined in **Appendix F** (Table F-1)

- Zone 2 Botany Road/McEvoy Street intersection has been divided into preliminary works and then six sub-stages (A-F) as outlined in **Appendix F** (Table F-2)
- Zone 3 Elizabeth Street/McEvoy Street intersection has been divided into preliminary works and then five sub-stages (A-E) as outlined in **Appendix F** (Table F-3)
- Zone 4: Lachlan Street/South Dowling Street/Dacey Avenue intersection has been divided into preliminary works and two sub-stages (Lachlan Street – Area 1 and South Dowling Street – Area 2) as outlined in **Appendix F** (Table F-4).

3.3.2 Construction hours and duration

Where possible, construction would be carried out during standard construction working hours in accordance with *the Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change (DECC), 2009) as follows:

- Monday to Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm
- Sunday and public holidays: No work.

However, in order to minimise disruption to daily traffic, maintain existing lanes during peak hours, reduce disturbance to surrounding landowners/businesses and for the safety of road users and pedestrians, it would be necessary to carry out some construction activities outside these standard working hours, including at night. This would include the relocation of existing utilities and some pavement works at intersections. For example, night work would be scheduled during pavement works at intersections and tie ins, most likely between the hours of 9:00pm and 5:00am Monday to Friday or as allowable in accordance with road occupancy licence (ROL) requirements. During scheduled night works, potentially impacted sensitive receivers such as local residents would be consulted and kept informed of construction progress to minimise any impacts. In addition, management and mitigation measures detailed within the CEMP would be implemented as required to further mitigate any construction impacts. This includes the development of an out-of-hours work protocol which would govern the management of works outside standard construction hours.

Weekend work would also likely be required to minimise traffic disruptions, subject to the ROL and construction staging. Night work or other out-of-hours work would be justified because of the importance of maintaining traffic flows through this critical part of the Sydney road network.

The work would be carried out in accordance with the ICNG (DECC, 2009), *Construction Noise and Vibration Guideline* (Roads and Maritime, 2016) and the *Noise Criteria Guidelines* (Roads and Maritime, 2015a). The contractor would give the community prior notice of any work planned to be carried out outside normal construction hours, refer to **Section 6.4**.

Where practical, materials and plant would be removed and delivered outside peak traffic periods to minimise delays. Traffic control measures would be used to manage general earthwork and the import and export of material.

3.3.3 Plant and equipment

An indicative list of plant and equipment that would typically be required during construction of the proposal is provided below. Additional equipment would likely be used and would be identified during detailed design by the construction contractor. Indicative equipment includes:

- 2t Tipper
- Asphalt Paver
- Light Vehicles
- Line Marking Truck

- Asphalt Truck and Sprayer
- Backhoe
- Bobcats
- Chainsaw 4-5hp
- Cherry Picker
- City Crane (for large trees)
- Compressor
- Concrete Pump
- Concrete Saw
- Concrete Truck
- Concrete Vibrator
- Drills
- Dump Truck
- Dump Truck (Bogie Truck) / 2t Tipper
- Dump Truck (Truck & Dog)
- Elevated work platforms
- Excavator (tracked) 20t
- Excavator (tracked) 35t
- Excavator (tracked) 5-12t (for stumps only)
- Forklifts
- Franna Crane
- Franna Crane 20t
- Front End Loader
- Graders
- Hand Tools
- Jackhammer
- Lighting Towers
- Pavement Laying Machine
- Pavement Profiler
- Piling Rig
- Plate Compactor/Tamper Rammer
- Pneumatic Hammer
- Power Generator
- Pulvi-mizers
- Road Truck
- Road Truck (Bogie)
- Road Truck (Hiab)
- Scissor Lift
- Scissor Lift / EWP (O/H Power relocation)
- Screed boards (petrol driven)
- Skid Steer
- Slip-Forming Machine
- Smooth Drum Roller
- Spray Seal Equipment
- Staff vehicles
- Truck Compressor
- Tub grinder/mulcher 40-50hp
- Underborers
- Vacuum Truck
- Vibratory Roller
- Vibratory Roller 20-30t
- Water carts
- Welding Equipment

3.3.4 Earthworks

The majority of the proposal would maintain the existing pavement levels, with minimal earthworks proposed. As such, earthworks for the proposal would generally be limited to minor excavation for pavement widening and pavement reconstruction. The proposal would aim to maximise the re-use of material on site, to reduce material import, and minimise traffic movements on the road network in and around construction zones.

The estimated quantities of materials associated with earthworks are provided in **Table 3-3**. The estimates may change depending on the actual quality of material, the depth to bedrock, and the suitability of the material for re-use in construction. Earthwork requirements would be confirmed during detailed design.

With the exception of the Selected Material Zone (SMZ) pavement layer, no imported fill would be required, and the earthworks would generally proceed as follows:

- Strip topsoil and store material at proposed stockpile site
- Cut material through excavation and move to the fill areas as required for minor cut and fill operations
- Provide appropriate base, sub-base as required for the works associated with the road upgrade

- Dispose of excess excavated cut material in accordance with the appropriate procedures.

Table 3-3 Indicative earthworks quantities

Material	Estimated volume (m ³)
Excavation (cut) volume	4,000 m ³
Fill volume (imported or borrowed)	2,500 m ³
Excess (to spoil)	4,000 m ³

3.3.5 Source and quantity of materials

Construction materials

The major materials that would be required from the proposal include culverts (reinforced concrete), SMZ and pavement gravels, asphalt, steel reinforcement and concrete.

Estimated quantities of construction materials are outlined in **Table 3-4**.

Table 3-4 Summary of material quantities

Material	Estimated quantity
Road surface sealant	4,000 m ²
Asphalt	2000 m ²
Concrete	1,000 m ²
New pavement (SMZ)	2,000 m ³
Milling	14,000 m ³

The source and quantity of materials required to construct the proposal would be finalised during detailed design through the development of a construction materials and resources plan. Where possible, materials would be sourced from quarries nearby from commercial suppliers within the Sydney region or other viable sources such as other nearby infrastructure projects. The materials would also be sourced from appropriately licensed facilities. None of the materials proposed to be used are considered to be in short supply.

Surplus material that cannot be used on site would be re-used or disposed of in the following order of priority:

- Transfer to other Roads and Maritime projects for immediate re-use in line with the NSW Environmental Protection Authority (EPA) Excavated Public Road Material Resource Recovery Exemption
- Transport off site for re-use by a third party in line with a relevant EPA resource recovery exemption
- Disposal at an approved materials recycling or waste disposal facility
- As otherwise provided for by the relevant waste legislation.

Water

Water would be required for earthwork and dust control. The volume of water required for construction is currently unknown. However, it is anticipated that the likely quantity and quality of water would be available from existing sources in the local area. This would be defined by the construction contractor during detailed design.

Water would be sourced from authorised off-site sources, including recycled and re-used water, groundwater bores.

Steel and concrete

Required quantities for these materials are not yet known, however, these would be calculated during detailed design. Material sources would be identified by the construction contractor during detailed design.

Surplus materials

Surplus material that cannot be used as part of the proposal would be re-used or disposed of in the following order of priority:

- Transfer to other nearby Roads and Maritime projects for immediate use
- Transfer to a Roads and Maritime approved temporary stockpile site for future use during projects or routine maintenance
- Transfer to a Roads and Maritime approved site for reuse on a concurrent private and/or local government project (with appropriate approvals as required)
- Disposal at an approved materials recycling or waste disposal facility
- As otherwise provided for by the relevant waste legislation.

The process for managing excess material would be detailed in a waste management plan that would form part of the CEMP (refer to **Section 6.11**).

3.3.6 Traffic management and access

As described in **Section 3.2.2**, pedestrian, cyclist and road traffic would be impacted during all stages of construction at the four construction zones. Construction has been staged to allow the existing road corridor to remain open to traffic, cyclist and pedestrian movements during construction. Potential impacts to pedestrian, cyclist and road traffic have been provided in **Section 6.1**.

Construction traffic volumes

Construction vehicles would generally access the proposal from major roadways feeding into the proposal, resulting in a temporary increase in heavy vehicle movements in the surrounding road network. Construction traffic would include vehicles, light and heavy trucks, and concrete trucks. Construction traffic would be greatest during the main earthwork and civil construction, and would comprise vehicles transporting equipment, materials and spoil, and construction workers accessing the work sites.

The construction traffic volumes during work hours have been anticipated to be in the order of 20 – 30 heavy vehicle movements and 20 – 30 light vehicle movements within each active construction zone. The largest traffic volume would generally be generated during bulk excavation activities.

During construction it would be necessary to move a large amount of road building materials. Any haulage movement across or along the proposal would be in accordance with an approved Traffic Management Plan (TMP), refer further to mitigation measures included in **Section 6.1**.

As a proportion of the required fill material would be sourced from outside of the proposal area, major material truck haulage routes would be required between the proposal area and the sourced material. Material being imported from the local quarries would use major roadways where possible and would access the proposal from established and designated access points.

Site access for construction vehicles

Construction vehicles would access the proposal area from the western and eastern extents of the construction zones, via a planned tapered entrance within the approach/departure of each works zone. It is anticipated that construction traffic movements in each of the four construction zones would adopt a “left-in, left-out” access arrangement.

Access to discrete work zones would be managed by traffic controllers directing the movements of construction vehicles from pre-determined temporary waiting areas in the surrounding construction vehicle allowable road network, to travel into the work zone as directed.

Construction workers would generally arrive by car and either park at one of the five compound sites or in the surrounding area (refer to **Figure 1-2** and **Section 3.4**). Construction personnel would then access the work zone from established compound sites either via pedestrian access or through vehicle access in mini bus type vehicles to reduce vehicular movements. The method of access/egress to be implemented during construction would be defined by the contractor.

Access management

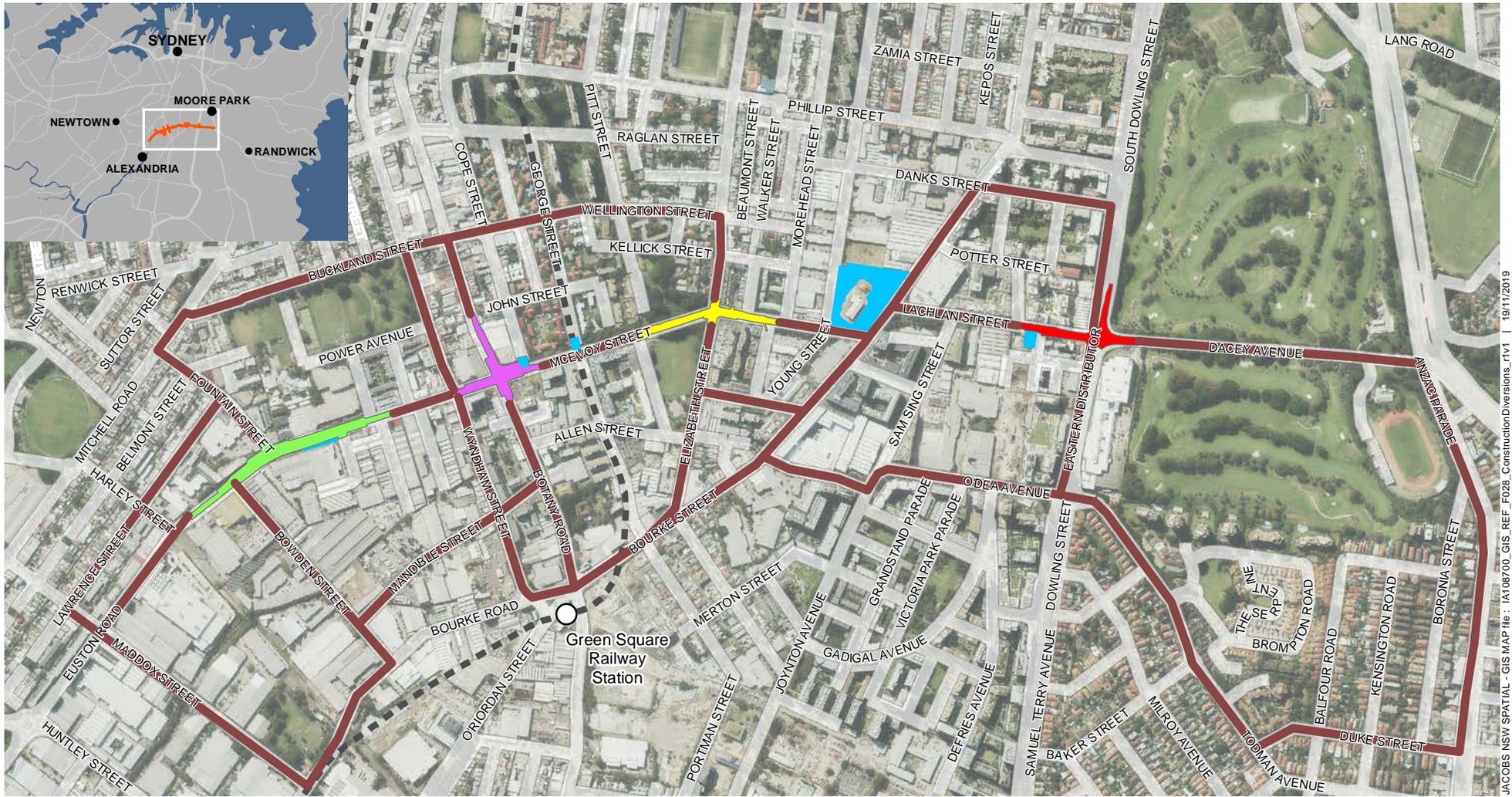
As described in **Section 3.3.1**, daytime lane closures are proposed along the majority of the McEvoy Street/Lachlan Street corridor (construction zones 1 to 4) during the various construction stages. Generally, the construction staging would maintain two lanes along the proposal (one lane in each direction) at all times during construction. There are a few exceptions to this when the traffic would be limited to one lane in one direction and during these times there would be temporary traffic diversions in place, these are discussed further in the section below. Widening for turning bays would also be provided at the major signalised intersections.

Night works are proposed at all construction zones in order to minimise the traffic impacts during construction. Access for emergency services would be maintained with the contractor who would be required to carry out the necessary consultation with the emergency services before any changed traffic conditions are implemented.

Access to properties and businesses along the proposal would be maintained during construction. Temporary property access would be provided to residences and businesses where required. The management of property access would be considered by the construction contractor and detailed as part of the final staging plan for the proposal.

Temporary traffic diversions during construction

Some construction activities associated with the proposal would require that traffic is temporarily redirected onto other nearby roads. Possible temporary diversion routes are shown on Figure 3-7 and routes would vary according to whether eastbound, or westbound traffic needs to be diverted off the proposal corridor. Temporary traffic diversions would occur in each of the four construction zones but not for the whole construction period. As these temporary diversions would occur at night during construction of the proposal only small volumes of traffic is expected.



Legend

- | | |
|---|--|
|  Temporary construction traffic diversions | Construction zones |
|  Road |  Zone 1 |
|  Railway line |  Zone 2 |
|  Construction compounds |  Zone 3 |
| |  Zone 4 |



Figure 3-7 | Temporary construction traffic diversions
Alexandria to Moore Park Stage 1

JACOBS NSW SPATIAL - GIS MAP file: I:\108700_GIS_REF_F028_ConstructionDivisions_r1v1 | 19/11/2019

Construction traffic management plan

Standard traffic management measures would be employed to minimise short-term traffic impacts that could be expected during construction. A detailed construction traffic management plan would be prepared in accordance with the *Traffic Control at Work Sites Manual Version 4* (Roads and Traffic Authority (RTA), 2010) and *Specification G10 – Control of Traffic* (RTA, 2006) and would need to be approved by Roads and Maritime before implementation. The construction traffic management plan would provide details of traffic management to be implemented during construction to ensure traffic flow on the surrounding network is maintained where possible

The traffic management plan would provide details of traffic management to be implemented to ensure that traffic flow along the proposal is maintained throughout construction. Impacts to the public (including traffic, pedestrians and cyclists) during construction would be managed through the traffic management plan and detailed pedestrian traffic control plans. Pedestrian and cyclist routes would be managed on a regular basis to suit construction activities. These routes would be coordinated with the stages of construction to ensure safe access.

The traffic management plan would detail specific haulage routes that construction traffic would follow during the construction phase. To avoid major congestion, lane closures would only occur during off-peak periods and in consultation with the Transport Management Centre. A reduced speed limit may be introduced for the duration of the work.

Bus stops requiring relocation or temporary closure during construction would be carried out in consultation with City of Sydney, Transport for NSW and the local bus operator. Any proposed relocation would consider implications for commuters. Additional access for garbage trucks during construction would be taken into account.

Further details about the potential traffic impacts during construction are provided in **Section 6.1**.

3.4 Ancillary facilities

Ancillary facilities would be required throughout construction of the proposal. Refer to **Figure 1-2** for the location of the ancillary facilities. Ancillary facilities include five construction compound/stockpile locations as follows:

- Site 1 would be located at the car park on the south-west corner of the Stokes Avenue/McEvoy Street intersection, Alexandria
- Site 2 would be located within the road reserve at the southern end of Cope Street, Alexandria
- Site 3 would be located at the road reserve at the southern end of George Street, Alexandria
- Site 4 would be located within the vacant land (Lot 2 DP800705) at the corner the of Bourke Street/McEvoy Street intersection, Waterloo. Lot 1 DP800705 is in the middle of the site has a heritage listed building on it which is protected with a 10 metre buffer
- Site 5 would be located at Lot 1, 2 and 3 DP 76985, Lot 4 DP 86722 and Lot 14 DP80926 Lot 2 on the west corner of the Lachlan Street/Amelia Street intersection, Waterloo.

The construction compounds generally would operate during standard working hours (7:00am to 6:00pm), however there would be limited periods when night work would occur (6:00pm to 7:00am). A description of the activities that would occur at the ancillary facilities is summarised in **Table 3-5**.

Table 3-5 Description of ancillary facility activities

Site number	Type	Description
Site 1	Construction site compound	<ul style="list-style-type: none"> Site 1 is located within the car park on the south-west corner of the Stokes Avenue/McEvoy Street intersection, Alexandria. This is road reserve and as such has no lot or DP The total area of the site would be about 380 square metres This site is proposed for use during all stages of construction and is located at the western end of the proposal The site is currently used as car park with an industrial area The site would include portable buildings with amenities (such as lunch rooms and toilets), office space for on-site personnel and associated parking Access to the site would be via McEvoy Street Sensitive receivers are located all around this site.
Site 2	Construction site compound	<ul style="list-style-type: none"> Site 2 is located within the road reserve at the southern end of Cope Street, Alexandria. This is road reserve and as such has no lot or DP. The total area of the site would be about 445 square metres This site is proposed for use during all stages of construction and is located at the western end of the proposal The site would include portable buildings with amenities (such as lunch rooms and toilets), office space for on-site personnel and associated parking Access to the site would be via McEvoy Street Sensitive receivers are located all around this site.
Site 3	Construction site compound	<ul style="list-style-type: none"> Site 3 is located road reserve at the southern end of George Street, Alexandria. This is road reserve and as such has no lot or DP The total area of the site would be about 605 square metres This site is proposed for use during all stages of construction and is located at the western end of the proposal The site would include portable buildings with amenities (such as lunch rooms and toilets), office space for on-site personnel and associated parking Access to the site would be via McEvoy Street Sensitive receivers are located all around this site.
Site 4	Construction site compound	<ul style="list-style-type: none"> Site 4 is located within the vacant land (Lot 2 DP800705) at the corner of the Bourke Street/McEvoy Street intersection, Waterloo. Lot 1 DP800705 is in the middle of the site has a heritage listed building on it and which would be protected with a 10 metre buffer The total area of the site would be about 12,375 square metres This site is proposed for use during all stages of construction and is located at the western end of the proposal The site would include portable buildings with amenities (such as lunch rooms and toilets), office space for on-site personnel and associated parking Access to the site would be via McEvoy Street Sensitive receivers are located all around this site.
Site 5	Construction site compound	<ul style="list-style-type: none"> Site 5 is located at Lot 1, 2 and 3 DP 76985, Lot 4 DP 86722 and Lot 14 DP80926Lot 2 on the west corner of the Lachlan Street/Amelia Street intersection, Waterloo The total area of the site would be about 965 square metres This site is proposed for use during all stages of construction and is located at the western end of the proposal

Site number	Type	Description
		<ul style="list-style-type: none"> • The site would include portable buildings with amenities (such as lunch rooms and toilets), office space for on-site personnel and associated parking • Access to the site would be via Lachlan Street • Sensitive receivers are located all around this site.

The location of the stockpile and storage areas within the main construction compound area and construction footprint would be subject to the site location criteria set out in the *Stockpile Site Management Procedure* (RTA, 2011a) and *QA specification R44-Earthworks - IC-QA-R44* (Roads and Maritime, 2011b).

No long term stockpile areas have been included as part of the proposal. The final location of the compounds, hardstands, retaining wall access roads, stockpile and storage sites would be identified during detailed design. Once the contractor has a preferred location for the stockpile and storage sites, they would consult with Roads and Maritime’s Environmental Officer before any work in those locations to identify if any additional environmental assessment is required.

3.5 Public utility adjustment

The utilities present within the proposal area are detailed in the *Alexandria to Moore Park Connectivity Upgrade Stage 1 Detailed Design Report* (Arup, 2019a). Utilities present include:

- Electrical supply and Street Lighting – Energy Australia / Ausgrid
- Gas – Jemena
- Telecommunications (optic fibre and telephone) – Telstra, Optus / Uecomm, Nextgen, Vocus, TPG / Pipenetworks, AAPT, NBN, Worldcom (Verizon) and Primus Telecom
- Water – Sydney Water
- Sewer – Sydney Water
- Private electrical supply – City of Sydney Council
- Intelligent Transport Systems (ITS).

These utilities would need to be relocated or protected as part of this proposal. The extent of the relocation or protection of these utilities would not be known until detailed design has been completed. Relocation and/or protection would also depend on procurement approach and the contractor(s) engaged for the construction of this proposal. All utilities to be adjusted which are located within the area to be impacted by the proposal are considered to be part of the assessment in this REF. However, any adjustments that extend beyond the impacted area may require a separate environmental assessment.

Consultation with the public utility authorities has been carried out as part of the development of the concept design to identify and locate existing utilities and incorporate utility authority requirements for relocations and/or adjustments. **Chapter 5** provides a summary of the consultation carried out for the proposal.

Confirmation of the relocation of utilities and associated strategies would be carried out in consultation with utility authorities during detailed design.

Roads and Maritime’s Senior Environmental Officer would be consulted to seek advice of further assessment requirements should any aspect of the design require disturbance or construction for public utilities, outside the proposal footprint (and therefore not assessed in this REF).

3.6 Property acquisition

Three privately owned lots and 11 publicly owned parcels of land would be required for the proposal. These would mainly be affected by partial acquisition for landscape and walkway adjustments.

Properties impacted by acquisition or adjustments are listed in **Table 3-6** and illustrated in **Appendix G**. **Table 3-6** also include detail of the current land use of each lot to be acquired.

Strip acquisition for the proposal would generally impact on landscaped areas that have been set back from the existing road to allow for future road widening works. The proposal would consequently require landscape adjustments, although some off-street car park areas would also be removed (refer to **Section 6.1**). Where partial acquisition of properties would occur, impacted infrastructure such as fencing and driveways would be rebuilt and relocated as part of the proposal.

The proposal boundary has been developed to maximise the design functionality, take into account the existing road affectation along the corridor and meet the proposal brief as well as minimise the property acquisitions required.

All acquisitions would be conducted in accordance with the Roads and Maritime *Land Acquisition Policy*, and compensation would be based on the requirements of the *Land Acquisition (Just Terms) Compensation Act 1991*.

Table 3-6 Proposed property acquisition

Area ID	Description	Total area (m ²)	Acquisition type	Current owner	Lot and DP	Land use zone (LEP)
03	147-161 McEvoy Street	1	Partial	Private property	SP71215	B4
04	37 Lachlan Street	3	Partial	Private property	Lot 1 DP848513	SP2
10	35 Lachlan Street	29	Strip (partial)	Private property	Lot 9 DP978753	SP2
01	141-161 McEvoy Street	996	Full	Public	Lot 3 DP101336	SP2
02	141-161 McEvoy Street	471	Full	Public	Lot 4 DP1013364	SP2
05	112 McEvoy Street	491	N/A	City of Sydney	SP77796	SP2
06	102-110 McEvoy Street	397	N/A	City of Sydney	SP33259	SP2
07	Road Reserve at the corner of Botany Road	1007	N/A	City of Sydney	N/A	SP2
08	Road reserve	263	N/A	City of Sydney		SP2
09	33A Lachlan Street	142	N/A	Roads and Maritime	Lot 2 DP1054399	SP2
11	37 Lachlan Street	29	N/A	Roads and Maritime	Lot 21 DP794313	SP2
12	853-855 South Dowling Street	130	N/A	Roads and Maritime	Lot 1 DP327949	SP2

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 (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP 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 a road and road infrastructure facilities and is to be carried out on behalf of Roads and Maritime, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* (NPW Act) or land identified as a mine subsidence precinct within the meaning of the *Mine Subsidence Compensation Act 1961*. The proposal is not adjacent to an aquatic reserve or a marine park declared under the *Marine Estate Management Act 2014* or within the Sydney Harbour Foreshore Area as defined by the *Sydney Harbour Foreshore Authority Act 1998*. The proposal does not affect land or development regulated by State Environmental Planning Policy (Coastal Management) 2018, State Environmental Planning Policy (State and Regional Development) 2011 or State Environmental Planning Policy (Major Development) 2005.

Part 2 of ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in chapter 5 of this REF.

State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State and Regional Development) 2011 aims to identify development that is State significant development (SSD), development that is State significant infrastructure (SSI) and critical SSI, and development that is regionally significant development (RSD). This SEPP outlines conditions for development to be considered SSD, SSI and RSD.

The proposal is not declared as critical SSI under Schedule 5 clause 2 of the State Environmental Planning Policy (State and Regional Development).

State Environmental Planning Policy No. 55 – Remediation of Land

The objective of State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) is to provide a State-wide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. In accordance with Clause 7(1) of SEPP 55, a consent authority must not consent to the carrying out of any development on land unless it has considered whether the land is contaminated and whether remediation is required. SEPP 55 also requires consideration of whether the land use is suitable for the intended use.

A *Stage 1 Contamination Assessment* carried out by Jacobs (2018b) identified 12 potential areas of environmental interest (AEIs) within or near to the proposal area that may present a low to moderate contamination risk to the proposed construction activities. The contamination assessment recommended that further contamination investigations are carried out prior to construction at areas of moderate risk within the proposal area. The findings from the contamination investigation and recommended environmental management measures are detailed in **Section 6.7**.

4.1.2 Local Environmental Plans

The proposal is located within the City of Sydney LGA, on land which is subject to the *Sydney Local Environmental Plan 2012* (the Sydney LEP).

Sydney Local Environmental Plan 2012 (Sydney LEP)

The Sydney LEP provides for development standards, zoning and planning controls for development in the City of Sydney LGA, refer to **Figure 4-1**. A substantial proportion of the proposal would be within the existing road corridor which is zoned SP2 Infrastructure (Classified Road), with impacts to other land use zones next to the road corridor where road widening, and ancillary sites would be required. The land that would be impacted by the proposal is zoned under the Sydney LEP as:

- B4 Mixed use
- B5 Business development
- B6 Enterprise corridor
- B7 Business park
- R1 General residential
- RE1 Public recreation
- R2 Low density residential
- SP2 Infrastructure (Classified Road).

The land use objectives for each of these land use zone under the Sydney LEP and the proposal's consistency with these objectives, are detailed in **Table 4-1**.

Table 4-1 Sydney LEP relevant zone objectives

Zone	Objective	Consistency of the proposal with the zone objective
B4 Mixed use zone	<ul style="list-style-type: none"> • Provide a mixture of compatible land uses • Integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling • Ensure uses support the viability of centres. 	The proposal is consistent with the zone's objectives as it would support the development of the adjacent area, nearby Green Square and the CSELR to maximise the public transport opportunities.
B5 Business development	<ul style="list-style-type: none"> • Enable a mix of business and warehouse uses, and bulky goods premises that require a large floor area, in locations that 	The proposal is consistent with the zone's objectives as it would support the development of the adjacent area and nearby Green Square. The proposal would provide efficient access for

Zone	Objective	Consistency of the proposal with the zone objective
	<p>are close to, and that support the viability of, centres</p> <ul style="list-style-type: none"> • Encourage employment opportunities • Enable other land uses that provide facilities or services to meet the day to day needs of the community • Promote uses with active street frontages. 	<p>vehicles to service the commercial businesses within this zone.</p> <p>Efficient access into and out of the city centre would encourage employment opportunities through reduced travel times.</p>
B6 Enterprise corridor	<ul style="list-style-type: none"> • To promote businesses along main roads and to encourage a mix of compatible uses • To provide a range of employment uses (including business, office, retail and light industrial uses) • To maintain the economic strength of centres by limiting retailing activity • To ensure uses support the viability of any adjoining industrial zone for industrial uses. 	<p>The proposal would improve access to the businesses within the area of land zoned for this purpose and is therefore considered consistent with the objectives of this zone.</p>
B7 Business park	<ul style="list-style-type: none"> • To provide a range of office and light industrial uses • To encourage employment opportunities • To enable other land uses that provides facilities or services to meet the day to day needs of workers in the area • To ensure uses support the viability of nearby centres. 	<p>The proposal would improve access to the office industrial businesses within the area of land zoned for this purpose and is therefore considered consistent with the objectives of this zone.</p>
R1 General residential	<ul style="list-style-type: none"> • Provide housing needs of the community • Provide a variety of housing types and densities • Enable other land uses that provide facilities or services • Maintain the existing land use pattern of predominantly residential uses. 	<p>The proposal does not conflict with this objective as it could facilitate further development in the LGA. It would maintain the efficiency of the road network, and help to enable other land uses by providing additional capacity.</p>
R2 Low density residential	<ul style="list-style-type: none"> • To provide for the housing needs of the community within a low density residential environment • To enable other land uses that provides facilities or services to meet the day to day needs of residents. 	<p>The proposal does not conflict with this objective as it could facilitate further development in the LGA. It would maintain the efficiency of the road network, and help to enable other land uses by providing additional capacity.</p>
RE1 Public recreation	<ul style="list-style-type: none"> • To enable land to be used for public open space or recreational purposes 	<p>The proposal would have a minor impact on access to public space. There would be temporary construction impacts. The proposal would strengthen and improve</p>

Zone	Objective	Consistency of the proposal with the zone objective
	<ul style="list-style-type: none"> • To provide a range of recreational settings and activities and compatible land uses • To protect and enhance the natural environment for recreational purposes • To provide links between open space areas • To retain and promote access by members of the public to areas in the public domain including recreation facilities and waterways and other natural features. 	links between existing open space areas, particularly Moore Park and nearby Centennial Park.
SP2 Infrastructure (Classified Road)	<ul style="list-style-type: none"> • To provide for infrastructure and related uses • To prevent development that is not compatible with or that may detract from the provision of infrastructure. 	The proposal is for a public road and would be consistent with the objectives for development in the SP2 Infrastructure zone.

As shown in **Table 4-1**, the LEP zone provisions provide that the proposal would be permitted with consent in all zones. However, as outlined in **Section 4.1.1** of this REF, under ISEPP the proposal is permitted without the consent of council. Therefore, the consent requirements of the LEP do not apply and the proposal may be determined under Division 5.1 of the EP&A Act.



JACOBS NSW SPATIAL - GIS MAP file: IA1108700_GIS_REF_F016_LandZoning_r2v4 | 8/11/2019

Legend

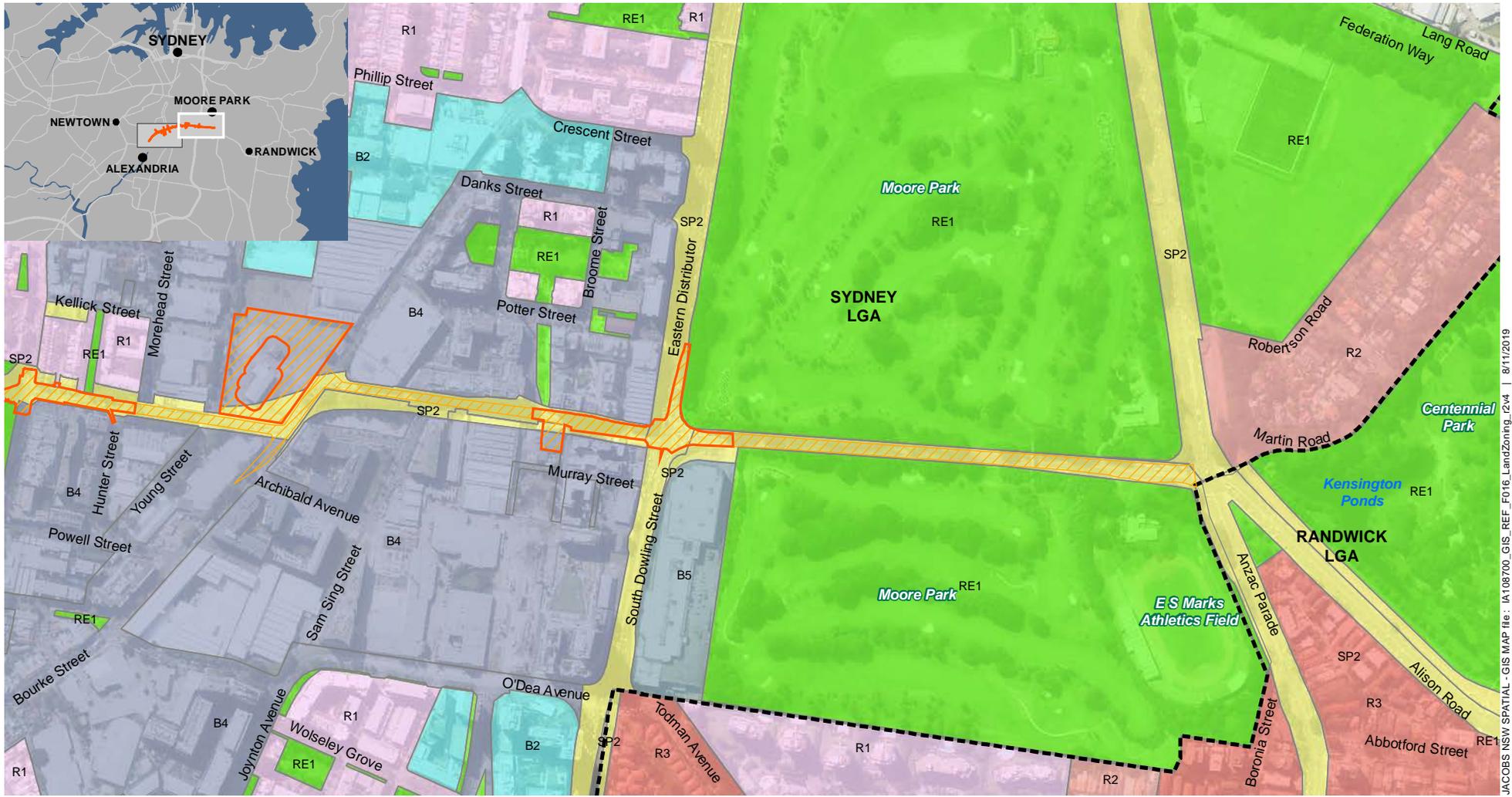
- | | | | |
|--|---|--|--|
|  Proposal area | LEP zoning (DPE 2017) |  B6 Enterprise corridor |  RE1 Public recreation |
|  Construction footprint |  B2 Local centre |  B7 Business park |  SP2 Infrastructure |
|  Railway line |  B4 Mixed use |  IN1 General industrial |  DM Deferred matter |
| |  B5 Business development |  R1 General residential |  R3 Medium density residential (LEP 1998) |



1:7,500 @ A4

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Figure 4-1a | City of Sydney and Randwick LEP zoning
Alexandria to Moore Park Stage 1



JACOBS NSW SPATIAL - GIS MAP file: IA1108700_GIS_REF_F016_LandZoning_12v4 | 8/11/2019

Legend

- Proposal area
- Construction footprint
- LGA boundary
- LEP zoning (DPE 2017)**
- B2 Local centre
- B4 Mixed use
- R1 General residential
- R2 Low density residential
- R3 Medium density residential
- RE1 Public recreation
- SP2 Infrastructure



1:7,500 @ A4

Figure 4-1b | City of Sydney and Randwick LEP zoning
Alexandria to Moore Park Stage 1

4.2 Other relevant NSW legislation

4.2.1 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides the legal framework for the management of air, noise, water and waste pollution. Under Part 3.2 of the POEO Act, the carrying out of scheduled development work as defined in Schedule 1 – road construction (meaning the construction, widening, or re-routing of roads) is relevant to the proposal.

Schedule 1 lists scheduled activities, including road construction on classified roads. The scheduled activities set out in Schedule 1 that are most relevant to Roads and Maritime include:

- Concrete works (clause 13)
- Dealing with certain types of waste. For road construction associated with widening, rerouting of existing roads, if the activities result in the existence of four or more traffic lanes for at least three kilometres in the metropolitan area, a licence would be required if more than 50,000 tonnes of materials are extracted or processed (Clause 35).

Based on the concept design and construction methodologies proposed (refer to **Section 3.3**) an Environment Protection Licence (EPL) would not be required for the proposal. This would be confirmed during detailed design.

4.2.2 Heritage Act 1977

The *Heritage Act 1977* aims to provide for the identification, registration and conservation of items of State heritage significance. Investigations of the proposal's potential to interact with or impact on items of heritage significance are documented in **Section 6.1**.

A Statement of Heritage Impact (SoHI) was completed for the proposal. The SoHI found that there are six heritage listed items and five unlisted potential heritage items within the proposal area and a further 19 listed heritage items next to or within view of the proposal (refer to **Section 6.2**).

As the proposal would involve temporary construction activities within the curtilage of the SHR listed 'Centennial Park, Moore Park, Queens Park', a section 57 notification would be submitted to, and approved by, the Heritage Council of NSW prior to construction of the proposal commencing

There are also several areas of historical archaeological potential that have been identified within the proposal area. Therefore, section 139 excavation permit covering the works located at ancillary Site 2 would be obtained from the NSW Heritage Division. An Archaeological Research Design (ARD) would be prepared to support the permit application. The ARD would outline archaeological management zoning for the proposal area. If intact remains associated with artefact bearing deposits are identified during the test excavations a section 140 permit for salvage excavations or archaeological monitoring and recording may be required prior to the work commencing.

Roads and Maritime have consulted with the City of Sydney on an ongoing basis, including ISEPP consultation for the ultimate concept design, refer to **Section 4.1.1**. The results of the consultation with the City of Sydney is summarised in **Section 5.4**.

If any item or material is uncovered during construction of the proposal that has potential heritage value or significance, Roads and Maritime would follow an established unexpected finds procedure. Under this procedure, all work at the location of the find would cease until the item or material can be investigated by a suitably qualified person, to establish whether the item or material is of heritage significance, and whether any further actions are warranted for its removal and/or protection.

4.2.3 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) is the primary legislation dealing with Aboriginal cultural heritage in NSW. Items of Aboriginal cultural heritage (Aboriginal objects) or Aboriginal places (declared under section 84) are protected and regulated under the NPW Act. Aboriginal objects are protected under section 86 of the Act. Under section 90(1) of the Act the Director-General may issue an Aboriginal heritage impact permit (AHIP) for an activity which would harm an Aboriginal object.

An assessment of the potential impacts on Aboriginal cultural heritage provided in the *Alexandria to Moore Park Project Aboriginal Archaeological Survey Report* (Aboriginal ASR (PACHCI Stage 2)) included as **Appendix H** and summarised in **Section 6.4**, notes that no previously recorded items under the Aboriginal Heritage Information Management system (AHIMS) are located within the proposal area. The assessment also concluded that the proposal area is of very low to low archaeological potential due to previous disturbances associated with historical road formation and local developments.

Roads and Maritime has undertaken consultation with the Aboriginal community in accordance with the requirements of the Office of Environment and Heritage (OEH) (2010) *Aboriginal cultural heritage consultation requirements for proponents 2010* and Roads and Maritime's *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI), refer further to **Section 5.3**.

4.2.4 Biodiversity Conservation Act 2016

The BC Act seeks to conserve biological diversity and promote ecologically sustainable development (ESD); to prevent extinction and promote recovery of threatened species, populations and ecological communities; and to protect areas of outstanding biodiversity value. The BC Act provides a listing of threatened species, populations and ecological communities, areas of outstanding biodiversity value, and key threatening processes.

Part 7 of the BC Act requires that the significance of the impact on threatened species, populations and endangered ecological communities listed under the BC Act or FM Act, are assessed using a five-part test. Where a significant impact is likely to occur, a SIS or Biodiversity Assessment Report (BAR) must be prepared in accordance with the Secretary's requirements.

In September 2015, a "strategic assessment" approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Roads and Maritime activities being assessed under Division 5.1 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, Roads and Maritime proposals assessed via a REF:

- Must address and consider potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the "avoid, minimise, mitigate and offset" hierarchy
- Do not require referral to the Federal Department of the Environment for these matters, even if the activity is likely to have a significant impact
- Must consider impacts to nationally listed threatened species, ecological communities and migratory species as part of the approval process under the strategic assessment. To assist with this, assessments are required in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment, 2013).

The biodiversity assessment (refer to **Section 6.9**) concluded that the proposal would not have a significant impact on threatened species or ecological communities or critical habitat and therefore a Species Impact Statement has not been prepared.

4.2.5 Land Acquisition (Just Terms Compensation) Act 1991

The proposal would require Roads and Maritime to fully and partially acquire strips of private owned land in the proposal area to accommodate the proposal. All land acquisitions would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*. Property requirements for the proposal are discussed in **Section 3.6**.

4.2.6 Water Management Act

The *Water Management Act 2000* (Water Management Act) controls the extraction of water, the use of water, the construction of infrastructure such as dams and weirs, and any activities in or near water sources in NSW. The *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* (Cooks River and Botany Bay Management Zone), apply to the proposal.

Licensing

Section 56 of the Water Management Act establishes access licences for the taking of water within a particular water management area. Under section 18(1) of the Water Management (General) Regulation 2011, Roads and Maritime, 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.

Activity approvals under Section 91 of the Water Management Act are required when a certain activity is likely to affect waterfront land or interfere with an aquifer. The proposal is not expected to impact on groundwater from geotechnical investigations. However, clause 38 of the *Water Management (General) Regulation 2011* provides that Roads and Maritime, as a roads authority, is exempt from requiring controlled activity approval for all controlled activities that it carries out in, on or under waterfront land.

Aquifer interference policy

In September 2012, the NSW Government released the *Aquifer Interference Policy* which aims to protect groundwater aquifers while balancing different water uses. The Water Management Act defines a number of aquifer interference activities including penetration of, interference with and obstruction of water flow within an aquifer. Taking and disposing water from an aquifer are also defined as being aquifer interference activities. Any activity that results in the reduction in the groundwater resource pool of three megalitres per year or more, or at an instantaneous rate of greater than five litres per second would require a groundwater extraction and aquifer interference license. The proposal is not anticipated to reduce the groundwater resource pool by three mega litres per year or at a rate of greater than five litres per seconds, and therefore a licence is not required.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (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 are considered in **Appendix I** and **Chapter 6** of the REF.

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.

Potential impacts to these biodiversity matters are also considered as part of chapter 6 of the REF and **Appendix I**.

Findings – matters of national environmental significance

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 the Environment and Energy under the EPBC Act.

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

The assessment of the proposal's impact on nationally listed threatened species, endangered ecological communities and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Chapter 6 of the REF describes the safeguards and management measures to be applied.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and is being carried out by or on behalf of a public authority. Under clause 94 of the ISEPP the proposal is permissible without consent. The proposal is not SSI or SSD. The proposal can be assessed under Division 5.1 of the EP&A Act.

Roads and Maritime is the determining authority for the proposal. This REF fulfils Roads and Maritime's obligation under clause 111 of the EP&A Act 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.

5. Consultation

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

5.1 Consultation strategy

A Stakeholder and Community Engagement Plan (SCEP) was prepared in July 2016 by Roads and Maritime to outline the communication and consultation process and to support strategic planning activities for the proposal. As stated in the SCEP, consultation objectives for the proposal are to:

- Provide regular and targeted information to build awareness about the proposal and likely impacts and benefits of the proposal
- Give clear direction to the community and stakeholders about whether we are providing information or seeking feedback so that expectations are clear at all stages of engagement
- Ensure community and stakeholder views are continuously fed into the project's development and used to understand and effectively assess impacts.

The key stakeholders identified as part of the SCEP included:

- NSW Premier
- State and Federal Ministers and Member of Parliament (MPs)
- Member for Heffron
- Government partners:
 - Transport for NSW
 - NSW Department of Planning and Environment
 - Centennial Park and Moore Park Trust
 - CSELR
 - New M5
- Government agencies:
 - Office of Environment and Heritage (OEH) - NSW
 - NSW Environment Protection Authority
 - Urban Growth NSW
 - Sydney Catchment Authority
 - Sydney Water
 - Centennial Park and Moore Park Trust
- Councils: City of Sydney Council
- Other:
 - Utilities (major telecoms, power and water utilities in the area)
 - Residents and businesses impacted by the project
 - Third party developers currently undertaking work in the area (Mirvac, Probuild, Lendlease)
 - Business chambers and groups
 - Public transport users
 - Road users

- Community, sporting, action and environmental groups
- Media
- Aboriginal community.

The following sections outline the consultation that has been carried out specifically for the proposal.

5.2 Community involvement

5.2.1 Display of the corridor strategy (December 2016)

Roads and Maritime sought feedback on the full corridor strategy during a two-week open consultation period from 30 November to 16 December 2016. The aim of the consultation was to introduce the proposal to the community and to obtain community feedback understanding of perceived local traffic related issues.

Community members were encouraged to provide their feedback, leave comments and make submissions at the information sessions or via mail, email or phone contact with the project team.

Comments were received until 16 December 2016. Roads and Maritime received 142 comments focusing on the following issues:

- Property and access
- Parking
- The environment
- Public transport
- Traffic including lane configurations and clearways.

The consultation carried out in December 2016 was documented in the *Alexandria to Moore Park Project Consultation Report* (Roads and Maritime, 2017). The report is publicly available and can be found on the Roads and Maritime website at the following link: <http://www.rms.nsw.gov.au/documents/projects/sydney-inner/alexandria-moore-park-connectivity-upgrade/alexandria-moore-park-community-consultation-report-2017-04.pdf>.

Where appropriate, concerns raised have been addressed in the concept design development.

5.2.2 Display of the preliminary concept design (June 2017)

Roads and Maritime sought feedback on the preliminary concept design of the ultimate concept design during a four-week open consultation period from 8 June 2017 to 7 July 2017. The aim of the consultation was to introduce the proposal to the community and to obtain community feedback understanding of local traffic related issues.

The consultation carried out in June 2017 was documented in the *Alexandria to Moore Park Project Consultation Report* (Roads and Maritime, 2018a). The report is publicly available and can be found on the Roads and Maritime website at the following link: <http://www.rms.nsw.gov.au/documents/projects/sydney-inner/alexandria-moore-park-connectivity-upgrade/a2mp-community-consultation-report-2017-10.pdf>.

Roads and Maritime received feedback from 231 people via the online mapping tool who posted 846 comments. Additionally, 28 emails were received from 24 individuals, two community groups and two government organisations. Comments generally focused on the following issues:

- Property and access
- Parking

- The environment
- Public transport
- Traffic including lane configurations
- Clearways.

The key findings as summarised in *Alexandria to Moore Park Project Consultation Report* (Roads and Maritime, 2018a) are:

- The comments on the western end of the corridor were predominantly about potential changes to parking, the proposal to introduce clearways and the subsequent impact on trade and staff
- Parking was a major concern for the community particularly in response to large scale development already underway
- Impact to property and queries about the scale of property impact was another main area of concern both to property owners and the general community
- The community also scrutinised the configuration and operation of the proposed Continuous Flow Intersection (CFI) at the eastern end of the corridor. Comments also questioned how effectively the proposed intersection would improve traffic congestion, as well as how it would provide for cyclists and pedestrians
- Pedestrian and cyclist facilities along the corridor were also a major source of commentary with many comments in favour of separated cycle paths, pedestrian bridges and extended cycle paths
- Comments raised during the first round of consultation about potentially increasing traffic volumes following the road widening were repeated as were comments about public transport improvements
- Comments increased about the need to preserve as many trees as possible.

Where appropriate, concerns raised have been addressed in the concept design (as presented in this REF), or will be addressed during detailed design.

5.3 Aboriginal community involvement

Roads and Maritime is committed to effective consultation with Aboriginal communities about its activities and the potential for impact on Aboriginal cultural heritage. Roads and Maritime’s *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) and OEH’s *NSW Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (2010) (Code of Practice) were developed to provide a consistent means of effective consultation with Aboriginal communities about activities which may impact on Aboriginal cultural heritage, and a consistent assessment process for Roads and Maritime activities across NSW. A summary of the four stages of the PACHCI procedure is provided in **Table 5-1**.

Table 5-1 Summary of PACHCI procedure

Stage	Description
Stage 1	Initial desktop assessment to identify whether the project is likely to harm Aboriginal cultural heritage
Stage 2	Further assessment and site survey with Aboriginal stakeholders to assess a project’s potential to harm Aboriginal cultural heritage and to identify whether formal Aboriginal community consultation and an ACHAR is required

Stage	Description
Stage 3	Where Stages 1 and 2 have led to the preliminary view that harm to Aboriginal objects or places will occur or is likely to occur, formal consultation and preparation of an ACHAR must be completed. This stage may also involve archaeological test excavations
Stage 4	Implementation of mitigation measures

Aboriginal community consultation carried out to date has involved:

A site survey with representatives from the La Perouse Local Aboriginal Land Council (LALC) and Metropolitan LALC on 9 November 2016 in accordance with Stage 2 of the PACHCI. The findings from the site survey have been documented in the Aboriginal ASR (PACHCI Stage 2) completed by Artefact Heritage (2019a), refer to **Appendix H**. Refer to **Section 6.3** and **Appendix H**.

5.4 ISEPP consultation

Clauses 13 to 16 of the State Environmental Planning Policy (Infrastructure) (ISEPP) specify the requirements for consultation with councils and other public authorities for infrastructure development carried out by or on behalf of a public authority. Consultation is required in relation to specified development or development that impacts on:

- Council related infrastructure or services (clause 13)
- Local heritage (clause 14)
- Flood liable land (clause 15)
- Public authorities other than councils (clause 16).

Appendix D contains an ISEPP consultation checklist that documents how ISEPP consultation requirements have been considered.

As the proposal has the potential to impact on the local road network, existing flooding regimes and local heritage items, consultation in accordance with ISEPP was carried out with City of Sydney Council on 29 September 2017 for the ultimate concept design. A letter was also sent to the NSW State Emergency Services (NSW SES) on the 13 November 2019, due to proposal being located on flood liable land (clause 15AA). The letters provided information on the proposal and requested input in terms of any issues or concerns. A summary of the response received from the City of Sydney Council received on 19 October 2017, and issues raised, is provided in **Table 5-3** NSW SES responded on the 19 November 2019, to advise that the proposal appears to have minimal risk to NSW SES response operations and request that they are notification where there are likely to be significant delays in the operation of the roads affected by the proposal.

A copy of the letters sent, and the response received are provided in **Appendix D**.

Table 5-2: Issues raised through ISEPP consultation for ultimate concept design

Issue raised to response to the ultimate concept design	Road and Maritime response for the proposal	REF cross reference (where applicable)
Traffic		
<p>Clause 13 (1) (b) of SEPP (Infrastructure) requires consultation with the council where the development “is likely to generate traffic to an extent that will strain the capacity of the road system in a local government area”.</p> <p>Roads and Maritime has not provided any traffic modelling data or outputs to the City of Sydney (or the broader stakeholder community). This in itself calls into question the validity of the project and the pre-REF consultation process. Our own assessment indicates that the development of the Alexandria to Moore Park Connector will generate significant traffic and strain the local roads next to the project corridor.</p> <p>The City of Sydney’s definition of mitigation measures will likely differ significantly to Roads and Maritime:</p> <ul style="list-style-type: none"> • Roads and Maritime generally focusses on mitigating delays to through traffic by augmenting road corridors through some or all of the following: intersection and road widening, banning parking in local centres, removal of trees, footpaths and cycling facilities • The City of Sydney has a different view on mitigation. In areas where the Alexandria to Moore Park Connector risks leading to additional traffic demand on the surface street network, the City of Sydney’s priority will be to protect the amenity of the local areas and avoid these impacts by constraining traffic flows and the associated noise, emissions and safety risks. <p>To this end the REF must provide sufficient detail of the likely impacts for communities affected by the proposal. The City of Sydney requests a copy of the peer reviewed traffic model looking at the impacts on local side streets, including all</p>	<p>Roads and Maritime has consulted with City of Sydney under ISEPP. The proposal has been developed in response to existing congestion and the proposal seeks to reduce congestion and improve travel times. Traffic modelling and assessment has been prepared and will be displayed as part of this REF.</p> <p>As described in Section 5.6, consultation with the City of Sydney Council will be ongoing.</p> <p>The <i>Alexandria to Moore Park Project Traffic and Transport Assessment</i> (Arup, 2019b) will be available to the City of Sydney as part of the display of the REF and is included as Appendix J.</p> <p>Noted</p>	<p>Section 6.1</p>

Issue raised to response to the ultimate concept design	Road and Maritime response for the proposal	REF cross reference (where applicable)
<p>proposed mitigation measures that will address the issues the traffic model highlights. Once the City of Sydney receives the above requested information, we will be able commence engagement with Roads and Maritime on this issue.</p>		
<p>Heritage</p>		
<p>As per the requirements of clause 14 of the Infrastructure SEPP a SoHI has been prepared and submitted for the Sydney of City Council to review. The City of Sydney provides the following comments on the SoHI for the ultimate concept design:</p>	-	-
<p>Waterloo Park and Oval:</p> <ul style="list-style-type: none"> The proponent is to minimise any impact on the existing significant trees surrounding the park The proponent is to minimise visual clutter associated with the operation of the road to protect the landscape setting of the heritage park. The form and building material of the new retaining walls must relate to the existing retaining walls (in particular those on the northern section of the park) and be blended naturally with the park landscaping The proponent must consult with the City of Sydney on the design of the retaining walls. 	<p>Noted.</p> <p>Roads and Maritime will consult with the City of Sydney during detailed design regarding the design of the proposal retaining walls and location of the wider footpaths and shared pathways.</p>	<p>Section 5.6</p>
<p>Substation at 336 George Street:</p> <ul style="list-style-type: none"> The substation at corner of George and McEvoy Street is listed under South Sydney LEP 1998, which is still a valid local listing (https://www.legislation.nsw.gov.au/#/view/EPI/1998/225/sch2). The substation is No. 174. The SoHI does not mention this heritage item in the assessment The proponent must update the SoHI to include an assessment of the substation and to provide advice on mitigation measures. 	<p>The substation at 336 George Street will no longer be impacted by the proposal. The SoHI has been updated to reflect this.</p>	<p>Section 6.2 and Appendix K</p>

Issue raised to response to the ultimate concept design	Road and Maritime response for the proposal	REF cross reference (where applicable)
<p>Water board site at 903-921 Bourke Street:</p> <ul style="list-style-type: none"> The proponent will demolish parts of the curtilage of the heritage site The proponent will demolish the footings of the former factory buildings and fences to facilitate the widening The proponent must update the SoHI to ensure the affected footings are recorded before and during the demolition process. 	<p>The proposal would no longer have a direct impact on this heritage item. However, a temporary ancillary Site (Site 4) within the heritage curtilage of the item would be established as part of proposal in areas already declared under a separate development application (DA 2019/428). The structures associated with this heritage item are outside of Site 4 footprint and would not be directly impacted or modified to accommodate the compound, as a 10 metre buffer has been established around Lot DP800705 which is the area where the structures are located.</p> <p>The SoHI has now been updated to include a mitigation measure for the protection of this item.</p>	<p>Section 6.2</p>
<p>Waterloo Conservation Area</p> <p>The City of Sydney notes that the proponent will protect or reinstate stone street kerbs.</p>	<p>Noted</p>	<p>Section 6.2</p>
<p>23, 25 and 27 Lachlan Street</p> <p>The City of Sydney considers that the recommended mitigation measures for the old buildings at no 23 and no 25-27 Lachlan Street are acceptable.</p>	<p>Noted. The buildings at 23 and no 25-27 Lachlan Street will no longer be impacted by the proposal. The SoHI has been updated to reflect this.</p>	<p>Section 6.2</p>
<p>Weatherboard buildings at 90 and 92 McEvoy Street, Alexandria</p> <ul style="list-style-type: none"> The two weatherboard buildings at 90 and 92 McEvoy Street, Alexandria were constructed as dwellings in the early twentieth century, c.1915. These weatherboard buildings were not included within the North Alexandria industrial heritage conservation area (C74) because they were not part of the inter-war and post-war industrial development of Alexandria 	<p>The weatherboard buildings at 90 and 92 McEvoy Street will no longer be impacted by the proposal. The SoHI has been updated to reflect this.</p>	<p>Section 6.2</p>

Issue raised to response to the ultimate concept design	Road and Maritime response for the proposal	REF cross reference (where applicable)
<ul style="list-style-type: none"> Section 3.10.2 of the Sydney Development Control Plan (DCP) 2012 has specific objectives and provisions for weatherboard buildings older than 50 years. Where permission is sought to demolish a weatherboard building, Section 3.10.2(5) of the DCP requires the applicant to demonstrate, with independent documentary evidence, that the building has little significance or that retention of the building is no longer viable for either structural or pest management reasons. The SoHI assessed these weatherboard cottages as having historical and aesthetic significance at a local level The SoHI for the ultimate concept design recommended comprehensive archival recording of the two weatherboard buildings at 90 and 92 McEvoy Street prior to demolition (p.108). The City of Sydney supports this as it is consistent with Section 3.9.1(7) of the DCP The SoHI for the ultimate concept design recommended a Heritage Interpretation Strategy (to include the two weatherboard buildings at 90 and 92 McEvoy Street) be incorporated into future designs and planning (p.108). “Opportunities for interpretive displays in appropriate locations along the proposal design route would be explored.” The City of Sydney supports this as it is consistent with Section 3.9.1(7) of the DCP Notwithstanding the above, the City of Sydney recommends that consideration be given to the salvage and relocation of whole buildings if these buildings are in good physical condition and could be re-used elsewhere. They do not have to be relocated within the City of Sydney LGA. 		
<p>131 Wyndham Street, Alexandria</p> <ul style="list-style-type: none"> The building (single-storey rendered brick residence with attached workshop) at 131 Wyndham Street, Alexandria was constructed in the late nineteenth to early twentieth century. It is not located within any heritage conservation area 	<p>Noted. The buildings at 131 Wyndham Street, Alexandria will no longer be impacted by the proposal. The SoHI has been updated to reflect this.</p>	<p>Section 6.2</p>

Issue raised to response to the ultimate concept design	Road and Maritime response for the proposal	REF cross reference (where applicable)
<ul style="list-style-type: none"> Where permission is sought to demolish a building older than 50 years old, Section 3.9.1(2) of the DCP requires a heritage impact statement to assess the heritage significance of the building and the impact the proposed demolition has on the building and its setting. The SoHI assessed the building as having historical and aesthetic significance at a local level The SoHI recommended comprehensive archival recording of the building at 131 Wyndham Street prior to demolition (p.108). The City of Sydney supports this recommendation The SoHI recommended a Heritage Interpretation Strategy (to include 131 Wyndham Street) be incorporated into future designs and planning (p.108). The City of Sydney supports this recommendation. 		
<p>Protection of heritage item in the vicinity: 32-42 McCauley Street, Alexandria</p> <ul style="list-style-type: none"> The brick warehouse building at 32-42 McCauley Street, Alexandria is a heritage item listed in Schedule 5 of the Sydney Local Environmental Plan 2012 (Item No. I21) The SoHI recommended Temporary Protection Zones (TPZ) <i>“TPZs will be required in all areas where works about a heritage item to protect the item, or within a heritage item, where only part of that item is being impacted, to protect the remainder of the item”</i> (p.108) The proponent must conduct consultations with the stockholders of the neighbouring heritage site, record and monitor the conditions of the heritage building and take suitable measures to control and minimise any risks to the heritage fabric during demolition and construction. The proponent must include these protection measures in the construction management and protection plan. 	<p>The warehouse building at 32-42 McCauley Street, Alexandria will no longer be impacted by the proposal. The SoHI has been updated to reflect this.</p>	<p>Section 6.2</p>
<p>Protection of heritage item in the vicinity: 20-30 Maddox Street, Alexandria</p>	<p>The brick industrial building (“Frank G Spurway”) at 20-30 Maddox Street, Alexandria will no longer be</p>	<p>Section 6.2</p>

Issue raised to response to the ultimate concept design	Road and Maritime response for the proposal	REF cross reference (where applicable)
<ul style="list-style-type: none"> The brick industrial building (“Frank G Spurway”) at 20-30 Maddox Street, Alexandria is a heritage item listed in Schedule 5 of the Sydney Local Environmental Plan 2012 (Item No. I20). It lies just outside of the proposal area at the intersection of Euston Road and Maddox Street The SoHI recommends TPZ <i>“TPZs will be required in all areas where works about a heritage item to protect the item, or within a heritage item, where only part of that item is being impacted, to protect the remainder of the item”</i> (p.108) The proponent’s works will create vibration impacts which could damage these brick buildings. The proponent must include these protection measures in the construction management and protection plan. 	<p>impacted by the proposal. The SoHI has been updated to reflect this.</p>	
<p>Potential archaeology: Remains of Chinese Market Gardens</p> <ul style="list-style-type: none"> <i>“A survey plan of the area completed in the late 19th century shows a Chinese market garden occupied land between what is now Botany Road and McCauley Street. Potential remains of the site may be impacted by the proposal”</i> (p.137) The proponent must stop work immediately and contact Heritage Council of NSW if relics are discovered, in accordance with section 146 of the <i>Heritage Act 1977</i>. The proponent must also inform the City of Sydney. 	<p>The SoHI has now been updated to include the requirement to stop work immediately and contact Roads and Maritime, who would contact Heritage Council of NSW and the City of Sydney if relics are discovered, in accordance with section 146 of the <i>Heritage Act 1977</i>.</p>	<p>Section 6.2</p>
<p>Moore Park Conservation Area</p> <p>The works extend into Moore Park Conservation Area. The Statement of Significance for the Moore Park Conservation Area in the Heritage Inventory report includes the following paragraph:</p> <p>Moore Park is of aesthetic significance for its large expanse of open space and important tree plantings, as well as numerous elements including the entry gates and five memorial fountains. The majestic fig trees, which are set off the expansive fields, or line the main roadways, including Anzac Parade, Federation Way, Cleveland Street, Lang Road,</p>	<p>Moore Park is a State Heritage item under the care and consultation of the Centennial and Moore Park Trust. Roads and Maritime will continue to consult with the Trust and OEH and Heritage branch in regard to the management of this heritage item.</p> <p>No trees would be impact by the proposal within the Moore Park Conservation Area.</p>	<p>Section 4.2.9 and Section 6.2</p>

Issue raised to response to the ultimate concept design	Road and Maritime response for the proposal	REF cross reference (where applicable)
<p>Dacey Avenue, South Dowling Street and Moore Park Road, are significant landscape elements.</p> <p>Whilst the recommended mitigated measures in the SoHI are generally acceptable for the Moore Park Conservation Area, please note the following comments:</p> <ol style="list-style-type: none"> 1. Removal of trees – the removal of any trees is not supported by the City of Sydney. The trees are an important part of the character of Moore Park. In the occurrence of any tree removal, the proponent must consult with the City of Sydney to agree mitigation measures 2. Opportunities for retaining or re-instating items – The proponent must retain and conserve all heritage items listed within the SoHI, if they cannot be retained in-situ they be relocated to appropriate locations. 		
Flood liability		
<p>The proposal is located within the Alexandra Canal drainage catchment. The City of Sydney has completed flood studies for this catchment.</p> <p>The flood studies indicate that a number of locations within the corridor are flood affected in one per cent Annual Exceedance Probability (AEP) flood. The flood risk for all users including drivers and property owners should be reduced, desirably to safe levels where practicable.</p> <p>This should be supported by Roads and Maritime submitting a flood report on pre and post development and showing no changes to flood levels for the 1 in 100 year and probable maximum flood (PMF) design floods. This flood study will determine flood affects that the Roads and Maritime will have to mitigate against. Once Roads and Maritime provides the information requested above the City of Sydney will consider consultation to have commenced on this issue.</p>	<p>The <i>Alexandria to Moore Park Stage 1 Project Flooding Working Paper</i> (Arup, 2019c) will be available to the City of Sydney as part of the display of the REF.</p>	<p>Section 6.5 and Appendix L</p>

5.5 Government agency and stakeholder involvement

Roads and Maritime has consulted on an ongoing basis with key State and local government agencies, utility service owners as well as a number of businesses in the proposal area. This consultation was designed to ensure issues and concerns were understood, documented and addressed, and that stakeholders had an opportunity to discuss any aspect of the proposed upgrade. Consultation has included phone calls, emails, letters and face-to-face meetings.

The summary of consultation and any issues that have been raised as a result of consultation with these agencies and stakeholders are outlined below in **Table 5-3**.

Table 5-3: Issues raised through stakeholder consultation for the ultimate concept design

Agency/stakeholder	Consultation summary	Roads and Maritime response	Relevant REF section
City of Sydney	<p>Various briefings have been held over the course of the proposal and City of Sydney have attended various project value management and value engineering sessions.</p> <p>Roads and Maritime have also consulted with the City of Sydney as part of the ISEPP consultation and a formal submission was provided, refer further to Section 5.4.</p> <p>The City of Sydney objects to the proposal.</p>	<p>Key proposal (Stage 1) changes responding to City of Sydney concerns between the draft and final concept designs include:</p> <ul style="list-style-type: none"> • Narrowing of the corridor by removal of central medians in order to reduce property impacts • Introduction of right turn restrictions at local side streets to improve traffic flow and safety and reduce through traffic in these side streets • Introduction of 50 kilometre per hour speed limit • Planting of street trees near the kerb. 	Section 5.4 and Section 2.4
Randwick City Council	<p>Various briefings have been held over the course of the proposal. Randwick is at the eastern extremity of the project and main issues concern the detailed design of the Anzac Parade intersection and the shared paths.</p>	<p>The project team would ensure that Randwick City Council is closely consulted during the ultimate detailed design stage.</p>	Section 5.6
Centennial and Moore Park Trust	<p>Regular briefings have been led over the course of the proposal. Key issues are the proposal's impact on Moore Park, including on trees and on land, and the need for the project to be consistent with the Moore Park South Master Plan.</p>	<p>Roads and Maritime have considered the Moore Park South Master Plan as part of the concept design.</p>	Section 2.4 and 3.2
CSELR	<p>Regular briefings have been held over the course of the proposal. Key issue is to be cognisant of the need for the proposal to take account of the light rail operations.</p>	<p>The proposal would not impact on the CSELR.</p>	Section 3.3 and Section 6.1
New M5	<p>Regular briefings have been held over the course of the project. Key issue is the need to integrate with the New M5 design at Euston Road and Maddox Street.</p>	<p>The final ultimate concept design integrates with the New M5 design at Euston Road and Maddox Street.</p>	Section 3.3 and Section 6.1

Agency/stake holder	Consultation summary	Roads and Maritime response	Relevant REF section
Urban Growth	Briefings have been held as required throughout the proposal. Key issue is for the project team to be aware of proposed Urban Growth developments in the area.	Final concept design integrates with proposed Urban Growth initiatives in the area. During the detailed design stage Roads and Maritime would continue to understand the planning arrangements for the Waterloo Precinct site.	Section 3.6.2
Heritage Council	Briefings have been held as required throughout the project. Key issues are changes at Anzac Parade, including to Tay Reserve, and protection of items of heritage importance along the corridor.	Heritage Council will continue to be consulted as detailed design of the proposal is progressed in relation to items of heritage importance along the proposal.	Section 5.6
Ausgrid	<p>Meetings with Ausgrid were held on 30 November 2016, 19 January, 22 March, 19 April, 5 May, 10 August, 22 August and 30 August 2017. The main items discussed included:</p> <ul style="list-style-type: none"> • Ausgrid owns two 132kV transmission routes that run beneath Euston Road and McEvoy Street within the project extents. One route (9SA & 92P) runs within the Alexandria to Moore Park corridor from Maddox Street to Loveridge Street. The other route (260 & 261) runs from Maddox Street to George Street. • The relocation and treatment of critical infrastructure including a 132kV transmission cables and associated joint bays within the proposal area • Opportunities for undergrounding overhead assets in the Lachlan Street corridor to be considered • Issues surrounding CSELR utility pits and other utilities • Utility investigations including borehole test and Ground penetrating radar (GPR) • Potential clashes with drainage pipes also noted 	Discussions with Ausgrid have led to the relocation of the existing 132kV (9SA & 92P) transmission route aligning with the relocation works would be completed as part of the New M5 project.	Section 3.5.

Agency/stake holder	Consultation summary	Roads and Maritime response	Relevant REF section
	<ul style="list-style-type: none"> Affected assets would be split into design package for treatment by Ausgrid. 		
Telstra	<p>A meeting with Telstra was held at their offices on the 8 December 2017. Telstra advised that they have sufficient duct capacity in the proposal area. Telstra agreed with the proposal and there were no major issues.</p>	Noted	-
Optus	<p>A meeting with Optus at the Arup office on the 13 December 2016. The main items discussed included:</p> <ul style="list-style-type: none"> Optus noted that their preference would be to protect assets with concrete or steel protections and to undertake the utility works prior to the civil works Optus indicated that a sub-marine communication network is maintained by Optus through the proposal area 	The plans provided by Optus indicate that the proposal would not impact on the network.	-
Sydney Water	<p>Meetings with Sydney Water were held on the 18 January and 26 June 2017. The main items discussed included:</p> <ul style="list-style-type: none"> Concept design to be revised to allow sufficient access for a single rigid truck to the Sydney Water Waterloo pumping station. Sydney Water provided the frequency of use and size of the vehicle required to access the pumping station Retention or relocation of a critical 900 mm trunk main on South Dowling Street. Significant planning for a diversion would be required, with restrictions on the time of year that this could happen The 500 mm trunk main on Euston Road/McEvoy Street Sydney Water to provide comments of proposed treatment of Sydney Water assets 	Options have been explored which both retain and relocate the 900 mm trunk main in the eastern verge of South Dowling Street.	Section 3.4 and Section 5.4

Agency/stake holder	Consultation summary	Roads and Maritime response	Relevant REF section
	<ul style="list-style-type: none"> Roads and Maritime have also consulted with Sydney Water as part of the ISEPP consultation and a formal submission was provided, refer further to Section 5.4. 		
Jemena	<p>A meeting with Jemena at the Arup office on the 17 March 2017. The main items discussed included:</p> <ul style="list-style-type: none"> Potholing will carry out to determine whether the existing high pressure gas main at the intersection of Maddox Street and Euston Road would be impacted by proposal If the proposal impacts the disused gas mains, it would have to be replaced. Jemena will advise if the isolated gas mains may be reused, and agreed to confirm the abandonment/retention of this main. 	The proposal would not impact the high pressure gas main at Maddox Street.	Section 3.2 and Section 3.5

5.6 Ongoing stakeholder engagement

Since the ultimate concept design was displaced in 2017, Roads and Maritime have been carrying out further stakeholder engagement including with City of Sydney including briefings in 2019. Since this time major changes have been made to the ultimate concept design include a decision to stage it and a major reduction in the number and extent of intersection works being considered. A 50 kilometre per hour speed limit has also been introduced along the corridor in response to City of Sydney representations, with a review proposed after one year of operation.

In addition more detailed planning has been undertaken on the urban renewal precincts, and the broader integrated transport strategy for the Alexandria to Moore Park area.

The subsequent feedback on the staged design (the proposal) from the City of Sydney officers is outlined in Table 5-4.

Table 5-4 Subsequent feedback on the staged design (the proposal)

Issue / comment	Roads and Maritime comment	REF cross reference (where applicable)
Better landscaping and more street tree planting required at intersections including at South Dowling Street and Lachlan Street.	Roads and Maritime will continue to work with City of Sydney on street tree plantings and land scaping treatments.	Section 6.6
Corner truncations should be minimal to reflect the urban renewal nature of the corridor.	This will be reviewed in detail design phase.	
Question the need for any changes along the corridor, including clearways, given its changing nature	Noted.	-
A 40 kilometre per hour speed limit should be implemented along the corridor	A 50 kilometre per hour speed limit has recently been put in place along the corridor and this will be reviewed over the next year.	Section 5.2.3

5.7 Future consultation

Information sessions would be held during the REF public display period. Details of these information dates and locations would be advertised prior to the events and issued in a Roads and Maritime project update.

The following consultation would be ongoing:

- Current proposal information would be provided through the website: <https://www.rms.nsw.gov.au/projects/sydney-inner/alexandria-moore-park/>

- Meetings with City of Sydney Council, utility providers and other government agencies
- Updates to the immediately affected community during the detailed design phase and construction phases
- Consultation with community stakeholders to help manage impacts during construction
- Follow-up meetings to discuss and agree access arrangements with directly affected landowners prior to and during construction
- Media releases and project advertisements in local media
- Should the proposal proceed, the construction contractor would develop a Community and Stakeholder Involvement Plan to keep residents and road users up to date about construction progress. This would include:
 - Notifying residents when work is proposed to start
 - Notifying residents of night work
 - Notifying residents of access issues
- Any changes to the access arrangements of Sydney Water assets would be made in consultation with Sydney Water.

6. Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of:

- Potential impacts on matters of national environmental significance under the EPBC Act
- The factors specified in the guidelines *Is an EIS required?* (DUAP 1995/1996) as required under clause 228(1) of the Environmental Planning and Assessment Regulation 2000 and the *Roads and Related Facilities EIS Guideline (DUAP 1996)*. The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in **Appendix I**.

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Traffic and transport

The potential impacts of the proposal on traffic and transport are assessed in the *Alexandria to Moore Park Project Traffic and Transport Assessment* (Arup, 2019b) provided in **Appendix J**. The potential impacts of the proposal on parking are assessed in the *Alexandria to Moore Project Parking Assessment* (Jacobs, 2019a) refer to **Appendix C**. The potential impacts, and safeguards to mitigate them, are summarised in this section.

6.1.1 Traffic and transport methodology

The methodology used for the traffic and transport assessment completed by Arup (2019) included:

- A review of the existing traffic and transport conditions in the proposal area including the local road network, traffic flows, public transport services, pedestrian and cycle facilities, road safety and an assessment against the movement and place framework
- Modelling of existing and forecast traffic scenarios at 2021 and 2031 to evaluate impacts
- An assessment of the impacts of the construction and operation of the proposal on existing road, pedestrian, cycling and public transport infrastructure, road safety, movement and place
- The identification of mitigation measures required to minimise these impacts.

Study area

The study area for the traffic and transport assessment includes the east-west road corridor formed by Euston Road, McEvoy Street, Lachlan Street and Dacey Avenue from Maddox Street in Alexandria to Anzac Parade in Centennial Park as shown in **Figure 1-2**.

Traffic data

Data representing average daily traffic profiles within the local road network were derived from traffic surveys carried out between 23 February 2016 and 3 May 2016 for the Moore Park and Alexandria areas respectively. Intersection turning movement counts (TMC) were carried out in 2014, 2015, 2016 and 2017. Long-term, unattended tube count traffic surveys were also carried out on Euston Road, McEvoy Street, Bourke Street, Lachlan Street, South Dowling Street and Dacey Avenue during the period between 1st and 24th February 2017.

Traffic and transport modelling

The traffic and transport modelling for the proposal was based on a 2014 version of Roads and Maritime's Sydney Traffic Forecasting Model (STFM), originally developed by WSP. The STFM is a link-based traffic assignment model that covers the entire Sydney Greater Metropolitan Area and was used to supply estimates of future changes in traffic patterns and demands in the study area.

The methodology used for modelling included:

- Development of a micro simulation traffic model of existing traffic conditions using the microscopic multi-modal traffic flow simulation software package (VISSIM) (version 8.00-04), calibrated and validated according to the principles outlined in the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013)
- Development of future year (2021 and 2031) forecasts for the proposal to understand the operational impacts of the proposal
- The use of the STFM to understand future traffic demands in 2021 and 2031 with and without the proposal.

Level of service

The operational performance of intersections within the proposal area has been assessed using the standard Level of Service (LoS) measure defined by Roads and Maritime within the *Guide to Traffic Generating Developments* (RTA, 2002). These are ranked from LoS 'A' representing the best performance to LoS 'F' representing the worst (see **Table 6-1**). The LoS measure was applied to the current performance of the intersections (2016) as well as the forecast performance of the intersections for future years (2021 and 2031) based on an assessment of performance without the proposal and with the proposal in operation.

Table 6-1 Level of service criteria for intersections

LoS	Average delay per vehicle (sec)	Traffic signals, roundabouts	Give way & stop signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; incidents would cause excessive delays at signals	At capacity, requires other control mode
F	>70	Over capacity; unstable operation	Over capacity; unstable operation

Source: Guide to Traffic Generating Developments (RTA, 2002)

Construction impacts

The impacts related to construction of the proposal were assessed considering the potential impacts of construction vehicles at intersections, construction vehicle noise as well as potential impacts to public transport and cycle infrastructure provision.

Operational impacts

The impacts related to operation of the proposal were assessed based on traffic modelling for the following assessment scenarios:

- 2016 (Base year)
- 2021 and 2031 'without the proposal'
- 2021 and 2031 'with the proposal'.

Each scenario includes a series of assumptions regarding future transport and land use across the network. Most relevant to the study area, the model includes assumptions regarding the delivery of the planned motorway network in the area, which were consistent with NSW Government planning at the time of initial project development. The 2021 scenarios consider New M5 Stage 1 and 2. The 2031 scenarios consider the following network projects:

- New M5 Stage 1 and 2
- New M5 Stage 3
- Sydney Harbour Gateway
- Western Harbour Tunnel
- Beaches Link
- M6 Stage 1.

Assessment of road safety and place and movement functions

Road safety

An analysis of existing road safety trends was carried out using crash statistics over a five year period from July 2013 to June 2018, provided by Roads and Maritime. Minor crashes, in which driver's exchange details, which are not required to be recorded, are not included in the crash data. Future changes in road safety are qualified based on an understanding of forecast change in road operating conditions and traffic management of the corridor.

Place

The traffic and transport assessment included a review of how the proposal relates to the local places alongside the proposal corridor. This included consideration of available planning documentation to understand future developments and how the corridor relates to existing and future centres (refer to **Section 6.13.2** for further details). A review was also undertaken to establish how the proposal impacts on existing transport facilities (eg bus stops, bicycle parking) and how future proposal road operations (eg traffic volumes, speed) impact place.

Movement

The traffic and transport assessment also considered how the proposal would impact on the movement of:

- Pedestrians – included consideration of connectivity and footpath crowding
- Cyclists – focused on cycle facility and traffic signals or other features that require cyclists to stop
- Public transport – reviewed travel time and reliability
- General traffic – considered travel speeds and intersection delay.

6.1.2 Parking assessment methodology

An assessment of impacts to on-street and off-street parking along the proposal corridor from the proposal was completed by Jacobs (2019a). This included the following:

- A review of the existing parking restrictions in the proposal area
- An assessment of parking capacity and utilisation along the proposal corridor and side streets
- An assessment of changes in existing parking restrictions and an assessment of impacts to capacity, which also considered of utilisation and availability of parking on surrounding side-streets to accommodate vehicles. Parking availability was identified in the next side street in the direction of travel along Euston Road and McEvoy Street, minus the existing demand for parking. Gaps and surplus capacity in the local side streets was identified.

Parking survey

Parking surveys were carried out by Matrix Traffic and Transport Data (Matrix) over a two-day period which included one weekday – Thursday 24 August 2017 and one day of the weekend – Saturday 26 August 2017. Weekday and weekend parking data was collected between 6:00am and 7:00pm). An updated survey of the existing parking conditions was completed by Jacobs on the 21 August 2019 to identify any changes in existing conditions. The parking surveys were not carried out during holiday periods. Parking surveys focused on retail areas along the proposal.

The parking survey included:

- A parking inventory along the proposal corridor and side streets adjoining the proposal to identify capacity and existing parking restrictions
- A drive through survey to check that no illegal parking was occurring
- A thirty-minute duration of stay survey and a thirty-minute parking occupancy survey to establish utilisation.

6.1.3 Existing environment

The proposal area is principally identified as a movement corridor which provides for the movement of general traffic, freight and buses in an east-west direction. In the future there would be new precincts developed along the corridor.

Existing road network

The existing road network and infrastructure is described in **Section 2.2** and **Appendix B**, then summarised below.

Euston Road/McEvoy Street corridor

Located along Euston Road and McEvoy Street between Maddox Street and Bourke Street, both roads have a 50 kilometre per hour speed limit, which was implemented along the corridor in November 2019. Only the most eastern 260 metres of Euston Road is contained within the proposal area while all of McEvoy Street is included. The Euston Road/McEvoy Street corridor currently has width for two traffic lanes in each direction along its extent, however kerbside parking in both directions at times reduces the available road space. The Euston Road/McEvoy Street corridor passes through a series of intersections controlled by traffic signals and intersections with no traffic signals governed by give way rules.

Bourke Street/Lachlan Street/South Dowling Street corridor

Bourke Street is located at the eastern extent of McEvoy Street and is a classified arterial road between McEvoy Street and Lachlan Street but is a classified regional road for the remainder of its length. Bourke Street is a major north-south route for access into the CBD fringe suburb of Surry Hills and the CBD area and is comprised of two lanes in each direction. Bourke Street has a 50 kilometre per hour speed limit and has no road shoulders. Around 275 metres of Bourke Street is located within the proposal area including the intersections with McEvoy Street and Lachlan Street which are controlled by traffic signals. Lachlan Street is located wholly within the proposal area, is classified as an arterial road and has a 50 kilometre per hour speed limit. Two traffic lanes are predominantly available westbound through Lachlan Street except for between Gadigal Avenue and South Dowling Street where a single lane is available. Two traffic lanes are available for the majority of Lachlan Street in an eastbound direction, however for about 260 metres between Bourke Street and Gadigal Avenue only a single eastbound lane is provided before the corridor returns to two traffic lanes prior to reaching the South Dowling Street intersection. South Dowling Street is a major north-south route which runs parallel to the M1 Eastern Distributor for much of its length. South Dowling is comprised of a four-lane (two in each direction) divided dual carriageway, with additional turning bays for intersections as required. The northern leg of South Dowling Street includes a right hand turning lane and left turning lanes, while the southern leg South Dowling Street includes two right turning lanes.

The corridor passes through a series of intersections controlled by traffic signals and intersections with no traffic signals governed by give way rules. In both the east and westbound directions, traffic uses Bourke Street to travel through the corridor, this requires traffic in both directions to take left and right turns through two staggered intersections controlled by traffic signals.

Dacey Avenue corridor

Dacey Avenue is located wholly within the proposal area and is classified as an arterial road that services the suburb of Alexandria and provides east west access between the M1 Motorway, Anzac Parade and Alison Road. Dacey Avenue is around 650 metres long and is comprised of two lanes in both directions. Dacey Avenue has a 50 kilometre per hour speed limit and is generally undivided except near the major intersections at either end of the road extent where there are raised traffic islands separating eastbound and westbound traffic.

Existing traffic profiles and composition

Daily traffic profiles

The average daily traffic volumes for profiles for each segment of the corridor as well as for key interfacing roads are provide in **Table 6-2**.

Table 6-2 Average daily traffic profiles at the survey locations (2017)

Segment	Vehicles per day (VPD)
Alexandria to Moore Park Corridor	
Maddox Street to Fountain Street	25,900
Fountain Street to Botany Road	26,900
Botany Road to Elizabeth Street	18,400
Elizabeth Street to South Dowling Street	16,200

Segment	Vehicles per day (VPD)
South Dowling Street to Anzac Parade	32,600
Primary interfacing corridors	
Anzac Parade (south of Dacey Avenue)	41,300
Alison Road (east of Anzac Parade)	50,700
South Dowling Street (north of Dacey Avenue)	47,200
Botany Road (south of McEvoy Street)	27,300

Heavy vehicles

Dacey Avenue is the only portion of the corridor that is permitted for use by 25/26 metre B-Doubles, and both general mass limit (GML) and higher mass limit (HML) vehicles. The remainder of the corridor is only permitted for use by HML short-combination (up to 19 metres) vehicles.

Heavy vehicle traffic data collected in February 2017 is summarised in **Table 6-3**. The data suggests that east west freight volumes are generally modest (average percentage along the proposal ranges from about four per cent to nine per cent) along the corridor with light rigid making up the majority of the heavy vehicles (68 to 74 per cent).

Table 6-3 Heavy vehicle composition within the study area

Segment		Light rigid		Medium & heavy rigid		Articulated		Total VPD
From	To	VPD	%HVs	VPD	%HVs	VPD	%HVs	
Maddox Street	Fountain Street	1,560	68	600	26	150	6	2,300
Fountain Street	Botany Road	1,380	70	480	25	100	5	1,960
Botany Road	Elizabeth Street	780	74	123	22	50	4	1,060
Elizabeth Street	South Dowling Street	610	71	180	21	70	9	860
South Dowling Street	Anzac Parade	1,480	74	380	19	130	7	2,000

Traffic distribution

The study area provides for the movement of general traffic, freight and buses in an east-west direction between the corridors of Anzac Parade/Alison Road, South Dowling Street/M1 Eastern Distributor, Botany Road and Princes Highway.

The routes serve a range of different functions within the transport network, depending on location. Broadly, it is considered that:

- The proposal area facilitates cross-regional east-west connectivity between the Inner West, Inner South and Eastern Suburbs. At the east the corridor's key functions relate to connectivity between the large Eastern Suburbs catchment and the motorway network (M1 Eastern Distributor). Whilst at the west end of corridor, the key function relates to last-mile connectivity for longer range trips between the Princes Highway catchment to the south and the corridor study area and surrounds
- The interfacing north-south corridors accommodate substantial movement accessing the Harbour CBD, Sydney Harbour crossings and Sydney Airport radially via each Botany Road, South Dowling Street, M1 Eastern Distributor and Anzac Parade.

Public transport

Bus network

The existing public transport facilities within the study area include buses and one train line. As described in **Section 2.2.1**, there are number of bus routes that pass through the study area. The McEvoy Street corridor is less used by bus travel due to the proximity of the Green Square Train Station servicing the T2 Airport Line. There is no bus route that travels along the full extent east-west extent of the proposal area.

Rail network

Green Square is located at the O'Riordan Street/Bourke Street/Botany Road intersection, about 500 metres south-east of the Botany Road/McEvoy Street intersection and services the T2 Airport, Inner West and South Lines travelling from the City to Macarthur and Macarthur to the City via the Airport or Sydenham. During the morning peak, 10 trains depart per hour towards the City from Green Square and during the afternoon peak, eight trains arrive per hour at Green Square from the City. The proximity of the Green Square Train Station impacts the frequency and volume of buses through the western end of the proposal area.

Active transport (pedestrian and cycling)

As described in **Section 2.2.1**, the proposal area currently has a range of cycle and pedestrian facilities, refer to **Figure 2-3**. With pedestrian footpaths along almost all roads, those travelling by foot are well served by connections although paths are narrow at some pinch points. Cycle facilities are available next to or across the proposal area but not along the proposal other than as part of general on road traffic.

Existing aspects of place

The corridor lies within several kilometres of the Sydney CBD, strategic growth centres and local centres in the Sydney region, each of which represent important destinations within the broader urban setting that have high place value. These places require movement of people and goods along and across the proposal corridor by all transport modes but are not directly accessed from the proposal. Overall the abutting land uses are considered to generate relatively low place functions along the corridor, with the exception of active frontages between Botany Road and Fountain Street.

Existing road network performance

Existing conditions along the corridor indicate some areas of congestion during the peak periods in particular at the locations of Lachlan Street, Bourke Street, Botany Road, South Dowling Street and Anzac Parade/Alison Road intersection.

Travel times

Travel time surveys carried in March and April 2017 indicate that the average vehicle speed ratio (VSR) (that is the ratio of actual speed to posted speed limit) for end-to-end trips were generally below 30 per cent (18 kilometres per hour) during the morning and afternoon peaks for customers travelling in both directions. This equates to an average travel time along the route of 16 minutes.

The data in **Table 6-4**, indicates the primary existing performance issues for general traffic are a result of key intersections along the corridor operating at capacity.

Table 6-4 Peak period vehicle speed ratio (VSR) performance

Segment		2016 AM Peak VSR (%)		2016 PM Peak VSR (%)	
Western extent	Eastern extent	Eastbound	Westbound	Eastbound	Westbound
Maddox Street	Fountain Street	43	29	14	37
Fountain Street	Botany Road	14	28	11	28
Botany Road	Elizabeth Street	36	18	7	7
Elizabeth Street	South Dowling Street	7	63	5	61
South Dowling Street	Anzac Parade	35	63	16	65
Full corridor		16	32	8	24

Intersection performance

Existing intersection LoS for key intersections within the proposal area were derived from intersection turning movement counts for the base year (2016) and are shown in **Table 6-5**.

Table 6-5 Existing intersection performance

Intersecting road	AM peak		PM peak	
	Average delay (sec)	LoS	Average delay (sec)	LoS
Maddox Street	16	B	28	B
Fountain Street	22	B	52	D
Wyndham Street	52	D	42	D
Botany Road	56	E	94	F
Elizabeth Street	33	C	73	F
South Dowling Street	88	F	77	F

Table 6-5 shows that under existing condition Maddox Street operates positively (LoS B) with spare capacity in both the morning and afternoon peak periods. Fountain Street operates positively (LoS B) in the morning peak and near capacity (LoS D) in the afternoon peak. The following intersecting roads currently operate at capacity (LoS F) or near capacity (LoS D) during peak periods:

- Wyndahm Street
- Botany Road
- Elizabeth Street
- South Dowling Street.

Existing road safety trends

A review of crash history was carried out for the study area and includes the Alexandria to Moore Park corridor only from the Maddox Street/Euston Road intersection and extending east to the Anzac Parade/Alison Road/Dacey Avenue intersection. Crash data for the period July 2013 to June 2018 show that there were 320 crashes for this period. These comprised of one fatality, 53 serious injury crashes, 70 moderate injury crashes, 67 minor/other injury crashes, 129 non-casualty crashes, and 23 further crashes involving pedestrians. Key crash types identified across the corridor were crashes involving vehicles from:

- The same direction (40 per cent)
- Adjacent directions(17 per cent)
- Opposite directions (17 per cent)
- The rear-end (26 per cent).

The concentration of crashes is shown on **Figure 6-1**. **Figure 6-1** shows that almost two thirds of all crashes occurred at intersections, with the high concentration of crashes at and around the intersection at South Dowling Street and to a lesser extent along intersections with Anzac Parade, Alison Road, Bourke Street, Young Street, Elizabeth Street, Botany Road, Fountain Street and Maddox Street.

The crash history for the study area shows that road safety is a substantial issue for this area as crash rates are much higher than the Sydney-wide average for similar roads, as shown in **Table 6-6**. The Elizabeth Street to South Dowling Street segment had a particularly high casualty crash rate of 20 crashes per kilometre per year.

Table 6-6 Crash rates by segment, 2013-2018

Segment from	Segment to	Length (km)	Casualty rate	Casualties per 100 million vehicle kilometres travelled
Maddox Street	Fountain Street	0.52	9.2	105
Fountain Street	Botany Road	0.52	10.4	109
Botany Road	Elizabeth Street	0.48	13.3	196
Elizabeth Street	South Dowling Street	0.85	20.0	336
Average Sydney crash rate for State			2.6	55

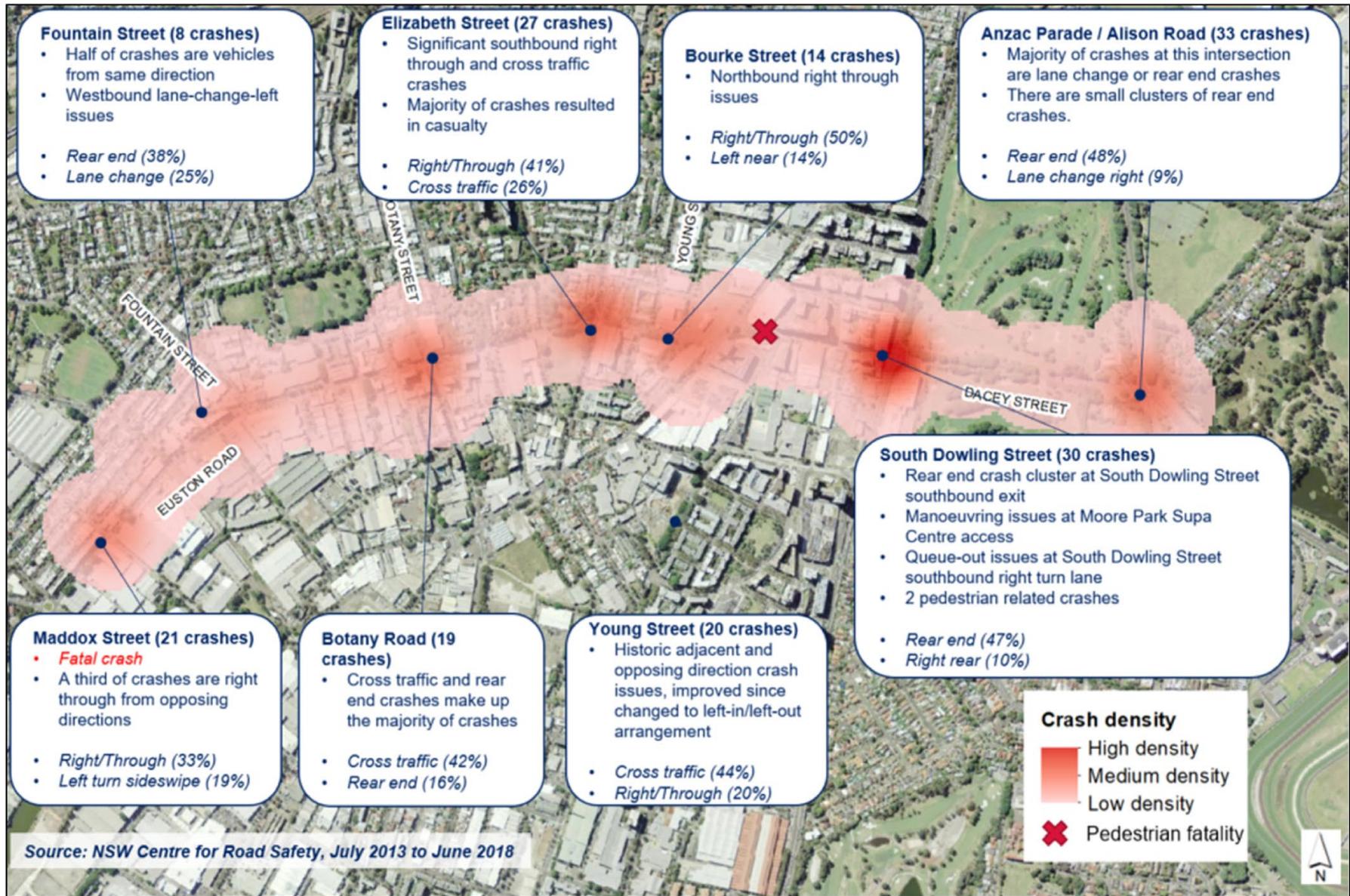


Figure 6-1 Crash concentration

Existing parking

A parking assessment has been completed along the proposal and is included as **Appendix C**. A summary of the existing parking environment is included in **Section 2.2.2** and shown in **Figure 2-2**. Further detail on existing parking conditions is included in **Table 3-3** of **Appendix C**.

The parking inventory of the existing environment of the proposal area identified a total of 652 existing on-street parking spaces distributed as follows:

- Zone 1 – Euston Road, McEvoy Street, Lachlan Street - 252 spaces
- Zone 2 – Anzac Parade and Tay Street - 11 spaces
- Zone 3 – Boronia Street -16 spaces
- Zone 4 – Side streets off Euston Road, McEvoy Street, Lachlan Street - 373 spaces.

The parking inventory identified a variety of parking restrictions along the proposal area within Zone 1 and Zone 4 and these are summarised in **Table 6-7** and **Table 6-8** respectively.

Table 6-7 Summary of parking restrictions for Zone 1 – Euston Road, McEvoy Street and Lachlan Street

Parking restrictions	Number of spaces	Per cent (%)
No Parking – 6:00am-10:00am Monday to Friday	125	49.6
No Parking – 6:00am-10:00am and 3:00pm-7:00pm Monday to Friday, half hour parking 10:00am-3:00pm Monday to Friday and 8:30am-12:30pm Saturday	10	4.0
No Parking – 6:00am-10:00am and 3:00pm-7:00pm Monday to Friday	5	2.0
No Parking – 3:00pm-7:00pm Monday to Friday	77	30.6
No Parking – 3:00pm-7:00pm and half hour parking 8:30am-3:00pm Monday to Friday	11	4.4
1 hour parking – 8:30am-6:00pm Monday to Friday and 8:30am-12:30pm Saturday	5	2.0
2 hour parking – 8:00am – 10:00 am Monday to Sunday	14	5.6
Disabled – No Time Restriction	4	1.6
Mail Zone	1	0.4
Total	252	100

Table 6-8 Summary of parking restrictions in Zone 4 – Side streets off Euston Road, McEvoy Street, Lachlan Street

Parking restrictions	Number of spaces	Per cent (%)
No Restriction	235	63.0
½ hour parking	10	2.7
½ hour and 4 hour parking	3	0.8
1 hour parking	14	3.8
2 hour parking	44	11.8
2 hour and 4 hour parking	7	1.9
4 hour parking	6	1.6
No Parking and 1 hour time restricted parking	9	2.4
No Parking and 2 hour time restricted parking	8	2.1
Disabled	1	0.3
Mail Zone	1	0.3
No Parking (Variable hours Monday to Friday)	11	2.9
No Parking (Authorised Car Share Excepted)	11	2.9
No Stopping (Variable hours Monday to Friday)	7	1.9
Work Zone	6	1.6
Total	373	100

Existing peak time parking restrictions are currently in place Monday to Friday at 228 locations in Zone 1 along Euston Road and McEvoy Street, and include:

- Morning 'No Parking' restrictions between 6:00am to 10:00am on the northern side of Euston Road and McEvoy Street (affecting 125 parking spaces)
- Afternoon 'No Parking' restrictions between 3:00pm to 7:00pm on the southern side of Euston Road and McEvoy Street (affecting 77 parking spaces)
- Morning and afternoon 'No Parking' restrictions between 6:00am to 10:00am and 3:00pm to 7:00pm (affecting 15 parking spaces – 10 of which also have hourly time restrictions outside these hours)
- Afternoon 'No Parking' restrictions between 3:00pm to 10:00pm and half hourly parking 8:30am to 3:00pm (affecting 11 spaces).

The remaining 9.5 per cent of parking in Zone 1 is comprised of one hour time restricted parking zones (five spaces) work zone (14 spaces), mail zone (one space), disabled zone (four spaces).

In comparison the bulk of the parking in Zone 4 along the side streets has no restrictions (235 spaces or 63 per cent) with a further 27.1 per cent or 101 spaces operating under ½ hour, one hour, two hour, four hour time and four hour ticket time restrictions. The remaining spaces in

Zone 4 are comprised of disabled zone (one space), mail zone (no parking zone – variable hours (11 spaces), no parking - authorised car share vehicles only (11 spaces), no stopping zone – variable hours (seven spaces) and work zone (six spaces).

For Zone 2 there are a total of 11 parking spaces available in Tay Street including four with no restriction and seven with a two hour parking restriction. For Zone 3 there are nine spaces with a 2 hour time restriction and seven no parking spaces along Boronia Street.

Parking is not available along the sections of Lachlan Street, South Dowling Street and Dacey Avenue, that are located within the proposal area.

For Zone 2 there are a total of 11 parking spaces available in Tay Street including four with no restriction and seven with a two hour parking restriction. For Zone 3 there are nine spaces with a 2 hour time restriction and seven no parking spaces along Boronia Street. A detailed description of all the parking restrictions identified in the parking survey of the proposal area is included in Table 3-3 of the Parking Assessment provided in **Appendix C** and shown in **Figure 2-2**.

An assessment of the existing capacity and utilisation of parking spaces was completed as part of the Parking Assessment (Jacobs, 2019a), refer to **Appendix C**. The assessment showed varied levels of occupation and utilisation throughout the day. The following peaks in utilisation along McEvoy Street were observed:

- Thursday 24 August 2017:
 - Morning period (6:00am-12:00pm) – peak of 52% at 11:00am
 - Afternoon period (12:00pm-7:00pm) – peak of 56% at 12:00pm
- Saturday 26 August 2017:
 - Morning period (6:00am-12:00pm) – peak of 55% at 11:00am
 - Afternoon period (12:00pm-7:00pm) – peak of 49% at 1:00pm.

Commercial car parks are also located near the proposal and include

- Fountain Street Car Park, which offers casual drive up parking from 6:00am to 6:00pm daily
- Virtus Health Car Park at Bowden Street, which offers drive up parking from 6:00am to 7:00pm weekdays
- 18 Danks Street Car Park, north of McEvoy Street, which provides casual hourly parking between 6:00am and 12:00am daily
- 26 Danks Street Car Park, north of Lachlan Street, which offers casual parking from 7:00am to 12:00am daily.

6.1.4 Potential impacts

Construction

As described in **Section 3.1.1**, the proposal would be constructed in four construction zones. The potential traffic and transport impacts that would occur temporarily during construction of the proposal within each zone would include:

- Changes to existing traffic conditions and traffic movement
- Impacts to place from use of construction compound sites and ancillary facilities
- Changes in access arrangements and parking conditions
- Impacts to movement - public transport
- Impacts to movement - pedestrians and cyclists.

These potential impacts are discussed in greater detail below.

Changes to existing traffic conditions and traffic movement

Increased traffic delays to the road network near to the proposal area would be expected during the construction period, particularly as there are a number of operational and alignment changes including the temporary closure of some traffic lanes.

The majority of the traffic impacts are expected to occur during night time construction works between the hours of 10:00 pm and 4:00 am. During these hours various temporary diversions routes would be in place to detour vehicles around the construction zones, refer to **Section 3.3.6**.

There would also be an increase in construction vehicles using the road network during construction and there would be changes in the road conditions and general traffic movement, potentially impacting on road safety.

In order to minimise the impacts of construction, it is intended that the proposal would be constructed in four separate construction zones to enable work to be completed safely while maintaining traffic flows at all times and minimising overall impacts on nearby residents and businesses. It is anticipated that construction traffic movements in each works zone would adopt a "left-in, left-out" access arrangement to minimise impact on traffic flow.

Further detail on construction activities and staging is provided in **Section 3** and **Appendix F**.

Construction compounds and ancillary facilities

Five ancillary facility sites would be established to facilitate the construction process, refer to **Figure 1-2**. The location and use of these sites are detailed in **Section 3**. Access and egress to these sites would be via the existing road network within the proposal area. Use of the construction compound sites by construction vehicles would potentially cause delay to traffic movement along the proposal and would temporarily impact on place and movement of people to important or strategic places in the Sydney region.

Potential safety issues associated with the movement of traffic into and out of work sites is a potential impact that would need to be managed during construction. Ancillary sites would generally incorporate acceleration and deceleration lanes for safe egress and entry. However, some site access and egress points would need to be controlled by a traffic controller in cases where construction vehicles cannot enter and exit via left-turn movements, or to facilitate manoeuvring by larger vehicles. Additionally, larger deliveries would not be done during peak periods to minimise impact on traffic.

Changes in access arrangements and parking conditions

There would be temporary changes or interruptions to property and local road access during construction of the proposal. Access to private properties near to construction works would be maintained during construction. Where temporary changes are required, suitable access arrangements would be implemented in consultation with affected property and business owners. There would also be changes in existing parking conditions along the proposal during construction that would require drivers seeking alternate parking locations on nearby side streets.

Public transport

Impacts to bus routes and bus stops

There would be temporary changes to bus routes and bus stop locations along the proposal during construction. Bus route (Route 305 and 370) may be affected by the proposal at the western end of the proposal. These bus routes would potentially be subjected to delays and consequently

increased travel times. Some delay may be also experienced by buses travelling in the north-south roads which intersect with the proposal area at Elizabeth Street.

The bus stop on Botany Road would require relocation or temporary closure during construction. The relocation of this bus stop would be carried out in consultation with City of Sydney, Transport for NSW and the local bus operator. Any proposed relocation would consider implications (such as walking distance to the new bus stop) for commuters.

Operation

Potential traffic and transport impacts that would occur during operation of the proposal include:

- Changes to existing traffic conditions and network performance
- Changes to public transport
- Impacts to existing parking conditions.

These potential impacts are discussed in greater detail below.

Future road network performance – without the proposal

Traffic growth

If the proposal was not constructed, forecast traffic flows under all future year scenarios, would result in increased queue lengths and travel times at the key intersections. The forecast change in peak periods traffic volumes increase at intersections across the study area from 2016 to 2031 is shown in **Table 6-9**.

Table 6-9 Forecast change in peak period traffic volumes at intersections (Arup, 2019)

Intersection road	2016-2021				2016-2031			
	AM Peak change		PM Peak change		AM Peak change		PM Peak change	
	Vehicles per hour	%						
Fountain Street	+680	+37	+650	+31	+860	+46	+960	+45
Botany Road	+460	+14	+540	+16	+590	+18	+660	+19
Elizabeth Street	+530	+20	+660	+21	+790	+29	+980	+32
South Dowling Street	+360	+8	+260	+6	+770	+18	+830	+19

The forecasts in **Table 6-9**, highlight a substantial increase (up to 46%) in peak period demands at several locations, particularly at the western end of the corridor where it intersects Fountain Street. Most of this growth would be realised with the delivery of the New M5. The forecast also indicates a higher relative change in peak periods relative to daily flows indicating higher relative attractiveness of the tolled motorway network during peak periods relative to off peak periods.

The forecast performance of the road network in the 2021 morning and afternoon peak periods without the proposal is summarised in **Table 6-10** and **Table 6-11**. It is noted that the 2031 without the proposal scenarios were unable to be realistically modelled due to excessive congestion and hence not reported. As such, 2021 is used as the key reference year for comparing performance with, verse without, the proposal. **Table 6-10** summarises the speed across the study area in the

base case (2016) as well as with and without the proposal. **Table 6-11** presents the peak period vehicle speed ratio.

Table 6-10 Forecast average speed of all vehicles with and without the proposal

Network-wide statistic	2016		2021 without proposal		2021 with proposal	
	AM	PM	AM	PM	AM	PM
Average traffic speed (km/h)*	16.7	19.0	11.4 (-32%)	13.3 (-30%)	15.2 (+33)	15.2 (+15%)
Vehicles hours travelled (hrs)#	-	-	6490	6190	5300 (-18%)	5450 (-12%)

* Based on average speeds in the critical second hour of each peak period

Base on the sum of travel time for all completed and active vehicle trips in the network over the two-hour peak period

Table 6-11 Peak period vehicle speed ratio (VSR) performance

Segment		2021 AM Peak VSR (%)		2021 PM Peak VSR (%)	
Western extent	Eastern extent	Eastbound	Westbound	Eastbound	Westbound
Maddox Street	Fountain Street	9	12	14	30
Fountain Street	Botany Road	8	7	16	26
Botany Road	Elizabeth Street	27	12	19	19
Elizabeth Street	South Dowling Street	24	53	11	51

The average speeds and LoS as presented in **Table 6-10** and **Table 6-12** indicate that performance at existing pinch points at the corridors intersections with South Dowling Street and Botany Road would be exacerbated, with congestion spreading across the network. The average speed of traffic is forecast to reduce around 30 per cent in peak periods by 2021.

Average speeds across the bus and light rail networks are also forecast to drop by 10 per cent to 15 per cent in peak periods by 2021, with key bus routes along Botany Road, Bourke Street and Elizabeth Street experiencing an increase in delays and a drop in reliability.

Future road network performance – with the proposal

Traffic patterns

The improvements to the corridor as a result of the proposal are anticipated to attract a degree of additional traffic demand. The forecast changes in peak period traffic volumes at key intersections as a result of the proposal for 2031 is provided in **Table 6-9**. As shown in this table, the forecasts indicate that demand at intersections may increase by an additional six to up to 46 per cent with the proposal (depending on location and peak period).

Performance

Table 6-10 above presents a comparison of network-wide performance statistics for the 2021 peak periods with and without the proposal. The results show that the average speed of traffic in each morning and afternoon peak one-hour periods is forecast to increase by 15 to 35 per cent. Meanwhile network wide travel times over each two-hour peak period are forecast to reduce in the order of 12 to 18 per cent. Over all the proposal is expected to improve the average travel speeds by 33 per cent and 15 per cent in the 2021 morning and afternoon peak hours respectively. The end-to-end travel time results also shows travel time savings for traffic movement along the proposal. The forecast performance of the road network indicates that performance at key existing pinch points at the corridors' intersections with South Dowling Street and Botany Road would substantially improve, though remain at capacity.

The traffic modelling also forecast that the average speed of buses would improve by about 12 per cent in the morning peak and three per cent in the afternoon peak in 2021.

A summary of performance of the intersections located along the proposal across the three modelled years (existing year (2016), future year 'without project' and 'with project') is included in **Table 6-12**. The proposal would increase the capacity of the network and reduce east-west travel times. It would be expected that east-west travel times in future would be largely better than those observed today, even though the volume of traffic would increase.

Table 6-12 Summary of current and future intersection performance (Arup, 2019)

Intersection	Peak	2016		2021			
		Existing		Without the proposal		With the proposal	
		Delay (s)	LoS	Delay (s)	LoS	Delay (s)	LoS
Fountain Street	AM	22	B	100	F	42	C
	PM	52	D	86	F	54	D
Botany Road	AM	56	E	249	F	109	F
	PM	94	F	134	F	138	F
Elizabeth Street	AM	33	C	71	F	39	C
	PM	73	F	82	F	92	F
South Dowling Street	AM	88	F	248	F	125	F
	PM	77	F	165	F	141	F

Table 6-12, shows that for future morning and afternoon peak, the proposal would improve intersection performance.

Road safety

The proposal is expected to improve road safety and reduce risk of serious injuries through:

- Reduced risk of right turn related crashes at minor intersections
- Reduced congestion related crashes along the proposal
- Ensuring pedestrian protection at upgraded intersections.

Place considerations

The proposal is anticipated to:

- Impact place along the corridor during peak periods through increased traffic volumes, and enhance place on nearby streets through decreased traffic volumes
- Enhance accessibility to nearby centres and planned urban renewal areas through improved journey time and reliability along and across the corridor
- Improve operational performance improvements, reducing the likelihood of rat-running behaviours and the use of nearby or parallel local streets for through-movement.

Movement considerations

A review of transport functions in the study area yielded that the key existing customer groups for movement:

- Across the corridor - are a combination of sustainable transport modes (bus, pedestrians, cyclists) accessing the Sydney CBD and surrounds and substantial volumes of private vehicle and freight movement at the M1 Eastern Distributor, South Dowling Street, Anzac Parade and Botany Road
- Along the corridor - is predominantly private vehicle movements, serving access between the adjacent suburbs that do not have competitive public transport alternatives, as well as providing connectivity between interfacing local and higher order routes and the motorway network. Freight, buses, pedestrians and cyclist movements are available along the proposal at select locations.

Impacts on movement – public and active transport (pedestrian and cycling)

The proposal does not include dedicated bus priority treatments such as bus lanes or bus only traffic lights. Minor changes to bus stop locations around Fountain Street and Botany Road are proposed to enable the new turning lanes to be constructed.

While the proposal would retain the majority of existing footpath conditions along the proposal, there would be some improvements to pedestrian and bicycle facilities at the upgraded intersections.

Impacts on movement – right hand turn bans

To reduce crash risk and improve traffic flow right turn bans at most intersections without traffic signals and a right turn ban into Bunnings from McEvoy Street would be implemented. These new bans would require road users who previously accessed these streets to use alternative routes. This would result in a minor impact to drivers. The alternative routes available are shown in **Figure 6-2**.

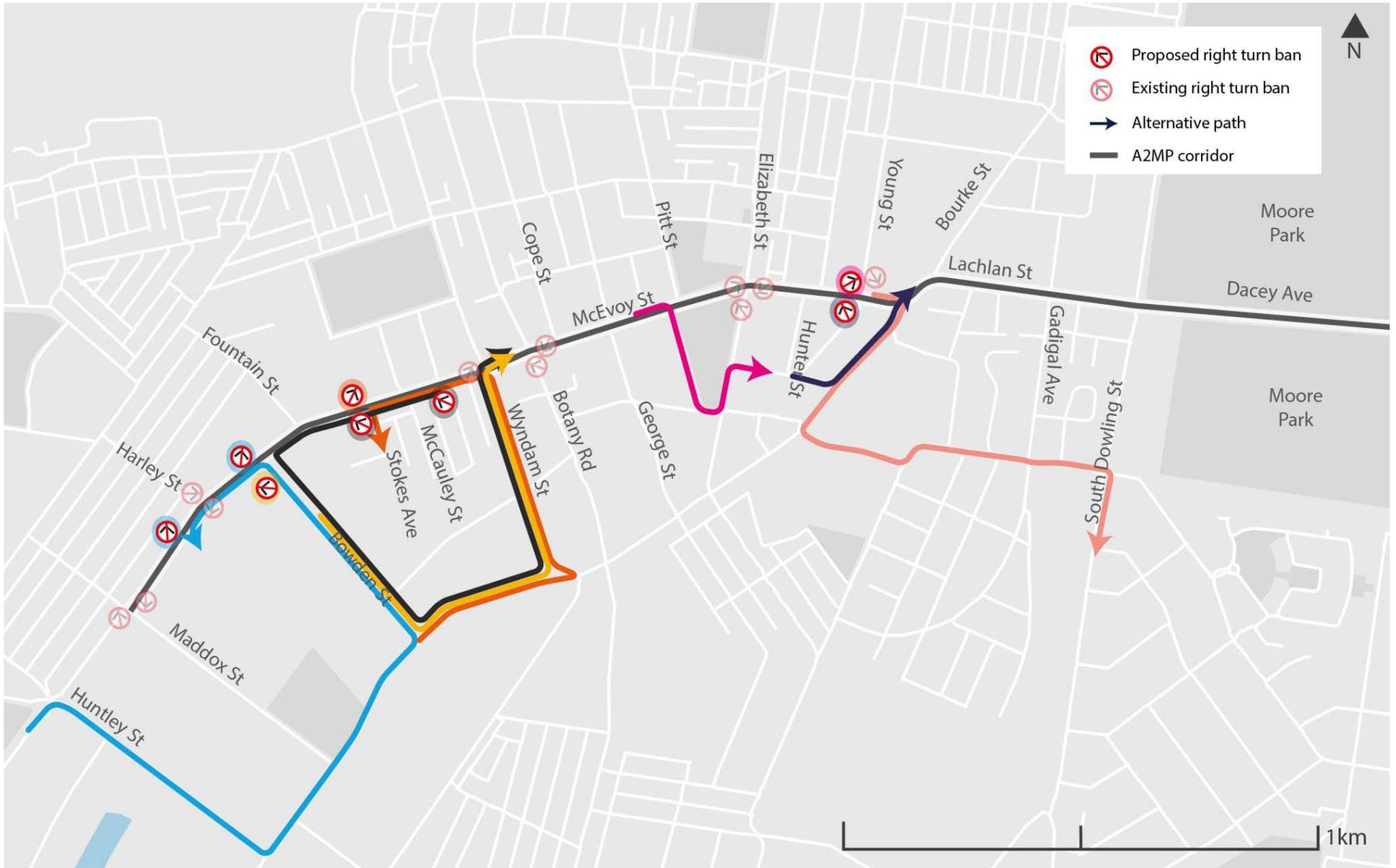


Figure 6-2 Alternative local access routes available for proposed right turn bans (Arup, 2019b)

Parking

Impacts on on-street parking

The proposed would include the following changes in existing parking restrictions:

- New clearway restrictions along both sides of Euston Road and McEvoy Street between 6:00am-7:00pm Monday to Friday and 9:00am-6:00pm on the weekends
- New clearway restrictions at all times along Lachlan Street and Dacey Avenue between Bourke Street and Anzac Parade.

The changes to day time clearways would be contained within Zone 1 along Euston Road and McEvoy Street, and there would be no change to existing parking restrictions located within Zone 2, 3 and 4 as a result of the proposal. There would also be changes to Zone 1 along Lachlan Street and Dacey Avenue between Bourke Street and Anzac Parade where the existing no stopping zones would become clearways in order to allow cars parked along these roads to be towed at any time, refer to **Figure 3-1**.

Zone 1 on-street parking impacts would therefore include a modification of all existing parking restrictions along Euston Road and McEvoy Street between Maddox Street and Bourke Street to include Clearway conditions during the following times:

- Monday to Friday 6:00am-7:00pm
- Weekends 9:00am-6:00pm.

Existing parking restrictions, for disabled parking and mail zones would be retained at all other times outside the Clearway restriction times. There would be no change to the existing bus zones in Zone 1.

A total of 252 parking spaces would be impacted by the proposal in Zone 1 of which 228 already operate under No Parking restrictions during morning or afternoon peaks. Changes in on-street parking restrictions as a result of the new clearway conditions are shown in **Figure 3-1** and described in detail in **Appendix C**. A summary of the impacts is provided in **Table 6-13**.

Table 6-13 On-street parking impacts – Zone 1 (excludes bus zones)

Existing parking restrictions	Spaces	Location	Proposed changes	Change in availability
No Parking – 6:00am-10:00am Monday to Friday	125	Northern side of Euston Road and McEvoy Road	Change to Clearway restrictions Monday to Friday 6:00am-7:00pm and weekends 9:00am-6:00pm	Additional restrictions over nine hours Monday to Friday and nine hours Saturday and Sunday
No Parking – 6:00am-10:00am and 3:00pm-7:00pm Monday to Friday, half hour parking 10:00am-3:00pm Monday to Friday and 8:30am-12:30pm Saturday	10	Northern side of Euston Road between Loveridge Street and Brennan Street	Change to Clearway restrictions Monday to Friday 6:00am-7:00pm and weekends 9:00am-6:00pm	Additional restrictions over five hours Monday to Friday and nine hours Saturday and Sunday. Existing half hourly parking conditions removed
No Parking – 6:00am-10:00am and 3:00pm-7:00pm Monday to Friday	5	Southern side of McEvoy Road between George Street and Botany Road	Change to Clearway restrictions Monday to Friday 6:00am-7:00pm and weekends 9:00am-6:00pm	Additional restrictions over five hours Monday to Friday and nine hours Saturday and Sunday
No Parking – 3:00pm-7:00pm Monday to Friday	77	Southern side of Euston Road and McEvoy Road between Maddox Street and Elizabeth Street	Change to Clearway restrictions Monday to Friday 6:00am-7:00pm and weekends 9:00am-6:00pm	Additional restrictions over nine hours Monday to Friday and nine hours Saturday and Sunday
No Parking – 3:00pm-7:00pm and half hour parking 8:30am-3:00pm Monday to Friday	11	Southern side of McEvoy Street between McCauley Lane and Stokes Avenue	Change to Clearway restrictions Monday to Friday 6:00am-7:00pm and weekends 9:00am-6:00pm	Additional restrictions over nine hours Monday to Friday and nine hours Saturday and Sunday. Existing half hourly parking conditions removed
One hour parking – 8:30am-6:00pm Monday to Friday and 8:30am-12:30pm Saturday	5	Southern side of McEvoy Street between Elizabeth Street and Hunter Street	Change to Clearway restrictions Monday to Friday 6:00am-7:00pm and weekends 9:00am-6:00pm	Monday to Friday and nine hours Saturday and Sunday. Existing half hourly and hourly parking conditions removed

Existing parking restrictions	Spaces	Location	Proposed changes	Change in availability
2 hour parking – 8:00am – 10:00 am Monday to Sunday	14	Southern side of McEvoy Street between Hunter Street and Young Street	Change to Clearway restrictions Monday to Friday 6:00am-7:00pm and weekends 9:00am-6:00pm	Additional restrictions over 13 hours Monday to Friday, 1.5 hours Saturday and nine hours Sunday. Existing 2hour parking conditions removed

As noted above there would be a loss of availability of up to 252 parking spaces (of which 228 already operate under No Parking restrictions during morning or afternoon peaks) during day time periods along Euston Road and McEvoy Street as a result of the proposal.

However, parking along Euston Road and McEvoy Street was not observed to be at capacity on either the surveyed weekday or weekend day and the parking surveys showed varied levels of occupation and utilisation throughout the day. An assessment of existing parking utilisation along Euston Road and McEvoy Street based on the survey results has shown that:

- On Thursday 24 August 2017, a peak of 135 vehicles utilised existing parking during the morning between 6:00am-12:00pm and a peak of 144 vehicles utilised existing parking during the afternoon between 12:00pm – 7:00pm
- On Saturday 26 August 2017, a peak of 133 vehicles utilised existing parking on the weekend between 9:00am – 5:00pm.

There is potential for the loss of on-street parking along Euston Road and McEvoy Street to be accommodated by existing parking capacity on local side streets located in Zone 4. Surrounding side streets which have the potential to accommodate lost parking in terms of peak demand, duration and utilisation and the ability to accommodate additional vehicles are detailed in **Appendix C**. However, the length of Euston Road and McEvoy Street impacted by the implementation of clearway restrictions is around 1.9 kilometres long, as such some parking spaces that are available at the extents of the proposal on existing side streets may not be within an acceptable walking distance for drivers seeking a parking space close to their destination.

An assessment of the local impacts from the loss of parking between each cross street along Euston Road and McEvoy Street has been completed and found that impacts are varied across the proposal area. The assessment considered impacts at each local side street from the proposed clearway restrictions during the week and on the weekend. In addition, the assessment of side street capacity considers the utilisation of the parking spaces on the side streets, as well as the utilisation of currently available parking spaces along Euston Road and McEvoy Street as identified in the parking survey completed on Thursday 24 August 2017 and Saturday 26 August 2017. The method for this assessment uses parking availability identified in the next side street in the direction of travel along Euston Road and McEvoy Street, minus the existing demand for parking. Gaps and surplus capacity in the local side streets was identified.

An impact rating was developed based upon dividing the parking deficiency by the available parking in the side street and is used to estimate the severity in the shortfall in parking spaces. The impact rating used is based on the following:

- No impacts are identified where parking is available on downstream local streets
- Minor impacts are identified as less than five vehicles displaced by the proposal on parking spaces in the downstream local streets
- Moderate impacts are identified as between five to 10 vehicles displaced by the proposal on parking spaces in the downstream local streets
- Substantial impacts are identified as between 10 and 15 vehicles displaced by the proposal on parking spaces in the downstream local streets.

The assessment of impacts to the loss of on-street parking from the proposal was considered against the results of the Thursday and the Saturday parking survey results. An overall assessment of impacts from the change in parking conditions is summarised in **Table 6-14**.

Table 6-14 Overall summary of impacts from changes in parking conditions from the proposal

Location	Parking assessment results based on parking availability on next side street
Northern side of Euston Road and McEvoy Street	
Maddox Street – Harley Street	Minor impact in the morning and moderate impact in the afternoon during the week and moderate and some minor impact on the weekend
Harley Street – Fountain Street	Substantial to moderate impact during the week and on the weekend
Fountain Street – Loveridge Street	Moderate to substantial impact during the week and on the weekend
Loveridge Street – Brennan Street	Minor impact during the week and on the weekend
Brennan Street – Wyndham Street (northern)	No parking currently, consequently no impacts expected
Wyndham Street (northern) – Botany Road (northern)	No parking currently, consequently no impacts expected
Botany Road – Elizabeth Street (northern)	Substantial and moderate impact during the week between 10am-4pm and the majority of the day on the weekend
Elizabeth Street (northern) – Kensington Lane	No parking currently, consequently no impacts expected
Kensington Lane – Kensington Street	No impact, parking available on side streets
Kensington Street – Morehead Street	Minor impacts between 10:00am-4:00pm during the week and no impacts on weekends
Morehead Street – Young Street (northern)	Minor impacts between 10:00am-4:00pm during the week and minor impacts 9:00am-3:00pm on the weekend
Young Street – Bourke Street	No parking currently, consequently no impacts expected
Northern side of Euston Road and McEvoy Street	
Bourke Street – Young Street (southern)	No parking currently, consequently no impacts expected
Young Street (southern) – Hunter Street	Moderate impacts between 10:00am-4:00pm during the week and minor impacts on the weekends

Location	Parking assessment results based on parking availability on next side street
Hunter Street – Elizabeth Street (southern)	Minor impacts between 9:00am-5:00pm during the week and minor impacts on the weekend
Elizabeth Street (southern) – Pitt Street	Minor impacts between 9:00am-3:00pm during the week and minor with some moderate impacts on the weekend
Pitt Street – George Street	Moderate impacts between 10:00am-3:00pm during the week and minor with some moderate impacts on the weekend
George Street – Botany Road (southern)	No impact expected, parking available on side streets
Botany Road (southern) – Wyndham Street (southern)	No impact expected, parking available on side streets
Wyndham Street (southern) – Hiles Lane	No parking currently, consequently no impacts expected
Hiles Lane – Hiles Street	No parking currently, consequently no impacts expected
Hiles Street – McCauley Lane	Minor impacts between 9:00am-5:00pm and no impacts all other times during the week and minor impacts on the weekends
McCauley Lane – McCauley Street	Minor to no impacts during the week and no impacts all other times including weekends
McCauley Street – Stokes Avenue	Minor to moderate impacts between 8:00am-5:00pm and minor to no impacts all other times during the week and no to minor impacts on the weekends
Stokes Avenue – Bowden Street	Moderate impacts between 10:00am-3:00pm and minor impacts all other times during the week and on weekends
Bowden Street – Maddox Street (southern)	Moderate impacts between 1:00am-3:00pm and minor to no impact other times during the week and minor impacts on weekends

Mitigation measures to ameliorate and manage the areas where there are moderate and substantial impacts from the proposal to on-street and off-street parking would be considered and developed during detailed design. This may include provision of inclusion of timed restrictions in areas that currently have no parking restrictions along side streets to allow for a greater turnover of parked vehicles during business hours.

Impacts on off-street parking

The proposal would also result in the loss of some off-street parking locations due to property acquisition and includes:

- Twenty-six public parking spaces at 102-112 McEvoy Street (Lot Y DP419800), Alexandria, located to the west of Stokes Avenue and opposite Fountain Street on the southern side of the proposal within a public parking space
- Two customer parking spaces at 35 Lachlan Street, Waterloo on the southern side of the proposal (Lot 9, DP 978753).

The parking assessment (Jacobs, 2019a) found that there was capacity to accommodate off-street parking lost at Lachlan Street, Alexandria as a result of the proposal. There would however be limited capacity to accommodate off-street parking lost at 102-112 McEvoy Street, Alexandria due to impacts to side streets in this area specifically McCauley Street, Stokes Avenue and Bowden Street, from the loss of on-street parking from the proposal. The loss of off-street parking in this location would increase the severity of impacts to substantial at these side streets. These impacts may be ameliorated through the use of commercial car parks located at:

- Fountain Street Car Park, which offers casual drive up parking from 6:00am to 6:00pm daily
- Virtus Health Car Park at Bowden Street, which offers drive up parking from 6:00am to 7:00pm weekdays.

Roads and Maritime would also investigate options to re-instate some of the public parking spaces at 102-112 McEvoy Street, Alexandria as part of detailed design and in consultation with surrounding property owners.

6.1.5 Safeguards and management measures

Safeguards and management measures for traffic and transport are presented in **Table 6-15**.

Table 6-15 Safeguards and management measures – traffic and transport

Impact	Environmental safeguards	Responsibility	Timing	Reference
Traffic and transport	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Roads and Maritime <i>Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008). The TMP will include:</p> <ul style="list-style-type: none"> • 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 	Construction contractor	Detailed design / Pre-construction	<p>Core standard safeguard TT1</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>community of impacts on the local road network</p> <ul style="list-style-type: none"> • 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. 			
Local community notification	<p>Consultation will be carried out with potentially affected residences prior to the commencement of and during works in accordance with the RTA's Community Involvement and Communications Resource Manual. Consultation will include but not be limited to door knocks, newsletters or letter box drops providing information on the proposal, working hours and a contact name and number for more information or to register complaints.</p>	Roads and Maritime	Pre-construction/ construction	Core standard safeguard
Access	<p>Requirements for any changes to local access arrangements will be confirmed during detailed design in consultation with the local road authority and any affected landowners.</p>	Roads and Maritime	Pre - construction/ detailed design/	Additional standard safeguard
Access	<p>Access to properties will be maintained during construction. Where that is not possible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners and the relevant local road authority</p>	Construction contractor	Pre – construction/ construction	Additional standard safeguard
Impacts to pedestrians and cyclists	<p>Pedestrian and cyclist access will be maintained throughout construction. Where that is not</p>	Construction contractor	Construction	Additional standard safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	possible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners and the local road authority.			
Community information	Road users and local communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Construction contractor	Construction	Additional standard safeguard
Disruption to public transport, including school bus services	Access for public transport services, including school bus services, will be maintained. The requirements for any temporary changes will be confirmed following consultation with local bus operators and the community.	Construction contractor	Construction	Additional standard safeguard
Access	Where any existing access arrangements to property is permanently affected, arrangements for appropriate alternative access will be determined in consultation with the affected landowner and local road authority.	Roads and Maritime	Pre - construction /detailed design/	Additional standard safeguard
Bus stops	The opportunity to consolidate stops between Fountain Street and Botany Road will be considered in consultation with local bus operators	Roads and Maritime	Detailed design/	Additional safeguard
Emergency services	Conduct consultation with emergency services to ensure adequate emergency vehicle access is maintained for the duration of construction. Provide regular updates to emergency services about any changes to local access during construction. The NSW SES will be notification where there are likely to be significant delays in the operation of the roads affected by the proposal.	Construction contractor	Construction	Additional safeguard
Change in availability of on-street parking	During detailed design TfNSW will investigate refinements to proposed parking restrictions to mitigate impacts, where possible.	Roads and Maritime	Detailed design	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
Change in availability of on-street parking	During detailed design Roads and Maritime will consider options for mitigating the loss of off-street parking for businesses through reconfiguration of remaining space at 102-112 McEvoy Street where possible.	Roads and Maritime	Detailed design	Additional safeguard
Parking during operation	Consult with the CoS on the possible inclusion of timed restrictions in areas that currently have no parking restrictions along side streets and along the proposal itself to allow for a greater turnover of parked vehicles during business hours.	Roads and Maritime	Detailed design	Additional safeguard
Parking during construction	Implement a construction workforce parking strategy to minimise loss of parking during construction. Provide parking for construction workforce within construction areas and implement worker parking policies to reduce demand for local parking.	Construction contractor	Construction	Additional safeguard

6.2 Noise and vibration

An assessment was carried out to identify the extent and magnitude of potential noise and vibration impacts associated with the proposal. The assessment is documented in the *Alexandria to Moore Park Stage 1 Noise and Vibration Assessment* (noise and vibration assessment) (Renzo Tonin, 2019), which is provided in **Appendix M**. A summary of the assessment is presented in this section, together with safeguards and management measures to mitigate any negative impacts.

6.2.1 Methodology

The noise and vibration assessment provided in **Appendix M** has been prepared in accordance with the following:

- *Noise Criteria Guideline* (Roads and Maritime, 2015) (NCG)
- *Construction Noise and Vibration Guideline* (CNVG) (Roads and Maritime 2016)
- ICNG (DECC,2009)
- *Road Noise Policy* (NSW Environment Protection Authority (EPA), 2011) (RNP)
- *Noise Mitigation Guideline* (NMG) (Roads and Maritime, 2015)
- *Environmental Noise Management Manual* (ENMM) (Roads and Maritime, 2001)
- *Industrial Noise Policy* (EPA, 2000)
- *Assessing Vibration: a technical guideline* (DEC, 2006)
- *British Standard BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2* (BSI, 1993)
- *DIN 4150: Part 3-1999 Structural vibration - Effects of vibration on structures* (Deutsches Institute fur Normung, 1999).
- *Calculation of Road Traffic Noise* (UK Department of Transport, 1988)
- *At-Receiver Noise Treatment Guideline* (Roads and Maritime Services, May 2017)
- *Procedure: Preparing a Post Construction Noise Assessment Report'* (Roads and Maritimes, 2014)
- *Procedure: Preparing an operational traffic and construction noise and vibration assessment report* (Roads and Maritime, 2016).

In summary, the methodology for the noise and vibration assessment included the following:

- Identifying noise and vibration sensitive receivers and defining the study area
- Carrying out noise monitoring to identify the existing noise environment
- Establishing noise and vibration assessment criteria
- Modelling predicted construction and operational noise levels
- Assessing predicted noise and vibration levels against the relevant criteria to identify potential impacts
- Identify safeguards
- and management measures to be implemented to minimise impacts.

Study area

The study area extends 600 metres from the proposal and consists of a mix of urban residential properties, commercial premises, industrial premises, educational facilities, places of worship and

recreational areas. The sensitive receivers around the proposal are currently exposed to existing road traffic noise.

Sensitive receivers were identified using aerial photography, GIS databases and information gathered from site visits. For the purpose of assessing the existing noise environment, the buildings within the study area were grouped into nine Noise Catchment Areas (NCAs) based on similar existing noise environments.

Noise monitoring

Long-term unattended and attended noise monitoring to identify the background noise levels for the proposal was carried out from 9 to 17 February 2016 by Jacobs at 12 representative locations (refer to **Section 6.4.2** and **Figure 6-3**) using automatic unattended noise monitoring equipment (ARL Ngara noise loggers). The loggers continuously measured the level of ambient noise over 15-minute periods for the duration of the monitoring period at each location. Measurements from noise monitoring were then used to derive construction noise goals and to provide a validation of the traffic data used in the noise modelling scenario for the proposal.

Traffic count surveys were carried out concurrently with the long-term unattended noise monitoring surveys. These traffic counts have been used only for the specific purpose of calibrating the noise model.

Noise modelling

Prediction of construction noise levels at sensitive receivers was modelled using the Soundplan (Version 7.4) noise modelling software. This three-dimensional model accounts for noise source and receiver locations, ground and air absorption as well as any acoustic screening provided by intervening topography and buildings. The construction noise assessment considered noise activities.

Operational traffic noise levels were modelled for the following future year scenarios:

- Year of opening (2021) without the proposal
- Year of opening (2021) with the proposal
- 10 years after opening (2031) without the proposal
- 10 years after opening (2031) with the proposal.

Modelling was based on the traffic volumes for the same assessment scenarios as outlined in the traffic and transport assessment (Arup, 2019b) (refer to **Appendix J**). The model was validated based on the noise monitoring results, as well as the results of traffic count surveys carried out concurrently with the long-term unattended noise monitoring.



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Legend

- The proposal
 - Road
 - Railway line
 - Unattended noise monitoring location
- | NCA | |
|------------|--------|
| | NCA 01 |
| | NCA 02 |
| | NCA 03 |
| | NCA 04 |
| | NCA 05 |
| | NCA 06 |
| | NCA 07 |
| | NCA 08 |
| | NCA 09 |
| | NCA 10 |



Figure 6-3 | Noise monitoring locations and NCAs
Alexandria to Moore Park Stage 1

6.2.2 Existing environment

Sensitive receivers

The majority of sensitive receivers identified within the study area are residential receivers, followed by commercial and education receivers. No hospital wards, aged care facilities or vibration-sensitive commercial or other land uses (such as medical imaging or electronics facilities) have been identified within the study area. Further details of each receiver are provided in **Appendix M**.

As it is not feasible to determine background noise levels for each receiver individually, noise monitoring has been carrying out for groups of receivers based on them having a common exposure to the same construction works. For the purpose of the noise assessment, receivers have been grouped into nine separate NCAs based on the extent to which they are exposed to similar existing background and ambient noise levels. The NCAs are outlined in **Table 6-16** and **Figure 6-3**.

Table 6-16 Noise catchment areas (NCA)

NCA	Number of receivers	Description of noise environment
1	560	Far west side of the study area, bounded by Princes Highway, Sydney Park Road, Huntley Street, Bourke Road and Campbell Road. Predominantly consists of Sydney Park on the north side, and commercial and industrial buildings to the south.
2	5,307	West side of the study area, bounded by Erskineville to St Peters rail line, Swanson Street, Mitchell Street, Harley Street, Euston Road and Sydney Park Road. Predominantly consists of multi-storey residential buildings to the west, single residential buildings to the north and south, and industrial buildings in the centre, with three parks in the north east.
3	8,248	Central-north west of the study area, bounded by Henderson Road, Botany Road, McEvoy Street, Harley Street, Mitchell Road and Swanson Street. Predominantly consists of single residential, commercial and industrial buildings along Botany Road and McEvoy Street and central parks.
4	570	Central-south west of the study area bounded by McEvoy Street, Botany Road, O’Riordan Street, Collins Street and Huntley Street. Predominantly consists of commercial and industrial buildings, with multi storey mixed and residential buildings along Botany Road, in the east.
5	7,069	Central-north of the study area bounded by Turner Street, Elizabeth Street, McEvoy Street and Botany Road. Predominantly consists of residential buildings in the east and north including dispersed multi storey residential towers. Government housing is located in the centre and south of this NCA, with a mix of residential, commercial and industrial along the western boundary, along Botany Road. Redfern Oval is located to the north east of the NCA.
6	7,026	Central-north of the study area bounded by Redfern Street, Young Street, Telopea Street, Bourke Street, Thurlow Street, South Dowling Street, Lachlan Street, McEvoy Street and Elizabeth Street. This NCA consists of single residential buildings in the north and west, multi storey residential

NCA	Number of receivers	Description of noise environment
		and mixed use buildings in the east and south east and commercial buildings in the centre and south.
7	8,431	Central-south of the study area bounded by McEvoy Street, Lachlan Street, South Dowling Street, Defries Avenue and Botany Road. This NCA consists of a mix between multi storey residential and mixed use buildings, dispersed through the NCA, single residential buildings and commercial buildings.
8	50	North east of the study area, with boundaries along South Dowling Street, (up to and including Sydney Boys High School), Anzac Parade, and Dacey Avenue. The NCA is predominantly made up of Moore Park Golf Course, with Sydney Girls High School and Sydney Boys High School in the north. There are no residences within this NCA.
9	4,187	South east of the study area, with boundaries along Dacey Avenue, Anzac Parade, Gloucester Pl, Winkurra Street and South Dowling Street. The NCA consists of single and multi-storey buildings in the southern half and Moore Park Golf Course in the northern half. ES Marks Athletics Field in in the east of the NCA and Moore Park Supa Centa is in the west.

Existing noise environment

The existing noise environment was identified based on the results of unattended noise monitoring carried out at representative locations within and surrounding the proposal area. In total 12 monitoring locations were selected as shown in **Figure 6-3** and described in **Table 6-16**.

The results of the long-term, unattended background noise monitoring and traffic noise monitoring carried out along the alignment are also summarised in **Table 6-16**.

Corresponding traffic count surveys were carried out concurrently with the long-term unattended noise monitoring in order to validate the noise model, the results of which are included in **Appendix M**.

The existing ambient noise at within the proposal area is predominantly from street traffic and industrial activity in Alexandria. In general, the background noise levels (RBLs) at these receivers are between 45-51 A-weighted decibels (dB(A)) during the daytime and between 35-38 dB(A) during the night time. Background noise levels at receivers further back and screened from this road corridor are typically 45 dB(A) during the daytime and 35 dB(A) during the night time.

The noise monitoring locations and associated NCAs are shown in **Figure 6-3**.

Table 6-17 Unattended monitoring results (construction noise parameters)

Noise monitoring location ID	Monitoring location	Measured Background Noise Level Rating Background Level - dB(A)				Measured LAeq Noise Level – dB(A)			
		Standard Hours	OOHW1 (Day)	OOHW1 (Evening)	OOHW2	Day Leq(15hour)	Night Leq(9hour)	Day Leq(1hour)	Night Leq(1hour)
NU1 ³ (within NCA 2)	Unit 48, 95 Euston Rd, Alexandria (Level 3 balcony facing Euston Rd)	61	54	54	40	69	63	69	67
NU2 ³ (within NCA 2)	189 Lawrence St, Alexandria	45	42	42	35	57	48	59	51
NU3 ³ (within NCA 3)	Unit M05, 147-161 McEvoy St, Alexandria (Level 2 balcony facing McEvoy St)	60	53	53	44	67	63	68	66
NU4 ³ (within NCA 4)	110A McEvoy St, Alexandria (Sunshade office)	51	50	50	38	61	58	62	62
NU5 ³ (within NCA 5)	2-6 Kellick St, Waterloo (Mount Carmel Catholic Primary School)	43	40	40	36	55	45	58	48
NU6 ³ (within NCA 6)	921 Bourke St, Waterloo (Sydney Water site facing McEvoy St)	56	56	56	55	63	59	64	61
NU7 ³ (within NCA 6)	921 Bourke St, Waterloo (Sydney Water site facing Bourke St)	56	53	53	46	62	57	63	60
NU8 ⁴ (within NCA 6)	10 Lachlan St, Waterloo (Level 12 terrace facing Lachlan St)	58	56	56	53	63	58	64	60
NU9 ³ (within NCA 6)	86 Mariott St, Redfern	44	41	41	40	56	46	59	49

Noise monitoring location ID	Monitoring location	Measured Background Noise Level Rating Background Level - dB(A)				Measured LAeq Noise Level – dB(A)			
		Standard Hours	OOHW1 (Day)	OOHW1 (Evening)	OOHW2	Day Leq(15hour)	Night Leq(9hour)	Day Leq(1hour)	Night Leq(1hour)
NU10 ⁴ (within NCA 7)	879 South Dowling St, Waterloo (Sydney Water site facing South Dowling St)	57	55	55	51	64	62	66	64
NU11 ³ (within NCA 6)	847 South Dowling St, Waterloo (Level 15 terrace facing South Dowling St)	64	63	63	51	67	64	68	67
NU12 ² (within NCA 9)	Moore Park Golf (at southern boundary near residential towers in Kensington)	46	44	44	39	55	46	56	48

Notes 1: "NU" = Unattended noise monitoring location

2: Existing L_{Aeq} noise levels are reported in terms of the RNP's day (7am-10pm) and night (10pm-7am) periods

3: Logger located At-facade (ie noise levels were monitored from a location within 1m of the building facade)

4: Logger located in free-field (ie noise levels were monitored from a location away from building facades)

6.2.3 Criteria

Construction hours

As described in **Section 3.3**, Roads and Maritime would limit construction activity to standard hours where it is feasible and reasonable to do. Where the standard construction hours are defined in the CNVG as:

- Monday – Friday: 7:00am to 6:00pm
- Saturday: 8:00am to 1:00pm
- No work on Sundays or Public holidays.

Periods outside of these standard hours are referred to as “Out of Hours (Works)” periods. The CNVG segregates “Out of Hours Works” periods into the following two bands according to the sensitivity of receivers to noise impacts:

- Out of Hours Works 1 (OOHW1): Monday - Friday 6:00 to 10:00pm, Saturday 7:00 to 8:00am and 1:00pm to 6:00pm, and Sunday 8:00am to 6:00pm
- Out of Hours Works 2 (OOHW2): Monday - Friday 10:00pm to 7:00am, Saturday 6:00pm to Sunday 8:00am, and Sunday 6:00pm to Monday 7:00am.

Some works such as tree felling or milling works for example, would likely need to be undertaken “out of hours”, to ensure safe work practices or to avoid unacceptable traffic disruptions.

Construction noise criteria

Construction noise criteria have been established for the proposal in accordance with the ICNG, in the form of construction Noise Management Levels (NMLs).

The NMLs for residential receivers are derived from the existing background noise levels, or rating background levels (RBL), with the relevant criteria applied in accordance with the ICNG for works during recommended standard hours and works outside these hours. Table 6-18 identifies the methodology applied in the development of NMLs for residential receivers.

Residential receivers are considered ‘noise affected’ where construction noise levels are greater than the noise management levels identified in **Table 6-18**.

Table 6-18 Development of construction noise management levels (NML)

Time of day	NML LAeq (15 min)	How to apply
Recommended standard hours Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm	Noise affected (RBL + 10 dB)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and the duration, as well as contact details.
No work on Sundays or public holidays	Highly noise affected (75 dB(A))	The highly noise affected level represents the point above which there may be strong community reaction to noise.

Time of day	NML LAeq (15 min)	How to apply
		<p>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:</p> <ol style="list-style-type: none"> 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 2. If the community is prepared to accept longer construction periods of higher noise activities over a shorter overall duration, in exchange for respite periods extending the length of time it takes for these works to be performed (for guidance on negotiating agreements see Section 7.2.2 of the ICNG (DECC, 2009).
Outside recommended standard hours	Noise affected (RBL + 5 dB)	<p>A strong justification would typically be required for works outside the recommended standard hours.</p> <p>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</p> <p>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.</p> <p>For guidance on negotiating agreements see Section 7.2.2 of the ICNG (DECC, 2009).</p>

Source: ICNG (DECC, 2009)

Based on the results of noise monitoring outlined in **Section 6.2.2** and the application of the criteria presented above, residential NMLs and residential sleep disturbance screening criteria has been established for each NCA as outlined in **Table 6-19**. The NMLs are derived as an allowable emergence above the level of night time background noise, defined as the Rating Background Level (RBL).

Table 6-19 Construction NMLs and sleep disturbance screening criteria at residences

NCA	RBL dB(A)			NML LAeq(15 minute) dB(A)				Sleep disturbance screening criterion (External screen level) LAmax dB(A) (RBL+15dB) ⁴
				Standard hours (RBL+10dB)	Out of Hours (OOH) (RBL+5dB)			
	Standard hours	OOWH1	OOWH2	Day	Day	Evening	Night	
1 ¹	45	42	35	55	47	47	40	55 ⁴
2 ²	45	42	35	55	47	47	40	55 ⁴
3	60	53	44	70	58	58	49	55 ⁴
4	51	50	38	61	56	55	43	55 ⁴

NCA	RBL dB(A)			NML $L_{Aeq(15\text{ minute})}$ dB(A)				Sleep disturbance screening criterion (External screen level) L_{Amax} dB(A) (RBL+15dB) ⁴
				Standard hours (RBL+10dB)		Out of Hours (OOH) (RBL+5dB)		
	Standard hours	OOWH1	OOWH2	Day	Day	Evening	Night	
5	43	40	36	53	45	45	41	55 ⁴
6 ³	44	41	40	54	46	46	45	55 ⁴
7	57	55	51	67	60	60	56	66
8	There are no residential receivers in NCA 8							
9	46	44	39	56	49	49	44	55 ⁴

Notes:

1. No noise monitoring was conducted within NCA 1, the RBL used was taken from the adjacent NCA 2
2. The RBL used for NCA 2 is the lowest RBL of the two monitoring locations within NCA 2
3. The RBL used for NCA 6 is the lowest RBL of the five monitoring locations within NCA 6
- 4 For sleep disturbance - 1. External screening level is less than 55dB(A) so the minimum screening level of 55dB(A) is set

NMLs for non-residential receivers have been adopted based on the ICNG as outlined in **Table 6-20**. As the study area includes high rise apartment blocks and multi storey dwellings, the assessment has assessed noise impacts per floor per building. Each floor on each building facade has been treated as a separate receiver. **Table 6-20** also details the number of receivers in the study area categorised by usage. For buildings with a mixed usage in the study area contain a commercial receiver on the ground floor and residential receivers for each floor above this.

Table 6-20 Construction NMLs - Non-residential receivers

Non-residential land use	NML* $L_{Aeq(15\text{ minute})}$ dB(A)
Classrooms at schools and other education institutions	45
Hospital wards and operating theatres	45
Places of worship	45
Active recreation	65
Passive recreation	60
Commercial premises (offices, retail outlets and small commercial premises)	70
Industrial premises	75

* When in use

For classrooms at schools and other educational institutions, hospital wards and operating theatres and places of worship, assuming that the building structures would typically provide a minimum of 10dB(A)

reduction from external noise levels to internal noise levels, the external NML are set to 10dBA above the internal NML (that is 55 dB(A)).

Construction traffic noise

Operational road traffic criteria adopted from the RNP is also considered to be applicable to construction traffic noise, therefore a relative increase in criteria of 2 dB(A) has been adopted for the assessment of construction traffic impacts associated with the proposal.

Sleep disturbance criteria

The assessment of the potential for sleep disturbance within residences from night time construction works is taken from the ICNG, which prescribes the following sleep disturbance “screening criterion”:

$$L_{Amax} \leq L_{A90(15min)} + 15 \text{ dB(A)}$$

This screening criterion indicates that sleep disturbance may be possible where the L_{Amax} maximum noise level from construction exceeds the background noise level by more than 15 dB(A). The sleep disturbance screening criteria is presented in **Table 6-19**.

In situations where this results in an external screening level of less than 55 dB(A), a minimum screening level of 55 dB(A) is set.

Construction vibration criteria

Construction vibration criteria are separated into two categories being vibration effects on humans, and vibration impacts on building structures.

Human comfort criteria

The NSW EPA classifies vibration as one of three types:

- Continuous – where vibration occurs uninterrupted and can include sources such as machinery and constant road traffic
- Impulsive – where vibration occurs over a short duration (i.e. less than 2 seconds) and occurs less than three times during the assessment period, which is not defined. This may include activities such as occasional dropping of heavy equipment or loading/unloading activities
- Intermittent – occurs where continuous vibration activities are regularly interrupted, or where impulsive activities recur. This may include activities such as rock hammering, drilling, pile driving and heavy vehicle or train pass bys.

Maximum and preferred values for continuous and impulsive vibration are provided in **Table 6-21**.

Table 6-21 Preferred and maximum level for human comfort

Location	Assessment period	Preferred values		Maximum values	
		z-axis	x and y axis	z-axis	x and y axis
Continuous vibration					
Critical areas ²	Day or night time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014

Location	Assessment period	Preferred values		Maximum values	
		z-axis	x and y axis	z-axis	x and y axis
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day or night time	0.020	0.014	0.040	0.028
Workshops	Day or night time	0.04	0.029	0.080	0.058
Impulsive vibration					
Critical areas ²	Day or night time	0.0050	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day or night time	0.64	0.46	1.28	0.92
Workshops	Day or night time	0.64	0.46	1.28	0.92
Daytime is 7.00am to 10.00pm and night-time is 10.00pm to 7.00am					

Intermittent vibration is assessed using vibration dose values (VDV). Preferred and maximum VDV's are defined in Table 2.4 of *Assessing Vibration – A Technical Guideline* (DECC, 2006) and reproduced in **Table 6-22**.

Table 6-22 Acceptable vibration dose values for intermittent vibration (ms^{-1.75})

Locations	Daytime (7:00am–10:00pm)		Night-time (10:00pm–7:00am)	
	Preferred values	Maximum values	Preferred values	Maximum values
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80

Structural damage criteria

The British Standard 7385 is used as a guide to assess the likelihood of building damage from ground vibration such as that caused by piling, compaction, construction equipment and road and rail traffic. The standard recommends levels at which ‘cosmetic’, ‘minor’ and ‘major’ categories of damage might occur based on the type of structure affected, using the peak particle velocity (PPV) parameter. The criteria are presented in **Table 6-23**.

Table 6-23 Structural damage criteria

Group	Type of structure	Damage level	Peak particle velocity (PPV) - mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50	50	50
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50

The levels for structural damage outlined in the standard refer to non-continuous vibration sources and are considered ‘safe limits’ up to which no damage due to vibration effects are expected to occur for the various building types. Where vibration is continuous these levels may be reduced by up to 50 per cent and additional assessment against the standard would be necessary.

Where heritage structures have the potential to be impacted, the German DIN Standard 4150-3 would be used for guidance. This standard recommends guideline values for short term vibration impacts on heritage structures and have been summarised in **Table 6-24**.

Table 6-24 Vibration guidelines for heritage buildings

Type of structure	Guideline values for velocity - mm/s			
	Vibration at the foundation at a frequency of			Vibration at the horizontal plane of the highest floor at all frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	
Heritage buildings	3	3 – 8	8 – 10	8

Operational noise criteria

Residential receivers

Under the RNP, road development is either classified as a “new road” or a “redevelopment of an existing road”. For the purpose of the operational noise assessment, the proposal is considered to be redeveloped road. As such the operational threshold for the proposal is adopted from the redeveloped road criteria listed in **Table 6-25**.

Table 6-25 Operational noise criteria for residential receivers

Road category	Type of project/land use	Assessment Criteria	
		Daytime (7am-10pm)	Night-time (10pm-7am)
Freeway/arterial/sub-arterial roads	Type 2 - Existing residences affected by noise from redevelopment of existing freeway/arterial/sub-arterial roads	L _{Aeq} (15hour) 60 dB (A)	L _{Aeq} (9hour) 55 dB (A)

Non-residential receivers

Noise criteria for non-residential land uses are presented in **Table 6-26**. These criteria are based on the level of impact below which normal operations or use would be able to continue with minimal interruption or disturbance.

Table 6-26 Operational noise criteria for non-residential receivers

Receiver type	Assessment criteria dB(A)		Additional considerations*
	Day (7 a.m.– 10 p.m.)	Night (10 p.m.– 7 a.m.)	
School classrooms	40 L _{Aeq,1hour} (internal) when in use	–	In the case of buildings used for education or health care, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the ‘maximum’ levels shown in Australian Standard 2107:2000 (Standards Australia 2000).
Places of Worship	40 L _{Aeq,1hour} (internal)	40 L _{Aeq,1hour} (internal)	The criteria are internal, ie the inside of a church. Areas outside the place of worship, such as a churchyard or cemetery, may also be a place of worship. Therefore, in determining appropriate criteria for such external areas, it should be established what is in these areas that may be affected by road traffic noise. No external worship land uses have been identified in the study area.
Open space (active use)	60 L _{Aeq,15hour} , (external) when in use	–	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.
Open space (passive use)	55 L _{Aeq,15hour} , (external) when in use	–	Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. playing chess, reading. For areas where there may be a mix of passive and active recreation, e.g. school playgrounds, the more stringent criteria apply. Open space may also be used as a buffer zone for more sensitive land uses.
Child care facilities	Sleeping rooms	–	Multipurpose spaces, eg Shared indoor play/sleeping rooms should meet the lower of the respective criteria.

Receiver type	Assessment criteria dB(A)		Additional considerations*
	Day (7 a.m.– 10 p.m.)	Night (10 p.m.– 7 a.m.)	
	LAeq,1hour 35 (internal) Indoor play areas LAeq,1hour 40 (internal) Outdoor play areas LAeq,1hour 55 (external)		Measurements for sleeping rooms should be taken during designated sleeping times for the facility, or if these are not known, during the highest hourly traffic noise level during the opening hours of the facility.
Mixed use development	-	-	Each component of use in a mixed use development should be considered separately. For example, in a mixed use development containing residences and child care facility, the residential component should be assessed against the appropriate criteria for residences and the child care component should be assessed against the appropriate criteria for child care facilities.

*Notes; No motels, aged care facilities or hospital wards were identified within the study area of this assessment.

It is to be noted that the noise criteria for some non-residential uses such as schools and places of worship are noise criteria assessed internal to the premises. These may be re-interpreted as external noise criteria by adding 10 dB(A) to the internal criteria. This reflects the sound attenuation assumed to be provided by the facade of typical buildings when the facade glazing is open for the purpose of ventilation. This assumption would be reviewed during detailed design and where required, site specific monitoring carried out to accurately identify the acoustic performance of the building facade.

Receivers qualify for the consideration of noise mitigation where predicted operational noise levels exceed these criteria presented in **Table 6-26**.

Sleep disturbance criteria

Similar to the construction sleep disturbance criterion, a guide for assessing the potential for sleep disturbance within residences from the proposal's vehicle pass by is provided in the RNP which refers to ENMM Practice Note iii which indicates that:

- Maximum internal noise levels below 50–55 dB(A) are unlikely to cause awakening reactions
- One or two noise events per night with maximum internal noise levels of 65–70 dB(A) are not likely to significantly affect health and wellbeing.

It is generally accepted that the level of traffic noise within a dwelling having its windows open is 10 dB(A) lower than the corresponding noise level immediately outside the facade (refer ICNG). Therefore, these internal noise goals may be re-expressed as external noise goals as follows:

- Maximum external noise levels below 60–65 dB(A) are unlikely to cause awakening reactions

- One or two noise events per night with maximum external noise levels of 75–80 dB(A) are not likely to significantly affect health and wellbeing.

Operational noise mitigation criteria

The NMG provides three triggers where a receiver may qualify for consideration of noise mitigation (beyond the adoption of road design and traffic management measures). These triggers are:

- Trigger 1: The predicted Build noise level exceeds the NCG controlling criterion and the noise level increase due to the project (ie the noise predictions for the Build minus the No Build) is greater than 2 dB(A)
- Trigger 2: The predicted Build noise level is 5 dB(A) or more above the criteria (exceeds the cumulative limit) and the receiver is significantly influenced by project road noise, regardless of the incremental impact of the project
- Trigger 3: The noise level contribution from the road proposal is “acute”, which is to say, at least 65 dB(A) $L_{eq,15hour}$ during daytime periods or at least 60 dB(A) $L_{eq,15hour}$ during night periods) then it qualifies for consideration of noise mitigation even if noise levels are dominated by another road.

Note that these criteria do not prescribe that a receiver shall receive mitigation necessarily, as there are matters of the “feasibility and reasonableness” of the mitigation measures to additionally consider

The eligibility of receivers for consideration of additional noise mitigation is determined before the benefit of additional noise mitigation (quieter pavement and noise barriers) is included. The requirement for the proposal is to provide reasonable and feasible additional mitigation for these eligible receivers to meet the NCG controlling criterion. If the NCG criterion cannot be satisfied with quieter pavement and noise barriers, then the receiver is eligible for consideration of at-property treatment.

6.2.4 Potential impacts

Construction

The proposal would be constructed over a 36 month period. For the purpose of the noise and vibration assessment, construction impacts have been assessed based on the construction activities and sound power levels summarised in **Table 6-27**.

Table 6-27 Proposed typical construction activities and sound power levels

Construction activity	Total activity sound power level $L_{Aeq(15min)}$
Mobilisation and site establishment (indicative time of exposure to any one receiver: 1 week)	106
Tree felling (To be undertaken only out of hours. Indicative time exposure of any receiver: 2-3 nights with noise respite periods)	119
Utility relocation (indicative time of exposure to any one receiver: 1-10 weeks)	125
Utility relocation (minor) (indicative time of exposure to any one receiver: 1-10 weeks)	119
Drainage infrastructure (indicative time of exposure to any one receiver: 1-5 weeks)	117

Construction activity	Total activity sound power level $L_{Aeq(15min)}$
Roadworks and tie-ins (indicative time of exposure to any one receiver: 1-3 weeks)	120
Milling work (indicative time of exposure to any one receiver: 1-3 weeks)	120
Paving work (indicative time of exposure to any one receiver: 1-6 weeks)	120
Finishing work (indicative time of exposure to any one receiver: 1-5 weeks)	110
Construction of compounds (includes demolition of any existing buildings)	114
Site compounds (operation)	115

These activities occur at various stages in each construction zone as described in **Section 3.3.1**. The final construction methodology and staging would be refined during the detailed design phase of the proposal, and associated noise and vibration impacts, and mitigation measures re-assessed as required.

Construction traffic

The proposal would generate up to 20 - 30 light vehicle and up to 20 - 30 heavy vehicle movements per day (per direction) during peak construction within each construction stage. It is assumed that traffic associated with the construction of the proposal would use Euston Road, McEvoy Street and South Dowling Street as a route to and from the construction site.

Based on the estimated construction traffic movements and the traffic volumes along the potential roads used to access the project, it is expected that construction traffic would increase existing traffic volumes by less than one per cent which equates to a noise increase of less than 1 dB(A). Therefore, noise from construction traffic would be well within the requirements of the CNVG.

Construction traffic noise impacts should be confirmed during the preparation of the Construction Noise and Vibration Management Plan (CNVMP) as part of the detailed design stage when the final construction scheduling is determined.

Predicted construction noise impacts

Construction noise impacts were predicted to the receiver locations surrounding the proposal by modelling the noise sources, receiver locations and construction activities as outlined above. Predicted noise level ranges determined for each construction activity represent the quietest plant item operating at the furthest distance to receivers and all plant items operating concurrently at the closest distance to receivers. This approach is conservative and has been adopted to ensure the full extent of possible noise impacts are assessed (ie worst-case scenario and is based on the noisiest activities – utility relocation, civil works and operation of site compounds occurring concurrently).

Predicted construction noise impacts noise levels and contours for each individual activity and the site compounds associated with the construction phase and for activities expected to occur concurrently are provided in detail in Appendix B and Appendix C respectively of the noise and vibration assessment (**Appendix M**).

Based on the predicted construction noise levels presented in Appendix B of the noise and vibration assessment (**Appendix M**), the day, evening and night construction noise management levels would

generally be exceeded at most residential receivers in each NCA. Residential receivers closest to the proposal and directly next to the construction works are also predicted to be highly noise affected, that is noise levels over 75dB(A) during the day period.

For sensitive land uses and commercial premises, construction noise levels exceed the relevant NMLs at some receiver locations and also exceed the highly noise affected level of 75dB(A).

It is noted that in most cases the exceedances of the NMLs and highly noise affected level of 75dB(A) are based on the activity occurring at a point nearest to the receiver and with all plant and equipment operating concurrently. However, not all plant and equipment would typically operate concurrently and this is considered to be a worst case scenario.

Noise contours and NML exceedance at each receiver for the loudest proposed standard hours and out of hours construction works for the worst case scenario (utility relocation, civil works and operation of site compounds occurring concurrently) are shown in **Figure 6-4** and **Figure 6-5** respectively.

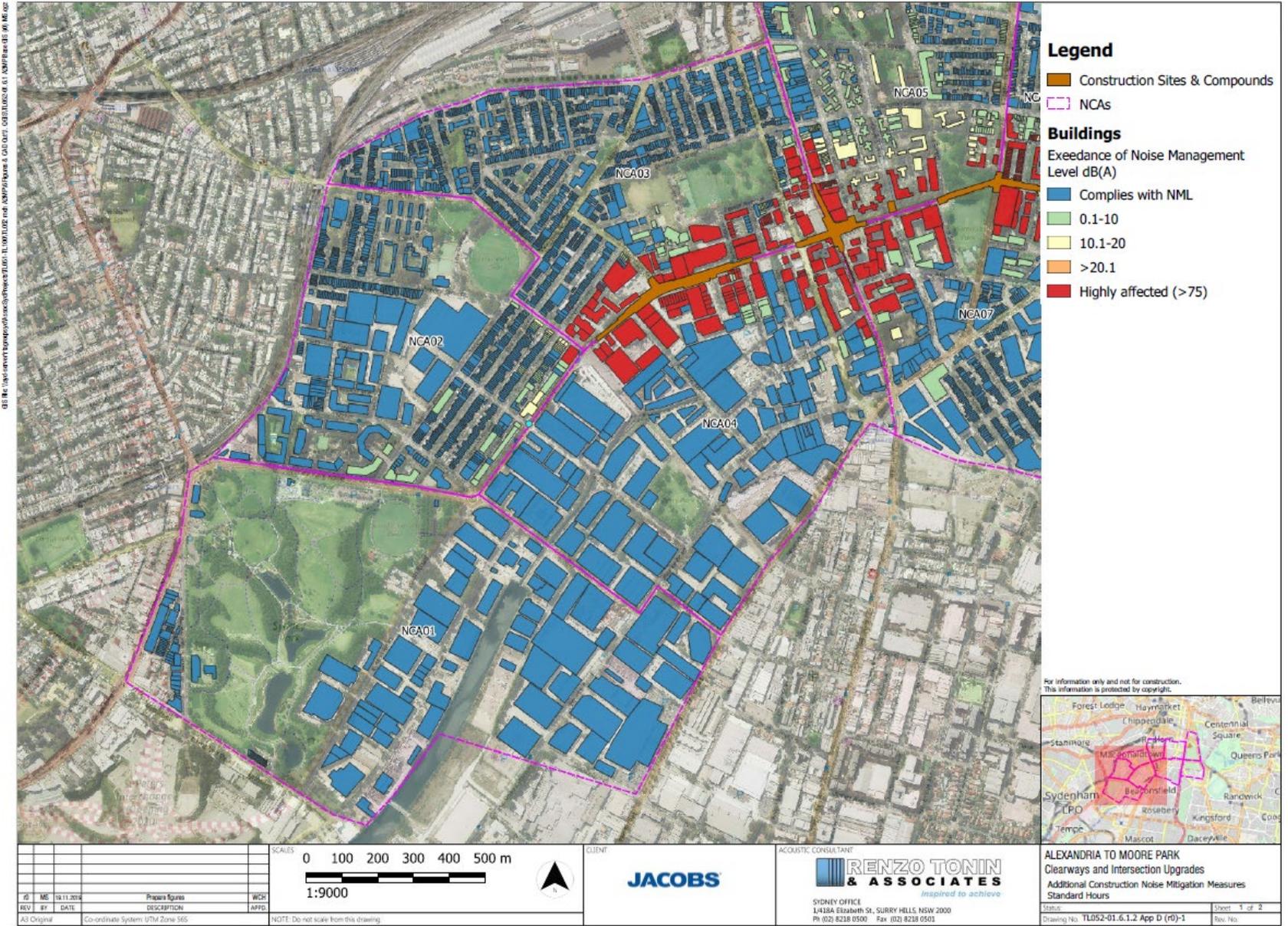


Figure 6-4a NML exceedance standard hours

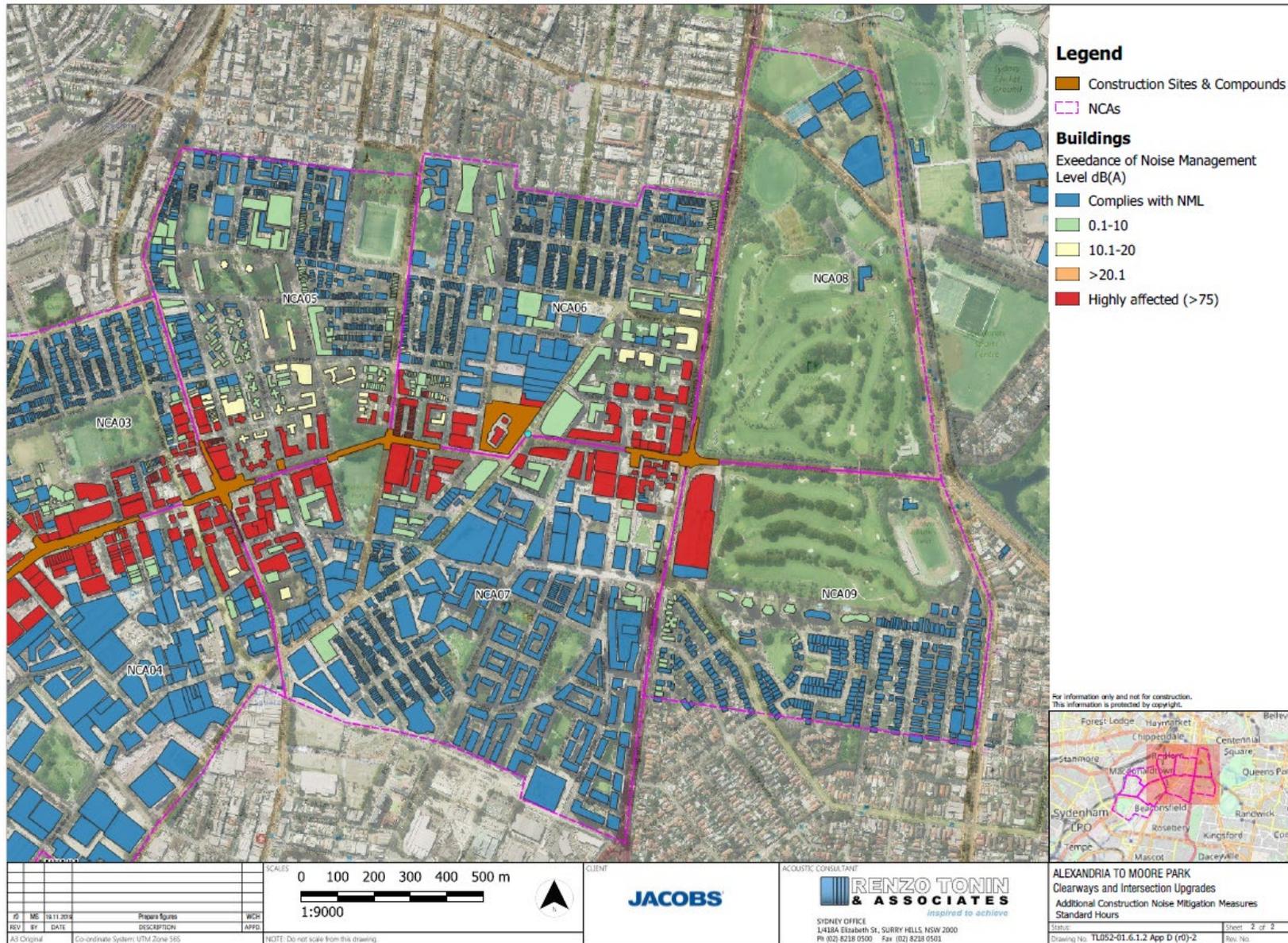


Figure 6-4b NML exceedance standard hours

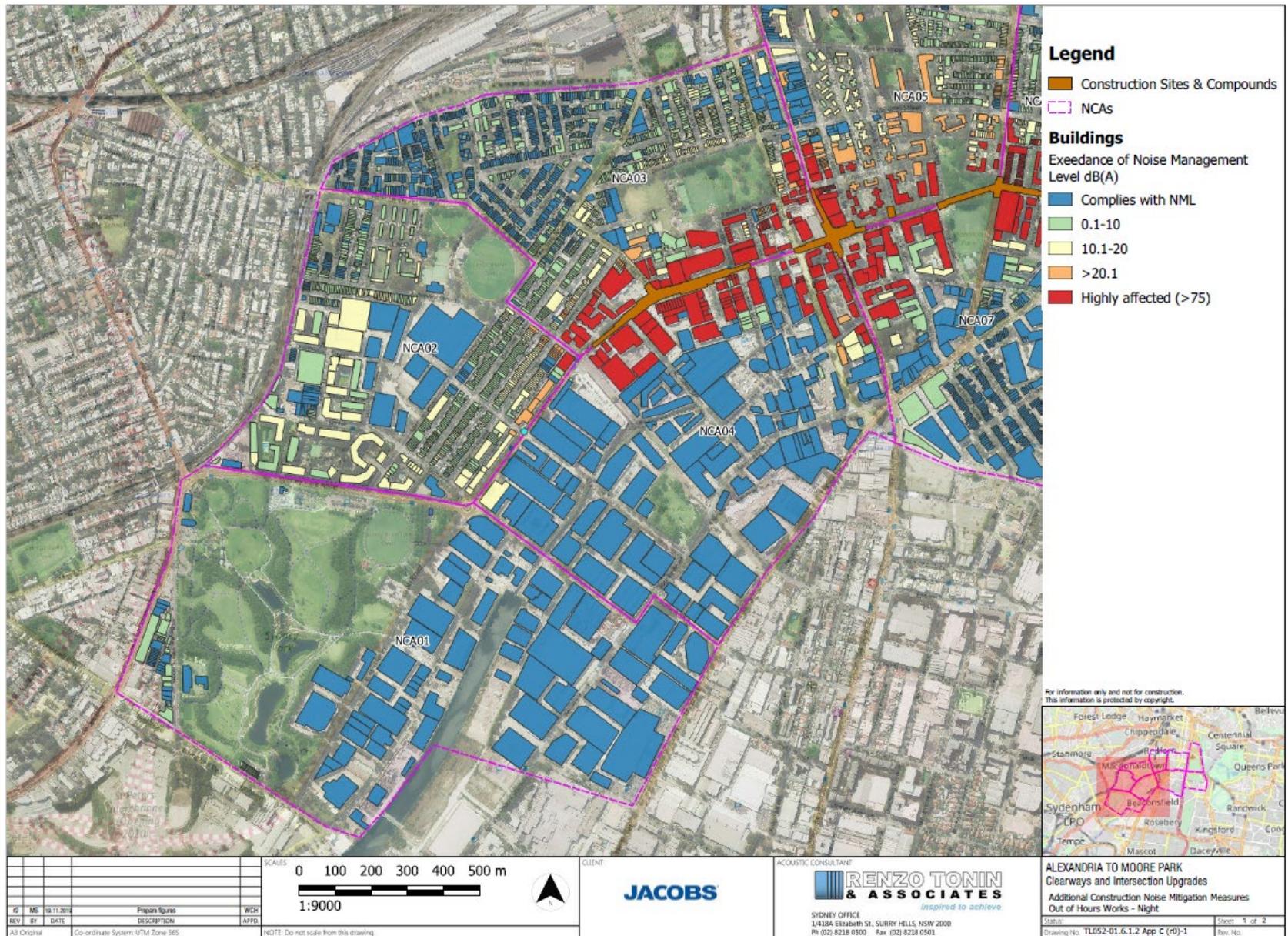


Figure 6-5a NML exceedance out of hours standard (night)

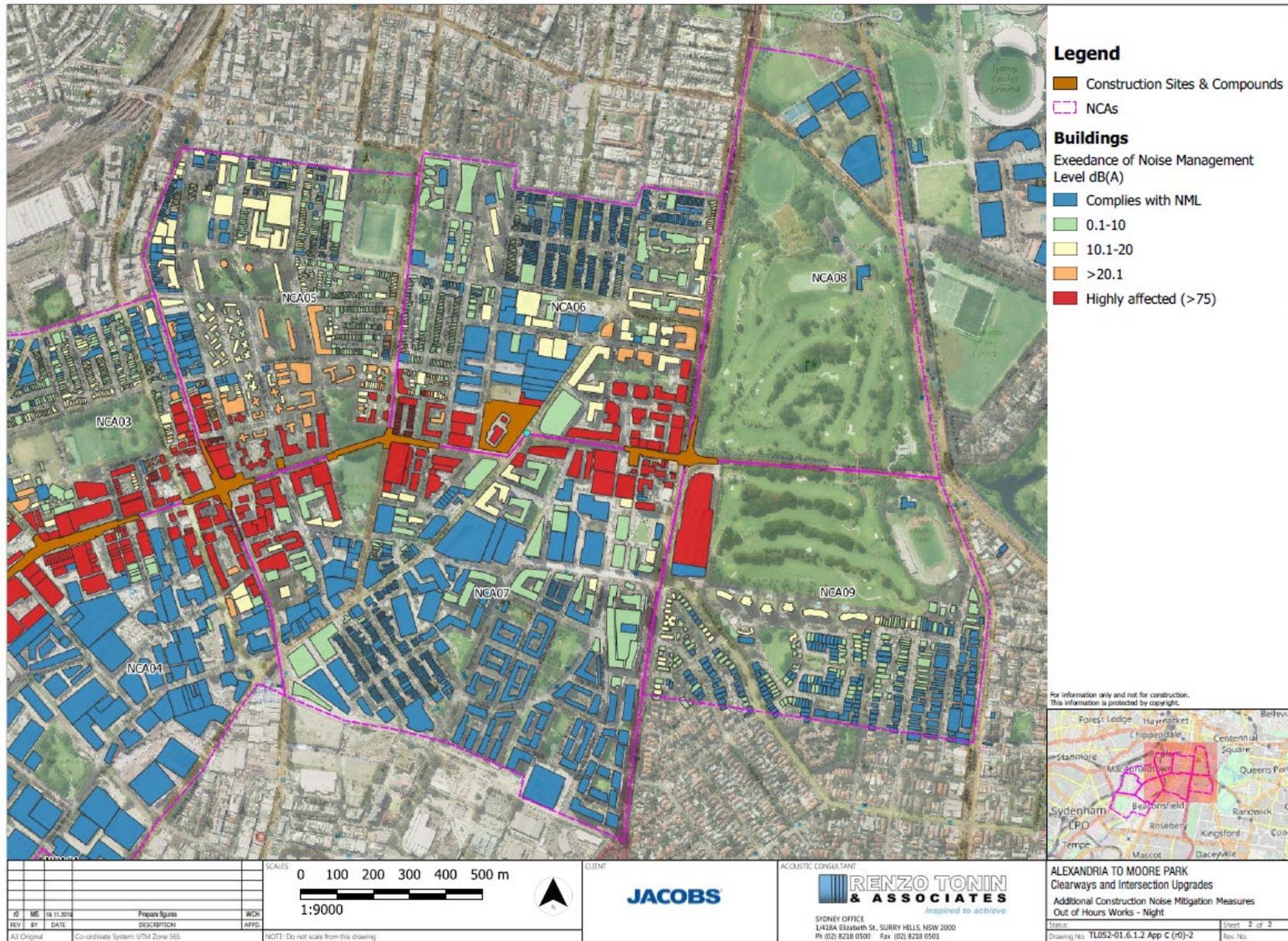


Figure 6-5b NML exceedance out of hours standard (night)

Construction vibration

Vibration intensive plant proposed includes pile boring rigs, vibrator rollers, compactors and excavators. The potential vibration impacts from the proposal is based on plant and equipment outlined in **Section 3.3.3** and summarised in **Table 6-28**.

Table 6-28 Potential vibration impact assessment for residential and commercial properties

NCA	Approximate distance to nearest buildings from works	Assessment on Potential Vibration Impacts	
		Structural Damage Risk	Human Disturbance
1	>50	Very low risk of structural damage	Very low risk of adverse comment
2	>50		
3	<10	High risk of structural damage from vibratory rolling	High risk of adverse comment as a result of compacting, truck traffic and/ or vibratory rolling.
4	<10	Medium risk of structural damage from other activities.	
5	<10		
6	<10		
7	<10		
8	>50m (commercial receivers)	Very low risk of structural damage.	Very low risk of adverse comment.
9	21m to 30m	High risk of structural damage from vibratory rolling Medium risk of structural damage from other activities.	Medium risk of adverse comment as a result of compacting, truck traffic and/ or vibratory rolling.

Where vibration intensive plant is used, vibration would need to be managed to minimise disturbance to building occupants and avoid damage to buildings and other structures. Based on the relevant guidelines, the recommended safe working distances for typical items of vibration intensive plant are outlined in **Table 6-29**.

In relation to human response, the safe working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are considered acceptable. Additional assessment would be carried out where the human response criteria have been exceeded.

Table 6-29 Recommended minimum working distances for vibration intensive plant

Plant item	Rating/description	Safe working distance (metres)	
		Cosmetic damage (British Std 7385)	Human response (DECCW)
Vibratory roller	<50 kN (typically 1-2 t)	5	15 to 20
	<100 kN (typically 2-4 t)	6	20
	<200 kN (typically 4-6 t)	12	40
	<300 kN (typically 7-13 t)	15	100
	>300 kN (typically 13-18 t)	20	100
	>300 kN (> 18 t)	25	100
Pile boring	≤ 800 mm	2	n/a
Jackhammer	Hand held	1	Avoid contact with structure
Compactors	-	15	100
Grader	≤ 20 tonne	2	10
Excavators	≤ 20 tonne (travelling /digging)	10	15
Truck movements			10

For heritage items, the risk of damage will be dependent on the condition and construction of the item. Dilapidation studies of heritage items will help inform of the level of risk from construction vibration impacts.

Vibratory rolling would be expected to be carried out within 100 metres of residences and commercial buildings for various stages of works (refer Section 3.3.3) and so may impact human comfort within those buildings.

Operation

Assessment of operation noise impacts

The predicted operational noise levels upon receivers within the study area that have been assessed as part of the noise and vibration assessment are detailed in **Appendix M** of this REF and a summary provided below.

The results for the number of receivers impacted upon for the design year 2031 are summarised in **Table 6-30**.

Table 6-30 Number of Receivers Impacted Due to Build Option for Design Year 2031

NCA	Number of receivers assessed in NCA	Day Period – Number of Residences				Night Period – Number of Residences				Requiring Further Treatment
		Exceed NCG Noise Criteria Level1	>2dB(A) Increase2	Exceed Cumulative Noise Limit	Experience Acute Noise Levels [≥ 65dB(A)]	Exceed NCG Noise Criteria Level1	>2dB(A) Increase2	Exceed Cumulative Noise Limit	Experience Acute Noise Levels [≥ 65dB(A)]	
1	560	0	0	0	0	0	0	0	0	0
2	5,307	94	0	8	8	90	0	8	8	8
3	8,248	308	0	52	54	279	0	54	54	54
4	570	201	0	29	29	179	0	29	29	29
5	7,069	272	0	28	15	224	0	15	15	28
6	7,026	449	0	129	160	417	0	157	159	161
7	8,431	578	0	103	109	527	0	103	109	109
8	50	0	0	0	0	0	0	0	0	0
9	4,187	63	0	0	0	56	0	0	0	0
Total	43,785	1,979	0	379	375	1,785	0	364	374	389

Notes:

1. NCG noise criteria level based on 'Redeveloped Road' criteria as per RNP
2. >2dB(A) increase based on comparison between 'build option' and 'no build option' for the design year 2031
3. Includes sensitive receiver at 2A Kellick Street, Waterloo (Our Lady of Mt Carmel Catholic Primary).

As shown in **Table 6-30**, exceedance of the NCG noise criteria was predicted for 1,979 receivers during the day period and 1,785 receivers during the night period in the year 2031, 10 years after the opening of the proposal.

Traffic noise levels in the year 2031 are predicted to generally increase marginally by no more than 2 dB(A) at all receivers.

The noise and vibration assessment (**Appendix M**) identified 379 receivers would exceed the cumulative limits for the day period and 364 receivers during the night period in the year 2031. Furthermore, the assessment identified 375 receivers would exceed the acute noise threshold for the day period and 374 receivers during the night period in the year 2031.

Table 6-37 and **Figure 6-6**, identifies that 389 receivers within 48 residential, educational, hotel and child care buildings were identified as potentially requiring additional noise mitigation treatment due to them exceeding the NCG noise criteria and/or exceeding the cumulative / acute noise limits. The application of noise mitigation measures is detailed in the noise and vibration assessment (**Appendix M**) and discussed in further below.



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Legend

- The proposal
- Construction footprint
- Road
- Railway line
- Noise catchment area
- Buildings eligible for at-property acoustic treatment
- Buildings not eligible for at-property acoustic treatment



Figure 6-6 | Buildings eligible for at-property acoustic treatment
Alexandria to Moore Park Stage 1

Application of noise mitigation

In accordance with the relevant guidelines, the following operational noise mitigations have been assessed for the proposal:

- Quieter pavements
- Installation of low noise pavements
- Erection of noise barriers and or mounds
- Provision of at-property treatments.

Receivers do not qualify for these noise mitigation treatment(s) automatically where NCG criteria exceedances are predicted. The provision of these mitigation measures depends whether it is “feasible and reasonable” to provide these treatments. For example, it is not cost-effective (and therefore not reasonable) to provide a quieter road pavement surface where future traffic speeds are expected to be lower than 70 kilometres per hour, as in this case vehicle motor noise would dominate over tyre/road noise. In this example, it may be more cost-effective to provide at-property treatments to dwellings. An assessment of reasonable and feasible noise mitigation measures for the proposal is summarised below.

Quieter Pavements

The use of low-noise pavements is generally a preferred form of noise mitigation on road proposals as its use has the potential to benefit the largest number of receivers. However, this would not be feasible for the proposal due to the number of traffic lights, the likelihood of stop-start traffic as well as low future traffic speeds (refer to **Section 6.1**). These issues would negate the potential acoustic benefit of using low-noise pavement, such that it would not be considered a reasonable mitigation measure for this proposal.

Based on this assessment, low-noise pavement was not considered a viable mitigation measure during operation of the proposal.

Noise barriers

As with low noise pavements, a noise barrier (whether a mound or wall) can reduce both internal and external noise levels at a sensitive receiver. However, the use of noise mounds or barriers would not be a feasible mitigation option for this proposal due to visual impact, security, the presence of significant trees, state heritage considerations, space constraints and access requirements. Therefore, noise barriers were not considered a viable mitigation measure during operation of the proposal.

At-property treatments

Where noise barriers and/or low noise pavements were not considered feasible or reasonable, noise impacts at affected dwellings would be required to be mitigated using at-property treatments. In accordance with the relevant guidelines, the following treatments would be considered at impacted receivers:

- The installation of courtyard screen walls
- Fresh air ventilation systems that meet Building Code of Australia requirements with the windows and doors shut
- Upgraded windows and glazing and solid core doors on the exposed facades of masonry structures only (these techniques would be unlikely to produce any noticeable benefit for light frame structures with no acoustic insulation in the walls)
- Upgrading window and door seals and treatment of sub floor ventilation
- The sealing of wall vents
- The sealing of the underfloor below the bearers
- The sealing of eaves.

The preferred operational noise mitigation option for the receivers that qualify for noise mitigation would be at-property architectural treatment, rather than by implementing low noise road pavements or roadside noise barriers, as these latter measures would not be feasible and reasonable.

The specific acoustic treatment for each of the 389 receivers within in 48 buildings would be determined following a site visit to establish the feasibility and reasonableness of applying such treatments and in consultation with the landowner. In particular, this relates to whether the existing building facade already provides a level of noise attenuation equal to that which would be provided by Roads and Maritime in response to the proposal's operational noise impacts.

Further assessment of individual receivers requiring treatment and consultation with affected property owners would be carried out during detailed design.

Roads and Maritime has carried out a survey identifying developments approved over the last 10 years to identify which of the 48 impacted buildings have likely already been treated for high existing noise levels from existing traffic as a result of their consented building approval. Thirty building have been identified as newly developed buildings of which Roads and Maritime would carry out additional acoustic design survey to confirm if the level of acoustic treatment within buildings is already equivalent to the acoustic treatments that would be offered by the NMG and the Roads and Maritime *At-Receiver Noise Treatment Guideline* before committing to offering additional at-property treatment.

The remaining 18 properties (refer to **Figure 6-6**) that are eligible for at-property treatment are subject to site inspections confirming that it is feasible and reasonable to apply those treatments. Any feasible and reasonable acoustic treatments proposed would be considered in consultation with the landowners.

During the detailed design stage of the proposal, further investigation of all reasonable and feasible noise control options would be required as a result of any exceedances of the applicable NCG noise criteria. All reasonable and feasible noise mitigation treatments would be considered for the affected receivers as part of the proposal to reduce traffic noise levels at residences to within the applicable noise limits.

Sleep disturbance

Given that the traffic volumes remain the same for the 2031 'Build' scenario as the 2031 'No Build' scenario, there would be no change to the number of heavy vehicles accessing the proposal corridor at night time. With the improved traffic flow from the proposal, it would be reasonable to expect that fewer truck braking and acceleration locations would be required in the future 'Build' scenario along the proposal corridor and the incidence of night time maximum noise level events across the study area would be reduced. A more detailed sleep disturbance assessment would be undertaken during the detailed design stage of the proposal to confirm this.

6.2.5 Safeguards and management measures

Safeguards and management measures for noise and vibration impacts are presented in **Table 6-31**.

Table 6-31 Noise and vibration safeguards and mitigation measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Noise and vibration	<p>A CNVMP will be prepared and implemented as part of the CEMP. The CNVMP will generally follow the approach in the ICNG and identify:</p> <ul style="list-style-type: none"> All potential significant noise and vibration generating activities associated with the activity Site inductions 	Contractor	Detailed design/ pre-construction	<p>Core standard safeguard NV1</p> <p>Section 4.6 of QA G36 Environment Protection</p>

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> Feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014) 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 Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria. 			
Noise and vibration	<p>All sensitive receivers (eg schools, local residents) likely to be affected will be notified at least five days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> The project The construction period and construction hours Contact information for project management staff Complaint and incident reporting How to obtain further information. 	Contractor	Detailed design / pre-construction	Additional safeguard
Construction hours and scheduling	Where feasible and reasonable, construction will be carried out during the standard daytime working hours and work generating high noise levels will be scheduled during less sensitive time periods.	Construction contractor	Construction	Additional safeguard
Construction respite period during normal hours and out-of-hours	<p>The duration and respite of high noise generating activities will be carrying out in accordance with the CNVG, and consultation with the community.</p> <p>As a guide, high noise generating activities near receivers will be carried out in blocks that do not exceed hour hours each, with a minimum respite period of one hour between each block. The</p>	Construction contractor	Detailed design/pre-construction /construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	duration of each block of work and respite will be flexible to accommodate the usage and amenity at nearby receivers.			
Equipment selection	Use quieter and less noise emitting construction methods where feasible and reasonable. Ensure plant including the silencer is well maintained.	Construction contractor	Detailed design/pre-construction	Additional safeguard
Plant noise levels	The noise levels of plant and equipment will have operating Sound Power or Sound Pressure Levels compliant with the criteria in Appendix F of the CNVG. A noise monitoring audit program will be implemented to ensure equipment remains within the more stringent of the manufacturer's specifications or Appendix F of the CNVG. The noise levels of plant and equipment items will be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in the CNVG. Use only the necessary size and power of equipment will be used	Construction contractor	Detailed design/pre-construction	Additional safeguard
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers will be maximised. Plant used intermittently will be throttled down or shut down. Noise-emitting plant will be directed away from sensitive receivers. Only have necessary equipment on site.	Construction contractor	Detailed design/pre-construction	Additional safeguard
Plan worksites and activities to minimise noise	Locate compounds away from sensitive receivers and discourage access from local roads where possible. Parking and loading/unloading areas will be planned to minimise reversing movements within the site. Where additional activities or plant may only result in a marginal noise increase	Construction contractor	Detailed design/pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible.</p> <p>Very noisy activities will be scheduled for normal working hours. If the work cannot be undertaken during the day, it should be completed before 11:00pm where possible.</p> <p>If programmed night works is postponed the work will be re-programmed and the approaches in the CNVG apply again.</p>			
<p>Non-tonal and ambient sensitive reversing alarms</p>	<p>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 out of hours work.</p> <p>The use of ambient sensitive alarms that adjust output relative to the ambient noise level will be considered.</p>	<p>Construction contractor</p>	<p>Detailed design/pre-construction</p>	<p>Additional safeguard</p>
<p>Minimise disturbance arising from delivery of goods to construction sites</p>	<p>Loading and unloading of material/deliveries is to occur as far as possible from sensitive receivers.</p> <p>Select site access points and roads as far as possible away from sensitive receiver.</p> <p>Dedicated loading/unloading areas will be shielded if close to sensitive receivers.</p> <p>Delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible.</p> <p>Avoid or minimise these out of hours movements where possible.</p>	<p>Construction contractor</p>	<p>Detailed design/pre-construction</p>	<p>Additional safeguard</p>
<p>Engine compression braking</p>	<p>Limit the use of engine compression brakes at night and in residential areas.</p> <p>Vehicles will be are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'in-service test procedure' and standard.</p>	<p>Construction contractor</p>	<p>Detailed design/pre-construction</p>	<p>Additional safeguard</p>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources will be enclosed or shielded where feasible and reasonable while ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding.	Construction contractor	Detailed design/pre-construction	Additional safeguard
Additional noise mitigation measures	Where the NML at a receiver is exceeded after the standard mitigation measures from Section 4.5.1 of the noise and vibration assessment (Appendix M) have been implemented, additional noise mitigation measures as per Appendix C of the CNVG will be considered.	Construction contractor	Detailed design/pre-construction	Additional safeguard
Vibration	Dilapidation surveys should be conducted at all residential and other sensitive receivers identified to be impacted by vibration from the construction site.	Construction contractor	Construction	Additional safeguard
At property treatments	<p>Further investigation of all reasonable and feasible noise control options will be required as a result of any exceedances of the applicable NCG noise criteria.</p> <p>All reasonable and feasible noise mitigation treatments would be considered for the affected receivers as part of the proposal to reduce traffic noise levels at residences to within the applicable noise limits.</p> <p>Additional acoustic design survey to confirm if the level of acoustic treatment within the 30 newly-developed buildings is already equivalent to the acoustic treatments that would be offered by the NMG and the Roads and Maritime <i>At-Receiver Noise Treatment Guideline</i> before committing to offering additional at-property treatment.</p>	Roads and Maritime	Detail design	Additional safeguard
Operation sleep disturbance	A more detailed sleep disturbance assessment will be carried out during the detailed design stage for the operation impacts of the proposal.	Roads and Maritime	Detail design	Additional safeguard

6.3 Non-Aboriginal heritage

An assessment has been prepared to identify the extent and magnitude of potential impacts of the proposal on non-Aboriginal heritage items. This assessment is presented in the *Alexandria to Moore Park Project Statement of Heritage Impact* (SoHI) (Artefact Heritage, 2019b) which is provided in **Appendix K**. A summary of the SoHI is presented in this section, together with safeguards and management measures to mitigate any negative impacts.

6.3.1 Methodology

The heritage impact assessment was carried out in accordance with the following guidelines, including:

- *NSW Heritage Manual* (NSW Heritage Office, 2002)
- *Statement of Heritage Impact* (NSW Heritage Office, 2002)
- *Australia International Council on Monuments and Sites* (ICOMOS) Burra Charter for Places of Cultural Significance (Burra Charter).

The study area for the non-Aboriginal heritage assessment is the proposal area as defined in **Section 1.2.1** and shown on **Figure 1-2**. For this non-Aboriginal heritage assessment, the proposal area was divided into four construction zones as defined in **Section 3.3.1** and shown in **Figure 3-6**.

The assessment comprised of:

- Background historical research, including a review of previous heritage assessments to identify the potential for archaeological and heritage items to be present within the proposal area, to further define the scope of the site inspection
- A search of all available heritage registers based on a 100 metre buffer. This included the State Heritage Register (SHR), State Heritage Inventory (SHI), Section 170 Heritage and Conservation Registers, relevant LEPs, National Trust of Australia (NSW) list (NTAR), Register of the National Estate (RNE), Commonwealth Heritage List (CHL), National Heritage List (NHL) and World Heritage List (WHL) to identify previously recorded non-Aboriginal heritage items in the study area, and the legislative obligations related to these
- Site inspection carried out by Artefact Heritage Archaeologist on 8 November 2016 to inspect the intactness of the study area, identify any historical heritage items and buildings, assess the sight lines to and from nearby heritage listed items and to inform the assessment of archaeological potential (refer to **Appendix K**). Additional site inspections were carried out on 30 October 2017 and 22 October 2019 to update site conditions
- The determined level of significance of each heritage item
- Determining the potential impacts of the proposal on non-Aboriginal heritage items, conservation areas and archaeology and visual impacts
- Provision of measures to manage the proposal's potential impact on non-Aboriginal heritage items, conservation areas and archaeology through the application of the 'avoid, minimise and mitigate' hierarchy.

6.3.2 Existing environment

Historical context

The SoHI (Artefact Heritage, 2019b) describes the historical background of the study area in five main historical phases post European colonisation (see **Section 6.3.2** for Aboriginal historical background) and

the potential archaeological remains which could be present from each phase. Refer to the SoHI in **Appendix K** for the full historical background of the study area.

Phase one: Early European Exploration and Land Use: 1770-1848.

The first recorded European to explore Botany Bay and the Randwick, Alexandria and Moore Park area was Captain James Cook in 1770.

The study area originally consisted of coastal sand dunes, marshes, swamps and freshwater streams that drained into Sheas Creek and the Cooks River. Part of the eastern extend of the proposal area (Moore Park) was set aside for a Common by Governor Macquarie in 1811, and residential or industrial occupation did not occur in the area. Early land use consisted of timber getting, grazing and fishing, with European occupation of the majority of the study area likely to have been temporary. Between 1823 and 1848 various mills and wool-washing facilities had been informally established along major streams in the western vicinity of the study area near Waterloo and Alexandria.

Archaeological remains associated with this period are likely to include:

- Archaeological features associated with low intensity land use associated with marginal swamp land, cattle grazing and farming include tree boles, field drains, fence line post holes, isolated artefact scatters
- Archaeological features associated with industrial activities including post holes, timber, brick or stone footings, evidence of landscape modification and refuse pits, isolated artefact scatters, drainage channels and land fill.

Phase two: Industrial Land Use and Residential Settlement: 1848-1860

During 1848-1860, Land use within Zone 1 to 3 consisted of scattered industrial activities such as woolwashing, soap making, tanning, paper making and boiling down works. Chinese market gardens were also established during this phase alongside St Silas Church and School, which was partially located within Zone 2. Some residential settlement was also taking place, although it was largely informal. No known structures occupied and construction footprints within the study area.

Archaeological remains associated with this period are likely to include:

- Archaeological features associated with industrial activities and market gardening such as brick, stone or timber footings, domestic and industrial refuse pits, landscape modification, drainage channels, land fill, wells, post holes, gardening implements, remains of irrigation systems, cisterns, sedimentary deposits associated with industrial activities, handmade bricks, tanbark and leather fragments and ash deposits
- Archaeological features associated with the St Silas Church and School, located immediately north of McEvoy Street and east of Botany Road in Zone 2. These may comprise of postholes, brick footings and refuse deposits.

Phase three: Subdivisions, Formal and Informal Settlement and Industry: 1860-1900

This phase is associated with the diversion of waterways such as Sheas Creek, construction of the Main Southern Outfall Sewer, informal and formal residential and industrial occupation. Land within Waterloo was opened up for reclamation and subdivisions at this time and rows of terraces and weatherboard worker's cottages fronted McEvoy Street. A number of pubs and hotels such as the Parkview Hotel (now Moore Park View Hotel) and Iron Duke Hotel (demolished and relocated in the 20th century) were built to service the growing population. Industrial activities continued during this phase.

Archaeological remains associated with this period are likely to include:

- Archaeological features associated with formalised residential and commercial settlement including sandstone, brick or timber footings and/or foundations, post holes, refuse pits, ceramic service pipes,

brick drainage pits, cisterns, land fill, artefact scatters, yard surfaces and fence lines in Zone 2 and Zone 4

- Archaeological features associated with the St Silas Church and School, located immediately north of McEvoy Street and east of Botany Road in Zone 2. These may comprise of postholes, brick footings and refuse deposits
- Archaeological features associated with the former Iron Duke Hotel in Zone 2 including postholes, stone or brick footings and artefact scatters or refuse pits
- Archaeological features associated with unrecorded industrial activities and market gardening such as brick, stone or timber footings, domestic and industrial refuse pits, landscape modification, drainage channels, land fill, wells, post holes, gardening implements, cisterns, sedimentary deposits associated with industrial activities, tanbark and leather fragments and ash deposits
- Evidence of formalised road infrastructure such as road surfaces, culverts, drains and paving.

Phase four: Cooper Estate Subdivisions and World War Two: 1900 to 1960

The Waterloo Estate (which covered Zone 1 - Zone 3) was broken up in 1914 and large areas were further subdivided and used for industrial and residential purposes. Some buildings were modernised, and the Moore Park View Hotel replaced the 1890 Parkview Hotel in 1938.

Urban renewal programs in Waterloo led to the demolition of informal 19th century residences and industrial sites. As Sydney's electricity network spread throughout the city, substations, water pumping stations and additional modernised infrastructure were constructed within the study area. A tram line was established along Botany Road, Elizabeth Street, South Dowling Street and Dacey Avenue.

Moore Park and Centennial Park were taken over by the Army in 1940 and small huts, air raid shelters and training facilities were established. The Dowling Street Tram Depot occupied the western extent of Moore Park during this phase, in Zone 4.

Archaeological remains associated with this period are likely to include:

- Archaeological remains of residential terraces and cottages along McEvoy Street in Zone 2 and Lachlan Street in Zone 4 including brick, timber and stone footings and foundations, refuse pits, ceramic service pipes, brick drainage pits, land fill, artefact scatters, yard surfaces, fence lines and remains of early footpaths
- Remains of a linear building in Dowling Street Tram Depot.

Phase five: Redevelopment and Modernisation: 1960-Present

By the 1960s, many early factories and residences were replaced with larger, modern industrial buildings and warehouses. The 1980s saw many industries moving out of the area and replaced by cafes, car mechanics, community spaces, shopfronts and high density housing. By the 1990s and 2000s, redevelopments had increased and included the construction of high rise apartments near Lachlan Street, Waterloo, which replaced 19th and 20th century factories and warehouses.

Moore Park and the Moore Park Golf Course remained intact during this period.

Assessment of archaeological potential

An assessment of archaeological potential was carried out in the SoHI, where historical archaeological potential is defined as the potential of a site to contain historical archaeological relics, as classified under the *NSW Heritage Act 1977*. The assessment of archaeological potential is based on the identification of former land uses and evaluating whether subsequent actions (either natural or human) would have impacted on archaeological evidence for these former land uses. Activities that occurred during Phase 4 and Phase 5 occupation of the study area are likely to have incurred the most impacts to potential archaeological remains. The areas identified as having the potential to contain archaeological remains and

the likelihood of these remains surviving in the study area are outlined in **Table 6-32**, and shown on **Figure 6-7**.

Table 6-32 Assessment of archaeological potential for the study area

Phase	Known Structures/Activities	Archaeological potential
1 (1770-1848)	<ul style="list-style-type: none"> No documentary evidence of specific activities such as grain milling or wool washing within the site, although these activities were occurring in the vicinity of the study area No documentary evidence of residential land use in the study area 	Nil
2 (1848-1860)	<ul style="list-style-type: none"> <i>Noxious Trades Act</i> of 1848 brings industries such as wool washing, soap making, tanning, paper making and boiling down works into the eastern portion of the study area, although no known structures within study area Chinese market gardens established in vicinity of study area Informal residential settlement in vicinity of study area St Silas School and church established along McEvoy Street and Botany Road (Zone 2) 	<p>St Silas School and Church (Zone 2)</p> <p>Low</p> <p>Remainder of the study area (Zone 1, 3 and 4)</p> <p>Nil</p>
3 (1860-1900)	<ul style="list-style-type: none"> Potential remains of terrace and cottage frontages along McEvoy Street (Zone 2) and Lachlan Street (Zone 4) Potential remains of the Iron Duke Hotel (ancillary Site 2) St Silas School and church continues to occupy land in and around Zone 2 Establishment of trams lines along Botany Road (Zone 2), Elizabeth Street (Zone 3) and South Dowling Street (Zone 4) 	<p>Terrace and cottage frontages along McEvoy Street (Zone 2) and Lachlan Street (Zone 4):</p> <p>Low - moderate</p> <p>Former Iron Duke Hotel</p> <p>Low - moderate</p> <p>St Silas School and Church (Zone 2)</p> <p>Low</p> <p>Potential remains of 19th and 20th century tram tracks along Botany Road (Zone 2), Elizabeth Street (Zone 3) and South Dowling Street (Zone 4):</p> <p>Moderate</p>
4 (1900-1960)	<ul style="list-style-type: none"> Moore Park and Centennial Park occupied by the Australian Army and small huts, air raid shelters and training facilities established Substations, water pumping stations and additional modernised infrastructure constructed within the study area replacing St Silas School buildings in Zone 2, and 	<p>Linear building within Dowling Street Tram Depot (Zone 4):</p> <p>Low</p> <p>Potential remains of 19th and 20th century tram tracks along Botany Road</p>

Phase	Known Structures/Activities	Archaeological potential
	residences along Lachlan Street (Zone 4) and McEvoy Street (Zone 2).	(Zone 2), Elizabeth Street (Zone 3) and South Dowling Street (Zone 4): Moderate

Listed non-Aboriginal heritage items

There are 18 heritage items and three heritage conservation area located within 100 metres of the study area. However, many of these items possess no visual connection to the study area due to local topography and the surrounding built urban environment. Therefore, only the heritage listed items within the study area within view of the study area were considered. These heritage items are listed in **Table 6-32** and shown on **Figure 6-8** by the listing number.

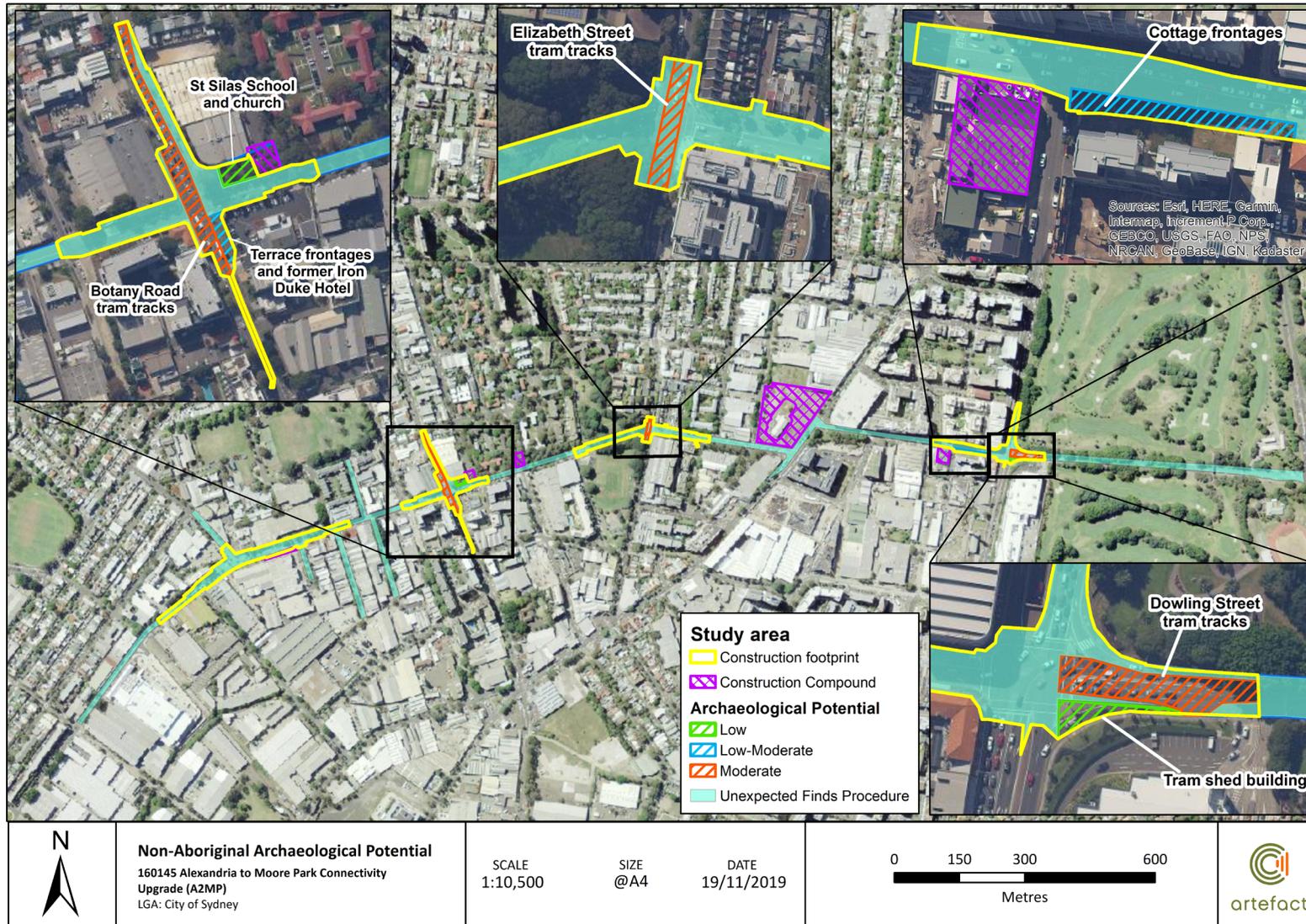


Figure 6-7 Archaeological potential (Artefact, 2019a)

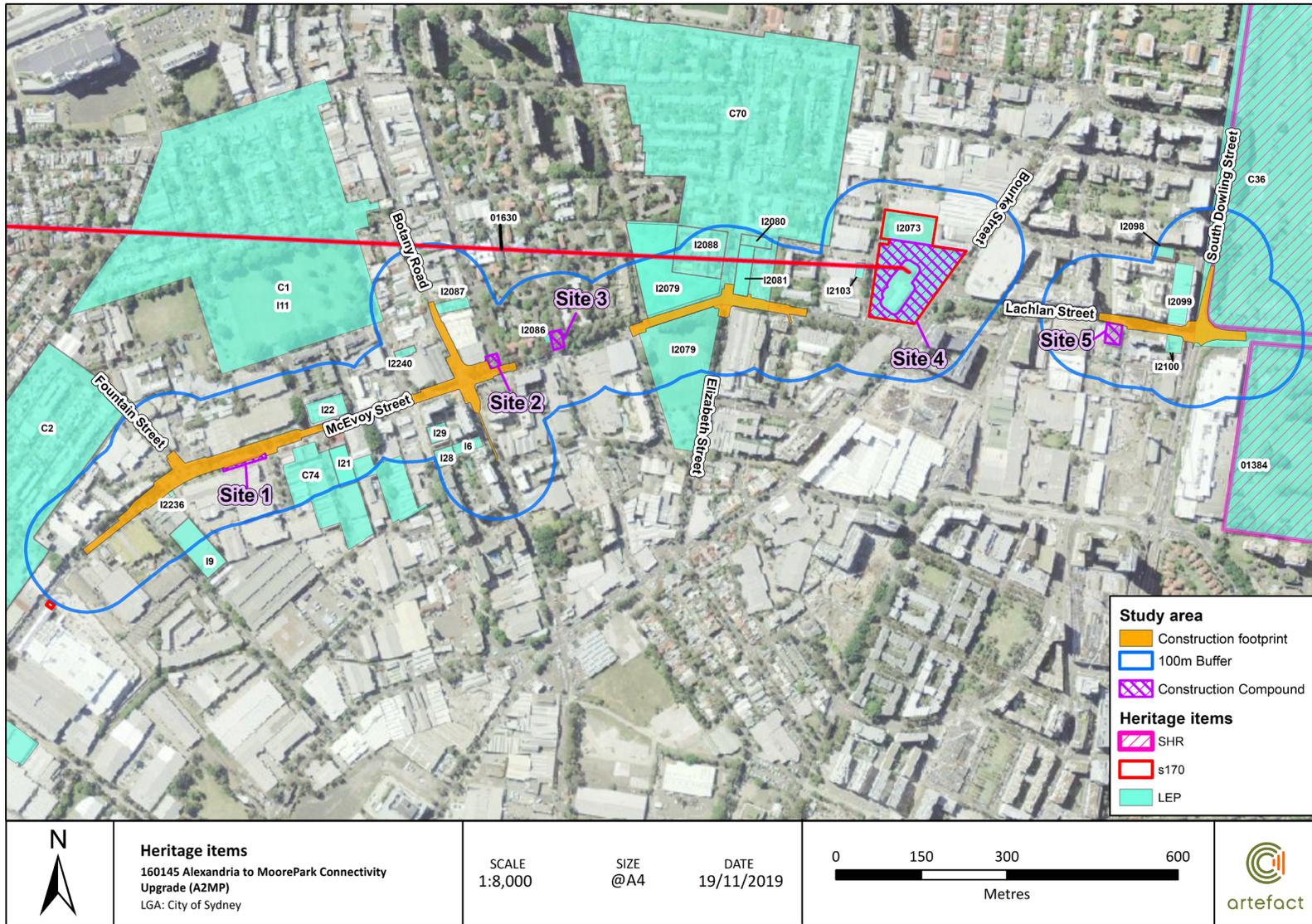


Figure 6-8 Non Aboriginal heritage in the study area (Artefact, 2019a)

Table 6-33 Non-Aboriginal heritage within the study area and within view of the study area

Item name	Address	Register	Significance	Estimated Distance from study area
Non-Aboriginal heritage within the study area				
Centennial Park, Moore Park, Queens Park	Randwick and City of Sydney LGA	<ul style="list-style-type: none"> • SHR (1384) • Register of the National Estate • National Trust Register 	State	Within
Moore Park Heritage Conservation Area	Moore Park Road, Drivers Ave, Lang Rd, Robertson Rd, Anzac Parade, Boronia Street, the southern boundary of the Sydney Athletic Field, the southern boundary of the Moore Park Golf Course, the eastern boundary of the Supa Centa, Dacey Avenue and South Dowling Street	<ul style="list-style-type: none"> • Sydney LEP (C36) • National Trust Register 	State	Within
Pressure Tunnel and Shafts	Potts Hill to Waterloo	<ul style="list-style-type: none"> • SHR (01630) • Sydney Water S170 Register (4570942) 	State	30 metres north
Former Sydney Water Pumping Station & Valve House Incl. Interiors & Associated	903-921 Bourke Street, Waterloo	<ul style="list-style-type: none"> • Sydney LEP (I2073) • Sydney Water S170 Register (4570470) 	Local	Within
Waterloo Heritage Conservation Area	Bounded by Phillip St, Morehead Street, McEvoy Street and Pitt Street	<ul style="list-style-type: none"> • Sydney LEP (C70) 	Local	Within
Waterloo Park and Oval Including Grounds and Landscaping	Elizabeth Street, Waterloo (Lot 1 DP136176 and Lot 2 DP1361770)	<ul style="list-style-type: none"> • Sydney LEP (I2079) 	Local	Within

Item name	Address	Register	Significance	Estimated Distance from study area
Non-Aboriginal heritage within view of the study area				
Cooper Estate Conservation Area	Alexandria	<ul style="list-style-type: none"> Sydney LEP (C2) 	Local	59 metres north-west
Industrial building “Eclipse House” including interior	8–22 Bowden Street, Alexandria (Lot 3 DP 107936; Lot 1 DP 664697)	<ul style="list-style-type: none"> Sydney (I9) 	Local	Next to study area
Former Electricity Substation No 152 including interiors	124 McEvoy Street, Alexandria (Lot 1, DP 85600)	<ul style="list-style-type: none"> Sydney LEP (I2236) 	Local	Next to study area
Former industrial building including interior	111–117 McEvoy Street, Alexandria (Lot 120 DP 1048809)	<ul style="list-style-type: none"> Sydney LEP (I 22) 	Local	5 metres north, refer to Photo 6-1
Warehouse including interior	32–42 McCauley Street, Alexandria (Lot A, DP 420788; Lots 1 and 2, DP 537726)	<ul style="list-style-type: none"> Sydney LEP (I21) 	Local	35 metres north
North Alexandria Industrial Conservation Area	Includes properties within Stokes Ave, Hiles St, Hiles Ln, McCauley St and Balaclava Ln, Alexandria	<ul style="list-style-type: none"> Sydney LEP (C74) 	Local	Immediately next to the study area
Former Electric Light Substation No 89 including interiors	212–214 Wyndham Street, Alexandria (Lot 1, DP 585736)	<ul style="list-style-type: none"> Sydney LEP (I2240) 	Local	48 metres north
Yin Ming Temple	16-22 Retreat Street, Alexandria (Lot 1 DP 197155)	<ul style="list-style-type: none"> SHR (01297) Sydney LEP (I28) 	State	47 metres south
Terrace group (17A–29 Retreat Street) including interiors	16–29 Retreat Street, Alexandria (Lot 1 DP 197155)	<ul style="list-style-type: none"> Sydney LEP (I29) 	Local	47 metres south

Item name	Address	Register	Significance	Estimated Distance from study area
Glenroy Hotel including interior	246–250 Botany Road, Alexandria (Lot 1 DP 84748)	<ul style="list-style-type: none"> Sydney LEP (I6) 	Local	10 metres south
Terrace group “Gordon Terrace” including interiors	1–25 John Street, Waterloo 9 Lots 1 and 2, DP 713820; Lots 4–7 and 9–13, DP 229389; Lot 8, DP 10680; Lot 1, DP 135984)	<ul style="list-style-type: none"> Sydney LEP (I2087) 	Local	Next to study area
Electrical Substation No. 174	336 George Street, Waterloo (Lots 6 & 7 DP 17271)	<ul style="list-style-type: none"> Sydney LEP (I2086) 	Local	Next to study area. Refer to Photo 6-2
Our Lady of Mt Carmel Church and School buildings including interiors and grounds	2–6 Kellick Street, Waterloo (Lot 1 DP 86295)	<ul style="list-style-type: none"> Sydney LEP (I2088) 	Local	11 metres north-west
Terrace group including interiors	772–808 Elizabeth Street, Waterloo (Lots 1 and 2, DP 713820; Lots 4–7 and 9–13, DP 229389; Lot 8, DP 10680; Lot 1, DP 135984)	<ul style="list-style-type: none"> Sydney LEP (I2081) 	Local	Next to study area
Waterloo Town Hall including interior and former air raid shelter	770 Elizabeth Street, Waterloo (Lot 1 DP 997169)	<ul style="list-style-type: none"> Sydney LEP (I2080) 	Local	71 metres north
Commercial building part of 'Federation Business Centre' (222 Young Street)	198–222 Young Street, Waterloo (Lot 1, DP 792863 (SP 36039, SP 36721, SP 37210, SP 64460)	<ul style="list-style-type: none"> Sydney LEP (I2103) 	Local	20 west
Electrical substation	241 Young Street, Waterloo (Lot 1, DP 606446)	<ul style="list-style-type: none"> Sydney LEP 2012 (I2104) Ausgrid section 170 register (3430492) 	Local	Immediately next to the study area

Item name	Address	Register	Significance	Estimated Distance from study area
Moore Park View Hotel	853-855 South Dowling Street, Waterloo (Lot 1 DP 328069)	<ul style="list-style-type: none"> Sydney LEP (I2100) 	Local	Next to study area
Former ACI Administration Building including interior	849 South Dowling Street, Waterloo (Lot 106 DP 1017691)	<ul style="list-style-type: none"> Sydney LEP (I2098) 	Local	67 metres north
Former ACI AGM Building including interior	851 South Dowling Street, Waterloo (Lot 10 DP 1004914)	<ul style="list-style-type: none"> Sydney LEP (I2099) 	Local	Next to study area, refer to Photo 6-3



Photo 6-1 Industrial Building, located at the corner of Brennan and McEvoy Street



Photo 6-2 Electrical substation (I 2086) at corner of McEvoy and George Street



Photo 6-3 Former ACI AGM Building (I2099) the right and Moore Park View Hotel (I2100) to the left. View east from Dacey Avenue

Unlisted heritage items

In addition to heritage listed items, The SoHI (Artefact Heritage, 2018b) identified sandstone kerbs at the corner of Wyndham and McEvoy Streets within the construction Zone 3. These extended east along McEvoy Street between Botany Road and George Street, and were situated on the northern side of the road corridor. The sandstone kerbs represent early subdivision activities in Sydney, when formalised residential development being established.

The City of Sydney Register of Significant Trees

The City of Sydney *Register of Significant Trees* identifies and recognises the importance of significant trees as part of the natural and cultural landscape of the City of Sydney. There are four locations that contain trees on the City of Sydney *Register of Significant Trees* within or near to the study area. These areas include:

- Waterloo Park – South: This location includes four species: seven Port Jackson Figs (*Ficus rubiginosa forma glabrescens*); one Port Jackson Fig (*F. rubiginosa*); four Moreton Bay Figs (*F. macrophylla*) and two Deciduous Figs (*F. superba var. henneana*). The listing criterion for these trees is historical, social and visual
- Waterloo Park – North: This location includes four species: 27 Port Jackson Fig (*Ficus rubiginosa forma glabrescens*); two Port Jackson Figs (*F. rubiginosa*); six Moreton Bay Figs (*F. macrophylla*); and one Silky Oak (*Grevillea robusta*). The listing criterion for these trees is botanic, historical and visual
- Centennial Parklands - South Dowling Street - one species: 11 Washington Palm (*Washingtonia robusta*). The listing criterion for these trees is historical, social and visual

- Centennial Parklands - Moore Park Golf Course - four species: 36 Moreton Bay Fig (*F. macrophylla*); two Port Jackson Fig (*F. rubiginosa*); one Norfolk Island Pine (*Araucaria heterophylla*); and six Canary Island Date Palm (*Phoenix canariensis*). The listing criterion for these trees is historical and visual.

The following trees listed on the City of Sydney *Register of Significant Trees* are within the study area:

- The Morton Bay and Port Jackson Figs within the north and south portion of Waterloo Park
- Morton Bay Figs, Washington Palms and a Norfolk Island Pine are located within Centennial Parklands - Moore Park Golf Course.

6.3.3 Assessment of significance

Assessments of significance (refer to **Appendix P**) were carried out for listed and unlisted heritage items and areas of archaeological potential within and near the study area. Heritage assessments and statements of heritage significance from existing registers such as the State Heritage Inventory (SHI) have been included where referenced.

The assessments were carried out by using a system of assessment centred on the Burra Charter of Australia ICOMOS. In NSW, heritage is assessed against seven criteria. If an item meets one or more of the seven heritage criteria, and retains the integrity of its key attributes, it can be considered to have significance. The heritage significance of the listed and unlisted heritage items within the study area is provided in the SoHI (Artefact Heritage, 2019b) (refer to **Appendix K**).

6.3.4 Potential impacts

Built and natural heritage

Much of the proposal also maintains tree lined boulevards throughout the study area where possible. Therefore, much of the historically significant built and natural landscape features associated with these areas would be retained.

No trees listed of the City of Sydney *Register of Significant Trees* would be directly impacted by the proposal. However there is potential for indirect impacts to the roots of some of the trees in Waterloo Park from utility relocations. The proposal would also involve the removal of 25 mature trees and 24 immature trees, mainly at Fountain Street which would result in visual impacts.

In addition, excavations in areas that may contain potential archaeological remains would potentially impact on any situ remains, at the site formerly occupied by the St Silas School and Church near to the Botany Road/McEvoy street intersection (Site 2) and the potential remains of former tram tracks along Botany Road (Site 2), Elizabeth Street (Site 3) and South Dowling Street.

An assessment of the potential impacts from the proposal on Non-Aboriginal heritage and the terminology used for assessing the magnitude of the impact is provided in **Table 6-34**. The potential impacts on heritage items within and with a view of the study area are summarised in **Table 6-35**.

Table 6-34 Terminology for assessing the magnitude of heritage impact

Grading	Definition
Major	Actions that would have a long-term and substantial impact on the significance of a heritage item. Actions that would remove key historic building elements, key historic landscape features, or significant archaeological materials, thereby resulting in a change of historic character, or altering of a historical resource. These actions cannot be fully mitigated.
Moderate	Actions involving the modification of a heritage item, including altering the setting of a heritage item or landscape, partially removing archaeological resources, or the alteration of significant elements of fabric from historic structures. The impacts arising from such actions may be able to be partially mitigated.
Minor	Actions that would result in the slight alteration of heritage buildings, archaeological resources, or the setting of an historical item. The impacts arising from such actions can usually be mitigated.
Negligible	Actions that would result in very minor changes to heritage items.

Table 6-35 Heritage impact assessment for listed and unlisted heritage items in and within view of the study area

Item Name	Heritage Listing(s)	Impacts	Direct impact	Visual impact	Archaeological impact
Items impacted by the proposal					
Centennial Park, Moore Park, Queens Park and Moore Park Heritage Conservation Area	SHR (01384) Sydney LEP (C36)	Minor realignment of the eastern boundary of South Dowling Street near its intersection with Lachlan Street This would not require direct impacts to the SHR curtilage of this item. However construction vehicles may potentially access land temporarily within the curtilage during construction Road upgrade works would also occur within the Sydney LEP 2012 curtilage of the Moore Park Heritage Conservation Area where the existing South Dowling street road corridor would be modified.	Minor	Minor	Neutral

Item Name	Heritage Listing(s)	Impacts	Direct impact	Visual impact	Archaeological impact
Pressure Tunnel and Shafts	SHR (01630) Sydney Water S170 Register (4570942)	A temporary ancillary site (Site 4) would be located directly above the item. However, the significant depth of the pressure tunnel below the existing ground surface and distance of the shaft from the compound area footprint would protect them from any indirect impacts.	Neutral	Neutral	Neutral
Former Sydney Water Pumping Station & Valve House Incl. Interiors and Waterloo Water Pumping Station	Sydney LEP (I2073) Sydney Water section 170 Register (002132)	Establishment of a temporary ancillary site (Site 4) within the heritage curtilage of the item. This would include stockpiling construction materials and establishing site offices on the property However, structures associated with the item are located about 10 metres outside of Site 4 footprint and would not be directly impacted or modified to accommodate the compound Indirect vibration impacts may also occur.	Minor	Moderate (temporary)	Neutral
Waterloo Heritage Conservation Area	Sydney LEP (C70)	The proposal would slightly alter the present streetscape along McEvoy Street between Elizabeth and Pitt Street within the Waterloo Heritage Conservation Area by modifying the north-west and north-east edges of Waterloo Oval. Modifications would involve the addition of turning lanes, which would require the reduction of the Waterloo Park and Oval heritage curtilage by up to 10 metres and modify existing footpaths and kerbs at these intersections. In addition, intact sandstone kerbs would be removed and replaced with new stone along Kensington Lane and Elizabeth Street to accommodate road widening along the northern boundary of McEvoy Street. However temporary impacts may occur to the roots of some of the trees located within the curtilage of Waterloo Park during utility relocations.	Minor	Minor	Neutral
Waterloo Park & Oval Including Grounds and Landscaping	Sydney LEP (I2079_	The proposal would slightly modify the north-west and north-east corners of Waterloo Oval to accommodate new turning lanes at the McEvoy and Pitt Street and McEvoy and Elizabeth Street intersections. This would require the reduction of the Waterloo Park and Oval's heritage curtilage by up to 10 metres and modify existing footpaths and kerbs in these areas.	Minor	Minor	Neutral

Item Name	Heritage Listing(s)	Impacts	Direct impact	Visual impact	Archaeological impact
		It should be noted that areas to be modified currently comprise of formalised footpaths within the road reserve. No trees or plantings associated with the park would be removed for these works.			
Items located near to the proposal area					
Cooper Estate Conservation Area	Sydney LEP (C2)	Works taking place 18 metres north-west of the item. Modifications would be made to road corridors in view of the item. These would not alter its current setting as views are generally obstructed by trees and residential development.	Neutral	Neutral	Neutral
Industrial building “Eclipse House” including interior	Sydney LEP (I9)	Works are taking 55 metres south-east of the item. This would involve modifications to road corridors in view of the item. However, these would not alter its current setting or views towards McEvoy Street.	Neutral	Neutral	Neutral
Former Electricity Substation No 152 including interiors	Sydney LEP (I2236)	Works are taking place next to the item. This would involve modifications to road corridors in view of the item. However, these would not significantly alter its current setting.	Neutral	Neutral	Neutral
Former industrial building including interior	Sydney LEP (I22)	Works are taking place 5 metres south of the item. This would involve modifications to road corridors in view of the item. However, they would not significantly alter its current setting.	Neutral	Neutral	Neutral
Warehouse including interior	Sydney LEP (I21)	Works are taking place 35 metres south of the item. This would involve modifications to road corridors in view of the item. However, they would not significantly alter its current setting.	Neutral	Neutral	Neutral
North Alexandria industrial heritage conservation area	Sydney LEP (C74)	Works are taking place 8 metres north of the conservation area. This would involve modifications to road corridors in view of the item and would slightly alter its current setting.	Neutral	Minor	Neutral e

Item Name	Heritage Listing(s)	Impacts	Direct impact	Visual impact	Archaeological impact
Former Electric Light Substation No 89 including interiors	Sydney LEP (I2240)	Works are taking place 48 metres north of the item. Modifications would be made to road corridors in view of the item. These would not significantly alter its current setting.	Neutral	Neutral	Neutral
Yin Ming Temple	State Heritage Register (01297) Sydney LEP (I28)	Works taking place 16 metres south of the item. Modifications would be made to road corridors in view of the item. These would not significantly alter its current setting.	Neutral	Neutral	Neutral
Terrace group (17A–29 Retreat Street) including interiors	Sydney LEP (I29)	Works taking place 40 metres south of the item Modifications would be made to road corridors in view of the item. These would not significantly alter its current setting.	Neutral	Neutral	Neutral
Glenroy Hotel including interior	Sydney LEP (I6)	Works taking place 80 metres south of the item Modifications would be made to road corridors in view of the item. These would not significantly alter its current setting.	Neutral	Neutral	Neutral
Terrace group 'Gordon Terrace' 1–25 John Street	Sydney LEP (I2087)	Works are taking place next to the item. This would involve modifications to road corridors in view of the item and subsurface excavations immediately next to the commercial building (associated with the terrace group). This would slightly alter its current setting Indirect vibration impacts may also occur.	Neutral	Minor	Negligible
Electrical Substation no. 174	Sydney LEP (I2086)	Works are taking place next to item. These may alter its current setting; however changes would be minimal Indirect vibration impacts may also occur.	Neutral	Neutral	Neutral

Item Name	Heritage Listing(s)	Impacts	Direct impact	Visual impact	Archaeological impact
Our Lady of Mt Carmel Church and School buildings including interiors and grounds	Sydney LEP (I2088)	Works are taking place 11 metres west of the item. Modifications would be made to road corridors in view of the item. However, they would not significantly alter its current setting.	Neutral	Neutral	Neutral
Terrace group including interiors	Sydney LEP (I2081)	Works taking place next to item. Modifications would be made to road corridors in view of the item and sandstone kerbs along Kensington Lane would be removed and replaced Indirect vibration impacts may also occur.	Minor	Minor	Neutral
Waterloo Town Hall including interior and former air raid shelter	Sydney LEP (I2080)	Works taking place 71 metres north of the item. Modifications would be made to road corridors in view of the item. These would not significantly alter its current setting.	Neutral	Neutral	Neutral
Commercial building part of 'Federation Business Centre' (222 Young Street)	Sydney LEP (I2103)	Works taking place 20 metres west of the item. Modifications would be made to road corridors in view of the item. These would not significantly alter its current setting.	Neutral	Neutral	Neutral
Electrical substation	Sydney LEP (I2104) Ausgrid section 170 register (3430492)	Establishment of a temporary ancillary site (Site 4) immediately next to the heritage curtilage of the item. This would include stockpiling construction materials and establishing site offices on the property.	Neutral	Negligible	Neutral
Moore Park View Hotel	Sydney LEP (I2100)	Works taking place next to the item. Modifications would be made to road corridors in view of the item. These would not significantly alter its current setting.	Neutral	Minor	Negligible

Item Name	Heritage Listing(s)	Impacts	Direct impact	Visual impact	Archaeological impact
Former ACI AGM Building including interior	Sydney LEP (I2099)	Works taking place next to item. Modifications would be made to road corridors in view of the item. These would not significantly alter its current setting.	Neutral	Minor	Neutral
Former ACI Administration Building including interior	Sydney LEP (I2098)	Works taking place 77 metres north of the item. Modifications would be made to road corridors in view of the item. These would not significantly alter its current setting.	Neutral	Neutral	Neutral
Sandstone kerbs	Not listed	<p>Upgrades to kerbs and guttering along the length of the proposal. This would include the removal and replacement of intact sandstone kerbs along McEvoy Street, Kensington Lane and Lachlan Street</p> <p>Sandstone kerbs and gutters provide physical evidence for early road construction activities associated with some of the first residential subdivisions in Waterloo. Many of these have been removed over time and replaced with concrete kerbs and gutters.</p>	<p>Major impact to sandstone kerbs with construction footprints if not reinstated with original material</p> <p>Minor impact to kerbs if reinstated following the completion of proposed works.</p>	<p>Major visual impact if not reinstated with original material</p> <p>Moderate visual impact if reinstated with new sandstone kerb</p> <p>Minor visual impact if reinstated with original sandstone kerb following the completion of proposed works.</p>	Neutral
Significant Trees	City of Sydney <i>Register of Significant Trees</i> 2013	No trees listed on the City of Sydney register would be directly impacted by the proposal.	Neutral	Neutral	Neutral

As shown in Table 6-35, the proposal would result in the following impacts to the heritage listed items:

- Moderate (temporary) impacts to Former Sydney Water Pumping Station & Valve House Incl. Interiors and Waterloo Water Pumping Station listed on the Sydney Local Environment Plan 2012 (Sydney LEP) and Sydney Water section 170 Register (Item 002132) due to the establishment of a temporary construction compound (Site 4) immediately next to the heritage curtilage. Impacts would reduce to negligible with the implementation of mitigation measures
- Minor direct and/or indirect impact to ‘Centennial Park, Moore Park, Queens Park and Moore Park Heritage Conservation Area’ listed on the State Heritage Register (SHR), Register of national estate (RNE) and Sydney LEP may occur during construction. Impacts would be temporary
- Minor direct and/or indirect impact to ‘Waterloo Park & Oval Including Grounds and Landscaping’ and ‘Waterloo Heritage Conservation Area’ both listed on the Sydney LEP associated with slight modifications to the northwest and northeast corners of the Elizabeth Street/McEvoy Street intersection. Temporary impacts may also occur to the roots of some of the trees located within the curtilage of Waterloo Park during utility relocations
- Minor visual and potential vibration impacts to:
 - ‘Terrace group ‘Gordon Terrace’ listed on the Sydney LEP
 - ‘Terrace group including interiors’ listed on the Sydney LEP
 - ‘Moore Park View Hotel’ listed on the Sydney LEP
 - ‘Former ACI AGM Building including interior’ listed on the Sydney LEP
- Negligible impact to the Pressure Tunnel and Shafts listed on the SHR and the Sydney water section 170 register. The tunnel is located well below the surface and no impacts are expected.

The proposal would also have a major impact on sections of sandstone kerbs along Kensington Lane, McEvoy Street and Lachlan Street which are unlisted items of heritage significance. Sandstone kerbs would be retained where possible. If retention is not feasible, they would be reinstated or replaced.

In addition the proposal would involve the removal of 25 mature trees and 24 immature trees within the construction footprint, this would result in visual impacts across the study area. None of the trees to be removed are listed on the City of Sydney’s *Register of Significant Trees* (2013) or within a heritage conservation area part of a heritage listed item.

Several areas of historical archaeological potential have been identified within the proposal area. A section 139 excavation permit covering the works in an area formerly occupied by the St Silas School and Church near to the Botany Road/McEvoy street intersection would be obtained from the NSW Heritage Division. This would be accompanied by an Archaeological Research Design (ARD) and excavation. Test excavations would be designed to investigate the presence of intact structural remains and/or artefact deposits associated with the former building within the construction footprint and subsequently provide management advice for the proposal.

6.3.5 Safeguards and management measures

Safeguards and management measures for non-Aboriginal heritage are presented in **Table 6-36**.

Table 6-36 Safeguards and management measures – Non-Aboriginal heritage

Impact	Environmental safeguards	Responsibility	Timing	Reference
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	Contractor	Detailed design/ pre-construction	Core standard safeguard NA1

Impact	Environmental safeguards	Responsibility	Timing	Reference
	and controls to be implemented to avoid and mitigate impacts to non-Aboriginal heritage.			Section 4.10 of QA G36 Environment Protection
Centennial Park, Moore Park, Queens Park and Moore Park Heritage Conservation Area	As the proposal will involve temporary construction activities within the curtilage of the SHR listed 'Centennial Park, Moore Park, Queens Park', a section 57 notification would be submitted to, and approved by, the Heritage Council of NSW prior to construction of the proposal commencing.	Roads and Maritime	Detailed design/pre-construction	Additional safeguard
Non-Aboriginal heritage	The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
Site induction	All personnel working on site will receive training to ensure awareness of requirements of the NAHMP and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of identified non-Aboriginal heritage items.	Contractor	Pre-construction	Additional standard safeguard
Non-Aboriginal heritage	The City of Sydney and Sydney Water will be consulted as part of this development process to ensure any requirements about their heritage assets are identified and incorporated into the proposal.	Roads and Maritime	Detailed design/pre-construction	Additional safeguard
Non-Aboriginal heritage	Materials chosen for signage, kerbs, and other road infrastructure would be compatible and complimentary to the surrounding heritage character of the study area.	Roads and Maritime	Detailed design/pre-construction	Additional safeguard
Protect Non-Aboriginal cultural heritage items	The protection of areas of identified non-Aboriginal cultural heritage value that are to be retained will occur in accordance with the adopted NAHMP.	Contractor	Pre-construction	Additional standard safeguard
Non-Aboriginal heritage	To prevent inadvertent impacts to significant heritage listed buildings and fabric during construction temporary	Roads and Maritime	Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>protection zones (TPZ) such as fencing or protective padding will be placed around the following heritage items:</p> <ul style="list-style-type: none"> • 'Former Sydney Water Pumping Station & Valve House Incl. Interiors' • 'Electrical substation' • 'Former Electricity Substation No 152 including interiors' • 'Terrace group "Gordon Terrace" including interiors' • 'Electrical Substation no. 174' • 'Terrace group including interiors' • 'Moore Park View Hotel Including Interior' • 'Former ACI AGM Building including interior'. 		and construction	
Impact to trees	TPZ would be established around trees within the construction footprint to prevent inadvertent impacts to these items during construction. This would require advice from a qualified arborist.	Contractor	Pre-construction and construction	Additional safeguard
Impact to trees	In order to prevent inadvertent impacts to trees listed on the City of Sydney <i>Register of Significant Trees</i> (2013) and those located within the SHR curtilage for the Centennial Park, Moore Park, Queens Park and Moore Park Heritage Conservation Area located closed to the proposal, Tree Protection Zones (TPZ) would be established while construction of the proposal is in progress. This would require advice and management from a qualified arborist.	Contractor	Pre-construction and construction	Additional safeguard
Sandstone kerbs	Sandstone kerbs will be retained where possible. If retention is not possible, they will be reinstated or replaced as per guidelines set out by the City of Sydney's <i>Sydney Streets Technical Specifications: Kerb and Gutter</i> booklet (2013).	Roads and Maritime	Pre-construction and construction	Additional safeguard
Archaeological potential in ancillary Site 2	A section 139 excavation permit covering the works at construction compound (ancillary Site 2) would be obtained from the NSW Heritage Division. An ARD would be prepared to support the permit	Roads and Maritime	Detailed design/pre-construction/c onstruction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>application. The ARD would outline archaeological management zoning for the proposal area.</p> <p>Test excavations would be designed to investigate the presence of intact structural remains and/or artefact deposits associated with the former building within the construction footprint and subsequently provide management advice for the proposal.</p> <p>If intact remains associated with artefact bearing deposits were identified during the test excavations a section 140 permit for salvage excavations or archaeological monitoring and recording may be required prior to the work commencing.</p>			
Archaeological potential in ancillary Site 2 and Site 3	An ARD and excavation methodology would also be prepared to manage requirements for the potential remains of former tram tracks along Botany Road (Site 2), Elizabeth Street (Site 3) and South Dowling Street. These have been assessed as 'works' containing local significance. Impacts to works do not require approval under the <i>Heritage Act 1977</i> , although they would be managed according to their significance.	Contractor	Construction	Additional safeguard
Archaeology	If relics are discovered during construction work must stop work immediately and the Heritage Council of NSW contacted, in accordance with section 146 of the <i>Heritage Act 1977</i> . The proponent must also inform the either the City of Sydney, Randwick City Council or Centennial Park and Moore Park Trust depending on where the item is found.	Contractor	Construction	Additional safeguard
Vibration impacts to heritage items	<p>All feasible and reasonable vibration mitigation measures will be implemented to avoid vibration impacts to:</p> <ul style="list-style-type: none"> Former Sydney Water Pumping Station & Valve House Including Interiors and Waterloo Water Pumping Station Terrace group 'Gordon Terrace' 1–25 John Street 	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> • Electrical Substation no. 174 • Terrace group including interiors • Electrical substation • Moore Park View Hotel. <p>Mitigation measures will include using construction methods with reduced levels of vibration, and monitoring of vibration levels in accordance with the noise and vibration assessment (refer to Section 6.2.5 and Appendix M).</p>			

6.4 Aboriginal heritage

The potential impacts of the proposal on Aboriginal heritage items are assessed in the *Alexandria to Moore Park Project Aboriginal Archaeological Survey Report* (Aboriginal ASR (PACHCI Stage 2)) prepared by Artefact Heritage (2019b) and provided in **Appendix H**. The potential impacts, and safeguards to mitigate them, are summarised in this section.

6.4.1 Methodology

The Aboriginal ASR (PACHCI Stage 2) was prepared in accordance with the:

- Stage 2 requirements of the PACHCI
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH, 2010)
- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (OEH), 2011).

The assessment comprised of:

- An overview of the Aboriginal history of the study area
- A search of the AHIMS Register maintained by the OEH
- Identification of Aboriginal sites and areas of archaeological potential within the study area
- A site survey with Local Aboriginal Land Councils (LALC)
- Assessment of the significance of identified Aboriginal sites
- Assessment of the potential for unidentified Aboriginal sites
- Recommendations and mitigation measures.

6.4.2 Existing environment

Aboriginal background

Aboriginal groups recorded in the wider region and surrounds of the study area include the Cadigal, Wangal, Kameygal and Muru-Ora-Dial.

The study area is currently within the lands of the Metropolitan LALC, to the east of the M1 Eastern Distributor and in the lands of the La Perouse LALC to the west of the M1 Eastern Distributor. The La Perouse Aboriginal community includes members who can trace their attachment to country through and before colonisation by the British. Families within the La Perouse LALC have longstanding associations with the area recorded in both Aboriginal tradition and stories, and European documentary history.

Aboriginal technologies for fishing and seafood extraction have been historically portrayed in detail and were capable of supporting many local Aboriginal people on a year-round basis, without the need to travel widely in order to obtain sustenance. Travel outside of core country (estate) may have been undertaken for trade, social, and ritual purposes in order to maintain ties to people and places of significance. Colonisation had a devastating effect on the ability of Aboriginal people to continue their traditional lifestyles. As is evident from early sources the elements of landscape that were most attractive to European colonists were often the camping places and resources of the Aboriginal people. The fishing areas of Port Jackson, including shellfish sources that had supported local Aboriginal people for many generations, were rapidly depleted freshwater sources were blocked from access and spoiled, and scrub and woods were cleared from the surrounds of the harbour and streams.

Regional character

Prior to development and modification, the proposal area within the Botany Sands geological unit which was comprised of vegetated sand dunes with swamps, watercourses and low-lying land. Such active sands can capture and preferentially preserve archaeological material within them.

Historical land use

The proposal area has been subject to a wide variety of historical impacts including widespread sand drift due to devegetation, and sand mining. The proposal area is now highly developed character and retains little if any of the area's natural landform.

Database searches

A search of the OEH's AHIMS was carried out on 18 November 2019 as part of the PACHCI Stage 2 assessment. Eight records were identified within one kilometre of the proposal, and these are summarised in **Table 6-37**. None of the records are located within the proposal area. Two registered Aboriginal sites are located within 250 metres of the proposal area. These are site Tay Reserve Artefact Site ID 45-6-370, Moore Park AS1 Site ID 45-6-3155.

Table 6-37 AHIMS sites within one kilometre of the proposal

Site ID	Site name	Type of site
45-6-3245	Doncaster Avenue Building Potential Aboriginal Deposit (PAD)	PAD
45-6-3155	Moore Park AS1	Artefact
45-6-3246	Randwick Stabling Yards 1 (RSY1)	Artefacts (>1,000)
45-6-3704	Tay Reserve Artefact	Artefacts (2)
45-6-2767	Tent Embassy	Aboriginal resource and gathering
45-6-2745	University of Sydney Law Building PAD	PAD
45-6-2822	USYD Central	Artefact
45-6-2597	Wynyard Street Midden	Shell Midden

Details of recorded Aboriginal sites near the proposal

Tay Reserve Artefact Site ID 45-6-3704

Tay Reserve Artefact Site ID 45-6-3704 is about 50 metres east of the eastern end of the proposal area. Archaeological testing at Tay Reserve was carried out by Artefact Heritage in 2018 in connection with the CSELR project. Testing consisted of machine excavation of four test pits in the reserve. The site comprises two Aboriginal lithic artefacts retrieved from disturbed soils. Although the test pits excavated showed that the original dune surface was truncated in that location, there is still potential for intact profiles to remain within the proposal area and in the Tay Reserve artefact site. There is also the potential at Tay Reserve for preserved archaeology associated with King Billy and the former toll house, providing evidence around early Aboriginal-European interactions in the area. The low density of artefacts retrieved from this site suggest a similar level of archaeological sensitivity to Moore Park AS1 Site ID 45-6-3155 which is

discussed in more detail below. As a result of test excavations, the whole of Tay Reserve has been registered as an Aboriginal site; Tay Reserve Artefact Site ID 45-6-3704.

Moore Park AS1 (45-6-3155)

Site ID 45-6-3155 is located about 150 metres to the north-east of the proposal at the Moore Park Tennis Centre. It comprised eight artefacts found in, or slightly below, grey sands between 0.9 to 1.2 metres in depth. This assessment found that the site extends into the study area.

Five lithic artefacts were retrieved from Test Pit 4, from a transition layer between light greyish brown (remnant A1 unit) and bleached white sand (A2 unit) at between 900 millimetres and 1000 millimetres depth.

Staged salvage excavations were carried out, particularly in the surrounds of Test Pit 4. These excavations identified a further three artefacts; two at transition to bleached white sand and one in a disturbed context (Artefact, 2014).

Based on the results of archaeological test and salvage excavation, Moore Park AS1 was assessed as demonstrating moderate archaeological significance. Despite the site consisting of only a low density scatter, the significance of the site has been bolstered by its uniqueness, due to the rarity of archaeological excavation within a local context (Artefact, 2014).

The extent of Site ID 45-6-3155 has been increased to within 250 metres of the proposal area. This increase in extent of Site ID 45-6-3155 was undertaken in order to include areas next to it that are of similar low slope and base of slope landform and which are therefore potentially of similar archaeological sensitivity to the tested extent of Site ID 45-6-3155. The extent of Moore Park AS1 does not include the current roadway. This reflects the considerable disturbance beneath the roadway as evidenced by geotechnical testing and excavation associated with road maintenance and formation works that have been monitored by Artefact Heritage.

Background reports

The study area and surrounds has been the subject of several archaeological investigations for the other projects including:

- Centennial, Moore and Queens Parks (Attenbrow, 2002)
- 200 George Street Sydney (GML Heritage, 2014)
- CBD and South East Light Rail Project (GML Heritage, 2013)
- Moore Park Tennis Centre (Artefact Heritage, 2014)
- Randwick Stabling Yards (Steele, 2006 and GML Heritage, 2015)
- Randwick Racecourse (Steele, 2006)
- Rose Bay Golf Club (JMCHM, 2009 and Donlon, 2005).

Except for the findings at the Randwick Stabling Yards, no investigations have located archaeological deposits of any density within one kilometre around the study area. The low number of recorded Aboriginal sites in and around the study area does not indicate that Aboriginal archaeology is not present in the study area. Rather, it was reported that the current highly built up land use and soil disturbance combined with limitations on archaeological testing has made the detection of sites difficult.

The above studies have indicated that the two primary factors in indicating likely archaeological potential are landform and levels of soil disturbance. Throughout the proposal area there is a similar dune and lower dune slope landform to that encountered at Moore Park AS1 (Site ID 45-6-3155). It seems probable that Site ID 45-6-3155 reflects patterns of local landform utilisation by Aboriginal people in the past, and that this

pattern of utilisation would have been similar through the proposal area. Variations in sensitivity of this landform would most likely result from historical soil disturbances.

Excavation results

Artefact Heritage has undertaken multiple as-yet unpublished excavations in Botany Sands for the CSELR project between Central Station and Randwick, including within roadways. Reporting for this project is in preparation. These excavations include those mentioned above at Tay Reserve. Other excavations in Botany Sands along Alison Road and Anzac Parade near the eastern end of the proposal area did not locate any Aboriginal objects. In almost all cases the construction of existing roadway and associated landform modification had removed the archaeologically sensitive.

Predictive model

Local landforms of heightened potential appear to be dune crests and lower slopes and swales, with the highest density artefact deposits likely to be found in preserved upper grey sand layers such as identified at Moore Park AS1 Site ID 45-6-3155. Moore Park AS1 Site ID 45-6-3155 may occupy part of the same preserved dune foot that is possibly present in Tay Reserve Artefact Site ID 45-6-3704.

These potential archaeological values are greatly reduced by the extent of disturbance to local soils that has taken place. Previous archaeological reporting indicates that where Botany Sands have been truncated by road formation their archaeological potential is considerably diminished. Excavations carried out by Artefact Heritage in Botany Sands beneath roadways near the proposal indicate a nil to low archaeological sensitivity for such truncated locations.

The following levels of sensitivity as associated with landform types have been defined for the proposal area:

- Low-Moderate: Preserved dune systems or elevated ground
- Low: Disturbed dune systems or elevated ground
- Very Low: Disturbed lower lying ground.

Site survey

An archaeological survey of the study area in accordance with Stage 2 of the PACHCI and the OEH Code of Practice was conducted on 9 November 2016. The survey team comprised of archaeologists from Artefact Heritage and members from the Metropolitan LALC and La Perouse LALC.

An additional archaeological survey of the proposal area was conducted on the 22 October 2019. The second survey team was comprised of archaeologists from Artefact Heritage and the Aboriginal Cultural Heritage Officer for Roads and Maritime. Members from the Metropolitan LALC and La Perouse LALC were invited to participation in the site survey, but were not available to participate.

The second site survey divided up the proposal area into four survey areas (see **Table 6-38**) and survey concentrated on the identification of exposed or potentially less disturbed areas of ground surface.

Surface visibility was effectively nil in most of the study area due to the presence of roadway and pavement. The survey area locations and features are summarised in **Table 6-38**.

No locations of preserved dune systems or elevated ground were identified through site survey. Locations formerly on crest or upper slopes in the proposal area have been subject to substantial disturbance. The proposal area is therefore of very low to low archaeological sensitivity.

Table 6-38 Survey areas and summary of assessment

Survey unit	Location	Summary of assessment
1	McEvoy and Fountain Streets	No areas of undisturbed land or of likely archaeological potential were identified.
2	McEvoy Street and Botany Road	No areas of undisturbed land or of likely archaeological potential were identified.
3	McEvoy and Elizabeth Streets	No areas of undisturbed land or of likely archaeological potential were identified
4	South Dowling Street, Lachlan Street and Dacey Avenue	No areas of undisturbed land or of likely archaeological potential were identified

6.4.3 Potential impacts

Construction

The proposal would not impact any registered AHIMS sites. The proposal would only impact areas that have been assessed as of very low to low Aboriginal archaeological sensitivity, therefore impacts to Aboriginal objects are therefore considered unlikely

Operation

The operation of the proposal would not adversely impact Aboriginal heritage significance or archaeological potential within the proposal area.

6.4.4 Safeguards and management measures

Safeguards and management measures for Aboriginal heritage are presented in **Table 6-39**.

Table 6-39 Safeguards and management measures – Aboriginal heritage

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal heritage	<p><i>The Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered.</p> <p>Work will only re-commence once the requirements of that Procedure have been satisfied.</p>	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>

6.5 Hydrology and flooding

A flooding and hydrology assessment was completed for the proposal to identify strategies to manage impacts to flooding during construction and operation. The assessment is presented in the *Alexandria to Moore Park Stage 1 Project Flooding Working Paper* (Arup, 2019c) and is provided in full in **Appendix L** and summarised below.

6.5.1 Methodology

The methodology for the flooding and hydrology assessment involved:

- Reviewing background information relevant to the proposal, including the *Alexandra Canal Flood Study* (Cardno, 2014) and the *Alexandra Canal Catchment Flood Study Model Conversion - Stage 1 Report* (Cardno, 2014)
- Survey data collected for the proposal area
- Geographic information system (GIS) data
- Review and update of hydraulic models with ground survey along the proposal area
- Running the hydraulic models for the proposal area to assess baseline conditions
- Update of the hydraulic models with the proposal design, including road and drainage design
- Running the hydraulic models to assess design case conditions, identify flooding impacts in terms of changes in flooding conditions from baseline case for a range of annual exceedance probabilities (AEP)
- Identify potential mitigation measures and strategies to mitigate flood impacts.

Flood modelling

The flooding assessment involved reviewing and updating the available TUFLOW (a flooding simulator) flood models that cover the Alexandra Canal, in which all physical works within the proposal area located. The flood assessment has not been carried out for the small portion of the proposal located within the Botany Wetlands catchment (east of the crest at Dacey Avenue), as no physical works are proposed as part of the proposal.

Updating the model included combining and extending models as necessary and incorporating ground survey along the proposal alignment, incorporating finer surface features such as medians and gutters, along with other minor amendments.

The Alexandra Canal Catchment Flood Study Model (Cardno, 2014) was updated by BMT WBM (2015) for City of Sydney. This updated Alexandra Canal TUFLOW model (BMT WBM 2015) used was adopted as the base model for the assessment of the proposal.

Baseline flooding conditions have been defined within the updated model. Flood events assessed include the 0.2 Exceedances per Year (EY) and five per cent, two per cent and one per cent AEP events. EY is the number of times an event is likely to occur or be exceeded within any given year while the AEP event is the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. The flooding assessment refers to both methods of defining events.

It is noted that CSELR and New M5 (St Peters interchange) projects are both nearing completion. As there are no physical works proposed as part of the proposal at these project interfaces, the flooding issues associated with either of these projects has not been considered.

6.5.2 Existing environment

Catchment

The proposal area traverses two catchment areas and includes the Alexandra Canal and Botany Wetlands catchments, refer to **Figure 6-9**. As shown on **Figure 6-9**, the majority of the proposal located within the Alexandra Canal catchment with a very small area of the eastern extent of the proposal is within the Botany Wetlands catchment. None of the works associated with the proposal would be within the Botany Wetlands catchment.

The Alexandra Canal catchment drains a total area of about 13.8 square kilometres. The major sub-catchments contribute to Alexandra Canal catchment, including Sheas Creek, Roseberry, Munni Street-Erskineville and Alexandra Canal. The proposal traverses east to west through the mid to upper sections of the Alexandra Canal catchment area, within the Sheas Creek sub-catchment. The Sheas Creek sub-catchment generally drains in south to south-westerly direction to Alexandra Canal, which discharges to the Cooks River and then Botany Bay. The catchment drains a large part of inner Sydney and is fully urbanised and surrounded by medium to high density housing, commercial and industrial development with some large open spaces such as Moore Park and Waterloo Park. Drainage systems consisting of open channels, covered channels, in-ground pipes, culverts and pits to convey runoff from the catchment to Alexandra Canal. The majority of the trunk drainage system is owned by Sydney Water Corporation, with the feeding drainage systems primarily owned by the City of Sydney.

The Botany Wetlands catchment, upstream of Gardeners Road, drains an area of about nine square kilometres. The main drainage line (Botany Wetlands Main Branch) of the catchment starts in Waverley and the northern part of Randwick, draining through Centennial Park, and then southward, before discharging into the Botany Wetlands to the south of the proposal.

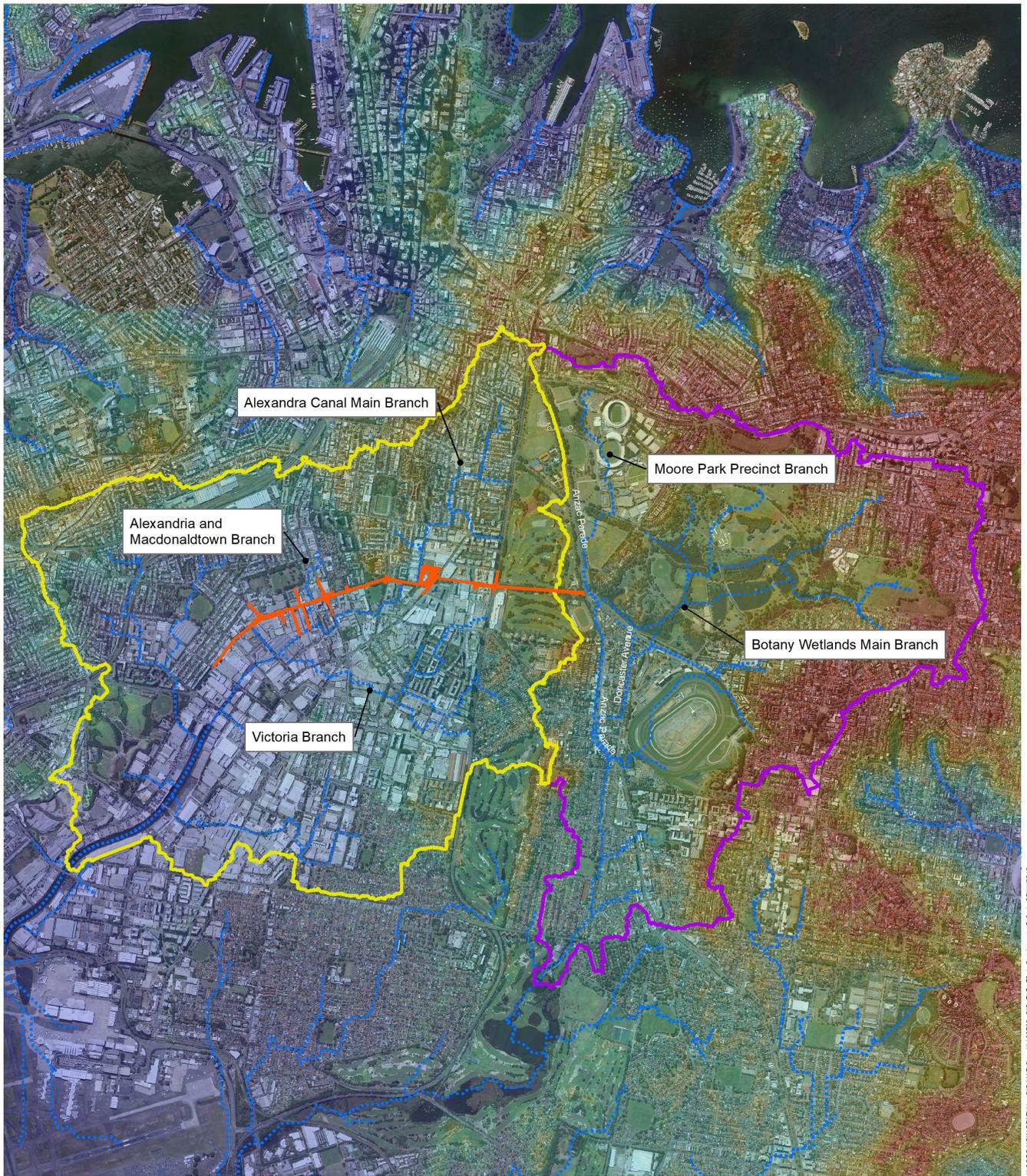
Groundwater

A search of the NSW DPI groundwater database identified 171 registered groundwater wells, including five with limited available data and 20 with licences that are lapsed or cancelled, within a 500 metre radius of the proposal.

Six registered groundwater bores are within the study area. All six of these bores are located within the Sydney Water site at 921 Bourke Street, Waterloo and were listed as monitoring bores. Hydrogeological records obtained from these bores indicate that groundwater levels within at 921 Bourke Street range from one metre below ground level (mbgl) in the south and four mbgl in the north (Jacobs, 2019b).

The *Alexandria to Moore Park Project: Geotechnical Report* (Arup, 2016) identified four publicly available groundwater monitoring boreholes within 100 metres of the proposal. These boreholes recorded groundwater depth between 2.60 and four mbgl. During the geotechnical investigations, groundwater was encountered in two test locations along McEvoy Street within the proposal area at depths of 1.1 and 1.15 mbgl.

While the depth to groundwater or direction of groundwater flow could not be definitively assessed based on available information, the surrounding topography of the proposal area and location of waterbodies suggests that the likely flow would be in a south-westerly direction towards the Alexandra Canal (Jacobs, 2018b). In the Botany Wetlands Catchment towards the western end of the proposal, groundwater flow is generally to the south-west toward Botany Bay. The groundwater depth would be expected to be variable, due to the geology, and shallow with depths between ground level at saturation and four mbgl. Given a large portion of the proposal is underlain by the Botany Sandsheets, groundwater recharge is expected to occur via rainfall infiltration and would potentially vary in accordance with the frequency and intensity of rainfall events.



Legend

- Proposal area
- Alexandria Canal Catchment
- Botany Wetlands Catchment
- ⋯ Drainage Line
- Roads

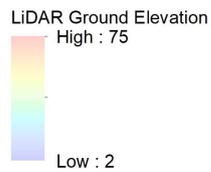


Figure 6-9 Catchment boundaries and topography

Flooding

Flooding along the proposal area is generally influenced by shorter-duration storm events of less than two hours in duration.

The proposal area generally becomes flood-affected in events as frequent as the 0.2 EY (about the 18 per cent AEP) event, with flood extends increasing in larger flood events (Arup, 2019c).

Alexandra Canal Catchment

In the Alexandra Canal catchment, flooding originates from overland flow conveyed primarily by the road network. In frequent storm events, the capacity of the underground pipe network can be exceeded and water starts flowing overland, contributing to flooding. There are generally three main sub-sections of the Sheas Creek sub-catchment (refer to **Figure 6-9**) that contribute to flooding of the proposal and include:

- **The ‘Alexandria and Macdonaldtown Branch’:** This branch drains water from east of the Australian Technology Park primarily along Botany Road and Cope Street toward McEvoy Street. Floodwater is conveyed onto McEvoy Street from Fountain Street, Loveridge Street, Brennan Street and Wyndham Street and generally flows west, discharging onto the side streets on the southern side of the road, between Bowden Street and Botany Road. These flows are picked up by an open channel running south-west through industrial properties from Wyndham Street to Bowden Street. Downstream of Bowden Street, the channel is larger and conveys flows into the upstream end of Alexandra Canal
- **The ‘Alexandra Canal Main Branch’:** This branch drains water from the most upstream end of the catchment near the Albion Street/Flinders Street intersection to Alexandra Canal, through a series of low points in the road network where water ponds. Floodwater enters the proposal area primarily from Young Street and Morehead Street and ponds on McEvoy Street before discharging onto Hunter Street and Young Street. These flows then discharge into the open channel downstream of Bowden Street via Bourke Road and Mandible Street, or discharge into Alexandra Canal
- **The ‘Victoria Branch’:** This drains the area to the east of South Dowling Street in areas of West Kensington and extending north into the Moore Park Golf Course towards Joynton Avenue. In the vicinity of the proposal area floodwater is conveyed along Dacey Avenue, crosses South Dowling Street and continues along Lachlan Street. Water ponds on Lachlan Street near Sam Sing Street and flows down Sam Sing Street toward Joynton Avenue. Runoff from the block to the north of Lachlan Street also contributes to the flooding of Lachlan Street.

Flood depths

The proposal passes through a number of areas which are already considered to be flooding trouble spots at a number of sag points within the proposal area. Further details of which are provided below. The proposal is also impacted by a number of overland flow paths, most notably along McEvoy Street between Botany Road and Bowden Street. McEvoy Street acts as a flow path conveying flows from Botany Road to Bowden Street. Along this section, flows are received from the north via Wyndham Street, Brennan Street, Loveridge Street and Fountain Street and are conveyed west along McEvoy Street, discharging to the south into Botany Road, Wyndham Street, Hiles Lane, Hiles Street, McCauley Street, Stokes Avenue and Bowden Street. There are also overland flow paths along Dacey Avenue between the catchment boundary (west of Anzac Parade) and South Dowling Street. Floodwaters flow in a westerly direction along before being conveyed either to the north or to the south along South Dowling Street.

Critical sag points that are subject to flooding along the proposal alignment are listed below:

- McEvoy Street, between Fountain Street and Bowden Street westbound where water ponds before flowing into Bowden Street. Flood depths at this location reach 0.59 metres in the 0.2 EY event and 0.75 metres in the one per cent AEP event
- George Street/McEvoy Street intersection eastbound. Flood depths in this location range from approximately 0.49 metres in the 0.2 EY event to 0.61 metres in the one per cent AEP event

- Euston Road, between Huntley Street and Harley Street. Floodwaters enter this area from the north via Morehead Street and Young Street, and from the east via Bourke Street, before ponding in this location. The overland flow leaves the site to the south along Hunter Street. Flood depths reach 1.0 metre in the 0.2 EY event and 1.2 metre in one per cent AEP event
- Lachlan Street, near the intersection with Sam Sing Street. This area receives flow from Bourke Street, Gadigal Avenue and through a pedestrian plaza to the north of the sag point. Flood depths range between 0.70 metres in the 0.2 EY event and 0.80 metres in the one per cent AEP event.

Flood immunity

Flood immunity of a road may be described in general terms as the smallest flood event which causes the road to become flooded and untrafficable. The proposal area is currently flood-affected in events as frequent as the 0.2 EY event.

Flood hazard

Flood hazard categorisation (NSW Government, 2005) identifies areas likely to be subject to high flood depths, high flow velocities or both in a flooding event. The existing flood hazard for the one per cent AEP is shown on **Figure 6-10**. Areas of high flood hazard within the proposal area include:

- The southern side of McEvoy Street between Fountain Street and into Bowden Street
- Along McEvoy Street, between Hunter Street and Young Street.

Existing flood risk to vehicles

Small vehicles may become buoyant and potentially be swept away by floodwaters when depths exceed 0.3 metres. If flow velocities are greater than one metre per second, this could reduce the threshold flood depths to 0.2 metres or lower. Floodwaters of such depths currently occur within the proposal area. Hence, there is already an existing risk to vehicles using the roads within the proposal area.

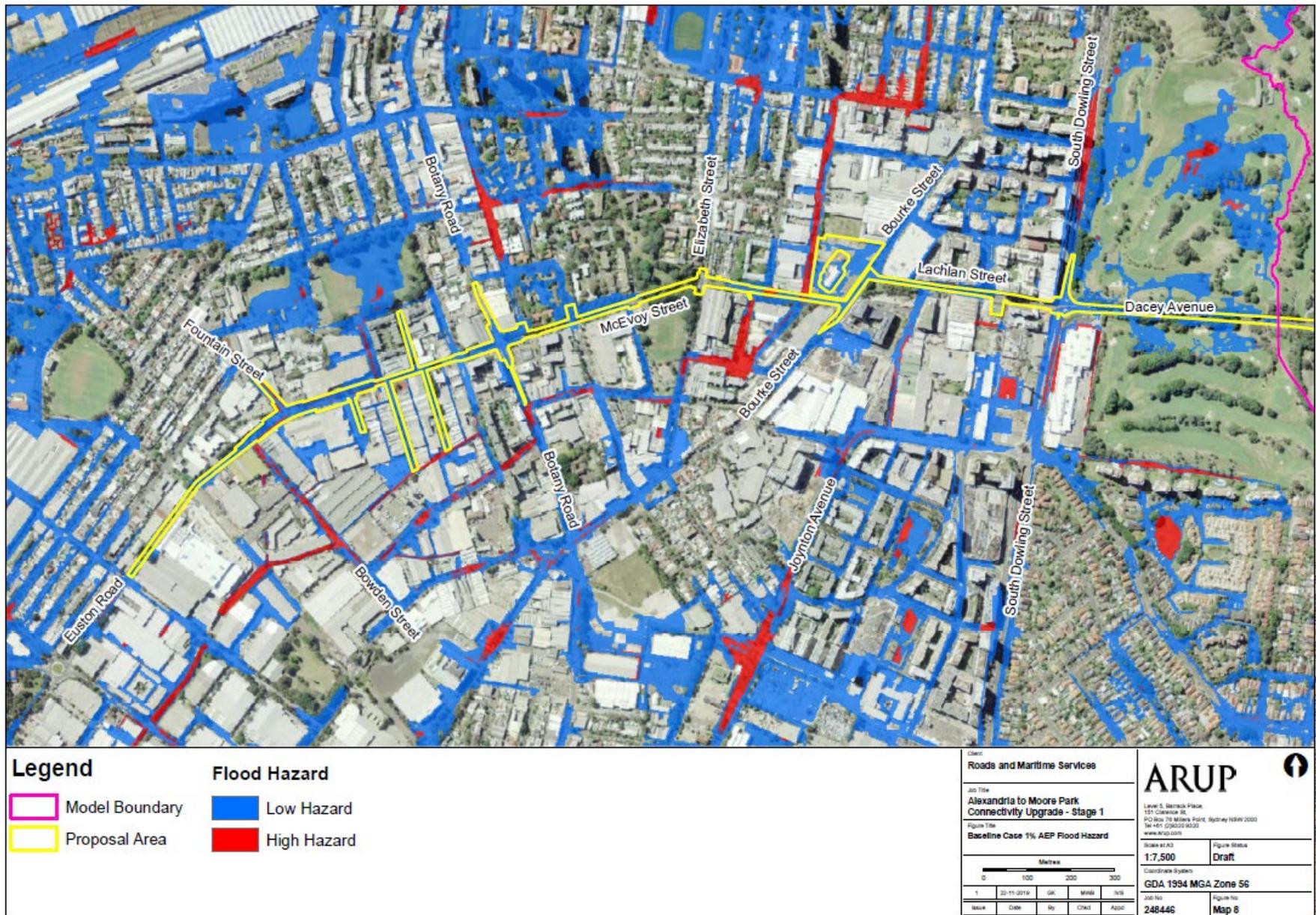


Figure 6-10 Existing flood hazard for the one per cent AEP (Arup, 2019c)

6.5.3 Potential impacts

Construction

Surface water

Construction of the proposal presents a risk to downstream water quality if management measures are not implemented, monitored and maintained. If unmitigated, the highest risk to water quality would occur through the following construction activities:

- Construction upstream of waterways such as the Alexandra Canal and Sheas Creek
- General earthworks, including stripping of topsoil and excavations
- Removal of vegetation
- Stockpiling of topsoil and vegetation
- Transportation of cut and/or fill materials
- Movement of heavy vehicles across exposed earth
- Accidental spills of fuels, oils or other chemicals from construction vehicles or equipment.

Erosion and sediment controls would be implemented throughout the proposal area during construction. Provided the safeguards and management measures are implemented for ancillary sites no major impacts to water quality would be expected.

Flooding

Impacts to flooding behaviour during construction would mainly be due to temporary stockpiles, safety barriers and other construction elements being located in flood flow paths, resulting in obstructing flows during a flood event. Flooding impacts would also potentially occur if drainage systems are temporarily decommissioned during the work.

Three ancillary sites (Sites 1, Site 2 and Site 4) are generally located outside of the main identified flooding flow paths, although portions of these sites may be impacted by shallow overland flows during flood events. Stockpiles and other obstructions within these sites are not expected to result in substantial flood impact due to the shallow flow depths predicted (less than 0.1 metres). Site 4 would be located within a natural sag point and is likely to be affected by flooding due to flood depths predicted at this location (greater than 0.5 metres). Site 5 is not flood affected. Further flood model would be required to confirm if any flood impact are likely during construction.

Groundwater

Construction can have an impact on groundwater systems where excavations or structures intersect these systems or dewatering is carried out or caused. Construction can also impact groundwater quality where contamination from construction activities enters the subsurface and reaches the groundwater.

The proposal involves activities that may intersect the groundwater table, including trenching and piling for utility relocations and retaining wall construction. However, should groundwater be encountered during excavations and dewatering be required during construction, water would be tested and managed appropriately. For example this may involve disposal to an appropriately licensed facility. These measures would be managed in CEMP. If impacts to groundwater do occur this would be expected to be temporary and limited to a localised area for the duration of construction. As discussed in **Section 4.2.8**, the proposal is not expected to reduce the groundwater resource pool by three megalitres per year or at a rate of greater than five litres per second, and therefore an aquifer interference licence is not required.

Operation

Surface water and groundwater

While there would be a small increase in the impervious surface area within the proposal area, impacts on surface water and groundwater flow conditions and quality would not be expected to be substantial. This is, primarily due to the majority of the proposal being within an existing road corridor.

Flooding

Change in flood levels

The concept design was assessed in the localised TUFLOW model to identify the potential impacts to flooding. The modelling results show that flood level increases of up to 0.25 metres would be expected at McEvoy Street near the Fountain Street intersection in all events up to the one per AEP. This increase could potentially cause substantial impacts to existing buildings and properties, while, the high flood hazard areas are expected to be localised and limited to the road corridor.

Outside the proposal area, there are minor increases in flood levels which generally would not exceed 0.02 metres in all events assessed along Bowden Street. **Figure 6-11** shows the flood levels for the one per cent AEP event.

The increased flooding impacts would generally be a result of changed road surface levels and geometry, including regrading and reconfiguration of the road and intersections and inclusion of new median kerbs and changes to the stormwater network. This would result in redistribution of flows passing through the proposal area, with some downstream areas experiencing increased flows and hence flood levels and depths, while other areas experience reduced flows, flood levels and depths. Drainage infrastructure installed as part of the proposal would provide increased stormwater pit inflow and pipe capacities. This would convey increased flows into the existing drainage systems which in some instances results in increased discharge to downstream areas and increases in flood levels. Strategic consideration and refinement of aspects of the proposed design and specific locations along the proposal alignment is recommended to mitigate these flood impacts.

The flooding impacts through and around the proposal area are summarised below:

- **Fountain Street/McEvoy Street Intersection:** Flood levels in this section would be increased by up to 0.25 metres in the one per cent AEP events along the northern side of McEvoy Street between the Fountain Street intersection and Stokes Avenue as a result of raised finished road levels and addition of a raised median along McEvoy Street. The new median would prevent flows from crossing from the northern to southern side of McEvoy Street contributing to the increase in flood levels. There would also be a reduction in flood levels on the southern side of Euston Road would occur as a result of the new median. There would also be localised area at the Bowden Street/McEvoy Street intersection in which peak flood levels are increased up to 0.07 metres from existing conditions in the one per cent AEP. The increase in flood levels may affect the adjacent buildings along McEvoy Street which are outside the proposal area, however, depths would be relatively shallow (less than 0.02 metre in a one per cent AEP event). Change in flood levels are shown in **Figure 6-11**
- **Botany Road/McEvoy Street intersection:** Flood levels would increase in the southern side McEvoy Street by up to 0.20 metres in the one per cent AEP event as a result road finished levels along Botany Road, and McEvoy Street to provide increase in flows from east to west through the intersection. Increased overland flow resulting from the changes in the road profile at the Botany Road/McEvoy Street intersection would also contributing to flood level increases of up to 0.06 metres in the one per cent AEP. Proportionate reductions in peak water levels would be expected along Botany Road to the south of the Botany Road/McEvoy Street intersection. Flood levels through the intersection are generally shallow (less than 0.05 metres) in the one per cent AEP. Increases in flood levels of up to 0.03 metres would occur along the open channel downstream of Wyndham Street, near Hiles Street and Hiles Lane. Change in flood levels are shown in **Figure 6-12**

- **Elizabeth Street/McEvoy intersection:** Elizabeth Street is a high point within the proposal area and as such overland flow paths would not be substantially altered. There would be isolated spots where the change in flood levels may exceed 0.01 metres along on Pitt Street to the proposal. Change in flood levels are shown in **Figure 6-13**
- **Lachlan Street/South Dowling Street/Dacey Avenue intersection:** Changes to the flood levels in the vicinity of Lachlan Street/South Dowling Street/Dacey Avenue intersection would be minimal due to the work associated with the proposal that would be limited to minor kerb adjustments. Change in flood levels are shown in **Figure 6-14**.



Figure 6-11 Change in flood levels for the one per cent AEP event at the Fountain Street/McEvoy Street intersection



Figure 6-12 Change in flood levels for the one per cent AEP event at Botany Road/McEvoy Street intersection



Figure 6-13 Change in flood levels for the one per cent AEP event at Elizabeth Street/McEvoy Street intersection



Figure 6-14 Change in flood levels for the one per cent AEP event at the Lachlan Street/South Dowling Street/Dacey Avenue intersection

Impacts to properties

The flood level increases described above would have the potential to affect existing development and properties. Properties were deemed to be impacted if the flood level increases were up against the existing building outline. Locations where the increased flood level potentially impact existing properties are summarised in **Table 6-40**. As can be seen from this table many of the locations experience impacts which would be relatively minor, however, there would be a number of properties where flood impacts may exceed 0.25 metre.

Table 6-40 Flooding impacts to existing properties

Location	Increase in flood level (metres)
Within or immediately next to proposal area	
McEvoy Street, near Bowden Street (westbound)	+0.06 m 1% AEP
McEvoy Street, near Fountain Street (eastbound)	+0.25 m in 5% AEP and 1% AEP
McEvoy Street, near Wyndham Street (westbound)	+0.17 m in 0.2 EY

Location	Increase in flood level (metres)
	+0.21 m in 1% AEP
McEvoy Street, near Elizabeth Street (eastbound)	+0.10 m in 1% AEP
Away from proposal area	
Bowden Street near McEvoy Street, Alexandria	+0.02 m in 0.2 EY +0.02 m in 1% AEP
Wyndham Street, south of McEvoy Street Alexandria	+0.08 m in 0.2 EY +0.06 m in 1% AEP
Open channel between Hiles Street and McCauley Street, Alexandria	+0.03 m in 0.2 EY +0.01 m in 1% AEP

Overall, the flood level increases would be generally contained within the road corridor. The impacted locations listed in **Table 6-40** are typically localised and may not have substantial impact to buildings and properties. No assessment of whether the flood levels affected building floor levels or building entrances has been carried out at this stage. Residual flooding impacts from the proposal would be investigated further and feasible mitigation work quantified at detail design.

Flood depths and flood risks to vehicles

As described in **Section 6.5.2**, the proposal area currently has locations where the flood conditions would be unsafe to vehicles with flood depths exceeding 0.3 metres at a number of low points. The flood depths along the proposal are generally similar to existing conditions, although the locations of maximum flood depths at intersections are shifted slightly due to changes to the road profile.

The only area where a visible change can be observed is on the south side of McEvoy Street at the sag point between Fountain Street and Bowden Street, where the extent of unsafe area is slightly increased from existing. This is primarily due to the road level being lowered from existing, resulting in higher flood depths in all events compared to existing conditions. Conversely, there is reduction of unsafe area on northern side McEvoy Street at this same location.

Flood risk to vehicles outside the proposal area would be unchanged compared with existing conditions.

Change in flood hazard

The increases in the high flood hazard areas as a result of the proposal are expected to be minor and localised. These increases would be generally characterised as small fringe extensions of existing high flood hazard areas and are offset by small reductions in other areas along the proposal.

There is not expected to be a material increase in the flood risk to people and property as a result of these changes.

Flood immunity

The proposal area is currently flood-affected in events as frequent as the 0.2 EY event. The proposal would not change the flood immunity, that is, the study area would still be flood-affected in the 0.2 EY event and the flood-affectation does not appear to be increased.

Mitigation measures to reduce any additional impact to water quality and flooding as a result of the proposal have been provided in **Section 6.5.4** and **Table 6-41**.

6.5.4 Safeguards and management measures

Safeguards and management measures for flooding and hydrology risks are presented in **Table 6-41**.

Table 6-41 Safeguards and management measures for hydrology and flooding

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and water	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.	Contractor	Detailed design/pre-construction	Core standard safeguard SW1 Section 2.1 of QA G38 Soil and Water Management
Soil and water	A site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the Soil and Water Management Plan The Plan will include 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	Detailed design/Pre-construction	Core standard safeguard SW2 Section 2.2 of QA G38 Soil and Water Management
Dewatering	During detailed design, additional geotechnical investigations will be completed and will include an investigation of groundwater depth. Should excavation dewatering be required during construction, water will be tested and managed appropriately. For example this may involve disposal to an appropriately licensed facility. These measures will be managed under the CEMP. Confirmation of whether or not a licence under the <i>Water Management Act 2000</i> as defined under the <i>Aquifer Interference Policy</i> is required will be confirmed prior to any dewatering activity commencing.	Contractor	Construction	Additional safeguard
Minimise risks to water quality and soil impacts	Stockpiles will be designed, established, operated and decommissioned in accordance with the <i>RTA Stockpile Site Management Guideline 2011</i> .	Contractor	Construction	Additional standard safeguard SW9

Impact	Environmental safeguards	Responsibility	Timing	Reference
Hydrology and flooding	<p>The following measures will be implemented during detailed design:</p> <ul style="list-style-type: none"> • Flooding impacts will be reassessed for both the construction and operation of the proposal as refinements to the road and drainage designs are expected to change the flooding impacts • The flood risk to vehicles will also be reassessed and the design adjusted to provide safe flow conditions for vehicles, if possible • Stormwater survey received from ongoing site investigations should be reviewed against the stormwater data incorporated in the baseline model, and any necessary updates made to the model for both the baseline and design case scenarios • The identified mitigation measures and strategies will be reviewed and reassessed in light of any changes to the flooding impacts resulting from the detailed design • Flood impacts of the proposal on the probable maximum flood event will be carried out to ensure no adverse flood impacts due to the proposal. 	Roads and Maritime	Detail design	Additional Safeguard
Impacts to building	Any residual flood impacts to properties after implementing feasible mitigation works will be quantified. Floor level survey data will be collected to quantify impacts to above-floor flooding of properties located along the proposal that may be impacted.	Roads and Maritime	Detail design	Additional safeguard
Flooding	The CEMP will consider the potential impacts of temporary construction works including trenching, solid traffic barriers and stockpiles on overland flows and incorporate appropriate management measures to address these issues.	Contractor	Construction	Additional safeguard

6.6 Landscape character and visual impacts

The extent and magnitude of the proposal on landscape character and visual amenity are assessed in the *Alexandria to Moore Park Project Urban Design & Landscape Strategy and Visual Impact Assessment* (Context, 2019) which is provided in **Appendix E**. A summary of the assessment is presented in this section, together with safeguards and management measures to mitigate any negative impacts.

6.6.1 Methodology

The assessment was prepared in accordance with Roads and Maritime documents, *Guidelines for Landscape Character and Visual Impact Assessment* (Roads and Maritime, 2018) and *Beyond the Pavement* (Roads and Maritime, 2014).

Visual impact assessment

Visual impact assessment is carried out to understand the day-to-day visual effects of a proposal on views. It is based on the assessment of a number of selected key viewpoints that are rated according to the sensitivity of the view and the magnitude of the proposal within that view. The locations and directions of the chosen viewpoints are representative of the range of viewpoints both within and beyond the road corridor.

Fifteen viewpoints (VP) were identified along the length of the proposal. These are shown on **Figure 6-15**. As the proposal lies in an inner-city area with no long distance views of the proposal area, all the VPs are located within the proposal area looking across and along the corridor.

The assessment of the visual impact on these VPs has considered the sensitivity of the view (that is, the quality of the view and how it would be affected by the proposal) and the magnitude of the proposal within that view (that is, the physical size and scale of the change and its proximity to the viewer). The combination of sensitivity and magnitude was then used to derive the visual impact rating (refer to **Table 6-42**).

Table 6-42 Landscape Character and Visual impact matrix (Roads and Maritime, 2013)

SENSITIVITY	MAGNITUDE						
		High	High to Moderate	Moderate	Moderate to Low	Low	Negligible
High	High	High	Moderate/High	Moderate/High	Moderate	Negligible	Negligible
Moderate	Moderate to High	Moderate/High	Moderate	Moderate	Moderate/Low	Negligible	Negligible
Low	Moderate	Moderate	Moderate/Low	Moderate/Low	Low	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible



Figure 7-3, Key Viewpoint Map

Figure 6-15 Key Viewpoints (Context, 2019)

6.6.2 Existing environment

The proposal is surrounded by a modified urban environment which includes a mix of residential, commercial/business, recreational, industrial and transport related land uses. The proposal is bounded to the north by the established dense urban areas of Surry Hills, Redfern and Erskineville composed largely of terrace housing, and the old industrial areas of Alexandria and Zetland to the South which are rapidly transforming into high rise residential precincts. In the east the proposal passes through the historic parkland spaces of Centennial and Moore Park.

The Alexandria to Moore Park road corridor has historically been a through route between the industrial areas and inner suburbs connecting the east to the south of the city. While the route serves as a network link it also serves in part as a local road to residents. As discussed in **Section 6.1.2**, the study area includes several major transport corridors, including roads, rail and bus corridors; and pedestrian and cycle networks.

In addition to increasing urban density and consolidation in the areas surrounding the proposal new public transport developments including the CSELR and a potential dedicated public transport corridor along Gadigal Avenue (known as the Eastern Transit Corridor), the interaction with historic parklands, the New M5 and anticipated traffic demands all contribute to the complexity of the local environmental.

The main elements of the local context in which the proposal area is situated is shown in **Figure 1-3** and described in **Section 1.2**.

The proposal area has been substantially changed by development with the natural vegetation modified by past land uses and development. The vegetation surrounding the proposal area is largely composed of native and exotic introduced streetscape species. As described in **Section 6.3**, there are four locations that contain Significant Trees on the City of Sydney Register next to the proposal area. There are also a large number of heritage items located within and around the proposal (refer to **Section 6.3**).

The proposal is located with the Botany Sands geological unit, which are composed of a complex of Aeolian sand dunes of the Holocene era. The Botany Sands results in a natural landform of rounded sand dunes and expanses of gentle slopes with local depressions and exposed water tables (ponds and marshes). The topography of the proposal area is generally flat with Dacey Avenue cutting through a small ridgeline. The proposal traverses two catchment areas and includes the Alexandra Canal and Botany Wetlands catchments, refer to **Figure 6-9** and **Section 6.5.2**.

As described in **Section 6.3** (Non-Aboriginal heritage) and **Section 6.4** (Aboriginal heritage), there are a number of non-Aboriginal and Aboriginal heritage items and sites in and around the proposal area.

6.6.3 Potential impacts

Construction

During construction, there would be temporary impacts on visual amenity from the five construction compounds, clearing of vegetation, generation of wastes and construction activities. During construction, temporary lighting would be required at the construction compound/ancillary facilities sites and during night works, where these are required. Particular attention would be given to design and location of temporary lighting, to avoid light spill into residential areas and any other identified sensitive receivers. These impacts would occur throughout construction. Construction staging would result in the impact not being spread across the entire proposal area at the one time. With exception of the 49 planted trees (comprised of 25 mature and 24 immature) to be removed, these impacts would be temporary for the duration of construction.

Mitigation measures to ameliorate the visual impacts are summarised in **Section 6.6.4**.

Operation

Visual impact

The potential visual impacts of the proposal was assessed according to the impact of the proposal at 15 separate viewpoints (VP), refer to **Figure 6-15**. The 15 VP are centered around the four main construction zones. Impacts to view points are based on the VPs sensitivity to change and the magnitude of the proposed changes that would be seen from the VP. The impacts from the proposal are summarised in **Table 6-43**.

Table 6-43 Visual impact assessment

VP	Impact			Comment and photos of key viewpoints (Context 2019)
	Sensitivity	Magnitude	Overall impact	
Fountain Street/McEvoy Street intersection				
VP1	Low	Moderate	Moderate	<p>Predominantly businesses and industrial warehouses are located along this section of McEvoy Street. The users / residents of these premises would have only a low sensitivity to this proposal at this location.</p> <p>There would be minor alterations to the existing road layout along the northern side and several metres of road widening along the southern side of McEvoy Street. A number of street trees around the Fountain Street and McEvoy Street Intersection would be removed. Trees located further away from the works would be retained where possible. New trees would be planted as part of the proposal.</p>
VP2	Low	Moderate	Moderate	
VP3	Low	Moderate	Moderate	
 <p>The image shows an aerial view of the McEvoy Street intersection with Fountain Street. The road is shown with a widening on the southern side. Several trees are highlighted in yellow, with arrows pointing to them from a label 'Indicative tree removal'. Another label 'Indicative road widening' points to the widened section of the road. The surrounding area includes buildings, parked cars, and a pedestrian.</p>				
Botany Road/McEvoy Street intersection				
VP4	Moderate	High	Moderate to high	<p>The businesses located along both sides of the road and residents along the southern side would have a moderate to high sensitivity to the proposal due to the loss of trees and public open space.</p> <p>The proposal would result in minor alterations to the existing road layout along the south-west side of the intersection without tree removal. However, the proposal would require the removal of several large trees along the</p>
VP5	Moderate	High	Moderate to high	
VP6	Moderate	High	Moderate to high	

VP	Impact			Comment and photos of key viewpoints (Context 2019)
	Sensitivity	Magnitude	Overall impact	
VP7	Moderate	High	Moderate to high	<p>north-west side of the intersection to allow for the road widening at this location. New street trees would be planted as part of proposal</p>  <p>Viewpoint 04: Botany Road and McEvoy Street intersection, looking north into McEvoy</p>
Elizabeth Street/McEvoy Street intersection				
VP8	High	Negligible	Negligible	<p>The residents and the overall community along the Waterloo Park section would have a high sensitivity to the proposal, as Waterloo Park is an important and valued asset for the local community. Very minor alterations to the existing road along the southern side of McEvoy Street would occur. The proposed road layout would be retained within existing kerb line without impacting the existing trees. Raised walkways would be considered to minimise impacts on the existing fig trees.</p>
VP9	High	Negligible	Negligible	
VP10	High	Negligible	Negligible	

VP	Impact			Comment and photos of key viewpoints (Context 2019)
	Sensitivity	Magnitude	Overall impact	
				 <p>Viewpoint 08: Elizabeth Street and McEvoy Street intersection, looking south at Elizabeth Street</p>

Lachlan Street/South Dowling Street/Dacey Avenue intersection

VP11	Moderate	Negligible	Negligible	<p>The community in general would have a moderate sensitivity to the proposal due to the prominence and high visibility of the site.</p> <p>The road widening works at this location are minor would not impact adjacent trees or landscape</p>  <p>Viewpoint 13: South Dowling Street / Lachlan Street / Dacey Avenue intersection, looking east into Dacey Street</p>
VP12	Moderate	Negligible	Negligible	
VP13	Moderate	Negligible	Negligible	
VP14	Moderate	Negligible	Negligible	
VP15	Moderate	Negligible	Negligible	

As shown in **Table 6-43**, the range of visual impact ratings from the proposal were as follows:

- Four VPs located at the Elizabeth Street/McEvoy Street intersection would have a moderate to high visual impact
- Three VPs located at the Fountain Street/McEvoy Street intersection would have a moderate visual impact
- Eight VPs located at the Botany Road/McEvoy Street intersection and the Lachlan Street/South Dowling Street/Dacey Avenue intersection would have negligible visual impact.

High visual impacts occur in an area where proximity and sensitivity to the proposal would be greatest, such as in areas with large mature trees, which are highly valued by the community.

Beyond these locations, the impact ratings were identified as moderate, low and negligible ratings. This generally reflected the low visibility of the existing road corridor and the proposal. It also indicates that the scale of the proposal would be consistent with the existing street environment.

The visual impact would be reduced by planting new trees near kerbs where practical, refer to **Appendix E**.

6.6.4 Safeguards and management measures

Safeguards and management measures for landscape character and visual impacts are presented in **Table 6-44**.

Table 6-44 Safeguards and management measures - landscape character and visual impact

Impact	Environmental safeguards	Responsibility	Timing	Reference
Landscape character and visual impact	<p>An Urban Design Plan will be prepared to support the final detailed project design and implemented as part of the CEMP.</p> <p>The Urban Design Plan will present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The Plan will include design treatments for:</p> <ul style="list-style-type: none"> • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements including retaining walls, bridges and noise walls • Pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • Fixtures such as seating, lighting, fencing and signs • Details of the staging of landscape works taking account of related environmental controls such as 	Contractor	Detailed design / pre-construction	Core standard safeguard UD1

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>erosion and sedimentation controls and drainage</p> <ul style="list-style-type: none"> Procedures for monitoring and maintaining landscaped or rehabilitated areas. <p>The Urban Design Plan will be prepared in accordance with relevant guidelines, including:</p> <ul style="list-style-type: none"> <i>Beyond the Pavement urban design policy, process and principles</i> (Roads and Maritime, 2014) <i>Landscape Guideline</i> (RTA, 2008) <i>Bridge Aesthetics</i> (Roads and Maritime 2012) <i>Noise Wall Design Guidelines</i> (RTA, 2006) <i>Shotcrete Design Guideline</i> (RTA, 2005). 			
Work sites	Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) will be managed to minimise visual impacts, including appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials.	Construction contractor	Construction	Core standard safeguard UD2
Impact on street trees	A detailed tree assessment of trees impacted by the proposal and detailed tree survey will be carried out prior to construction based on the detail design.	Contractor	Detailed design / pre-construction	Additional safeguard
Vegetation and landscaping	Where feasible and reasonable: <ul style="list-style-type: none"> Street trees will be retained along Euston Road, McEvoy Street and Lachlan Street All new tree plantings would be planted in the vegetated area at the front of the foot path Existing trees next to the kerb would be retained and the path moved away from the kerb where possible Where space constraints are present next to existing buildings, the wider footpaths would be adjusted to allow 	Roads and Maritime / Contractor	Detailed design/pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>for a vegetated verge next to the kerb</p> <ul style="list-style-type: none"> Elevated walkways and wider footpaths will be constructed where paths have the potential to impact on trees or tree roots New street trees will be planted in accordance with the City of Sydney's Street Tree Masterplan where possible and in consultation with the City of Sydney. Tree species to be used include: <ul style="list-style-type: none"> <i>Ficus microcarpa var. hillii</i> (Hill's Fig) <i>Waterhousea floribunda</i> 'Green Avenue' (Weeping Lilly Pilly) <i>Lophostemon confertus</i> (Brush Box) <i>Platanus acerifolia</i> (London Plane). 			
Visual impact of work sites	Compound and ancillary facilities will be decommissioned and the sites rehabilitated to their existing condition or as otherwise agreed with the landowner on completion of works.	Contractor	Construction	Additional safeguard
Light spill from work sites	Temporary lighting will be located and designed to avoid light spill into residential properties and identified sensitive receptors.	Contractor	Construction	Additional safeguard
Green infrastructure	Consideration will be given to Water Urban Sensitive Design (WSUD) initiatives, given it's the proposals low lying condition of the area and propensity for flooding.	Roads and Maritime	Detailed design / pre-construction	Additional safeguard

6.7 Contaminated land

An assessment was carried out to identify the extent and magnitude of contamination within the proposal area. The assessment is documented in the *Alexandria to Moore Park Project Stage 1 Contamination Assessment* (Jacobs, 2019b) which is provided in **Appendix M**. A summary of the assessment is presented in this section, together with safeguards and management measures to mitigate any negative impacts.

6.7.1 Methodology

A Stage 1 contamination assessment was carried out and comprised a review of publicly available information and proposal specific historical aerial photography, a site inspection, identification of potential Areas of Environmental Interest (AEI) and an assessment of qualitative health risk to construction workers and sensitive receivers.

The contamination assessment did not include any ground investigations, sampling or testing of soils and was carried out in accordance with following NSW EPA guidelines:

- *Acid Sulfate Soils Assessment Guidelines* (Department of Planning, 2008)
- *Managing Land Contamination: Planning Guidelines State Environmental Planning Policy (SEPP) 55 – Remediation of Land*, (Department of Urban Affairs and Planning & Environmental Protection Authority, 1998).
- *Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2000).

Public information sources in relation to land contamination include the EPA contaminated sites register and record of notices, local council websites including DA search for contamination notices, Commonwealth Scientific and Industrial Research Organisation (CSIRO) Australian Soil Resource Information System (ASRIS) database, DPI groundwater database and previous contamination site investigations. These sources were reviewed and used to inform the assessment.

The objective of the assessment was to identify potential AEIs, to help identify construction limitations/constraints within the proposal area with respect to contamination. The AEIs were considered to be those potential risks associated with soil, groundwater and vapour contamination that may be present as a result of historic and/or current activities carried out on and/or next to the proposal area.

Site inspections were conducted on 10 October 2016 and on 23 November 2019. The site inspection focused on the proposal area, particularly those areas likely to be affected by construction activities. Adjacent land uses and potential AEIs were also considered.

Based on the assessment findings, recommendations were made about the need for further contamination investigations and included recommendations for sampling and testing of soils at certain locations.

6.7.2 Existing environment

The proposal area consists primarily of commercial/industrial and high density residential land uses. The surrounding areas are generally medium to high density residential, commercial land uses and open space.

Historical aerial photography

Aerial photographs for the years 1931, 1943, 1951, 1961, 1970, 1982, 1991, and 2002 were reviewed. These photographs indicated that the proposal area has been a major road in Sydney's inner suburbs since the 1930s. The proposal area itself has changed little since then, with some minor lane alterations and road safety additions.

The land use in the surrounding area has become increasingly commercial/industrial since the 1930s, with some large areas in Waterloo still under construction. Moore Park Golf Course has been an ongoing project since the 1930s, with some major refurbishments and vegetation cover establishment occurring in the 1960s. The quarrying activities in St Peters (Sydney Park) appeared to be a major feature of the urban landscape until the 1960s, where the landfilling and creation of Sydney Park continued until the 1990s. The quarrying and landfilling in this area did not appear to be within the proposal area at any time.

NSW EPA Contaminated Sites Register

A search of the NSW EPA Contaminated Sites Register and Record of Notices (under Section 58 of the *Contaminated Land Management Act 1997* (CLM ACT)) indicated that there are 17 sites registered with the NSW EPA within 500 metres of the proposal area that were either regulated or had been notified, or within the LGA throughout the proposal area. These sites are summarised in **Table 6-45**. The Lawrence Dry Cleaners (site 10) located hydraulically up gradient of the proposal area could pose a potential risk to construction activities throughout the proposal.

Table 6-45 Notified sites within 500 metres of the proposal area

Site	Suburb	Notified site address	Notified site activity	Contamination status	Location relative to proposal
1	Alexandria	146 – 156 Wyndham Street	Unclassified	Under assessment	About 220 metres north of the proposal area in Alexandria.
2	Alexandria	146 – 156 Botany Road	Unclassified	Under assessment	About 220 metres north of the proposal area in Alexandria.
3	Alexandria	133 Wyndham Street	Service station	Under assessment	Adjacent to construction element Botany Road/McEvoy Street intersection in Alexandria.
4	Alexandria	1B Maddox Street	Former landfill	Regulation under CLM Act not required	About 420 metres south east of the proposal area in Alexandria.
5	Alexandria	Off Huntley Street	Alexandria Canal sediments	Contamination currently regulated under CLM Act	About 290 metres south east of the proposal area in Alexandria.
6	Alexandria	Sydney Park, Alexandria Road (Sydney Park Rd and Euston Rd)	Landfill	Contamination currently regulated under CLM Act	About 270 metres south west of the proposal area in Alexandria
7	Erskineville	36/A1 Coulson Street	Other industry	Regulation under CLM Act not required	About 460 metres west of the proposal area in Alexandria.
8	Erskineville	1A Coulson Street	Other petroleum	Regulation under CLM Act not required	About 300 metres north west of the proposal area in Alexandria.
9	St Peters	Sydney Park	Former landfill	Under assessment	About 200 metres south west of the proposal area in Alexandria.

Site	Suburb	Notified site address	Notified site activity	Contamination status	Location relative to proposal
10	Waterloo	1-13 Archibald Avenue	Other industry	Under assessment	About 150 metres south of the proposal area in Waterloo.
11	Waterloo	2 John Street	Proposed construction site	Regulation under CLM Act not required	About 160 metres north of the proposal area in Waterloo.
12	Waterloo	867-877 South Dowling Street	Service station	Regulation under CLM Act not required	About 90 metres south of the proposal area in Waterloo/Moore Park.
13	Waterloo	887-893 Bourke Street	Lawrence Dry Cleaners	Contamination currently regulated under CLM Act	About 140 metres north of the proposal area in Waterloo.
14	Waterloo	830-838 Elizabeth Street	Iconic (Former Chubb Factory)	Regulation under CLM Act not required	About 190 metres south east to south of the proposal area in Waterloo.
15	Waterloo	22-24 Archibald Avenue	Other petroleum	Regulation under CLM Act not required	About 150 metres south of the proposal area in Waterloo.
16	Moore Park	Area 2, Driver Avenue	Unclassified	Regulation under CLM Act not required	About 220 metres east of the proposal area in Moore Park.
17	Kensington	10-20 Anzac Parade	Service station	Regulation under CLM Act not required	About 220 metres south east of the proposal area in Moore Park.

City of Sydney Development Application Search

A search of current and historical DA within the Sydney LGA along the proposal was carried out in February 2017 and updated in November 2019. The results of the DA search indicated that 11 sites along the proposal have current or historical DA that involved management of ground contamination (soil and groundwater) or asbestos. In some cases these sites have been remediated and validated but, in some instances, it is not clear whether remediation, validation and correct removal/disposal of wastes was carried out during the activities subject of the respective DA. Therefore, contamination on these sites (if present) and if impacted by the proposal may present a risk to construction activities during construction of the proposal. **Table 6-46** lists the 11 sites with relevant associated contamination notices identified during the DA search. Refer to the contamination assessment provided in **Appendix N** for the contamination assessment associated with these sites.

Table 6-46 Sites along the proposal with relevant contamination notices as part of current or historical DA

Address	DA Number	Description	Contamination Issues within DA
903-921 Bourke Street, Waterloo	D/2019/429	Demolition of existing structures and hardstand areas, excavations of between 0.3m – 4m and remediation of contaminated land.	The site is currently under assessment and a determination notice listing contamination issues is yet to be issued. The site (i.e. 903-921 Bourke Street) is not listed as a contaminated site on the NSW EPA Contaminated Sites Register and Record of Notices (under Section 58 of the CLM Act). However, located approximately 50-60 metres to the north, a neighbouring property, 887-893 Bourke Street (Lawrence Dry Cleaners) is listed and currently under a NSW EPA 'Management Order'.
132-138 McEvoy Street, Alexandria	D/2018/1615	Demolition of existing buildings and construction of a new four storey mixed use development comprising ground floor shops and food and drink premises with office premises on levels above, 43 car parking spaces at ground level, signage and landscaping.	(48) Asbestos removal (60) Erosion and sediment control (62) Waste classification (63) Acid Sulfate Soils (64) Discharge of contaminate groundwater (65) Environmental Management Plan (66) Imported fill materials (67) Land remediation (68) Notification – New contamination evidence (69) Registration of covenant (70, 71) Site Audit Statement (72) Stockpiles (96) Land dedication – Remediation capping layer (145) Hazardous and industrial waste.
141-143 McEvoy Street, Alexandria	D/2011/1582	Demolition of existing structures and construction of two buildings comprising 36 residential apartments, retail space and car parking plus strata subdivision into 37 lots.	(45, 48 & 49) Asbestos Removal (47) Waste Classification (63) Land Contamination (64) Site Audit Statement (66) Acid Sulfate Soils
145 McEvoy St, Alexandria	D/2011/1915	Demolition of existing building and construction of two buildings including 42 apartments 2 retail units and basement and ground level parking.	(4) Remediation Action Plan (5) Site Audit Statement (46) Asbestos removal (48) Waste classification (64) Water pollution

Address	DA Number	Description	Contamination Issues within DA
1-17 Euston Road, Alexandria	D/2017/1297	Demolition of existing structures on site, excavation and construction of a new 4 storey mixed-use building comprising 2 ground floor retail tenancies, 27 residential apartments on the upper levels, communal roof terrace, 2 levels of basement car parking for 36 cars and associated landscaping. The application is Integrated Development requiring the approval of WaterNSW for temporary dewatering of the site under the Water Management Act 2000.	(56) Asbestos removal (57 & 58) Hazardous materials (74) Waste classification (75 & 76) Acid Sulphate Soils (77) Discharge of contaminated groundwater (78) Environmental Management Plan (79) Imported fill materials (80) Notification – new contamination evidence (81) Stockpiles
8-40 Euston Rd, Alexandria	D/2009/882	Demolition of existing buildings on site with the exception of the Euston Road building, remediation of site, and landscaping of remediated site.	(6) Land Contamination (7) Acid Sulfate Soils (10-15) Asbestos Removal
33 Euston Rd, Alexandria	D/2013/630	Demolition of existing building and construction of new mixed use development comprising of 46 residential units, 4 retail tenancies and basement car parking for 40 cars with vehicle access provided off Euston Lane.	(46) Asbestos Removal (60) Remediation (61) Waste Classification (63) Hazardous and Industrial Waste
100-110 Euston Rd, Alexandria	D/2012/1282	Construction and use of new plasterboard and building supplies warehouse building with associated mezzanine offices, showroom, signage and street level car parking, operating between 6.00am to 4.30pm Monday to Saturday.	(55) Asbestos Removal
1-9 Lachlan St, Waterloo	D/2006/1196	Integrated DA for the construction of 2-9 storey commercial/retail building fronting Lachlan Street on the site known as 'Block A' within the area known as 'Sydneygate'. This also includes the fitout and use of a first floor tenancy as a child care centre, street level and basement car parking and associated road construction and landscaping.	(52) Site Audit Statement
13-17 Lachlan St, Waterloo	D/2015/570	Demolition of existing buildings and structures on site, land remediation, excavation and construction of a mixed use development comprising six mixed use buildings, incorporating 227 residential units, ground floor retail tenancies along Lachlan Street and future Gadigal Avenue, 210 car parking spaces, vehicle access via future Tung Hop Street and associated landscaping.	(2) Land Contamination – Remediation Action Plan (3) Land Contamination – Site Audit Statement (59) Asbestos Removal Works (60) Waste Classification (61) Discharge of Contaminated Groundwater (62) Environmental Management Plan (63) Imported Fill Material (64) Land Remediation (65) Notification – New Contamination Evidence (66) Site Audit Statement

Address	DA Number	Description	Contamination Issues within DA
			(67) Compliance with Acid Sulfate Soils Management Plan (68) Stockpiles (69) Underground storage tank removal
834 Bourke St, Waterloo	D/2013/1995	Development Application for Integrated Development Application for the construction of a 10 storey mixed use development (known as Block A of the former Sydneygate site) including a 59 place child care centre, 3 ground level retail tenancies, 143 residential apartments, 136 car parking spaces and 65 bicycle parking spaces in 2 basement levels, 18 at grade car parking spaces off the private lane and associated landscaping and the provision of community infrastructure including dedicated setback to Sam Sing street.	(71) Asbestos Removal Works (72) Waste Classification (73) Discharge of Contaminated Groundwater (74) Imported Fill Materials (75) Land Remediation (76) Notification – New Contamination Evidence (77) Site Audit Statement (78) Stockpiles

Potential areas of environmental interest

A number of potential AEIs were identified during the information review and site inspection as detailed in **Table 6-47** and shown in **Figure 6-16**. No high risk AEIs were identified. **Table 6-47** also outlines associated risks to environmental receptors, construction limitations, and site users in consideration of the potential for contamination and proposed construction activities. Sites within the proposal area are highlighted light grey.

Anecdotal information provided to Roads and Maritime by City of Sydney during a recent site inspection indicated that fill containing asbestos containing materials maybe present beneath areas underlying a portion of the proposal alignment from 112 McEvoy Street to the corner of Stokes Avenue.

Table 6-47 Areas of environmental interest and qualitative contamination risk assessment

Site	AEI	Location	Potential contamination source and contaminants of concern	Risk ranking	Comments
1	Former substation	Within proposal area (corner of Euston Road and Harley Street)	Historical use as a substation – hydrocarbons and Polychlorinated Biphenyls (PCB)	Low (possible contamination/no excavation activities)	Substations represent potential sources of hydrocarbons and PCB due to the known historical use of PCB based transformer oil. The excavations associated with the proposal are expected to take place next to the former substation, and not directly within the substation footprint. There is a low migration potential of the contaminants of concern.
2	Former substation	Within proposal area (124 McEvoy Street)	Historical use as a substation – hydrocarbons and PCB	Low (possible contamination/no excavation activities)	Substations represent potential sources of hydrocarbons and PCB due to the known historical use of PCB based transformer oil. The excavations associated with the proposal are expected to take place next to the former substation, and not directly within the substation footprint. There is a low migration potential of the contaminants of concern.
3	Caltex service station	Immediately next to the proposal area (corner of McEvoy and Wyndham Streets)	Fuel storage – hydrocarbons and heavy metals	Low (possible contamination/no excavation activities)	The potential source of contamination are associated with leaks and spills from fuel storage infrastructure. The proposal would require excavations next to the services station and not within the service station footprint. Contamination impacts (if present) from the service station to adjoining areas are likely to be present at depth in groundwater and possible vapour portioning from groundwater. Considering the depth of construction activities is likely to be relatively shallow, groundwater is unlikely to be encountered. Volatile compounds in vapour (if present) may need to be managed during construction activities.
4	Potential areas of fill material within Waterloo Park and Moore	Next to proposal area (less than 50 metres from the proposal area along McEvoy Street)	Historical activities/fill material	Low (possible contamination/no excavation activities)	The suspected areas of fill material within Waterloo Park and Moore Park Golf Course represent a potential source of contamination associated with unknown historical use of reclaimed soils (such as metals, hydrocarbons,

Site	AEI	Location	Potential contamination source and contaminants of concern	Risk ranking	Comments
	Park Golf Course	and Dacey Avenue respectively)			pesticides, PCB and asbestos). The contaminants originating from the possible fill material would have the potential to migrate towards the proposal via groundwater. Considering the depth of construction activities is likely to be relatively shallow, groundwater is unlikely to be encountered.
5	Ausgrid substation	Next to proposal area (less than 20 metres from the proposal on the corner of George and McEvoy Streets)	Current use as a substation – hydrocarbons and PCB	Low (possible contamination/no excavation activities)	Substations represent potential sources of hydrocarbons and PCB due to the known historical use of PCB based transformer oil. The excavations associated with the proposal are expected to take place next to the former substation, and not directly within the substation footprint. There is a low migration potential of the contaminants of concern.
6	Substation (unknown occupation)	Within proposal area (Lachlan Street opposite Gadigal Avenue)	Historical and/or current use as a substation – hydrocarbons and PCB	Low (possible contamination/ no excavation activities)	Substations represent potential sources of hydrocarbons and PCB due to the known historical use of PCB based transformer oil. The excavations associated with the proposal are not expected to take place within the substation footprint and there is and the low migration potential of the contaminants of concern.
7	Moore Park Golf Course	Next to the proposal area (less than 50 metres from the proposal along Dacey Avenue)	Potential diffuse use of herbicides associated with onsite activities	Low (possible contamination/no excavation activities)	The golf course represents a potential source of diffuse herbicide and pesticide contamination associated with vegetation and pest control and maintenance across the golf course. No excavations are expected to take place within the golf course. However the diffuse nature of herbicide/pesticide application gives rise to the potential for deposition on proposed excavation areas via wind action.
8	Lawrence dry cleaners / 903-921 Bourke Street, Waterloo	About 140 metres north and hydraulically up gradient of the proposal area in Waterloo	On site activities associated with dry cleaning - chlorinated hydrocarbons, including tetrachloroethene (PCE),	Low (known contamination/migration potential/ no excavation activities down gradient)	The site represents a known source of contamination associated with the chemicals used in the dry cleaning process (ie chlorinated hydrocarbons, and volatile organic compounds). The dry cleaning site is notified to the NSW

Site	AEI	Location	Potential contamination source and contaminants of concern	Risk ranking	Comments
			trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride (VC)		EPA and the contamination is currently regulated under the CLM Act. The dry cleaners site poses a low risk to the proposal given that there are no construction activities located immediately down gradient of the site, and that groundwater is expected to flow in a south-south-westerly direction towards Alexandra Canal (that is away from the closest proposed construction activities at Lachlan Street/South Dowling Street/Dacey Avenue intersection). If construction activities are to occur down gradient of the site, volatile compounds (if present) may need to be managed during construction activities.
9	General commercial/ industrial land use within Alexandria and Waterloo	Within proposal area	Historical and current commercial/industrial activities (incl. automotive and other industry, asbestos use/dumping)	Low - Moderate (possible contamination/proposed excavation activities)	The potential source of widespread/regional contamination is associated with the use of miscellaneous chemicals and asbestos associated with historical commercial/industrial operations. The proposal may require excavation of potentially contaminated soils and contact with potentially contaminated groundwater associated with historical commercial/industrial.
10	Unsealed areas eg nature strips, residential gardens, open space	Adjacent to the Elizabeth Street/McEvoy Street intersection and Lachlan Street/South Dowling Street/Dacey Avenue intersection (less than 50 metres from the proposal and construction elements, primarily within Moore Park and Waterloo Park)	Deposition of particulates and spills/leaks from use as roads	Low - Moderate (possible contamination/proposed excavation activities)	The historical and continued use of arterial and local roads within the proposal area represents a potential source for localised point sources of contamination to exist along road corridors, in nature strips and residential gardens. This could be associated with spills, leaks and particulate deposition from vehicles. Without appropriate controls, the risk to site users during construction is low to moderate. This is due to the increased likelihood of exposure to potential contamination associated with any excavation across the proposal area.
11	Class 3 ASS	McEvoy Street (between Harley and Wyndham Streets) are located within areas of Class 3	ASS	Moderate (possible contamination/proposed excavation activities)	Given that construction and excavation for services is required within these Class 3 areas and that there is the potential for works to be below one metre from ground

Site	AEI	Location	Potential contamination source and contaminants of concern	Risk ranking	Comments
		ASS (Sydney LEP 2012) and this includes all construction work associated with the upgrade of the Fountain Street/McEvoy Street intersection (refer to Figure 6-16).			level, the potential presence of ASS in these areas could represent a risk to construction activities.
12	Potential fill containing ACM	Within proposal area (112 McEvoy Street and corner of Stoke Avenue)	Asbestos and/or asbestos containing materials (ACM) in fill.	Moderate (possible contamination / proposed excavation activities)	Anecdotal information from the City of Sydney Council provided to Roads and Maritime indicated potential ACM is present within fill underlying the Sunshades carpark at 112 McEvoy Street to the corner of Stokes Avenue. Given that construction and excavation is expected to occur or occur in close proximity to the area and that works are likely to disturb fill material, the possibility of asbestos in the fill material in this area represents a moderate risk to construction activities.



JACOBS NSW SPATIAL - GIS MAP file : IA108700_GIS_Con_F006_ContaminatedSites_r5v5 | 25/11/2019

Legend

- | | | | |
|---|------------------------|---|--|
|  | Construction footprint |  | Potential AEI risk |
|  | Proposal area |  | Low (possible contamination / no excavation activities) |
|  | Road | | Moderate (possible contamination / proposed excavation activities) |
|  | Railway line | | |

- | Site no. | Site name |
|----------|--|
| 1 | - Former substation |
| 2 | - Former substation |
| 3 | - Caltex service station |
| 4 | - Potential areas of fill material within Waterloo Park and Moore Park Golf Course |
| 5 | - AusGrid substation |
| 11 | - Areas of Class 3 ASS - works below 1 metre below natural ground surface |
| 12 | - Potential asbestos remains under car park |



Figure 6-16a | Contaminated sites
Alexandria to Moore Park Stage 1



JACOBS NSW SPATIAL - GIS MAP file: IA108700_GIS_Con_F06_ContamSites_r5v5 | 25/11/2019

Legend

- | | | | |
|---|------------------------|---|--|
|  | Construction footprint |  | Potential AEI risk |
|  | Proposal area |  | Low (possible contamination / no excavation activities) |
|  | Road |  | Moderate (possible contamination / proposed excavation activities) |
|  | Railway line | | Moderate (known contamination / migration potential / excavation activities down gradient) |

- | Site no. | Site name |
|----------|--|
| 4 | Potential areas of fill material within Waterloo Park and Moore Park Golf Course |
| 6 | Substation (unknown occupation) |
| 7 | Moore Park Golf Course |
| 8 | Lawrence dry cleaners |



Figure 6-16b | Contaminated sites
Alexandria to Moore Park Stage 1

Acid sulfate soils

Acid sulfate soils (ASS) are the common name given to naturally occurring sediments and soils containing iron sulfides (principally iron sulfide or iron disulfide or their precursors). The exposure of the sulfide in these soils to oxygen by drainage or excavation leads to the generation of sulfuric acid. Areas of ASS can typically be found in low lying and flat locations which are often swampy or prone to flooding.

ASS Risk Maps from the CSIRO Australian Soil Resource Information System (ASRIS) database were reviewed to ascertain the probability of ASS being present across the proposal area. Based on this information, the western portion of the proposal area is assessed as having a low probability of ASS presence, and the eastern portion of the proposal area is assessed as having an extremely low probability of ASS presence, refer to **Figure 6-17**.

A review of the ASS risk map from the Sydney LEP indicated that Euston Road (between Sydney Park Road and Maddox Street), and McEvoy Street (between Harley and Wyndham Streets) are within an area of Class 3 ASS. The remaining areas of the proposal area are within an area of Class 5 ASS.

The Sydney LEP states that:

“Development consent is required for the carrying out of works described in the Table to this subclause on land shown on the Acid Sulfate Soils Map as being of the class specified for those works.

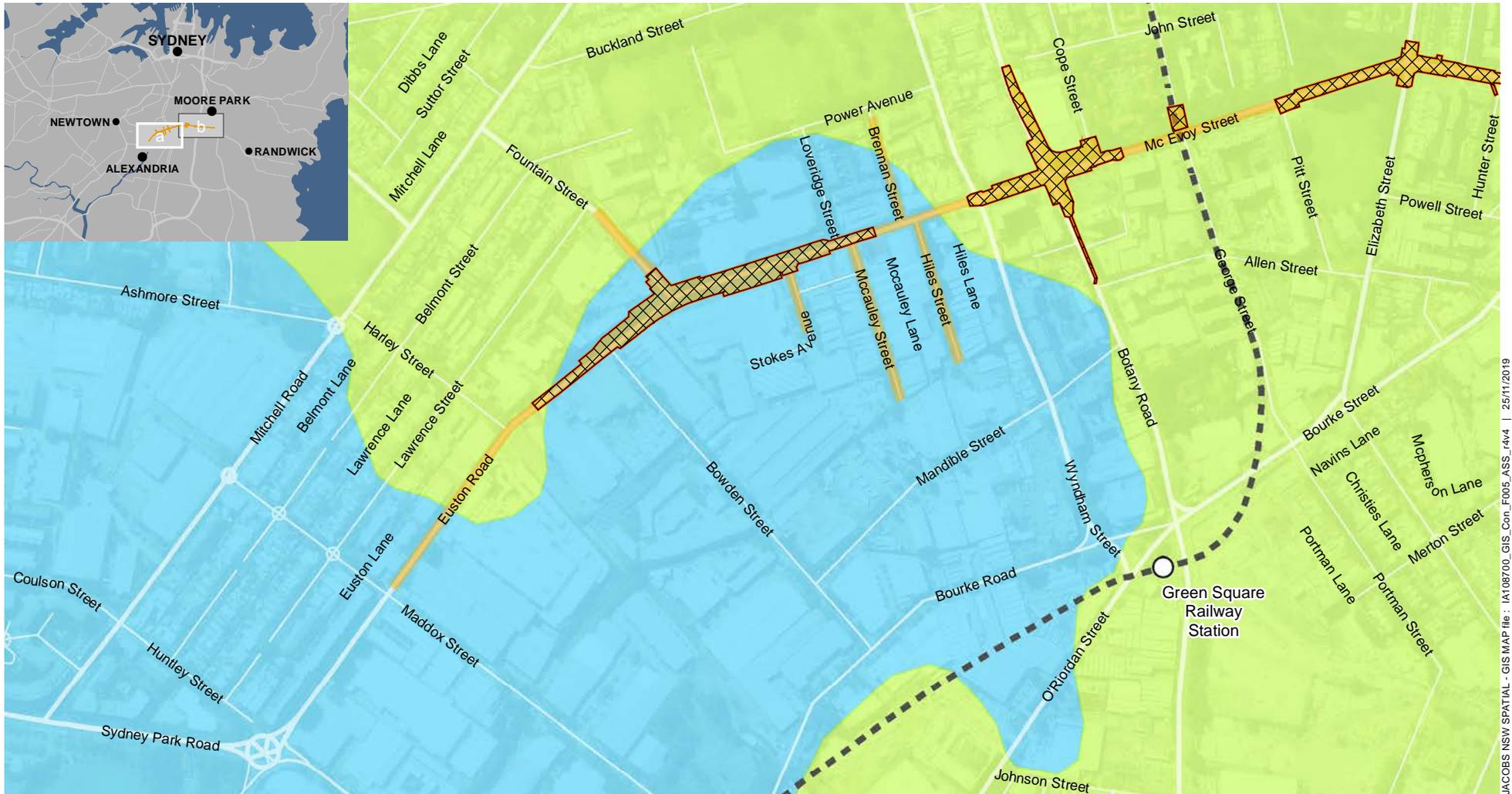
- Class 3: Work more than 1 metre below the natural ground surface. Work by which the water table is likely to be lowered more than 1 metre below the natural ground surface.
- Class 5: Work within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below five metres Australian Height Datum and by which the water table is likely to be lowered below one metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land.”

The Stage 1 contamination assessment (Jacobs, 2019b) concluded that there would be a risk of encountering ASS during construction of the proposal and that an ASS investigation within Class 3 areas where works are proposed to extend one metre below ground level would be carried out prior to construction.

Groundwater

The search of the NSW DPI groundwater database indicated that impacts from the migration of contamination (if any) within the proposal area on beneficial groundwater users are expected to be low given that sensitive receivers are located hydraulically up gradient of the proposal area, or are located greater than 500 metres from the proposal area. As described in **Section 6.5.2**, the groundwater depth is expected to be variable with depths ranging between ground level at saturation and four mbgl.

The geology of the area would support contaminant migration and the risks would depend on the prevailing direction of any offsite contamination, and the depth and extent of excavation required for the proposal. In addition, the erodibility of the underlying soil could promote runoff and dust generation during construction. Further discussion on the geology within the proposal area is included in **Section 6.8**.



JACOBS NSW SPATIAL - GIS MAP file: I:\108700_GIS_Con_F005_ASS_r4v4 | 25/11/2019

Legend

- | | | | |
|---|------------------------|---|---|
|  | Construction footprint |  | Acid sulphate soil planning classes (DPE 2006) |
|  | Proposal area |  | Class 3 - Works beyond 1 metre below natural ground surface. Works by which the watertable is likely to be lowered beyond 1 metre below natural ground surface |
|  | Road | | |
|  | Railway line | | |
| | | | Class 5 - Works within 500 metres of adjacent Class 1, 2, 3 or 4. Land which are likely to lower the watertable below 1 metre AHD on adjacent Class 1, 2, 3 or 4 land |



Figure 6-17a | Acid sulphate soil risk
Alexandria to Moore Park Stage 1



JACOBS NSW SPATIAL - GIS MAP file: I\1108700_GIS_Con_F005_ASS_r4v4 | 25/11/2019

Legend

-  Construction footprint
-  Proposal area
-  Road
-  Railway line
-  Acid sulphate soil planning classes (DPE 2006)
-  Class 5 - Works within 500 metres of adjacent Class 1, 2, 3 or 4. Land which are likely to lower the watertable below 1 metre AHD on adjacent Class 1, 2, 3 or 4 land



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Figure 6-17b | Acid sulphate soil risk
Alexandria to Moore Park Stage 1

6.7.3 Potential impacts

Construction

As summarised in **Table 6-47**, there are five AEIs located within the proposal area and seven near the proposal area that may present a low to moderate contamination or soil management risk during construction. In addition, the search of the City of Sydney Council website for current or historical DA along the proposal identified eight sites with contamination notices associated with DA. These sites may pose a risk to construction and construction site workers.

Construction would have the following potential contamination impacts:

- Disturbance of locations identified as potentially being contaminated may pose a health risk to construction workers. These locations include any of the AEI as identified in **Table 6-47**, and the eight sites with contamination notices associated with DAs
- Contaminated land on and/or next to the proposal area, if not managed appropriately, would potentially impact upon sensitive receivers, sensitive receiving environments (such as Alexandra Canal and Sheas Creek) and construction workers
- Exposure or disturbance of contaminated land during construction would potentially have the following impacts:
 - Mobilisation of surface and subsurface contaminants during construction (potentially impacting groundwater, surface water and soils)
 - Migration of potential contaminants into surrounding areas (potentially impacting groundwater, surface water and soils) via leaching, overland flow and/or subsurface flow (water and/or vapour)
 - Mobilising potential groundwater and/or surface water contamination if present
 - Risk of exposure to site workers, site users and site visitors
 - Risk of exposure to surrounding environmental receptors (ie flora, fauna and, surrounding ecosystems)
- Exposure of ASS could lead to the generation of acidic condition and subsequent leaching of heavy metals from soils which have the potential to contaminate the receiving environment
- Spills of contaminating materials or contaminants. There would be potential for construction activities to result in contamination of soil and/or water due to leaks and spills of potentially contaminating materials.

Based on the results of the Stage 1 contamination assessment (Jacobs, 2018b), further contamination investigation is recommended at areas of moderate risk within the proposal area, prior to construction to ensure the implement appropriate risk management measures are implemented, refer further to **Section 6.7.4**.

Operation

Contamination impacts would generally be associated with contaminated run-off, which may arise from normal vehicle operation (such as tyre wear, minor leaks of lubricants and fuels), maintenance practices, or a spill or accident.

6.7.4 Safeguards and management measures

Safeguards and management measures for contamination are in **Table 6-48**.

Table 6-48 Safeguards and management measures – contaminated land

Impact	Environmental safeguards	Responsibility	Timing	Reference
Contaminated land	<p>A Contaminated Land Management Plan will be prepared in accordance with the <i>Guideline for the Management of Contamination</i> (Roads and Maritime, 2013) and implemented as part of the CEMP. The plan will include, but not be limited to:</p> <ul style="list-style-type: none"> • Capture and management of any surface runoff contaminated by exposure to the contaminated land • Further investigations required to determine the extent, concentration and type of contamination, as identified in the detailed site investigation (Phase 2) • Management of the remediation and subsequent validation of the contaminated land, including any certification required • Measures to ensure the safety of site personnel and local communities during construction. 	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>
Contaminated land	<p>If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.</p>	Contractor	Construction	<p>Core standard safeguard C2</p> <p>Section 4.2 of QA G36 <i>Environment Protection</i></p>
Contaminated land	<p>Where excavation works are required within low risk areas, the CEMP will detail contingency measures. These measures will manage potentially contaminated materials if materials are suspected and/or encountered during construction activities.</p>	Contractor	Detailed design/Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	In these low risk areas, no testing is required unless contamination is suspected or encountered during construction activities. The process for the testing and/or management of suspected or encountered contamination in these lower risk areas will be addressed in the CEMP.			
Accidental spill	A site specific emergency spill plan will be developed, and include spill management measures in accordance with the <i>Roads and Maritime Code of Practice for Water Management</i> (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 Roads and Maritime and EPA officers).	Contractor	Detailed design/Pre-construction	Core standard safeguard C3 Section 4.3 of QA G36 Environment Protection
Contaminated land	If potentially contaminated materials (including asbestos) are suspected and/or encountered during construction, these will be managed by an unexpected finds protocol incorporated in the CEMP.	Contractor	Construction	Additional safeguard
Removed of excavated material	An in-situ waste classification will be carried out in accordance with the <i>NSW Waste Classification Guidelines</i> (EPA, 2004) for any materials which are excavated and removed from the proposal area.	Contractor	Construction	Additional safeguard
Acid Sulfate Materials Management Plan	An ASS investigation within Class 3 areas where works are proposed to extend one metre below ground level. If ASS are confirmed, an appropriate ASS management plan will be prepared and implemented as part of the CEMP. The Plan will be prepared in accordance with the <i>Roads and Maritime's Guidelines for the Management of Acid Sulfate Materials</i> (RTA, 2005).	Contractor	Pre-construction	Additional safeguard
Temporary construction facilities	Should contamination exist within the temporary construction facilities of Sites 1 to 5, contamination will need to be managed under a CEMP during establishment of the facilities, and	Contractor	Pre-construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p>during operation to reduce risk of contamination to site users.</p> <p>Should deeper excavations which encounter groundwater occur within temporary construction facility Site 4, volatile compounds (if present) may need to be managed during construction activities.</p> <p>Should temporary site buildings need to be established within Site 4 during construction, buildings should be raised above ground level to mitigate any potential exposure from volatile compounds which may be present as a result of VOC contaminated groundwater beneath the site.</p>			

Other safeguards and management measures that would address contamination impacts are identified in **Section 6.5** (hydrology and flooding), and **Section 6.10** (other impacts).

6.8 Property, land use and socio-economic

An assessment was carried out to identify the extent and magnitude of potential socio-economic impacts associated with the proposal. The assessment is documented in the *Alexandria to Moore Park Stage 1 Socio-Economic Assessment* (Jacobs, 2019c), refer to **Appendix O**, and is summarised below.

6.8.1 Methodology

The socio-economic assessment was prepared in accordance with Roads and Maritime's *Environmental Impact Assessment Practice Note N05 – Socio-economic assessment* (moderate assessment) (Roads and Maritime, 2013). The methodology for the preparation of the socio-economic assessment involved:

- Scoping of the potential socio-economic issues for the proposal and identification of communities likely to be affected by the proposal
- Describing the existing socio-economic environment of the study area to provide a baseline from which impacts of the proposal were assessed
- Undertaking a visual survey of businesses in the study area
- Undertaking a desktop review, including consideration of the Australian Bureau of Statistics (ABS) *Census of Population and Housing 2016* data and describing the existing socio-economic environment of the study area to provide a baseline from which impacts of the proposed were assessed
- Identifying and assessing the potential socio-economic impacts of the proposal's construction and operation, such as:
 - Impacts on property
 - Changes to local amenity
 - Direct and indirect impacts on social infrastructure near to the proposal
 - Impacts on local business, including from changes to customer and staff parking
 - Changes to local access and connectivity, including for motorists, pedestrians, public transport users and cyclists
- Identifying and assessing the potential socio-economic impacts of the proposal's construction and operation based on the results of the:
 - Survey of businesses near the proposal, including at McEvoy Street, Euston Street, Lachlan Street and surrounding side streets
 - Outcomes of the parking assessment (Jacobs, 2019a) refer to **Appendix C** that was completed for the business impact assessment
 - Community and stakeholder consultation carried out for this and other proposals located in the study area.

Community and stakeholder consultation carried out for the proposal that is documented in **Chapter 5** of the REF.

Study area

The study area for the socio-economic assessment is based on those communities and groups such as residents, workers, business customers, visitors and public transport users that are likely to experience changes to socio-economic conditions from the construction and operation of the proposal. The study area is located within the ABS Statistical Areas Level 2 (SA2) locations of:

- Erskineville-Alexandria SA2
- Waterloo-Beaconsfield SA2.

Benefits and impacts of the proposal's construction and operation may also be experienced by communities outside of the study area. This assessment also considered at a broader level, impacts on regional communities and businesses in the Sydney LGA and wider Sydney region as relevant.

Business surveys

Face-to-face surveys were conducted of businesses in the proposal area to gather information on local businesses (for example, the type and nature of businesses, business operations, their access and delivery requirements) and perceptions of business owners and managers about potential benefits and impacts of the proposal.

Jacobs consultants undertook face-to-face surveys between 14 August and 16 August 2019 with owners and/or managers of businesses located along the sections of Euston Road, McEvoy Street and Lachlan Street within the proposal area and surrounding side streets. Attempts were made to approach all businesses along the road corridor. Forty-eight businesses agreed to participate in the survey. Further information on the business surveys, including a summary of the survey outcomes, is provided in Appendix A of the socio-economic impact assessment (**Appendix O**).

Evaluation matrix

An evaluation matrix was used to evaluate the significance of the proposal's negative socio-economic impacts. The significance of identified impacts was determined with consideration of:

- Sensitivity of receptors (ie environmental characteristics, communities, businesses, business clusters, social infrastructure, residences)
- Magnitude of the proposal.

The sensitivity of receptors refers to the qualities which influence a receptors' vulnerability to changes from the proposal and/or capacity to adapt. This can be influenced by existing conditions relating to such things as amenity, demographic characteristics, economic activity and types of industry and/or businesses present, connectivity and access, property and land use types and known future changes (eg rezoning), community values and community cohesion. The level of community concern about a project can also influence the sensitivity of receptors.

The magnitude of proposal refers to the scale, duration, intensity and scope of the proposal, including how it would be constructed and operated. This can be influenced by such things as the geographical area affected, the type, frequency and duration of works; and operational uses and built form. The criteria for determining sensitivity and magnitude is provided at the bottom of in **Table 6-49**.

The significance of an identified negative impacts is determined by the combination of sensitivity and magnitude compared to the existing baseline condition. In evaluating the level of significance, consideration is given to:

- The range of potential direct and indirect impacts during construction and operation
- Cumulative impacts with other projects.

The matrix for determining the level of significance is outlined in **Table 6-49**.

Table 6-49 Assessing level of significance

Sensitivity of receptor	Magnitude			
	High	Moderate	Low	Negligible
High	High impact	High-moderate	Moderate	Negligible
Moderate	High-moderate	Moderate	Moderate-low	Negligible
Low	Moderate	Moderate-low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Levels of sensitivity

Negligible - No vulnerability and able to absorb or adapt to change.

Low – Minimal areas of vulnerabilities and a high ability to absorb or adapt to change.

Moderate - A number of vulnerabilities but retains some ability to absorb or adapt to change.

High - Multiple vulnerabilities and/or very little capacity to absorb or adapt to change.

Levels of magnitude

Negligible – No discernible positive or negative changes caused by the impact. Change from the baseline remains within the range commonly experienced by receptors.

Low – A discernible change from baseline conditions. Tendency is that the impact is to a small proportion of receptors over a limited geographical area and mainly within the vicinity of the project. The impact may be short term, or some impacts may extend over the life of the proposal.

Moderate - A clearly noticeable difference from baseline conditions. Tendency is that the impact is to a small to large proportion of receptors and may be over an area beyond the vicinity of the project. Duration may be short term to medium or some impacts may extend over the life of the project.

High - A change that dominates over existing baseline conditions. The change is widespread or persists over many years or is effectively permanent.

6.8.2 Existing environment

Social profile

The study area had an estimated residential population of 58,770 people in June 2018 (ABS, 2019). The study area is generally characterised by high population growth. Over the ten years to 2018, the study area experienced relatively high population growth with an average rate of growth at 5.8 per cent annually, more than three times the Greater Sydney average. The high rate of growth in the study area is generally driven by high population growth within the Waterloo-Beaconsfield, which experienced an average growth rate of 7.6 per cent annually. This is likely to reflect the recent establishment of high density residential developments at Zetland and Waterloo.

Population projection data is available at an LGA level. The population of the Sydney LGA is expected to continue to grow at a higher rate than the Sydney metropolitan area. By 2036, the population of the Sydney LGA is projected to increase to about 315,200 people, representing a total increase in population between 2011 and 2036 of 72 per cent, or an average of 2.2 per cent annually. This is compared to an average annual rate of growth of 1.6 per cent for the Sydney metropolitan area and 1.3 per cent for NSW as a whole (NSW Department of Planning and Environment, 2016).

High population growth is expected to continue in Waterloo-Beaconsfield and Erskineville-Alexandria, with the delivery of urban renewal projects at Green Square and the Ashmore and Lachlan Street precincts. The Green Square Urban Renewal Area is expected to accommodate about 61,000 people by 2030, including about 6600 people in the Lachlan Precinct in the eastern section of the proposal. The Ashmore Precinct at Erskineville is also proposed have a population of about 6,000 residents by the same period.

The key findings of the socio-economic assessment in terms of the demographics within the study area can be summarised as follows:

- Residents in the study area has a higher proportion of working age people, with about 83.6 per cent of residents aged 15-64 years at the 2016 Census, compared to 67.4 per cent in Greater Sydney
- The study area had significantly lower proportions of children aged 14 years or younger, with the proportion of this group about half of the proportion in Greater Sydney
- The study area also had relatively low proportions of elderly people, with about 7.2 per cent of the population aged 65 years or older, compared to 13.9 per cent in Greater Sydney
- The study area has a relatively higher proportion of people born overseas and lower proportion of non-English speaking households. At the 2016 Census, approximately 47 per cent of the study area's population were born overseas, while about 36.9 per cent spoke a language other than English at home. This is compared to 36.8 per cent and 35.8 per cent respectively in Greater Sydney. This was generally largely driven by very high proportions of overseas born and non-English speaking households in the Waterloo-Beaconsfield SA2
- The study area generally had a lower proportion of family households and higher proportions of group or lone person households compared to Greater Sydney
- The majority of residents in the study area live in higher density dwellings such as flats, units, apartments, with 72.5 per cent of households residing in these dwelling types at the 2016 Census. This is compared to 21.7 per cent in Greater Sydney at the same time. The lower proportion of family households and high number of high-density dwellings is typical of the study area's inner-city location.
- High proportions of dwellings within the study area are rented, which also reflects the inner city location of the study area. About 58.6 per cent of dwellings in the study area were rented in 2016, compared to 34.1 per cent in Greater Sydney
- Residents in the study area have a relatively low level of need of assistance in one or more of the three core activity areas of self-care, mobility or communication because of a long-term disability, health condition or old age
- At the 2016 Census, median weekly household incomes varied across the study area with households in Erskineville-Alexandria SA2 displaying median weekly household incomes well above the Greater Sydney average, while the Waterloo-Beaconsfield SA2 recorded household incomes similar to the Greater Sydney average
- Between March 2018 and March 2019, levels of unemployment within the study area varied, with Erskineville-Alexandria SA2 generally having rates of unemployment below the Sydney LGA, while Waterloo-Beaconsfield SA2 had levels of unemployment above the Sydney LGA
- In 2016, there were about 38,078 people working in the study area, of which about 62 per cent worked in Erskineville-Alexandria SA2
- The largest industries of employment in the study area included retail trade (15.6 per cent); wholesale trade (10.6 per cent); transport, postal and warehousing (10 per cent); and professional, scientific and technical services (8.5 per cent)
- Travel to work by residents in the study area reflects the area's high level of public transport access and proximity to employment and activity centres such as the CBD, the University of New South Wales at Randwick, and Sydney Airport
- While private vehicle, was the dominant mode of travel to work for residents in the study area, residents in the study area were more likely to use public transport, walk or cycle for travel to work compared to Greater Sydney. In 2016, about 44.3 per cent of residents in the study area aged 15 years or older used a bus or train for all or part of their journey to work, compared to about 24.9 per cent in Greater Sydney. Of these, about 17.8 per cent of residents used the bus, more than double the average for Greater Sydney, and about 26.5 per cent used train

- Travel by private vehicle was the dominant mode of travel for people who worked in the study area, with about 61 per cent of workers aged 15 years or over using a car, either as driver or passenger, for all or part of their journey to work. This was above the average for Greater Sydney, at 58.3 per cent. The proportion of workers using public transport to travel to a workplace in the study area was similar to the average for Greater Sydney, while the proportion of workers who walked or cycled was slightly above Greater Sydney.

Land use

The proposal is located in the suburbs of Alexandria, Waterloo, Moore Park within the City of Sydney LGA. The proposal is surrounded by a modified urban environment which includes a mix of residential, commercial/business, recreational, industrial and transport related land uses. The main features of the proposal area are described in **Section 1.2** and shown in **Figure 1-3**.

Land use zoning surrounding the proposal has been defined previously in **Section 4.1.2** and shown on **Figure 4-1**.

Local business

Local businesses in the study area comprise a mix of business types including retail uses, professional services, light industrial and food services (for example cafes). Business types shown in **Figure 6-18** and generally include:

- Retail uses and professional services businesses; as well as a large retail use being Bunnings, between Euston Road and Harley Street
- Retail and wholesale trade uses such as White Mica, The House of INOA Fashion Group, Gypsy Espresso and Sunshades Eyewear; professional services uses such as Smith and Tzannes architects; and food services including cafes and restaurants (for example Sub-station Café, Bake Bar and numerous eateries at 21 Fountain Street), between Harley Street and Loveridge Street
- Retail uses, including clothing stores, a service station, grocery store and appliance store; food services (for example, restaurants, take-away, pub); and services businesses including vehicle repairs and gym, between Loveridge Street and Botany Road
- A mix of commercial office uses; food services including McDonalds and Baby Coffee Co; chemist and health care; and wholesale trade between Botany Road and Bourke Street
- A mix of retail uses; offices; personal services (for example gym and dog day care); and food services, including a pub; and the Moore Park Supa Centa between Bourke Street and Anzac Avenue
- Industrial and warehouse uses at Young Street, McCauley Street, McEvoy Street and Lachlan Street.

Businesses in the study area service customers from the local area as well as from surrounding suburbs and the wider Sydney region. Many businesses service both local and regional customers. About 60 per cent of businesses who participated in the business survey indicated that their customers include people who live or work locally. Businesses that reported high proportions of local customers included cafes, restaurants, supermarkets, and services businesses such as car repairer, beauty salon and gym.

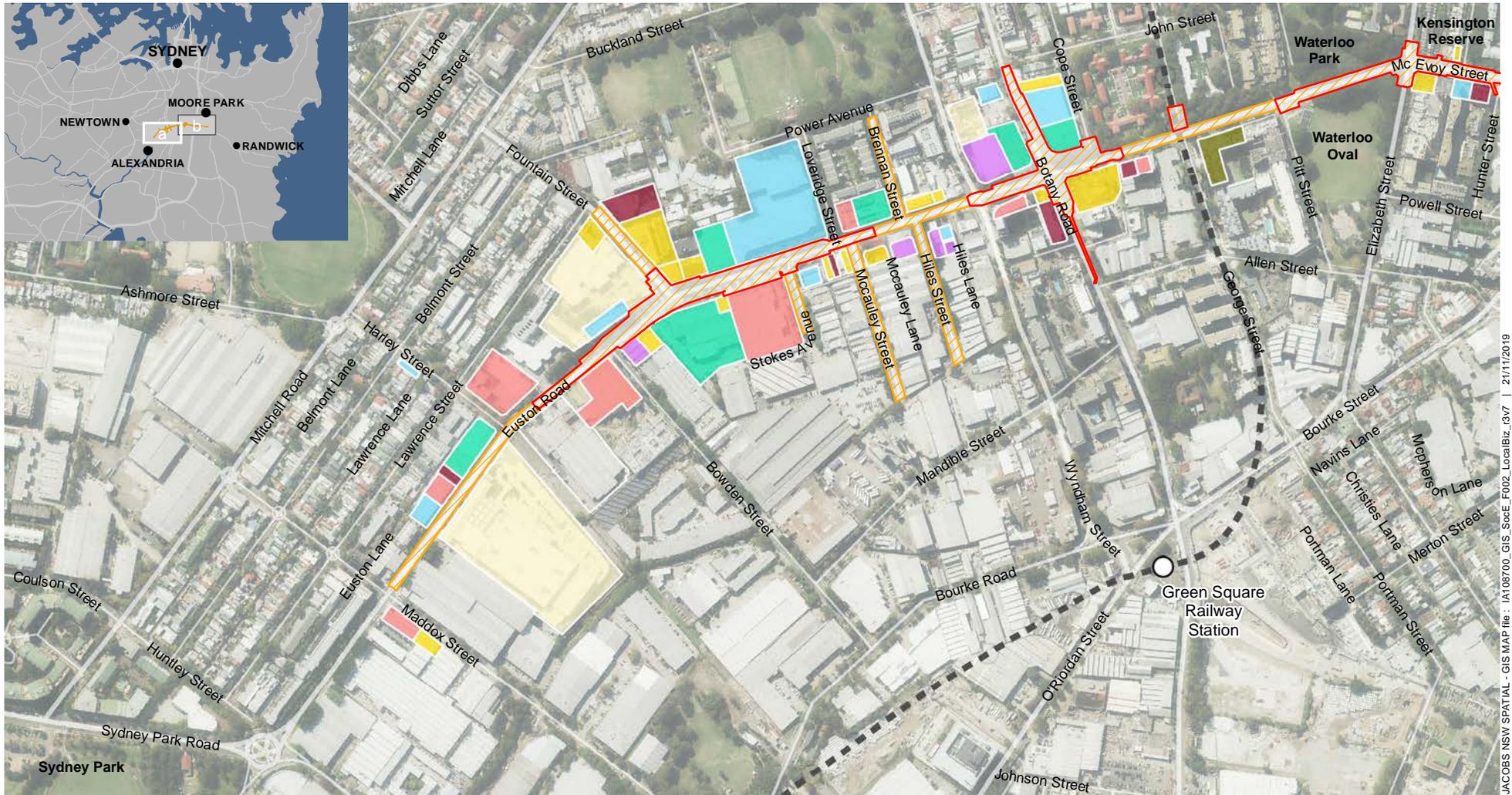
Around 56 per cent of businesses, indicated they attract customers from across the Greater Sydney region, including from Parramatta, and the inner city areas. Businesses who reported their customers came from across the wider Sydney region mainly included services businesses (for example, architects, photographer, car repairs), wholesale businesses (for example wholesale clothing and fabric), retail clothing businesses, and cafes and restaurants.

The level of reliance of a business on 'passing trade', that is customers who access a business because they see it while they are walking or driving past, is likely to be influenced by the type or nature of the

business. For example, passing trade is likely to be of higher importance for businesses such as service stations, takeaway food stores and cafes, compared to speciality retail or personal service businesses

About two thirds of businesses surveyed indicated that up to about 20 per cent of their customers and trade are from passing motorists, while 8.4 per cent of businesses indicated that passing trade accounts for more than 60 per cent of their trade.

The amount of time customers spent at individual businesses varied from less than 15 minutes to more than two hours. Customers staying between 30 minutes and one hour comprised the largest group of responses (29.2 per cent), followed by 15-30 minutes. About 16 per cent of businesses surveyed indicated that customers generally stay longer than one hour.



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|---|------------------------|---|---|---|---|
|  | Proposal area |  | Accommodation |  | Health or personal services |
|  | Construction footprint |  | Cafe, restaurant, pub or take-away |  | Motor repair |
|  | Road |  | Commercial, office or professional services |  | Retail - clothing, wholesale, homewares |
|  | Railway line |  | Retail - large scale |  | Retail - other |

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Figure 6-18a | Local businesses near the proposal
 Alexandria to Moore Park Stage 1



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Legend

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|---|---------------|---|---|---|---|
|  | Proposal area |  | Construction footprint |  | Health or personal services |
|  | Road |  | Accommodation |  | Motor repair |
| | |  | Cafe, restaurant, pub or take-away |  | Retail - clothing, wholesale, homewares |
| | |  | Commercial, office or professional services |  | Retail - large scale |
| | | | |  | Retail - other |



Figure 6-18b | Local businesses near the proposal
Alexandria to Moore Park Stage 1

Traffic and access

As discussed in **Section 6.1.1**, the study area includes several major transport corridors, including roads, rail and bus corridors; and pedestrian and cycle networks. The existing pedestrian and cycle network are shown in **Figure 2-3**.

As described in **Section 2.2**, there is time restricted road side parking available along the Euston Road/McEvoy Street corridor. There is no road parking along the sections of South Dowling Street, Bourke Street, Lachlan Street, Dacey Avenue and Anzac Parade within the proposal area.

Some commercial properties within the study area also provide off-street parking for customers and/or staff. About 15 businesses who participated in the survey (31 per cent) indicated that they have on-site customer parking, either for the individual business or in a shared parking arrangement with other businesses. Three businesses indicated that they have less than five car parks and four businesses reported to have between six and ten car parks. Three businesses have more than about 20 on-site car parks for customers.

Twenty-six public car parks are also located on land owned by the City of Sydney Council at the corner of McEvoy Street and Stokes Avenue. These public car parking spaces are currently used by customers, staff and delivery drivers of surrounding businesses, particularly Sunshades Eyewear.

The frequency of deliveries for businesses in the proposal area ranged from hourly to weekly. Around 24 per cent of businesses surveyed (9 businesses) receive deliveries on an hourly basis, while 14 per cent (5 businesses) receive deliveries twice a day and 38 per cent (14 businesses) daily. The remaining 24 per cent of businesses (9 businesses) receive deliveries weekly.

Almost half of the deliveries were reported to be made at around midday, while 44 per cent of deliveries were reported to be made during morning peak hours (e.g. 7.30am to 9.20am), and 9 per cent during afternoon peak hours. No businesses reported receiving deliveries during the early morning (e.g. midnight to 7.30am) or the evening (e.g. 6.30pm to midnight) periods. Around 38 per cent of delivery vehicles use on-street parking areas, while 32 per cent use on-site car parks, including driveways of the business. The remaining 30 per cent use on-street loading zones.

Social infrastructure

The study area accommodates a wide range of community services and facilities to meet the needs of both local and regional communities. These include education facilities; health, medical and emergency services; sport, recreation and leisure facilities; and community and cultural facilities. The main social infrastructure and community facilities located near to the proposal includes mainly open space, recreation and leisure uses, education facilities and cultural uses, refer to **Figure 6-19**.

A light rail station as part of the CSELR project would service Moore Park and surrounding uses. The light rail station would be located at Anzac Parade, north of Lang Road.

High density social housing is located along McEvoy Street between Pitt and George Streets. Social housing is rental housing provided by not-for-profit, nongovernment or government organisations to assist people who are unable to access suitable accommodation in the private rental market. The social housing is provided by not-for-profit community housing providers and the NSW Department of Family and Community Services.

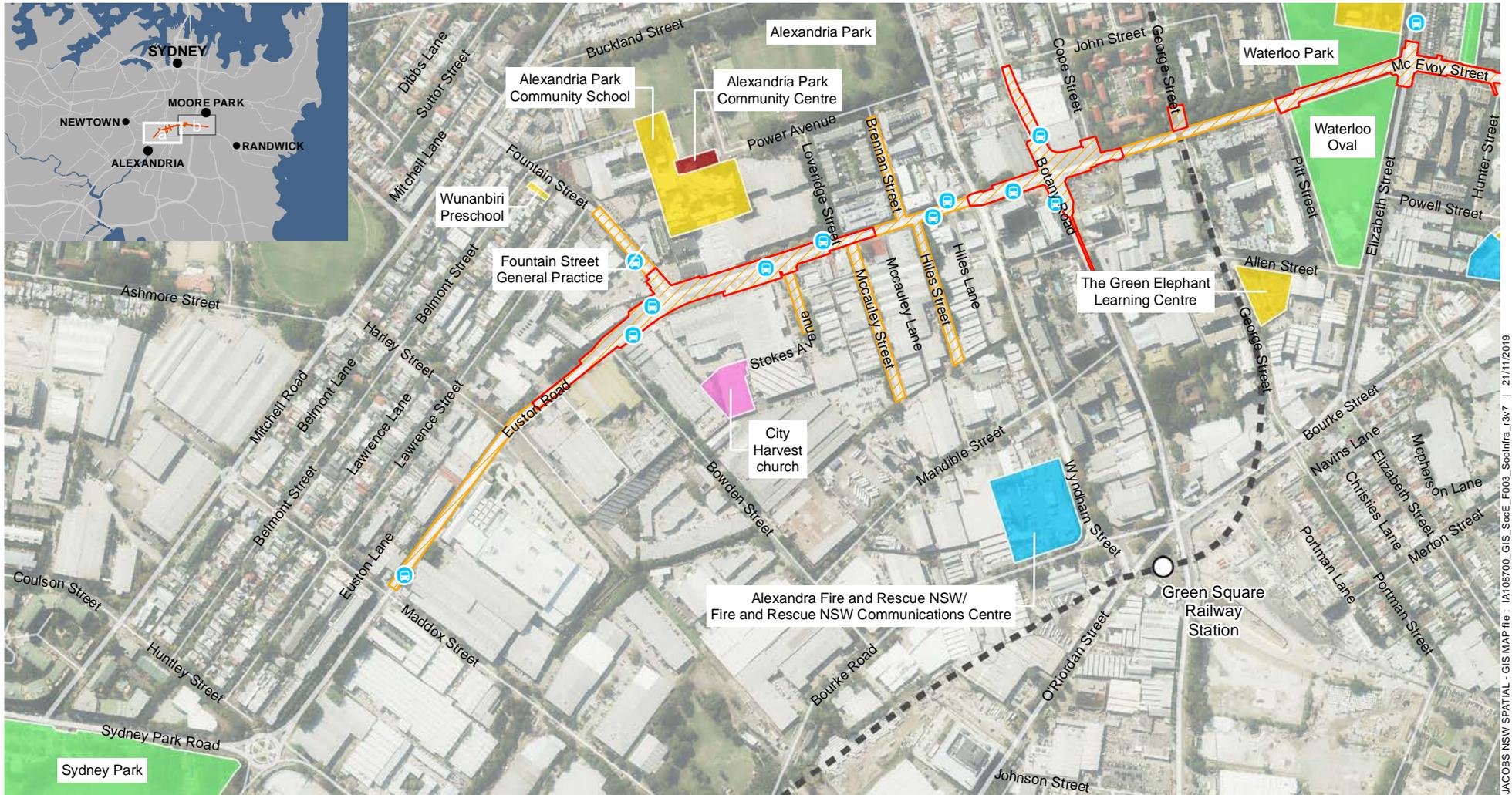
Other social infrastructure near the proposal is outlined in Table 6-50.

Table 6-50 Social infrastructure near the proposal

Facility type	Facility	Location	Description
Sport, recreation and leisure	Moore Park Golf Course	Corner of Anzac Parade and Cleveland Street, Moore Park	The golf course features a driving range, the Sydney Golf Academy, function rooms, putting and chipping practice greens, and one of the oldest golf clubs in Sydney.
	E.S. Marks Athletics Field	Boronia Street and Anzac Parade, Kensington	The field includes a 400-metre synthetic track, main field and covered stand with seating for 1,000 people and is used by more than 50,000 patrons a year for public training nights, school carnivals and more. It is open at nights for public training from Monday to Thursday from 3:30pm to 8:30pm. Entry to the field is via Boronia Street.
	Parklands Sports Centre	Corner of Anzac Parade and Lang Road, Moore Park	The sports centre comprises a tennis centre and netball centre. It has 11 tennis courts and 10 netball courts as well as a synthetic hockey field. A number of cricket fields are also located near the sports centre to the east of Anzac Parade.
	Alexandria Park	Buckland Street, Alexandria	The Park hosts a multi-purpose sports field, tennis courts, a basketball court, children's playground and picnic facilities.
	Waterloo Oval	McEvoy Street, Waterloo	The area includes a skate park, and a sporting field suitable for cricket and rugby.
	Waterloo Park	McEvoy Street, Waterloo	The park includes an enclosed children's playground.
	Tay Reserve	Tay Street, Kensington	The reserve is located at the junction of Anzac Parade and Alison Road. It was the site of one of two toll houses located within the land now known as Centennial Parklands. The reserve includes a number of established trees, although has limited recreational values. The reserve was used as a construction worksite for the CSELR project.
	Centennial Park	East of Alison Road, Randwick	The park includes open space, ponds, landscaped areas, the Belvedere Amphitheatre and sport facilities such as the McKay Sports Ground and Equestrian Grounds.
Education	Little Learning School	Burrows Road, Alexandria	The child care centre has 84 places catering for up to school aged children. It operates 7:00am to 6:00pm, Monday to Friday.
	Wunanbiri Preschool	Belmont Lane, Alexandria	The preschool is a non-profit community based Aboriginal centre which caters to Indigenous and low incomes families in the inner-city area. It operates 8:00am to 4:00pm, Monday to Friday.

Facility type	Facility	Location	Description
	Alexandria Park Community School Junior campus	Park Road, Alexandria	The Junior Campus of Alexandria Park Community School caters for students in Kindergarten to Year 7. The school has about 150 students, with senior students located at the senior campus on Mitchell Road.
	Our Lady of Mount Carmel Catholic	Kellick Street, Waterloo	The primary school caters for up to 120 students from Kindergarten to Year 6. It is one of Sydney's oldest catholic schools.
	Taylor College	Bourke Street, Waterloo	Taylor College provides university preparation courses. The Sydney campus consists of classrooms, a library, science laboratories and music studios.
	The Green Elephant Waterloo	Allen Street, Waterloo	The long day child care centre caters for up to 60 children a day on Monday to Friday from 7:00am to 6:00pm.
	Moore Park Children's Early Learning Centre	Potter Street, Waterloo	The centre operates 7:30am to 6:00pm, Monday to Friday. It caters up to 77 children from six months of age to pre-school age.
	KU Centennial Parklands Children's Centre	Dacey Avenue, Moore Park	KU Centennial Parklands Children's Centre is located on the south-west corner of Anzac Parade and Dacey Avenue and provides long day care for about 60 children up to school age. The centre operates 7:00am to 6:00pm, Monday to Friday, and is accessed via Dacey Road.
Community/ cultural facility	Alexandria Park Community Centre	Corner Power and Park Road, Alexandria	The community centre is located on the grounds of the junior campus of Alexandria Park Community School. It provides playgroup for multicultural families, music classes, parenting programs, a community garden and a food co-op for families.
	St Vladimir's Russian Orthodox Church Centennial Park	Robertson Road, Centennial Park	The temple is one of the oldest Russian Orthodox churches in Sydney. Services at the temple take place on Saturdays at 5:00pm and Sundays at 9:00am.
	Grace City Church	Bourke Street, Waterloo	The new church hosts a service every Sunday at 10:00am. The church also offers community groups, such as bible study groups and youth groups.
Health, medical and	Fountain Street General Practice	Fountain Street, Alexandria	The medical centre is a family medical practice. It provides a range of general practice services, as well as specialist services pathology, paediatrics and psychology. It is open Monday to Friday from 8:00am to 6:00pm, and Saturday mornings.

Facility type	Facility	Location	Description
emergency services	Green Square Health Centre	Bourke Street, Waterloo	The health centre provides a range of general services, including travel medicine, physiotherapy, family planning and dermatology. It opens Monday to Friday from 8:00am to 7:00pm, and Saturday mornings.
	Life Medical Clinic	Bourke Street, Waterloo	The centre provides general medical services, including acupuncture mental health services. The centre operates Monday to Friday from 8:30am to 6:00pm, and on Saturday mornings.
	Alexandria Fire and Rescue NSW Station and Fire and Rescue NSW Communications Centre	Wyndham Street, Alexandria	The Alexandria Fire and Rescue NSW Station and Fire and Rescue NSW Operational Communications Centre are located on Wyndham Street, both of which operate 24 hours.



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|---|------------------------|---|--------------|---|---|---|------------------|
|  | Proposal area |  | Road | Socio-economic infrastructure |  | Health, medical and emergency services | |
|  | Construction footprint |  | Bus stop |  | Community facility |  | Park/open space |
| | |  | Railway line |  | Education |  | Place of worship |

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Figure 6-19a | Social infrastructure near the proposal
Alexandria to Moore Park Stage 1



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|--|--|---|--|
|  Proposal area |  Road | Socio-economic infrastructure |  Health, medical and emergency services |
|  Construction footprint |  Bus stop |  Education |  Park/open space |
| |  Railway line | |  Place of worship |

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Figure 6-19b | Social infrastructure near the proposal
Alexandria to Moore Park Stage 1

Community values

Community values relate to those things held as important to residents for quality of life and well-being. They include physical elements such as parks, landscapes and pedestrian connectivity, and intangible qualities such as sense of place and community cohesion. Social infrastructure, such as religious facilities, schools, public places and community centres are highly valued in local communities, as are demographic characteristics and local features.

Consultation for the City of Sydney's *Social Sustainability Policy* (Straight Talk, 2016) highlighted the importance of the following values for the community within the study area:

- Safety, included road safety for cyclists
- A high level of access and connectivity
- The need for improved walking and cycling facilities and integrated public transport infrastructure
- Accessibility in the public domain for people with disability.

These values are discussed in further detail below.

Local amenity

Local amenity in the study area is generally characterised by a diversity of land uses including inner city residential neighbourhoods; community facilities such as open space and parkland; and areas of retail, commercial and industrial uses. Overall, the study area displays high levels of amenity, with good access to transport networks; community facilities of state significance such as universities and hospitals; access to large areas of open space and recreation located within Moore Park and Waterloo Park; and residential neighbourhoods within easy reach of local services, employment and major centres such as the Sydney CBD.

Mature fig trees are located along the proposal alignment, including within Waterloo Park bordering McEvoy Road, and within Moore Park along South Dowling Street Dacey Avenue. Heritage listed Washington Palm trees are with the curtilage of Moore Park Golf Course (City of Sydney, 2014b). The Washington Palm trees are listed as significant trees on the City of Sydney *Significant Trees Schedule* for their visual, aesthetic, historical and social values and are therefore likely to be valued by community members.

During consultation for the ultimate concept design, community feedback included a variety of comments around the need to preserve the remaining trees, particularly the fig trees within the curtilage of Moore Park.

Current traffic volumes and heavy traffic on the Euston Road-McEvoy Street-Lachlan Street corridor currently creates a perceived barrier local movement and connectivity within the study corridor, particularly for pedestrians.

Local character and identity

The character and identity of the study area is transitioning from an area comprising former industrial, manufacturing and warehouse uses to mixed-use residential, commercial and retail area. The establishment of new cafes and restaurants has contributed to the character and amenity of the study area, helping to attract a greater number of people from the wider region at weekends. The study area has also seen an influx of fashion and professional services businesses relocating from suburbs such as Surry Hills, Chippendale and Redfern. Feedback from the business survey indicated that in part this was due to accessibility and availability of parking.

The study area's heritage and history associated with Aboriginal culture and early European settlement of Sydney is important to the character and identity of the study area, particularly Moore Park. Moore Park was established as Sydney's Second Common in 1866, and became the focus for major sporting events and entertainment facilities with the establishment of the Zoological Gardens in 1879; the Royal Agricultural Society Showground; and the first course of the Australian Golf Club in 1882. Moore Park contains several significant notable heritage-listed features, including the Toll House, Anzac Parade Obelisk and other heritage buildings. A number of memorials and commemorative structures are also located within the Park, including the Korean War Memorial, Cricketer's Memorial and Comrie Memorial Fountain, indicating the area is of cultural importance for local and regional communities. Refer to Section 6.2 and Section 6.3 for further details.

Safety

Safety is important for communities in the study area, with this identified as an important issue by residents during consultation for the City of Sydney's Social Sustainability Policy. This included road safety for cyclists. A high level of access and connectivity is also important to communities in the study area. Transport was identified as a priority issue during consultation for Council's Social Sustainability Policy, with congestion of the transport network recognised as an issue that would only get worse. The need for improved walking and cycling facilities and integrated public transport infrastructure were identified as critical. Accessibility in the public domain for people with disability was also identified as important (Straight Talk, 2016).

6.8.3 Potential impacts

Construction

The proposal has the potential to generate socio-economic impacts during construction (refer to **Chapter 3** for further details). The potential impacts are summarised below.

Property acquisition and land use

As discussed in **Section 3.6** the proposal would require the acquisition (partial and full) of three privately owned lots. Six publicly owned lots and three lots owned by Roads and Maritime would also be required for road widening and walkway adjustments. Privately owned lots required for the proposal comprise residential and commercial uses. These would mainly be affected by partial acquisition for landscape and walkway adjustments.

Two public lots at 147-161 McEvoy Street would be fully affected by the proposal. These lots are located at the frontage of commercial properties and would be required for the establishment of a walkway and landscaping adjustments.

Seven lots identified as road reserve would be required for proposal. These would mainly be affected by local road widening and walkway and landscaping adjustments.

Properties impacted by acquisition or adjustments are discussed in **Section 3.6**. Partial or full property acquisition for the proposal would not require the demolition of any buildings or require the relocation of any commercial or residential uses.

Strip acquisition for the proposal would generally impact on landscaping areas, requiring landscape adjustments, although some off-street car park areas would be removed. Where partial acquisition of properties occurs, impacted infrastructure such as fencing and driveways would be rebuilt and relocated as part of the proposal.

Acquisition of land for the proposal would require changes to a private car park area at one commercial property and a public car park area used by staff and customers of surrounding businesses. Other impacts on commercial properties would mainly be associated with adjustments to landscape areas. Potential impacts of these changes on the business operations is described below.

Roads and Maritime has commenced consultation and would continue to consult with property and business owners about the acquisition process and potential adjustments required to properties to allow for commercial and business owners to make decisions about the future of their business operations. Consultation would continue during the detailed design and construction phases of the proposal. **Chapter 5** details the consultation process and consultation activities to be carried out.

Local business and industry

During construction, the proposal would have temporary impacts, both beneficial and adverse, on some local businesses closest to proposal area.

Construction of the proposal is likely to have a beneficial impact on some businesses through increased demand for local goods and services. In particular, some local shops and food outlets (eg cafes and take-away shops) near to the proposal may benefit from increased business in response to the day-to-day needs of construction workers. Businesses supplying goods and services to construction works may also experience benefits from increased construction activity.

Without mitigation, increased construction noise, dust and construction traffic may have temporary adverse impacts on amenity for some businesses near the proposal. The effect of this impact would depend on such things as the nature and type of business, but would potentially include impacts on employee productivity, ability to interact with customers, or changes to general business ambience. Local amenity changes would be likely to have the greatest impact on businesses that have outdoor dining or open customer areas or that are located closest to the proposed construction works. Increased noise and dust from construction activities may impact on the use and enjoyment of these outdoor areas for some customers.

Concerns about disruptions to business amenity were identified by some business surveyed for the proposal, and some businesses suggested that construction activities are likely to have a 'negative' impact on businesses.

Potential impacts on customer and staff parking were identified as a concern for business owners in the business survey. In particular:

- One business indicated that construction activities are likely to have a significant 'negative' impact on both customer and staff parking
- Five businesses reported that they believe construction activities are likely to have a 'negative' impact on customer parking
- Three businesses indicated that construction activities are likely to have a 'negative' impact on staff parking.

Access to businesses near the proposal would be maintained during construction, temporary changes to local roads and footpaths would change access to some local businesses for workers, customers and service vehicles. This includes temporary changes to:

- On-street loading zones or on-street parking areas, particularly for businesses near to intersection works at Botany Road /McEvoy Street, Elizabeth Street/McEvoy Street and Fountain Street/McEvoy Street

- Traffic access, including closure of some traffic lanes and night-time traffic diversions
- Pedestrian access near to construction works for safety.

Publicly owned land used for public car parking would be acquired for the upgrade of the Fountain Street and McEvoy Street intersection. This land would be used as a construction compound during the construction phase resulting in the loss of 26 public parking spaces on this land from the start of construction. These car parking spaces are currently used by customers, staff and delivery drivers of surrounding businesses, including Sunshades Eyewear. Changes to on-street loading and parking zones during construction would also impact on the availability of parking for customers, staff and delivery drivers of nearby businesses. Increased demand for parking by construction workers near to construction worksites may also impact on the availability of on-street parking.

Reduced availability of on-street and off-street public parking would particularly impact customers, staff and delivery drivers of businesses with no or limited on-site parking. About 15 businesses who participated in the survey (31 per cent) indicated that they have on-site customer parking, either for the individual business or in a shared parking arrangement with other businesses. Three businesses indicated that they have less than five car parks and four businesses reported to have between six and ten car parks. Three businesses have more than about 20 on-site car parks for customers. Reduced on-street and off-street public parking may make finding a convenient car park more difficult for some customers, staff and delivery drivers of businesses near to the proposal, possibly requiring some people to walk further to the business. This impact is likely to already be occurring due to the level of development activity currently being undertaken in the study area and is most likely to affect those businesses that do not have dedicated off-street parking.

The need to walk further for parking or take longer to search for a convenient car park may deter some customers from accessing some businesses, particularly where visits are for a short duration (for example, to pick up takeaway food or drinks or to buy 'convenience' goods such as bread, milk or newspapers) or where goods or services are readily available from other nearby locations with easier and more convenient parking access. Further detail regarding the impacts of the proposal to off-street parking are provided in the Parking Assessment (Jacobs, 2019a), the results of which are summarised in **Section 6.1**.

Traffic flow would generally be maintained through the proposal during construction, although temporary land closures and traffic diversions would be required. Traffic diversions have potential to reduce the visibility of some businesses to passing traffic and affect customer access.

Traffic diversions during construction would generally occur at night and outside of standard business hours (for example, between 9:00pm and 5:00am), which would help to reduce potential impacts on customer access for many businesses. However, between about 20 per cent and 30 per cent of businesses surveyed for this assessment indicated that their opening hours extended into the evening and night-time on some days (for example, 5:30pm to midnight). These mainly comprised restaurants/ bars, takeaway shops, supermarket and personal services businesses, with a number located near the Fountain Street/McEvoy Road intersection, which is likely to be subject to temporary traffic diversions. A small number of businesses also indicated that they operate from midnight to 8:00am, including the petrol station, supermarket and gym near the

Botany Road/McEvoy Street intersection, which would also require temporary traffic diversions to allow part road closures.

Access would be maintained to open businesses during the temporary traffic diversion periods, although some people may need to travel longer distances to access these businesses causing inconvenience for some customers and potentially discouraging some people from visiting businesses near the proposed diversions. Ongoing communication with business owners and local communities about proposed traffic changes, and minimising the length of diversion route, would help to minimise potential business impacts.

Temporary changes to pedestrian access would be required near construction works, which may require some pedestrians to change their route or walk further to access businesses near to construction works. This may temporarily reduce the level of passing pedestrian traffic or discourage some pedestrians from visiting some businesses. This is likely to have the greatest effect on those businesses that rely on passing pedestrian trade such as small scale retail uses, cafes, restaurants and takeaway outlets.

Further details on construction activities is provided in **Section 3.3**. As construction would be staged, not all businesses along the alignment would be impacted at the same time nor would the impacts be for the whole duration of the construction. Construction impacts to businesses and shoppers would therefore be limited to the duration of the works in each construction work zone. In addition, some of the construction work in the road corridor would most likely occur outside of peak hours or as night works, resulting in reduced impacts to businesses during work hours. The main construction activities that would impact on businesses are associated with the construction of improved footpaths and any relocation of utilities that are located outside the footprint of the existing road. This is because these activities are likely to restrict pedestrian access to businesses and can occur during business hours.

Social infrastructure and amenity

During construction, potential impacts on social infrastructure would mainly relate to temporary access changes, with the proposed works mainly located away from social infrastructure. Access would be maintained to social infrastructure near the proposal, although traffic disruptions and changes to local roads may temporarily change accessibility to some social infrastructure near the proposal and in the broader study area. These include:

- Little Learning School located on Burrow Road in Alexandria
- Our Lady of Mount Carmel Catholic Primary School located on Kellick Street in Waterloo
- Grace City Church located on Bourke Street in Waterloo
- Fountain Street General Practice located on Fountain Street in Alexandria.

Alexandria Fire and Rescue Station is located on Wyndham Street to the south of the proposal alignment. Traffic access would be maintained through the proposal area during construction, although increased traffic congestion and disruptions may require the station to plan for alternative routes should they require travel along the proposal alignment.

Further discussion of potential amenity impacts is provided in **Section 6.3** (noise and vibration) and **Section 6.10** (other impacts), while changes to local access are discussed in detail in **Section 6.1** (traffic and transport).

Community values

During construction, the proposal would impact positively on local employment through the creation of direct construction related employment opportunities and indirect employment opportunities in businesses and industries that support the construction work. As such, increased employment

opportunities locally may assist in supporting improved social and economic outcomes for some individuals.

Adverse changes to amenity may temporarily impact on the potential use and enjoyment of some residential properties closest to construction worksites, particularly within outdoor areas such as balconies. A number of high-density residential units and apartments are located near to the proposal. Work would be required to be undertaken outside of standard day-time work hours, for example at night and weekends, to minimise traffic impacts. Noise and lighting from these works may temporarily impact on night-time amenity or disrupt sleeping patterns for some residents closest to the construction works, although given the extent of works required, potential impacts are generally expected to be minor. Use of local streets for traffic diversions may also increase night-time traffic noise at some residential properties, potentially disrupting night-time amenity for residents.

The proposal would remove existing landscaping and about 25 mature street trees and 24 immature street trees which has potential to impact on the visual and landscape amenity of the streetscape. Following construction, replacement street tree plantings would be provided at these locations and over time, potential impacts on the amenity of the streetscape would reduce as the trees become established.

The proposal would not require the clearing of any mature fig trees or heritage listed trees within Waterloo Park and Oval or Moore Park, although utility relocation works for the proposal have potential to result in indirect impacts by intersecting tree roots of fig trees along Waterloo Park. These impacts would be managed by an arborist and are not expected to affect the overall health of the trees, however, these trees contribute to the visual and landscape amenity of the park and streetscape of McEvoy Street in this location, and any potential impact on these trees is likely to be a concern for community members. Options to minimise potential impacts on these trees would be considered through the detailed design process. Communities in the study area have been subject to construction impacts from other transport and urban development projects in the study area, including CSELR project, New M5 and urban redevelopment, such as Green Square Precinct and Ashmore Precinct. Early construction works for the Sydney Metro project also commenced in 2017, with surface works at Waterloo to occur from 2021 to 2023.

It is recognised that the works for the proposal are smaller in scale relative to many other major transport and urban development projects occurring in or near the study area. As such, the contribution of the proposal to potential cumulative impacts relating to such things as construction vehicle traffic, changes to land use and visual amenity are expected to be relatively minor compared to other developments recently completed, under construction or proposed in the study area.

Access and connectivity

As discussed in **Section 6.1**, potential impacts on local access and connectivity during construction would generally relate to:

- Traffic delays and disruptions for motorists, including from temporary closure of some traffic lanes, traffic diversions and increases in construction vehicles using the road
- Potential disruptions or changes to public transport services, including from the temporary relocation of bus stops and changes to local road conditions
- Changes to road conditions, potentially impacting on perceptions of road safety
- Potential changes to private property access

- Changes to pedestrian and cycle access near to construction works, including temporary closure or changes to footpaths, resulting in possible disruptions or impacts on safety for some users
- Loss of on-street and off-street parking.

Traffic flow would be maintained through the proposal area throughout construction, although construction activities may result in disruptions and delays for some motorists, cyclists and pedestrians. In particular, temporary night-time traffic diversions to allow for part road closures, and increased traffic congestion from construction traffic and road changes result in temporary delays and disruptions for residents, workers and customers access to areas in or near the proposal, increasing travel times and causing inconvenience for some motorists.

Access to private properties near to construction works would be maintained during construction. Where temporary changes are required, suitable access arrangements would be implemented in consultation with affected property and business owners. The presence of construction works, changes to local road conditions (for example, lane closures), and increased traffic on local streets during night-time diversion periods may influence perceptions of road safety for local communities and some motorists, pedestrians and cyclists. Traffic management measures would be implemented throughout construction to maintain traffic safety near to proposed works.

Changes to public transport services, including any relocation or temporary closure of bus stops required during construction, would be carried out in consultation with City of Sydney, Transport for NSW and the local bus operator. Any proposed relocation of bus stops would also consider implications for commuters and would be located as close as possible to the existing location, to minimise potential impacts on local residents and commuters.

Access for pedestrians and cyclists would be maintained near to construction works, although temporary access changes, including diversion of pedestrian and cycle paths, may be required for safety. However for residents and workers who walk or cycle as part of their journey to work, or who catch public transport for which walking is likely to be part of their journey to work, the temporary access changes may impact on perceptions of safety or cause delays and disruptions. The Fountain Street /McEvoy Street intersection particularly is a focus for pedestrian and cycle movements given that this location has a relatively high number of nearby retail, personal service, café and restaurant uses. Access changes at this location consequently have the potential to impact on a relatively large number of pedestrians and cyclists. Management measures would be implemented near to construction works to minimise impacts on pedestrians and cyclists. Minimising the extent and length of pedestrian and cycle path diversions would also be important in minimising potential impacts on local communities and surrounding uses.

A detailed assessment of potential construction traffic impacts on local access and connectivity is provided in **Section 6.1** (Traffic and transport).

Operation

The proposal would have both wider regional and local benefits through reduced traffic congestion, improved safety for all road users and improved access and connectivity. However, the proposal would also result in some changes to the existing socio-economic environment for communities and businesses within the study area and the wider region. These impacts are summarised below.

Business and industry

At a regional level, the proposal would have beneficial impacts on the local on business and industry through improved access and connectivity to the Sydney CBD and growth areas in south-eastern Sydney. In particular, the proposal would reduce congestion and improve travel reliability for motorists and commercial vehicles, supporting reduced transport costs.

Locally, the proposal would improve road safety and accessibility, supporting general improvements to local business in the study area. Through reducing congestion on local inner city roads, the proposal would improve access for workers and customers to commercial and employment centres, which would benefit businesses in the study area. However, the proposal would have potential negative impacts for some businesses due to property acquisition, changes to parking conditions, local access and changes to business amenity.

Potential impacts on businesses of partial acquisition would generally be associated with landscaping adjustments, and removal of off-street car parking areas. As indicated in **Section 3.6**, four lots affected by property acquisition accommodate commercial uses. Three lots would be affected by landscaping adjustments or establishment of walkways and impacts on the long-term business operation are not expected.

The proposal would impact on land owned by the City of Sydney Council (lots SP77796 and SP33259) as part of the work at the Fountain Street/McEvoy Street intersection. This would include direct impacts to 26 public parking spaces at 102-112 McEvoy Street. These parking spaces are used by staff, customers and delivery drivers of surrounding businesses, particularly Sunshades Eyewear. Further discussion of potential impacts on the loss of these parking spaces is provided below.

The upgrade of the Lachlan Street/South Dowling Street/Dacey Avenue intersection would require localised widening of Lachlan Street. This would require the strip acquisition of private land at 35 Lachlan Street (Lot 9, DP978753), which accommodates a kitchen design and supplier showroom. The strip acquisition would impact on two on-site customer car parks located at the front of the business, requiring customers to find alternative parking elsewhere. While this is likely to be an inconvenience customers, it is generally not expected to impact on ongoing business operations. as the nature of this business means that it is more likely to be a destination that most customers choose to visit for a specific reason rather than stopping opportunistically as they are passing.

Roads and Maritime would continue to investigate options through the detailed design phase for mitigating the loss of off-street parking for businesses, including through the reconfiguration of off-street parking areas affected by partial acquisition to minimise the loss of parking spaces.

As indicated in **Section 3.6**, compensation for land acquired by Roads and Maritime is assessed in accordance with the *NSW Property Acquisition (Just Terms Compensation) Act 1991*.

Roads and Maritime has commenced consultation with affected business owners to ensure they are aware of potential property impacts of the proposal.

Operation of the proposal would result in a change in availability of on-street parking during day periods (including on weekends) to around 252 existing parking spaces along Euston Road and McEvoy Street within the proposal area, of which 228 already operate under No Parking restrictions during morning or afternoon peaks. This is required to establish a time limited 'Clearway' during day time periods and would involve existing time restricted parking spaces, disabled parking spaces, mail zones, unrestricted parking, work zones; and no parking morning and afternoon restrictions. The proposed time limited 'Clearway' restrictions would apply to both

sides of the Euston Road and McEvoy Street between Maddox Street and Bourke Street as follows:

- Monday to Friday between 6:00am to 7:00pm
- Weekends between 9:00am to 6:00pm.

The proposal would also include new controls at all times along Lachlan Street and Dacey Avenue between Bourke Street and Anzac Parade. The proposed parking conditions are shown in **Figure 3-1**. The proposal would also impact on 28 off-street parking spaces.

An assessment of potential impacts on businesses along Euston Road to McEvoy Street from changes in parking conditions to 'clearway' conditions is provided in Table 6-51. This is based on the results of the parking assessment (Jacobs, 2019a) (refer to **Appendix C**) and **Section 6.1.4**. The parking assessment considered the capacity of side streets to accommodate the change in availability of parking as a result of the proposal.

The parking assessment found that local side streets in the study area would generally have capacity to accommodate any parking places displaced by the clearway operation, with the exception of three locations at the western end of the proposal including:

- On the northern side of McEvoy Road between Harley Street and Fountain Street
- On the northern side of McEvoy Road between Fountain Street and Loveridge Street
- On the northern side of McEvoy Road between Botany Road and Elizabeth Street.

The use of commercial car parks located near the areas of impact may assist in reducing potential impacts from the loss of on-street and off-street parking in these locations.

The assessment of the impacts on businesses due to the loss of on-street and off-street parking determined that overall, there is expected to be a low impact to businesses located along Euston Road and McEvoy Street from proposed changes in parking conditions, with businesses in many locations along the proposal likely to experience either no or negligible impacts to customer or staff parking due to the proposal. The exception to this includes four locations where moderate to high impacts on businesses are expected, including:

- On the northern side of Euston Road between Maddox Street and Harley Street where there is potential for a high impact on customer and staff parking for one newsagency, one real estate, one convenience store and five retail outlets during the individual businesses operating hours
- On the northern side of McEvoy Road between Harley Street and Fountain Street where there is potential for a moderate-high impact on customer and staff parking for one professional services business (architect) located on McEvoy Street during business hours and a number of additional businesses on Fountain Street, although some businesses have off-street parking
- On the northern side of McEvoy Road between Fountain Street and Loveridge Street where there is potential for high impact on customer and staff parking for two cafés/ restaurants, five retail outlets and one engineering business during the week and on the weekend
- On the southern side of McEvoy Road between Stokes Avenue and Bowden Street where there is potential for a high impact to customer and staff parking for one light industrial (automotive repair) business, three food outlets such as cafes, and five retail outlets during the week and on the weekend, as well as the head office and distribution centre for an eyewear company, particularly when the loss of on-street parking is combined with the loss of off-street public parking from the proposal.

Table 6-51 Summary of impacts to businesses from the changed parking conditions

Location	Outcomes of the parking assessment*	Summary of businesses and potential parking impacts	Overall impact on businesses		
			Sensitivity of businesses	Magnitude of impacts	Level of significance
Northern side of Euston Road and McEvoy Street					
Maddox Street – Harley Street	Mainly moderate impacts during business hours during the week and during the weekend. Substantial impacts between 1:00pm-2:00pm during the week.	There is potential for impact to one newsagency, one real estate, one convenience store and five retail outlets during the individual businesses operating hours	High	High	High
Harley Street – Fountain Street	Substantial to moderate impact during the week and on the weekend	There is potential for impact on one professional services business (architect) located on McEvoy Street during business hours and a number of additional businesses on Fountain Street. Some businesses have off-street parking for customers and staff	Moderate	High	Moderate – high
Fountain Street – Loveridge Street	Moderate to substantial impact during the week and on the weekend	There is potential for impact to two cafés/ restaurants, five retail outlets and one engineering business during the week and on the weekend	High	High	High
Loveridge Street – Brennan Street	Minor impact during the week and on the weekend	Potential impact to five retail businesses during the week and on the weekend	Moderate	Low	Moderate-low
Brennan Street – Wyndham Street (northern)	No parking currently, consequently no impacts expected	Businesses include two restaurants/ takeaway shops and concrete manufacturer. No change to existing parking is proposed and consequently impacts are expected to be negligible	Low	Negligible	Negligible
Wyndham Street (northern) – Botany Road (northern)	No parking currently, consequently no impacts expected	Businesses in this section include auto glass repairer, pet supplies store, household appliance showroom and gym, most of which have off-street parking for either customers or staff. No change to existing parking is proposed and consequently impacts are expected to be negligible	Low	Negligible	Negligible

Location	Outcomes of the parking assessment*	Summary of businesses and potential parking impacts	Overall impact on businesses		
			Sensitivity of businesses	Magnitude of impacts	Level of significance
Botany Road – Elizabeth Street (northern)	Moderate impact during the week between 10am-4pm and the majority of the day on the weekend, except between 11:00am when substantial impacts are anticipated	Two office-based businesses and office furniture showroom are located at the corner of Botany Road and McEvoy Street, which are open on weekdays only	Low	Moderate	Moderate-low
Elizabeth Street (northern) – Kensington Lane	No parking currently, consequently no impacts expected	There are no businesses in this section, consequently no impacts expected	n/a	Negligible	-
Kensington Lane – Kensington Street	No impact, parking available on side streets	A café and takeaway shop is located at the corner of McEvoy Street and Kensington Lane. Sufficient parking is available in side streets and impacts are expected to be negligible	Low	Negligible	Negligible
Kensington Street – Morehead Street	Minor impacts between 10:00am-5:00pm during the week and no impacts on weekends	There are no businesses in this location, so no impact is expected	n/a	Low	-
Morehead Street – Young Street (northern)	No parking currently, consequently no impacts expected	There are no businesses in this location or changes to existing parking, so no impact is expected	n/a	Negligible	-
Young Street – Bourke Street	No parking currently, consequently no impacts expected	There are no businesses in this location or changes to existing parking, so no impact is expected	n/a	Negligible	-
Southern side of McEvoy Street and Euston Road					
Bourke Street – Young Street (southern)	No parking currently, consequently no impacts expected	A wholesale retail business is located at the corner of Bourke Street and McEvoy Street. No changes to existing parking is proposed and impacts are expected to be negligible	Low	Negligible	Negligible

Location	Outcomes of the parking assessment*	Summary of businesses and potential parking impacts	Overall impact on businesses		
			Sensitivity of businesses	Magnitude of impacts	Level of significance
Young Street (southern) – Hunter Street	Moderate impacts between 10:00am-4:00pm during the week and minor impacts on the weekends	There are no businesses in this location and the adjoining site is currently being redeveloped for residential uses	n/a	Moderate	-
Hunter Street – Elizabeth Street (southern)	Minor impacts between 9:00am-5:00pm during the week and minor impacts on the weekend	There is potential for impact to a dog day-care and dog wash business, real estate, Indian restaurant/ takeaway shop and café during the individual businesses operating hours	Moderate	Low	Moderate-low
Elizabeth Street (southern) – Pitt Street	Minor impacts between 9:00am-3:00pm during the week and minor with some moderate impacts on the weekend	There are no businesses in this location, so no impact expected	n/a	Low	-
Pitt Street – George Street	Moderate impacts between 10:00am-3:00pm during the week and minor with some moderate impacts on the weekend	There would be a potential impact to one commercial/ professional services business during the individual businesses operating hours	Low	Moderate	Moderate-low
George Street – Botany Road (southern)	No impact expected, parking available on side streets	Businesses in this location include a chemist, health care business (physiotherapist) and McDonalds restaurant. A café is also located the corner of George Street and McEvoy Street, although this was 'closed until further notice' at the time of the business survey. No changes to existing parking is proposed and impacts are expected to be negligible	Low	Negligible	Negligible
Botany Road (southern) – Wyndham Street (southern)	No impact expected, parking available on side streets	Businesses in this section include a hotel and a supermarket, which has off-street parking for customers. Sufficient parking is available in side streets and impacts are expected to be negligible	Low	Negligible	Negligible
Wyndham Street (southern) – Hiles Lane	No parking currently, consequently no impacts expected	A service station is located in this section. No change is proposed to existing parking consequently impacts expected to be negligible	Negligible	Negligible	Negligible
Hiles Lane – Hiles Street	No parking currently, consequently no impacts expected	Businesses in this location include a light industrial business (automotive repair) and 24-hour gym, which has limited on-site parking for customers	Low	Negligible	Negligible

Location	Outcomes of the parking assessment*	Summary of businesses and potential parking impacts	Overall impact on businesses		
			Sensitivity of businesses	Magnitude of impacts	Level of significance
		and staff. No change is proposed to existing parking consequently impacts expected to be negligible			
Hiles Street – McCauley Lane	Minor impacts between 8:00am-3:00pm weekdays and 9:00am-6:00pm on weekends, no impacts all other times	There would be a potential impact to one light industrial (automotive repair) business during week days	Low	Low	Low
McCauley Lane – McCauley Street	Minor impacts during weekends	There would be a potential impact to a retail business at McEvoy Street and gym located on McCauley Street during the weekend. A light industrial business (automotive repair) is also located at McCauley Street	Low	Low	Low
McCauley Street – Stokes Avenue	Minor impacts between 9:00am-5:00pm weekdays and 10:00am-4:00pm weekends and no impacts all other times	There would be potential impact to one takeaway food outlet, one retail business, one technical services business and one fitness facility during the week and weekend periods. A bar and retail uses are also located in McCauley Street	Moderate	Low	Moderate-low
Stokes Avenue – Bowden Street	Moderate impacts between 10:00am-3:00pm and minor impacts all other times during the week and on weekends from the loss of on-street parking. This would be exacerbated by the loss of up to 26 public off-street parks, which are used by customers and staff of surrounding businesses, increasing the impacts to substantial in this area.	Potential impact to one light industrial (automotive repair) business, three food outlets, including cafes, and coffee manufacturer and retailer, and five retail outlets during the week and on the weekends. The head office and distribution centre for an eyewear company is located at the corner of McEvoy Street and Stokes Avenue and is the main user	High	High	High
Bowden Street – Maddox Street (southern)	Moderate impacts between 1:00am-3:00pm and minor to no impact other times during the week and minor impacts on weekends	There would be a potential impact during the week to one party supplies businesses and one hardware store. The site of the party supplies business has been identified for future mixed-use development. Both businesses have off-street parking for customers.	Low	Moderate	Moderate-low

The removal of on-street parking may impact customer access to local business during clearway times for customers, staff and delivery drivers, particularly where businesses do not have access to on-site parking. The business survey identified that more than 56 per cent of businesses do not have on-site parking, either for the individual business or in a shared parking arrangement, with most businesses relying on on-street parking for customers, particularly McEvoy Street. While a larger proportion of businesses have on-site parking available for staff, reliance on on-street parking for staff is also important, including McEvoy Street, McCauley Street and surrounding streets. Further findings of the business survey are presented in the Appendix A of the socio-economic assessment which is provided as **Appendix O**. The business survey also identified that:

- Fifteen businesses indicated that the operation of the proposal would have a negative impact on customer parking, while 14 businesses suggested that potential impacts on customer parking would be significantly negative
- Eleven businesses indicated that the proposal would have a negative impact on staff parking, with 10 also indicating that potential impacts would be significantly negative
- One business indicated that they believed the proposal would have a positive impact on staff parking, with two businesses indicating that impacts on customer parking would be positive.

Reduced availability of on-street parking may make finding a convenient park more difficult for customers and staff, possibly requiring some people to walk further to businesses. Reducing the availability of on-street parking is also likely impact delivery services for those businesses with no off-street parking, with delivery drivers required to find alternative parking areas.

The need to walk further for parking or search longer for a convenient car park may deter some customers from accessing businesses, particularly where visits are for a short duration (for example, to pick up takeaway food or drinks or to buy 'convenience' goods such as bread, milk or newspapers) or where goods or services are readily available from other nearby locations with easier and more convenient parking access, potentially impacting the number of customers for some businesses.

Concerns about potential impacts of the proposal on business turnover/ number of customers were identified through consultation with business owners, with 26 businesses indicating that the operation of the proposal would have a 'negative' or 'significantly negative' impact on business turnover/ number of customers. Specific issues identified through the business survey included:

- Recognise the need for the clearway, but important to balance the need for parking for businesses
- Parking was a key reason for one business relocating to Alexandria from another inner Sydney suburb
- People come to the area by private vehicle (as public transport not enough in the area), and if there was no parking they would not continue to come and would go elsewhere
- Customers go through the store as quickly as possible due to parking issues and the business is quiet after 3:00pm, which is the time the current clearway commences
- Lots of clothing outlets have closed due to parking issues
- The business depends on other local businesses and café would suffer if local businesses suffer.

Additional time limited parking would be investigated in detail design on side streets to minimise impacts from the proposal on local businesses. The study area is undergoing a period of substantial urban renewal and population growth, which is likely to increase the number of potential customers for local businesses and off-set in part any changes to the levels of customers due to the proposal.

Reduced availability of car parking would also impact on staff parking. While numerous businesses indicated that their staff used public transport or walked/ cycled to work, about two thirds of businesses surveyed indicating that staff use private vehicle to travel to work. Twenty-three businesses surveyed

(about 48 per cent) suggested that the proposal would have a 'negative' or 'significantly negative' impact on staff parking. In particular, concerns were raised that due to restricted time parking on side streets, staff would be required to move their car every two hours. Another business owner suggested that staff would ask to transfer to another store with better or more convenient parking if they are not able to park on the street.

One business impacted by the loss of off-street parking by the proposal indicated that the loss of off-street parking would result in a loss of staff as they rely on this parking capacity which currently caters for 10-12 staff. The business also noted that the off-street parking facility had been recently upgraded and at a cost to the business. Reduced on-street parking may increase the time needed for staff to search for parking and require staff to move their cars more frequently, potentially affecting staff productivity. Reduced on-street parking may also mean some staff are required to use commercial car parking, increasing parking costs for individuals. The provision of additional time-limited parking would assist in minimising potential impacts on staff, although would continue to require staff to move their cars. There are a number of major heavy and light rail projects currently under construction or planned in the study area. These projects would improve public transport access in the study area, potentially supporting increased use of public transport by workers of local businesses.

For most businesses in the broader proposal area, current access arrangements would be maintained during operation of the proposal. However, the removal of right-turn access at some existing intersections along the proposal corridor would change how some customers access individual businesses. Right-turn access would be maintained at key intersections with the implementation of right-turn lanes. While the removal of some right-turns would improve safety and travel for road users, this would increase travel distance for some customers, staff and delivery drivers to some businesses along the proposal area, which may be an inconvenience for some customers. While this inconvenience may deter some customers, particularly those associated with passing traffic, any associated drop in customers that may occur is likely to be balanced by the projected increase in traffic flows along the corridor over time.

Concerns about customer and staff access were raised during the business survey, with 15 businesses indicating that the proposal would have a negative or significantly negative impact on customer access, and 34 businesses indicating that negative or significantly negative impacts would result on staff access. Two businesses indicated that the proposal would have positive impacts on customer access, while one suggested that impacts on staff access would be positive.

Concerns about potential impacts of the proposal on business turnover/ number of customers and passing trade were identified through consultation with business owners. Twenty-six businesses indicated that the operation of the proposal would have a 'negative' or 'significantly negative' impact on business turnover/ number of customers, while six businesses considered that the proposal would have a 'negative' impact on passing trade and three businesses suggesting that this would be 'significantly negative'. Other issues raised through the business survey included:

- Recognise the need for the clearway, but need to balance the need for parking for businesses
- Parking was a key reason for one business relocating to Alexandria from another inner Sydney suburb
- Number of disabled patients that need close drop-off to the business
- Customers would try to park in the McDonalds car park, which may cause a conflict
- No parking would mean that customers would go elsewhere
- The business depends on other local businesses and café would suffer if local businesses suffer
- Customers go through the store as quickly as possible due to parking issues and the business is quiet after 3:00pm (the introduction of the current clearway)
- Lots of clothing outlets have closed due to parking issues
- People come to the area by private vehicle (as public transport not enough in the area), and if there was no parking they would not continue to come.

- The business has a number of disabled patients that need close drop-off to the business
- Customers would try to park in the McDonalds car park, which may cause a conflict.

During operation, some businesses near to the proposal may experience changes in amenity relating to changes in traffic noise and visual impacts, including from the removal of existing landscaping and vegetation. Disturbances to the business environment were a concern for some business owners with 16 businesses reporting that the operation of the project would have a 'negative' or 'significantly negative' impact on the business environment. These impacts and possible management measures are discussed in the relevant sections of this REF including **Section 6.1** (Traffic and transport), **Section 6.2** (Noise and vibration) and **Section 6.6** (Landscape character, visual assessment and urban design).

Social infrastructure

Property acquisition or temporary lease of land for the proposal would not affect land accommodating social infrastructure. The proposal would improve access and connectivity to community services and facilities within the study area through improved time and reliability. This would be likely to have beneficial impacts on local and regional communities.

Community values

The proposal would not require the full acquisition of residential uses and no households would be required to relocate due to property acquisitions. As such, potential impacts on community cohesion are not expected.

Once operational, the proposal would support better access for motorists and public transport users to local employment, community services and facilities, and recreation. This would be likely to have a positive impact on community well-being by providing improved access to economic and social opportunities.

The Euston Road-McEvoy Street-Lachlan Street corridor currently creates a perceived barrier to movement between either side of the corridor for some pedestrians. However, existing on-street parking along Euston Road and McEvoy Street has the effect of restricting traffic speeds and reducing traffic to a single lane in each direction outside of peak periods in some sections of the corridor.

The removal of car parking and establishment of clearways during day time business hours would help to alleviate congestion and increase the volume and speed of traffic, which is likely to reinforce the perceived barrier effect of the corridor to local movement. This may detract from the amenity of the study area for some community members and potentially influence some people's perception of road safety along the proposal area.

Some business owners and employees facing changes due to property acquisition or proposed changes from the proposal may experience stress and anxiety about these changes, potentially impacting on health and well-being as described previously.

Access and connectivity

The proposal would provide a range of long-term socio-economic benefits for residents, business and workers in the study area as well as communities and businesses in the wider region. These include:

- Reduced traffic congestion and improvement to traffic flow, improving access and connectivity
- Enhanced access to new urban precincts, such as the Green Square Precinct.

The proposal would result in the partial loss of on-street and off-street parking for some properties near the proposal, refer to **Section 6.1.3**. The loss of car parks may impact on accessibility to businesses and social infrastructure located near to the proposal. The proposal area has generally good access to public transport and services and this would improve in future with the opening of the Sydney Metro station in Botany Road.

The proposal would remove some right turns into local side streets and businesses along Euston Road, McEvoy Street and Lachlan Street, meaning that some drivers would need to use alternate routes to access businesses and side roads. This would result in a minor impact to drivers. A detailed discussion on the potential benefits and impacts of the proposal's operation on access and connectivity is provided in **Section 6.1**.

During operation, the proposal would have a positive cumulative impact on access within the study area by reducing travel times and congestion, improving road safety and supporting nearby urban renewal and transport projects such as the CSELR. The existing ambient noise within the proposal area is already dominated by street traffic noise. The proposal would contribute to an increase in ambient noise of the area, refer to **Section 6.4.4**.

Land use impacts

The main impacts to land use during operation would be the permanent change from industry, commercial, public recreation and residential land uses to road transport corridor through property acquisition. **Section 3.6** provides a summary of the properties that would be impacted by the proposal and describes the estimated area of acquisition.

The proposal would not have any direct impacts on the viability of land identified for future urban development.

Summary of impacts

Table 6-52 summarises the potential benefits and impacts of the proposal's construction and operation on local and regional communities and businesses as well as the evaluation of the significance of the impact is also provided based on the evaluation framework identified in Table 6-49.

Table 6-52: Evaluation of significance

Summary of impact	Impact significance (without mitigation)			Management measure	Impact significance (with mitigation)		
	Sensitivity	Magnitude	Significance		Sensitivity	Magnitude	Significance
Property impacts							
Acquisition of private property	Mod	Low	Mod-Low	<ul style="list-style-type: none"> Provide appropriate compensation in accordance with <i>NSW Land Acquisition (Just Terms Compensation) Act</i> Rebuild and/or relocate affected infrastructure (eg fencing and driveways) Replace affected landscaping 	Low	Low	Low
Temporary lease of land for construction	Low	Low	Low		Low	Low	Low
Construction impacts							
Local business and industry – impact on business amenity	Mod	Mod	Mod	<ul style="list-style-type: none"> Implementation of environmental management measures (for example noise and dust management) Consultation with affected businesses 	Moderate	Low	Moderate-low
Local business and industry – disruption to business access	Mod	Mod	Mod	<ul style="list-style-type: none"> Maintain access to businesses during opening hours Consultation with affected businesses about potential access changes 	Moderate	Low	Moderate-low
Local business and industry – disruption to customer and staff parking	High	High	High	<ul style="list-style-type: none"> Minimise extent of parking areas affected by construction works 	High	Moderate	High-moderate
Local business and industry – increased demand for worker parking	High	High	High	<ul style="list-style-type: none"> Provide worker parking within construction worksites Implement measures to encourage workers to use alternative transport 	High	Moderate	High-moderate
Amenity disruption to social infrastructure (eg noise and dust)	Low	Low	Low	<ul style="list-style-type: none"> Implementation of environmental management measures (for example noise and dust management) Consultation with managers of affected social infrastructure 	Low	Low	Low

Summary of impact	Impact significance (without mitigation)			Management measure	Impact significance (with mitigation)		
	Sensitivity	Magnitude	Significance		Sensitivity	Magnitude	Significance
Emergency services access	Moderate	Low	Moderate-low	<ul style="list-style-type: none"> Maintain access for emergency services within work areas Consultation with emergency services 	Low	Low	Low
Community values – impacts on local amenity due to increased construction noise, dust and out of hours work	Moderate	Moderate	Moderate	<ul style="list-style-type: none"> Implementation of environmental management measures (for example noise and dust management) Consultation with affected residents 	Mod	Low	Moderate-low
Traffic delays and disruptions	High	Moderate	High-moderate	<ul style="list-style-type: none"> Implementation of traffic management measures Consultation and communication about potential changes 	Moderate	Moderate	Moderate
Changes to public transport services	High	Moderate	High-moderate	<ul style="list-style-type: none"> Implementation of traffic management measures Consultation and communication about potential changes 	Moderate	Moderate	Moderate
Disruption to pedestrian and cycle access	High	Moderate	High-moderate	<ul style="list-style-type: none"> Implementation of traffic management measures Consultation and communication about potential changes 	Moderate	Moderate	Moderate
Operation impacts							
Local business and industry – property acquisition	Mod	Low	Moderate-Low	<ul style="list-style-type: none"> Refer to mitigation measures above 	Low	Low	Low
Local business and industry – changes to parking conditions (northern side of Euston Road between Maddox and Harley Streets, northern side of McEvoy Road between Fountain and Loveridge Streets, southern side of McEvoy Street between Stokes Avenue and Bowden Street)	High	High	High	<ul style="list-style-type: none"> Consider implementation of additional parking controls 	High	Moderate	Moderate-high
Local business and industry – changes to parking conditions (northern side of McEvoy Road between Harley and Fountain Streets)	Mod	High	Moderate-high	<ul style="list-style-type: none"> Consider implementation of additional parking controls 	Mod	Moderate	Moderate

Summary of impact	Impact significance (without mitigation)			Management measure	Impact significance (with mitigation)		
	Sensitivity	Magnitude	Significance		Sensitivity	Magnitude	Significance
Local business and industry – changes to parking conditions (other locations)	Low	Low	Low	<ul style="list-style-type: none"> Maintain access to businesses 	Low	Low	Low
Social infrastructure	Low	Negligible	Negligible	-	Low	Negligible	Negligible
Community values – reinforce barrier effect of Euston Road, McEvoy Street, Lachlan Street corridor	Moderate	Low	Moderate-low	<ul style="list-style-type: none"> Provide pedestrian crossings at key intersections 	Low	Low	Low
Community values – stress and anxiety about changes	Moderate	Low	Moderate-low	<ul style="list-style-type: none"> Consult with affected business owners and residents about proposed changes with the project 	Low	Low	Low
Changes to local access and connectivity	Moderate	Moderate	Moderate	<ul style="list-style-type: none"> Communicate proposed changes to motorists early 	Moderate	Low	Moderate-low

6.8.4 Safeguards and management measures

Safeguards and management measures for property, land use and socio-economic impacts are presented in **Table 6-53**.

Table 6-53 Safeguards and management measures – property, land use and socio-economic

Impact	Environmental safeguards	Responsibility	Timing	Reference
Communications	<p>A Communication Plan (CP) will be prepared 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):</p> <ul style="list-style-type: none"> • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for complaints. <p>The CP will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Construction contractor	Detailed design / pre-construction	Core standard safeguard SE3
Emergency vehicle access	<p>Consultation will be completed with emergency services prior to construction commencing to ensure adequate emergency vehicle access is maintained for the duration of construction.</p> <p>Regular updates will be provided to emergency services about any changes to local access during construction.</p> <p>Access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency.</p>	Construction contractor	Pre-construction and construction	Core standard safeguard SE
Property acquisition	All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2012) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	Roads and Maritime project manager	Pre-construction and construction	Core standard safeguard SE3
Impacts to residents	Consultation will be carried out with potentially affected residences prior to the commencement of and during works in accordance with the <i>Community Involvement and Communications</i>	Construction contractor	Construction	Additional standard safeguard SE4

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<p><i>Resource Manual</i> (RTA, 2008). Consultation will include but not be limited to door knocks, newsletters or letter box drops providing information on the proposal, working hours and a contact name and number for more information or to register complaints.</p>			
Impacts on viability of businesses	Consultation will occur with impacted businesses to identify appropriate management strategies to avoid or minimise impacts on access and operations. This will include consideration of measures such as additional signage and alternative access arrangements.	Construction contractor	Construction	Additional standard safeguard SE6
Impacts on businesses	<p>Maintain pedestrian and vehicle access to businesses near to construction works for the duration of construction and consult with local communities and motorists about changes to local access and any temporary changes required. Where temporary changes are required to property access, these will be identified in consultation with the property owner and business owner.</p> <p>Ensure businesses near to construction works remain visible during construction. Where screening of construction works is required that may potentially impact on visibility of businesses, this will be established in consultation with affected business owners with signage provided.</p> <p>The Communication Plan will identify any specific mitigation and management measures in consultation with business owners to address any unexpected issues that arise during construction.</p>	Construction contractor	Construction	Additional safeguard
Impacts on businesses	Roads and Maritime will engage local businesses affected by the proposal to identify strategies to support them.	Roads and Maritime	Construction	Additional safeguard
Impacts on businesses	<p>Roads and Maritime will review loading zones along the alignment during detailed design.</p> <p>Roads and Maritime to investigate options for mitigating the loss of off-street parking</p>	Roads and Maritime	Detailed design	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	for businesses through reconfiguration of remaining space at 102-112 McEvoy Street.			

Other safeguards and management measures that would address socio-economic impacts are identified in **Section 6.1** (Traffic and transport), **Section 6.2** (Noise and vibration), **Section 6.6** (Landscape character and visual amenity) and **Section 6.10** (Other impacts).

6.9 Biodiversity

The potential impact on biodiversity from proposal are presented in this section, together with safeguards and management measures to mitigate any negative impacts.

6.9.1 Methodology

The following provides a summary of the methodology used.

The assessment areas referenced throughout this section are defined as:

- **Proposal construction footprint:** The proposal is the environmental assessment construction footprint as defined by Roads and Maritime for the proposal as outlined in **Figure 6-20**
- **Study area:** This includes the proposal area with a 20 metre buffer. Boundaries of the study area are displayed in **Figure 6-20**
- **Locality:** This included the area within a 10 kilometre radius surrounding the proposal area.

The methodology for the biodiversity assessment involved:

- A desktop review of relevant database records and previous studies within the locality to identify Commonwealth and State listed threatened species, populations and ecological communities
- The mapping of vegetation communities and flora through aerial photograph interpretation, broad-scale vegetation mapping data to stratify vegetation and habitats in the investigation area
- Targeted terrestrial flora and fauna survey carried out on 10 October 2016
- Vegetation and habitat condition assessment. The habitat assessment for all potentially occurring threatened species was carried out during the surveys with particular emphasis on those species considered to have a high or moderate likelihood of occurrence. While the flora survey aimed to provide baseline data for the presence of threatened plant species, populations and ecological communities to provide a basis for the prediction of impacts
- An assessment of threatened species to identify the likely occurrence of State and nationally listed threatened species; these were identified from background reviews based on their habitat requirements
- An assessment of significance for threatened species and ecological communities positively identified during surveys and inspections or that are considered to have a moderate or high likelihood of occurring in the investigation area
- Identification of impacts and associated mitigation measures to reduce and manage impacts.

Desk top review

A review of existing information and government maintained databases relevant to the study area was carried out. Database searches were carried out in October 2016 and again in May 2019. The following information was reviewed:

- NSW BioNet - the website for the *Atlas of NSW Wildlife* and *OEH BioBanking Threatened Species Profile* (Office of Environment and Heritage, 2016)
- EPBC Act *protected matters search tool* (Department of the Environment 2016)
- OEH *Critical habitat register* (Office of Environment and Heritage, 2016)
- OEH *vegetation information system (VIS) database* (Office of Environment and Heritage 2015)
- OEH *Vegetation Types Database* (Office of Environment and Heritage, 2016)
- The Federal Bureau of Meteorology's *Atlas of Groundwater Dependent Ecosystems* (Bureau of Meteorology 2016)
- Department of Environment's *Directory of Important Wetlands* (Department of the Environment 2016)

- Commonwealth Department of Environment *Flying Fox camp database* (Department of the Environment 2016)
- Department of Planning and Environments *SEPP 14 wetlands* spatial data
- Available regional vegetation mapping including the *Native Vegetation of the Sydney Metropolitan Area* (OEH, 2013)
- *Soil Landscapes of the Sydney 1:100,000* Sheet map (Chapman and Murphy, 1989)
- Sydney 1:100 000 Geological Sheet 9130 (Herbert, 1983)
- Aerial photography for the study area
- Existing reports for the study area including the *Alexandria to Moore Park Project Urban Design Strategy Technical Paper* (Context Landscape Design, 2019).

Field survey

Field surveys were carried out on the 10 October 2016 by ecologists from Jacobs. The field survey included vegetation and fauna field surveys. The field survey method included transect sampling, habitat surveys, searches for evidence of threatened fauna, opportunistically recording fauna species active at the time of the survey. Specifically, the following threatened plants were targeted, as these species are commonly planted as street trees in Sydney:

- *Eucalyptus nicholii* (Narrow-leaved Peppermint) listed as vulnerable under both the BC Act and EPBC Act
- *Eucalyptus scoparia* (Wallangarra White Gum) identified as endangered under the BC Act and vulnerable under the EPBC Act.
- *Syzygium paniculatum* (Magenta Lilly Pilly) identified as endangered under the BC Act and vulnerable under the EPBC Act.

In addition, targeted fauna surveys were carried out for the Grey-headed Flying-fox (*Pteropus poliocephalus*). No other threatened fauna species were targeted during the survey as the habitat in the study area is not considered likely to support the other threatened species.



JACOBS NSW SPATIAL - GIS MAP file: I:\108700_GIS_REF_F008_BDSStudyArea_2\4 | 19/11/2019

Legend

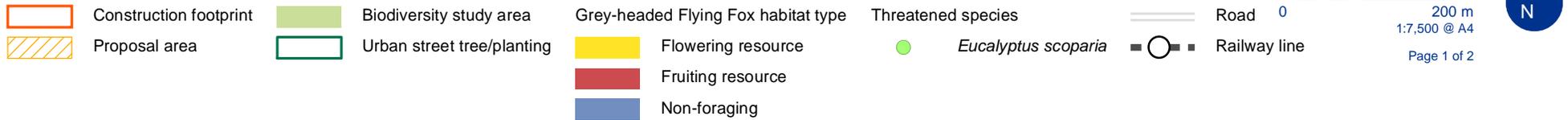


Figure 6-20a | Biodiversity study area, threatened species and habitat
Alexandria to Moore Park Stage 1



JACOBS NSW SPATIAL - GIS MAP file: IA1108700_GIS_REF_F008_BDStudyArea_2x4 | 19/11/2019

Legend

- Construction footprint
- Biodiversity study area
- Grey-headed Flying Fox habitat type
- Threatened species
- Flowering resource
- Fruiting resource
- Non-foraging
- Proposal area
- Urban street tree/planting
- Eucalyptus nicholii*
- Eucalyptus scoparia*

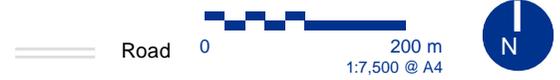


Figure 6-20b | Biodiversity study area, threatened species and habitat
Alexandria to Moore Park Stage 1

6.9.2 Existing environment

The proposal is located in the Sydney Basin bioregion (Pittwater subregion) (Thackway and Cresswell, 1995) and within the Sydney Metro Catchment Management Area (CMA).

The locality is highly urbanised and industrialised. Historical aerial photographs of the study area from 1943 indicate that the study area had been comprehensively cleared of native vegetation and the original native vegetation has been replaced with plantings.

Plant communities

The vegetation of the study area is characterised by landscape plantings, street trees, gardens and mowed lawns. In amongst the plantings, opportunistic vegetation (such as weeds) have established in the disturbed areas. Much of the areas in between plantings are maintained by regular mowing and pedestrian traffic. There are no native vegetation communities or plant community types (PCTs) as identified in the NSW Native Vegetation Information System (VIS) 2.1 present in the study area. There are no threatened ecological communities (TECs) listed under the BC Act or EPBC Act in the study area.

Urban Tree Management (2016) mapped the trees in the area around the proposal. Trees identified range from large examples of mature eucalypts and figs to exotic trees and palms.

There are no groundwater dependent ecosystems in the study area as indicated from the review of the federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems.

Fauna habitat and condition and wildlife connectivity corridors

Natural fauna habitats in the locality have been largely removed and/or heavily modified by residential and industrial development and road infrastructure. The habitat that is present in the study area is limited to planted roadside and parkland vegetation. The habitats within the study area generally lack important features for shelter such as hollow bearing trees (although some larger fig trees have hollows), dense litter layer, or woody debris. The vegetation structure consists only of canopy trees in most areas. The ground layer is generally absent or consists of mown lawn grass. The vegetation in the study area does not provide any significant habitat for fauna but may provide limited foraging opportunities for urban adapted birds (such as the Australian Magpie, Magpie Lark, and Noisy Miner). The vegetation along Dacey Avenue at the edge of the Moore Park Golf Course has a dense shrub layer in places that is suitable for some native birds such as the Superb Fairy Wren (*Malurus cyaneus*).

The eucalypts, figs and palm trees that are planted along the roadside and in the parks provide foraging habitat (flowering and fruiting) for the threatened Grey-headed Flying-fox (*Pteropus poliocephalus*), refer to **Figure 6-20**. The Powerful Owl (*Ninox strenua*) has been recorded in trees near to the study area at Wyndham Street, Alexandria. Therefore, while the study area is largely disturbed, the habitat remains suitable for some more mobile flying species. The habitats in the study area provide limited shelter, breeding and foraging resources for common frog, reptile and bird species. Several habitat trees with small to medium sized hollows next to the study area may provide habitat for common mammals.

There are no mapped areas of connectivity or corridors in the study area. Planted vegetation may be used by local resident species passing through, however it does not form an important habitat corridor.

Threatened flora

Forty-three threatened flora species have been previously recorded or modelled as having potential to occur in the locality. Many of these species favour habitats that are not represented in the study area or are only known to exist in populations restricted to specific geologies, vegetation types and localities.

Flora in the study area is dominated by planted street trees which include threatened species *Eucalyptus nicholii* (Narrow-leaved Peppermint) and *Eucalyptus scoparia* (Wallangarra White Gum), refer to **Figure**

6-20, Photo 6-4 and Photo 6-5. These two species are currently not able to complete their natural life cycles (reproduce) as they have been planted in an urban environment outside of their natural range. Once these trees become senescent and die, or replaced by the local council if they become hazardous to the public, they would be lost from the study area.



Photo 6-4 *Eucalyptus nicholii* (Narrow-leaved Peppermint) planted along Bourke Street



Photo 6-5 *Eucalyptus scoparia* (Wallangarra White Gum) planted along McEvoy Street

Threatened fauna

Based on regional records (refer to **Figure 6-20**) and the presence of suitable habitat, 53 threatened fauna species have been identified in the locality. This includes 17 mammals, 28 birds, two reptiles and five frogs, and one invertebrate. The study area does not contain suitable habitat for many of the species as there are no sandstone ridge tops or gullies and no wet or rainforest habitat. However, habitats within the study area are of suitable quality for only two threatened species of animal, the Grey-headed Flying-fox and Powerful Owl. These species which have been recorded in similar habitats in the vicinity in recent years. No suitable habitat for threatened fish is present in the study area.

There are two known Grey-headed Flying-fox camps close to the study area at Centennial Park and Wolli Creek. The Centennial Park camp is known to contain about 16,000 to 50,000 bats, while the Wolli Creek camp is known to contain about 10,000 to 16,000 bats. The Grey-headed Flying-fox is known to forage on the fig trees, eucalypts and palms within the study area (refer to **Figure 6-20** and **Photo 6-6**). The study area would form part of the local foraging habitat for the Grey-headed Flying-fox.

The Powerful Owl (*Ninox strenua*) was recorded near the study area on Wyndham Street Alexandria in 2012. This bird is likely one of the pair that roosts and breeds in the Royal Botanic Gardens. These birds would use trees within parks and the street plantings in the locality for foraging, and potentially the study area, as roosting habitat. Possums and Grey-headed Flying-foxes in the area would make up a large portion of this breeding pair's diet. However, breeding is unlikely to occur in the study area as no suitable nesting trees (for example trees with large hollows) are present.



Photo 6-6 The large mature *Ficus macrophylla* (Moreton Bay Fig) trees along Anzac Parade at Moore Park provide a summer fruiting resource for the Grey-headed Flying-fox

6.9.3 Potential impacts

Construction

Removal of vegetation

No native vegetation communities or PCTs would be removed by the proposal. There are no naturally occurring PCTs within the proposal area. Impacts to vegetation are limited to planted trees and landscaping including shrubs and exotic groundcover.

The potential removal of planted trees within the proposal area has been identified in the *Alexandria to Moore Park Project Urban Design Strategy Technical Paper* (Context, 2019). About 49 planted trees would be removed as part of the proposal, comprised of 25 mature trees and 24 immature trees. All of the 25 mature trees all are native trees and are considered to be foraging resources that provide potential habitat for threatened species. Further discussion on the proposal's impact on foraging resources is provided below. A map series showing the location of these impacts is included in **Appendix P**.

Removal of habitat for threatened fauna species

The potential loss of vegetation and habitat associated with the proposal is summarised in **Table 6-54**. As shown in **Table 6-54** the proposal would remove about 25 mature planted trees, that are all flowering trees and provide suitable foraging habitat for the Powerful Owl (*Ninox strenua*) and Grey-headed Flying Fox. This is generally limited to foraging habitat. The proposal would not impact any flying fox camps or hollow-bearing trees suitable for nesting by the Powerful Owl (*Ninox strenua*) (none of these are located within the study area). The clearing of habitat would impact native fauna through loss of foraging resources, reduction in habitat size and increasing barriers to fauna movement. No State significant or regionally significant biodiversity links occur in the study area.

Table 6-54 Impacts on threatened fauna and fauna habitat

Species	Potential occurrence	Impacted by proposal	Impact
Powerful Owl (<i>Ninox strenua</i>)	Moderate	Yes – foraging habitat removal	25 mature flowering trees providing potential foraging habitat
Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>)	High	Yes – foraging habitat removal	25 mature flowering trees providing potential foraging habitat

A summary of the flowering and foraging tree species impacted by the proposal is summarised in **Table 6-55** below and the location of trees impacted is shown in included in **Appendix P**. While all of these trees are potential habitat, many are marginal and the Powerful Owl (*Ninox strenua*) would be likely to only use large fig trees for hunting Grey-headed Flying Fox (*Pteropus poliocephalus*) and other common urban mammals. A further 15 mature trees would be indirectly impacted by the proposal. Of these, 13 are native trees of which 13 are flowering and one is fruiting. The remaining mature tree that is indirectly impacted is exotic. The twenty-four immature trees that are directly impacted and the one mature exotic tree species that is indirectly impacted by the proposal have minimal value as habitat for threatened fauna.

Impacts have been quantified based on the concept design and “existing trees to be removed” as identified by in the *Alexandria to Moore Park Project Urban Design Strategy Technical Paper* (Context Landscape Design, 2019).

Table 6-55 Summary of flowering and fruiting foraging mature tree species impacted by the proposal

Scientific name	Common name	Flowering or fruiting resource	Number of foraging mature trees impacted
<i>Callisetmon salignus</i>	Sydney Blue Gum	Flowering	2
<i>Eucalyptus sideroxylon</i>	Mugga Ironbark	Flowering	1
<i>Lophostemon confertus</i>	Brush Box	Flowering	19
<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark	Flowering	3
Total number of mature foraging trees impacted			25

As described in **Section 3.4** and shown on **Figure 1-2**, five construction compound sites have been identified for use during construction of the proposal. These sites would be located in generally cleared and disturbed areas and would not affect native vegetation comprising potential habitat for threatened species.

Removal of threatened flora

The proposal would potentially result in indirect impact to three *Eucalyptus scoparia* trees (refer to **Table 6-56**). These trees are currently not able to complete their natural life cycles as they have been planted in an urban environment outside of their natural range.

Table 6-56 Impacts on threatened flora

Threatened species	Status		Individuals impacted by the proposal	Individuals in the area surveyed
	BC Act	EPBC Act		
Wallangarra White Gum (<i>Eucalyptus scoparia</i>)	Endangered	Vulnerable	3 (indirect impacts)	19

Injury and mortality of fauna

Fauna injury or death has the greatest potential to occur during vegetation clearing and the extent of this impact would be proportionate to the extent of vegetation that would be cleared. The majority of fauna species that would be likely to occur within the proposal area are mobile species, such as birds, and may be able to move away from the path of clearing and may not be greatly affected unless they are nesting. However, other species that would be less mobile (such as ground dwelling reptiles), or those that are nocturnal and nest or roost in trees during the day (such as arboreal mammals and microchiropteran bat species), may find it difficult to move rapidly when disturbed.

Entrapment of wildlife in any trenches that are dug would be a possibility if the trenches are deep and steep sided. Wildlife may also become trapped in machinery that would be stored in the proposal area overnight, and this may result in injury or death.

Invasion and spread of weeds

During construction there would be potential to disperse seeds and plant material from exotic species already present within the proposal area into adjoining areas of vegetation or off-site. The most likely causes of weed dispersal are associated with clearing of vegetation and stockpile of contaminated mulch

and topsoil during earthworks, and movement of soil and attachment of seed (and other propagules) to construction vehicles and machinery.

Invasion and spread of pathogens and disease

While pathogens were not observed or tested for in the proposal area the potential for pathogens to occur should be treated as a risk during construction. Safeguards and mitigation measures for the potential introduction and spread of pathogens are provided in **Table 6-58**.

Operation

The operational impact of the proposal would relate to the cumulative impacts associated with clearing native vegetation and the loss of habitat for flora and fauna species.

The potential biodiversity impacts of the proposal must be considered as a consequence of the construction and operation of the proposal within the existing environment. The proposal would not act alone in causing impacts to biodiversity, as very large areas of vegetation within the locality have already been removed, predominately for urban and industrial development in the recent past. The incremental effects of multiple sources of impact (past, present and future) are referred to as cumulative impacts and provide an opportunity to consider the proposal within a strategic context.

The impacts of recent projects near the proposal are outlined in **Table 6-57**. As shown in this table, the greatest impacts to native vegetation and threatened species habitat have arisen from the New M5 project while the CSELR has contributed to the loss of street trees in the locality. The proposal would add to the loss of street trees in the locality adding to the cumulative impacts as described in **Section 6.11.3**. New street trees would however be planted as part of the proposal.

Table 6-57 Past, present and future projects

Project	Construction impacts
New M5	<ul style="list-style-type: none"> • Removal of 3.36 hectares of native vegetation communities • Removal of 3.27 hectares of TECs listed under the BC Act • Removal of 1.4 hectares of TECs listed under the EPBC Act • Removal of 7.90 hectares of Green and Golden Bell Frog foraging, sheltering and dispersal habitat • Removal of 10.8 hectares of Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>) foraging habitat • Removal of 8 hollow bearing trees.
CSELR	Removal of foraging trees for Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>), Powerful Owl (<i>Ninox strenua</i>) and Eastern Bentwing-bat (exact number not identified in EIS).
The proposal	Removal of 49 planted trees, including 25 mature flowering and fruiting trees that provide potential habitat as foraging trees for the Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>) and Powerful Owl (<i>Ninox strenua</i>).

Conclusion on significance of impacts

The proposal would not be likely to significantly impact threatened species, populations or ecological communities or their habitats, within the meaning of the BC Act or FM Act and therefore a Species Impact Statement or entry into the Biodiversity Offset Scheme is not required.

The following threatened species were assessed for significance under the BC Act:

- *Eucalyptus scoparia* (Wallangarra White Gum)
- Powerful Owl (*Ninox strenua*)
- Grey-headed Flying Fox (*Pteropus poliocephalus*).

The follow threatened species were assessed for significance under the EPBC Act:

- *Eucalyptus scoparia* (Wallangarra White Gum)
- Grey-headed Flying Fox (*Pteropus poliocephalus*).

The assessments of significance found that the proposal would not be likely to significantly impact threatened species, populations, ecological communities or migratory species, within the meaning of the EPBC Act or the BC Act. The significance assessments are provided in **Appendix P**.

6.9.4 Safeguards and management measures

Safeguards and management measures for biodiversity are presented in **Table 6-58**.

Table 6-58 Safeguards and management measures – biodiversity

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	<p>A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> • Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • Requirements set out in the <i>Landscape Guideline</i> (RTA, 2008) • Pre-clearing survey requirements • Procedures for unexpected threatened species finds and fauna handling • Protocols to manage weeds and pathogens. 	Contractor	Detailed design / pre-construction	<p>Core standard safeguard B1</p> <p>Section 4.8 of QA G36 <i>Environment Protection</i></p>
Minimise risks to native flora and fauna during construction	<p>A pre-construction check of native flora and fauna species and habitat will be conducted in accordance with the <i>Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects</i>. Biodiversity management measures identified during the pre-construction check will be incorporated into the CEMP Flora and Fauna Management Plan.</p>	Contractor	Pre-construction and construction	Core standard safeguard B2

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Contractor	Detailed design / pre-construction	Core standard safeguard B3
Protect native flora and fauna, minimise edge effects and avoid inadvertent impacts	All personnel working on site will receive training to ensure awareness of requirements of the Flora and Fauna Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of areas of identified biodiversity value that are to be protected.	Contractor	Construction	Core standard safeguard B4
Unexpected threatened species	Consistent with the Biodiversity Guidelines - <i>Protecting and managing biodiversity on RTA projects</i> , and any specific requirements of the approved Flora and Fauna Management Plan, an unexpected finds procedure will be implemented in the event that a threatened species or ecological community that had not been identified and assessed by the REF is unexpectedly encountered during the construction process.	Contractor	Construction	Core standard safeguard B5
Protect native flora and fauna, minimise edge effects and avoid inadvertent impacts	Consistent with the approved Flora and Fauna Management Plan: <ul style="list-style-type: none"> The limits of clearing within the construction site will be delineated using appropriate signage and barriers, identified on site construction drawings and during construction staff induction Vegetation and habitat features to be retained, such as hollow-bearing trees, will be clearly identified and protected by suitable fencing, signage or markings. 	Contractor	Construction	Additional safeguard
Fauna handling	Consistent with the Biodiversity Guidelines - <i>Protecting and managing biodiversity on RTA projects</i> , and any specific requirements of the approved Flora and Fauna Management Plan, management arrangements will be implemented to ensure safe fauna handling. As a minimum that will include: <ul style="list-style-type: none"> Fauna handling being carried out by appropriately licenced ecologists or wildlife carers 	Contractor	Construction	Additional safeguard

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> Liaison with local animal rescue agency, wildlife carer group or vet to establish agreed arrangements for fauna rescue or injured animal assistance Induction information for construction staff. 			
Minimise weed, pest species and pathogen risks	<p>Weed, Pest Species and Pathogen Management Consistent with the <i>Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects</i>, and any specific requirements of the approved Flora and Fauna Management Plan, management arrangements will be implemented to manage environmental risks associated with weeds, pest species and pathogens. As a minimum that will include:</p> <ul style="list-style-type: none"> Completion of a site weed assessment and, if necessary, based on the assessment outcomes, a weed management plan Implementation of appropriate weed control methods and weed disposal Implementation of appropriate hygiene protocols where there are potential or known pathogen risks. 	Contractor	Construction	Additional safeguard

Other safeguards and management measures that would address biodiversity impacts are identified in **Section 6.6** (Landscape character, visual impact and urban design).

6.9.5 Biodiversity offsets

The biodiversity assessment identifies that the proposal would not be likely to have a significant impact on any threatened biodiversity listed under the BC Act or EPBC Act. In this instance, and due to the Strategic Assessment, the EPBC Act environmental offsets policy does not apply.

Under the Roads and Maritime policy, offsets would not be required for the proposal as:

- The proposal would not impact a national or NSW listed critically endangered or endangered ecological community
- The threatened flora species to be impacted have been planted as part of a road corridor landscaping program
- The threatened species habitat that would be impacted has been planted as part of a road corridor landscaping program
- As part of the *Alexandria to Moore Park Project Urban Design Strategy Technical Paper* (Context Landscape Design, 2019) a replacement street tree program has been developed to mitigate the loss of urban amenity caused by this proposal. This program would, in the long term, replace much of the habitat which would be lost as a result of the project.

6.10 Other impacts

6.10.1 Existing environment and potential impacts

Environmental factor	Existing environment	Potential impacts
Topography, geology and soils	<p>The topography of the area undulates in a west-east direction throughout the proposal area. There is also a generalised slope towards the south across the length of the proposal area. Dacey Avenue breaks through a ridgeline which runs from north to south through Moore Park. The ground elevation across the proposal area varies from about five to 40 metres Australian height datum (AHD).</p> <p>A review of the 1:100,000 Sydney Geological Sheet (Geological Series Sheet 9130, Edition 1, NSW Government, 1983) indicates that the proposal area is predominately underlain by quaternary aged alluvium, predominately fine to medium grained marine sands known as the Botany Sands.</p> <p>There is also likely to be areas of fill due to the long history of disturbance and development in the locality</p>	<p>During construction of the proposal, erosion of soil could occur from disturbed areas and material stockpiles. This would mainly occur due to surface water runoff and wind erosion and movement of vehicles across disturbed areas. The main impact of this erosion is the potential loss of downstream water quality, as discussed in Section 6.5.</p> <p>Once the proposal is operational, there would be potential for indirect impacts on soils as a result of run-off and drainage. This potential impact would be managed through the revegetation of exposed soils and construction of operational water quality measures, which are described in Section 6.5.4.</p>
Air quality and greenhouse gas	<p>Local air quality at the proposal would be influenced by many sources but the main sources relevant to the proposal would be associated with motor vehicles. The main air pollutants from motor vehicles are carbon monoxide (CO), nitrogen dioxide (NO₂) and fine particles (PM₁₀, ie particulate matter with equivalent aerodynamic diameters of less than 10 microns) and Volatile organic compounds (VOCs). The primary pollutants of concern during construction and</p>	<p>During construction air quality impacts would potentially occur in the vicinity of the proposal and would be dependent upon atmospheric conditions. The proposal would have potential to generate dust from earthworks, stockpiles and the use of imported fill. Levels of air borne dust would be expected to be low level and unlikely to cause concern to sensitive receivers provided the mitigation measures provided in Section 7.2 are implemented. Construction equipment and plant would emit exhaust fumes and would contribute to local air quality.</p>

Environmental factor	Existing environment	Potential impacts
	<p>operations of the proposal would include total suspended solids (TSP), deposited dust, particulate matter, CO, NOx (as NO₂) and VOCs.</p>	<p>However, in the context of the existing vehicular movements within the proposal area, this is considered to be negligible.</p> <p>During operation the potential air quality impacts would be similar to those currently experienced.</p>
<p>Waste and resource use</p>	<p>The roads within proposal area create very little waste. This generally consists of some green waste associated with the maintenance of roadside vegetation, roadside litter from motorists and other road users and, possibly, material from clearing roadside drainage.</p>	<p>In summary, waste-generating activities would include:</p> <ul style="list-style-type: none"> • Vegetation clearance, generating green waste such mulched material • Construction of temporary construction compounds, constructing roads, road surface grading, temporary drainage structure installation and the placement of gravel road base where required, generating asphalt waste, pipe cuts and green waste • Installation of environmental controls, fencing, silt fences, and lockable gates, generating material off cuts • Demolition of kerbs, fencing, road surfaces, barriers, signage, lighting, parapets • Potential contaminated material unearthed during construction (refer to Section 6.7). <p>All waste would be managed in accordance with Roads and Maritime guidelines and disposed of by a licensed contractor to an appropriately licensed facility.</p> <p>The waste associated with the operation of the proposal would not be expected to change from the existing environment.</p> <p>Timber from the existing timber bridge would be assessed by Roads and Maritime to determine its appropriate reuse or disposal.</p> <p>The quantities of each type of waste would be defined during detailed design.</p>

6.10.2 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Topography, geology and soils	Spoil and fill management measures will be prepared and implemented as part of the CEMP. The Plan will identify the locations of spoil and fill stockpiles, sources of imported fill, and methods to re-use or dispose of excess or unsuitable spoil material including estimated volumes and disposal sites.	Contractor	Pre-construction	Additional safeguard
Air quality	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: <ul style="list-style-type: none"> • Potential sources of air pollution • Air quality management objectives consistent with any relevant published EPA and/or OEH 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 <i>Environment Protection</i>
Waste	A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to: <ul style="list-style-type: none"> • Measures to avoid and minimise waste associated with the project • Classification of wastes and management options (re-use, recycle, stockpile, disposal) • 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. <p>The WMP will be prepared taking into account the <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets.</p>	Contractor	Detailed design / pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Existing condition of ancillary sites	<p>Prior to land being used for ancillary construction purposes (compounds, storage, parking, etc) a pre-construction land assessment will be carried out to identify the presence of any pre-existing wastes.</p> <p>The assessment will be prepared in accordance with the Roads and Maritime's Environmental <i>Procedure - Management of Wastes on Roads and Maritime Services Land</i>. Where the land is privately owned, a copy of the assessment will be provided to the landowner.</p>	Contractor	Pre-construction	Additional safeguard W2
Waste and resource use	Waste materials (such as soils and aggregates) obtained from the project and to be exported for use on another construction site or project will be sampled and managed in accordance with relevant resource recovery orders and exemptions as issued by the NSW EPA.	Contractor	Construction	Additional safeguard
Waste and resource use	A Spoil Management Strategy will be developed prior to the commencement of construction and implemented during construction. The strategy will identify spoil disposal site(s) and describe the management of spoil on-site and during off-site transport.	Contractor	Pre-construction Construction	Additional safeguard
Utilities	<p>Prior to the commencement of works:</p> <ul style="list-style-type: none"> The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners If the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint, further assessment will be undertaken. 	Contractor	Detailed design / pre-construction	Core standard safeguard U1
Hazards and risk management	<p>A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to:</p> <ul style="list-style-type: none"> Details of hazards and risks associated with the activity Measures to be implemented during construction to minimise these risks 	Contractor	Detailed design / pre-construction	Core standard safeguard HAZ1

Impact	Environmental safeguards	Responsibility	Timing	Reference
	<ul style="list-style-type: none"> • Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials • A monitoring program to assess performance in managing the identified risks • Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations. <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or Office of Environment and Heritage publications.</p>			

6.11 Cumulative impacts

Cumulative impacts have the potential to arise from the interaction of individual elements within the proposal and the additive effects of the proposal with other external projects. Roads and Maritime is required under clause 228 (2) of the *Environmental Planning and Assessment Regulation 2000*, to take into account potential cumulative impacts as a result of the proposal.

Cumulative impacts relate to the combined effects of the proposal and other nearby projects. The potential cumulative impacts of the proposal are assessed below.

6.11.1 Study area

The study area used for the assessment of cumulative impacts has been defined by identifying other developments or activities that are under way now, or are likely to commence during the proposal's scheduled construction timeframe within the suburbs of Alexandria, Waterloo and Moore.

Proposed developments with the potential for cumulative impacts with the proposal were identified through:

- A search of the Department of Planning and Environment major projects register on 6 June 2019
- A search of the NSW Planning Assessment Commission's project register for Sydney City and Randwick local government areas on 6 June 2019
- A search of City of Sydney, Randwick City Council, Transport for NSW and Roads and Maritime Services websites
- A review of background documents including planning strategies and major facility master plans.

The specialist studies carried out have assessed the proposal to predict and describe the construction impacts compared to the existing environment. The assessment of operational impacts has also incorporated the predictions from external projects in modelling to describe operational impacts in relation to traffic and traffic noise. The methodology for the flooding study has built on available flood modelling associated with surrounding projects to the extent available at the time of modelling.

The assessment of cumulative impacts has been limited to desktop review of the predicted impacts of external projects and consideration of where these impacts would overlap with the proposal. These potential cumulative impacts have been described in general terms to identify the implications over and above those that would result if the proposal were to be constructed in isolation.

6.11.2 Other projects and developments

City of Sydney is undergoing a period of substantial urban renewal, with a range of urban renewal initiatives located near the proposal. A number of other transport projects are also currently under construction or planned in the study area to support this urban renewal and population growth. These are described below.

CSELR

As discussed in **Section 2.2.1**, the CSELR is a new 12 kilometres long light rail network for Sydney. The CSELR is located to the east of the proposal. On the basis that construction periods would not be expected to overlap, cumulative implications would be limited to operational outcomes and contribution to construction fatigue. The location of potential cumulative impacts would also be limited to the eastern extent of the proposal.

New M5

New M5 is a 33 kilometre long road project currently under construction by the NSW Government as part of the State Infrastructure Strategy released in October 2012. The project involves the widening of the M4 Motorway east of Parramatta, a duplication of the M5 East Motorway and new sections of motorway to provide a connection between the two corridors. More than two-thirds of New M5 would be built underground.

Work is currently underway on New M5, which involves widening and extending the M4 and M5 and joining them to create a free flowing motorway network. It would include twin tunnels, an upgrade of King Georges Road Interchange and a new interchange at St Peters, refer to **Figure 2-1**. The new interchange at St Peters and local road upgrades would extend to the Euston Road/Maddox Street intersection at the western end of proposal.

There is potential for the construction works period for New M5 to overlap with that of the proposal and as such cumulative construction impacts would be possible. Cumulative operational outcomes would also be likely but would be limited to the western extent of the proposal.

Sydney Metro

Sydney Metro is a standalone railway which would deliver 31 metro stations and more than 65 kilometres of new metro rail. The metro rail would run from Sydney's North-west region under Sydney Harbour, through new underground stations in the CBD and beyond to the south-west.

This project is being delivered in two stages, with Stage 1: Sydney Metro North-west opening in 2019. Stage 2: Sydney Metro City and South-west includes new twin rail tunnels from Chatswood to Sydenham and proposed new stations at Crows Nest, Victoria Cross (North Sydney), Barangaroo, Martin Place, Pitt Street, Central and Waterloo. The Waterloo station would be located between Botany Road and Cope Street, Raglan Street and Wellington Street about 500 metres north of McEvoy Street outside proposal area. Stage 2 construction is expected to commence in 2018 and is due to open in 2024.

The construction periods for the proposal and Sydney Metro would overlap. The proposal direct impact areas for the proposal and Sydney Metro do not overlap but construction traffic from Sydney Metro may be directed through the proposal area.

Sydney Metro have submitted a Concept SSD application seeking consent for the broad concept for an Over Station Development above the Waterloo Metro Station. The SSD application was on public exhibition until 30 January 2019.

The over station development would deliver new homes, shops, community services and a new public plaza with a freestanding building that could house community and recreational facilities. Sydney Metro are seeking approval for:

- Maximum building envelopes for:
 - A three storey building along Cope Street
 - Three mid-rise buildings between four to 10 storeys along Cope Street
 - Three towers with heights up to 23 storeys, 25 storeys and 29 storeys above a three storey podium along Botany Road
 - A maximum gross floor area of 68,750 square metres
 - About 700 dwellings, including social housing dwellings and affordable housing
 - Up to 427 car parking spaces, 1,140 bicycle spaces, 36 motorcycle spaces and eight service vehicle spaces.

The development would be completed close to when Sydney Metro City and Southwest services start in 2024.

Green Square Urban Renewal Precinct

The Green Square Urban Renewal Precinct is Australia's largest urban renewal site and one of the inner city's fastest growing areas. The 278 hectare urban renewal area covers part of the suburbs of Waterloo, Zetland and Beaconsfield, with the town centre located at the Green Square railway station. Green Square is proposed to be a key town centre for the City. Development within the former industrial precinct is proposed to include high density residential housing; recreation, cultural and community uses; and small retail and commercial uses. The precinct is expected to accommodate about 60,000 people across 30,000 new residential dwellings by 2030.

The Lachlan Precinct is located wholly within the Green Square Precinct. A section of the proposal is located in the northern section of the Green Square Urban Renewal Precinct and includes all of McEvoy Street and Lachlan Street and sections of Bourke Street, and South Dowling Street. It would continue to gradually transition from industrial and warehouse uses to a mixed use residential neighbourhood with high quality buildings and public spaces. This precinct is envisaged to accommodate up to 6,600 residents by 2030 (City of Sydney, 2014).

As part of the Green Square development, transport infrastructure would also be constructed including the:

- Green Square to Ashmore Connector Road (previously the East West Relief Route)
- Gadigal Avenue corridor north-south transit corridor.

The timing and area of impact may overlap with the proposal. Specific details of individual projects are not readily available as a result of the range of separate public and private developments contemplated within the overall renewal strategy. A general increase in construction activity in the area of the proposal would be expected and should be considered in subsequent assessments of individual projects.

Ashmore Precinct

The Ashmore Precinct is located in Erskineville and next to Alexandria, bounded by Ashmore Street and Mitchell Road. This project involves the industrial site being redeveloped into a sustainable neighbourhood, to provide a mix of dwelling types, with some associated retail and commercial uses to serve the new population of about 6,000 residents. The redevelopment would create new streets, some with separated bicycle lanes, a large central park and systems to manage stormwater. The Ashmore Precinct is located about 250 metres north-west of the western end of the proposal.

The timing of impacts may overlap with the proposal. The nature of the development is different to that of the proposal and the areas of direct impact does not overlap. Cumulative impacts would be expected to be limited to cumulative traffic impacts on roads affected by the proposal.

Waterloo Estate Precinct

The Central to Eveleigh Redevelopment Project by UrbanGrowth NSW encompasses the rail corridor from Central to Eveleigh, and includes five 'renewal' precincts. Of relevance to the proposal is the Waterloo Estate Precinct, which is bounded by McEvoy Street, Cope Street, Raglan Street and Pitt Street. UrbanGrowth NSW is currently preparing a master plan in consultation with the Department of Family and Community Services. It is anticipated that around 5,000 additional homes would be established on the site to replace the 2,000 existing social housing dwellings.

The timing of impacts may overlap with the proposal. The nature of the development is different to that of the proposal however access arrangements in McEvoy Street may overlap. Cumulative impacts would be expected to be limited to cumulative traffic impacts on roads affected by the proposal.

Alexandria Park Community School

Alexandria Park Community School is being redeveloped to cater for increasing student enrolments from Kindergarten to Year 12. This State significant development would deliver a new school to accommodate 1,000 primary school students and up to 1,200 high school students. The redevelopment would replace existing classrooms and provide 104 new permanent learning spaces, 6 special education learning spaces, and 12 special program rooms (high school). Construction has started in early 2019 and is expected to be completed by 2020.

Other local development projects

A search of the DA tracking database for City of Sydney and Randwick City Council was carried out on 6 June 2019. Applications in the study area relate mainly to residential modifications and a number of multi-story residential developments. Many of the developments would be constructed concurrently with the proposal.

6.11.3 Potential impacts

Construction specific cumulative effects would most likely occur where construction works overlap in terms of timing and/or location. Cumulative effects from construction activities usually relate to noise and vibration, traffic and access, visual amenity and air quality impacts. The scale of the impacts largely depends on the type of work, its duration, and the sensitivity of surrounding land uses. Based on the findings of the specialist studies summarised in the preceding sections, cumulative construction impacts may include contributions to:

- Increases in construction vehicle traffic on local roads causing noise/vibration and air quality impacts on sensitive receivers
- Extended construction zones which would likely result in delays from roadwork, reduced speed limits, and overall longer travel times
- Noise impacts associated with multiple construction works, especially at night
- Increased flood levels at isolated spots along the proposal due to the changes in surface levels of the road and footpath at some of the intersections to improve the grades
- Disturbance to existing and future land uses and access
- Loss of mature trees in some locations
- Changes to visual amenity of the area
- Reduction of heritage value of the area
- Complexity of the provision and maintenance of utilities and services
- Changes to water quality of nearby waterways or groundwater from multiple construction sites
- Visual amenity impacts
- Extended periods of disruptions related to construction, which would be magnified by other developments.

Projects do not have to overlap in terms of construction timing to have cumulative impacts. If various projects follow progressively and are concentrated in a general locality, there may also be a cumulative effect associated with an overall increased duration of disturbance on sensitive receivers, particularly residents and businesses. This effect is often termed 'construction fatigue'. This is potentially a key issue

for the proposal due to the length of the construction program and the concentration of a number of major development projects in close proximity, particularly the CSELR and M5 and urban redevelopment including at Green Square.

It is recognised that the works for the proposal are smaller in scale relative to many other major transport and urban development projects occurring in or near the study area. As such, the contribution of the proposal to potential cumulative impacts relating to such things as construction vehicle traffic, changes to land use and visual amenity are expected to be relatively minor compared to other developments recently completed, under construction or proposed in the study area.

During construction, community concerns about impacts on local road changes, loss of establish street trees and reduced local amenity from construction activities may be intensified when considered with impacts of other projects under construction or planned to be concurrently constructed in the study area. There may be particular concern about these effects extending over a number of years.

During operation, the proposal and adjoining road upgrades would have a positive cumulative impact on access within the study area by reducing travel times and congestion, improving road safety and supporting nearby urban renewal and transport projects such as the CSELR and New M5. This would allow for the anticipated increase in traffic volumes as a result of future population growth in the area. The existing ambient noise at within the proposal area is already dominated by street traffic noise. The proposal would further contribute to an increase in ambient noise of the area. The visual and amenity impacts resulting from construction may also persist into the operational stage in the absence of appropriate replacement landscaping improvement while access issues may also persist through a cumulative change in parking availability.

The likely cumulative impacts of the proposal, other projects and developments during construction and operation are summarised in **Table 6-59**.

Table 6-59 Potential cumulative impacts

Environmental factor	Construction	Operation
Traffic and transport	<p>As a result of multiple construction projects being carried out near the proposal within a similar time period, there is potential for impacts on traffic and transport to be greater than those that were identified for the proposal in isolation. Impacts would primarily be a result of road and lane closures and an increase in construction-related traffic. The potential cumulative impacts would include:</p> <ul style="list-style-type: none"> • Increased travelling time on the road network • Increased traffic volumes on alternative routes, resulting in congestion • Reduced traffic speeds on the road network • Increases in construction vehicle traffic causing noise/vibration and air quality impacts on sensitive receivers • Extended construction zones • Use of alternative construction vehicle access routes • Compounding effects of increase construction traffic needing to travel through surrounding construction zones. 	<p>The proposal would have a positive cumulative impact on travel times and road safety and help manage congestion and growth and support substantial nearby urban renewal.</p> <p>The proposal is however predicted to result in the change of availability of 252 of on-street parking spaces along McEvoy Street and Euston Road within the proposal area due to the new parking conditions. Currently 228 of these spaces already operate under No Parking restrictions during morning or afternoon peaks.</p> <p>Vehicles displaced would largely be accommodated in existing side streets with the exception of several areas including:</p> <ul style="list-style-type: none"> • On the northern side of McEvoy Road between Harley Street and Fountain Street • On the northern side of McEvoy Road between Fountain Street and Loveridge Street • On the northern side of McEvoy Road between Botany Road and Elizabeth Street. <p>Despite the loss of on-street parking, a cumulative improvement in access and safety for road uses would be expected with.</p> <p>It is also noted that the loss of parking ties in to one of the key actions of <i>Connecting our city</i> (see Section 2.1.7) in which the City of Sydney would develop a comprehensive parking policy with the objective to minimise growth in private vehicle use over time and to limit parking in areas with high access to public transport and service. The proposal area has good access to public transport and services.</p>

Environmental factor	Construction	Operation
Flooding	<p>Construction work for the proposal may result in impacts to flooding mainly due to temporary stockpiles, safety barriers and other elements being located in flood flow paths and obstructing flows during a flood event. Impacts could also potentially occur if drainage systems are temporarily decommissioned for any reason. Flooding impacts would be further exacerbated where construction activities or stormwater controls in overlapping or adjacent construction projects direct flows to the same location or combine to impede flows.</p> <p>Cumulative construction flooding impacts would not be anticipated with CSELR and New M5 (St Peters interchange) as both projects are nearing completion.</p>	<p>The flood study carried out for the proposal has not identified any operation cumulative impacts with other projects in the locality (refer to Section 6.5).</p>
Noise and vibration	<p>There is potential for cumulative noise and vibration impacts during construction for residents and other sensitive receivers located in areas that overlap with construction of adjoining projects such as CSELR, New M5 and other urban renewal projects such as Green Square.</p>	<p>The existing ambient noise at within the proposal area is already dominated by street traffic noise. The noise assessment identified that without treatment, noise management levels would be exceeded for receivers next to the proposal. Therefore, the proposal would further contribute to an increase in ambient noise of the area.</p>
Visual amenity and landscape character	<p>Multiple construction activities could have a cumulative impact on visual amenity. Earthworks, construction compounds, stockpile sites, and construction machinery would be highly visible.</p>	<p>The proposal area is experiencing substantial changes in land use as due to urban renewal initiatives. The form and intensity of development would result in gradual but substantial long-term changes to the landscape.</p> <p>The proposal would remove a total of 49 planted trees would be removed as part of the proposal, comprised of 25 mature trees and 24 immature trees.</p> <p>While there is an opportunity to strengthen the character with additional street tree plantings, planted trees that would take a number of years to mature.</p>

Environmental factor	Construction	Operation
		<p>In the short term there would be a visual amenity impact resulting from the cumulative loss of trees in proposal area, however in the longer term the visual character of the area would be returned as trees planted as part of the proposal mature.</p>
<p>Social impacts</p>	<p>Multiple construction activities over an extended period would likely result in 'construction fatigue' and amenity impacts (such as air quality, noise and visual) for local residents and businesses located near the construction areas for roads and major land use changes such as the planned urban renewal projects.</p> <p>Other long-term developments being planned such as the proposed precinct developments such as Green Square Urban Renewal would likely result in anxiety and uncertainty for residents and land owners, due to the current lack of definition around what is proposed, and when it is likely to occur.</p> <p>The projects contributing to cumulative construction impacts are generally located outside the proposal area and each contributing project dominates social impacts within its area of influence. Loss of on-street parking would impact on businesses that rely on on-street parking for passing trade. Section 6.9 describes the property, land use and socio-economic impacts of the development.</p> <p>There would also be a cumulative impact on resource use, demand for construction materials and waste management.</p>	<p>In the long term, the developments now being planned are expected to deliver social and economic benefits to the southern fringe of the Sydney CBD through improved transport connections, employment and business opportunities. These developments would likely change the nature of the land uses and communities in the area.</p> <p>The area is undergoing change in land use generally involving transition from industrial to higher density residential, commercial and mixed uses. Cumulative social impacts are expected to result in higher population densities and activity over extended hours. The proposals contribution to cumulative operational impacts would be beneficial through the provision of more efficient transport and travel in the area.</p>

6.11.4 Safeguards and management measures

Safeguards and management measures for cumulative impacts are presented in **Table 6-60**.

Table 6-60 Safeguards and management measures – cumulative impacts

Impact	Environmental safeguards	Responsibility	Timing	Reference
Cumulative impacts from construction of multiple projects	The CEMP will be updated as required to address cumulative impacts as other projects/activities begin. This will include a process to review and update mitigation measures as new work begins or if complaints are received.	Contractor	Pre-construction/ Construction	Additional safeguard
Cumulative traffic and access impacts	The Traffic Management Plan will be prepared in consultation with Roads and Maritime's Sydney Coordination Office, City of Sydney and Randwick City councils	Contractor	Pre-construction	Additional safeguard
Cumulative construction impacts	The Consultation Plan will include consultation with proponents of projects in the vicinity of the proposal: <ul style="list-style-type: none"> • Increase awareness of construction timeframes and impacts • Coordinate impact mitigation and management (eg respite periods). 	Road and Maritime	Pre-construction/ Construction	Additional safeguard
Cumulative flooding impacts	The flood model for the proposal will be updated to incorporate changes to design levels and updated flood model impacts associated with the New M5 designs.	Road and Maritime	Pre-construction	Additional safeguard

Other safeguards and management measures that would address cumulative impacts are presented in **Sections 6.1** (Traffic and transport), **Section 6.2** (Noise), **Section 6.6** (Landscape character, visual assessment and urban design) and **Section 6.9** (Property, land use and social economics).

7. Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts throughout detailed design, construction and operation. A framework for managing the 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 also listed.

7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result 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 CEMP will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Roads and Maritime Environment Officer, Greater Sydney Project, prior to the commencement of any on-site works. The CEMP will 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*
- *QA Specification G10 - Traffic Management.*

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will 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 will minimise any potential adverse impacts arising from the proposal on the surrounding environment. The safeguards and management measures are summarised in **Table 7-1**.

Table 7-1 Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
General					
GEN1	General - minimise environmental impacts during construction	<p>A CEMP will be prepared and submitted for review and endorsement of the Roads and Maritime Environment Manager prior to commencement of the activity.</p> <p>As a minimum, the CEMP will address the following:</p> <ul style="list-style-type: none"> • 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. <p>The endorsed CEMP will be implemented during the undertaking of the activity.</p>	Contractor / Roads and Maritime project manager	Pre-construction / detailed design	Core standard safeguard GEN1

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN2	General - notification	All businesses, residential properties and other key stakeholders (eg schools, local councils) affected by the activity will be notified at least five days prior to commencement of the activity.	Contractor / Roads and Maritime project manager	Pre-construction	Core standard safeguard GEN2
GEN3	General – environmental awareness	<p>All personnel working on site will receive training to ensure awareness of environment protection requirements to be implemented during the project. This will include up-front site induction and regular "toolbox" style briefings.</p> <p>Site-specific training will be provided to personnel engaged in activities or areas of higher risk. These include:</p> <ul style="list-style-type: none"> • Areas of Aboriginal heritage sensitivity • Non-Aboriginal heritage management including unexpected finds procedures • Trees to be protected • Adjoining residential areas requiring particular noise management measures] • Dust and air quality management. 	Contractor / Roads and Maritime project manager	Pre-construction / detailed design	Core standard safeguard GEN3
GEN4	Utilities	<p>Prior to the commencement of works:</p> <ul style="list-style-type: none"> • The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners • If the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint, further assessment will be carried out. 	Contractor	Detailed design/ pre-construction	Core standard safeguard U1
GEN5	Waste	In the event a trade waste licence is requested, it will be obtained in accordance with the correct approval process- usually through Sydney Water - and relevant guidelines.	Contractor	Detailed design/ pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		The discharge protocols of chlorinated water due to shut down and reconnection of live Sydney Water assets may need to be adjusted as part of the proposal.			
Traffic and transport					
TT1	Traffic and transport	<p>A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the <i>Roads and Maritime Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Roads and Maritime, 2008). The TMP will include:</p> <ul style="list-style-type: none"> • 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. 	Construction contractor	Detailed design / Pre-construction	Core standard safeguard TT1 Section 4.8 of QA G36 <i>Environment Protection</i>
TT2	Local community notification	<p>Consultation will be carried out with potentially affected residences prior to the commencement of and during works in accordance with the RTA's <i>Community Involvement and Communications Resource Manual</i>. Consultation will include but not be limited to door knocks, newsletters or</p>	Roads and Maritime	Pre-construction/ construction	Core standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		letter box drops providing information on the proposal, working hours and a contact name and number for more information or to register complaints.			
TT3	Access	Requirements for any changes to local access arrangements will be confirmed during detailed design in consultation with the local road authority and any affected landowners.	Roads and Maritime	Pre - construction/ detailed design/	Additional standard safeguard
TT4	Access	Access to properties will be maintained during construction. Where that is not possible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners and the relevant local road authority	Construction contractor	Pre – construction/ construction	Additional standard safeguard
TT5	Impacts to pedestrians and cyclists	Pedestrian and cyclist access will be maintained throughout construction. Where that is not possible or necessary, temporary alternative access arrangements will be provided following consultation with affected landowners and the local road authority.	Construction contractor	Construction	Additional standard safeguard
TT6	Community information	Road users and local communities will be provided with timely, accurate, relevant and accessible information about changed traffic arrangements and delays owing to construction activities.	Construction contractor	Construction	Additional standard safeguard
TT7	Disruption to public transport, including school bus services	Access for public transport services, including school bus services, will be maintained. The requirements for any temporary changes will be confirmed following consultation with local bus operators and the community.	Construction contractor	Construction	Additional standard safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
TT8	Access	Where any existing access arrangements to property is permanently affected, arrangements for appropriate alternative access will be determined in consultation with the affected landowner and local road authority.	Roads and Maritime	Pre - construction /detailed design/	Additional standard safeguard
TT9	Bus stops	The opportunity to consolidate stops between Fountain Street and Botany Road will be considered in consultation with local bus operators	Roads and Maritime	Detailed design/	Additional safeguard
TT10	Emergency services	Conduct consultation with emergency services to ensure adequate emergency vehicle access is maintained for the duration of construction. Provide regular updates to emergency services about any changes to local access during construction. The NSW SES will be notification where there are likely to be significant delays in the operation of the roads affected by the proposal.	Construction contractor	Construction	Additional safeguard
TT11	Change in availability of on-street parking	During detailed design TfNSW will investigate refinements to proposed parking restrictions to mitigate impacts, where possible.	Roads and Maritime	Detailed design	Additional safeguard
TT12	Change in availability of on-street parking	During detailed design Roads and Maritime will consider options for mitigating the loss of off-street parking for businesses through reconfiguration of remaining space at 102-112 McEvoy Street where possible.	Roads and Maritime	Detailed design	Additional safeguard
TT13	Parking during operation	Consult with the CoS on the possible inclusion of timed restrictions in areas that currently have no parking restrictions along side streets and along the proposal itself to allow for a greater turnover of parked vehicles during business hours.	Roads and Maritime	Detailed design	Additional safeguard
TT14	Parking during construction	Implement a construction workforce parking strategy to minimise loss of parking during construction. Provide parking for construction workforce	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		within construction areas and implement worker parking policies to reduce demand for local parking.			
Noise and vibration					
NV1	Noise and vibration	<p>A CNVMP will be prepared and implemented as part of the CEMP. The CNVMP will generally follow the approach in the ICNG and identify:</p> <ul style="list-style-type: none"> • All potential significant noise and vibration generating activities associated with the activity • Site inductions • Feasible and reasonable mitigation measures to be implemented, taking into account <i>Beyond the Pavement: urban design policy, process and principles</i> (Roads and Maritime, 2014) • 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 <p>Contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.</p>	Contractor	Detailed design/ pre-construction	Core standard safeguard NV1 Section 4.6 of QA G36 Environment Protection
NV2	Noise and vibration	<p>All sensitive receivers (eg schools, local residents) likely to be affected will be notified at least five days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of:</p> <ul style="list-style-type: none"> • The project • The construction period and construction hours • Contact information for project management staff • Complaint and incident reporting <p>How to obtain further information.</p>	Contractor	Detailed design / pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV3	Construction hours and scheduling	Where feasible and reasonable, construction will be carried out during the standard daytime working hours and work generating high noise levels will be scheduled during less sensitive time periods.	Construction contractor	Construction	Additional safeguard
NV4	Construction respite period during normal hours and out-of-hours	<p>The duration and respite of high noise generating activities will be carrying out in accordance with the CNVG, and consultation with the community.</p> <p>As a guide, high noise generating activities near receivers will be carried out in blocks that do not exceed hour hours each, with a minimum respite period of one hour between each block. The duration of each block of work and respite will be flexible to accommodate the usage and amenity at nearby receivers.</p>	Construction contractor	Detailed design/pre-construction /construction	Additional safeguard
NV5	Equipment selection	<p>Use quieter and less noise emitting construction methods where feasible and reasonable.</p> <p>Ensure plant including the silencer is well maintained.</p>	Construction contractor	Detailed design/pre-construction	Additional safeguard
NV6	Plant noise levels	<p>The noise levels of plant and equipment will have operating Sound Power or Sound Pressure Levels compliant with the criteria in Appendix F of the CNVG.</p> <p>A noise monitoring audit program will be implemented to ensure equipment remains within the more stringent of the manufacturer's specifications or Appendix F of the CNVG.</p> <p>The noise levels of plant and equipment items will be considered in rental decisions and in any case cannot be used on site unless compliant with the criteria in the CNVG.</p> <p>Use only the necessary size and power of equipment will be used</p>	Construction contractor	Detailed design/pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV7	Use and siting of plant	<p>The offset distance between noisy plant and adjacent sensitive receivers will be maximised.</p> <p>Plant used intermittently will be throttled down or shut down.</p> <p>Noise-emitting plant will be directed away from sensitive receivers. Only have necessary equipment on site.</p>	Construction contractor	Detailed design/pre-construction	Additional safeguard
NV8	Plan worksites and activities to minimise noise	<p>Locate compounds away from sensitive receivers and discourage access from local roads where possible.</p> <p>Parking and loading/unloading areas will be planned to minimise reversing movements within the site.</p> <p>Where additional activities or plant may only result in a marginal noise increase and speed up works, consider limiting duration of impact by concentrating noisy activities at one location and move to another as quickly as possible.</p> <p>Very noisy activities will be scheduled for normal working hours. If the work cannot be undertaken during the day, it should be completed before 11:00pm where possible.</p> <p>If programmed night works is postponed the work will be re-programmed and the approaches in the CNVG apply again.</p>	Construction contractor	Detailed design/pre-construction	Additional safeguard
NV9	Non-tonal and ambient sensitive reversing alarms	<p>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 out of hours work.</p> <p>The use of ambient sensitive alarms that adjust output relative to the ambient noise level will be considered.</p>	Construction contractor	Detailed design/pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV10	Minimise disturbance arising from delivery of goods to construction sites	<p>Loading and unloading of material/deliveries is to occur as far as possible from sensitive receivers.</p> <p>Select site access points and roads as far as possible away from sensitive receiver.</p> <p>Dedicated loading/unloading areas will be shielded if close to sensitive receivers.</p> <p>Delivery vehicles will be fitted with straps rather than chains for unloading, wherever possible.</p> <p>Avoid or minimise these out of hours movements where possible.</p>	Construction contractor	Detailed design/pre-construction	Additional safeguard
NV11	Engine compression braking	<p>Limit the use of engine compression brakes at night and in residential areas.</p> <p>Vehicles will be are fitted with a maintained Original Equipment Manufacturer exhaust silencer or a silencer that complies with the National Transport Commission's 'in-service test procedure' and standard.</p>	Construction contractor	Detailed design/pre-construction	Additional safeguard
NV12	Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources will be enclosed or shielded where feasible and reasonable while ensuring that the occupational health and safety of workers is maintained. Appendix D of AS 2436:2010 lists materials suitable for shielding.	Construction contractor	Detailed design/pre-construction	Additional safeguard
NV13	Additional noise mitigation measures	Where the NML at a receiver is exceeded after the standard mitigation measures from Section 4.5.1 of the noise and vibration assessment (Appendix M) have been implemented, additional noise mitigation measures as per Appendix C of the CNVG will be considered.	Construction contractor	Detailed design/pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV14	Vibration	Dilapidation surveys should be conducted at all residential and other sensitive receivers identified to be impacted by vibration from the construction site.	Construction contractor	Construction	Additional safeguard
NV15	At property treatments	<p>Further investigation of all reasonable and feasible noise control options will be required as a result of any exceedances of the applicable NCG noise criteria.</p> <p>All reasonable and feasible noise mitigation treatments would be considered for the affected receivers as part of the proposal to reduce traffic noise levels at residences to within the applicable noise limits.</p> <p>Additional acoustic design survey to confirm if the level of acoustic treatment within the 30 newly-developed buildings is already equivalent to the acoustic treatments that would be offered by the NMG and the Roads and Maritime At-Receiver Noise Treatment Guideline before committing to offering additional at-property treatment.</p>	Roads and Maritime	Detail design	Additional safeguard
NV16	Operation sleep disturbance	A more detailed sleep disturbance assessment will be carried out during the detailed design stage for the operation impacts of the proposal.	Roads and Maritime	Detail design	Additional safeguard
Non-Aboriginal heritage					
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	Core standard safeguard NA1 Section 4.10 of QA G36 Environment Protection
NAH2	Centennial Park, Moore Park, Queens	As the proposal will involve temporary construction activities within the curtilage of the SHR listed 'Centennial Park, Moore Park, Queens Park', a section 57 notification would be submitted to, and approved by, the	Roads and Maritime	Detailed design/pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
	Park and Moore Park Heritage Conservation Area	Heritage Council of NSW prior to construction of the proposal commencing.			
NAH3	Non-Aboriginal heritage	The <i>Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
NAH4	Site induction	All personnel working on site will receive training to ensure awareness of requirements of the NAHMP and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of identified non-Aboriginal heritage items.	Contractor	Pre-construction	Additional standard safeguard
NAH5	Non-Aboriginal heritage	The City of Sydney and Sydney Water will be consulted as part of this development process to ensure any requirements about their heritage assets are identified and incorporated into the proposal.	Roads and Maritime	Detailed design/pre-construction	Additional safeguard
NAH6	Non-Aboriginal heritage	Materials chosen for signage, kerbs, and other road infrastructure would be compatible and complimentary to the surrounding heritage character of the study area.	Roads and Maritime	Detailed design/pre-construction	Additional safeguard
NAH7	Protect Non-Aboriginal cultural heritage items	The protection of areas of identified non-Aboriginal cultural heritage value that are to be retained will occur in accordance with the adopted NAHMP.	Contractor	Pre-construction	Additional standard safeguard
NAH8	Non-Aboriginal heritage	To prevent inadvertent impacts to significant heritage listed buildings and fabric during construction temporary protection zones (TPZ) such as	Roads and Maritime	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<p>fencing or protective padding will be placed around the following heritage items:</p> <ul style="list-style-type: none"> • 'Former Sydney Water Pumping Station & Valve House Incl. Interiors' • 'Electrical substation' • 'Former Electricity Substation No 152 including interiors' • 'Terrace group "Gordon Terrace" including interiors' • 'Electrical Substation no. 174' • 'Terrace group including interiors' • 'Moore Park View Hotel Including Interior' • 'Former ACI AGM Building including interior'. 		and construction	
NAH9	Impact to trees	TPZ would be established around trees within the construction footprint to prevent inadvertent impacts to these items during construction. This would require advice from a qualified arborist.	Contractor	Pre-construction and construction	Additional safeguard
NAH11	Impact to trees	In order to prevent inadvertent impacts to trees listed on the City of Sydney <i>Register of Significant Trees</i> (2013) and those located within the SHR curtilage for the Centennial Park, Moore Park, Queens Park and Moore Park Heritage Conservation Area located closed to the proposal, Tree Protection Zones (TPZ) would be established while construction of the proposal is in progress. This would require advice and management from a qualified arborist	Contractor	Pre-construction and construction	Additional safeguard
NAH11	Sandstone kerbs	Sandstone kerbs will be retained where possible. If retention is not possible, they will be reinstated or replaced as per guidelines set out by the City of Sydney's <i>Sydney Streets Technical Specifications: Kerb and Gutter</i> booklet (2013).	Roads and Maritime	Pre-construction and construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NAH12	Archaeological potential in ancillary Site 2	<p>A section 139 excavation permit covering the works at construction compound (ancillary Site 2) would be obtained from the NSW Heritage Division. An ARD would be prepared to support the permit application. The ARD would outline archaeological management zoning for the proposal area.</p> <p>Test excavations would be designed to investigate the presence of intact structural remains and/or artefact deposits associated with the former building within the construction footprint and subsequently provide management advice for the proposal.</p> <p>If intact remains associated with artefact bearing deposits were identified during the test excavations a section 140 permit for salvage excavations or archaeological monitoring and recording may be required prior to the work commencing.</p>	Roads and Maritime	Detailed design/pre-construction/construction	Additional safeguard
NAH13	Archaeological potential in ancillary Site 2 and Site 3	An ARD and excavation methodology would also be prepared to manage requirements for the potential remains of former tram tracks along Botany Road (Site 2), Elizabeth Street (Site 3) and South Dowling Street. These have been assessed as 'works' containing local significance. Impacts to works do not require approval under the <i>Heritage Act 1977</i> , although they would be managed according to their significance.	Contractor	Construction	Additional safeguard
NAH14	Archaeology	If relics are discovered during construction work must stop work immediately and the Heritage Council of NSW contacted, in accordance with section 146 of the <i>Heritage Act 1977</i> . The proponent must also inform the either the City of Sydney, Randwick City Council or Centennial Park and Moore Park Trust depending on where the item is found.	Contractor	Construction	Additional safeguard
NAH15	Vibration impacts to heritage items	All feasible and reasonable vibration mitigation measures will be implemented to avoid vibration impacts to:	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> Former Sydney Water Pumping Station & Valve House Including Interiors and Waterloo Water Pumping Station Terrace group 'Gordon Terrace' 1–25 John Street Electrical Substation no. 174 Terrace group including interiors Electrical substation Moore Park View Hotel. <p>Mitigation measures will include using construction methods with reduced levels of vibration, and monitoring of vibration levels in accordance with the noise and vibration assessment (refer to Section 6.2.5 and Appendix M).</p>			
Aboriginal heritage					
AH1	Aboriginal heritage	<p><i>The Standard Management Procedure - Unexpected Heritage Items</i> (Roads and Maritime, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of Non-Aboriginal origin are encountered.</p> <p>Work will only re-commence once the requirements of that Procedure have been satisfied.</p>	Contractor	Detailed design / pre-construction	Section 4.10 of QA G36 <i>Environment Protection</i>
Hydrology and flooding					
HF1	Soil and water	A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will identify all reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.	Contractor	Detailed design/pre-construction	Core standard safeguard SW1 Section 2.1 of QA G38 Soil

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
					and Water Management
HF2	Soil and water	<p>A site specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the Soil and Water Management Plan</p> <p>The Plan will include 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.</p>	Contractor	Detailed design/Pre-construction	<p>Core standard safeguard SW2</p> <p>Section 2.2 of QA G38 Soil and Water Management</p>
HF3	Dewatering	<p>During detailed design, additional geotechnical investigations will be completed and will include an investigation of groundwater depth.</p> <p>Should excavation dewatering be required during construction, water will be tested and managed appropriately. For example this may involve disposal to an appropriately licensed facility. These measures will be managed under the CEMP.</p> <p>Confirmation of whether or not a licence under the <i>Water Management Act 2000</i> as defined under the <i>Aquifer Interference Policy</i> is required will be confirmed prior to any dewatering activity commencing.</p>	Contractor	Construction	Additional safeguard
HF4	Minimise risks to water quality and soil impacts	Stockpiles will be designed, established, operated and decommissioned in accordance with the <i>RTA Stockpile Site Management Guideline 2011</i> .	Contractor	Construction	Additional standard safeguard SW9
HF5	Hydrology and flooding	<p>The following measures will be implemented during detailed design:</p> <ul style="list-style-type: none"> Flooding impacts will be reassessed for both the construction and operation of the proposal as refinements to the road and drainage designs are expected to change the flooding impacts 	Roads and Maritime	Detail design	Additional Safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> The flood risk to vehicles will also be reassessed and the design adjusted to provide safe flow conditions for vehicles, if possible Stormwater survey received from ongoing site investigations should be reviewed against the stormwater data incorporated in the baseline model, and any necessary updates made to the model for both the baseline and design case scenarios The identified mitigation measures and strategies will be reviewed and reassessed in light of any changes to the flooding impacts resulting from the detailed design Flood impacts of the proposal on the probable maximum flood event will be carried out to ensure no adverse flood impacts due to the proposal. 			
HF6	Impacts to building	Any residual flood impacts to properties after implementing feasible mitigation works will be quantified. Floor level survey data will be collected to quantify impacts to above-floor flooding of properties located along the proposal that may be impacted.	Roads and Maritime	Detail design	Additional safeguard
HF7	Flooding	The CEMP will consider the potential impacts of temporary construction works including trenching, solid traffic barriers and stockpiles on overland flows and incorporate appropriate management measures to address these issues.	Contractor	Construction	Additional safeguard
Landscape character and visual impact					
VI1	Landscape character and visual impact	<p>An Urban Design Plan will be prepared to support the final detailed project design and implemented as part of the CEMP.</p> <p>The Urban Design Plan will present an integrated urban design for the project, providing practical detail on the application of design principles</p>	Contractor	Detailed design / pre-construction	Core standard safeguard UD1

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<p>and objectives identified in the environmental assessment. The Plan will include design treatments for:</p> <ul style="list-style-type: none"> • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements including retaining walls, bridges and noise walls • Pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • Fixtures such as seating, lighting, fencing and signs • Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage • Procedures for monitoring and maintaining landscaped or rehabilitated areas. <p>The Urban Design Plan will be prepared in accordance with relevant guidelines, including:</p> <ul style="list-style-type: none"> • <i>Beyond the Pavement urban design policy, process and principles</i> (Roads and Maritime, 2014) • <i>Landscape Guideline</i> (RTA, 2008) • <i>Bridge Aesthetics</i> (Roads and Maritime 2012) • <i>Noise Wall Design Guidelines</i> (RTA, 2006) • <i>Shotcrete Design Guideline</i> (RTA, 2005). 			
VI2	Work sites	Project work sites, including construction areas and supporting facilities (such as storage compounds and offices) will be managed to minimise visual impacts, including appropriate storage of equipment, parking, stockpile screening and arrangements for the storage and removal of rubbish and waste materials.	Construction contractor	Construction	Core standard safeguard UD2

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
VI3	Impact on street trees	A detailed tree assessment of trees impacted by the proposal and detailed tree survey will be carried out prior to construction based on the detail design.	Contractor	Detailed design / pre-construction	Additional safeguard
VI4	Vegetation and landscaping	<p>Where feasible and reasonable:</p> <ul style="list-style-type: none"> Street trees will be retained along Euston Road, McEvoy Street and Lachlan Street All new tree plantings would be planted in the vegetated area at the front of the foot path. Existing trees next to the kerb would be retained and the path moved away from the kerb where possible. Where space constraints are present next to existing buildings, the wider footpaths would be adjusted to allow for a vegetated verge next to the kerb Elevated walkways and wider footpaths will be constructed where paths have the potential to impact on trees or tree roots New street trees will be planted in accordance with the City of Sydney's Street Tree Masterplan where possible and in consultation with the City of Sydney. Tree species to be used include: <ul style="list-style-type: none"> <i>Ficus microcarpa var. hillii</i> (Hill's Fig) <i>Waterhousea floribunda</i> 'Green Avenue' (Weeping Lilly Pilly) <i>Lophostemon confertus</i> (Brush Box) <i>Platanus acerifolia</i> (London Plane). 	Roads and Maritime / Contractor	Detailed design/pre-construction	Additional safeguard
VI5	Visual impact of work sites	Compound and ancillary facilities will be decommissioned and the sites rehabilitated to their existing condition or as otherwise agreed with the landowner on completion of works.	Contractor	Construction	Additional safeguard
VI6	Light spill from work sites	Temporary lighting will be located and designed to avoid light spill into residential properties and identified sensitive receptors.	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
VI7	Green infrastructure	Consideration will be given to Water Urban Sensitive Design (WSUD) initiatives, given it's the proposals low lying condition of the area and propensity for flooding.	Roads and Maritime	Detailed design / pre-construction	Additional safeguard
Contaminated land					
CL1	Contaminated land	<p>A Contaminated Land Management Plan will be prepared in accordance with the <i>Guideline for the Management of Contamination</i> (Roads and Maritime, 2013) and implemented as part of the CEMP. The plan will include, but not be limited to:</p> <ul style="list-style-type: none"> • Capture and management of any surface runoff contaminated by exposure to the contaminated land • Further investigations required to determine the extent, concentration and type of contamination, as identified in the detailed site investigation (Phase 2) • Management of the remediation and subsequent validation of the contaminated land, including any certification required • Measures to ensure the safety of site personnel and local communities during construction. 	Contractor	Detailed design / Pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>
CL2	Contaminated land	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Roads and Maritime Environment Manager and/or EPA.	Contractor	Construction	<p>Core standard safeguard C2</p> <p>Section 4.2 of QA G36 <i>Environment Protection</i></p>
CL3	Contaminated land	Where excavation works are required within low risk areas, the CEMP will detail contingency measures. These measures will manage potentially	Contractor	Detailed design/Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<p>contaminated materials if materials are suspected and/or encountered during construction activities.</p> <p>In these low risk areas, no testing is required unless contamination is suspected or encountered during construction activities. The process for the testing and/or management of suspected or encountered contamination in these lower risk areas will be addressed in the CEMP.</p>			
CL4	Accidental spill	A site specific emergency spill plan will be developed, and include spill management measures in accordance with the Roads and Maritime <i>Code of Practice for Water Management</i> (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 Roads and Maritime and EPA officers).	Contractor	Detailed design/Pre-construction	<p>Core standard safeguard C3</p> <p>Section 4.3 of QA G36 Environment Protection</p>
CL5	Contaminated land	If potentially contaminated materials (including asbestos) are suspected and/or encountered during construction, these will be managed by an unexpected finds protocol incorporated in the CEMP.	Contractor	Construction	Additional safeguard
CL6	Removed of excavated material	An in-situ waste classification will be carried out in accordance with the NSW <i>Waste Classification Guidelines</i> (EPA, 2004) for any materials which are excavated and removed from the proposal area.	Contractor	Construction	Additional safeguard
CL7	Acid Sulfate Materials Management Plan	An ASS investigation within Class 3 areas where works are proposed to extend one metre below ground level. If ASS are confirmed, an appropriate ASS management plan will be prepared and implemented as part of the CEMP. The Plan will be prepared in accordance with the Roads and Maritime's <i>Guidelines for the Management of Acid Sulfate Materials</i> (RTA, 2005).	Contractor	Pre-construction	Additional safeguard
CL8	Temporary construction facilities	Should contamination exist within the temporary construction facilities of Sites 1 to 5, contamination will need to be managed under a CEMP	Contractor	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<p>during establishment of the facilities, and during operation to reduce risk of contamination to site users.</p> <p>Should deeper excavations which encounter groundwater occur within temporary construction facility Site 4, volatile compounds (if present) may need to be managed during construction activities.</p> <p>Should temporary site buildings need to be established within Site 4 during construction, buildings should be raised above ground level to mitigate any potential exposure from volatile compounds which may be present as a result of VOC contaminated groundwater beneath the site.</p>			
Property, land use and socio-economic					
SE1	Communications	<p>A Communication Plan (CP) will be prepared 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):</p> <ul style="list-style-type: none"> • Mechanisms to provide details and timing of proposed activities to affected residents, including changed traffic and access conditions • Contact name and number for complaints. <p>The CP will be prepared in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008).</p>	Construction contractor	Detailed design / pre-construction	Core standard safeguard SE3
SE2	Emergency vehicle access	<p>Consultation will be completed with emergency services prior to construction commencing to ensure adequate emergency vehicle access is maintained for the duration of construction.</p> <p>Regular updates will be provided to emergency services about any changes to local access during construction.</p> <p>Access for emergency vehicles will be maintained at all times during construction. Any site-specific requirements will be determined in consultation with the relevant emergency services agency</p>	Construction contractor	Pre-construction and construction	Core standard safeguard SE

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SE3	Property acquisition	All property acquisition will be carried out in accordance with the <i>Land Acquisition Information Guide</i> (Roads and Maritime, 2012) and the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	Roads and Maritime project manager	Pre-construction and construction	Core standard safeguard SE3
SE4	Impacts to residents	Consultation will be carried out with potentially affected residences prior to the commencement of and during works in accordance with the <i>Community Involvement and Communications Resource Manual</i> (RTA, 2008). Consultation will include but not be limited to door knocks, newsletters or letter box drops providing information on the proposal, working hours and a contact name and number for more information or to register complaints.	Construction contractor	Construction	Additional standard safeguard SE4
SE5	Impacts on viability of businesses	Consultation will occur with impacted businesses to identify appropriate management strategies to avoid or minimise impacts on access and operations. This will include consideration of measures such as additional signage and alternative access arrangements.	Construction contractor	Construction	Additional standard safeguard SE6
SE6	Impacts on businesses	Maintain pedestrian and vehicle access to businesses near to construction works for the duration of construction and consult with local communities and motorists about changes to local access and any temporary changes required. Where temporary changes are required to property access, these will be identified in consultation with the property owner and business owner. Ensure businesses near to construction works remain visible during construction. Where screening of construction works is required that may potentially impact on visibility of businesses, this will be established in consultation with affected business owners with signage provided.	Construction contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		The Communication Plan will identify any specific mitigation and management measures in consultation with business owners to address any unexpected issues that arise during construction.			
SE7	Impacts on businesses	Roads and Maritime will engage local businesses affected by the proposal to identify strategies to support them.	Roads and Maritime	Construction	Additional safeguard
SE8	Impacts on businesses	Roads and Maritime will review loading zones along the alignment during detailed design. Roads and Maritime to investigate options for mitigating the loss of off-street parking for businesses through reconfiguration of remaining space at 102-112 McEvoy Street.	Roads and Maritime	Detailed design	Additional safeguard
Biodiversity					
B1	Biodiversity	A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</i> (RTA, 2011) and implemented as part of the CEMP. It will include, but not be limited to: <ul style="list-style-type: none"> Plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas Requirements set out in the <i>Landscape Guideline</i> (RTA, 2008) Pre-clearing survey requirements Procedures for unexpected threatened species finds and fauna handling Protocols to manage weeds and pathogens. 	Contractor	Detailed design / pre-construction	Core standard safeguard B1 Section 4.8 of QA G36 <i>Environment Protection</i>

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B2	Minimise risks to native flora and fauna during construction	A pre-construction check of native flora and fauna species and habitat will be conducted in accordance with the <i>Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects</i> . Biodiversity management measures identified during the pre-construction check will be incorporated into the CEMP Flora and Fauna Management Plan.	Contractor	Pre-construction and construction	Core standard safeguard B2
B3	Biodiversity	Measures to further avoid and minimise the construction footprint and native vegetation or habitat removal will be investigated during detailed design and implemented where practicable and feasible.	Contractor	Detailed design / pre-construction	Core standard safeguard B3
B4	Protect native flora and fauna, minimise edge effects and avoid inadvertent impacts	All personnel working on site will receive training to ensure awareness of requirements of the Flora and Fauna Management Plan and relevant statutory responsibilities. Site-specific training will be given to personnel when working in the vicinity of areas of identified biodiversity value that are to be protected.	Contractor	Construction	Core standard safeguard B4
B5	Unexpected threatened species	Consistent with the Biodiversity Guidelines - <i>Protecting and managing biodiversity on RTA projects</i> , and any specific requirements of the approved Flora and Fauna Management Plan, an unexpected finds procedure will be implemented in the event that a threatened species or ecological community that had not been identified and assessed by the REF is unexpectedly encountered during the construction process.	Contractor	Construction	Core standard safeguard B5
B6	Protect native flora and fauna, minimise edge effects and avoid inadvertent impacts	Consistent with the approved Flora and Fauna Management Plan: <ul style="list-style-type: none"> The limits of clearing within the construction site will be delineated using appropriate signage and barriers, identified on site construction drawings and during construction staff induction Vegetation and habitat features to be retained, such as hollow-bearing trees, will be clearly identified and protected by suitable fencing, signage or markings. 	Contractor	Construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B7	Fauna handling	<p>Consistent with the Biodiversity Guidelines - <i>Protecting and managing biodiversity on RTA projects</i>, and any specific requirements of the approved Flora and Fauna Management Plan, management arrangements will be implemented to ensure safe fauna handling. As a minimum that will include:</p> <ul style="list-style-type: none"> • Fauna handling being carried out by appropriately licenced ecologists or wildlife carers • Liaison with local animal rescue agency, wildlife carer group or vet to establish agreed arrangements for fauna rescue or injured animal assistance • Induction information for construction staff. 	Contractor	Construction	Additional safeguard
B8	Minimise weed, pest species and pathogen risks	<p>Weed, Pest Species and Pathogen Management Consistent with the <i>Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects</i>, and any specific requirements of the approved Flora and Fauna Management Plan, management arrangements will be implemented to manage environmental risks associated with weeds, pest species and pathogens. As a minimum that will include:</p> <ul style="list-style-type: none"> • Completion of a site weed assessment and, if necessary, based on the assessment outcomes, a weed management plan • Implementation of appropriate weed control methods and weed disposal • Implementation of appropriate hygiene protocols where there are potential or known pathogen risks. 	Contractor	Construction	Additional safeguard
Other					
O1	Topography, geology and soils	<p>Spoil and fill management measures will be prepared and implemented as part of the CEMP. The Plan will identify the locations of spoil and fill stockpiles, sources of imported fill, and methods to re-use or dispose of excess or unsuitable spoil material including estimated volumes and disposal sites.</p>	Contractor	Pre-construction	Additional safeguard

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
O2	Air quality	<p>An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to:</p> <ul style="list-style-type: none"> • Potential sources of air pollution • Air quality management objectives consistent with any relevant published EPA and/or OEH 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 <i>Environment Protection</i>
O3	Waste	<p>A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:</p> <ul style="list-style-type: none"> • Measures to avoid and minimise waste associated with the project • Classification of wastes and management options (re-use, recycle, stockpile, disposal) • 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. <p>The WMP will be prepared taking into account the <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> (Roads and Maritime, 2014) and relevant Roads and Maritime Waste Fact Sheets.</p>	Contractor	Detailed design / pre-construction	Section 4.2 of QA G36 <i>Environment Protection</i>
O4	Existing condition of ancillary sites	Prior to land being used for ancillary construction purposes (compounds, storage, parking, etc) a pre-construction land assessment will be carried out to identify the presence of any pre-existing wastes.	Contractor	Pre-construction	Additional safeguard W2

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		The assessment will be prepared in accordance with the Roads and Maritime's <i>Environmental Procedure - Management of Wastes on Roads and Maritime Services Land</i> . Where the land is privately owned, a copy of the assessment will be provided to the landowner.			
O5	Waste and resource use	Waste materials (such as soils and aggregates) obtained from the project and to be exported for use on another construction site or project will be sampled and managed in accordance with relevant resource recovery orders and exemptions as issued by the NSW EPA.	Contractor	Construction	Additional safeguard
O6	Waste and resource use	A Spoil Management Strategy will be developed prior to the commencement of construction and implemented during construction. The strategy will identify spoil disposal site(s) and describe the management of spoil on-site and during off-site transport.	Contractor	Pre-construction Construction	Additional safeguard
O7	Utilities	Prior to the commencement of works: <ul style="list-style-type: none"> The location of existing utilities and relocation details will be confirmed following consultation with the affected utility owners If the scope or location of proposed utility relocation works falls outside of the assessed proposal scope and footprint, further assessment will be undertaken. 	Contractor	Detailed design / pre-construction	Core standard safeguard U1
O8	Hazards and risk management	A Hazard and Risk Management Plan (HRMP) will be prepared and implemented as part of the CEMP. The HRMP will include, but not be limited to: <ul style="list-style-type: none"> Details of hazards and risks associated with the activity Measures to be implemented during construction to minimise these risks Record keeping arrangements, including information on the materials present on the site, material safety data sheets, and personnel trained and authorised to use such materials 	Contractor	Detailed design / pre-construction	Core standard safeguard HAZ1

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> A monitoring program to assess performance in managing the identified risks Contingency measures to be implemented in the event of unexpected hazards or risks arising, including emergency situations. <p>The HRMP will be prepared in accordance with relevant guidelines and standards, including relevant Safe Work Australia Codes of Practice, and EPA or Office of Environment and Heritage publications.</p>			
Cumulative impacts					
C1	Cumulative impacts from construction of multiple projects	The CEMP will be updated as required to address cumulative impacts as other projects/activities begin. This will include a process to review and update mitigation measures as new work begins or if complaints are received.	Contractor	Pre-construction/ Construction	Additional safeguard
C2	Cumulative traffic and access impacts	The Traffic Management Plan will be prepared in consultation with Roads and Maritime's Sydney Coordination Office, City of Sydney and Randwick City councils	Contractor	Pre-construction	Additional safeguard
C3	Cumulative construction impacts	The Consultation Plan will include consultation with proponents of projects in the vicinity of the proposal: <ul style="list-style-type: none"> Increase awareness of construction timeframes and impacts Coordinate impact mitigation and management (eg respite periods). 	Road and Maritime	Pre-construction/ Construction	Additional safeguard
C4	Cumulative flooding impacts	The flood model for the proposal will be updated to incorporate changes to design levels and updated flood model impacts associated with the New M5 designs.	Road and Maritime	Pre-construction	Additional safeguard

7.3 Licensing and approvals

Before the proposal can proceed, additional licences and/or approvals would be required to be obtained from the relevant authorities, as listed in **Table 7-2** below.

Table 7-2 Summary of licensing and approvals required

Instrument	Requirement	Timing
<i>Roads Act 1993</i>	ROL would need to be obtained as necessary prior to construction commencing.	Prior to start of the activity.
Permission from private landowners and residents	Permission from private landowners and residents must be obtained to access proposal work sites. This would likely be obtained through temporary lease arrangements or land acquisition.	Before accessing any private property.
POEO Act (s43)	EPL for scheduled activities (road construction/extractive activities/crushing, grinding or separating waste processing or storage) from the EPA.	Prior to start of the activity.
<i>Heritage Act 1977 (section 57)</i>	As the proposal would involve temporary construction activities within the curtilage of the SHR listed 'Centennial Park, Moore Park, Queens Park', a section 57 notification would be submitted to, and approved by, the Heritage Council of NSW prior to construction of the proposal commencing.	Prior to start of the activity.
<i>Heritage Act 1977 (section 139 or section 140)</i>	<p>A section 139 excavation permit covering the works at located at ancillary Site 2 would be obtained from the Heritage Council of NSW.</p> <p>An ARD would be prepared to support the permit application. The ARD would outline archaeological management zoning for the proposal area. If intact remains associated with artefact bearing deposits are identified during the test excavations a section 140 permit for salvage excavations or archaeological monitoring and recording may be required prior to the work commencing.</p>	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 Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

8.1 Justification

The Alexandria to Moore Park road corridor is one of the primary southern CBD bypass routes connecting the northern extents of the Princes Highway and inner West Sydney suburbs with the M1 Motorway and major eastern transport connections such as Anzac Parade and Alison Road.

The main intersections with the north south arterial roads located along this east west corridor are already congested and long delays are common during peak periods at South Dowling Street and Botany Road. The intersections at Bourke Street and Elizabeth Street are also currently close to capacity. Congestion is expected to increase due to a substantial growth in residential population of more than 40,000 people within 1.5 kilometres of the corridor over the next 15 years. The opening of major transport projects as well as planned urban renewal developments at Green Square, Waterloo and Redfern would also contribute to increases in congestion. If conditions remain as they are, by average speed of traffic across the network is forecast to reduce by 20 to 30 percent in peak periods by 2021.

Road safety is already an issue on the corridor with crash rates much higher than would normally be expected for a road of this type in Sydney. The likelihood of congestion related crashes – in particular rear ends – would increase as traffic grows.

Major bus routes cross the corridor at Elizabeth Street, Bourke Street and Botany Road and demand from more commuters moving into the urban renewal precincts along the corridor would further highlight performance issues. The average speed for buses along the corridor is forecast to decrease to 15 per cent in peak periods by 2021 with bus routes along Botany Road, Bourke Street and Elizabeth Street experiencing an increase in delays and a drop in reliability.

The proposal is needed to improve intersection performance, safety and trip reliability along the road corridor and at priority intersections where the proposal is located as well as support substantial nearby urban renewal and transport projects with better amenity and safety for customers.

The proposal responds to the NSW Government's aim to deliver a fully integrated transport network in the Sydney CBD over a 20-year period. The focus of the proposal is to improve traffic flow and road safety along the proposal and at priority intersections in the southern CBD fringe suburbs of Alexandria, Waterloo and Moore Park and interface with other transport. The proposal would support local urban renewal initiatives planned in the area including such developments as Green Square by providing access and improved road infrastructure.

The proposal, as described in this REF, best meets the proposal objectives. However, it would still result in some potential impacts during construction and operation including construction noise and vibration, changes to access and traffic delays during construction, land acquisition and property adjustments, visual and landscape changes, loss of street parking and established street trees with community value, heritage impacts and flooding impacts. The remaining potential impacts would be managed and minimised by mitigation measures during construction and operation of the proposal.

8.1.1 Social factors

As documented in **Section 6.9**, the proposal would have some negative social impacts as a result of the disturbance and change that would occur during construction. The combined effect of construction noise,

dust, local access changes, and general disturbance caused by construction activity, construction traffic and machinery movements would result in a general loss of amenity for residents, motorists, workers and others who live near the proposal area and those who visit the proposal area on a regular basis.

Communities in the study area have been subject to construction impacts from other transport and urban development projects in the study area, including CSELR project, New M5 and urban redevelopment, such as Green Square Precinct and Ashmore Precinct. Early construction works for the Sydney Metro project also commenced in 2017, with surface works at Waterloo to occur from 2021 to 2023

The proposal would also require removal of about 49 planted street trees, comprised of 25 mature trees and 24 immature trees which have community value.

The proposal requires strip acquisition of three privately owned commercial properties of between one and 29 square metres. There are a further nine landscaping lots that are already in public ownership that would be required.

Operation of the proposal would result in a change in availability of on-street parking during daytime periods (including on weekends) to around 252 existing parking spaces along Euston Road and McEvoy Street including time restricted parking, disabled parking, mail zones, and no parking morning and afternoon restrictions to establish a time limited Clearway. Of the 252 parking spaces, existing peak time parking restrictions are in place on Monday to Friday for 228 parking spaces. The proposal would also impact on 28 off-street parking spaces. Local side streets at three locations at the western end of the proposal have limited capacity to accommodate the loss of on-street and off-street parking, however the use of commercial car parks located near the areas of impact may assist in reducing potential impacts.

An assessment of the impacts on businesses due to the loss of on-street and off-street parking determined that overall, there is expected to be a low impact to businesses located along Euston Road and McEvoy Street from proposed changes in parking conditions, with businesses in many locations along the proposal likely to experience either no or negligible impacts to customer or staff parking due to the proposal. The exception to this includes four locations where moderate to high impacts on businesses are expected. This includes businesses:

- On the northern side of Euston Road between Maddox Street and Harley Street
- On the northern side of McEvoy Road between Harley Street and Loveridge Street
- On the southern side of McEvoy Road / Euston Road between Bowden Avenue and Maddox Street
- On the southern side of McEvoy Road between Stokes Avenue and Bowden Street.

Mitigation measures, such as providing more localised timed parking on nearby side streets, would be considered to minimise the loss of on-street parking from clearways. Roads and Maritime would investigate options to re-instate some of the off-street public parking spaces at 102-112 McEvoy Street, Alexandria as part of detailed design.

During operation, the proposal and adjoining road upgrades would have a positive cumulative impact on access within the study area by reducing travel times and congestion, improving road safety and supporting nearby urban renewal and transport projects such as the CSELR and New M5.

8.1.2 Biophysical factors

The proposal involves widening an existing main road corridor. The proposal would therefore minimise the amount of land required for its development and the consequential impact on adjoining land uses, watercourses and ecosystems. The proposal would generally follow the existing topography and would thereby minimise the need for earthworks.

The proposal would impact on about 49 planted trees comprised of 25 mature trees and 24 immature trees. All 25 mature trees all are native trees and are considered to be foraging resources that provide potential habitat for the Powerful Owl (*Ninox strenua*) and for the Grey-headed Flying Fox (*Pteropus poliocephalus*).

The proposal may also impact indirectly on three *Eucalyptus scoparia* (Wallangarra White Gum) identified as endangered the BC Act and vulnerable under the EPBC Act.

Assessments of Significance (refer to **Appendix P**) have been carried out for threatened species impacted by the proposal and found that the proposal is unlikely to have a significant impact.

The proposal would require excavation, removal of vegetation, disturbance of soils and the construction of road surfaces and drains, which may lead to exposed soils, sediment entering waterways and the degradation of water quality.

A Stage 1 Contamination Assessment was completed for the proposal. The investigation identified 12 potential AElS within or in near to the proposal area that may present a low to moderate contamination risk to the proposed construction activities. The Stage 1 Contamination Assessment recommended that further contamination investigations are recommended prior to construction at areas of moderate risk within the proposal area.

The proposal has some long-term negative biophysical impacts that would be managed through implementation of the mitigation measures proposed in **Section 7.2**. However, these impacts of the proposal would be outweighed by the long-term benefits once the proposal is operational through improvements to the transport network in and around the proposal area.

8.1.3 Economic factors

The proposal would be constructed largely within the existing road corridor, with minimal land acquisition required. The upgrade of an existing road corridor would minimise long-term disruption and economic impacts on residents, businesses and motorists.

The proposal would deliver long-term economic benefits on its own and as part of a number of strategic plans for infrastructure investment in Sydney's CBD including the *State Infrastructure Strategy 2012–2038* (Infrastructure New South Wales, 2017) and the *Future Transport Strategy 2056* (Transport for NSW, 2018).

The proposal would improve safety by providing additional turning lanes at priority intersections and by enhancing pedestrian and cycle facilities within the proposal area. The proposal would support local urban renewal initiatives planned in the area including such developments as Green Square by providing access and improved road infrastructure.

8.1.4 Public interest

The public interest is best served through the equitable distribution of resources, and investment in public infrastructure that fulfils the needs of the majority. The proposal represents a cost-efficient investment in public infrastructure that would maximise the long-term social and economic benefits, while minimising the long-term negative impacts on communities and the environment. By improving local and regional transport facilities, the proposal would better enable the movement of people, goods and services.

The proposal would result in some short-term impacts on amenity, accessibility and transport efficiency during construction. In addition, some clearing of planted street trees would be required to construct the proposal, that have community value. Mitigation measures including planting new street trees would be implemented to manage and reduce short term construction impacts.

There are a number of Commonwealth and State strategic plans that specifically refer to the significance of the improving safety and efficiency in roads in Sydney's CBD. The proposal is consistent with these strategic plans including the *State Infrastructure Strategy 2012–2032* and the *Future Transport Strategy 2056* (Transport for NSW, 2018) among others.

Consequently, the impacts of the proposal would be outweighed by the long-term benefits once the proposal is operational. As a result, the proposal is considered to be in the public interest.

8.2 Objects of the EP&A Act

The objects of the EP&A Act, and how these are addressed in the proposal, are presented in **Table 8-1**.

Table 8-1 How the proposal addresses the objects of the EP&A Act

Object	Comment
<p>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.</p>	<p>The proposal would also improve the social and economic welfare of the community by improving the road safety within the proposal area.</p> <p>However, during construction the community and businesses in the area would be likely to experience temporary traffic delays, noise and air quality and visual amenity impacts. In addition, the proposal would remove about 49 planted trees comprised of 25 mature trees and 24 immature trees.</p> <p>The proposal requires strip acquisition of three privately owned commercial properties of between one and 29 square metres. There are a further nine landscaping lots that are already in public ownership that would be required.</p> <p>Operation of the proposal would result in a change in availability of on-street parking during daytime periods (including on weekends) to around 252 existing parking spaces along Euston Road and McEvoy Street including time restricted parking, disabled parking, mail zones, and no parking morning and afternoon restrictions to establish a time limited Clearway. Of the 252 parking spaces, existing peak time parking restrictions are in place on Monday to Friday for 228 parking spaces. The proposal would also impact on 28 off-street parking spaces. The loss of on-street and off-street parking would result in moderate to high impacts to businesses located:</p> <ul style="list-style-type: none"> • On the northern side of Euston Road between Maddox Street and Harley Street • On the northern side of McEvoy Road between Harley Street and Loveridge Street • On the southern side of McEvoy Road / Euston Road between Bowden Avenue and Maddox Street • On the southern side of McEvoy Road between Stokes Avenue and Bowden Street. <p>The proposal design, impact, safeguards and management measures detailed in this REF allow for the proper management, development and conservation of natural and artificial resources.</p>
<p>1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.</p>	<p>Ecologically sustainable development is considered in Sections 8.2.1 to Section 8.2.4 below and Chapter 6 of this REF has considered relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.</p>

Object	Comment
1.3(c) To promote the orderly and economic use and development of land.	The proposal has considered anticipated growth within the area and where appropriate included consideration of it in the design, including the urban renewal initiatives including Green Square and the Lachlan Precinct
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the project.
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.	<p>The proposal would occur within a modified and disturbed environment. The proposal would impact on about 49 planted trees, comprised of 25 mature trees and 24 immature trees. All of the 254 mature trees all are native trees and are considered to be foraging resources that provide potential habitat for the Powerful Owl (<i>Ninox strenua</i>) and for the Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>). The proposal may also impact indirectly on three Eucalyptus scoparia (<i>Wallangarra White Gum</i>) identified as endangered the BC Act and vulnerable under the EPBC Act.</p> <p>Assessments of Significance (refer to Appendix P) have been carried out for threatened species impacted by the proposal and found that the proposal is unlikely to have a significant impact.</p>
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	<p>An assessment of impacts to Aboriginal heritage has been undertaken in accordance with the requirements of the PACHCI, refer to Section 6.4.</p> <p>The assessment concluded that the proposal would not impact any registered AHIMS sites. The proposal would only impact areas that have been assessed as of very low to low Aboriginal archaeological sensitivity, therefore impacts to Aboriginal objects are therefore considered unlikely.</p>
1.3(g) To promote good design and amenity of the built environment.	Not relevant to the project.
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 project.
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 project.
1.3(j) To provide increased opportunity for community	Consultation with the community and relevant government agencies was carried out during the development of the proposal. There would be further opportunities for the public to comment on the proposal during

Object	Comment
participation in environmental planning and assessment.	the exhibition of the REF. Details of this consultation can be found in Chapter 5 .

8.2.1 The precautionary principle

This principle states: “if there are threats of serious or irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation”.

Evaluation and assessment of alternatives and options have aimed to reduce the risk of serious and irreversible impacts on the environment. Stakeholder consultation considered issues raised by stakeholders and a range of specialist studies were carried out for key issues to provide accurate and impartial information to assist in the evaluation of options.

The concept design has sought to minimise impacts on the amenity of the study area while maintaining engineering feasibility and safety for all road users. A number of safeguards are proposed to minimise potential impacts. These safeguards would be implemented during construction and operation of the proposal. No safeguards have been postponed out of any lack of scientific certainty.

A CEMP would be prepared before construction starts. This requirement would ensure the proposal achieves a high level of environmental performance. No mitigation measures or management mechanisms would be postponed because of a lack of information.

8.2.2 Intergenerational equity

The principle states: “the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations”.

The proposal would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations.

The proposal would cater for future population and traffic growth in the region. The proposal would benefit future generations by helping to addressing the future increases in traffic volumes and traffic congestion associated with movement of traffic in Sydney’s CBD fringe area. While the proposal would have some adverse impacts, they are not considered to be of a nature or extent that would result in disadvantage to any specific section of the community or to future generations.

Should the proposal not proceed, the principle of intergenerational equity may be compromised, as future generations would inherit a lower LoS associated with the performance of Alexandria to Moore Park road corridor.

8.2.3 Conservation of biological diversity and ecological integrity

This principle states: “the diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival”.

The environment in which the proposal would be carried out is a modified urban environment. A thorough assessment of the existing local environment was carried out to identify and manage any potential impacts of the proposal on local biodiversity. The proposal would result in the removal of about 49 planted trees comprised of 25 mature trees and 24 immature trees. All of the 25 mature trees are native and are considered to be foraging resources that present suitable foraging habitat for the Powerful Owl (*Ninox strenua*) and for the Grey-headed Flying Fox (*Pteropus poliocephalus*). The proposal may also impact indirectly on three *Eucalyptus scoparia* (Wallangarra White Gum) identified as endangered the BC Act and vulnerable under the EPBC Act. Assessments of Significance (refer to **Appendix P**) have been carried out for threatened species impacted by the proposal and found that the proposal is unlikely to have a significant

impact. The concept design has been developed to minimise, wherever possible, direct impacts on biodiversity. Opportunities to further minimise these impacts would be explored during detailed design.

With implementation of the recommended management measures and safeguards, the proposal would not have a significant impact on biological diversity and ecological integrity. A biodiversity assessment and appropriate site-specific safeguards are provided in **Section 6.7**.

8.2.4 Improved valuation, pricing and incentive mechanisms

This principle is defined as:

improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

This REF has examined the environmental consequences of the proposal and identified mitigation measures to manage the potential for adverse impacts. The requirement to implement these mitigation measures would result in an economic cost to Roads and Maritime, and would increase the capital and operating costs of the proposal. The costs of the generation and management of waste and pollution would be captured in any waste disposal charges for construction activities. This signifies that environmental resources have been given appropriate valuation.

The concept design has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the proposal is being developed with an environmental objective in mind.

8.3 Conclusion

The proposal to upgrade four intersections and introduce clearways between the Euston Road/Maddox Street intersection in Alexandria and the Anzac Parade/Alison Road/Dacey Avenue intersection in Moore Park 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 Federal EPBC Act.

A number of 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 potential impacts during construction and operation including construction noise and vibration, changes to access and traffic delays during construction, land

acquisition and property adjustments, visual and landscape changes, loss of street parking and established street trees with community value, heritage impacts and flooding impacts. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts.

The proposal would improve intersection performance, safety and trip reliability within the Alexandria to Moore Park corridor as well as support substantial nearby urban renewal and transport projects with better amenity and safety for customers. 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 and approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or 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 or the environment of Commonwealth land within the meaning of the EPBC Act. A referral to the Australian Department of the Environment and Energy 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.



Tina Donovan

Senior Environment Scientist
Jacobs
Date: 27/11/2019

I have examined this review of environmental factors and accept it on behalf of Transport for New South Wales.



Richard Hine
Director Program management
Greater Sydney Project Office
Date: 27/11/2019

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- Transport for NSW, 2018. *Future Transport Strategy 2056*.

Terms and acronyms used in this REF

Term / Acronym	Description
AAPT	Telecommunications Company Broadband Internet, Data, Voice, Cloud, Network and Carrier
ABS	Australian Bureau of Statistics
Aboriginal ASR	<i>Alexandria to Moore Park Project Aboriginal Archaeological Survey Report (PACHCI Stage 2)</i>
ACHA	Aboriginal Cultural Heritage Assessment
ACHAR	Aboriginal Cultural Heritage Assessment Report
AEI	Areas of Environmental Interest
AEP	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. In this study AEP has been used consistently to define the probability of occurrence of flooding. It is to be noted that design rainfalls used in the estimation of design floods up to and including 100 year ARI (ie. 1% AEP) events was derived from 1987 Australian Rainfall and Runoff. The following relationships between EY, AEP and ARI applies to this study (Australian Rainfall and Runoff, 2016).

Term / Acronym	Description				
	Frequency Descriptor	EY	AEP (%)	AEP (1 in x)	ARI
	Very frequent	12			
		6	99.75	1.002	0.17
		4	98.17	1.02	0.25
		3	95.02	1.05	0.33
		2	86.47	1.16	0.50
		1	63.2	1.58	1.00
	Frequent	0.69	50.00	2	1.44
		0.5	39.35	2.54	2.00
		0.22	20.00	5	4.48
		0.2	18.13	5.52	5.00
	Infrequent	0.11	10.00	10.00	9.49
		0.05	5.00	20	20.0
		0.02	2.00	50	50.0
		0.01	1.00	100	100
	Rare	0.005	0.50	200	200
		0.002	0.20	500	500
		0.001	0.10	1000	1000
		0.0005	0.05	2000	2000
	Extremely Rare	0.0002	0.02	5000	5000
					
	Extreme			PMP	
AFG	Aboriginal Focus Group				
AHD	Australian height datum				
AHIMS	Aboriginal Heritage Information Management system				
AHIP	Aboriginal Heritage Impact Permit				
AQMP	Air Quality Management Plan				
ARD	Archaeological Research Design				
ASRIS	Australian Soil Resource Information System				
ASS	Acid sulfate soils				
BC Act	<i>Biodiversity Conservation Act 2016</i>				
BAR	Biodiversity Assessment Report				

Term / Acronym	Description
BDAR	Biodiversity Development Assessment Report
CBD	Central business district
CEMP	Construction environmental management plan
CFI	Continuous Flow Intersection
CHL	Commonwealth Heritage List
CLM Act	Contaminated Land Management Act 1997
CMA	Catchment Management Area
CMP	Conservation Management Plan
CO	Carbon monoxide
CNVG	Construction Noise and Vibration Guideline
CNVMP	Construction Noise and Vibration Management Plan
CSELR	Central Business District (CBD) and South East Light Rail
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Development application
Direct impact	Direct impacts occur through direct interaction of an activity with the environment. For biodiversity direct impacts include the removal of trees/vegetation by the proposal
DCE	Dichloroethene
DCP	Development Control Plan
DPI	Department of Primary Industries
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i> . Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i> . Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
EPL	Environmental protection licence
EIA	Environmental impact assessment
EIS	Environmental impact statement
ENMM	Environmental Noise Management Manual
EPA	Environment Protection Authority
EPL	Environmental protection licence

Term / Acronym	Description
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
EY	Exceedances per Year. The number of times an event is likely to occur or be exceeded within any given year.
FDA	Full Depth Asphalt
GIS	Geographic information system
GML	General mass limit
GPR	Ground penetrating radar
HBM	Heavily Bound Material
HML	Higher mass limit
HRMP	Hazard and Risk Management Plan
ICNG	Interim Construction Noise Guideline
ICOMOS	Australia International Council on Monuments and Sites
Indirect impact'	Indirect impacts on the environment are those that are not a direct result of the proposal and are often produced away from or as a result of a complex impact pathway. Indirect impacts are also known as secondary impacts. For biodiversity indirect impacts include construction machinery compacting the soil over tree roots or accidental damage by construction machinery.
kV	Kilovolt
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
ITS	Intelligent Transport Systems
LALC	Local Aboriginal Land Council
LEP	Local Environment Plan
LGA	Local Government Area
LoS	Level of Service
L _{eq}	Equivalent sound pressure level – the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring. The sound weighting of the noise measurement is commonly added, for example LA _{eq} or LC _{eq} .
mbgl	Metre below ground level
MPs	Member of Parliament
MNES	Matters of national environmental significance

Term / Acronym	Description
NAHMP	Non-Aboriginal Heritage Management Plan
NBN	National broadband Network
NCA	Noise Catchment Areas
NCG	Noise Criteria Guideline
NES	Matters of national environmental significance under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> .
NHL	National Heritage List
NMG	Noise Mitigation Guideline
NML	Noise Management Levels
NPW	<i>National Parks and Wildlife Act 1974 (NSW)</i>
NSW	New South Wales
NTAR	National Trust of Australia
NVMP	Noise and Vibration Management Plan
NO ₂	Nitrogen dioxide
OEH	Office of Environment and Heritage
OOH	Out of hours
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PAD	Potential Aboriginal Deposit
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PMF	Probable maximum flood
POEO	<i>Protection of the Environment Operations Act 1997</i>
PPV	Peak particle velocity
QA Specifications	Specifications developed by Roads and Maritime (formerly Roads and Maritime Services) for use with road work and bridge work contracts led by Roads and Maritime.
RBL	Rating background levels
REF	Review of Environmental Factors
RNE	Register of the National Estate
RNP	Road Noise Policy
ROL	Road Occupancy License
RSD	Regionally significant development

Term / Acronym	Description
RTA	Roads and Traffic Authority
SCEP	Stakeholder and Community Engagement Plan
SES	State Emergency Service
SHI	State Heritage Inventory
SHR	State Heritage Register
SIS	Species Impact Statement
SLR DJV	Sydney Light Rail Design Joint Venture
SMZ	Selected Material Zone
SOHI	Statement of Heritage Impact
SSD	State significant development
SSI	State significant infrastructure
STFM	Sydney Traffic Forecasting Model
SWMP	Soil and Water Management Plan
TCE	Trichloroethene
TCS	Traffic control signals
TMC	Transport Management Centre
TMP	Traffic Management Plan
TPZ	Temporary Protection Zones
TSP	Total suspended solids
VDV	Vibration dose values
VIS	Vegetation information system
VISSIM	Microscopic multi-modal traffic flow simulation software package used for traffic modelling
VOC	Volatile organic compounds
VPD	Vehicles per day
VSR	Vehicle speed ratio
WHL	World Heritage List
WMP	Waste Management Plan
WSUD	Water Urban Sensitive Design

Appendix A

Concept design drawings including Stage 1 and the ultimate concept design

Appendix B

Existing infrastructure

Table B-10-1 Intersections within the Euston Road corridor

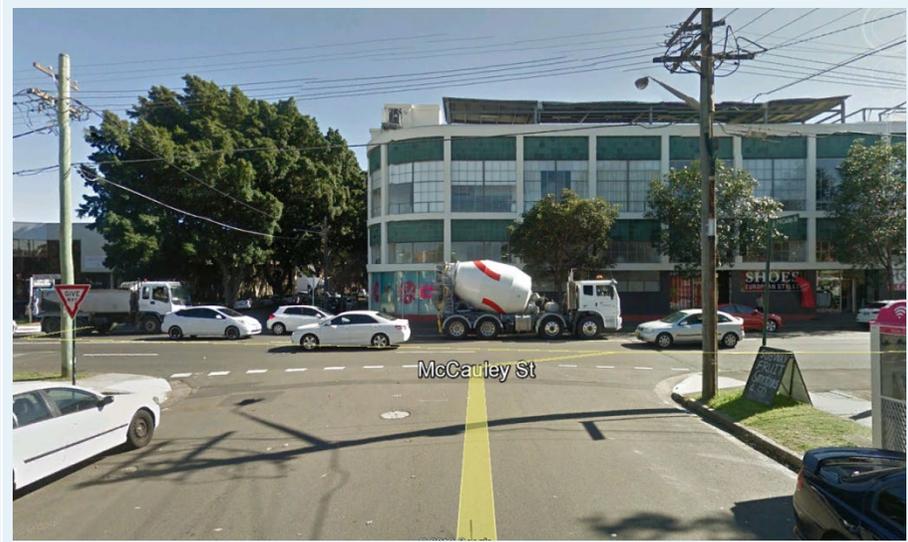
Intersection	Description	Image
The Maddox Street/Euston Road intersection	<p>Located at the western extent of the proposal, this four legged intersection is controlled by traffic signals.</p> <p>Maddox Street has two lanes in each direction and has a 50 kilometres per hour speed limit. There are traffic controlled pedestrian crossing facilities on all four legs of the intersection. Right turns are banned from both sides of Euston Road to Maddox Street.</p> <p>Image looking south-west from Maddox Street (Source: Google Earth Pro).</p>	
Euston Road/Bunnings Access Road intersection	<p>Located on the south-eastern side of Euston Road around 215 metres from the western extent of the proposal. The intersection is a three legged T-intersection that is controlled by traffic signals. The Bunnings access road includes two entry and two exit lanes. The two exit lanes are separated by a raised traffic island with a pedestrian crossing across the left turn exit lane. Traffic controlled pedestrian crossing facilities are located on all three legs of the intersection.</p> <p>Image looking north-east from the western side of Euston Road (Source: Google Earth Pro).</p>	

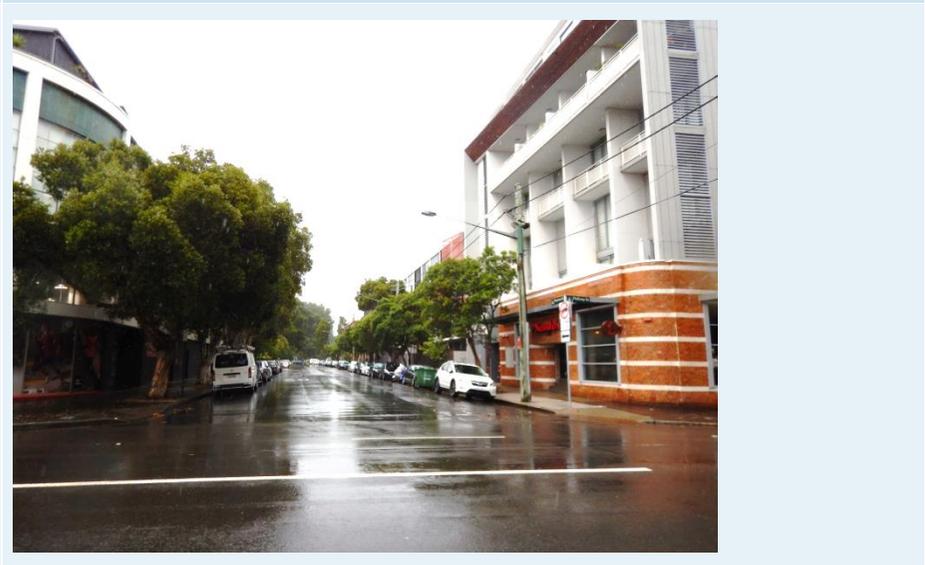
Intersection	Description	Image
<p>Harley Street/Euston Road/McEvoy Street intersection</p>	<p>Located to the north-west of Euston Road around 220 metres from the western extent of the proposal and five metres north of the Euston Road and Bunnings Access Road intersection. Harley Street is comprised of one lane in each direction that is separated by small raised traffic island and allows for left in and left out movements only. The intersection is governed by give way rules with priority for vehicles on Euston Road. The traffic island has a break to cater for pedestrians to cross the road and Harley Street has a 50 kilometres per hour speed limit.</p> <p>Image looking west from the eastern side of Euston Road.</p>	

Table B-10-2 Intersections along McEvoy Street

Intersection	Description	Image
<p>Bowden Street/McEvoy Street intersection</p>	<p>This T-intersection is located around 420 metres from the western extent of the proposal on the south-eastern side of McEvoy Street. Bowden Street is comprised of one lane in each direction and all traffic movements are permitted into and out of the street. A designated two-way cycle lane is located on the southern side of Bowden Street before it merges into the shared pedestrian cycle pathway located on the eastern side of McEvoy Street. Bowden Street has a 50 kilometres per hour speed limit. The intersection is governed by give way rules with priority for vehicles on McEvoy Street.</p> <p>Image looking north-east from McEvoy Street (Source: Google Earth Pro).</p>	

Intersection	Description	Image
Fountain Street/McEvoy Street intersection	<p>Located around 520 metres from the start of the western extent of the proposal on the north-western side of McEvoy Street, this T-intersection is controlled by traffic signals. Fountain Street is comprised of two lanes in each direction and all traffic movements are permitted into and out of the street. There are traffic controlled pedestrian crossing facilities on all three legs of the intersection. Fountain Street has a 50 kilometres per hour speed limit.</p> <p>Image looking north-west from the south-eastern side of the intersection.</p>	 A photograph of a T-intersection on a wet day. The view is from the south-eastern side looking north-west. A multi-story building with orange and grey facade is on the right. A silver car is in the foreground, and other vehicles are visible further down the street. A utility pole stands in the middle ground.
Stokes Avenue/McEvoy Street intersection	<p>This T-intersection is located around 680 metres from the western extent of the proposal on the southern side of Euston Road. Stokes Avenue is comprised of one lane in each direction and all traffic movements are permitted into and out of the street. Stokes Avenue is a no through road with a 50 kilometres per hour speed limit. The intersection is governed by give way rules with priority for vehicles on McEvoy Street.</p> <p>Image looking north-east from the south-western side of the intersection.</p>	 A photograph of a street intersection on a wet day. The view is from the south-western side looking north-east. The street is lined with trees and parked cars. A silver car is in the foreground, and other vehicles are visible further down the street. A utility pole stands in the middle ground.

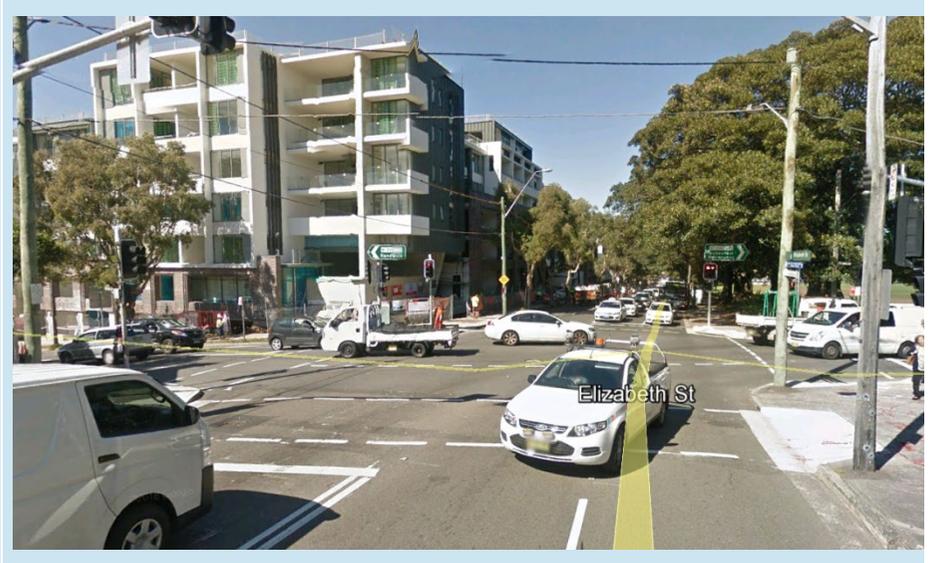
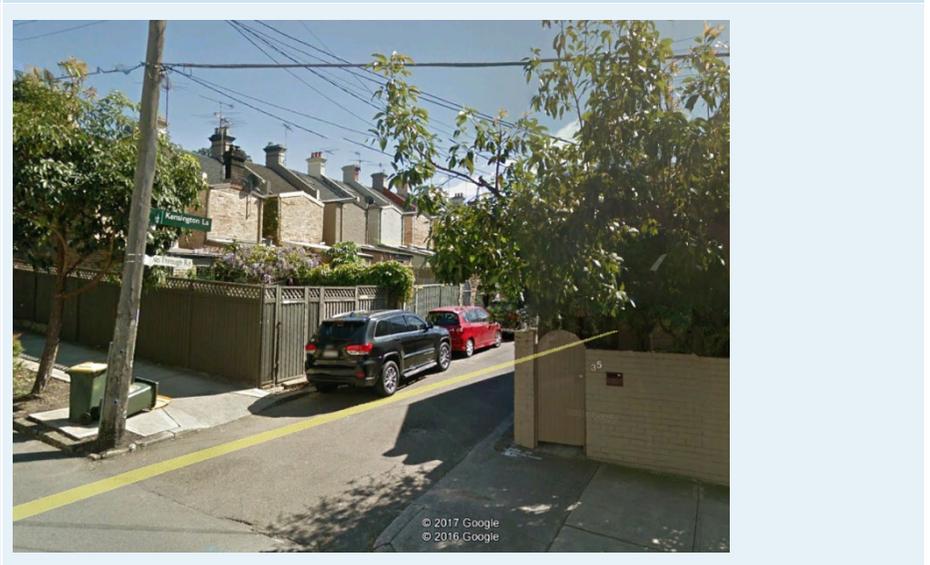
Intersection	Description	Image
<p>Loveridge Street/McEvoy Street intersection</p>	<p>This T-intersection is located around 740 metres from the western extent of the proposal on the northern side of Euston Road. Loveridge Street is comprised of one lane in each direction and all traffic movements are permitted into and out of the street. The intersection is governed by give way rules with priority for vehicles on McEvoy Street. Loveridge Street has a 50 kilometres per hour speed limit.</p> <p>Image looking north-east towards the Loveridge Street/McEvoy Street intersection from the south-western side of McEvoy Street.</p>	
<p>McCauley Street/McEvoy Street intersection</p>	<p>This T-intersection is located around 760 metres from the western extent of the proposal on the southern side of Euston Road. McCauley Street is comprised of one lane in each direction and all traffic movements are permitted into and out of the street. The intersection is governed by give way rules with priority for vehicles on McEvoy Street. McCauley Street has a 50 kilometres per hour speed limit.</p> <p>Image is looking north to McEvoy Street from McCauley Street (Source: Google Earth Pro).</p>	

Intersection	Description	Image
McCauley Lane/McEvoy Street intersection	<p>This T-intersection is located around 810 metres from the western extent of the proposal on the southern side of Euston Road. McCauley Lane is comprised of one lane and all traffic movements are permitted into and out of the street. The intersection is governed by give way rules with priority for vehicles on McEvoy Street. McCauley Lane has a 50 kilometres per hour speed limit.</p> <p>Image is looking south-west from McEvoy Street (Source: Google Earth Pro).</p>	 A satellite-style aerial view of a T-junction. A single-lane road, McCauley Lane, runs diagonally from the bottom-left towards the top-right, meeting a wider road, McEvoy Street, at a right angle. The intersection is marked with yellow painted lines. On the left side of the junction, there is a white building with a large sign that says "OUTLET SALE" and "70% off". A person is walking on the sidewalk near the building. The street name "McCauley Ln" is labeled on the road, and "McEvoy St" is labeled on the road to the right. A copyright notice "© 2016 Google" is visible at the bottom of the image.
Brennan Street/McEvoy Street intersection	<p>This T-intersection is located around 830 metres from the western extent of the proposal on the northern side of Euston Road. Brennan Street is comprised of one lane in each direction and all traffic movements are permitted into and out of the street. The intersection is governed by give way rules with priority for vehicles on McEvoy Street. Brennan Street has a 50 kilometres per hour speed limit.</p> <p>Image looking northerly from the southern side of McEvoy Street.</p>	 A street-level photograph looking north along Brennan Street. The road is wet, reflecting the sky and buildings. On the left side, there are lush green trees and a white van parked. On the right side, there is a multi-story building with a distinctive red and white facade. The street is lined with parked cars on both sides. The sky is overcast.

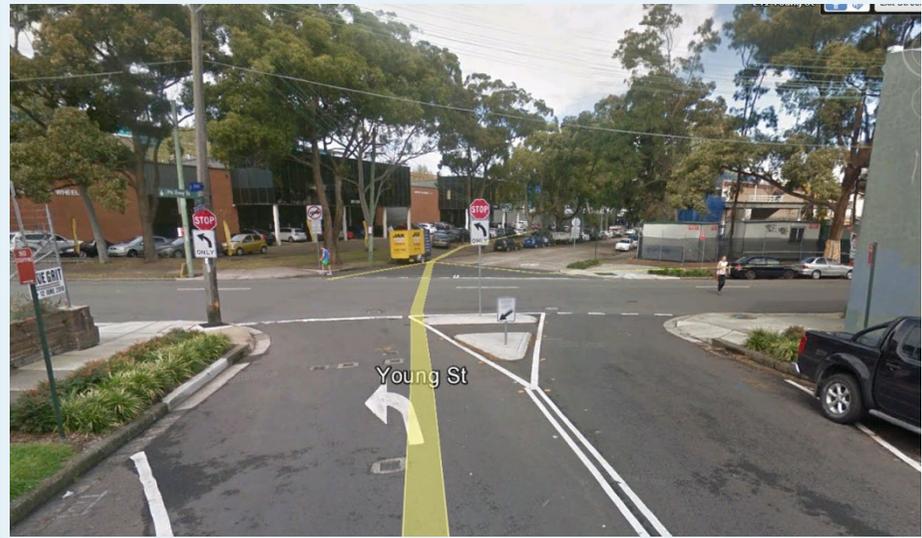
Intersection	Description	Image
<p>Hiles Street/McEvoy Street intersection</p>	<p>This T-intersection is located around 850 metres from the western extent of the proposal on the southern side of Euston Road. Hiles Street is comprised of one lane in each direction and all traffic movements are permitted into and out of the street. The intersection is governed by give way rules with priority for vehicles on McEvoy Street. Hiles Street has a 50 kilometres per hour speed limit.</p> <p>Image looking in an easterly direction from the western side of Hiles Street on McEvoy Street.</p>	
<p>Hiles Lane/McEvoy Street intersection</p>	<p>This T-intersection is located around 900 metres from the western extent of the proposal on the southern side of Euston Road. Hiles Lane is comprised of one lane in each direction and all traffic movements are permitted into and out of the street. The intersection is governed by give way rules with priority for vehicles on McEvoy Street. Hiles Lane has a 50 kilometres per hour speed limit.</p> <p>Image looking in a northerly direction towards McEvoy Street.</p>	

Intersection	Description	Image
<p>Wyndham Street/McEvoy Street intersection</p>	<p>Located around 930 metres from the western extent of the proposal, this four legged intersection is controlled by traffic signals. Wyndham Street is comprised of one lane in both directions. The northern leg of Wyndham Street has a second lane for southbound traffic that is 40 metres long. The southern leg of Wyndham Street does not have line markings for a second northbound exit lane however there is no parking for 60 metres from the intersection thus providing capacity for two lanes in this location. All traffic movements are permitted with the exception of right hand turns from the north-east bound lanes of McEvoy Street into Wyndham Street. Wyndham Street has a 50 kilometres per hour speed limit. Traffic controlled pedestrian crossing facilities are located across all four legs of the intersection.</p> <p>Image looking in a southerly direction from Wyndham Street (Source Google Earth Pro).</p>	
<p>Botany Road/McEvoy Street intersection</p>	<p>Located around 1030 metres from the western extent of the proposal, this four legged intersection is controlled by traffic signals. Botany Road is comprised of two lanes in both directions. Right hand turns are not permitted from any legs of the intersection except for southbound traffic on Botany Road turning right (westbound) into McEvoy Street. Botany Road has a 50 kilometres per hour speed limit. Traffic controlled pedestrian crossing facilities are located on all four legs of the intersection.</p> <p>Image is looking in an easterly direction from the western leg of McEvoy Street (Source Google Earth Pro).</p>	

Intersection	Description	Image
<p>George Street/McEvoy Street intersection</p>	<p>This T-intersection is located around 1210 metres from the western extent of the proposal on the southern side of McEvoy Street and is controlled by traffic signals. George Street is a one-way street catering for southbound traffic. George Street has a 50 kilometres per hour speed limit and is identified as a cycle route between Green Square and the CBD. A designated on road cycle way with a lane in each direction is provided on the south-western side of George Street and is separated from the road traffic by raised traffic islands and parked cars. The cycle route continues to the north of the intersection where George Street becomes a no through road. The area on the northern leg of George Street is paved and includes raised gardens with pathways provided for pedestrians and cyclists. Traffic controlled pedestrian crossing facilities are located on all three legs of the intersection.</p> <p>Image is looking northbound along George Street (Source Google Earth Pro).</p>	 <p>The image shows an aerial view of the intersection of George Street and McEvoy Street. A prominent yellow-painted cycle lane runs north-south along George Street. The intersection is controlled by traffic signals. A dark car is visible on the right side of the road. The surrounding area includes trees and buildings. A 'George St' label is overlaid on the image.</p>
<p>Pitt Street/McEvoy Street intersection</p>	<p>This T-intersection is located around 1340 metres from the western extent of the proposal on the southern side of McEvoy Street and is controlled by traffic signals. Pitt Street is comprised of one southbound lane and two northbound lanes. All traffic movements are permitted into and out of the street. Pitt Street has a 50 kilometres per hour speed limit. Traffic controlled pedestrian crossing facilities are located on all three legs of the intersection.</p> <p>Image is looking south across McEvoy Street to Pitt Street.</p>	 <p>The image shows a street-level view of the intersection of Pitt Street and McEvoy Street. The road is wet, reflecting the sky. A modern, multi-story building with balconies is visible on the right side of the street. A large tree is on the left. A white van is driving away from the camera on Pitt Street.</p>

Intersection	Description	Image
Elizabeth Street/McEvoy Street intersection	<p>This four legged intersection is located around 1520 metres from the western extent of the proposal and is controlled by traffic signals. Elizabeth Street is comprised of two lanes in each direction and has a 50 kilometres per hour speed limit. A second lane is provided on the west and east bound lanes of McEvoy Street. This is a dedicated left hand turning lane on the eastern leg of McEvoy Street for southbound traffic. Right hand traffic movements are not permitted from either leg of McEvoy Street or the northbound leg of Elizabeth Street but are permitted from the southbound leg of Elizabeth Street. Traffic controlled pedestrian crossing facilities are located on all four legs of the intersection. There is a red light camera located on the western leg of McEvoy Street.</p> <p>Image is looking south from Elizabeth Street) (Source Google Earth Pro).</p>	
Kensington Lane/McEvoy Street intersection	<p>This T-intersection is located around 1560 metres from the western extent of the proposal on the northern side of McEvoy Street. Kensington Lane is comprised of one lane and is a no through road. The intersection is governed by give way rules with priority for vehicles on McEvoy Street and all traffic movements are permitted into and out of the lane. Kensington Lane has a 50 kilometres per hour speed limit.</p> <p>Image is looking north from McEvoy Street (Source Google Earth Pro).</p>	

Intersection	Description	Image
<p>Kensington Street/McEvoy Street intersection</p>	<p>This T-intersection is located around 1590 metres from the western extent of the proposal on the northern side of McEvoy Street. Kensington Street is comprised of one lane and is one-way road for northbound traffic. Kensington Street has a 50 kilometres per hour speed limit and vehicles over three tonnes are restricted from entry.</p> <p>Image is looking north from McEvoy Street to Kensington Street (Source Google Earth Pro).</p>	
<p>Hunter Street/McEvoy Street intersection</p>	<p>This T-intersection is located around 1630 metres from the western extent of the proposal on the southern side of McEvoy Street. Hunter Street is comprised of one lane in each direction and all traffic movements are permitted into and out of the street. The intersection is governed by give way rules with priority for vehicles on McEvoy Street. Hunter Street has a 50 kilometres per hour speed limit.</p> <p>Image is looking east from McEvoy Street.</p>	

Intersection	Description	Image
<p>Morehead Street/McEvoy Street intersection</p>	<p>This T-intersection is located around 1680 metres from the western extent of the proposal on the northern side of McEvoy Street. Morehead Street is comprised of one lane in each direction and all traffic movements are permitted into and out of the street. The intersection is governed by give way rules with priority for vehicles on McEvoy Street. Morehead Street has a 50 kilometres per hour speed limit.</p> <p>Image is looking east from McEvoy Street (Source Google Earth Pro).</p>	
<p>Young Street/McEvoy Street intersection</p>	<p>Is a four legged intersection located around 1760 metres from the western extent of the proposal on the southern side of McEvoy Street. Young Street is comprised of one lane in each direction and has a 50 kilometres per hour speed limit. The intersection is governed by give way rules with priority for vehicles on McEvoy Street. Only left in and left out movements are allowed on the northern leg of Young Street from and into McEvoy Street and the lanes are separated by a curved traffic island at the road junction. Right out and left out movements are permitted for northbound traffic on the southern leg of Young Street and right in and right out movements are permitted from McEvoy Street. No straight through movements are permitted on either leg of Young Street.</p> <p>Image is looking south showing the left in and left out traffic movements along the northern leg of Young Street (Source Google Earth Pro).</p>	

Intersection	Description	Image
Bourke Street/McEvoy Street intersection	<p>Is a T-intersection controlled by traffic signals located around 1840 metres from the western extent of the proposal at the end of McEvoy Street. Bourke Street is orientated in a north-south direction and is comprised of two lanes in each direction. All traffic movements are permitted into and out of the street. On the approach to Bourke Street a 30 metre left hand turning lane is provided. Bourke Street has a 60 kilometres per hour speed limit. Bourke Street is classified as an arterial road, representing a major north-south route for access into the CBD Fringe suburb of Surry Hills and the Sydney CBD further north.</p> <p>Image is looking east along McEvoy Street to the Bourke Street intersection (Source Google Earth Pro).</p>	

Table B-3 Intersections along Lachlan Street

Intersection	Description	Image
<p>Bourke Street/Lachlan Street intersection</p>	<p>This T-intersection is located around 1900 metres from the western extent of the proposal and is controlled by traffic signals. All traffic movements are permitted into and out of the street. Bourke Street is orientated in a north-south direction and is comprised of two lanes in each direction. All traffic movements are permitted into and out of the street. Bourke Street has a 60 kilometres per hour speed limit. Bourke Street is classified as an arterial road, representing a major north-south route for access into the CBD Fringe suburb of Surry Hills and the Sydney CBD further north.</p> <p>Image looking south from Bourke Street to the Lachlan Street/Bourke Street intersection (Source Google Earth Pro).</p>	
<p>Sam Sing Street/Lachlan Street intersection</p>	<p>This T-intersection is located around 2030 metres from the western extent of the proposal on the southern side of Lachlan Street. Sam Sing Street is comprised of one lane in each direction. Only left in and left out movements are permitted into and out of the street respectively. Lanes are separated at the road junction with a raised traffic island that has a break to cater for pedestrians to cross the road. The intersection is governed by give way rules with priority for vehicles on Lachlan Street. Sam Sing Street has a 50 kilometres per hour speed limit.</p> <p>Image looking south-east from Lachlan Street to the Sam Sing intersection (Source Google Earth Pro).</p>	

Intersection	Description	Image
<p>Gadigal Avenue/ Lachlan Street intersection</p>	<p>This T-intersection is located around 2160 metres from the western extent of the proposal on the northern side of Lachlan Street. Gadigal Avenue is comprised of one lane in each direction. All traffic movements are permitted at the intersection except for right hand turns from Gadigal Avenue. Three raised traffic islands are located at the road junction to control traffic movements. A 60 metre left turning lane is provided on the western approach for eastbound traffic and a 110 metre right turning lane is provided on the eastern approach for westbound traffic. A 30 metre No Standing zone is located across Lachlan Street to allow right turns into Gadigal Avenue during periods when the road is congested. The intersection is governed by give way rules with priority for vehicles on Lachlan Street. Gadigal Avenue has a 50 kilometres per hour speed limit.</p> <p>Image is looking west along Lachlan Street to the Gadigal Avenue intersection (Source Google Earth Pro).</p>	
<p>Amelia Street/Lachlan Street intersection</p>	<p>This T-intersection is located around 2230 metres from the western extent of the proposal on the southern side of Lachlan Street. Amelia Street is comprised of one lane in each direction however there is a street parking on both sides of the road causing it to narrow to one lane. The intersection is governed by give way rules with priority for vehicles on Lachlan Street. All traffic movements are permitted at the intersection. Amelia Street has a 50 kilometres per hour speed limit. A 16 metre no parking restriction is located across the entrance to Amelia Street to allow access to and from the road during periods when the road is congested.</p> <p>Image is looking south across Lachlan Street down Amelia Street (Source Google Earth Pro).</p>	

Intersection	Description	Image
<p>South Dowling Street/Lachlan Street/Dacey Avenue intersection</p>	<p>This four legged intersection is located around 2340 metres from the western extent of the proposal and is controlled by traffic signals. Lachlan Street forms the western leg, South Dowling Street forms the northern and southern legs and Dacey Avenue forms the eastern leg of the intersection. The northern leg of South Dowling Street includes a 90 metre right hand turning lane and a 50 metre left turning lane that provides access to Lachlan Street and Dacey Avenue respectively. The southern leg of South Dowling Street includes two 90 metre right turning lanes that provide access to Dacey Avenue. The kerbside through lane of the southern leg of South Dowling Street also allows for left turn movements into Lachlan Street. Dacey Avenue is comprised of two lanes in each direction at the intersection and includes an 80 metre right turning lane and a 90 metre left turning lane that provide access into South Dowling Street and Lachlan Street respectively. The left hand turning lanes located on Dacey Avenue and the northern leg of South Dowling Street are separated from the through lanes by raised traffic islands that provided pedestrian refuge. These two designated left turning lanes are not signalised, but controlled through give-way signs. Pedestrian crossings are located across these left turning lanes and traffic controlled pedestrian crossing facilities are located on all four legs of the intersection. South Dowling Street and Dacey Avenue both have a 60 kilometres per hour speed limit. All traffic movements are permitted at the intersection however vehicles over nine metres are not permitted to turn left from Lachlan Street into the northbound lanes of South Dowling Street.</p> <p>Image of the South Dowling Street, Lachlan Street and Dacey Avenue intersection (Source Google Earth Pro). Additional images of the intersection included in Table 2-4.</p>	 <p>An aerial photograph showing a complex four-legged intersection. The streets are South Dowling Street (north-south), Lachlan Street (west-east), and Dacey Avenue (east-west). The intersection is controlled by traffic signals. There are several buildings, including a large white industrial-style building on the north side. A green landscaped area with trees and a parking lot is visible on the east side. Numerous cars are visible on the roads, and the overall scene is captured from a high-angle perspective.</p>

Table B-4 Summary of intersections along Dacey Avenue

Intersection	Description	Image
<p>Supa Centa Access Road/Dacey Avenue intersection</p>	<p>This T-intersection is located around 2435 metres from the western extent of the proposal on the southern side of Dacey Avenue and is controlled by traffic signals. The Supa Centa Access Road is comprised of two entry and three exit lanes comprised of one right hand turning lane and two left turning lanes. No right hand turns are permitted into the Supa Centa Access Road from the eastbound lanes of Dacey Avenue.</p> <p>Image looking east from Dacey Avenue towards the intersection with the Supa Centa Access Road (Source Google Earth Pro).</p>	
<p>ES Marks Athletics Field Access Road/Dacey Avenue intersection</p>	<p>This T-intersection is located around 2435 metres from the western extent of the proposal on the southern side of Dacey Avenue. E.S Marks Athletics Field Access Road is comprised of one entry lane and one exit lane. A 65 metre left turning lane is provided for westbound traffic along Dacey Avenue. No right hand turns are permitted into the E.S Marks Athletics Field Access Road from the eastbound lanes of Dacey Avenue as there is a raised island separating the east and west bound traffic in this location.</p> <p>Image looking east from Dacey Avenue towards the intersection with the E.S Marks Athletics Field Access Road (Source Google Earth Pro).</p>	

Intersection	Description	Image
Moore Park Maintenance Depot Access Road/Dacey Avenue intersection	<p>This T-intersection is located around 2460 metres from the western extent of the proposal on the northern side of Dacey Avenue. Moore Park Maintenance Depot Access Road is comprised of one entry and one exit lanes. Access is from the eastbound lane left turning lane for the Anzac Parade/Alison Road/Dacey Avenue intersection. No right hand turns are permitted into the Moore Park Maintenance Depot Access Road from the westbound lanes of Dacey Avenue as there is a raised island separating the east and west bound traffic in this location.</p> <p>Image looking north from Dacey Avenue towards the intersection with the Moore Park Maintenance Depot Access Road (Source Google Earth Pro).</p>	

Appendix C

Parking assessment

Appendix D

Consultation and statutory consultation checklists

Infrastructure SEPP

Certain development types

Development type	Description	Yes / No	If 'yes' consult with	ISEPP clause
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No		ISEPP cl. 95A
Bus Depots	Does the project propose a bus depot?	No		ISEPP cl. 95A
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		ISEPP cl. 95A

Development within the Coastal Zone

Issue	Description	Yes / No / NA	If 'yes' consult with	ISEPP clause
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		ISEPP cl. 15A

Council related infrastructure or services

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Stormwater	Are the works likely to have a <i>substantial</i> impact on the stormwater management services which are provided by council?	No		ISEPP cl.13(1)(a)
Traffic	Are the works likely to generate traffic to an extent that will <i>strain</i> the capacity of the existing road system in a local government area?	Yes	City of Sydney	ISEPP cl.13(1)(b)
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a <i>substantial</i> impact on the capacity of any part of the system?	No		ISEPP cl.13(1)(c)
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a <i>substantial</i> volume of water?	No		ISEPP cl.13(1)(d)
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	Yes	City of Sydney	ISEPP cl.13(1)(e)

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
	management or control? If so, will this cause more than a <i>minor</i> or <i>inconsequential</i> disruption to pedestrian or vehicular flow?			
Road & footpath excavation	Will the works involve more than <i>minor</i> or <i>inconsequential</i> excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	Yes	City of Sydney	ISEPP cl.13(1)(f)

Local heritage items

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
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 <i>minor</i> or <i>inconsequential</i> ?	Yes	City of Sydney	ISEPP cl.14

Flood liable land

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a <i>minor</i> extent?	Yes	City of Sydney	ISEPP cl.15
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 Email: erm@ses.nsw.gov.au	ISEPP cl.15AA

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

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the <i>National Parks and Wildlife Act</i>	No	Office of Environment and Heritage	ISEPP cl.16(2)(a)

Issue	Potential impact	Yes / No	If 'yes' consult with	ISEPP clause
	1974, or on land acquired under that Act?			
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	Office of Environment and Heritage	ISEPP cl. 16(2)(b)
Aquatic reserves	Are the works adjacent to an aquatic reserve or a marine park declared under the <i>Marine Estate Management Act 2014</i> ?	No	Department of Industry	ISEPP cl.16(2)(c)
Sydney Harbour foreshore	Are the works in the Sydney Harbour Foreshore Area as defined by the <i>Sydney Harbour Foreshore Authority Act 1998</i> ?	No	Sydney Harbour Foreshore Authority	ISEPP cl.16(2)(d)
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	ISEPP cl.16(2)(f)
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	ISEPP cl.16(2)(g)
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 clause 5.15 of Lockhardt LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	Secretary of the Commonwealth Department of Defence	ISEPP cl. 16(2)(h)
Mine subsidence land	Are the works on land in a mine subsidence district within the meaning of the <i>Mine Subsidence Compensation Act 1961</i> ?	No	Mine Subsidence Board	ISEPP cl. 16(2)(i)

Appendix E

Urban design and landscape strategy and visual impact assessment

Appendix F

Construction staging

Table F-1 Zone 1: Fountain Street/McEvoy Street intersection construction staging

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
Preworks	Day	<ul style="list-style-type: none"> • Utilities – Relocate power infrastructure in the footpaths. 	No change.
Preworks	Night	<ul style="list-style-type: none"> • Utilities – Temporarily relocate power infrastructure • Civil – Install temporary traffic control signals (TCS) ducts and kelly blocks. 	One lane in each direction along McEvoy Street and two lanes in each direction along Fountain Street.
A	Day	<ul style="list-style-type: none"> • Traffic – set up traffic switch • Utilities – Relocate communications and power infrastructure • Drainage – construct new stormwater • Civil – Excavate old pavement and construct new pavement, rebuild kerb and pedestrian pathway. 	One eastbound lane and one westbound lane along McEvoy. A third lane is located in between the eastbound and westbound lanes and would be used for tidal traffic flow during peak periods. Fountain Street has one northbound lane and two south bound lanes.
A	Night (set-up 1)	<ul style="list-style-type: none"> • Traffic – set up traffic switch • Utilities – Relocate communications and power infrastructure • Drainage – construct new stormwater • Civil – Mill and fill and construct new pavement, rebuild kerb and pedestrian pathway. 	One lane in each direction along McEvoy Street and one lane in each direction along Fountain Street.
A	Night (set-up 2)	<ul style="list-style-type: none"> • Traffic – set up traffic switch • Utilities – Relocate communications and water infrastructure • Drainage – construct new stormwater • Civil – Mill and fill. 	One eastbound lane along McEvoy Street and one northbound lane and one southbound right turning lane along Fountain Street.
A	Night (set-up 3)	<ul style="list-style-type: none"> • Utilities – Relocate communications and water infrastructure 	One westbound lane along McEvoy Street and one lane in each direction along Fountain Street. The southbound lane only allows right hand turn movements at the McEvoy Street / Fountain Street intersection.
B	Day	<ul style="list-style-type: none"> • Traffic – set up traffic switch • Utilities – Relocate communications, gas and power infrastructure • Drainage – construct new stormwater 	One eastbound lane and one west bound lane along McEvoy. A third lane is located in between the eastbound and westbound lanes and would be

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
		<ul style="list-style-type: none"> Civil – rebuild kerb and build new pedestrian pathway. 	used for tidal traffic flow during peak periods. Fountain Street has one northbound lane and two south bound lanes.
B	Night (set-up 1)	<ul style="list-style-type: none"> Utilities – Relocate water, communications, gas and power infrastructure Drainage – construct new stormwater Civil – rebuild kerb and build new pedestrian pathway. 	One lane in each direction along McEvoy Street. One northbound and southbound lane along Fountain Street with provision for right and left turns into McEvoy Street from the southbound lane.
B	Night (set-up 2)	<ul style="list-style-type: none"> Utilities – Relocate communications, gas and power infrastructure Drainage – construct new stormwater Civil – construct new stormwater. 	One lane in each direction along McEvoy Street. One southbound lane from Fountain Street with provision for right and left turns into McEvoy Street.
B	Night (set-up 3)	<ul style="list-style-type: none"> Traffic - set up traffic switch Utilities - Relocate communications and power infrastructure Drainage – construct new stormwater Civil – remove old pavement and install new pavement. 	One westbound lane along McEvoy Street and one eastbound lane on McEvoy Street from the McEvoy Street/Fountain Street intersection. One southbound lane from Fountain Street with provision for right and left turns into McEvoy Street.
B	Night (set-up 4)	<ul style="list-style-type: none"> Traffic - set up traffic switch Utilities - Relocate communications, power and gas infrastructure. 	One eastbound lane along McEvoy Street and one northbound lane on Fountain Street.
B	Night (set-up 5)	<ul style="list-style-type: none"> Utilities - Relocate communications and power infrastructure Drainage – build stormwater. 	One eastbound lane along McEvoy Street and one southbound left turning lane on Fountain Street.
C	Day	<ul style="list-style-type: none"> Traffic - set up traffic switch Utilities – adjust sewage manholes Drainage – build new stormwater Civil – rebuild kerb and construct a new pedestrian pathway. 	One eastbound lane and one west bound lane along McEvoy. A third lane is located in between the eastbound and westbound lanes and would be used for tidal traffic flow during peak periods. Fountain Street has one northbound lane and two south bound lanes.
C	Night (set-up 1)	<ul style="list-style-type: none"> Drainage – build stormwater Civil – construct new pavement, rebuild kerb and new pedestrian pathways. 	One lane in each direction along McEvoy Street and one northbound lane along Fountain Street.

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
C	Night (set-up 2)	<ul style="list-style-type: none"> • Drainage – build stormwater. 	One westbound lane on McEvoy Street and one eastbound turning lane into Fountain Street and one northbound lane along Fountain Street.
C	Night (set-up 3)	<ul style="list-style-type: none"> • Utilities – exhume and relocate water pipes. 	One lane in each direction along McEvoy Street and Fountain Street.
D	Day	<ul style="list-style-type: none"> • Set up traffic switch. 	One eastbound lane and one west bound lane along McEvoy. A third lane is located in between the eastbound and westbound lanes and would be used for tidal traffic flow during peak periods. Fountain Street has one northbound lane and two south bound lanes.
D	Night (set-up 1)	<ul style="list-style-type: none"> • Utilities – adjust manhole for sewer and protect underground transmission line • Civil – construct stormwater, new pavement, rebuild kerb and new pedestrian pathways. 	One lane in each direction along McEvoy Street and Fountain Street.
D	Night (set-up 2)	<ul style="list-style-type: none"> • Civil – new pavement. 	One eastbound lane along McEvoy Street and one lane in each direction along Fountain Street
E	Day	<ul style="list-style-type: none"> • Set up traffic switch. 	One eastbound lane along McEvoy Street and one lane in each direction along Fountain Street
E	Night (set-up 1)	<ul style="list-style-type: none"> • Utilities – adjust manhole for sewer • Drainage – build stormwater and connect to existing stormwater culverts • Civil – construct median slab and rebuild kerb within median. 	One lane in each direction along McEvoy Street separated by a work zone. Two lanes in each direction along Fountain Street.
F	Day	<ul style="list-style-type: none"> • Traffic switch – clear all barriers. 	
F	Night (set-up 1)	<ul style="list-style-type: none"> • Civil – mill and re-sheet intersection • Final TCS works. 	One westbound lane along McEvoy Street and one turning lane into Fountain Street.

Table F-2 Zone 2: Botany Road/McEvoy Street intersection construction staging

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
Preworks	Night (set-up 1)	<ul style="list-style-type: none"> Utilities – Relocate energy infrastructure, energy cutover 	One lane in each direction
Preworks	Night (set-up 2)	<ul style="list-style-type: none"> Utilities – Relocate energy infrastructure, energy cutover 	One lane in each direction
Preworks	Night (set-up 3)	<ul style="list-style-type: none"> Civil – Kerb removal TCS – Install temporary TCS ducts and kelly blocks 	Two lanes in each direction on McEvoy Street. One direction in each direction on Botany Road.
A.1	Day	<ul style="list-style-type: none"> Traffic – Set up traffic switch Utilities – Exhume and relay water infrastructure, relocate communications infrastructure 	Two lanes in each direction on Botany Road. Three lanes operating on McEvoy Street.
A.2	Day	<ul style="list-style-type: none"> Civil – Remove kerb, construct new pavement and kerb 	Two lanes in each direction on Botany Road. Three lanes operating on McEvoy Street.
A	Night (Set-up 1)	<ul style="list-style-type: none"> Utilities – Relocate communications infrastructure, exhume and relay water infrastructure, communications cutover, gas cutover, pole removal Civil – Install permanent TCS, construct footpath Drainage – Build stormwater 	One lane in each direction
A	Night (set-up 2)	<ul style="list-style-type: none"> Utilities – Exhume and relay water infrastructure, inspect gas infrastructure and lower pressure, adjust sewer manhole Drainage – Build stormwater 	One lane in each direction on Botany Road and the southern leg of McEvoy Street. One lane operating northbound on the northern leg of McEvoy Street.
A	Night (set-up 3)	<ul style="list-style-type: none"> Utilities – Inspect gas infrastructure and lower pressure Drainage – Connect to existing stormwater, build stormwater Civil – Remove kerb, interface drain, construct pavement and kerb, construct footpath 	One lane in each direction on McEvoy Street. One westbound lane (eastern leg of Botany Street) operating on Botany Street. Two lanes operating on the western leg of Botany Street. Left hand turn only on the eastbound lane into McEvoy Street.
A	Night (set-up 4)	<ul style="list-style-type: none"> Utilities – Exhume and relay water infrastructure, inspect gas infrastructure and lower pressure 	One lane in each direction on McEvoy Street. One eastbound lane on Botany Road operating. Westbound lane on Botany Road operating to the east of McEvoy Street and right turn onto McEvoy Street at intersection.

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
A	Night (set-up 5)	<ul style="list-style-type: none"> Utilities – Exhume and relay water infrastructure, water infrastructure cutover, inspect gas infrastructure and lower pressure 	One lane in each direction on McEvoy Street. One lane in each direction on Botany Road with a right hand turning lane from Botany Road onto McEvoy.
B	Day	<ul style="list-style-type: none"> Traffic – Set up traffic switch Drainage – Build stormwater Civil – Remove kerb, build new kerb, build pavement, build pedestrian path 	Two eastbound lanes and one westbound lane in operation on Botany Road. Three lanes operating on McEvoy Street, with one right turn lane on McEvoy Street.
B	Night (set-up 1)	<ul style="list-style-type: none"> Civil – Remove kerb, excavate pavement, construct interface drain, build pavement, kerb and pedestrian path, tie in pavement to existing pavement TCS – Install permanent TCS Drainage – Build stormwater, stormwater works 	One lane in each direction on McEvoy Street, and a right hand turning lane (southern leg) onto Botany Road. One lane in each direction on Botany Road.
C	Day	<ul style="list-style-type: none"> Traffic – Set up traffic switch Drainage – Build stormwater 	Two lanes north bound on McEvoy Street, one lane southbound and one right hand southbound turning lane. Two lanes eastbound and one lane westbound on Botany Road.
C	Night (set-up 1)	<ul style="list-style-type: none"> Utilities – Relocate water infrastructure, install new communications infrastructure, water infrastructure cutover Civil – Rebuild kerb Drainage – Build stormwater TCS – Adjust TCS 	One lane in each direction on Botany Road. One lane in each direction on McEvoy Street, one right hand turning lane on the northern leg.
D	Night (set-up 1)	<ul style="list-style-type: none"> Traffic – Set up traffic switch Drainage – Install stormwater Civil – Rebuild kerb 	<p>McEvoy Street: Southern leg - One lane in each direction and a right hand turning lane. Northern leg – two northbound lanes, one southbound lane and one right hand turning lane</p> <p>Botany Road: Two eastbound lanes, one westbound lane, one left hand turning lane (eastern leg)</p>

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
E	Day	<ul style="list-style-type: none"> Traffic – Set up traffic switch 	Two lanes in each direction on McEvoy Street. One lane in each direction on Botany Road, left hand turning lane in each direction.
E	Night (set-up 1)	<ul style="list-style-type: none"> Civil – Install new kerb, pour concrete pavement Drainage – Build new stormwater 	Two lanes in each direction on McEvoy Street, one lane in each direction on Botany Street.
E	Night (set-up 2)	<ul style="list-style-type: none"> Utilities – Adjust sewer manhole Civil – Mill and resheet 	<p>McEvoy Street: Two lane southbound, one lane northbound (southern leg) two lanes northbound (northern leg), one left hand turning lane on the southern leg.</p> <p>Botany Road: One lane westbound, one lane eastbound (eastern leg). One left hand tuning lane (eastern leg)</p>
E	Night (set-up 3)	<ul style="list-style-type: none"> Civil – Mill and resheet 	Two lanes in each direction on McEvoy Street. One eastbound lane on Botany Road. Eastbound right hand turning lane and westbound left hand turning lane.
E	Night (set-up 4)	<ul style="list-style-type: none"> Utilities – Adjust sewer manhole Civil – Mill and resheet 	Two lanes in each direction on McEvoy Street. One westbound lane on Botany Road. One eastbound lane on Botany Road, must turn left at McEvoy Street.
F	Night (set-up 1)	<ul style="list-style-type: none"> Traffic – Remove barriers Utilities – Adjust sewer manhole Civil – Mill and resheet 	One southbound lane operating on McEvoy Street. Normal operation of traffic lanes on Botany road
F	Night (set-up 2)	<ul style="list-style-type: none"> Civil – Mill and resheet 	One north bound lane operating on McEvoy Street. Botany Road operating as normal.
F	Night (set-up 3)	<ul style="list-style-type: none"> Civil – Mill and resheet 	Intersection closed

Table F-3 Zone 3: Elizabeth Street/McEvoy Street intersection construction staging

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
Preworks	Night (set-up 1)	<ul style="list-style-type: none"> • TCS – Adjust TCS into temporary state • Trees – Investigate roots of trees along North McEvoy • Utilities – Relocate power infrastructure 	One lane in each direction along McEvoy and Elizabeth Streets
Preworks	Night (set-up 2)	<ul style="list-style-type: none"> • Utilities – Relocate power infrastructure 	One lane in each direction along McEvoy and Elizabeth Streets
Preworks	Night (set-up 3)	<ul style="list-style-type: none"> • Utilities – Relocate power infrastructure 	One lane in each direction along McEvoy and Elizabeth Streets
A	Day	<ul style="list-style-type: none"> • Traffic – Set up traffic switch 	One lane operating each way McEvoy Street. A third lane is located in between the eastbound and westbound lanes and would be used for tidal traffic flow during peak periods. Two lanes each way operating Elizabeth Street north of McEvoy Street. Two lanes southbound, one lane northbound operating Elizabeth Street south of McEvoy Street
A	Night (set-up 1)	<ul style="list-style-type: none"> • Utilities – Relocate water infrastructure • Drainage – Connect stormwater • Civil – Pavement replacement and new footpath • TCS – Install new TCS 	One lane in each direction along McEvoy and Elizabeth Streets
A	Night (set-up 2)	<ul style="list-style-type: none"> • Drainage – Connect stormwater • Civil – Build new pavement and kerb • TCS – Install permanent TCS pole and connections 	One lane operating eastbound McEvoy Street west of Elizabeth Street. One lane each way operating McEvoy Street east of Elizabeth Street. Westbound lane must turn left at Elizabeth Street. One lane each way operating Elizabeth Street
B	Day	<ul style="list-style-type: none"> • Traffic – Set up traffic switch 	Three lanes operating McEvoy Street. Two lanes each way operating Elizabeth Street north of McEvoy Street. Left-most southbound lane must turn left at McEvoy Street. Two lanes northbound, one land southbound operating Elizabeth Street south of McEvoy Street

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
B	Night (set-up 1)	<ul style="list-style-type: none"> • Utilities – Relocate water infrastructure, protect communications infrastructure • Drainage – Connect stormwater • Civil – Remove old pavement and install new pavement • TCS – Install new TCS SE • Trees – Removal of trees 	One lane in each direction along McEvoy and Elizabeth Streets
B	Night (set-up 2)	<ul style="list-style-type: none"> • Civil – Rebuild pavement and interface drainage • Drainage – Stormwater works 	One lane in each direction along Elizabeth Street. One lane in each direction McEvoy Street west of Elizabeth Street. One lane eastbound McEvoy Street east of Elizabeth Street
C	Day	<ul style="list-style-type: none"> • Traffic – Set up traffic switch 	One lane operating each way McEvoy Street. A third lane is located in between the eastbound and westbound lanes and would be used for tidal traffic flow during peak periods. Two lanes operating northbound Elizabeth Street. Two lanes operating southbound Elizabeth Street south of McEvoy Street. One lane operating southbound north of McEvoy Street.
C	Night (set-up 1)	<ul style="list-style-type: none"> • Utilities – Relocate communications infrastructure. Protect underground services • Drainage – Stormwater works • Civil – Kerb replacement and new footpath • TCS – Install permanent TCS pole and connections 	One lane in each direction along McEvoy and Elizabeth Streets
C	Night (set-up 2)	<ul style="list-style-type: none"> • Drainage – Stormwater works 	One lane in each direction along Elizabeth Street. One lane westbound McEvoy Street. One lane eastbound McEvoy Street west of Elizabeth Street. Must turn left at Elizabeth Street from this lane.
D	Day	<ul style="list-style-type: none"> • Traffic – Set up traffic switch 	One lane operating each way McEvoy Street. A third lane is located in between the eastbound and westbound lanes and would be used for tidal traffic flow during peak periods. Two lanes southbound Elizabeth Street. Two lanes northbound Elizabeth Street south of McEvoy. Leftmost lane must turn left at McEvoy Street. One lane northbound Elizabeth Street north of McEvoy Street

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
D	Night (set-up 1)	<ul style="list-style-type: none"> • Utilities – Relocate communications infrastructure, protect underground services, construct protection over sewer • Drainage – Stormwater works • Civil – Removal of existing kerb and pavement, installation of new kerb and pavement, install subsoil drainage, install footpath • TCS – Install permanent TCS 	One lane in each direction along McEvoy and Elizabeth Streets
D	Night (set-up 2)	<ul style="list-style-type: none"> • Drainage – Stormwater works • Civil – Rebuild asphalt pavement 	One lane in each direction along Elizabeth Street. One lane westbound McEvoy Street. One lane eastbound McEvoy Street east of Elizabeth Street
E	Night (set-up 1)	<ul style="list-style-type: none"> • Civil – Mill and resheet • TCS – Remove barriers 	Two lanes each direction along Elizabeth Street. One lane eastbound McEvoy Street
E	Night (set-up 2)	<ul style="list-style-type: none"> • Civil – Mill and resheet • TCS – Remove barriers 	Two lanes each direction along Elizabeth Street. One lane westbound McEvoy Street
E	Night (set-up 3)	<ul style="list-style-type: none"> • Utilities – Adjust manhole cover • Civil – Mill and resheet • TCS – Remove barriers 	Intersection closed

Table F-4 Zone 4: Lachlan Street/South Dowling Street/Dacey Avenue intersection construction staging

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
Preworks	Night (set-up 1)	<ul style="list-style-type: none"> • Utilities – Relocate and protect power infrastructure • TCS – Install temporary TCS ducts and Kelly blocks 	All lanes operational South Dowling Street, Dacey Avenue. Two eastbound lanes, one westbound lane operational Lachlan Street.
Preworks	Night (set-up 2)	<ul style="list-style-type: none"> • Utilities – Relocate power infrastructure 	One lane eastbound operational Lachlan Street. Two lanes eastbound, two lanes westbound operational Dacey Avenue. Westbound lanes must turn onto South Dowling Street. Two lanes northbound, two lanes southbound South Dowling Street north of Lachlan Street/Dacey Avenue. Includes turning lane onto Dacey Avenue. All lanes operational South Dowling Street south of Lachlan Street/Dacey Avenue
Area 1	Day	<ul style="list-style-type: none"> • Traffic – Set up traffic switch • Utilities – Inspect gas infrastructure, exhume and relay water infrastructure, relocation communication infrastructure • Drainage – Stormwater works • Civil – Rebuild kerb, build new pedestrian path, build pavement 	All lanes operational South Dowling Street, Dacey Avenue. Two lanes eastbound, one land westbound operational Lachlan Street
Area 1	Night (set-up 1)	<ul style="list-style-type: none"> • Utilities – Inspect gas infrastructure and lower pressure, exhume and relay water infrastructure, cutover water, gas and communications infrastructure • Drainage – Connect existing stormwater, construct new stormwater • Civil – Remove traffic island, excavate pavement, construct new pavement, rebuild kerb, build pedestrian path, mill and resheet 	One lane eastbound operational Lachlan Street. Two lanes eastbound, two lanes westbound operational Dacey Avenue. Westbound lanes must tun onto South Dowling Street. All lanes operational South Dowling Street south of Lachlan Street/Dacey Avenue. Two lanes northbound, three lanes southbound operational South Dowling Street north of Lachlan Street/Dacey Avenue
Area 2	Day	<ul style="list-style-type: none"> • Traffic – Set up traffic switch • Drainage – Connect to existing stormwater, build new stormwater • Civil – Rebuild kerb 	All lanes operational
Area 2	Night (set-up 1)	<ul style="list-style-type: none"> • Civil – Rebuild kerb 	All lanes operational Lachlan Street, South Dowling Street north of Lachlan Street/Dacey Avenue. Two lanes eastbound, two lanes westbound operational Dacey Avenue. Westbound lanes must turn on South Dowling Street. Four lanes northbound, one lane southbound

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
			operational South Dowling Street south of Lachlan Street/Dacey Avenue
Area 2	Night (set-up 2)	<ul style="list-style-type: none"> • Utilities – Water infrastructure adjustment, cutover and protection, communications infrastructure protection and cutover, streetlight relocation, sewer manhole adjustment • Civil – Build new pavement, rebuild kerb, pour new splitter island slab • TCS – Install new pits and ducts 	All lanes operational Lachlan Street, South Dowling Street south of Lachlan Street/Dacey Avenue. One lane eastbound, four lanes westbound operational Dacey Avenue. Two lanes northbound, two lanes southbound operational South Dowling Street north of Lachlan Street/Dacey Avenue
Area 2	Night (set-up 3)	<ul style="list-style-type: none"> • Utilities – Relocate communications infrastructure • Civil – Build new pavement, rebuild kerb, pour median slab, mill and resheet • TCS – Install new pits and ducts 	All lanes operational Lachlan Street. Two lanes northbound, one lane southbound operational South Dowling Street. Three lanes westbound operational Dacey Avenue
Area 2	Night (set-up 4)	<ul style="list-style-type: none"> • Utilities – Relocate communications infrastructure • Civil – Mill and resheet 	All lanes operational Lachlan Street. Two lanes eastbound, three lanes westbound operational Dacey Avenue. Two lanes northbound, three lanes southbound operational South Dowling Street north of Lachlan Street/Dacey Avenue. Three lanes northbound South Dowling Street south of Lachlan Street/Dacey Avenue.
Area 2	Night (set-up 5)	<ul style="list-style-type: none"> • Civil – Mill and resheet 	All lanes operational Lachlan Street, Dacey Avenue, South Dowling Street south of Lachlan Street/Dacey Avenue. Two lanes northbound, two lanes southbound South Dowling Street north of Lachlan Street/Dacey Avenue.
Area 2	Night (set-up 6)	<ul style="list-style-type: none"> • Utilities – Protect communications infrastructure, adjust sewer manhole 	One lane eastbound, all lanes westbound operational Lachlan Street. All lanes operational Dacey Avenue. One lane northbound, all lanes southbound operational South Dowling Street north of Lachlan Street/Dacey Avenue. Three lanes northbound, two lanes southbound operational South Dowling Street south of Lachlan Street/Dacey Avenue
Area 2	Night (set-up 7)	<ul style="list-style-type: none"> • Utilities – Relocate communications infrastructure • Civil – Mill and resheet 	One lane each way operational South Dowling Street. Two lanes eastbound, one lane westbound Dacey Avenue. Westbound lane must turn left at South Dowling Street. All

Sub-stage	Time of day	Proposed construction work	Changes to traffic conditions
			lanes operational Lachlan Street. Eastbound lanes must turn left at South Dowling Street.
Area 2	Night (set-up 8)	<ul style="list-style-type: none"> • Civil – Mill and resheet • TCS – Final TCS works 	One lane each way South Dowling Street. Must turn left onto South Dowling Street from Dacey Avenue. Lachlan Street closed.

Appendix G

Property acquisition

Appendix H

Aboriginal Archaeological Survey Report

Appendix I

Consideration of clause 228(2) factors and matters of national environmental significance and Commonwealth land

Clause 228(2) Checklist

In addition to the requirements of the *Is an EIS required?* guideline (DUAP 1995/1996) and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in clause 228(2) of the Environmental Planning and Assessment Regulation 2000, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor	Impact
<p>a) Any environmental impact on a community?</p> <p>The proposal involves some impact on a community during construction including noise and vibration impacts, generation of airborne dust, temporary changes to traffic and access, and visual amenity impacts</p> <p>Temporary changes to local access would have short term impacts on access to private properties and businesses located in and around the proposal area. These impacts would be mitigated through a TMP, prepared by the Contractor as part of the overall CEMP.</p> <p>Operation of the proposal would result in a change in availability of on-street parking during daytime periods (including on weekends) to around 252 existing parking spaces along Euston Road and McEvoy Street including time restricted parking, disabled parking, mail zones, and no parking morning and afternoon restrictions to establish a time limited Clearway. Of the 252 parking spaces, existing peak time parking restrictions are in place on Monday to Friday for 228 parking spaces. The proposal would also result in the loss of 28 off-street parking. Local side streets at three locations at the western end of the proposal have limited capacity to accommodate the loss of this parking, however the use of commercial car parks located near the areas of impact may assist in reducing potential impacts.</p> <p>An assessment of the impacts on businesses due to the loss of on-street and off-street parking determined that overall, there is expected to be a low impact to businesses located along Euston Road and McEvoy Street from proposed changes in parking conditions, with businesses in many locations along the proposal likely to experience either no or negligible impacts to customer or staff parking due to the proposal. The exception to this includes four locations where moderate to high impacts on businesses are expected. This includes businesses:</p> <ul style="list-style-type: none"> • On the northern side of Euston Road between Maddox Street and Harley Street • On the northern side of McEvoy Road between Harley Street and Loveridge Street • On the southern side of McEvoy Road / Euston Road between Bowden Avenue and Maddox Street • On the southern side of McEvoy Road between Stokes Avenue and Bowden Street. <p>Mitigation measures, such as providing more localised timed parking on nearby side streets, would be considered to minimise the loss of on-street parking from clearways. Roads and Maritime would investigate options to re-instate some of the off-street public parking spaces at 102-112 McEvoy Street, Alexandria as part of detailed design.</p> <p>The flood impact assessment (Arup, 2019b) for the concept design concept, identified that flood level increases of up to 0.25 metres at McEvoy Street near the Fountain Street intersection, and up to 0.07 metres near the Bowden Street intersection in the one per</p>	<p>Short term, minor negative</p> <p>Long term - negative</p> <p>Long term - negative</p> <p>Long term – positive</p>

Factor	Impact
<p>cent AEP. These impacts potentially affect existing buildings and properties along the project corridor.</p> <p>However, the proposal would result in improved traffic flow and road safety along the road corridor and at priority intersections where the proposal is located.</p> <p>Chapter 6 of this REF describes the likely temporary and permanent impacts of the proposal, and lists recommended measures to mitigate impacts during construction and operation. The CEMP would incorporate all of the proposed safeguards for implementation throughout the proposal's construction phase.</p>	
<p>b) Any transformation of a locality?</p> <p>The proposal area is already a developed urban and semi-urban arterial road carrying high volumes of traffic. The proposal area would undergo temporary transformation during construction due to removal of about 49 planted street trees and earthworks required to widen the road corridor at selected locations intersections.</p> <p>The proposal requires strip acquisition of three privately owned commercial properties of between one and 29 square metres. There are a further nine landscaping lots that are already in public ownership that would be required.</p> <p>As discussed above, in the long term the proposal would impact on around 252 on street parking spaces during daytime traffic times of which 228 already operate under peak time parking restrictions. The parking assessment (Jacobs, 2019a) determined that local side streets in the study area would generally have capacity to accommodate any on-street parking places displaced by the clearway operation, with the exception of three locations at the western end of the proposal including:</p> <ul style="list-style-type: none"> • On the northern side of McEvoy Road between Harley Street and Fountain Street • On the northern side of McEvoy Road between Fountain Street and Loveridge Street • On the northern side of McEvoy Road between Botany Road and Elizabeth Street. <p>The proposal would also result in the loss of off-street parking including up to:</p> <ul style="list-style-type: none"> • Twenty-six public parking spaces at 102-112 McEvoy Street, Alexandria • Two customer parking spaces at 35 Lachlan Street, Waterloo. <p>Overall the results of the parking survey identified that there was capacity to accommodate off-street parking lost as a result of the proposal, with the exception of the parking at 102-112 McEvoy Street, Alexandria, where the side streets in this area showed limited capacity to accommodate displaced vehicles.</p>	<p>Long-term – negative</p> <p>Long-term - negative</p> <p>Long-term – negative</p> <p>Long-term - negative</p>
<p>c) Any environmental impact on the ecosystems of the locality?</p> <p>The proposal would result in the removed of about 49 planted trees, including 25 mature flowering and fruiting trees that provide potential habitat as foraging trees for the Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>) and Powerful Owl (<i>Ninox strenua</i>). Both of these species are listed as vulnerable under the BC Act and the Grey-headed Flying-fox is also listed as vulnerable under the EPBC Act.</p>	<p>Short term – minor negative</p>

Factor	Impact
<p>The proposal may also impact indirectly on three Eucalyptus scoparia (<i>Wallangarra White Gum</i>) identified as endangered the BC Act and vulnerable under the EPBC Act.</p> <p>The proposal would have no long term impacts on any aquatic ecosystems, habitats or species.</p> <p>Assessments of Significance (refer to Appendix P) have been carried out for threatened species impacted by the proposal and found that the proposal is unlikely to have a significant impact.</p>	
<p>d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?</p> <p>There would be a minor reduction in the aesthetic quality of the locality due to the removal of vegetation, slight increase in road at key intersections and changes to the intersection layout and some property boundaries. These changes, however, would be consistent with the regional context which is urban in character.</p> <p>Mitigation measures including planting of new street trees would be implemented to reduce visual impacts</p>	<p>Short term negative</p> <p>Long term positive</p>
<p>e) 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?</p> <p>The proposal would result in the following impacts to the heritage listed items:</p> <ul style="list-style-type: none"> • Moderate (temporary) impacts to Former Sydney Water Pumping Station & Valve House Incl. Interiors and Waterloo Water Pumping Station listed on the Sydney Local Environment Plan 2012 (Sydney LEP) and Sydney Water section 170 Register (Item 002132) due to the establishment of a temporary construction compound (Site 4) immediately next to the heritage curtilage. Impacts would reduce to negligible with the implementation of mitigation measures • Minor direct and/or indirect impact to ‘Centennial Park, Moore Park, Queens Park and Moore Park Heritage Conservation Area’ listed on the State Heritage Register (SHR), Register of national estate (RNE) and Sydney LEP may occur during construction. Impacts would be temporary • Minor direct and/or indirect impact to ‘Waterloo Park & Oval Including Grounds and Landscaping’ and ‘Waterloo Heritage Conservation Area’ both listed on the Sydney LEP associated with slight modifications to the northwest and northeast corners of the Elizabeth Street/McEvoy Street intersection. Temporary impacts may also occur to trees roots located within the curtilage of Waterloo Park during utility relocations • Minor visual and potential vibration impacts to: <ul style="list-style-type: none"> – ‘Terrace group ‘Gordon Terrace’ listed on the Sydney LEP – ‘Terrace group including interiors’ listed on the Sydney LEP – ‘Moore Park View Hotel’ listed on the Sydney LEP – ‘Former ACI AGM Building including interior’ listed on the Sydney LEP <p>The proposal would also have a major impact on sections of sandstone kerbs along Kensington Lane, McEvoy Street and Lachlan Street which are unlisted items of</p>	<p>Long term negative</p>

Factor	Impact
<p>heritage significance. Sandstone kerbs would be retained where possible. If retention is not feasible, they would be reinstated or replaced.</p>	
<p>f) Any impact on the habitat of protected fauna (within the meaning of the <i>National Parks and Wildlife Act 1974</i>)?</p> <p>The proposal would result in the removed of about 49 planted trees, including 25 mature flowering and fruiting trees that provide potential habitat as foraging trees for the Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>) and Powerful Owl (<i>Ninox strenua</i>). Both of these species are listed as vulnerable under the BC Act and the Grey-headed Flying-fox is also listed as vulnerable under the EPBC Act.</p> <p>The proposal may also impact indirectly on three Eucalyptus scoparia (<i>Wallangarra White Gum</i>) identified as endangered the BC Act and vulnerable under the EPBC Act.</p> <p>Assessments of Significance (refer to Appendix P) have been carried out for threatened species impacted by the proposal and found that the proposal is unlikely to have a significant impact. Refer further to Section 6.9.</p>	<p>Long term negative</p>
<p>g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?</p> <p>The proposal would result in the removed of about 49 planted trees, including 25 mature flowering and fruiting trees that provide potential habitat as foraging trees for the Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>) and Powerful Owl (<i>Ninox strenua</i>). Both of these species are listed as vulnerable under the BC Act and the Grey-headed Flying-fox is also listed as vulnerable under the EPBC Act.</p> <p>The proposal may also impact indirectly on three Eucalyptus scoparia (<i>Wallangarra White Gum</i>) identified as endangered the BC Act and vulnerable under the EPBC Act.</p> <p>Assessments of Significance (refer to Appendix P) have been carried out for threatened species impacted by the proposal and found that the proposal is unlikely to have a significant impact. Refer further to Section 6.9.</p>	<p>Long term negative</p>
<p>h) Any long-term effects on the environment?</p> <p>Benefits would be realised in terms of reduced congestion and improvements in road safety. However, the proposal requires strip acquisition of three privately owned commercial properties of between one and 29 square metres. There are a further nine landscaping lots that are already in public ownership that would be required.</p> <p>In addition, the proposal would change the availability in parking of about 252 on-street parking spaces along Euston Road and McEvoy Street of which 228 already operate under No Parking restrictions during morning or afternoon peaks. The proposal would also impact on around 28 off-street parking spaces with in the proposal area. Local side streets at three locations at the western end of the proposal have limited capacity to accommodate the loss of this parking, however the use of commercial car parks located near the areas of impact may assist in reducing potential impacts.</p> <p>The proposal would result in the removed of about 49 planted street trees comprised of 25 mature trees and 24 immature trees. The proposal would include an Urban Design Plan that would ameliorate these impacts.</p>	<p>Long term negative</p>

Factor	Impact
<p>i) Any degradation of the quality of the environment?</p> <p>Construction would have the potential to result in water quality, visual, noise and air quality impacts. These potential impacts would be managed by the implementation of safeguards listed in Section 7 of this REF.</p>	<p>Short term – minor negative</p>
<p>j) Any risk to the safety of the environment?</p> <p>Traffic management safeguards including the preparation of a traffic management plan, would address safety risks during construction.</p> <p>The flood impact assessment (Arup, 2019b) identified that flood level increases of up to 0.25 metres are predicted at McEvoy Street near the Fountain Street intersection, and up to 0.07 metres near the Bowden Street intersection in the one per cent AEP. These impacts potentially affect existing buildings and properties along the project corridor.</p> <p>The proposal would improve safety for road users during operation by reducing congestion, improved intersection performance and pedestrian/cyclist facilities.</p>	<p>Short term – potential negative</p> <p>Long term negative</p> <p>Long term – positive</p>
<p>k) Any reduction in the range of beneficial uses of the environment?</p> <p>The proposal would not reduce the range of beneficial uses of the environment.</p>	<p>Nil</p>
<p>l) Any pollution of the environment?</p> <p>There is the potential for accidental spills of chemicals during construction which could affect the surrounding land, surface water and groundwater. Management of impacts on surface and groundwater quality is addressed in Section 6.5 of this REF.</p> <p>There is the potential for air quality and acoustic amenity to be reduced during construction activities.</p>	<p>Short-term – minor negative</p>
<p>m) Any environmental problems associated with the disposal of waste?</p> <p>Waste streams generated during construction are common and would pose no difficulty in their disposal. Waste would be recycled wherever possible.</p>	<p>Nil</p>
<p>n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?</p> <p>All resources required for the proposal are readily available and are not in short supply.</p>	<p>Nil</p>
<p>o) Any cumulative environmental effect with other existing or likely future activities?</p> <p>Temporary potential cumulative impacts may occur as a result of construction activities occurring simultaneously with other projects around the proposal. This is potentially a key issue for the proposal due to the length of the construction program and the concentration of a number of major development projects in close proximity, particularly the CSELR and New M5 and urban redevelopment including at Green Square.</p> <p>It is recognised that the works for the proposal are smaller in scale relative to many other major transport and urban development projects occurring in or near the study</p>	<p>Short term – negative</p>

Factor	Impact
<p>area. As such, the contribution of the proposal to potential cumulative impacts relating to such things as construction vehicle traffic, changes to land use and visual amenity are expected to be relatively minor compared to other developments recently completed, under construction or proposed in the study area.</p> <p>The long-term effect of the proposal would have a positive cumulative impact on access within the study area by reducing travel times and congestion, improving road safety and supporting nearby urban renewal and transport projects such as the CSELR and New M5.</p> <p>Cumulative impacts of the proposal are discussed in detail in Section 6.11 of this REF.</p>	
<p>p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?</p> <p>The proposal is not located within a coastal area and would not result in any impact on coastal processes and coastal hazards.</p>	Nil

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act 1999, 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 Government Department of the Environment and Energy.

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
a) Any impact on a World Heritage property?	Nil
b) Any impact on a National Heritage place?	Nil
c) Any impact on a wetland of international importance?	Nil
d) Any impact on a listed threatened species or communities? The proposal would remove about 49 planted trees comprised of 25 mature trees and 24 immature trees. Of the 25 mature trees all are native flowering that present suitable foraging habitat for the Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>) and the Powerful Owl (<i>Ninox strenua</i>) listed as vulnerable under the EPBC Act. The proposal may also have indirect impacts to three <i>Eucalyptus scoparia</i> (Wallangara White Gum) trees, both of which listed as vulnerable under the EBPC Act. These trees are currently not able to complete their natural life cycles as they have been planted in an urban environment outside of their natural range. The Assessments of Significance (refer to Appendix P) found that the proposal would not be likely to significantly impact threatened species. Refer to Section 6.10 .	Long term minor negative
e) Any impacts on listed migratory species?	Nil
f) Any impact on a Commonwealth marine area?	Nil
g) Does the proposal involve a nuclear action (including uranium mining)?	Nil
h) Additionally, any impact (direct or indirect) on the environment of Commonwealth land?	Nil

Appendix J

Traffic and transport assessment

Appendix K

Statement of Heritage Impact

Appendix L

Flooding assessment

Appendix M

Noise and vibration assessment

Appendix N

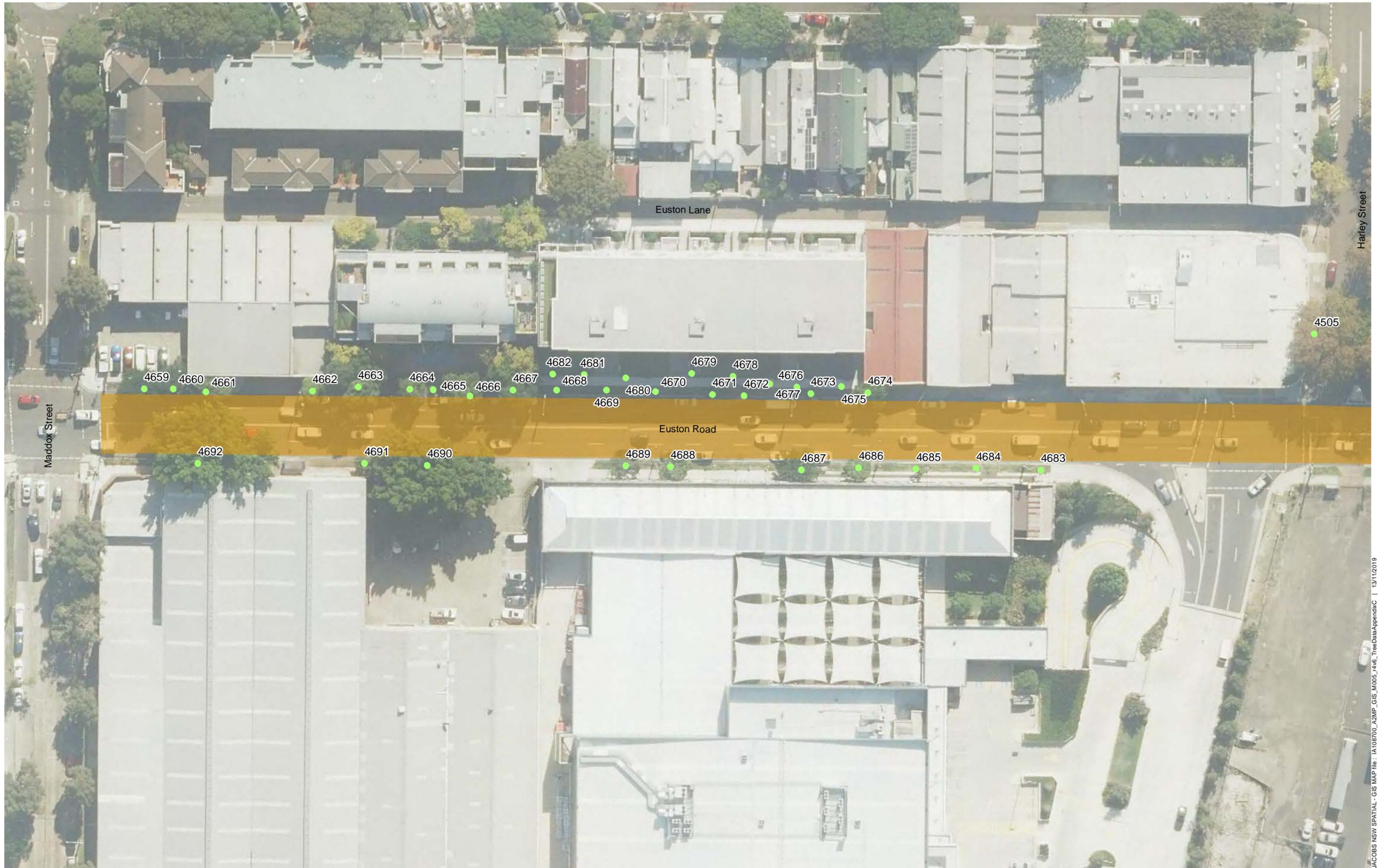
Stage 1 contamination assessment

Appendix O

Social impact assessment

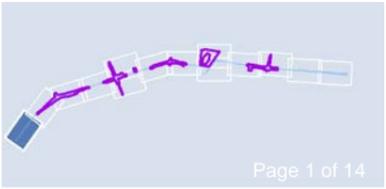
Appendix P

Tree impact figure and Assessment of significance



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| Concept design | -- Linemarking - dashed | Proposal area | Operational impacts: | ▲ Directly impacted mature tree |
| — Bitumen Edge | - - D-EWKS-Ground Interface | Construction impacts: | ■ Clearways and intersection upgrades | ★ Directly impacted immature tree |
| — Kerb | — Footpath/Driveway | □ Construction footprint | ■ Parking changes in side streets | ● Trees to remain and be protected during construction |
| — Linemarking - solid | - - Stormwater | ■ Construction compounds | | ● No impact outside proposal area |
| | — Stormwater pit/pipe | | | |

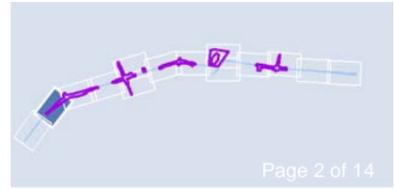


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| | — Stormwater pit/pipe | | | |



Imagery: AUSIMAGE (May 2016)

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| — Bitumen Edge | — D-EWKS-Ground Interface | Construction impacts: | ■ Clearways and intersection upgrades | ★ Directly impacted immature tree |
| — Kerb | — Footpath/Driveway | □ Construction footprint | ■ Parking changes in side streets | ● Trees to remain and be protected during construction |
| — Linemarking - solid | — Stormwater | ■ Construction compounds | | ● No impact outside proposal area |
| | — Stormwater pit/pipe | | | |



Imagery: AUSIMAGE (May 2016)

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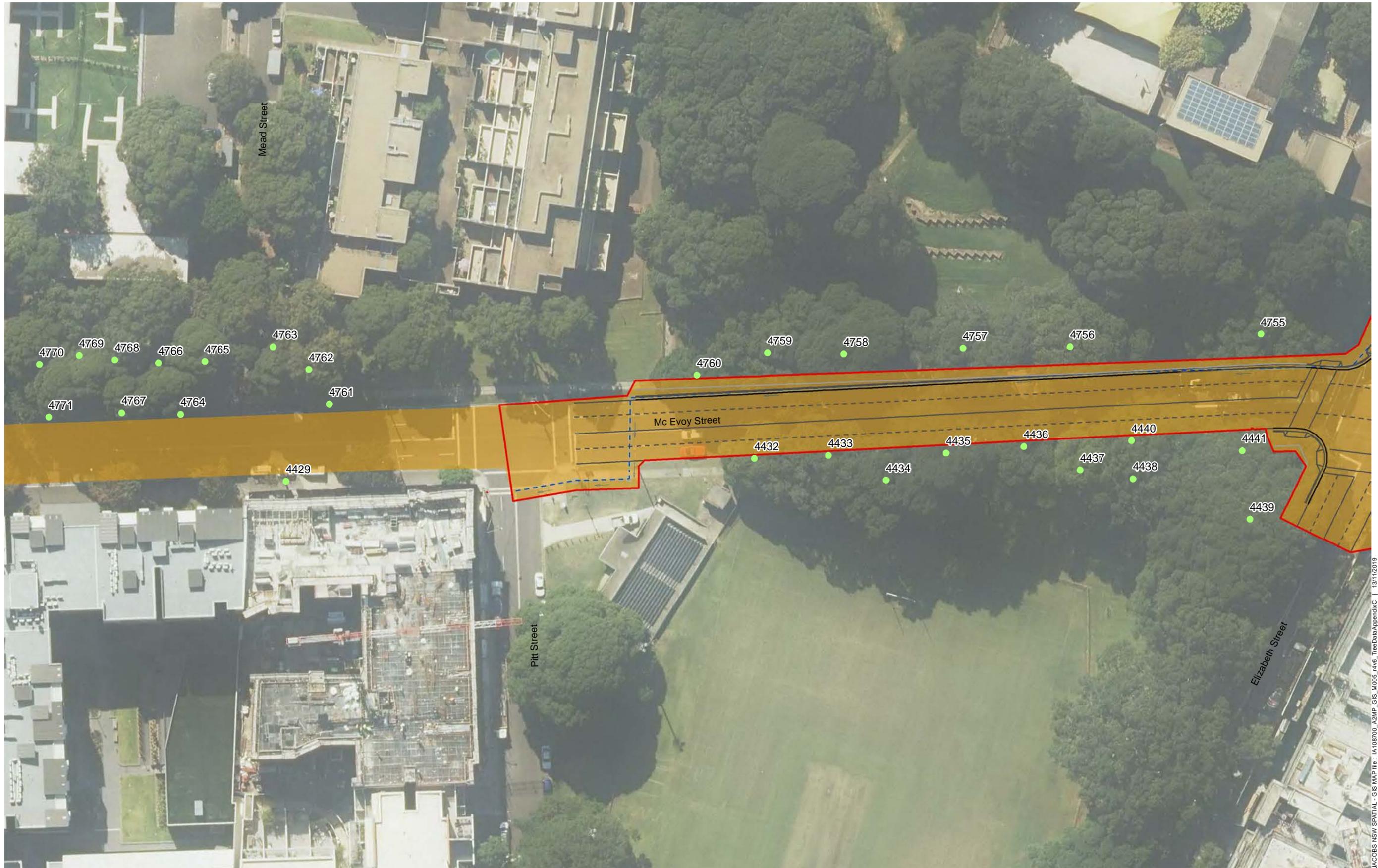
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Imagery: AUSIMAGE (May 2016)

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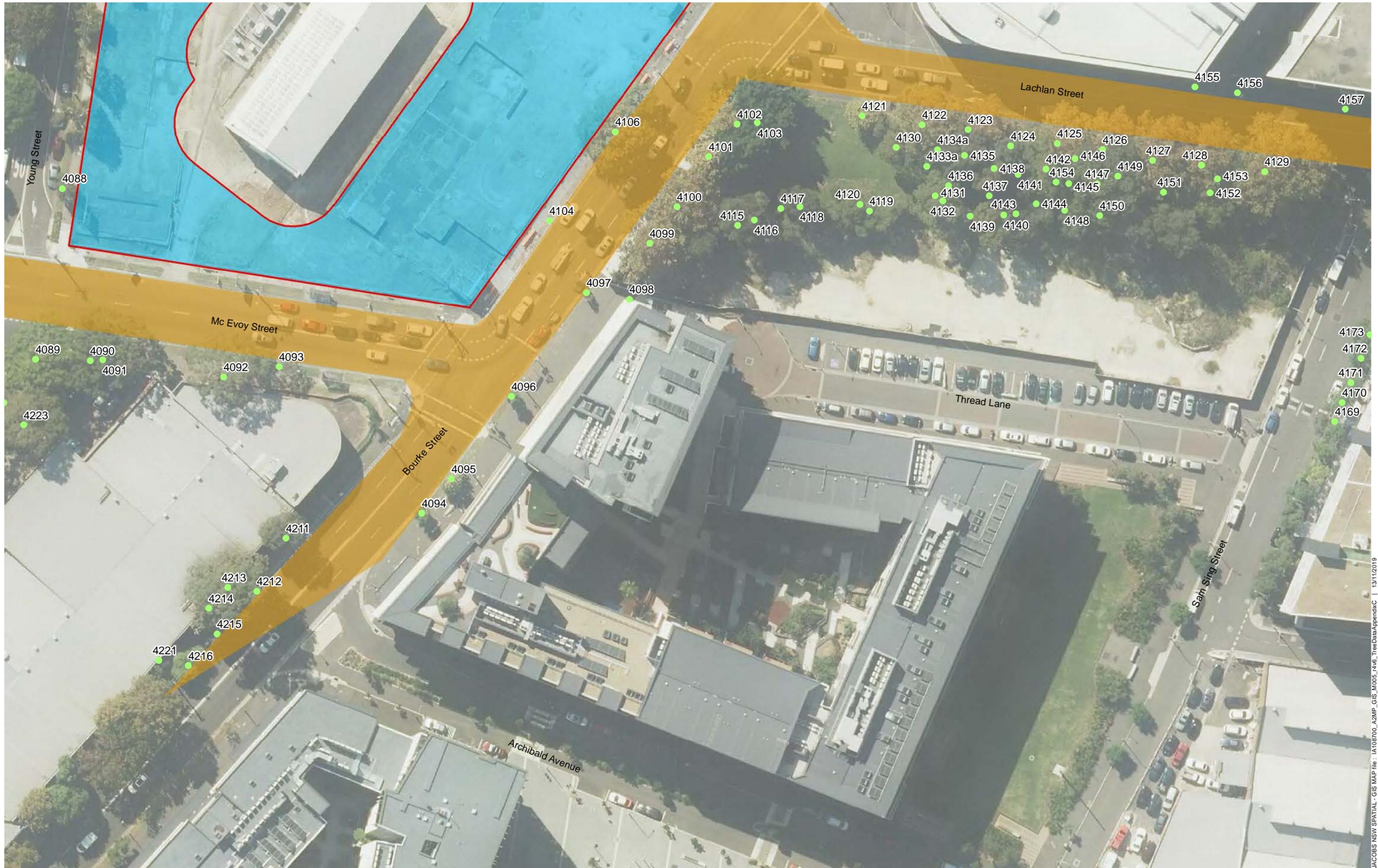
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| — Bitumen Edge | — D-EWKS-Ground Interface | Construction impacts: | ■ Clearways and intersection upgrades | ★ Directly impacted immature tree |
| — Kerb | — Footpath/Driveway | □ Construction footprint | ■ Parking changes in side streets | ● Trees to remain and be protected during construction |
| — Linemarking - solid | — Stormwater | ■ Construction compounds | | ● No impact outside proposal area |
| | — Stormwater pit/pipe | | | |



There are other trees in the proposal area which have not been numbered. These trees will not be impacted or have already been removed. Jacobs does not warrant that this document is definitive nor free of error and does not accept liability for any loss caused or arising from reliance upon information provided herein.

JACOBS NSW SPATIAL - GIS MAP file : I:\1008700_A2MP_GIS_M005_r4v6_TreeDataAppendixC | 13/11/2019



Legend

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|-----------------------|---------------------------|--------------------------|---------------------------------------|--|
| Concept design | -- Linemarking - dashed | Proposal area | Operational impacts: | ▲ Directly impacted mature tree |
| — Bitumen Edge | — D-EWKS-Ground Interface | Construction impacts: | ■ Clearways and intersection upgrades | ★ Directly impacted immature tree |
| — Kerb | — Footpath/Driveway | □ Construction footprint | ■ Parking changes in side streets | ● Trees to remain and be protected during construction |
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JACOBS NSW SPATIAL - GIS MAP file : I:\1006700_A2MP_GIS_M005_14v6_TreeDataAppendixC | 13/11/2019



Legend

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|-----------------------|---------------------------|--------------------------|---------------------------------------|--|
| Concept design | -- Linemarking - dashed | Proposal area | Operational impacts: | ▲ Directly impacted mature tree |
| — Bitumen Edge | — D-EWKS-Ground Interface | Construction impacts: | ■ Clearways and intersection upgrades | ★ Directly impacted immature tree |
| — Kerb | — Footpath/Driveway | □ Construction footprint | ■ Parking changes in side streets | ● Trees to remain and be protected during construction |
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JACOBS NSW SPATIAL - GIS MAP file: IA108700_A2MP_GIS_M005_r4v6_TreeDataAppendixC | 13/11/2019



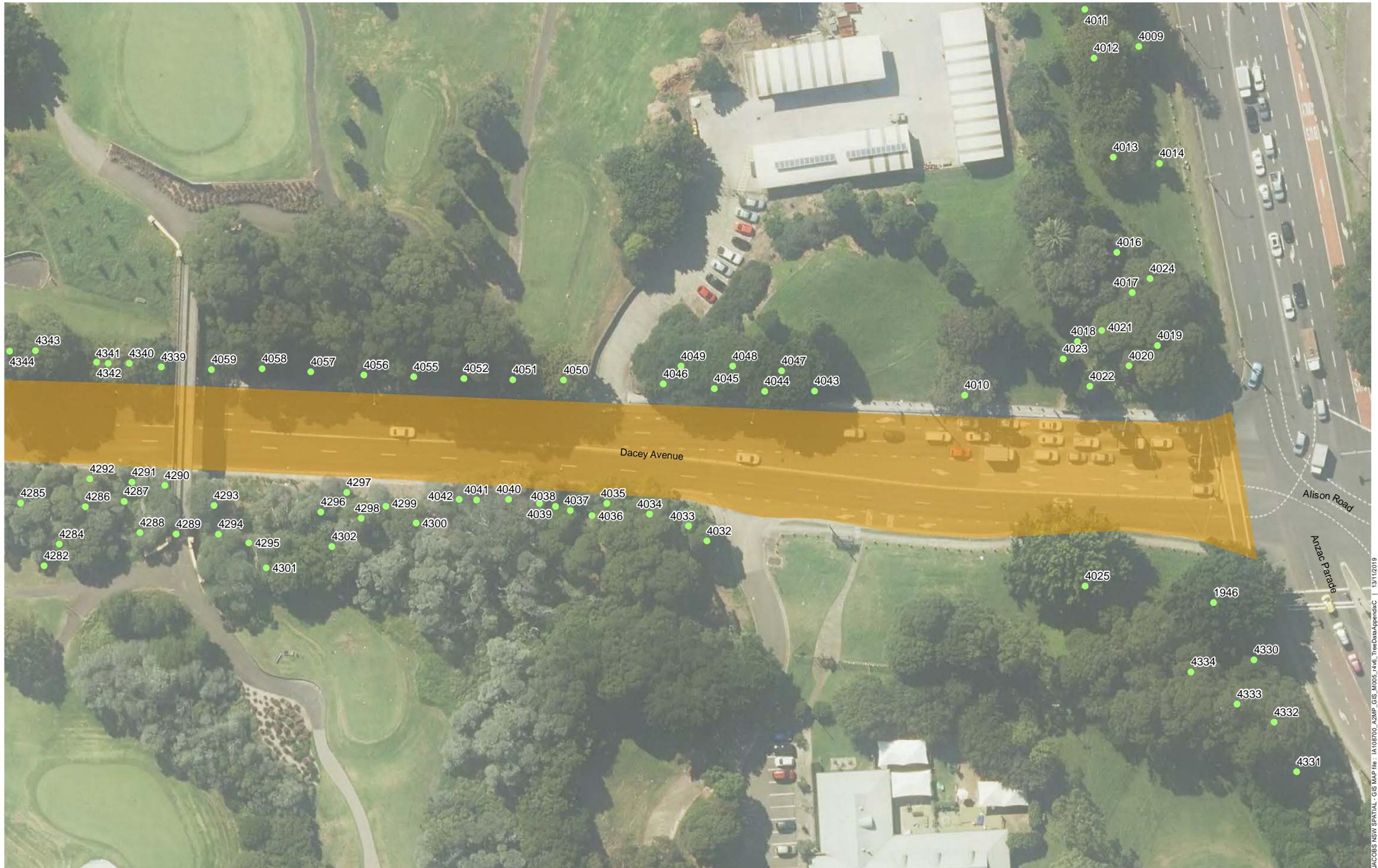
Legend

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|-----------------------|---------------------------|--------------------------|---------------------------------------|--|
| Concept design | -- Linemarking - dashed | Proposal area | Operational impacts: | ▲ Directly impacted mature tree |
| — Bitumen Edge | — D-EWKS-Ground Interface | Construction impacts: | ■ Clearways and intersection upgrades | ★ Directly impacted immature tree |
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JACOBS NSW SPATIAL - GIS MAP file: I:\108700_A2MP_GIS_M005_r4v6_TreeDataAppendixC | 13/11/2019



Legend

- | | | | | |
|---------------------|-------------------------------|--------------------------|---------------------------------------|--|
| Concept design | -- Linemarking - dashed | Proposal area | Operational impacts: | ▲ Directly impacted mature tree |
| Bitumen Edge | - - - D-EWKS-Ground Interface | Construction impacts: | ■ Clearways and intersection upgrades | ★ Directly impacted immature tree |
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| | — Stormwater pit/pipe | | | |



Imagery: AUSIMAGE (May 2016)

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Assessment of significance

NSW Biodiversity Conservation Act 2016

For threatened biodiversity listed under the BC Act a threatened species assessment as outlined in Section 7.3 of the BC Act (5-part test) was undertaken. The document Threatened Species Test of Significance Guidelines (Office of Environment and Heritage, 2018) outlines a set of guidelines to help applicants/proponents of a development or activity with interpreting and applying the factors of assessment in the 5-part test.

Planted threatened trees (*Eucalyptus scoparia*)

Eucalyptus scoparia has been planted as street trees within the study area. This species is not in its natural habitat and is outside its natural range.

Eucalyptus scoparia occurs in only three known locations within NSW, all near Tenterfield in the far northern New England Tableland Bioregion. It does not naturally occur in the Sydney region.

Eucalyptus scoparia is listed as a threatened species under the BC Act. Genetics are an important component of biodiversity and as such, impacts to these planted trees must be assessed.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Eucalyptus scoparia trees within the study area have been planted and are not in their natural habitat. The trees are viable, and may be good examples of genetic variation within the species, but they are not in an environment that allows for the normal elements of their life cycle to occur. For example, these trees are likely to flower and may be pollinated. As such, the trees may potentially set seed and disperse seed into the adjacent environment. However, while these species may set seed, it is unlikely that seedlings would develop as the habitat is maintained by mowing and natural processes that stimulate and/or promote seed germination in eucalypts are not occurring. These species are unlikely to ever reproduce in the study area and once the trees become senescent and die, or are replaced by the local council if they become hazardous to the public, they would be lost from the study area. These trees are currently not able to complete their natural life cycles as they have been planted in an urban environment outside of their natural range.

The proposal would indirectly impact on three *Eucalyptus scoparia* trees. This impact is not predicted to place this species at risk of extinction. The proposal would not have an effect on the natural occurrences of this species. Many specimens of this species are planted as street trees in Sydney and as such the local occurrence is expected to continue to exist. Furthermore, nursery stock can be planted in the locality to replace the impacted trees and this may be a consideration for a landscape plan associated with the proposal.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- i) **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- ii) **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community:

- i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The proposal would indirectly impact on three *Eucalyptus scoparia* trees. The habitat is not natural so the extent of habitat for this species that is to be impacted is not applicable.

There would not be any fragmentation of habitat for this species as a result of the proposal.

The habitat is not natural and is not considered important for *Eucalyptus scoparia*.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal would not impact on any declared areas of outstanding biodiversity value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

No naturally occurring native vegetation or habitats would be impacted by the proposal. As such, the proposal is considered unlikely to contribute to the operation of a key threatening process considered likely to affect this species.

Conclusion

The proposal would result in the removal of three planted *Eucalyptus scoparia* trees. No natural habitats would be affected and the natural occurrences of this species would not be affected. The recovery of this species would not be affected. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant effect to *Eucalyptus scoparia*.

Powerful Owl (*Ninox strenua*)

While no Powerful Owls (*Ninox strenua*) were recorded in the study area during the field survey, this species is considered moderately likely to occur based on the presence of suitable foraging habitat and nearby records. A Powerful Owl (*Ninox strenua*) was recorded near the study area on Wyndham Street Alexandria in 2012. This bird is likely one of the pair that roosts and breeds in the Royal Botanic Gardens. These birds are likely to utilise trees within parks and the street plantings in the locality, and potentially the study area, as roosting habitat. The birds are likely to forage on any possums and Grey-headed Flying-foxes in the area. Breeding is unlikely to occur in the study area as no suitable nesting trees are present.

The factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species or their habitats are outlined below:

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Optimal habitat for the Powerful Owl (*Ninox strenua*) includes a tall shrub layer and abundant hollows supporting high densities of arboreal marsupials (Department of Environment and Conservation (NSW), 2006). For roosting, this species prefers groves of dense mid-canopy trees or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines (Department of Environment and Conservation 2006). This species nests in old hollow eucalypts in unlogged, unburnt gullies and lower slopes within 100 metres of streams or minor drainage lines, with hollows greater than 45 centimetres diameter and greater than 100 centimetres deep; surrounded by canopy trees and sub canopy or understorey trees or tall shrubs (Department of Environment and Conservation 2006).

The study area contains some marginal foraging habitat for the Powerful Owl (*Ninox strenua*) consisting of planted street trees that provide habitat for prey animals such as ringtail possums and the Grey-headed Flying-fox. No suitable breeding habitat is present in the study area. The birds that may use the study area as foraging habitat are likely to be the birds that roost and nest in the Botanic Gardens. These birds are likely to utilise the vegetation in the study area as part of a home range.

The loss of vegetation within the study area would directly affect the opportunity for these species to feed in the area. However, the study area is not considered a critical area for the Powerful Owl. The proposal would remove approximately 25 trees of potential foraging habitat. However, removal of vegetation would be avoided where possible. The proposal would not result in the removal of any large hollow bearing trees which may be suitable as roosting habitat as none are present. The current potential for this species to occur based on the presence of potential foraging habitat is expected to remain after completion of the project such that foraging, movement and other life-cycle attributes would not be impacted. The proposal is unlikely to reduce the population size of the viable local population of the Powerful Owl (*Ninox strenua*) or decrease the reproductive success of this species.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- i) **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- ii) **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community:

- i) **the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
-

- ii) **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- iii) **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality**

The potential habitat of the Powerful within the study area is limited to some marginal foraging habitat. The extent of habitat for the Powerful Owl (*Ninox strenua*) would be reduced by approximately 25 trees. No hollow bearing trees suitable for nesting would be impacted. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered. The habitat to be affected by the proposal is not an important or limiting resource for the Powerful Owl.

Importantly, the proposal would not result in fragmentation of habitat for the Powerful Owl (*Ninox strenua*). No large blocks of high quality habitat for this species would be broken apart by the proposal. The Powerful Owl (*Ninox strenua*) is a highly mobile species that occupies a large home range and is able to persist in areas where small scale disturbances occur (as evidenced by the birds that live in the Botanic Gardens and forage in the suburbs of Sydney). The proposal would not affect the movement of the Powerful Owl (*Ninox strenua*) between habitat patches.

The loss of foraging habitat would directly affect this species opportunities to feed in the area; however, the study area is not considered a critical area for the Powerful Owl (*Ninox strenua*). The habitat to be affected by the proposal is not important or limiting and this species is only predicted to utilise the habitat in the study area intermittently for foraging. Extensive areas of similar habitats occur elsewhere in the locality and the current potential for the species to occur based on the presence of potential foraging habitat is expected to remain after completion of the project. It is unlikely that the proposal would impact on foraging, movement and other life-cycle attributes of the Powerful Owl (*Ninox strenua*).

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal would not impact on any declared areas of outstanding biodiversity value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

No naturally occurring native vegetation or habitats would be impacted by the proposal. As such, the proposal is considered unlikely to contribute to the operation of a key threatening process considered likely to affect this species.

Conclusion

The Powerful Owl (*Ninox strenua*) would suffer a small reduction in extent of marginal foraging habitat from the proposal. No nesting habitat would be impacted by the proposal. The proposal is unlikely to reduce the population size of this species or decrease its reproductive success. The proposal would not interfere with the recovery of this species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant effect to the Powerful Owl.

Grey-headed Flying Fox (*Pteropus poliocephalus*)

While no Grey-headed Flying Fox (*Pteropus poliocephalus*) were recorded in the study area during the field survey, this species is considered highly likely to occur based on the presence of suitable foraging habitat and nearby records. The Grey-headed Flying-fox is known to forage in the street trees within the study area. There are two known Grey-headed Flying-fox camps within close proximity to the study area: Centennial Park and Wolli Creek. The Centennial Park camp is known to contain 16,000 to 49,999 bats. The Wolli Creek camp is known to contain 10,000 to 15,999 bats. The bats from these two camps are likely to utilise the trees in the study area as foraging habitat.

The factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species, or their habitats are outlined below:

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Grey-headed Flying-fox (*Pteropus poliocephalus*) occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 kilometres of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.

The closest roost camp is located in Centennial Park, which is directly next to works at the eastern end of the proposal. However, no part of the camp is within the project footprint and at the time of this assessment the proposal would not directly impact on any part of this camp. As such, the impacts of the proposal to the Grey-headed Flying-fox would be limited to loss of foraging habitat caused by direct clearing or damage to street and parkland trees during the construction phase. Flowering and fruiting resources would be impacted.

The proposal would remove approximately 25 trees of potential foraging habitat. The proposal would not act alone in causing impacts to biodiversity, as very large areas of vegetation within the locality have already been removed, predominately for urban and industrial development in the recent past. The greatest recent impacts to native vegetation and threatened species habitat in the locality have arisen from the New M5 project while the Sydney Light Rail has contributed to the loss of street trees in the locality. The proposal would add to the loss of street trees in the locality adding to the cumulative impacts. However, removal of vegetation would be avoided where possible. Foraging habitat mainly comprises nectar resources from planted native trees and shrubs as well as fruit resources from planted fig trees and some exotic trees including palms. The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within the locality. The study area is not considered a critical habitat for this species and much of it is made up of planted roadside vegetation. Given the relative widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of the camps located near the study area (e.g. Royal National Park and Ku-ring-gai National Park), the project is not expected to significantly affect the life cycle of the species.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- i) **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- ii) **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction**

Not applicable.

(c) in relation to the habitat of a threatened species or ecological community:

- i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.**

The potential habitat of the Grey-headed Flying-fox within the study area is limited to foraging habitat and includes all fruiting and flowering trees and shrubs, notably eucalypts, fig trees and palms. The extent of habitat for the Grey-headed Flying-fox would be reduced by approximately 25 trees. This amount of habitat removal is small when the amount of available foraging habitat in the locality is considered.

Importantly, the proposal would not result in fragmentation of habitat for the Grey-headed Flying-fox. This species is highly mobile and would freely fly long distances (up to 50 kilometres) over open areas including urbanised city centres to move between roost camps and foraging sites. The proposal would not affect the movement of the Grey-headed Flying-fox between habitat patches.

Importantly, the proposal would not impact on the most important habitats for Grey-headed Flying-fox (*Pteropus poliocephalus*) within the locality. The most important habitats for the local Grey-headed Flying Fox (*Pteropus poliocephalus*) sub-populations are the roosting camps, notably the camp in Centennial Park which is next to the east end of the study area, and the Wolli Creek camp. These camps would not be affected by the proposal. The vegetation to be affected is planted roadside vegetation and would only form a small proportion of available habitat for this species. The foraging habitat within the study area is unlikely to be of critical importance for the survival of the Grey-headed Flying-fox within the locality.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The proposal would not impact on any declared areas of outstanding biodiversity value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

No naturally occurring native vegetation or habitats would be impacted by the proposal. As such, the proposal is considered unlikely to contribute to the operation of a key threatening process considered likely to affect this species.

Conclusion

The Grey-headed Flying-fox would suffer a small reduction in extent of suitable foraging habitat from the proposal. No camps or other important habitat would be impacted. Clearing protocols would be put in place to avoid impacts on any Grey-headed Flying-fox roosting in trees to be removed.

Clearing protocols would be implemented that include undertaking pre-clearing surveys in accordance with *Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (NSW Roads and Traffic Authority, 2011). The location of potential grey-headed Flying-fox feed trees to be removed would be confirmed before works begin. The details of each tree would be recorded including GPS location, species, and foraging resource type (ie flowering or fruiting). Habitat removal would be undertaken as outlined in *Guide 4: Clearing of vegetation and removal of bushrock*. The seasonal impact of habitat removal on the Grey-headed Flying-fox must be considered. *Lophostemon confertus* flowers in spring and summer and the figs on *Ficus* spp. ripen in the summer. As such, the habitat removal should be undertaken in autumn or winter when the fewest foraging resources are available. This would limit the presence of the Grey-headed Flying-fox in the habitats during construction. If a Grey-headed Flying-fox is present in any of the trees during removal, then works would stop and the environment

manager would be notified. Any Grey-headed Flying-foxes using the trees would be allowed to move on before works recommence.

The proposal is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. The proposal would not interfere with the recovery of the Grey-headed Flying-fox and would not contribute to the key threats to this species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant effect to the Grey-headed Flying-fox.

Environment Protection and Biodiversity Conservation Act 1999 assessment

For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50% chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility (Department of Environment, 2013).

Eucalyptus scoparia

Eucalyptus scoparia has been planted as street trees within the study area. This species is not in its natural habitat and is outside of its natural range. *Eucalyptus scoparia* occurs in only three known locations within NSW, all near Tenterfield in the far northern New England Tableland Bioregion. It does not naturally occur in the Sydney region. While this species has been planted in the study area, it is listed as threatened species under the EPBC Act. Genetics are an important component of biodiversity and as such, impacts to this planted species must be assessed.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it would:

Lead to a long-term decrease in the size of an important population of a species

The *Eucalyptus scoparia* plants in the study area do not form part of an important population as defined under the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines*

(Department of Environment, 2013). An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

The *Eucalyptus scoparia* plants in the study area are not part of a key source population, they are not necessary for maintaining genetic diversity (but may provide a good example of genetic variation), and are not near the limit of the species range as the plants are planted street trees far away from the natural occurrence. The *Eucalyptus scoparia* plants in the study area are not considered part of an important population and therefore the proposal is not considered likely to lead to a long-term decrease in the size of an important population of this species.

Reduce the area of occupancy of an important population

The *Eucalyptus scoparia* plants in the study area are not considered part of an important population.

Fragment an existing important population into two or more populations

The proposal is considered unlikely to result in any further fragmentation of habitat. No naturally occurring habitat will be affected and the proposal does not involve breaking apart of large habitat patches. The proposal would not introduce further fragmentation or fragmentation of the local population. Pollinators and seed dispersal agents are likely to be able to function in their normal capacity once the proposal has been completed.

Adversely affect habitat critical to the survival of a species

Habitat critical to the survival of a species refers to areas that are necessary for activities such as:

- Breeding or dispersal
- For the long-term maintenance of the species including the maintenance of other species essential to the survival of the species, such as pollinators
- To maintain genetic diversity and long-term evolutionary development
- For the reintroduction of populations or recovery of the species.

The habitat within which *Eucalyptus scoparia* exists in the study area is not considered important for the survival of this species. The trees have been planted in the study area and the habitat is not natural. Work in this habitat would not affect the survival of this species.

Disrupt the breeding cycle of an important population

The proposal is considered unlikely to result in an impact to any pollination vectors or seed dispersal agents. The breeding capacity of *Eucalyptus scoparia* in the study area is already restricted as this species is not in its natural environment. This species is not expected to produce offspring in the present environment, as there are limited chances for

The current breeding cycle of *Eucalyptus scoparia* is predicted to remain after the road widening has occurred.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

This species is not in its natural habitat and is outside of its natural range. *Eucalyptus scoparia* occurs in only three known locations within NSW, all near Tenterfield in the far northern New England Tableland Bioregion. It does not naturally occur in the Sydney region. The proposal would not impact habitat for this species.

Result in invasive species that are harmful to a vulnerable species becoming established in the Vulnerable species' habitat

The potential for weed invasion was considered possible with a proposal of this nature and appropriate controls are required during construction and operation of the road to reduce this threat. The management of invasive species would be managed under the construction environmental management plan. Weed management measures proposed are provided in Section 5.

Introduce disease that may cause the species to decline, or

There are no known disease issues affecting this species in relation to the proposal. The proposal would be unlikely to increase feral animal abundance or the potential for significant disease vectors to affect local populations.

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the road. This can be mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols as detailed in Section 5 on this proposal as part of the CEMP to prevent the introduction or spread of pathogens.

Interfere substantially with the recovery of the species

The approved conservation advice for *Eucalyptus scoparia* contains research and regional priority actions to assist the recovery of the species. These actions include (Threatened Species Scientific Committee, 2008):

- Undertake survey work in suitable habitat and potential habitat to locate any additional populations/occurrences/remnants
- Undertake seed germination and/or vegetative propagation trials to determine the requirements for successful establishment
- Investigate formal conservation arrangements such as the use of covenants, conservation agreements or inclusion in reserve tenure
- Raise awareness of Wallangarra White Gum within the local community, particularly among developers and bushwalkers
- Investigate options for enhancing or establishing additional populations
- Implement national translocation protocols (Vallee et al., 2004) if establishing additional populations is considered necessary and feasible.

These identified recovery actions would not be interfered with by the proposal.

Conclusion

Eucalyptus scoparia trees that would be impacted by the proposed works are planted roadside trees and are not part of a key source populations. These trees are outside of their natural occurrence range and the proposal is unlikely to impact an important population or habitat critical to the survival of this species. The proposal would not interfere with the recovery of *Eucalyptus scoparia* and would not contribute to the key threats to this species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to *Eucalyptus scoparia*.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

While the Grey-headed Flying-fox was not recorded in the study area during the field survey it is considered moderately likely to occur based on the presence of suitable foraging habitat and the nearby location of roosting camps, notably the camp within Centennial Park.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it would:

Lead to a long-term decrease in the size of an important population of a species

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
 - Populations that are necessary for maintaining genetic diversity, and/or
 - Populations that are near the limit of the species range.
-

There have been no roost camps identified in the project boundary to date and at the time of the REF the project would not directly impact on any known breeding / maternity site. Therefore, it is likely that the impacts of construction and operation of the project would be confined to loss of feeding habitat caused by direct clearing or damage to native vegetation during the construction phase.

The project would directly remove up to 25 trees of potential foraging habitat however vegetation would be avoided where possible. Much of this area comprises of planted vegetation. Foraging habitat mainly comprises nectar resources from planted native trees and shrubs as well as fruit resources from planted fig trees and some exotic trees. This area of habitat may be defined as a portion of the potential area of occupancy for feeding life-cycle attributes of the population. The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50 kilometre radius of the project boundary. Given the relative widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of regional populations, the project is not expected to lead to a long-term decrease in the size of an important population.

Reduce the area of occupancy of an important population

The project would directly remove up to 25 trees of foraging habitat however vegetation would be avoided where possible. Much of this area comprises of planted vegetation. Foraging habitat mainly comprises nectar resources from planted native trees and shrubs as well as fruit resources from planted fig trees and some exotic trees. This area of habitat may be defined as a portion of the potential area of occupancy for feeding life-cycle attributes of the population. The project would reduce the area of habitat available to the species; however, the area occupied by this species would remain the same.

Fragment an existing important population into two or more populations

There is currently a high degree of habitat fragmentation across the study area. Highly mobile species such as bats are expected to be less impacted by fragmentation and the grey-headed flying-fox is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom. The project would not fragment an important population of the Grey-headed Flying-fox.

Adversely affect habitat critical to the survival of a species

Habitat critical to the survival of a species refers to areas that are necessary for activities such as:

- Foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species including the maintenance of other species essential to the survival of the species, such as pollinators
- To maintain genetic diversity and long-term evolutionary development
- For the reintroduction of populations or recovery of the species.

The proposed area of habitat loss represents a small percentage of the potential foraging habitat for the Grey-headed Flying-fox within a 50 kilometre radius of the project boundary and known roost camps in the region. This species typically exhibits very large home ranges and Grey-headed Flying-fox are known to travel distances of at least 50 kilometres from roost sites to access seasonal foraging resources (Eby, 1991). No evidence of a camp site has been identified from the footprint of the upgrade.

The draft recovery plan for the Grey-headed Flying-fox identifies critical foraging habitat for this species as:

- Productive during winter and spring, when food bottlenecks have been identified
 - Known to support populations of >30,000 individuals, within an area of 50 kilometre radius
 - Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (Sept-May)
-

- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes
- Known to be continuously occupied as a camp site.

The project would directly remove up to 25 trees of foraging habitat however vegetation would be avoided where possible. Considering the close proximity of several roost camps and presence of important feed trees the habitats are consistent with the classification for critical foraging habitat (DECCW 2009). The affected area of foraging habitat would represent a small percentage of the total extent of important foraging vegetation types present within a 50 kilometre radius of the project boundary. Given the relative widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of regional populations, the project is not expected to adversely affect habitat critical to the survival of the species.

Disrupt the breeding cycle of an important population

As stated above there would be a minor impact on foraging habitat identified as important during the breeding cycle of the species. The upgrade would not directly impact on a known roost camp / breeding or maternity site.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

There is a roost camp within Centennial Park, next to the eastern extent of the study area, however no part of the camp is within the proposal area. Further, there would be a relatively minor impact on critical foraging habitat. This impact is not expected to lead to a decline in the species in this region.

Result in invasive species that are harmful to a vulnerable species becoming established in the Vulnerable species' habitat

The potential for weed invasion was considered possible with a project of this nature and appropriate controls are required during construction and operation of the road to reduce this threat. The management of invasive species would be managed under the construction environmental management plan and during operation of the highway using best practice methods as outlined in RTA (2011).

Introduce disease that may cause the species to decline, or

There are no known disease issues affecting this species in relation to the project. The project would be unlikely to increase feral animal abundance or the potential for significant disease vectors to affect local populations.

Interfere substantially with the recovery of the species.

The *Draft National Recovery Plan for the Grey-headed Flying-fox (Pteropus poliocephalus)* (Department of Environment, Climate Change and Water NSW. 2009) outlines the following actions:

- Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
 - Enhance winter and spring foraging habitat for Grey-headed Flying-foxes
 - Identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes
 - Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
 - Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps
 - Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions
-

- Monitor population trends for the Grey-headed Flying-fox
- Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan.

The recovery actions listed above are largely not applicable to the proposal as they focus on priority conservation lands which are outside of the study area.

Given the relative widespread nature of similar planted vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of regional populations, the project is not expected to interfere substantially with the recovery of the species.

Conclusion

The Grey-headed Flying-fox would suffer a small reduction in extent of suitable foraging habitat from the proposal. No breeding camps or other important habitat would be impacted. The proposal is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. The proposal would not interfere with the recovery of the Grey-headed Flying-fox and would not contribute to the key threats to this species. After consideration of the factors above, an overall conclusion has been made that the proposal is unlikely to result in a significant impact to the Grey-headed Flying-fox.

Clearing protocols would be implemented including undertaking pre-clearing surveys in accordance with *Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (NSW Roads and Traffic Authority, 2011). The location of potential grey-headed Flying-fox feed trees to be removed would be confirmed before works begin. The details of each tree would be recorded including GPS location, species, and foraging resource type (ie flowering or fruiting). Habitat removal would be undertaken as outlined in *Guide 4: Clearing of vegetation and removal of bushrock*. The seasonal impact of habitat removal on the Grey-headed Flying-fox must be considered. *Lophostemon confertus* flowers in spring and summer and the figs on *Ficus* spp. ripen in the summer. As such, the habitat removal should be undertaken in autumn or winter when the fewest foraging resources are available. This would limit the presence of the Grey-headed Flying-fox in the habitats during construction. If a Grey-headed Flying-fox is present in any of the trees during removal, then works would stop and the environment manager would be notified. Any Grey-headed Flying-foxes using the trees would be allowed to move on before works recommence.



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